

# **MAINTENANCE MANUAL**

**SMV 10-65 B / SMV 37-52 B GANTRY**



**ORIGINAL INSTRUCTIONS**  
**X068401en / A / 25 Feb 2016**  
**MMFLTB.01**



## TABLE OF CONTENTS

|            |                                                  |           |
|------------|--------------------------------------------------|-----------|
| <b>1</b>   | <b>INTRODUCTION.....</b>                         | <b>7</b>  |
| <b>1.1</b> | <b>About this manual.....</b>                    | <b>7</b>  |
| 1.1.1      | Use of the manual.....                           | 7         |
| 1.1.2      | Copyright notice.....                            | 7         |
| <b>1.2</b> | <b>About this product.....</b>                   | <b>7</b>  |
| 1.2.1      | Use of the product.....                          | 7         |
| 1.2.2      | Identification of the product .....              | 8         |
| <b>1.3</b> | <b>Standards and directives.....</b>             | <b>9</b>  |
| <b>1.4</b> | <b>Contact information.....</b>                  | <b>9</b>  |
| <b>2</b>   | <b>SAFETY AND ENVIRONMENT.....</b>               | <b>10</b> |
| <b>2.1</b> | <b>Safety messages and symbols.....</b>          | <b>10</b> |
| 2.1.1      | Signal words.....                                | 10        |
| 2.1.2      | Hazard symbols.....                              | 10        |
| 2.1.3      | Mandatory action symbols.....                    | 14        |
| 2.1.4      | Prohibited action symbols.....                   | 15        |
| <b>2.2</b> | <b>Responsibilities of the owner.....</b>        | <b>15</b> |
| 2.2.1      | Preventing work-related hazards.....             | 15        |
| 2.2.2      | Preventive maintenance.....                      | 15        |
| 2.2.3      | Personal protective equipment.....               | 16        |
| 2.2.4      | Incident reporting.....                          | 17        |
| <b>2.3</b> | <b>Limitations of the product.....</b>           | <b>17</b> |
| 2.3.1      | Prohibited use.....                              | 17        |
| 2.3.2      | Inclination angles.....                          | 17        |
| 2.3.3      | Changes to the product.....                      | 18        |
| <b>2.4</b> | <b>Protective measures.....</b>                  | <b>19</b> |
| 2.4.1      | Emergency stopping .....                         | 19        |
| 2.4.2      | Battery main switch.....                         | 19        |
| 2.4.3      | Releasing the hydraulic pressure.....            | 20        |
| 2.4.4      | Releasing the air pressure.....                  | 21        |
| 2.4.5      | Fire safety.....                                 | 21        |
| <b>2.5</b> | <b>Environmental information.....</b>            | <b>22</b> |
| 2.5.1      | Product life cycle stages.....                   | 22        |
| 2.5.2      | Energy consumption.....                          | 22        |
| <b>3</b>   | <b>SERVICE AND MAINTENANCE INSTRUCTIONS.....</b> | <b>23</b> |
| <b>3.1</b> | <b>Maintenance safety information.....</b>       | <b>23</b> |
| <b>3.2</b> | <b>Tilting the cabin.....</b>                    | <b>24</b> |
| <b>3.3</b> | <b>Electric welding.....</b>                     | <b>25</b> |
| <b>3.4</b> | <b>Jump-starting.....</b>                        | <b>25</b> |
| <b>3.5</b> | <b>Transport and towing.....</b>                 | <b>26</b> |
| 3.5.1      | Lifting the machine.....                         | 26        |
| 3.5.2      | Towing.....                                      | 26        |
| <b>3.6</b> | <b>Releasing the hydraulic pressure.....</b>     | <b>27</b> |
| <b>3.7</b> | <b>Changing the wheels.....</b>                  | <b>27</b> |
| 3.7.1      | Before changing the wheels.....                  | 27        |
| 3.7.2      | Positioning the jack.....                        | 28        |
| 3.7.3      | Deflating the tire.....                          | 29        |
| 3.7.4      | Inflating the tire.....                          | 30        |
| 3.7.5      | Dismantling the outer drive wheel.....           | 31        |
| 3.7.6      | Dismantling the inner drive wheel.....           | 32        |

|             |                                                                       |           |
|-------------|-----------------------------------------------------------------------|-----------|
| 3.7.7       | Mounting the inner drive wheels.....                                  | 33        |
| 3.7.8       | Mounting the outer drive wheel.....                                   | 33        |
| 3.7.9       | Dismantling the steer wheels.....                                     | 34        |
| 3.7.10      | Mounting the steer wheels.....                                        | 35        |
| <b>3.8</b>  | <b>Tightening the bolted joints.....</b>                              | <b>35</b> |
| 3.8.1       | Tightening torque.....                                                | 35        |
| 3.8.2       | Tightening the wheel nuts.....                                        | 37        |
| 3.8.3       | Tightening the bolts in the propshaft.....                            | 38        |
| 3.8.4       | Tightening the differential nuts.....                                 | 39        |
| 3.8.5       | Tightening the bolts in the engine and transmission mounting.....     | 39        |
| 3.8.6       | Tightening the bolts in the drive axle suspension.....                | 40        |
| 3.8.7       | Tightening the bolts in the hydraulic pumps.....                      | 41        |
| 3.8.8       | Tightening the bolts in the cabin suspension.....                     | 41        |
| 3.8.9       | Tightening the bolts in the counterweights.....                       | 42        |
| 3.8.10      | Tightening the bolts in the steer axle.....                           | 42        |
| <b>3.9</b>  | <b>Lubricating the machine.....</b>                                   | <b>43</b> |
| 3.9.1       | General lubrication rules.....                                        | 43        |
| 3.9.2       | Lubricating the steer axle.....                                       | 43        |
| 3.9.3       | Lubricating the hinges.....                                           | 44        |
| <b>3.10</b> | <b>Lubricating the mast and forks.....</b>                            | <b>45</b> |
| 3.10.1      | Lubricating the mast.....                                             | 45        |
| 3.10.2      | Lubricating the fork shaft system.....                                | 46        |
| <b>3.11</b> | <b>Maintenance common to all engines.....</b>                         | <b>47</b> |
| 3.11.1      | Cleaning and draining the fuel tank, all engines.....                 | 47        |
| 3.11.2      | Changing the AdBlue filter, AdBlue engines.....                       | 47        |
| 3.11.3      | Cleaning the engine air filter's coarse separator.....                | 49        |
| 3.11.4      | Cleaning and changing the engine air filter, all engines.....         | 50        |
| 3.11.5      | Changing the safety cartridge, all engines.....                       | 51        |
| 3.11.6      | Checking the air intake system, all engines.....                      | 51        |
| 3.11.7      | Checking the coolant system, all engines.....                         | 52        |
| 3.11.8      | Changing the coolant, all engines.....                                | 53        |
| 3.11.9      | Cleaning the radiator, intercooler, and oil coolers, all engines..... | 54        |
| 3.11.10     | Checking the drive belts, all engines.....                            | 54        |
| 3.11.11     | Checking the exhaust system, all engines.....                         | 55        |
| 3.11.12     | Checking the valve clearance, all engines.....                        | 56        |
| 3.11.13     | Checking the fuel system and fuel injectors, all engines.....         | 56        |
| <b>3.12</b> | <b>Maintaining the Volvo engines.....</b>                             | <b>56</b> |
| 3.12.1      | Changing Volvo engine oil and oil filter.....                         | 56        |
| 3.12.2      | Volvo fuel system.....                                                | 62        |
| <b>3.13</b> | <b>Maintaining the Scania engines.....</b>                            | <b>68</b> |
| 3.13.1      | Changing the Scania engine oil and oil filter.....                    | 69        |
| 3.13.2      | Scania fuel system.....                                               | 74        |
| <b>3.14</b> | <b>Maintaining the Cummins engines.....</b>                           | <b>77</b> |
| 3.14.1      | Changing the Cummins engine oil and oil filter.....                   | 77        |
| 3.14.2      | Changing the Cummins fuel filter.....                                 | 79        |
| <b>3.15</b> | <b>Maintaining the DANA transmissions.....</b>                        | <b>80</b> |
| 3.15.1      | Changing the DANA transmission oil.....                               | 80        |
| 3.15.2      | Changing the DANA transmission oil filter.....                        | 82        |
| 3.15.3      | Checking the DANA transmission breather.....                          | 83        |
| 3.15.4      | Calibrating the DANA transmission.....                                | 83        |
| <b>3.16</b> | <b>Maintaining the ZF transmissions.....</b>                          | <b>86</b> |
| 3.16.1      | Changing the ZF transmission oil filter.....                          | 86        |
| 3.16.2      | Changing the ZF transmission oil.....                                 | 88        |
| 3.16.3      | Calibrating the ZF transmission.....                                  | 89        |
| 3.16.4      | Checking the ZF transmission breather.....                            | 91        |

|                     |                                                                    |            |
|---------------------|--------------------------------------------------------------------|------------|
| <b>3.17</b>         | <b>Maintaining the drive axle.....</b>                             | <b>91</b>  |
| 3.17.1              | Checking the drive axle oil level.....                             | 91         |
| 3.17.2              | Changing the drive axle oil.....                                   | 92         |
| 3.17.3              | Checking the drive axle breather.....                              | 94         |
| 3.17.4              | Adjusting the parking brake.....                                   | 94         |
| 3.17.5              | Measuring the parking brake pressure.....                          | 95         |
| 3.17.6              | Manually releasing the parking brake.....                          | 95         |
| 3.17.7              | Bleeding the parking brake.....                                    | 96         |
| <b>3.18</b>         | <b>Maintaining the steer axle.....</b>                             | <b>97</b>  |
| 3.18.1              | Checking the steer axle bearings.....                              | 97         |
| 3.18.2              | Adjusting the wheel bearings.....                                  | 97         |
| 3.18.3              | Adjusting the spindle bearings.....                                | 98         |
| <b>3.19</b>         | <b>Maintaining the hydraulic system.....</b>                       | <b>99</b>  |
| 3.19.1              | Changing the hydraulic oil.....                                    | 99         |
| 3.19.2              | Starting the hydraulic pumps.....                                  | 100        |
| 3.19.3              | Changing the hydraulic oil filter.....                             | 101        |
| 3.19.4              | Changing the hydraulic tank breathing filter.....                  | 105        |
| <b>3.20</b>         | <b>Maintaining the mast and fork carriage.....</b>                 | <b>105</b> |
| 3.20.1              | Checking the mast and fork carriage.....                           | 105        |
| 3.20.2              | Checking the fork arms.....                                        | 106        |
| 3.20.3              | Checking the clearance between the mast and fork carriage.....     | 106        |
| 3.20.4              | Checking the fork shaft system.....                                | 107        |
| 3.20.5              | Checking the lift chains.....                                      | 108        |
| <b>3.21</b>         | <b>Maintaining the machine.....</b>                                | <b>109</b> |
| 3.21.1              | Cleaning the machine.....                                          | 109        |
| 3.21.2              | Changing the cabin air filter.....                                 | 110        |
| 3.21.3              | Checking the battery.....                                          | 111        |
| 3.21.4              | Checking the weld constructions.....                               | 112        |
| 3.21.5              | Changing the windshield wipers.....                                | 112        |
| <b>4</b>            | <b>MAINTENANCE SCHEDULE.....</b>                                   | <b>113</b> |
| <b>4.1</b>          | <b>Commissioning inspection.....</b>                               | <b>113</b> |
| <b>4.2</b>          | <b>Commissioning service.....</b>                                  | <b>113</b> |
| <b>4.3</b>          | <b>Maintenance points after the first 150 operating hours.....</b> | <b>114</b> |
| <b>4.4</b>          | <b>Regular service.....</b>                                        | <b>115</b> |
| <b>4.5</b>          | <b>Maintenance data.....</b>                                       | <b>122</b> |
| <b>APPENDIX I:</b>  | <b>FUEL AND OIL RECOMMENDATIONS.....</b>                           | <b>124</b> |
|                     | Quality of the engine oil.....                                     | 124        |
|                     | Extended oil change interval.....                                  | 125        |
|                     | Recommended fluids and lubricants.....                             | 125        |
| <b>APPENDIX II:</b> | <b>FUSES AND RELAYS.....</b>                                       | <b>129</b> |
|                     | Fuses.....                                                         | 129        |
|                     | Relays.....                                                        | 133        |



## 1 INTRODUCTION

### 1.1 About this manual

This manual offers guidance to enable safe and efficient operation of the equipment.

Taking the time to read this manual helps you to prevent damage to the equipment, and, most importantly, keep the personnel safe. The equipment is safe when used correctly. However, there are many potential hazards that are associated with incorrect operation, and these hazards can be avoided when you know how to recognize and anticipate them.

This manual also makes you aware of your responsibilities regarding the equipment and helps you to ensure that it is kept in a safe operating condition throughout its lifetime.

This manual is not intended as a substitute for proper training but provides recommendations and methods for safe and efficient operation and maintenance. The owner of the equipment must ensure that operators are properly trained before operation and, always, comply with all of the applicable and prevailing safety and other standards, rules, and regulations.

#### 1.1.1 Use of the manual

Every person that is exposed to the equipment of the manufacturer must, before operating, servicing and maintaining such products, read and understand the contents of this manual and strictly adhere and conform their conduct with and to the information, recommendations, and warnings that are provided in this manual.

##### NOTE

***Keep these instructions in a safe, accessible location for future reference by personnel operating the equipment or exposed to the operating equipment.***



##### **WARNING! IGNORING INSTRUCTIONS HAZARD**

**Failure to follow the given instructions could cause death or serious injury.**



**Read and understand the contents of this manual before operating, servicing, and maintaining the equipment.**

The manufacturer makes absolutely no warranty whatsoever regarding the contents of this manual, express or implied, whether arising by operation of law or otherwise, including, but not limited to, any implied warranties of merchantability or fitness for a particular purpose.

#### 1.1.2 Copyright notice

This document and the information contained herein, is the exclusive property of Konecranes Plc and represents a non-public, confidential and proprietary trade secret that may not be reproduced, disclosed to third parties, altered or otherwise employed in any manner whatsoever without the express written consent of Konecranes Plc. Copyright © 2016 Konecranes Plc. All rights reserved. Konecranes, Lifting Businesses and C are either registered trademarks or trademarks of Konecranes Plc.

### 1.2 About this product

#### 1.2.1 Use of the product

The machine is designed to perform lifting and transporting loads within the limits that are specified in the machine's capacity plate. For more information, see the machine's lifting capacity plate.

Contact the manufacturer or manufacturer's representative in case of doubt.

## 1.2.2 Identification of the product

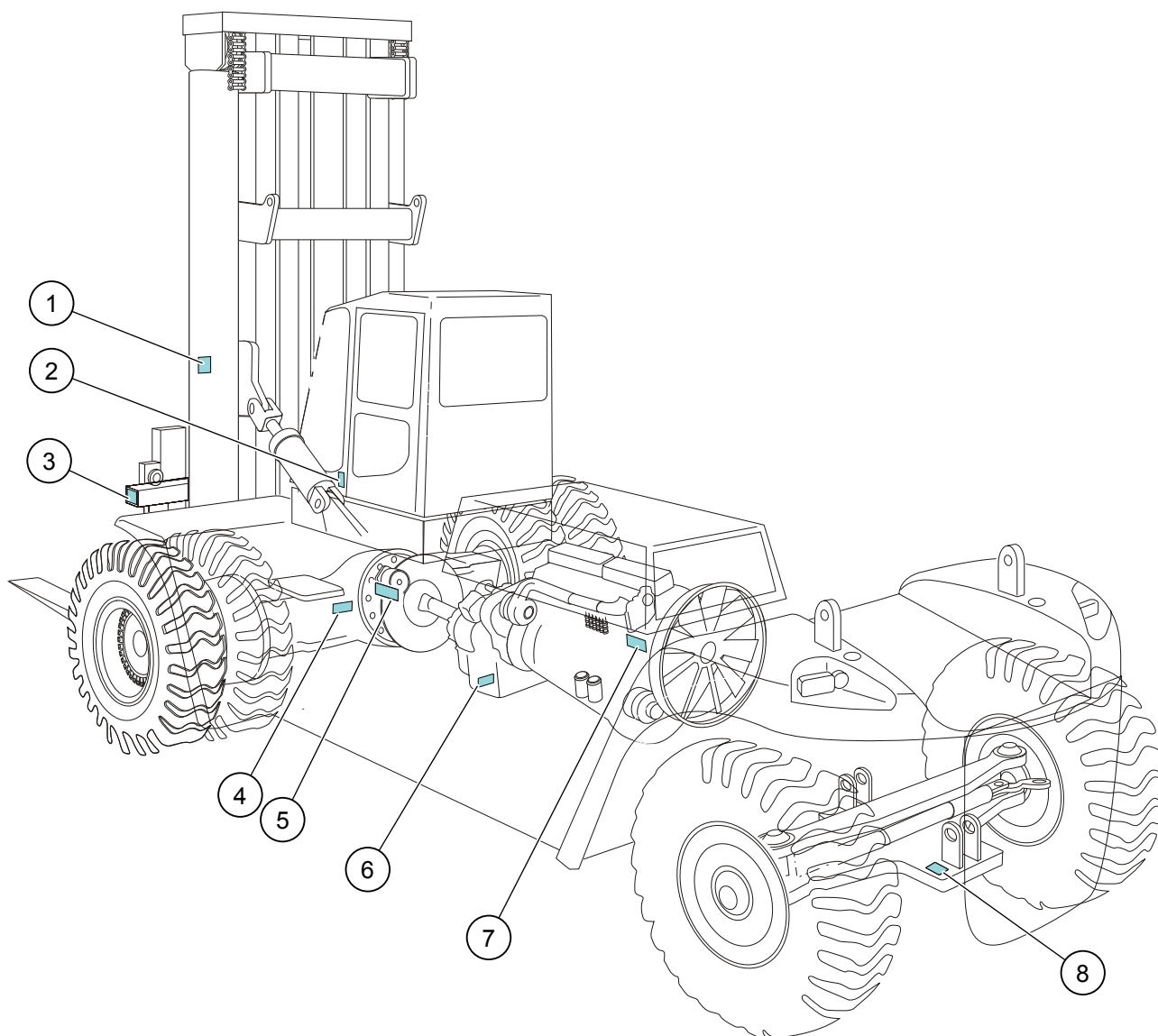


Figure 1. Plates and serial numbers

- |                           |                        |
|---------------------------|------------------------|
| 1. Mast number            | 5. Chassis number      |
| 2. Lifting capacity plate | 6. Transmission number |
| 3. Fork carriage number   | 7. Engine number       |
| 4. Drive axle number      | 8. Steer axle number   |

### 1.3 Standards and directives

This product has been designed and manufactured to conform to European and international standards and directives. The product also fulfills the requirements of the following standards (if applicable): CSA, UL, RoHS, OSHA, CCC.

Declaration of conformity and other certificates are included in the delivery package.

This product has been designed and manufactured to conform to:

- Health and safety: 2006/42/EC, EN 1459
- Noise: 2005/88/EC
- Vibrations: EN 13059
- Emissions: 2012/46/EC
- EMC: 2004/108/EC

### 1.4 Contact information

Konecranes Liftrucks AB

Anders Anderssons väg 13

285 35 Markaryd

Sweden

Tel. +46 433 733 00

## 2 SAFETY AND ENVIRONMENT

### 2.1 Safety messages and symbols

#### 2.1.1 Signal words

The following signal words and symbols are used to identify safety messages in these instructions.



Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.



Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.



Indicates a potentially hazardous situation that, if not avoided, could result in damage to property or environment.

#### 2.1.2 Hazard symbols

Hazard symbols are used to indicate the type of the hazard and the potential consequences. Hazard symbols are indicated by a yellow triangle with black symbols and a black triangle band that is surrounded by a yellow border. All personnel working on or in proximity of the machine must understand and follow the information that is given in all hazard symbols.

##### General hazard symbol



The general hazard symbol identifies important safety messages in this manual. When you see this symbol, carefully read and understand the message that follows, and inform other users when necessary.

**Mechanical hazard symbols**

Foot crushing hazard



Hand crushing hazard



Cutting hazard



Entanglement hazard



Falling load hazard



Hand entanglement hazard



Falling objects hazard



Forward or backward tipping hazard



Flying objects hazard



Flying objects to face hazard



Run over hazard



Moving vehicle hazard



Pressurized gas to face hazard



Slipping hazard



Falling hazard



Sideways tipping hazard



Automated startup hazard



Conveyor rail hazard



Crushing hazard



Hanging load hazard



Skin injection hazard



Tripping hazard

**Electrical hazard symbols**

Electrical hazard



Overhead power line hazard

## Material hazard symbols



Battery leakage hazard



Explosion hazard



Environment pollution hazard



Harmful substance hazard



High pressure hazard



Ignition hazard



Oxidizing substance hazard



Pressurized gas hazard



Hazardous or poisonous material hazard



Explosive atmosphere hazard



Biohazard



Corrosive chemical substance hazard



Hot liquid hazard

## Thermal hazard symbols



Hot surface hazard



Slippery when frozen hazard

## Noise hazard symbols



Noise hazard

**Radiation hazard symbols**

Radioactive hazard



Laser hazard



Light hazard



Strong magnetic field hazard

**Ergonomic hazard symbols**

Lifting hazard

### 2.1.3 Mandatory action symbols

Mandatory action symbols specify actions to be taken to avoid a hazard. Mandatory actions are indicated by white symbols on a blue background. All personnel working on or in proximity of the machine must understand and follow the information that is given in all mandatory action symbols.



Wear approved safety gloves



Wear approved hearing protectors



Wear approved protective clothing



Wear approved safety shoes



Wear approved safety harness



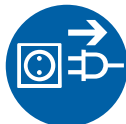
Wear approved hard hat



Wear approved high visibility clothing



Wear approved eye protector



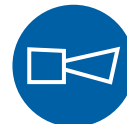
Disconnect equipment from power source



Apply indicator for pin-hole leak test



Use jack



Alarm horn



Switch off and lock-out equipment



Two persons for handling



Use walkway



Wash hands



Read manual



Wear approved respirator



Use seat belt

### 2.1.4 Prohibited action symbols

Prohibited action symbols indicate actions that are prohibited in order to avoid a hazard. Prohibited actions are indicated by a red circle with a red diagonal line across the circle. The action that is prohibited is always in black. All personnel working on or in proximity of the machine must understand and follow the information that is given in all prohibited action symbols.



General prohibition



Access prohibited



Do not climb



Do not remove guard



Do not smoke



Do not modify



Do not test for leak  
with hands



Do not touch



Pacemaker not  
allowed



Do not weld



No open fire



Restrict access

## 2.2 Responsibilities of the owner

### 2.2.1 Preventing work-related hazards

The user must always perform a local risk assessment before every new task, for example work phase or shift. This assessment, also known as a Real-Time Hazard Analysis, ensures that the user stops and thinks about what to do before starting to work.

- Identify potential hazards that could impact you, your colleagues, the environment, your product, or work method while you are performing the task
- Assess the risks and implement the actions that are needed to eliminate or reduce the risks

Only competent persons are allowed to carry out operation and other tasks. The employer must do the following.

- Provide training and orientation
- Validate training methods
- Verify competence and skills
- Monitor and evaluate user performance regularly

### 2.2.2 Preventive maintenance

Scheduled inspections and preventive maintenance are essential for keeping the product in safe working condition. Here are some general guidelines for preventive maintenance.

- It is the **product owner's responsibility** to organize proper regular inspections maintenance to ensure long-term safety, reliability, durability, operability, and warranty for the product.
- Owner must keep a record (log book) of all maintenance activities and usage relating to the product.
- Different maintenance actions must be carried out at different intervals and by different persons who are qualified and authorized to perform the checks which relate to them.
- Daily checks and minor lubrication must be carried out by operators or maintenance personnel. These checks are important for catching small faults before they become major faults.
- Maintenance actions, excluding the daily actions that are performed by operators, must be done by service personnel who are authorized by the owner of the product.
- Owner shall ensure that replacement parts and materials meet the specifications that are defined by the product manufacturer.
- Keep this manual in a safe, accessible location during the whole lifetime of the product.

#### **WARNING! MACHINE MALFUNCTION HAZARD**



**Failure to regularly and properly maintain the product can result in death, injury, or damage.**

**Do not allow the product to be used if it is not in proper condition or if it has not been maintained correctly. Contact a service agent that is authorized by the manufacturer or manufacturer's representative immediately in case of doubts.**

#### **RISK OF PROPERTY DAMAGE**

#### **NOTICE**

**Only use genuine spare parts, materials, and lubricants that are approved by the product manufacturer or manufacturer's representative. For more information, see the product spare part manual.**

### **2.2.3 Personal protective equipment**

#### **NOTE**

***This section proposes personal protective equipment to ensure the operator's full safety. Follow the local regulations and requirements of the working environment. Use only approved and accepted personal protective equipment that is marked with the CE symbol.***

For safety, the operator or others near the product may be required to wear personal protective equipment. Various types of personal protective equipment are available and must be selected according to the requirements of the working environment.

Operators and anyone in the vicinity of the product **MUST** wear approved personal protective equipment, which includes but is not limited to:

- Hard hat
- Eye-protector
- Hearing protectors
- Safety shoes
- Respirator
- Safety gloves
- Protective clothing
- Safety harness when working at heights
- High-visibility clothing

Do not wear loose clothing or jewelry that can get caught on controls or pulled into moving parts of the product.

Tie back long hair. Long hair can get entangled.

Select the appropriate clothing for each task, for example:

- Wear fire-resistant clothing when welding, flame cutting, or using an angle grinder
- Tear-resistant clothing must resist damage from sharp edges in the steel structure
- Wear anti-static clothing when working on electrical circuits so that components do not get damaged by a discharge of static electricity
- When working with lubricants, clothing must prevent direct skin contact with the lubricant
- Choose the clothing with consideration to the temperature at the working site

## 2.2.4 Incident reporting

Product safety issues that you must report are events in which the manufacturer's product has been involved in an accident or near-miss incident. Contact your local manufacturer's representative to report any safety-related feedback, such as unauthorized modifications, missing manuals and safety labels, neglected maintenance, or misuse. Reporting is mandatory to ensure safe working conditions for employees, to provide information for the risk assessment process, and to initiate product improvements. Contact your manufacturer's representative to report product safety issues.

## 2.3 Limitations of the product

### 2.3.1 Prohibited use



#### **WARNING! MACHINE MALFUNCTION HAZARD**

Using the machine outside the limits of its capacity or operating conditions could cause malfunction of the equipment and could lead to death, severe injury, or property damage.

**Do not use the machine outside the limits of its capacity or operating conditions.**

The misuse of the equipment includes, but is not limited to:

- Lifting and transporting people
- Having passengers in the cabin
- Driving on uneven terrain
- Driving on slopes with an inclination over 15%

For more information, see the Operator's manual. Contact the manufacturer or the manufacturer's representative in case of doubt.

### 2.3.2 Inclination angles



#### **WARNING! TIPPING AND COLLISION HAZARD**

If you drive on slopes steeper than 15%, the brakes may fail to stop the machine and the machine may roll. Risk of serious personal injury and damage to the machine.

**Do not drive on slopes steeper than 15%.**

#### **NOTE**

*If you must drive the machine along steeper slopes, contact your Konecranes Lifttrucks authorized dealer.*

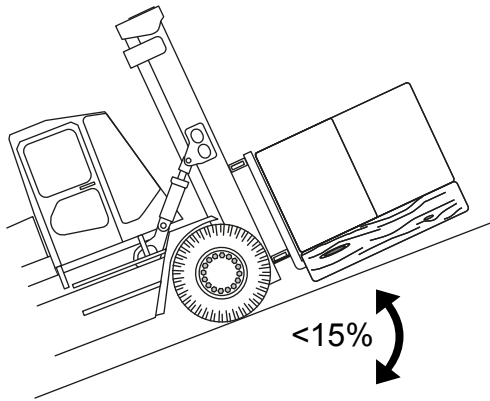


Figure 2. Do not drive on slopes steeper than 15%

### 2.3.3 Changes to the product

|                                                                                                                                                                         |                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b>                                                                        |                                                                                                                                                                                                                                                                            |
| <br> | <p><b>MACHINE MALFUNCTION HAZARD</b></p> <p>Unauthorized changes or modifications to the product could lead to death, severe injury or property damage.</p> <p>Always contact the manufacturer to get advance written approval for any product change or modification.</p> |

All modifications and corrections not authorized in the product manuals or which may affect the maintenance, operation, safety, and availability of the product need to be approved in writing by the manufacturer before implementation. Approval requires risk assessment taking into consideration any new risks that the changes and modifications may bring.

Changes and modifications without proper risk assessment, elimination or reduction of risk and without appropriate safety measures may lead to death, serious personal injuries or damage to property or environment. Unauthorized modifications will also void the warranty.

If a modification or correction as described above has been implemented without the manufacturing organization's permission, its effect on warranty liability will be considered case-by-case. Thus, the warranty application may be rejected altogether. Should you consider a modification or alteration necessary, you must contact the organization that manufactured and designed the product. No modification is permitted unless you first obtain the written approval of the manufacturer.

In order to plan and implement the modification you must deliver adequate documentation as follows.

- Product model and type
- Serial number of product
- Description of the modification or correction
- Related blueprints
- Related photos
- And other material, if necessary

## 2.4 Protective measures

### 2.4.1 Emergency stopping



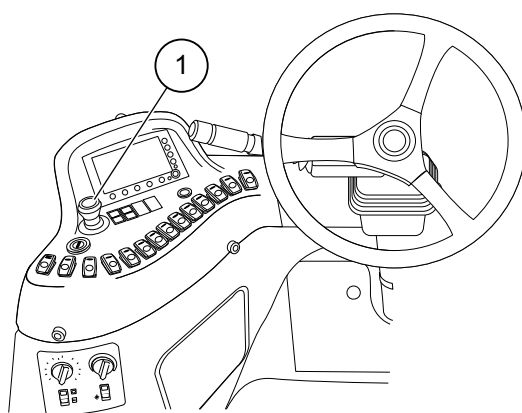
#### **WARNING! FORWARD TIPPING HAZARD**

If the emergency stop is used when the machine is moving, the machine may tip over. Risk of serious personal injury and damage to the machine.

Only use the emergency stop in an emergency.

After you press the emergency stop button (1), all functions are cut out, the parking brake is activated and the engine stops. In normal operation, do not use the emergency stop button to stop the machine. Instead, use the brake pedal. Routinely using the emergency stop button increases wear on the product.

You must check condition of the parking brake disc and the parking brake pads after each time you use the emergency stop. Contact the Konecranes Lifttrucks service personnel for the check-up.



#### **NOTE**

*Do not operate the equipment unless you know the location of the emergency stop button.*

### 2.4.2 Battery main switch

#### **NOTE**

*Do not operate the machine unless you know the location of the battery main switch.*

#### **NOTE**

*If the machine has an engine that uses the AdBlue solution, wait after turning off the ignition before you turn off the battery main switch. It takes time for the AdBlue pump to pump back the fluid in the hoses. The required time varies slightly between different engine models.*



#### **WARNING! ELECTRIC SHOCK HAZARD**

Even though the battery main switch is turned off, there may still be voltage present in some parts of the machine. This causes a risk of electric shocks, which can lead to death or serious personal injury.

Be aware of the battery main switch functionality.



#### **WARNING! TIPPING OVER HAZARD**

If you turn off the battery main switch when the machine is moving, the parking brake is activated. The machine may tip over, causing a risk of serious personal injury and damage to the machine. If you turn off the battery main switch when the machine is moving, check the condition of the parking brake disc and the parking brake pads afterwards.

Unless there is an emergency situation, do not turn off the battery main switch when the engine is running.

You can only operate the machine when the power is turned on. The owner must identify and document the location and function of the battery main switch and communicate this information to all operators.

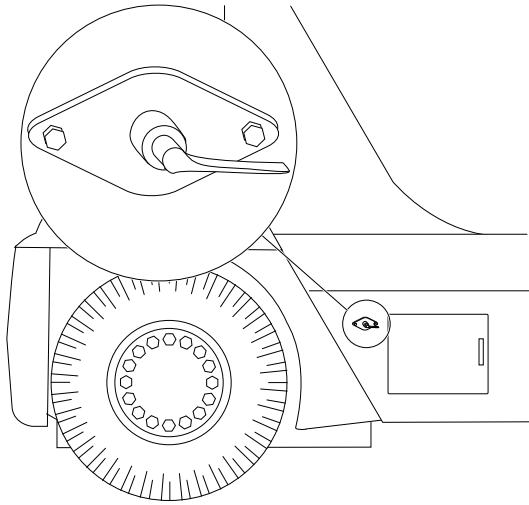


Figure 3. Battery main switch

### 2.4.3 Releasing the hydraulic pressure

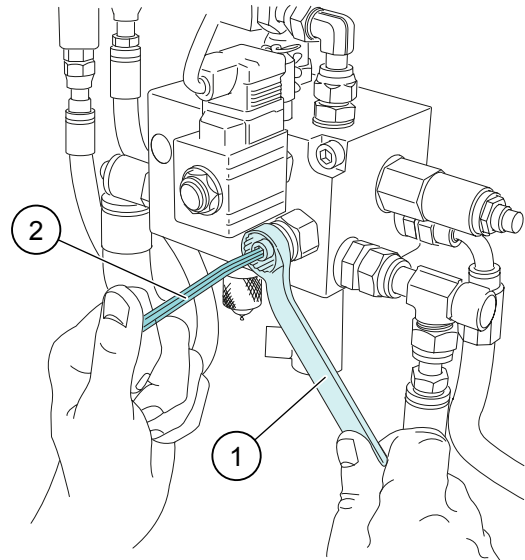
#### WARNING! HIGH PRESSURE HAZARD



The hydraulic system contains hydraulic accumulators to maintain the brake function during a possible engine failure. Risk of serious personal injury.

Always release the brake pressure before maintaining or servicing the hydraulics of the machine. Never loosen any hydraulic hoses without ensuring that the brake pressure is released.

1. Loosen the nut using a 11/16" box wrench (1).



2. Loosen the drainage screw using a 3/16" Allen wrench (2).

### 2.4.4 Releasing the air pressure

|  <b>DANGER</b>                                                                        |                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br> | <p><b>HIGH PRESSURE HAZARD</b></p> <p>The tires may explode when you are deflating them. Standing inside the danger zone during a tire explosion will cause death.</p> <p>Always stand aside the wheel when deflating or inflating tires, see deflating danger zone illustration. Use protective eye glasses.</p> |

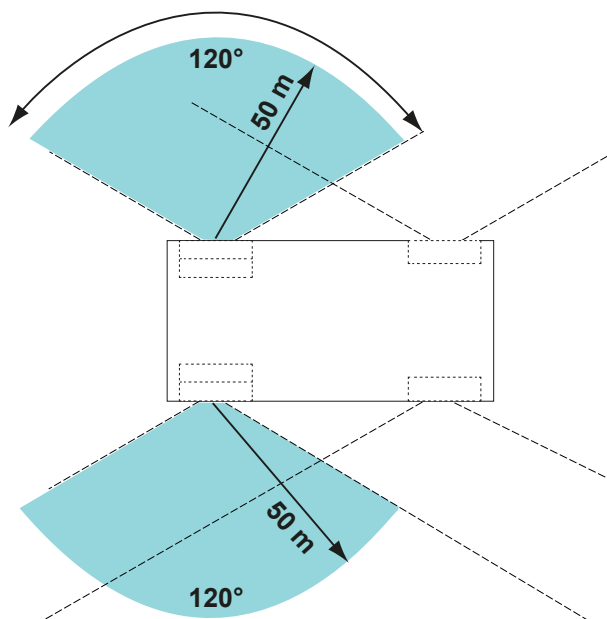


Figure 4. Deflating danger zone

Always use approved personal protective equipment when performing any maintenance work.

### 2.4.5 Fire safety

|  <b>WARNING</b>                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br> | <p><b>FIRE AND EXPLOSION HAZARD</b></p> <p>Ignition sources, such as smoking, open flames, welding work, and sparks, together with combustible materials, such as fuel, can cause fire and, if not avoided, could lead to death or severe injury.</p> <p>Ignition sources are prohibited in the vicinity of the machine.</p> <p>During maintenance, follow appropriate fire prevention and protection measures, including but not limited to trained personnel, proper fire extinguishing equipment and agents. Before starting any maintenance or repairs that require ignition sources, such as welding or flame cutting, carry out a proper risk assessment to control the risk.</p> |

- Smoking and open fire are prohibited in the vicinity of the product.
- Access to all fire-fighting equipment must be granted at all times, especially during maintenance and repair works.
- All fire-fighting equipment must be inspected and serviced regularly, according to local regulations.

- Damaged fire-fighting equipment and used fire extinguishers must be replaced immediately.
- Know the various types of fires and the appropriate fire-fighting methods. Various fires must not be extinguished with water. In most cases special extinguishing agents, dry powders or deoxygenating agents are required.
- All personnel must be trained regularly in fire-fighting methods, in cooperation with local authorities and rescue organizations. If there is a fire, the fire alarm must be activated and all available personnel must help with fire-fighting according to the predetermined fire plan of the workplace.

## 2.5 Environmental information

### 2.5.1 Product life cycle stages

Product life cycle stages include:

- Production of materials and components
- Equipment manufacturing and assembly
- Use phase, including maintenance and modernization
- Dismantling and recycling of waste materials
- Deliveries between each stage

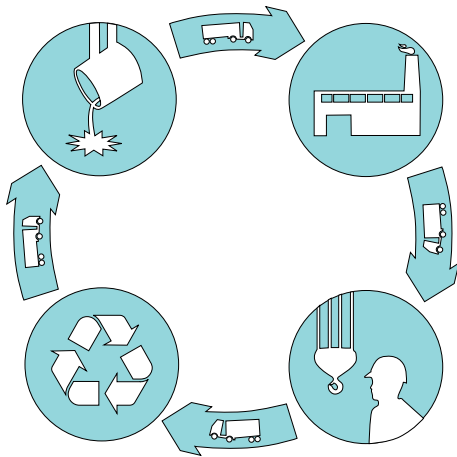


Figure 5. Product life cycle stages

### 2.5.2 Energy consumption

Energy consumption during the use phase has the biggest environmental impact. Diesel fuel is needed for lifting, transporting, lighting, heating, cooling, and other optional components that are part of the machine.

### 3 SERVICE AND MAINTENANCE INSTRUCTIONS

#### 3.1 Maintenance safety information

|  <b>WARNING</b>                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br> | <p><b>IRRITATING SUBSTANCE HAZARD</b></p> <p>The machine contains several chemical substances, which may cause skin irritation and allergies. Risk of personal injury when in prolonged contact with skin.</p> <p>When handling chemical substances, such as oils, hydraulic oils, fuel, grease, avoid direct contact with the skin. Use protective gloves. Immediately wash skin that comes in contact with chemical substances.</p> |

Preventive maintenance and maintenance must be carried out regularly and in accordance with the regulations supplied in the maintenance schedule.

Maintenance must only be carried out by trained staff or your Konecranes Lifttrucks authorized dealer in accordance with a service agreement. If you wish to service the machine, carry out the first three customer service checks in the presence of Konecranes Lifttrucks' authorized staff who can check that you are following the maintenance instructions.

Before any service work, check that:

- The machine is parked on firm, level ground.
- The machine is blocked so that it cannot roll.
- The engine is turned off and the ignition key removed.
- The fork carriage and the mast have been secured if they are in the raised position.
- The machine is firmly chocked if work must be carried out underneath when the machine is lifted.

After every service, carry out a test drive and an operational test on the machine.

#### RISK OF DAMAGE TO THE MACHINE

#### NOTICE

If the machine is used in extremely warm, cold, or dusty environments or in other unfavorable conditions, the service must be carried out more frequently than the intervals given in the service and maintenance schedule.

Clean the area around each component before lubricating, changing filters, or repairing the hydraulic system. Use only clean containers when topping up lubricants.

## 3.2 Tilting the cabin



### WARNING! FLYING OBJECTS HAZARD

Loose objects can fall out of the cabin and the cabin doors may come off their hinges. Risk of serious injury and damage to the machine.

Before the cabin is tilted, both cabin doors must be shut. Loose objects should be removed from the cabin. The mast should be vertical and the fork carriage in its lowest position.



### WARNING! FALLING LOAD HAZARD

If the cabin is not fully tilted, the cabin may fall and cause serious injury.

If you must work underneath the cabin when it is not fully tilted, secure the cabin with a support so that it cannot fall down.



### WARNING! MACHINE MISUSE HAZARD

Risk of serious injury and damage to the machine.

Do not drive the machine with the cabin partially or fully tilted.

All standard machines are equipped with manual, hydraulic cabin tilting (electric tilting is available as optional equipment).

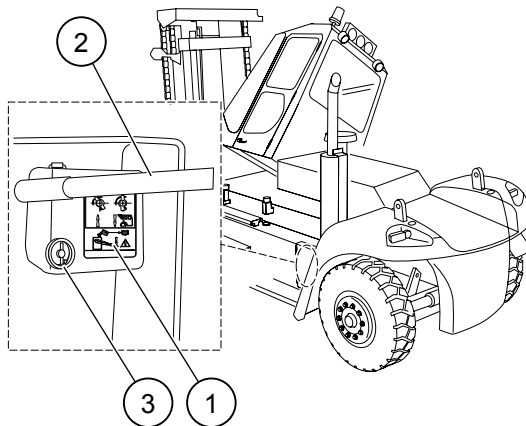


Figure 6. Tilting the cabin

1. Warning sticker
2. Pump handle
3. Mounting bracket

A warning sticker (1) is attached to the pump.

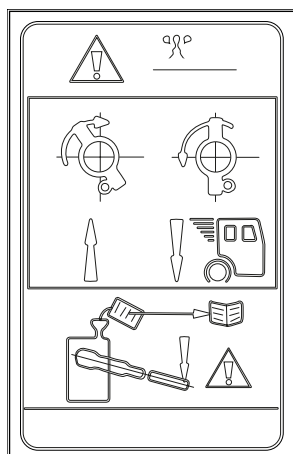


Figure 7. Pump warning sticker

1. Open the hatch (using a special key), placed to the right of the fuel tank on the left side of the machine.  
There is a pump handle (2) for tilting.
2. Fit the pump handle in the mounting bracket (3) and pump.
  - To tilt upwards, turn the valve clockwise, using the bottom end of the pump handle
  - To tilt downwards, turn the valve counter-clockwise, using the bottom end of the pump handle

### 3.3 Electric welding

#### RISK OF DAMAGE TO THE MACHINE

#### NOTICE

Follow these instructions when doing electric welding on the machine. Disconnect all battery connection, alternator, and all control units.

1. Remove the battery connections.
2. Remove the connections to the alternator.
3. Disconnect all control units in and on the machine.
4. Connect the welding clamp to the component to be welded and close to the welding point. Never connect the welding clamp to the engine or in such a manner that the current can pass over to a bearing.
5. When you have finished welding, connect the alternator and control unit before connecting the batteries.

### 3.4 Jump-starting



#### WARNING! RISK OF ARCING AND EXPLOSION.

Touching the connections during the jump-starting attempt can cause arcing and lead to serious personal injury or death.

Do not touch the connections during the jump-starting attempt.

#### RISK OF DAMAGE TO THE MACHINE

#### NOTICE

Jump-starting the machine with a quick charger, booster, power pack, or similar, can cause current surge and serious damage to the control units.

Do not jump-start the machine with a quick charger, booster, power pack, or similar.

1. Connect the black cable on the negative pole of the auxiliary battery to a chassis point, away from the discharged battery.
2. When the engine starts, remove the cables in the reverse order.

## 3.5 Transport and towing

### 3.5.1 Lifting the machine

#### RISK OF DAMAGE TO THE MACHINE

**NOTICE**

Use only lifting equipment and cranes which have sufficient lifting capacity. See the manufacturer's lifting capacity plate for the weight of the machine.

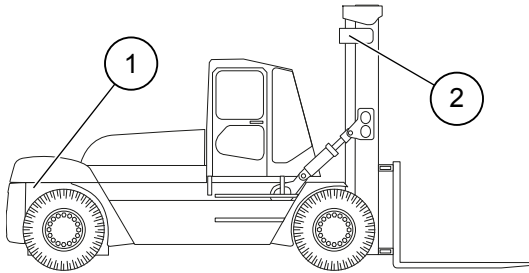


Figure 8. Lifting points

1. Attach two lifting hooks to the rear lifting eyes (1) at the counterweight.
2. Attach two lifting hooks to the front lifting eyes (2).

#### RISK OF DAMAGE TO THE MACHINE

**NOTICE**

When the machine is lifted, the lift slings must not rub against any part of the machine.

### 3.5.2 Towing

#### WARNING! RUN OVER HAZARD



If the engine or the electrical system is broken you may need to release the parking brake in order to tow the machine. In this situation, the machine has no brakes, which may lead to serious personal injury and damage to the machine.

Either the engine must be idling when the machine is towed or a vehicle with sufficient braking capacity to stop both vehicles must tow the machine.

To make use of the hydraulic brake system, servo-assisted steering system and transmission of the machine, the engine must be idling when being towed.

If idling is not possible, release the hydraulic parking brake. After you release the hydraulic parking brake, the machine has no brakes. A vehicle with sufficient braking capacity to stop both vehicles must tow the machine. For more information, see [Manually releasing the parking brake \(page 95\)](#).

1. Remove the propshaft.
2. Use the rear towing peg when fitting a sturdy towing pole on the machine.

### 3.6 Releasing the hydraulic pressure

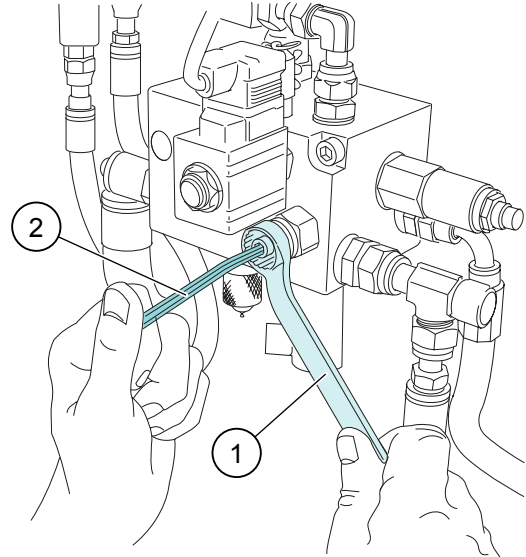


#### **WARNING! HIGH PRESSURE HAZARD**

The hydraulic system contains hydraulic accumulators to maintain the brake function during a possible engine failure. Risk of serious personal injury.

Always release the brake pressure before maintaining or servicing the hydraulics of the machine. Never loosen any hydraulic hoses without ensuring that the brake pressure is released.

1. Loosen the nut using a 11/16" box wrench (1).



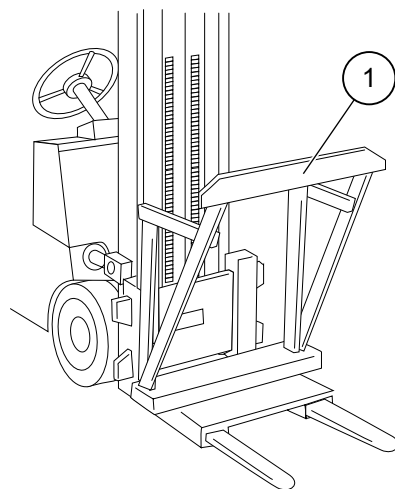
2. Loosen the drainage screw using a 3/16" Allen wrench (2).

### 3.7 Changing the wheels

#### 3.7.1 Before changing the wheels

Changing a wheel is a two-man operation.

A support truck that is fitted with an attachment for the wheel (1) facilitates the work.



*Figure 9. Support truck*

1. Position the machine on even ground.
2. Lift the side of the machine and support the underside of the chassis according to recommendations.

### 3.7.2 Positioning the jack



#### **WARNING! FALLING LOAD HAZARD**

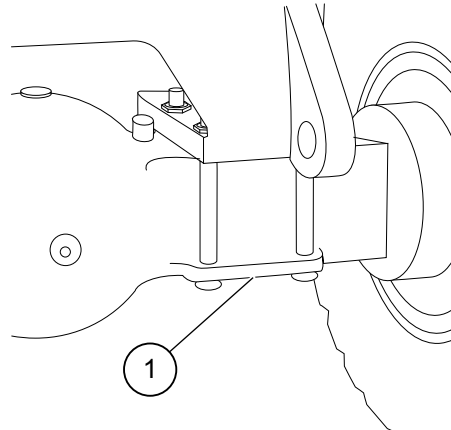
If you only rely on the jack and the ground is not good enough to sustain the jack, the jack may collapse and the machine may come down. Risk of injury and death.

Lift the machine up with a jack that has sufficient lifting capacity. Secure and block up the machine. Do not rely on the jack when working underneath.

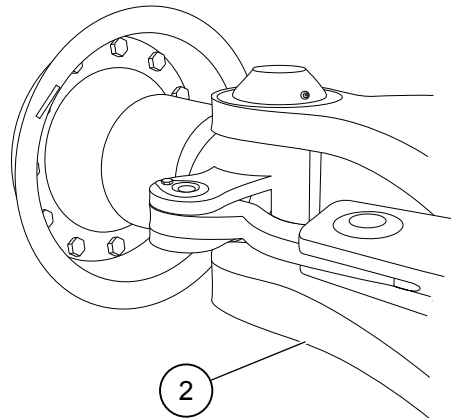
Observe the following regulations before lifting the machine.

- Specifications for tires: See machine card.
- Specifications for rims: Use only rims that are approved by the manufacturer of the machine.
- Other type of tires: The machine is designed to use pneumatic tires. Solid tires are used only in consultation with the manufacturer of the machine.

1. To lift the machine's drive axle, position the jack underneath the drive axle (1) and block the steer wheels.



2. To lift the steer axle of the machine, position the jack underneath the main plate of the steer axle (2) and block the drive wheels.



### 3.7.3 Deflating the tire

|  <b>DANGER</b>                                                                        |                                                                                                                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <br> | <p><b>HIGH PRESSURE HAZARD</b></p> <p>The tires may explode when you are deflating them. Standing inside the danger zone during a tire explosion will cause death.</p> <p>Always stand aside the wheel when deflating or inflating tires, see deflating danger zone illustration. Use safety glasses.</p> |

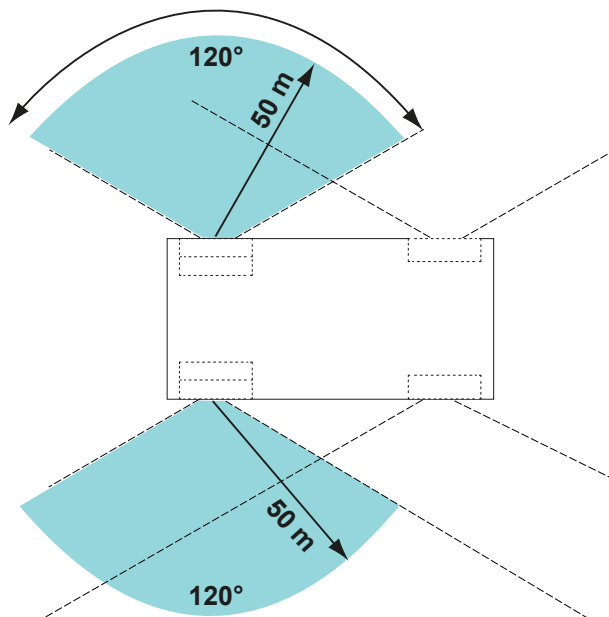


Figure 10. Deflating danger zone



**WARNING! HIGH PRESSURE HAZARD**

If the valve is broken, air cannot come out of the tire while deflating. This may cause the tire to explode.

Drill a hole into the tread to deflate the tire, as shown in the illustration below.

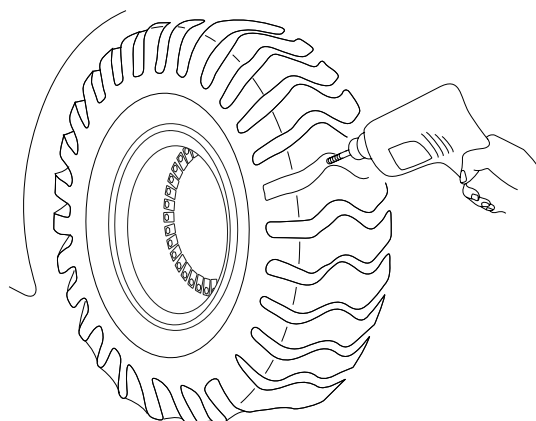


Figure 11. Drilling a hole into the tread

### RISK OF PROPERTY DAMAGE

#### NOTICE

When you are deflating the tire, the high pressure and moisture of the air may cause the valve to get covered with ice.

Heat the valve with a heat gun.

Deflate as follows:

1. Unscrew the valve cap.
2. Unscrew the valve plug. Ensure that no part of the body is in the possible trajectory of the valve mechanism.

### 3.7.4 Inflating the tire



## DANGER



#### HIGH PRESSURE HAZARD

The tires may explode when you are inflating them. Standing inside the danger zone during a tire explosion will cause death.

Always stand aside the wheel when deflating or inflating tires, see danger zone illustration. Use safety glasses.

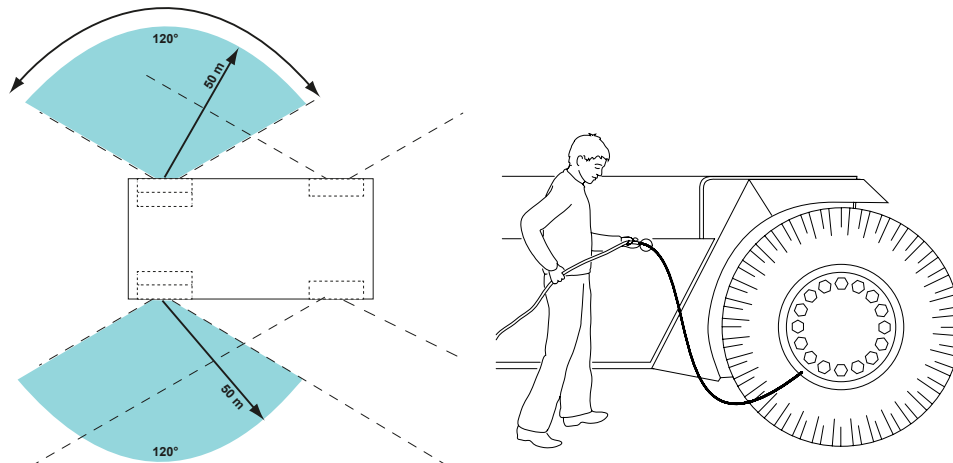


Figure 12. Inflating danger zone

- Never hit a tire or rim which is fully or partly inflated. The tire must not be inflated until all parts are assembled.
- Rim components must never be assembled with hammer blows during inflating.
- Disassemble the tire and check the rim for damage if the tire was deflated.
- It is important that all rim components are certified.
- Check that all components are in place when bead seating pressure is achieved.
- Final inflation adjustment to service pressure is performed with the wheel mounted to the machine or in a safety cage.
- If a safety cage is used, the tire can be inflated to maximum pressure. Otherwise the tire must be inflated to the bead seating pressure according to the tire manufacturer's instructions.
- The maximum pressures that are specified by the tire manufacturer must never be exceeded. If another rim or tire than recommended is used, other pressure values might be valid. Contact Konecranes Lifttrucks for advice.

Inflate the tire as follows:

1. Use a dryer filter on the compressor line to prevent the entry of humidity which leads to corrosion.

2. Check that locking rings and locking lugs are in place before starting inflation.
3. Connect the compressor line to the tire air valve.
4. Check that all components are in place when bead seating pressure is achieved.
5. Always stand aside the wheel until the bead seating pressure is achieved.
6. Mount the tire to the machine according to instructions.
7. Inflate the tire to the maximum pressures specified by the tire manufacturer.

### 3.7.5 Dismantling the outer drive wheel

#### **DANGER**



##### **HIGH PRESSURE HAZARD**

If you do not release the air from both tires, the wedge band and locking heads may release and shoot off when the pressure changes. Risk of serious personal injury and death.

Release the air from both tires.

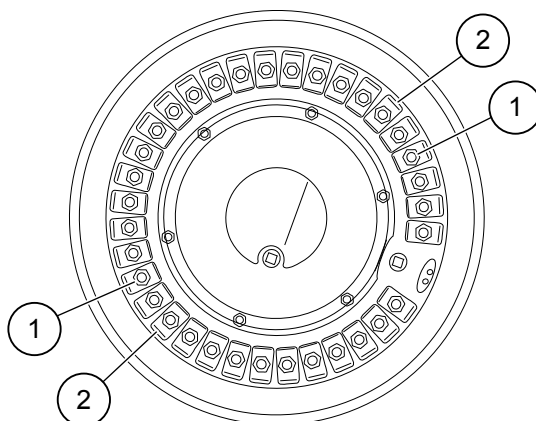


##### **WARNING! HIGH PRESSURE HAZARD**

Fitting tires that are not approved by the manufacturer may cause the tires to explode, which may cause serious personal injury or death.

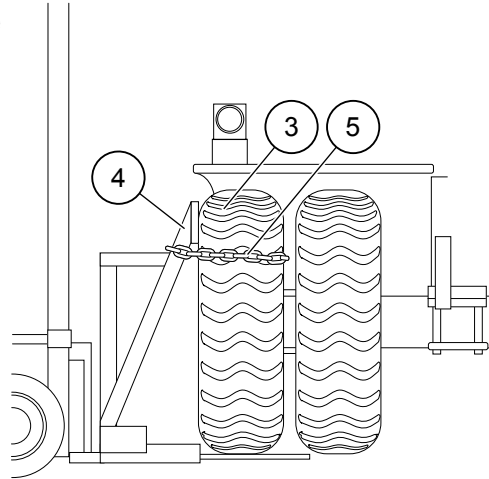
When changing tires, only use tires which are approved by the manufacturer.

1. Remove all but two of the nuts (1) and clamp units (2).



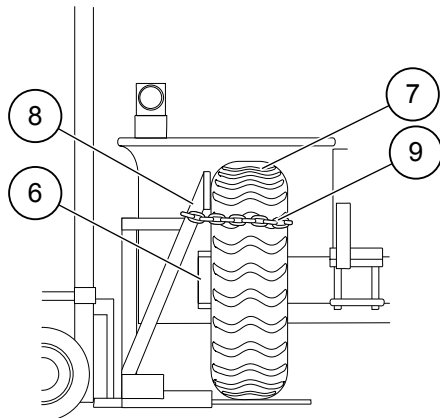
2. Use the support truck to support the weight of the outer wheel (3) on its forks.
3. Remove the two remaining nuts (1) and clamp units (2).

4. Lean the outer wheel (3) against the wheel support of the support truck (4), and secure it with a chain (5).



5. Reverse the support truck carefully and unload the outer wheel (3).

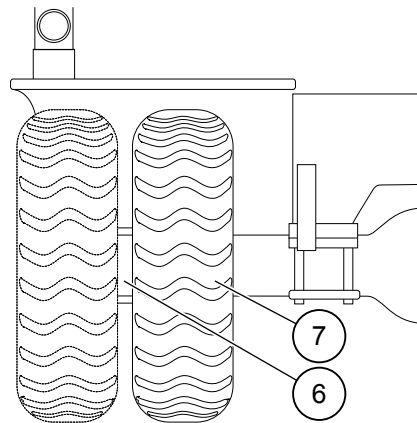
### 3.7.6 Dismantling the inner drive wheel



1. Remove the outer drive wheel.
2. Remove the spacer (6).
3. Use the forks of the support truck to support the weight of the inner drive wheel (7).
4. Lean the inner drive wheel (7) against the wheel support (8) and secure it with a chain (9).
5. Carefully reverse the support truck and unload the inner drive wheel (7).

### 3.7.7 Mounting the inner drive wheels

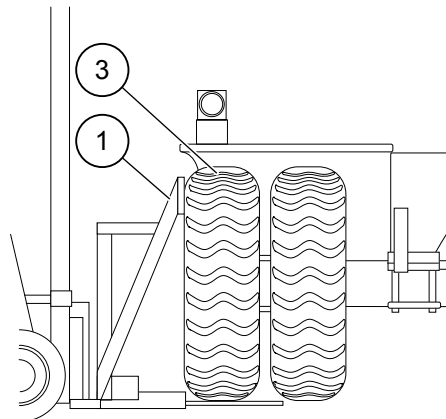
1. Load the inner drive wheel (7) onto the support truck and fasten it to the support.



2. Clean the contact surfaces.
3. Carefully drive the support truck to the required position and place the inner drive wheel (7) over the drive axle and the hub.
4. Straighten the wheel (7).
5. Lower the forks of the support truck until the inner drive wheel (7) is resting on the hub.
6. Carefully reverse the support truck.
7. Mount the spacer (6).

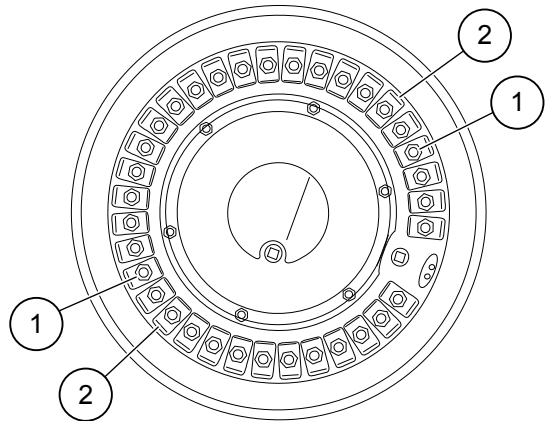
### 3.7.8 Mounting the outer drive wheel

1. Load the outer wheel (3) onto the support truck and secure it to the wheel support. Carefully drive the support truck (1) into position and place the outer wheel (3) over the hub.



2. Straighten the wheel (3).

3. To keep the rim in place, fasten two clamp units (2) and two wheel nuts (1) placed diagonally to each other.



4. Carefully reverse the support truck.
5. Fasten the remaining clamp units (2) and tighten the wheel nuts (1) crosswise. For the required torque, see [Tightening the wheel nuts \(page 37\)](#).
6. Pump the tires according to the recommendations of the tire manufacturer.

### 3.7.9 Dismantling the steer wheels



## DANGER

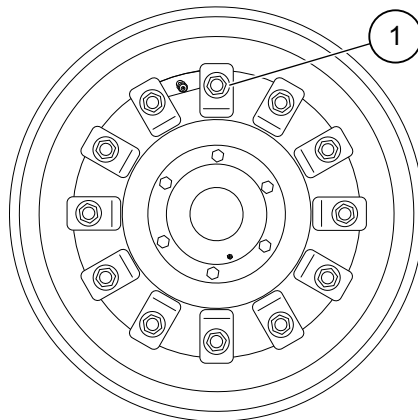


### HIGH AIR PRESSURE

If you do not release the air from both tires, the wedge band and locking heads may release and shoot off when the pressure changes. Risk of serious injury or death.

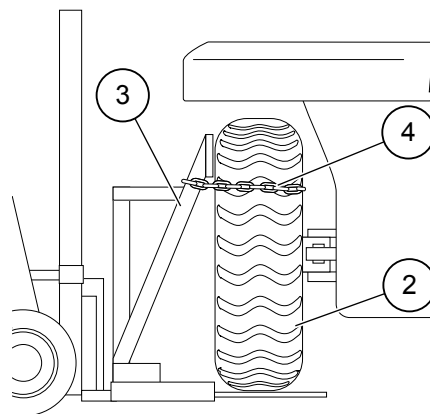
Release the air from both tires.

1. Remove all but two of the nuts (1) and clamp units.



2. To support the weight of the steer wheel (2), use the forks of the support truck.
3. Remove the remaining nuts and clamp units.

4. Lean the steer wheel (2) against the wheel support (3) and fasten it with a chain (4).



5. Carefully reverse the support truck and unload the steer wheel (2).

### 3.7.10 Mounting the steer wheels

1. Load the steer wheel (2) onto the support truck and secure it to the wheel support.
2. Clean the contact surfaces.
3. Carefully drive the support truck into position and place the steer wheel (2) against the hub.
4. To support the weight of the steer wheel, use the forks of the support truck.
5. Fix and tighten two of the clamp units and nuts (1) diagonal to each other.
6. Carefully reverse the support truck.
7. Fasten and tighten the remaining clamp units and nuts crosswise. For the required torque, see [Mounting the steer wheels \(page 35\)](#).
8. Pump the tires according to the recommendations of the tire manufacturer.

## 3.8 Tightening the bolted joints

### 3.8.1 Tightening torque



#### WARNING! MACHINE MALFUNCTION HAZARD

Failure to check the torque during first service and on regular intervals can result in death, injury, or damage.

Check the torque of the bolted joints regularly. Check the torque during first service.



#### WARNING! MACHINE MALFUNCTION HAZARD

Lubricating the bolts before tightening can result in death, injury, or damage.

The torques presented in the table apply only for dry bolts. Do not lubricate the bolts before tightening.

Table 1. Tightening torques

| Millimeter bolts |                        |       |       | Inch bolts |                        |       |       |
|------------------|------------------------|-------|-------|------------|------------------------|-------|-------|
| Thread M         | Tensile strength class |       |       | Thread UNC | Tensile strength class |       |       |
|                  | 8.8                    | 10.9  | 12.9  |            | 8.8                    | 10.9  | 12.9  |
| 6                | 9.8 Nm                 | 14 Nm | 17 Nm | 1/4"       | 11 Nm                  | 15 Nm | 19 Nm |
| 8                | 24 Nm                  | 33 Nm | 40 Nm | 5/16"      | 22 Nm                  | 31 Nm | 38 Nm |

| Millimeter bolts |         |         |         | Inch bolts |         |         |         |
|------------------|---------|---------|---------|------------|---------|---------|---------|
| 10               | 47 Nm   | 65 Nm   | 79 Nm   | 3/8"       | 38 Nm   | 54 Nm   | 68 Nm   |
| 12               | 81 Nm   | 114 Nm  | 136 Nm  | 7/16"      | 61 Nm   | 87 Nm   | 108 Nm  |
| 14               | 128 Nm  | 181 Nm  | 217 Nm  | 1/2"       | 93 Nm   | 131 Nm  | 163 Nm  |
| 16               | 197 Nm  | 277 Nm  | 333 Nm  | 9/16"      | 133 Nm  | 187 Nm  | 234 Nm  |
| 18               | 275 Nm  | 386 Nm  | 463 Nm  | 5/8"       | 183 Nm  | 259 Nm  | 323 Nm  |
| 20               | 385 Nm  | 541 Nm  | 649 Nm  | 3/4"       | 322 Nm  | 455 Nm  | 568 Nm  |
| 22               | 518 Nm  | 728 Nm  | 874 Nm  | 7/8"       | 516 Nm  | 729 Nm  | 909 Nm  |
| 24               | 665 Nm  | 935 Nm  | 1120 Nm | 1"         | 772 Nm  | 1090 Nm | 1360 Nm |
| 27               | 961 Nm  | 1350 Nm | 1620 Nm | 1 1/8"     | 1090 Nm | 1550 Nm | 1930 Nm |
| 30               | 1310 Nm | 1840 Nm | 2210 Nm | 1 1/4"     | 1530 Nm | 2160 Nm | 2690 Nm |
| 33               | 1770 Nm | 2480 Nm | 2980 Nm | 1 3/8"     | 2020 Nm | 2850 Nm | 3550 Nm |
| 36               | 2280 Nm | 3210 Nm | 3850 Nm | 1 1/2"     | 2650 Nm | 3750 Nm | 4680 Nm |

### 3.8.2 Tightening the wheel nuts

Check the torque of the wheel nuts daily for 14 days, or until the rim, clamp units, and nuts have settled in, and no more tightening is obtained.

Perform this check:

- After a new delivery of machine
- After the machine has been taken into use
- After a wheel has been removed or replaced



**WARNING! MACHINE MALFUNCTION HAZARD**

If you do not check the torque of the wheel nuts, the wheel nuts loosen, the rim comes loose and destroys the hub.

Check the torque of the wheel nuts as described above.

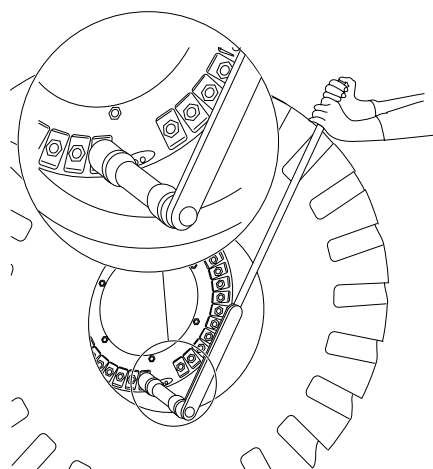


Figure 13. Drive wheel nuts

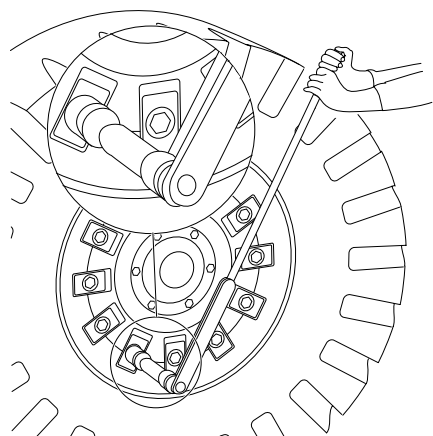


Figure 14. Steer wheel nuts

Tighten the nuts crosswise according to the following table.

Table 2. Drive wheel and steer wheel nuts torque

| Position   | Size    | Strength class | Torque                   | Clamps        |
|------------|---------|----------------|--------------------------|---------------|
| Drive axle | M18x2   | 10.9           | 400 Nm<br>(295 lbf ft)   | Yes           |
| Drive axle | M22x1.5 | 10.9           | 768 Nm<br>(566.4 lbf ft) | No (disc rim) |
| Steer axle | M22x1.5 | 10.9           | 400 Nm<br>(295 lbf ft)   | Yes           |
| Steer axle | M22x1.5 | 10.9           | 700 Nm<br>(516.3 lbf ft) | No (disc rim) |

### 3.8.3 Tightening the bolts in the propshaft

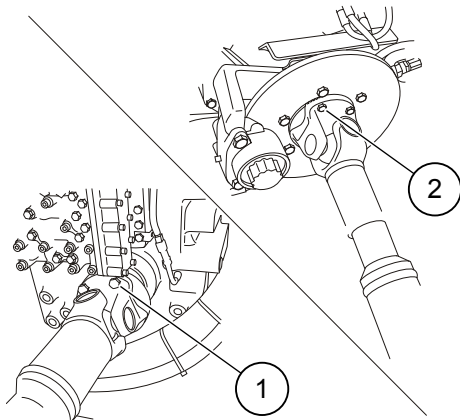


Figure 15. Propshaft SMV 10-18B

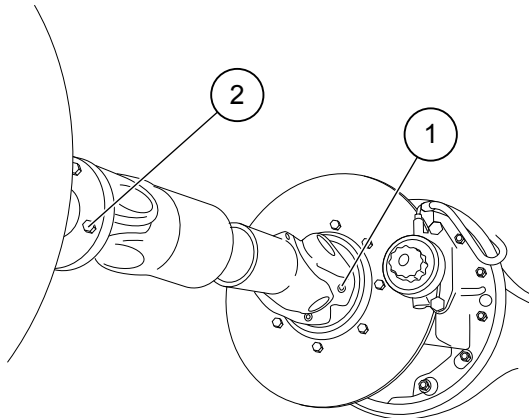


Figure 16. Propshaft SMV 32-60B

Select the right torque from the table according to the bolt size for the bolts on the drive axle side (1) and on the transmission side (2).

Table 3. Propshaft torque

| Size | Strength class | Torque               |
|------|----------------|----------------------|
| M14  | 8.8            | 128 Nm (94.4 lbf ft) |
| M12  | 8.8            | 81 Nm (59.7 lbf ft)  |

### 3.8.4 Tightening the differential nuts

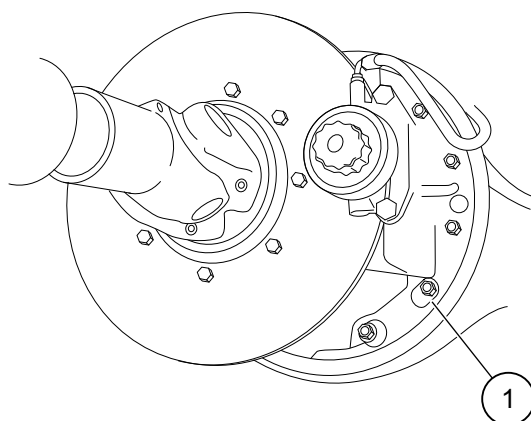


Figure 17. Differential nuts

Table 4. Differential nuts torque

| Position | Size | Strength class | Torque                |
|----------|------|----------------|-----------------------|
| 1        | M14  | 10.9           | 181 Nm (133.5 lbf ft) |

### 3.8.5 Tightening the bolts in the engine and transmission mounting

Check the condition of the rubber suspensions. If any wear and tear is discovered, replace the damaged parts.

The engine mountings are accessible from the engine compartment, one on each side of the rear part of the engine.

The transmission mountings are accessible from the engine compartment, one on each side of the transmission.

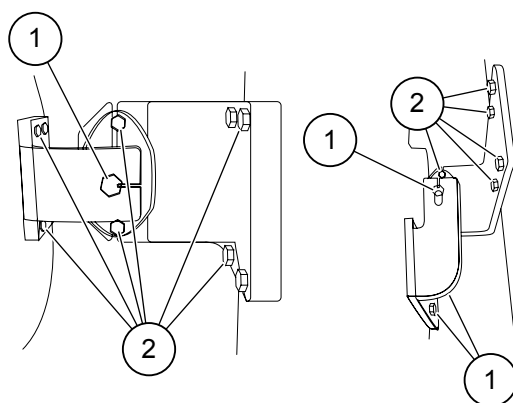


Figure 18. Engine mounting (left) and transmission mounting (right)

Table 5. Engine and transmission mounting torque

| Position | Size | Strength class | Torque                |
|----------|------|----------------|-----------------------|
| 1        | M20  | 8.8            | 385 Nm (284 lbf ft)   |
| 2        | M16  | 8.8            | 197 Nm (145.3 lbf ft) |
| 2        | M16  | 10.9           | 277 Nm (204.3 lbf ft) |

### 3.8.6 Tightening the bolts in the drive axle suspension

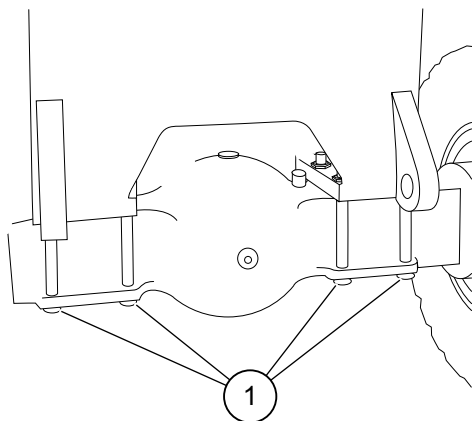


Figure 19. Drive axle suspension

There are four bolts on each side of the drive axle suspension. Select the right torque from the table according to the bolt size.

#### NOTE

**The torque values in this table do not correspond to the standard torque values presented in the table at the beginning of this chapter.**

Table 6. Drive axle suspension torque

| Position | Size | Strength class | Torque                     |
|----------|------|----------------|----------------------------|
| 1        | M24  | 10.9           | 900 Nm (663.8 lbf ft)      |
| 1        | M30  | 10.9           | 1,770 Nm<br>(1,305 lbf ft) |
| 1        | M36  | 10.9           | 3,100 Nm<br>(2,286 lbf ft) |

### 3.8.7 Tightening the bolts in the hydraulic pumps

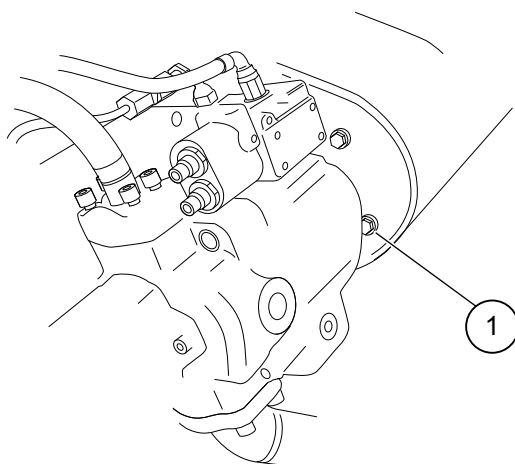


Figure 20. Hydraulic pumps

Table 7. Hydraulic pumps torque

| Position | Size   | Strength class | Torque              |
|----------|--------|----------------|---------------------|
| 1        | M12x40 | 8.8            | 81 Nm (59.7 lbf ft) |

### 3.8.8 Tightening the bolts in the cabin suspension

#### NOTE

*The torque must not be higher than the value that is presented in this table. Otherwise the suspension ears can be scrunched and damage the mounting brackets. The torque value does not correspond to the standard torque value presented in the table at the beginning of the chapter.*

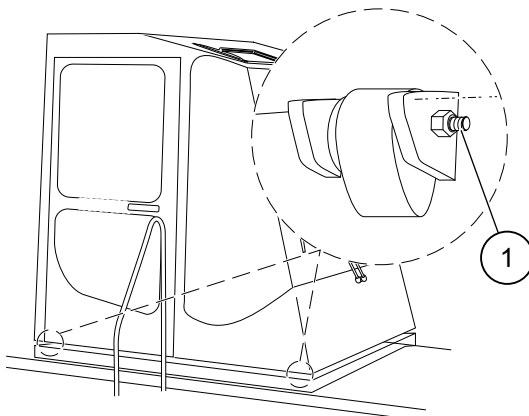


Figure 21. Cabin suspension

Table 8. Cabin suspension torque

| Position | Size | Strength class | Torque                |
|----------|------|----------------|-----------------------|
| 1        | M24  | 8.8            | 245 Nm (180.7 lbf ft) |

### 3.8.9 Tightening the bolts in the counterweights

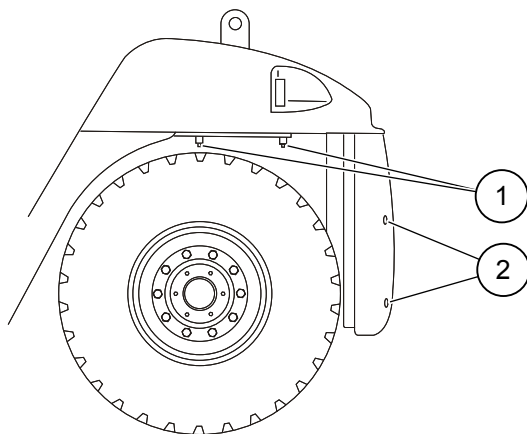


Figure 22. Counterweights

Select the right torque from the table according to the bolt size for the bolts of the counterweights (1) and (2).

Table 9. Counterweights torque

| Size | Strength class | Torque                  |
|------|----------------|-------------------------|
| M24  | 8.8            | 665 Nm (490.5 lbf ft)   |
| M36  | 8.8            | 2,280 Nm (1,682 lbf ft) |

### 3.8.10 Tightening the bolts in the steer axle

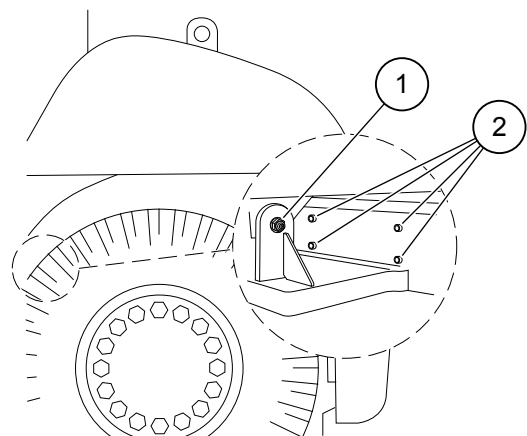


Figure 23. Steer axle

Table 10. Steer axle torque

| Position | Size | Strength class | Torque                  |
|----------|------|----------------|-------------------------|
| 1        | M36  | 8.8            | 2,280 Nm (1,682 lbf ft) |
| 2        | M20  | 8.8            | 385 Nm (284 lbf ft)     |
| 2        | M30  | 8.8            | 1,310 Nm (966.2 lbf ft) |

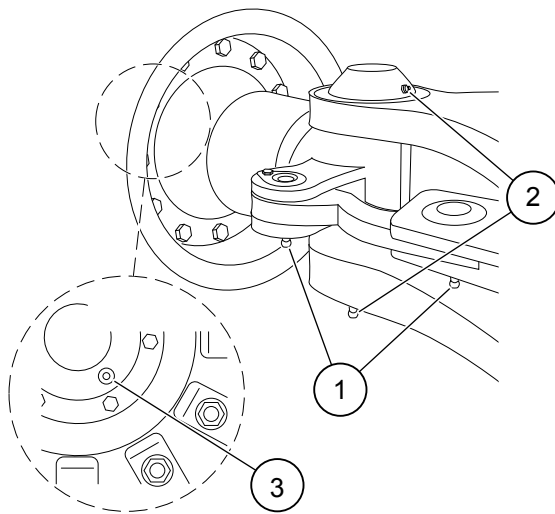
## 3.9 Lubricating the machine

### 3.9.1 General lubrication rules

Follow these rules during lubrication:

- Clean off old grease and clean grease nipples.
- Lubricate until fresh grease penetrates.
- Use only recommended grease.
- All wear pads must be free of pressure for the grease to be able to penetrate.
- Wear pads require frequent lubrication with a small amount of grease. Roller bearings require more grease less often.
- Check the function and bearing slackness when lubricating.
- Specified lubrication intervals apply in favorable conditions. More frequent lubrication is recommended in more demanding conditions, particularly of the wear pads.

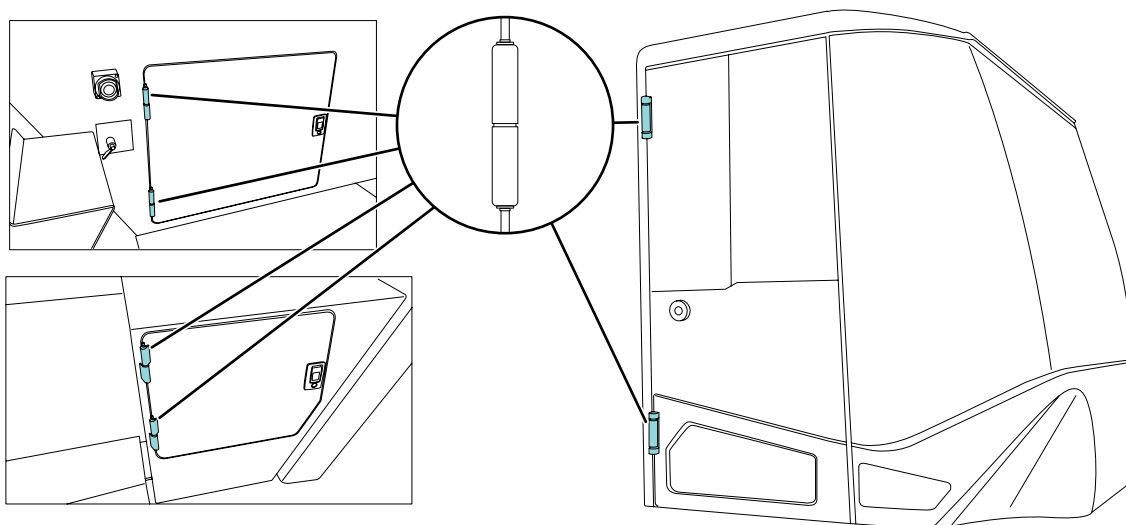
### 3.9.2 Lubricating the steer axle



*Figure 24. Lubrication points*

1. Remove any old grease and clean the grease nipples.
2. Lubricate the steering links, four points (1) - two points on each steer link.
3. Lubricate the spindle bolts (2), one upper and one lower on each side.
4. Lubricate the wheel bearings (3), one on each side.  
Grease penetrates onto the inside.

### 3.9.3 Lubricating the hinges



*Figure 25. Lubrication points*

1. Check and clean the hinges of the battery hatch and the screw cap for the equipment for cabin tilting.
2. Lubricate the hinges.  
To check that all parts of the hinges have been lubricated, open and close the hatches.

## 3.10 Lubricating the mast and forks

### 3.10.1 Lubricating the mast



#### WARNING! FALLING LOAD HAZARD

Certain tasks require that the inner mast and carriage are raised. If you do not secure them, they may fall and cause serious injury or death.

Secure the inner mast and carriage with a wooden block before starting work.

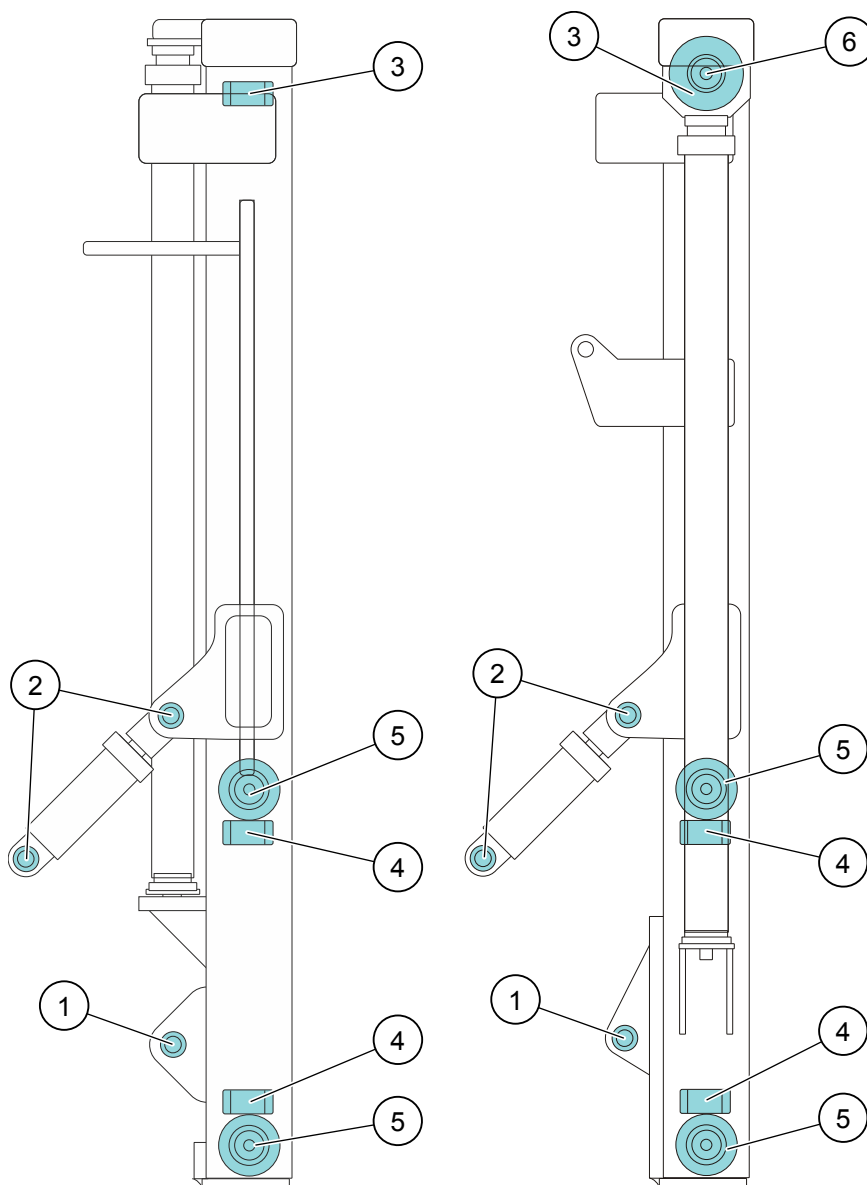


Figure 26. SMV 10-16 (left) and SMV 18-60 (right) mast lubrication points

#### NOTE

**Do not grease too much. Apply grease only to the bearings, not to the support rollers and mast wheels. Grease in the mast beams makes the rollers and wheel slide instead of roll.**

1. Apply grease to the suspension shafts (1) at the grease nipples, one on each side. The suspension shafts are accessible through the mast. Unload the shaft pins by lifting the mast either using a jack or a bench trestle and tilting it forwards.
2. Apply grease to the tilt cylinders (2) from the center of the shafts, two on each side. To unload the tilt cylinders, tilt the mast backwards.

3. Apply grease to the grease nipples of the top support rollers (3) of the outer mast, one on each side.  
To reach the support rollers, raise the mast.
4. Apply grease to the bearings of the side support rollers (4) of the inner mast and the fork carriage, two on each side.  
You can reach the support rollers of the fork carriage from the inside of the carriage. You can reach the support rollers of the inner mast from the inside of the inner mast. To reach the rollers and wheel, raise the carriage.
5. Apply grease to the mast wheels on the inner mast and the carriage (5), two on each side.  
You can reach the mast wheels from the inside of the inner mast and carriage. To reach the rollers and wheel, raise the carriage.
6. SMV18-60: Apply grease to the chain wheels (6) through the grease nipples.

### 3.10.2 Lubricating the fork shaft system

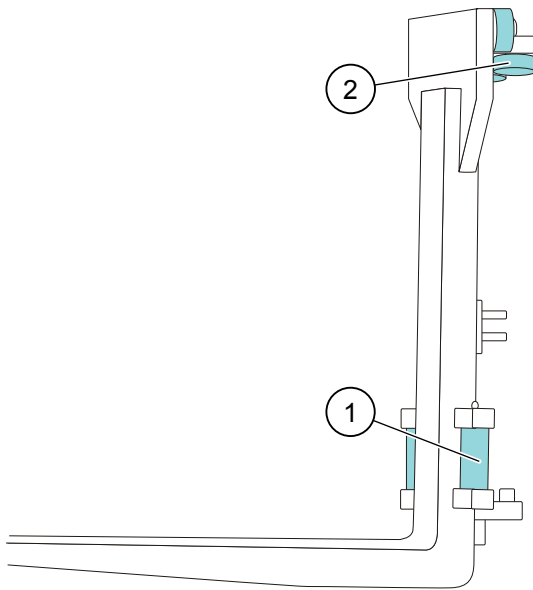


Figure 27. Forks and blades lubrication points

#### NOTE

***Do not grease too much. Apply grease only to the bearings, not to the support rollers. Grease in the carriage beams makes the rollers and wheel slide instead of roll.***

1. Apply grease to the bearings of the lower support rollers (1).  
There are two support rollers on each fork.
2. Apply grease to the bearings of the upper support rollers (2).  
There are four support rollers on each fork.

### 3.11 Maintenance common to all engines

#### 3.11.1 Cleaning and draining the fuel tank, all engines

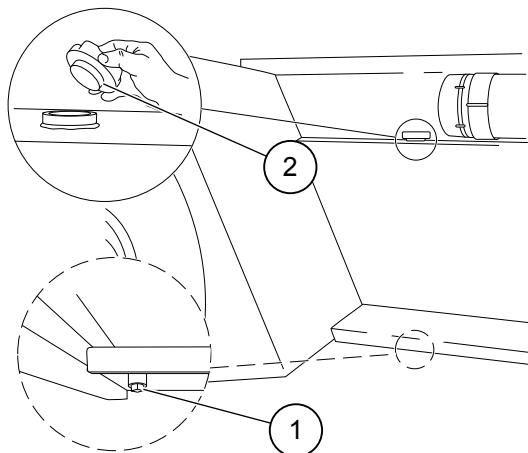


Figure 28. Fuel tank

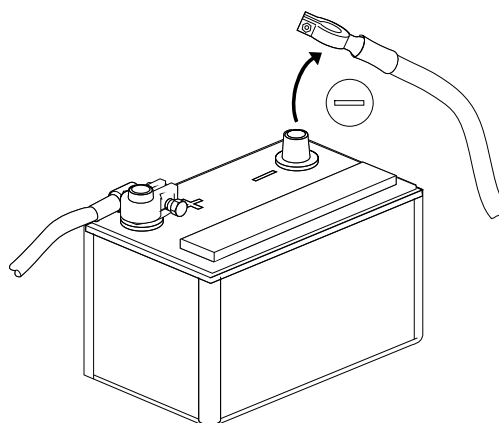
1. Check the tank for any leaks.
2. Drain the tank of any dirt and water through the drain plug (1).
3. Place a receptacle underneath the drain plug.
4. When clear fuel comes through, refit the drain plug.
5. Check the seal around the fuel cap (2).

#### 3.11.2 Changing the AdBlue filter, AdBlue engines

**NOTE**

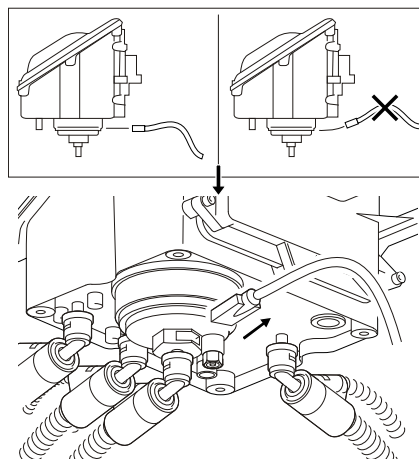
*Wait at least two minutes after the engine has been turned off before removing the AdBlue solution hoses, so that automatic drainage and depressurization of the selective catalytic reduction system can take place.*

1. Switch off the engine. Disconnect the battery negative terminal.

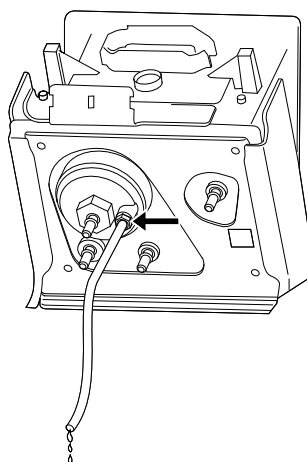


2. Remove the heater coil connector from the filter cover.

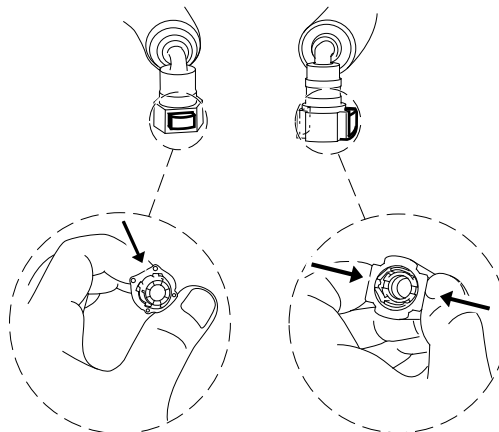
**NOTE** *Pull out the connector straight.*



3. Place a receptacle under the pump unit. Attach a plastic hose to the drainage screw and open the screw on the filter cover. Let the remainder of the solution run into the receptacle.



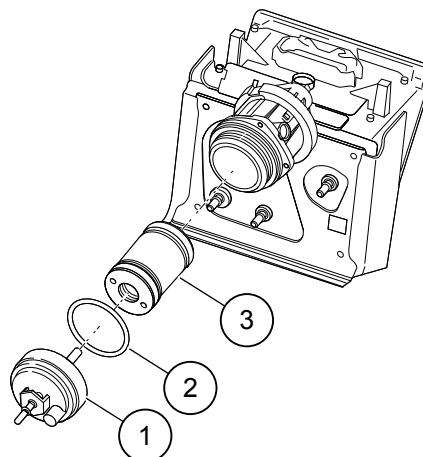
4. Remove the hose from the filter cover by pressing in the lock catches.



5. Remove the filter cover (1) from the pump unit. Remove the filter (3).

**NOTE**

*If the filter has been loosened it has to be fully removed, even if it is to be reused, before reinstalling it again.*



6. Install a new O-ring (2) in the new filter cover. Install a new filter with the filter cover. Install filter and cover together into the pump. Tighten the filter cover using a torque wrench.

**NOTE**

*Check that the drain valve is tightened.*

7. Reinstall the filter cover hose. Make sure that the connection locks securely.
8. Reconnect the heater coil connector. Make sure that the connection locks securely.

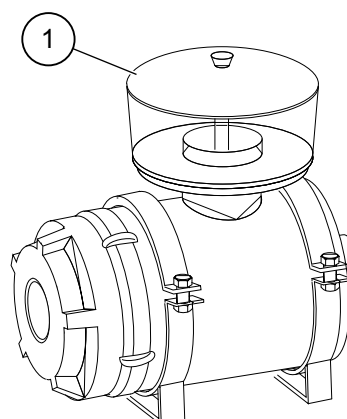
**NOTE**

*Make sure that the connector is fitted straight.*

9. Connect the battery negative terminal.
10. Start the engine and check that there are no leaks.
11. Take care of equipment and surplus AdBlue solution and leave them at a recycling station for destruction.

### 3.11.3 Cleaning the engine air filter's coarse separator

1. Remove the hatch (1) from the coarse separator .



2. Remove the coarse separator.
3. Remove particles and dry out the coarse separator with a cloth.
4. Refit the coarse separator and screw the hatch in place.

### 3.11.4 Cleaning and changing the engine air filter, all engines



#### WARNING! TOXIC SUBSTANCE HAZARD

The engine air filter contains a significant number of dust particles, which may lead to breathing problems and a major risk of engine damage if the filter element is damaged.



Always wear a protective mask when servicing the air intake system. Do not inhale the dust particles. Consider the environment when carrying out this work.

#### RISK OF PROPERTY DAMAGE

#### NOTICE

Cleaning the engine air filter always entails a risk of damaging it. After cleaning, the engine air filter has poorer dust capacity than a new element.

#### RISK OF PROPERTY DAMAGE

#### NOTICE

Do not clean the inside of the filter housing with compressed air. All maintenance on the air intake system must be carried out while the engine is turned off. The engine air filter is a dry filter element and must not be cleaned with water.

Clean or change the filter element if the low pressure indicator shows red.

Clean around the filter and the top of the tank nearby the filter before you open the clamp units.

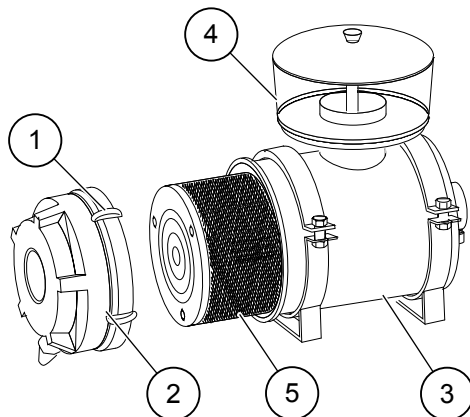


Figure 29. Main filter element

1. Open all of the clamp units (1) and remove the air filter cover (2).
2. Empty out the dust which has collected in the air filter cover and dry the air filter cover using a damp cloth.
3. Remove the element carefully (5).

**NOTE** *The safety cartridge must stay in place.*

4. Clean the inside of the filter housing (3) clean using a damp cloth.
5. Use a flashlight to check from the outside that there are no holes or cracks in the filter paper.
6. To clean the filter element, carefully blow-dry compressed air of maximum 5 bar (72.5 psi) over it from the inside, until no more dust comes out.

**NOTE** *The filter element is a dry filter element and must not be cleaned with water.*

7. After cleaning, write the date of cleaning on the filter element.
8. Discard the filter element:
  - If it has been cleaned four times
  - If it is damaged

9. Put back the filter element and close the air filter cover.
10. Reset the red plunger in the low-pressure indicator by pressing the button.

### 3.11.5 Changing the safety cartridge, all engines

**NOTE** *Never clean the safety cartridge. Do not remove the safety cartridge unnecessarily.*

Replace the safety cartridge (1) if there has been any damage to the main filter.

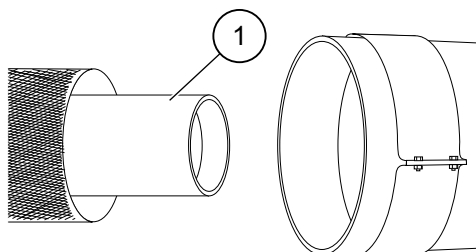


Figure 30. Safety cartridge

1. Disassemble the filter element as in [Cleaning and changing the engine air filter, all engines \(page 50\)](#).
2. Fit in a new safety cartridge.
3. Put back the filter element and close the air filter cover.

### 3.11.6 Checking the air intake system, all engines

The air intake system must be intact. Broken and leaking pipes shorten the life of the engine.

Check the system regularly.

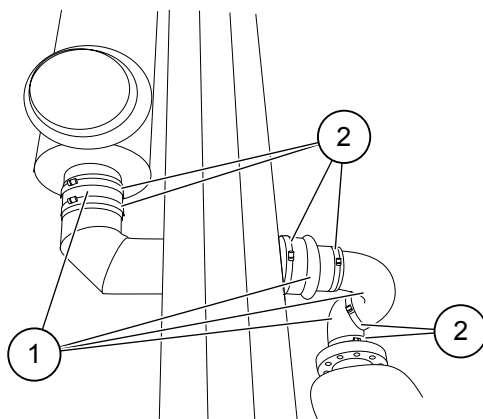
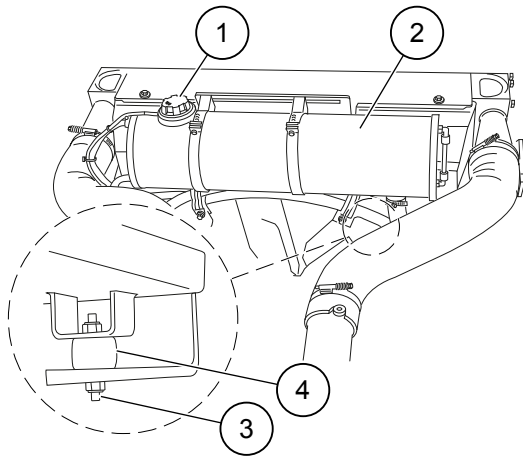


Figure 31. Air intake system

1. Check the hoses (1) for fissures and damage. If necessary, replace them.
2. Make sure that all hose clamps (2) are fit well.
3. Check that the filter housing is intact.

### 3.11.7 Checking the coolant system, all engines



*Figure 32. Cooling system*

1. To discover leaks and cracks, check all the hoses by pressing them. When in doubt, replace the hoses.
2. Check the radiator for damages and leaks, and that there are no deposits.
3. Check the functioning of the cabin heater.
4. Check the coolant in terms of:
  - Level
  - Freezing points
  - Any contaminations
5. Replace the coolant if it is not clean and clear.
6. Check the rubber suspensions (3) in the radiator mounting brackets at the bottom of the radiator. Replace the rubber mounts as necessary.
7. Ensure that the fixing bolts (4) are tightened.

### 3.11.8 Changing the coolant, all engines



**WARNING! HOT FLUID HAZARD**

Hot coolant may spray from the refill, which may cause a risk of serious injury. Allow engine to cool and release pressure before opening the filler cap.

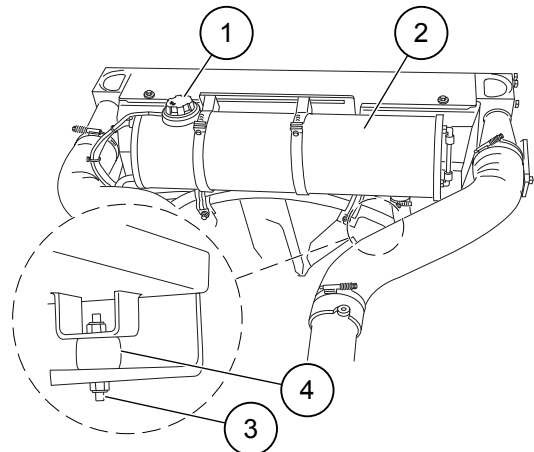


**WARNING! HIGH PRESSURE HAZARD**

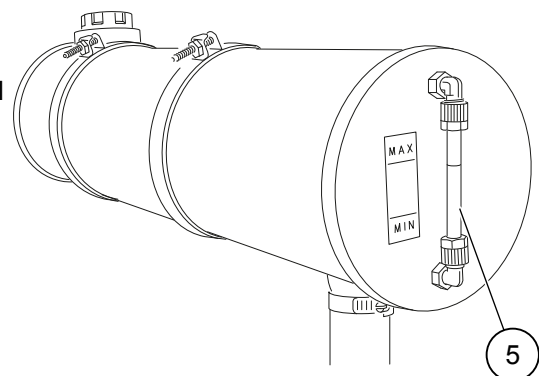
The system may be under pressure even if it is not of the high-pressure type. The coolant may be under pressure and hot, which may cause serious injury.

Open the filler cap slowly.

1. Remove the cap on the expansion tank (1).  
First turn 1/4 to ensure that the system is not under pressure when the filler cap is removed.



2. Refill the expansion tank (2) with coolant.
3. If necessary, replace the coolant.  
Drain the whole system using the drain tap on the side of the radiator when replacing hoses and components in the system.
4. Switch on the ignition to adjust the temperature for the cabin heater to maximum. After adjusting the temperature, switch off the ignition.
5. Place a receptacle under the drain valve.
6. Open the drain tap and drain the whole system.
7. Close the tap.
8. Fill through the filler cap on the expansion tank (1) to the maximum level.
9. Start the engine and run on idle.
10. Observe the level and fill as necessary.
  - When the operating temperature has been reached, the level stabilizes.
  - The level should be at the maximum level indicator on the side of the expansion tank (5).



11. Refit the filler cap.

### 3.11.9 Cleaning the radiator, intercooler, and oil coolers, all engines



#### WARNING! HOT SURFACE HAZARD

If you touch the radiator and coolers when they are hot, the heat may cause serious injury.



Only clean the radiator and coolers when the engine has been turned off and cooled down. Do not apply cold water on hot surface.

#### RISK OF PROPERTY DAMAGE

#### NOTICE

If you use a high-pressure steam cleaner, it may damage the fins of the radiator, intercooler, and oil coolers.

Use dry, compressed air.

To clean the radiator, intercooler, and oil coolers, use dry compressed air.

1. Blow against the direction of the fan.  
The radiator, intercooler, and oil coolers must not be cleaned with high-pressure water. In extreme cases, solvents or a jet of steam can also be used with great care.
2. Allow the solvent time to penetrate. Rinse off with water.
3. Run the engine warm so that surplus water evaporates and does not cause corrosion.

### 3.11.10 Checking the drive belts, all engines

If the drive belts (1) are oily, worn, or damaged, they must be replaced.

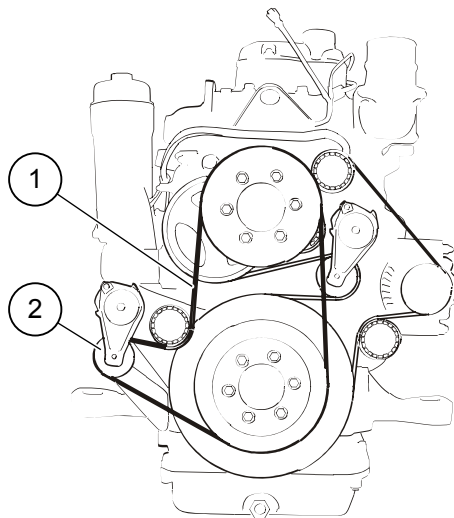


Figure 33. Drive belts

1. Check that the automatic belt tensioners (2) function and maintain the tension in the belts.
2. Loosen the screws that keep the alternator in place when tightening the alternator belt.
3. Check the belt after the operation when it is hot.  
It should be possible to depress the belt 3–4 mm (0.12–0.16 in) between the pulleys.

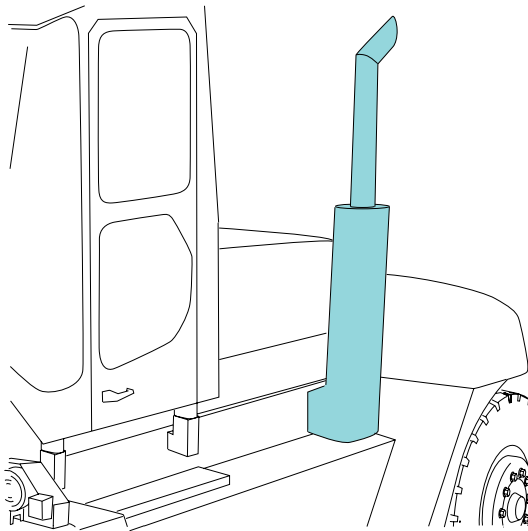
### 3.11.11 Checking the exhaust system, all engines



**WARNING! HOT SURFACE HAZARD**

Touching the exhaust system while it is hot may cause serious injury.

Wait until the exhaust system has cooled down before starting work.



*Figure 34. Exhaust system*

1. Check the overall condition of the exhaust system, replace pipes or the muffler if they are leaking due to corrosion.
2. Check all joints and bolted joints.
3. Check the exhaust manifold.
4. Check the suspension of the muffler. Replace if necessary.
5. Start the engine.
6. Check for any leaks in the exhaust system.

### 3.11.12 Checking the valve clearance, all engines

**NOTE** *Check the valve clearance when the engine is cold. Follow the instructions in the engine manufacturer's instruction book.*

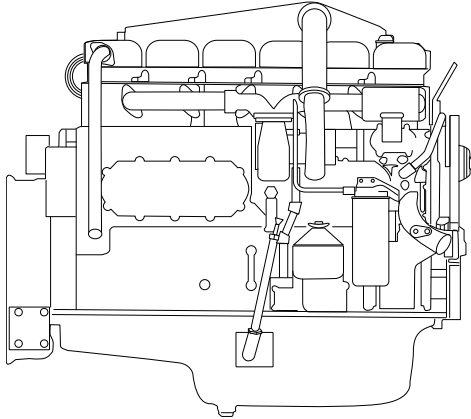


Figure 35. Valve clearance

### 3.11.13 Checking the fuel system and fuel injectors, all engines

#### RISK OF DAMAGE TO THE MACHINE

#### NOTICE

The fuel injectors must be checked and adjusted by a Konecranes Lifttrucks authorized dealer who has the necessary special equipment.

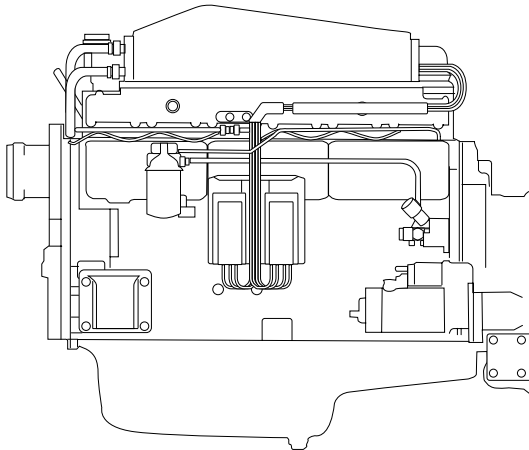


Figure 36. Fuel system and fuel injectors

1. Check the fuel system for leakage.

## 3.12 Maintaining the Volvo engines

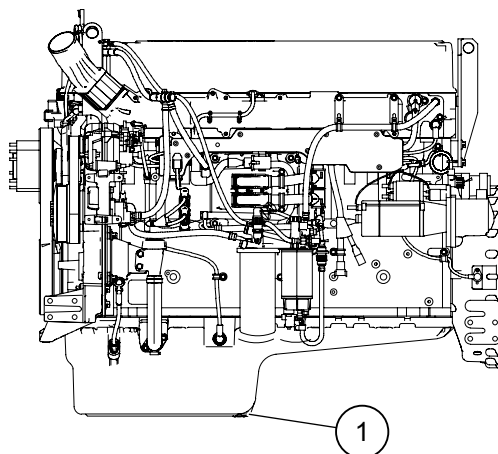
This chapter includes the instructions specific to Volvo engines.

### 3.12.1 Changing Volvo engine oil and oil filter

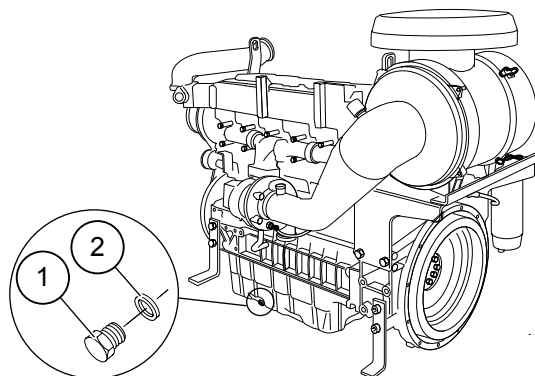
#### Changing the Volvo engine oil

**NOTE** *Drain the oil when it is at the operating temperature, at least 65°C (149°F).*

1. Place a receptacle underneath the drain plug (1).



*Figure 37. Changing the engine oil, all engines except Volvo TAD 560, 561, 762 VE*



*Figure 38. Changing the engine oil, Volvo TAD 560, 561, 762 VE*



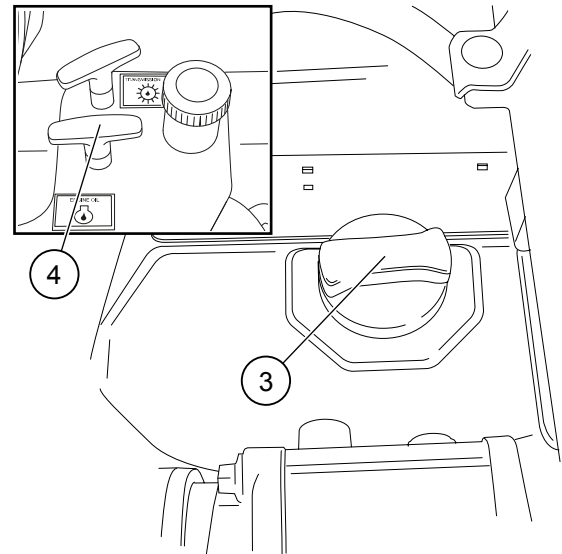
**WARNING! HOT FLUID HAZARD**

**Hot engine oil may cause serious personal injury.**

**To avoid burns, use care in opening the drain plug.**

2. Unscrew the drain plug (1).
3. Allow the oil to run out.
4. Check that the seal is not damaged.  
If necessary, renew the seal (2) (Volvo TAD 560, 561, 762, VE).
5. Fit the drain plug.
6. Tighten up the drain plug (1).

7. Remove the filler cap (3).



8. Pour oil through the opening.
9. Check the oil level using the dipstick (4). Fill with the recommended oil. Make sure that the oil level is between the minimum and maximum marks on the dipstick. Do not fill above the maximum oil level.
10. Check that there are no leaks from the drain plug or the oil filter.
11. Start the engine and check that there is no warning symbol for low oil pressure on the display.
12. To check the oil level, turn off the engine and check the oil level after 1 min.
13. Refit the filler cap (3).

## Changing the engine oil filter: Volvo TAD 560, 561, 762 VE

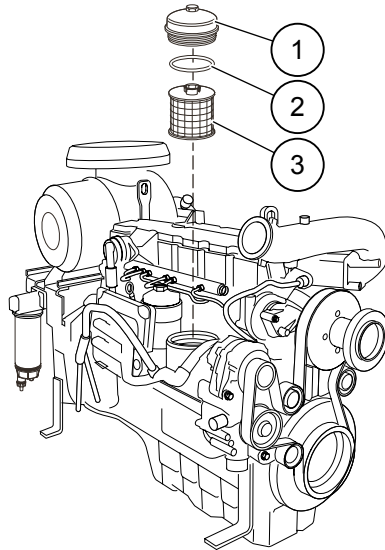
### **WARNING**



#### **HOT OIL AND HOT SURFACES HAZARD**

**Risk of personal injury.**

**Use protective gloves.**



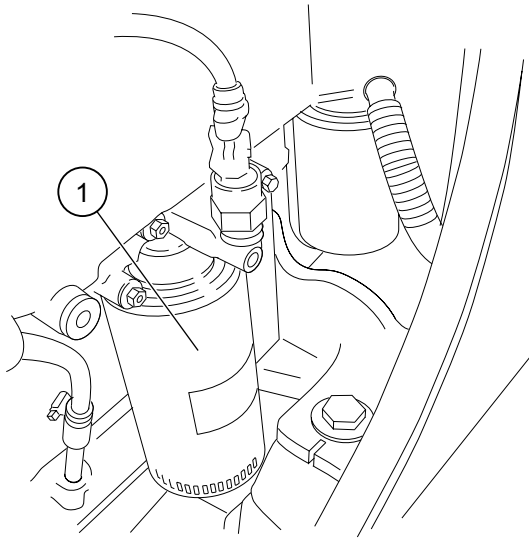
1. Clean around the oil filter.
2. Place a receptacle under the filter unit.
3. Remove the oil filter cover (1), O-ring (2), and filter (3).
4. Fit a new filter (3) and a new O-ring (2).
5. Install the filter cover (1) and tighten to 25 Nm (18.4 lbf ft).
6. Check the seals around the oil filters.
7. Top up with engine oil, start the engine, and let it run for 20–30 s.
8. Turn off the engine, check the oil level, and top up as required.

## Changing engine oil filter: Volvo TAD 620, 722, 660, 760 VE

 **WARNING****HOT OIL AND HOT SURFACES HAZARD**

Risk of personal injury.

Use protective gloves.

*Figure 39. Changing engine oil filter: VOLVO TAD 620, 722, 660, 760 VE*

1. Remove and dispose of the old filter (1).
2. Lubricate the rubber seal and fit a new filter.
3. Secure the filter by hand.

**NOTE** *Never use tools. The filter could get damaged and the circulation obstructed.*

4. Check the seals around the oil filters.
5. Top up with engine oil, start the engine, and let it run for 20–30 s.
6. Turn off the engine, check the oil level, and top up as required.

## Changing the engine oil filter: Volvo TAD , 1340, 1360, 1361 VE

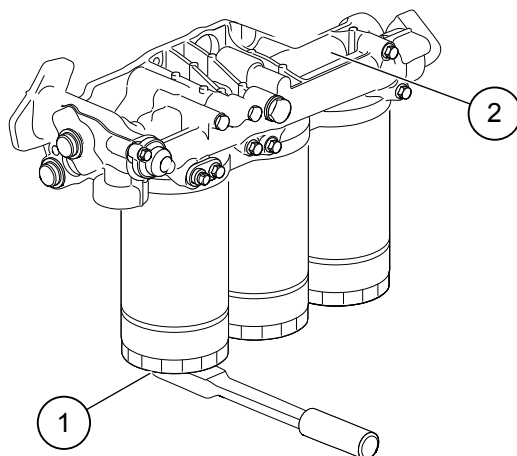
### **WARNING**



#### **HOT OIL AND HOT SURFACES HAZARD**

**Risk of personal injury.**

**Use protective gloves.**

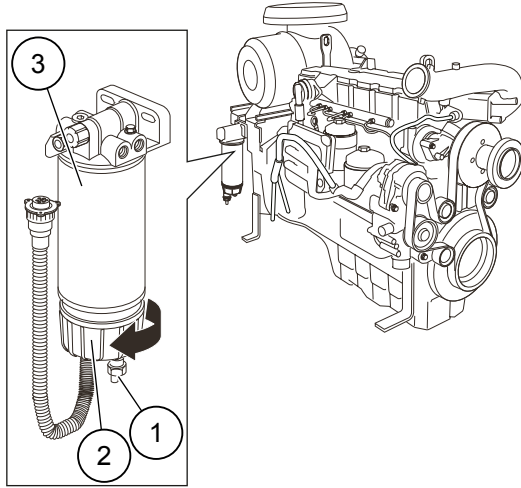


1. Clean the oil filter bracket (2).
2. Remove all oil filters with a suitable oil filter extractor (1).
3. Clean the mating surface of the oil filter bracket.
  - 3.1 Make sure that no remnants of old oil seal are left behind.
  - 3.2 Carefully clean round the inside of the protective rim (2) on the oil filter bracket.
4. Put a thin layer of engine oil on the seals of the new oil filters.
5. Install the new oil filters.
  - 5.1 Tighten the two full-flow filters (on the right of the illustration) 1/2–3/4 of a turn after they bottom.
  - 5.2 Tighten the bypass filter 3/4–1 turn after it bottoms.
6. Check the seals around the oil filters.
7. Top up with engine oil, start the engine, and let it run for 20–30 s.
8. Turn off the engine, check the oil level, and top up as required.

### 3.12.2 Volvo fuel system

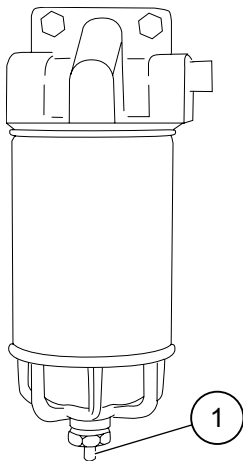
#### Draining the Volvo fuel prefilter

##### Draining the fuel prefilter: Volvo TAD 560, 561, 762 VE



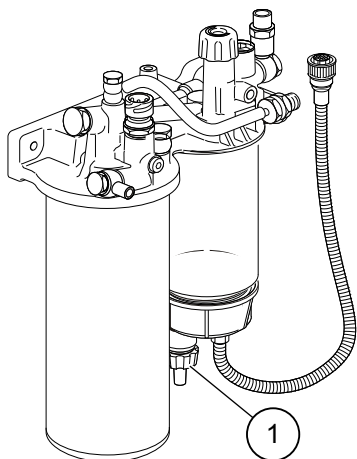
1. Stop the engine and close the fuel tap.
2. Put a container under the fuel prefilter (1) to collect any spillage.
3. Open the drain valve (1) and drain off fuel and water.
4. Unscrew the water separator (2) from prefilter (3).
5. Clean and refit the water separator (2).
6. Close the drain valve (1) and open the fuel tap.
7. Bleed the fuel system, see [Bleeding the fuel system: Volvo TAD 560, 561, 762 VE \(page 68\)](#).
8. Start the engine and check for leaks.

##### Draining the fuel prefilter: Volvo TAD 620, 722, 660, 760 VE



1. Put a receptacle under the fuel prefilter to collect the condensate and fuel.
2. Open the drain valve (1) in the base of the fuel prefilter.
3. Tighten the drain tap (1) when fuel without water starts to run out.

### Draining the fuel prefilter: Volvo TAD 1340, 1360, 1361 VE



1. Put a receptacle under the fuel prefilter to collect the condensate and fuel.
2. Open the drain valve (1) in the base of the fuel prefilter.
3. Tighten the drain tap (1) when fuel without water starts to run out.

### Changing the Volvo fuel filter

#### Changing the fuel filter: Volvo TAD 560, 561, 762 VE

Replace the fuel filter when the engine is cold.



#### **WARNING! IGNITION HAZARD**

A fuel spill onto a hot surface or an electrical component can cause a fire, which could lead to a risk of personal injury or death.

When carrying out work on the fuel system, make sure that the engine is cold. Store fuel-soaked rags so that they cannot cause fire.

Do not fill the new fuel filter with fuel before assembly. There is a risk that contamination could get into the system and cause malfunctions or damage.

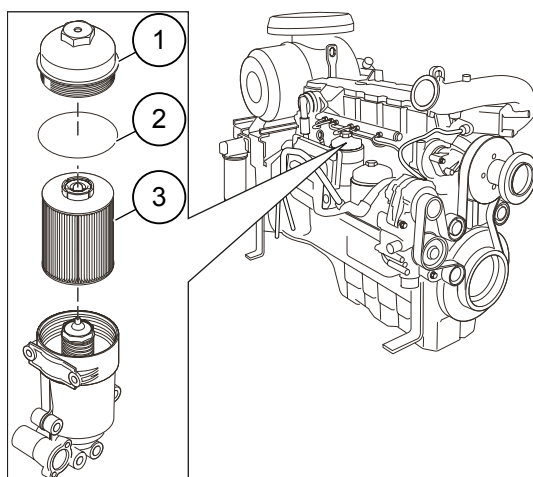


Figure 40. Changing the fuel filter

1. Clean round the fuel filter.
2. Place a receptacle under the fuel filter to collect any spilled fuel.
3. Remove the filter cover (1), O-ring (2), and old filter (3).
4. Install a new filter (3) and new O-ring (2).

5. Refit the filter cover (1).
6. Where necessary, bleed the fuel system.  
For more information, see *Bleeding the Volvo fuel system*.
7. After a test-drive, make sure that there are no leaks.

#### RISK OF DAMAGE TO THE MACHINE

#### NOTICE

A leaking seal allows air to enter the system and thus prevent the flow of fuel from the tank to the fuel pump.

Always use original parts when replacing the filters.

#### Changing the fuel filter: Volvo TAD 620, 722, 660, 760 VE

Replace the fuel filter when the engine is cold.

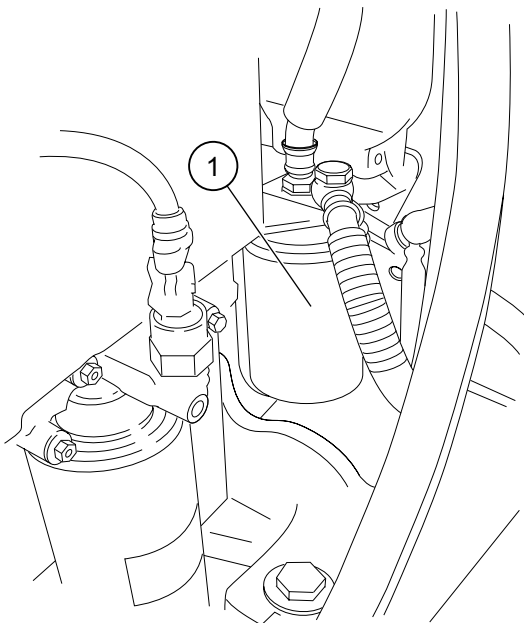
#### WARNING! IGNITION HAZARD



A fuel spill onto a hot surface or an electrical component can cause a fire, which could lead to a risk of personal injury or death.

When carrying out work on the fuel system, make sure that the engine is cold. Store fuel-soaked rags so that they cannot cause fire.

Do not fill the new fuel filter with fuel before assembly. There is a risk that contamination could get into the system and cause malfunction or damage.



1. Clean round the fuel filter.
2. Remove the filter with a suitable filter remover. Collect any spilled fuel in a receptacle.
3. Loosen the fuel filter with a filter wrench.
4. Unscrew and remove the filter by hand.
5. Check that the new filter and the covers are in good condition.
6. Lightly lubricate the new seals with fuel.
7. Screw in the new filters by hand until the seals are in contact with the screw cap.
8. Turn the filters a half circle by hand.
9. If necessary, bleed the fuel system.  
For more information, see *Bleeding the Volvo fuel system*.

10. If a water trap is installed, change the filter in it at the same time as the fuel filter.  
Clean the water trap in the plastic bowl under the filter with a soft rag.
11. After a test run, check that there are no leaks.

### Changing the fuel filter: Volvo TAD 1340, 1360, 1361 VE

Replace the fuel filter when the engine is cold.

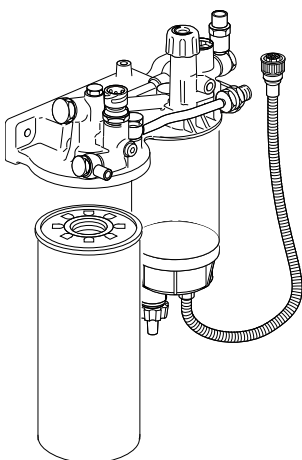


#### **WARNING! IGNITION HAZARD**

**A fuel spill onto a hot surface or an electrical component can cause a fire, which could lead to a risk of personal injury or death.**

**When carrying out work on the fuel system, make sure that the engine is cold. Store fuel soaked rags so that they cannot cause fire.**

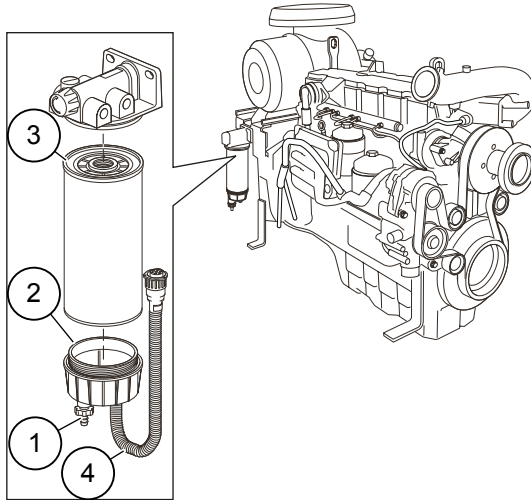
Do not fill the new fuel filter with fuel before assembly. There is a risk that contamination could get into the system and cause malfunctions or damage.



1. Clean round the fuel filter.
2. Remove the filter with a suitable filter remover. Collect any spilled fuel in a receptacle.
3. Clean the filter mating surface on the filter bracket.
4. Lubricate the seal with diesel fuel and install the new fuel filter. Tighten the fuel filter in accordance with the instructions on the fuel filter.
5. If necessary, bleed the fuel system. For more information, see *Bleeding the Volvo fuel system*.
6. If a water trap is installed, change the filter in it at the same time as the fuel filter.  
Clean the water trap in the plastic bowl under the filter with a soft rag.

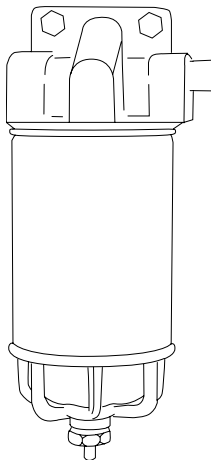
## Changing the Volvo fuel prefilter

### Changing the fuel prefilter: Volvo TAD 560, 561, 762 VE



1. Carefully clean around the prefilter and water separator.
2. Put a receptacle under the fuel prefilter to collect the condensate and fuel.
3. Tighten the drain valve (1).
4. Remove the hose (4) from sensor for the water separator.
5. Remove the lower part of the water separator (2).
6. Remove the prefilter (3) using a filter wrench.
7. Clean the mating surfaces and grease the gasket surfaces.
8. Fit a new prefilter (3).
9. Install the lower part of water separator (2) and new seal.
10. Bleed the fuel system. For more information, see *Bleeding the Volvo fuel system*.
11. Start the engine and check for leaks.

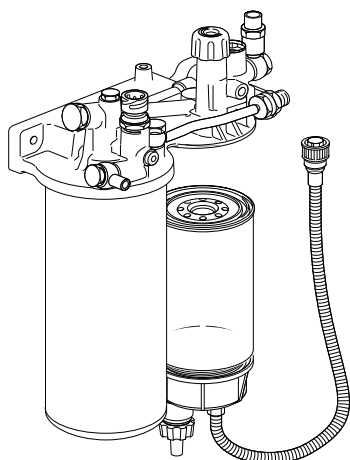
### Changing the fuel prefilter: Volvo TAD 620, 722, 660, 760 VE



1. Undo the cable from the water trap sensor.
2. Remove the water trap filter from the filter bracket. Collect any spilled fuel in a receptacle.
3. Remove the lower part of the water trap from the filter.

4. Clean the lower part of the water trap with a soft rag.  
Check that the drain hole in the lower part is not blocked.
5. Install a new seal on the lower part and lubricate the seal with diesel fuel. Reinstall the lower part of the new filter.
6. Lubricate the seal with diesel fuel.
7. Screw the new filter onto the filter bracket by hand until the rubber seal just touches the mating surface.  
Then tighten a further half turn, no more.
8. Connect the cable to the water trap sensor.
9. If necessary, bleed the fuel system.  
For more information, see *Bleeding the Volvo fuel system*.

### Changing the fuel prefilter: Volvo TAD 1340, 1360, 1361 VE



1. Undo the cable from the water trap sensor.
2. Remove the water trap filter from the filter bracket. Collect any spilled fuel in a receptacle.
3. Remove the lower part of the water trap from the filter.
4. Clean the lower part of the water trap with a soft rag.  
Check that the drain hole in the lower part is not blocked.
5. Install a new seal on the lower part and lubricate the seal with diesel fuel. Reinstall the lower part of the new filter.
6. Lubricate the seal with diesel fuel.
7. Screw the new filter onto the filter bracket by hand until the rubber seal just touches the mating surface.  
Then tighten a further half turn, no more.
8. Connect the cable to the water trap sensor.
9. If necessary, bleed the fuel system.  
For more information, see *Bleeding the Volvo fuel system*.

## Bleeding the Volvo fuel system

### Bleeding the fuel system: Volvo TAD 560, 561, 762 VE

Air can enter the fuel system when:

- Fuel tank has run completely dry
- Fuel pipes are replaced
- Fuel filter is replaced

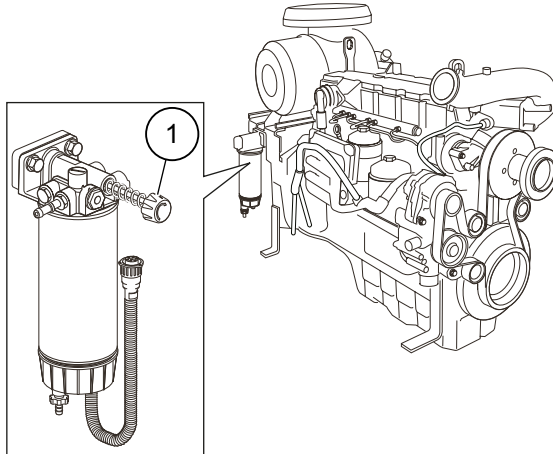


Figure 41. Bleeding the fuel system

1. Open the hand pump (1) by pressing it in and turning it counter-clockwise.
2. Pump the fuel using the hand pump (1) until resistance is felt in the pump.  
To bleed a fuel pipe, at least 250 pump strokes are required. Depending on the installation, more pump strokes may be required for the fuel to come out.
3. Close the hand pump (1).
4. Start the engine and let it idle for at least 5 min before increasing the speed.

### Bleeding the fuel system: Volvo TAD 620, 722, 660, 760 VE

Air can enter the fuel system when:

- Fuel tank has run completely dry
- Fuel pipes are replaced
- Fuel filter is replaced

1. Remove the fuel return line from the pipe.  
Connect a hose to the pipe. Place the other end of the hose into a container that is half filled with fuel.
2. Run the engine at 800–1000 rpm.  
Single bubbles can appear. If the number of bubbles increases or foam is built up, there is air in the system.
3. Remedy by tightening all connections.

### Bleeding the fuel system: Volvo TAD 1340, 1360, 1362 VE

1. The system does not need to be bled unless it has been run completely dry. In such a case, bleed the system with the hand pump on the fuel filter bracket.

## 3.13 Maintaining the Scania engines

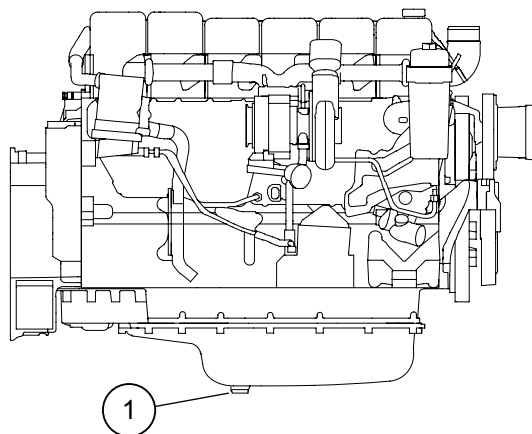
This chapter includes the maintenance instructions for the SCANIA engines.

### 3.13.1 Changing the Scania engine oil and oil filter

**Changing the engine oil: Scania DC13 - 74A, 76A, Scania DC13 - 77A, 81A, Scania DC13 - 084-384A, 087-387A**

**NOTE DRAIN THE OIL WHEN IT IS AT THE OPERATING TEMPERATURE.**

1. Place a receptacle underneath the drain plug (1).



2. Unscrew the drain plug.

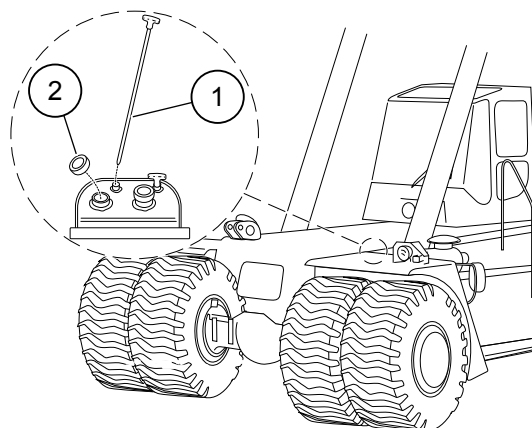


**WARNING! WARNING! HOT FLUID HAZARD!**

**Hot engine oil may cause serious personal injury.**

**To avoid burns, use care in opening the drain plug.**

3. Allow the oil to run out.
4. Check that the seal is not damaged.  
If necessary, renew the seal.
5. Fit the drain plug.
6. Tighten up the drain plug (1).
7. Remove the filler cap (3).



8. Pour oil through the opening.
9. Check the oil level using the dipstick (2). Fill up to the maximum indicator level.
10. Check that there are no leaks from the drain plug or the oil filter.
11. Start the engine, and check that there is no warning symbol for low oil pressure on the display.
12. To check the oil level, turn off the engine and check the oil level after 1 min.

13. Refit the filler cap.

### Cleaning the centrifugal oil cleaner: Scania DC13 - 74A, 76A, Scania DC13 - 77A, 81A, Scania DC13 - 084-384A, 087-387A

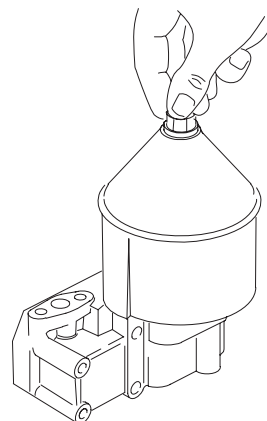


#### WARNING! HOT FLUID HAZARD

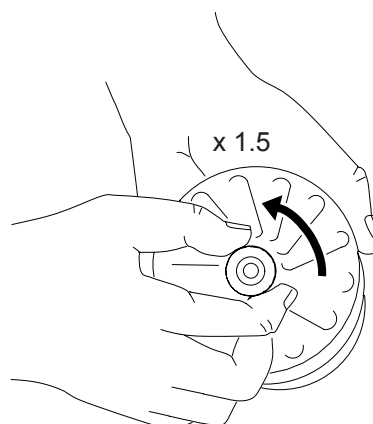
Hot engine oil may cause serious injury.

To avoid burns, use care in opening the cover.

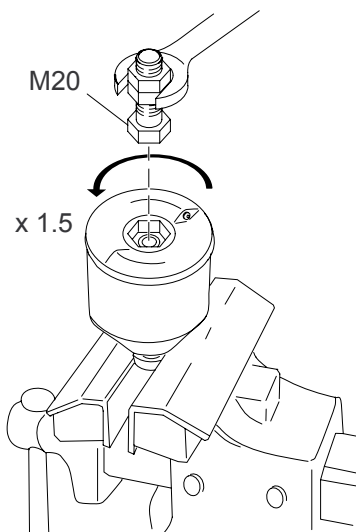
1. Clean the outside of the cover.
2. Unscrew the nut and remove the cover.



3. Lift out the rotor.  
Wipe off the outside of the rotor.  
Unscrew the rotor cover nut about one and a half turns.



4. If the rotor nut is jammed: Turn the rotor upside down and fasten the nut in a vice. Turn the rotor approximately one and a half turns anticlockwise by hand or use an M20 screw as illustrated.



5. Hold the rotor and tap lightly on the rotor nut with a plastic mallet or against the workbench. The rotor cover comes loose from the bottom plate.

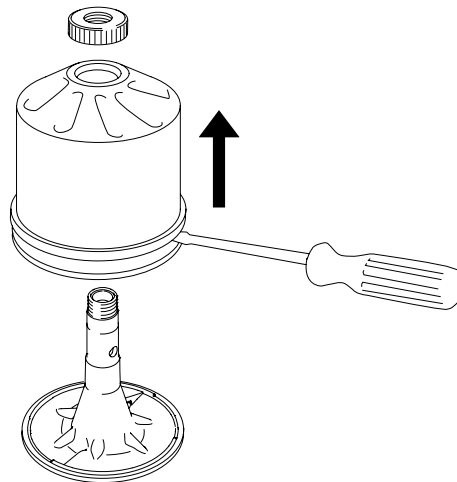
**RISK OF DAMAGE TO THE MACHINE**

**NOTICE**

If you hit the rotor, the hit may damage the bearings.

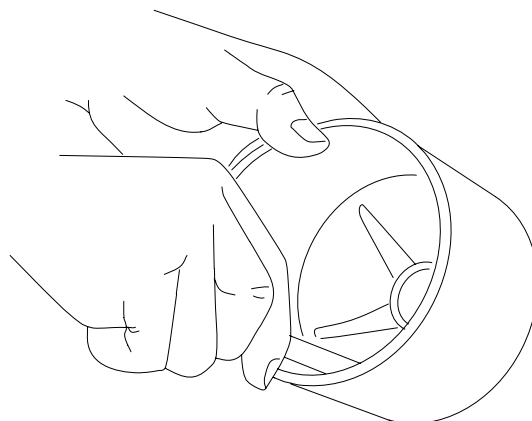
Do not hit the rotor.

6. Remove the strainer from the rotor cover. If the strainer is stuck, insert a screwdriver between the rotor cover and strainer and carefully prise them apart.



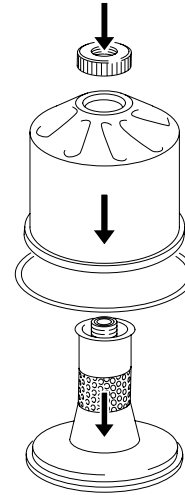
7. Scrape away the deposits inside the rotor cover with a knife. If there are no deposits, the centrifugal oil cleaner is not working.

Clean more often if deposits are thicker than 28 mm (1.1 in).

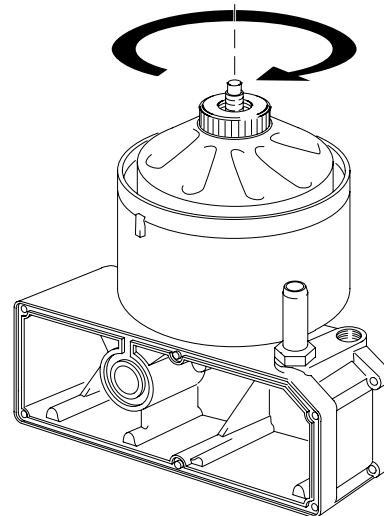


8. Wash the parts in diesel. Inspect the two nozzles on the rotor. Ensure that they are not blocked or damaged. Renew any damaged nozzles.
9. Check the bearings to ensure that they are not damaged.

10. Fit a new O-ring by sliding it over the strainer.

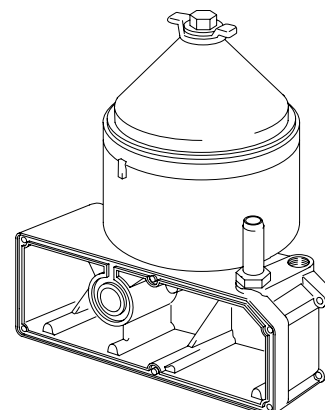


11. Refit the rotor cover.  
Make sure that the O-ring sits correctly on the inside.
12. Tighten the rotor nut by hand.
13. Check that the shaft is not loose.  
If it is, it should be locked using thread-locking fluid. Clean carefully with a suitable solvent.  
Tighten the rotor shaft.
14. Refit the rotor and screw it by hand to make sure that it rotates easily.



15. Renew the O-ring on the centrifugal oil cleaner housing cover.  
Tighten the locknut to 15 Nm (11 lbf ft).

15 Nm



## Changing the engine oil filter: Scania DC13 - 74A, 76A, Scania DC13 - 77A, 81A, Scania DC13 - 084-384A, 087-387A

### WARNING



#### HOT OIL AND HOT SURFACES HAZARD

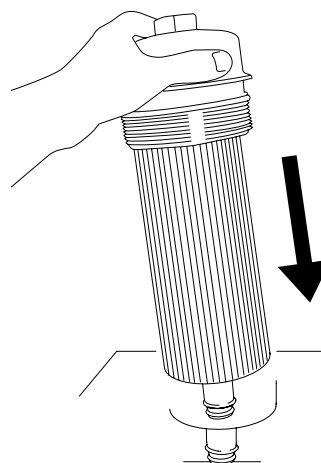
Risk of personal injury.

Use protective gloves.

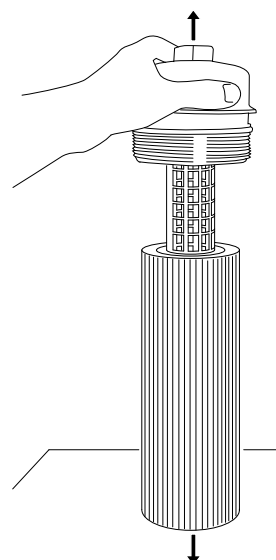
#### NOTE

*Clean the centrifugal oil cleaner when renewing the oil filter. Otherwise the oil filter is blocked and resistance in the filter increases. If this happens, an overflow valve in the filter retainer opens and lets the oil pass without being filtered.*

1. Unscrew the filter cover with a closed tool with hexagon driver, for example 36-mm socket.



2. Lift out the filter cover with filter element. The filter housing drains automatically once the filter has been removed.



3. Detach the old filter from the cover by holding the cover and carefully tapping the entire filter element against something hard. Remember that there may be oil splashes.
4. Fit the new filter and tighten the filter cover to 25 Nm (18 lbf ft).

### 3.13.2 Scania fuel system

**Changing the Scania fuel filter (AdBlue engines): Scania DC13 - 77A, 81A, Scania DC13 - 084-384A, 087-387A**

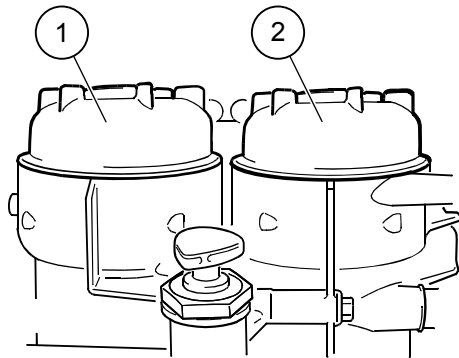


Figure 42. Changing the fuel filter

Engines with XPI (extra-high pressure injection), have dual fuel filters: a fuel prefilter and a fuel filter.

Collect all the fuel that comes out when renewing the fuel filter according to environmental regulations.

#### NOTE

**Start with the water separating suction filter (1). Do not open the fuel filter cover (2) until the filter housing for the fuel prefilter (1) is drained.**

#### RISK OF DAMAGE TO THE MACHINE

#### NOTICE

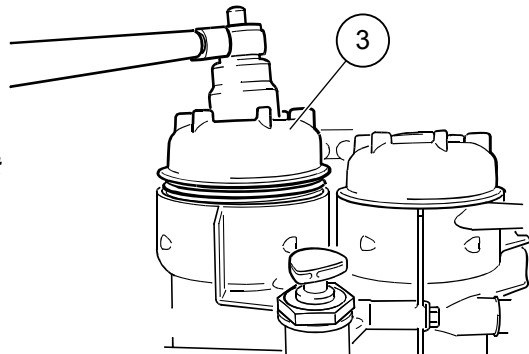
**Using an adjustable spanner or other open tool may damage the filter covers. Do not use an adjustable spanner or other open tool to undo the filter covers.**

To ensure that the filter housings are drained properly, the filter covers must be removed as follows:

1. Make a mark on the water separating suction filter cover (3). Unscrew the cover 3 to 4 turns using a closed tool with hexagon driver.

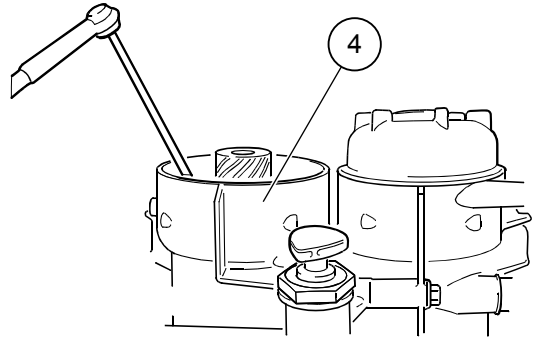
#### NOTE

**Wait a minimum of 2 min to allow as much of the fuel as possible to drain out of the filter housing.**

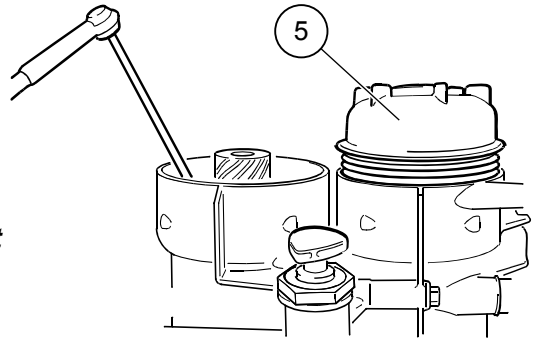


2. Unscrew the filter cover (3) and lift it up slowly with the filter element.
3. Make sure that the suction tool is drained before starting work. Draw out remaining fuel and any particles with the suction tool.

4. Keep the suction tool hose in the filter housing for the water separating suction filter (4).



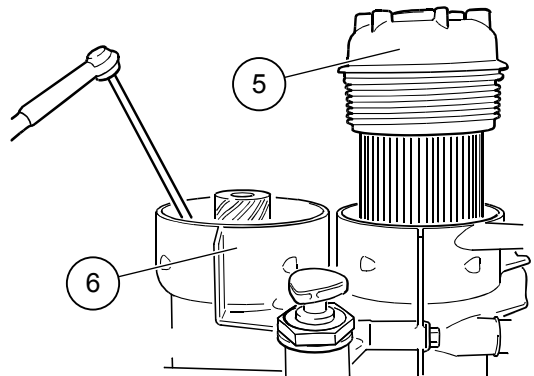
5. Make a mark on the fuel filter cover (5). Unscrew the cover 3 to 4 turns using a closed tool with hexagon driver. Draw out fuel which may drain into the water separating suction filter housing when the fuel filter is detached.



**NOTE**

***Wait a minimum of 2 min to allow as much of the fuel as possible to drain out of the filter housing.***

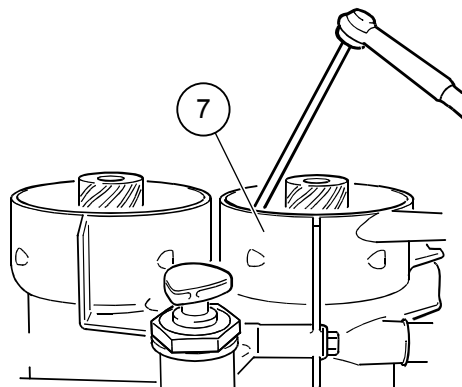
6. Unscrew the fuel filter cover (5) and lift it up slowly with the filter element.
7. Fuel from the fuel filter housing (5) flows into the water separating suction filter housing (6). Leave the suction tool in the water separating suction filter housing (6) until it is drained of fuel.



8. Move the suction tool to the fuel filter housing (7). Draw out remaining fuel and particles.

**NOTE**

***It is important to remove remaining fuel and particles from the filter housings to prevent fuel system contamination.***



9. Undo the old filter elements from the covers by carefully bending them to one side.

## Changing the AdBlue filter: SCANIA DC13 - 77A, 81A, SCANIA DC13 - 084-384A, 087-387A

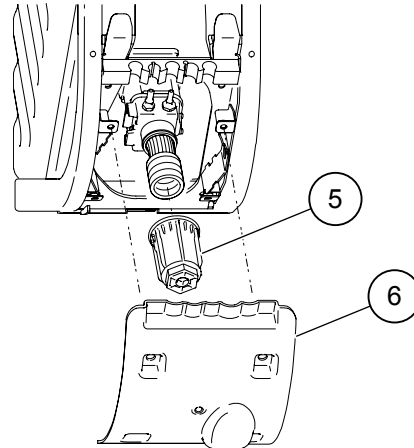


### WARNING! CORROSIVE SUBSTANCE HAZARD

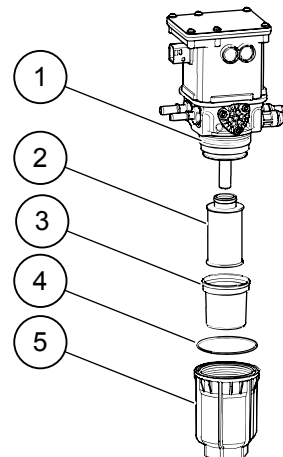
The AdBlue solution may cause skin and eye damage. It is corrosive towards certain metals such as copper and aluminum.

Do not allow AdBlue solution to come in contact with other chemicals. Use protective gloves.

1. Remove the cover (6) on the rear of the reductant tank.



2. Place a suitable container underneath.
3. Unscrew the filter cover (5).  
Use a 46-mm socket.
4. Remove the filter cover and O-ring.
5. Remove the frost protection device (3) and the filter (2).
6. Wipe the pump clean (1).



7. Check that the frost protection device and valve ring are correctly fitted in the new cover.
8. Fit the new filter (2).
9. Fit the new frost protection device (3).
10. Lubricate the threads with the spray.
11. Fit the new O-ring (4) in the new cover (5).
12. Fit the new cover (5) and tighten to 80 Nm (59 lbf ft).

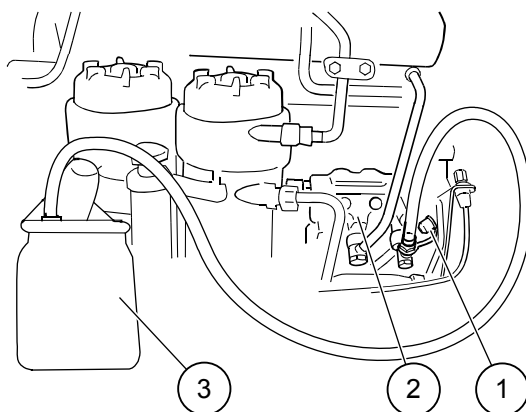
**Bleeding the fuel system: Scania DC13 - 74A, 76A, Scania DC13 - 77A, 81A, Scania DC13 - 084-384A, 087-387A**

Air can penetrate the fuel system when:

- Fuel tank runs empty
- Fuel pipes are disconnected
- Fuel filter is replaced

To bleed the fuel system:

1. Open the bleeder nipple (1) at the high-pressure pump (2) and connect a clear plastic hose from suction tool.



2. Drain the suction tool (3).  
Hold the suction tool straight and draw out a full container of fuel. Bleeding is now complete.
3. Start the engine.

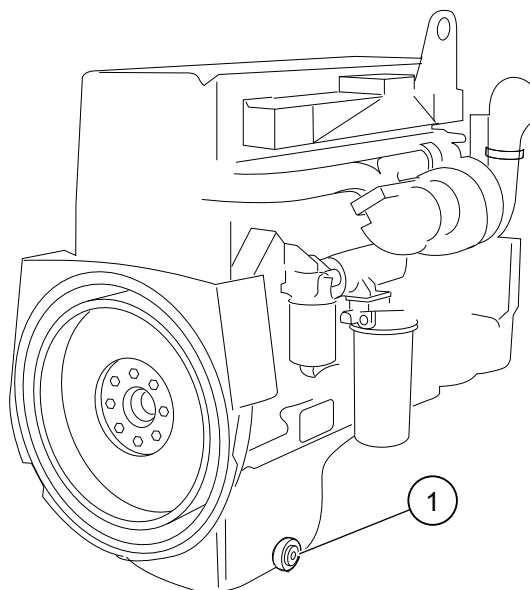
**3.14 Maintaining the Cummins engines**

This chapter includes the maintenance instructions for the Cummins engines.

**3.14.1 Changing the Cummins engine oil and oil filter****Changing the Cummins engine oil**

**NOTE** *Drain the oil when it is at the operating temperature, at least 65°C (149°F).*

1. Place a receptacle underneath the drain plug (1).



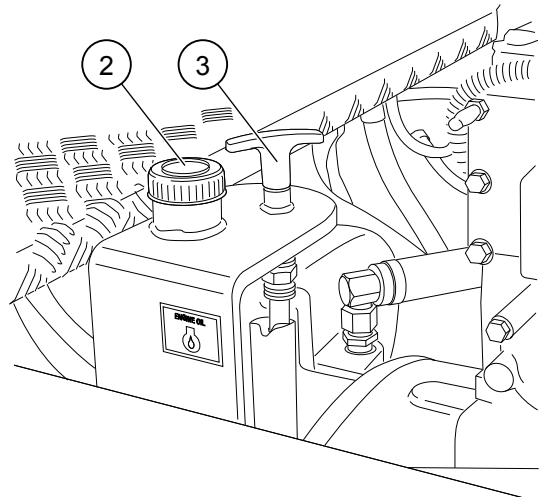
2. Unscrew the drain plug.

**WARNING! HOT FLUID HAZARD**

Hot engine oil may cause serious personal injury.

To avoid burns, use care in opening the drain plug.

3. Allow the oil to run out.
4. Check that the seal is not damaged.  
If necessary, renew the seal.
5. Fit the drain plug.
6. Tighten up the drain plug (1).
7. Remove the filler cap (2).



8. Pour oil through the opening.
9. Check the oil level using the dipstick (3). Fill up to the maximum indicator level.
10. Check that there are no leaks from the drain plug or the oil filter.
11. Start the engine, and check that there is no warning symbol for low oil pressure on the display.
12. To check the oil level, turn off the engine and check the oil level after 1 min.
13. Refit the filler cap.

## Changing the Cummins engine oil filter

### **WARNING**



#### **HOT OIL AND HOT SURFACES HAZARD**

Risk of personal injury.

Use protective gloves.

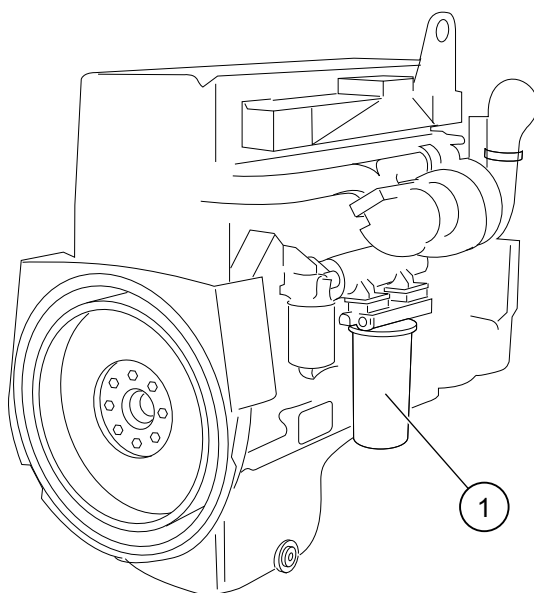


Figure 43. Changing the engine oil filter

1. Remove and dispose of the old filter (1).
2. Lubricate the rubber seal and fit a new filter.
3. Secure the filter by hand.

**NOTE** *Never use tools. The filter could get damaged and the circulation obstructed.*

4. Top up with engine oil, start the engine, and let it run for 20–30 s.
5. Turn off the engine, check the oil level, and top up as required.
6. Check the sealing around the oil filters.

### 3.14.2 Changing the Cummins fuel filter

1. Clean around the fuel filter.
2. Remove the fuel filter with a suitable filter remover. Collect any spilled fuel in a receptacle.
3. Remove the thread adapter seal.  
Clean the gasket surface on the fuel filter head.
4. Lubricate the fuel filter gasket with clean engine oil.
5. Fill the new fuel filter with clean diesel fuel.
6. Install the new thread adapter seal that is supplied with the new filter.
7. Install the filter on the filter head.

8. Turn the filter until the gasket contacts the filter head surface. Tighten the fuel filter in accordance with the instructions of the filter manufacturer.

### 3.15 Maintaining the DANA transmissions

#### 3.15.1 Changing the DANA transmission oil

**NOTE** *Replace the oil when it is at the operating temperature.*

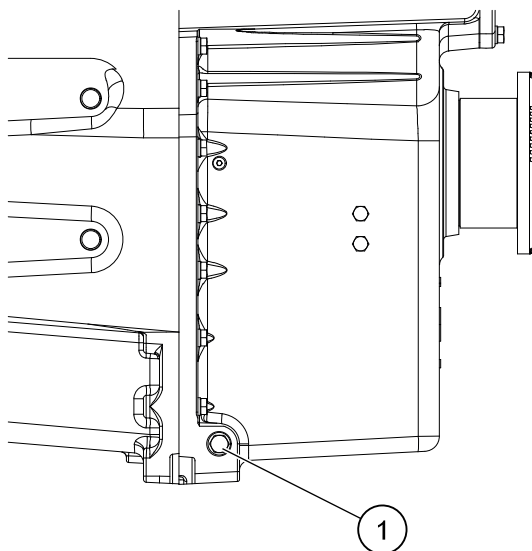


Figure 44. DANA TE30

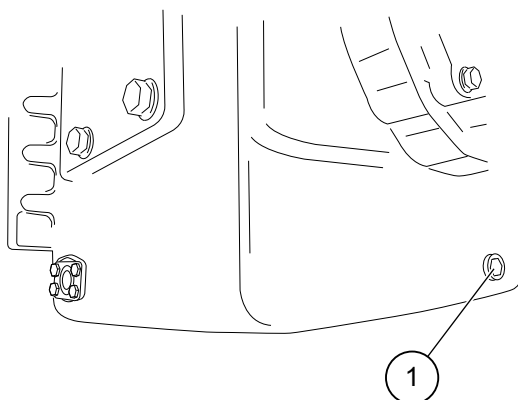


Figure 45. DANA TE27/32,

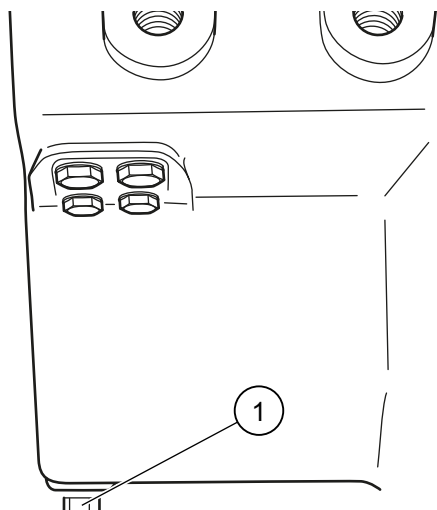


Figure 46. DANA TE17

1. Clean around the drain plug (1).
2. Place a receptacle underneath the drain plug.
3. Remove the drain plug (1) and allow the oil to run out.

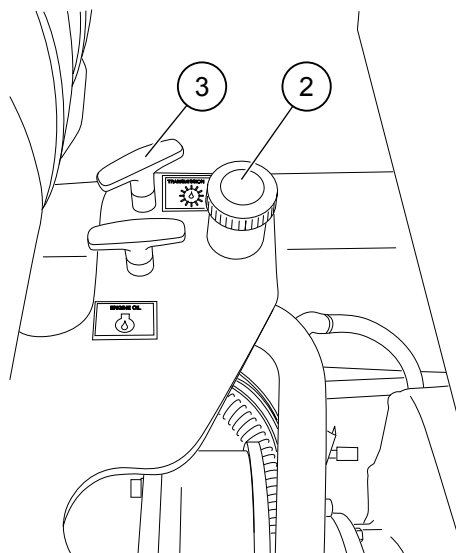


**WARNING! HOT OIL HAZARD**

**Risk of serious personal injury.**

**To avoid burns, use care in opening the drain plug.**

4. Refit the drain plug (1).
5. Change the transmission oil filter.  
For more information, see [Changing the DANA transmission oil filter \(page 82\)](#).
6. Remove the filler cap (2).



7. Fill with the recommended oil to the maximum level indicator on the dipstick (3).
8. To fill the torque converter and pipes, turn the engine on and let it idle for one minute.
9. Check the level of the oil while the engine is still running and then fill up with oil to the minimum indicator.
10. Check the oil level again when the operating temperature has reached 82°C...93°C (179.6°F...199.4°F). Fill to the maximum level indicator.

### 3.15.2 Changing the DANA transmission oil filter

#### RISK OF PROPERTY DAMAGE

#### NOTICE

Handle the filter with care. Do not fit a damaged filter. Make sure that no dirt or sludge penetrates into the transmission.

1. Clean the outside of the filter unit.
2. Place a receptacle underneath the filters (1) to collect any oil.

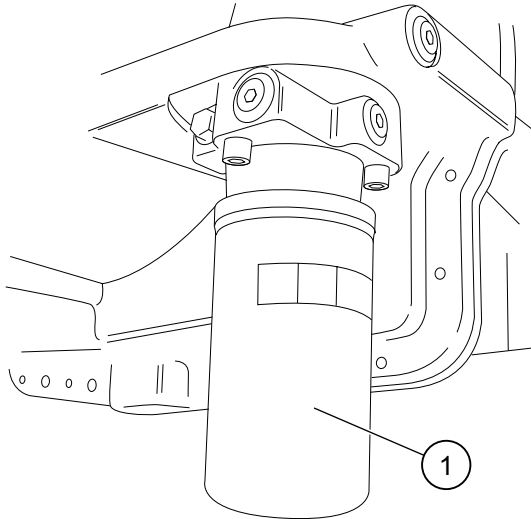


Figure 47. DANA TE17 transmission oil filter

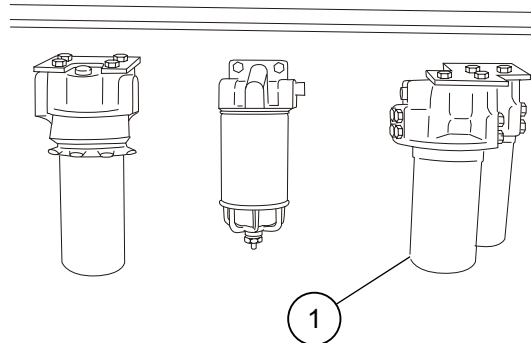


Figure 48. DANA TE27/32, DANA TE30 transmission oil filter

3. Loosen the filters by hand or with a filter wrench.
4. Remove the filters.
5. Check the new filters and the seals.
6. Lightly lubricate the seals with oil.
7. Screw on the filters until the seal is in contact with the filter housing, tighten the filter one half turn by hand at the most.
8. Start the engine and check that there are no leaks.
9. Check the oil level with the dipstick.
10. Switch off the engine.

### 3.15.3 Checking the DANA transmission breather

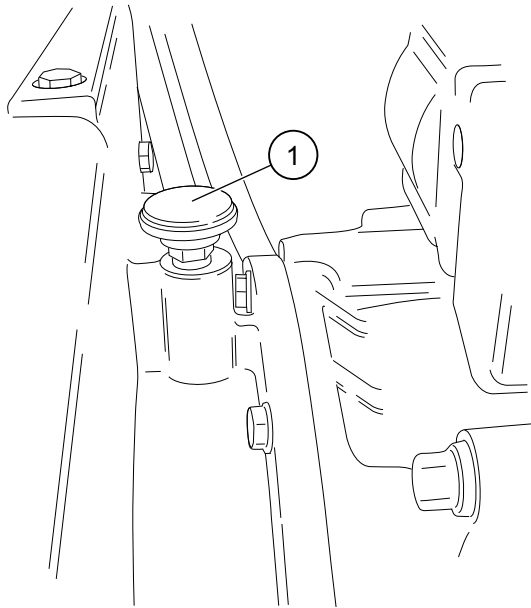


Figure 49. DANA TE17

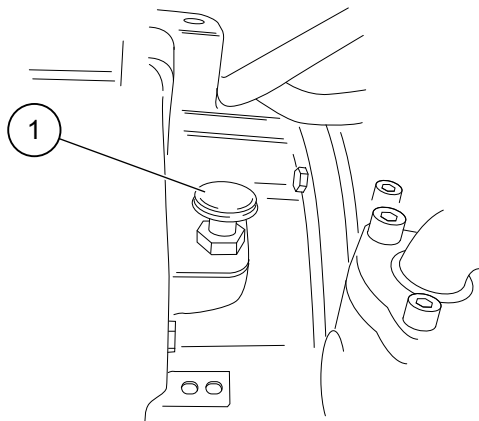


Figure 50. DANA TE27/32, DANA TE30

1. Clean the transmission breather (1) with a cloth.
2. Check that the transmission breather (1) is not clogged.
3. Replace if necessary.  
Unscrew the transmission breather (1) and replace with a new transmission breather.

### 3.15.4 Calibrating the DANA transmission

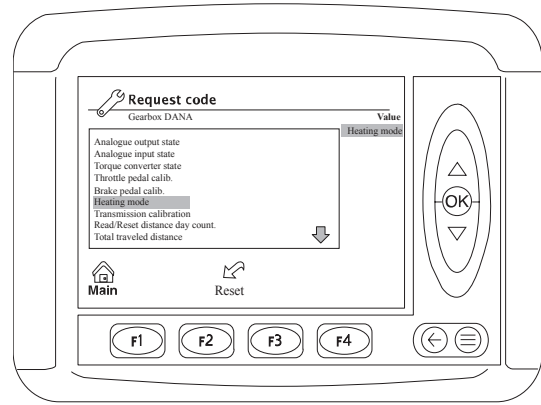
#### Heating up the transmission

Heat up the transmission before the calibration procedure.

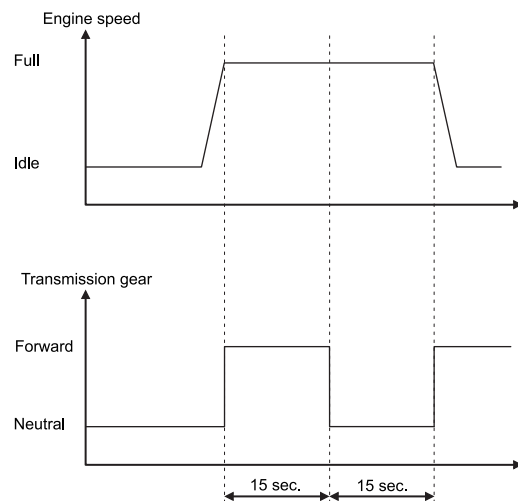
When the heating mode is selected, the following functions are possible:

- Forward or reverse can be selected when the parking brake is activated
  - Inching and declutch are disabled
  - Highest gear is selected automatically
1. To go to the Transmission page, press F2 on the Home page.
  2. To go to the Diagnostic page, press the OK button on the Transmission page.

3. To open the window and highlight the Heating mode, press the OK button.



4. To go to the Transmission page, press ←.
5. Make sure that the parking brake is activated and works properly.
6. To apply the service brakes, use the brake pedal in the cabin.
7. Select driving direction forward.
8. Run the engine at maximum RPM.
9. After about 15 seconds at maximum RPM, select neutral.
10. Continue at maximum RPM.
11. Keep the transmission in neutral at maximum RPM for another 15 seconds. The following figure shows the heating cycle for the transmission.



12. Release the speed pedal and allow the engine to slow down to idle.
13. Repeat the procedure from step 6 until the transmission has reached a temperature of 80°C...90°C (176°F...190°F).
14. You can now calibrate the transmission.

**NOTE** *When the converter output temperature exceeds 120°C (248°F), the engine is reduced to half RPM.*

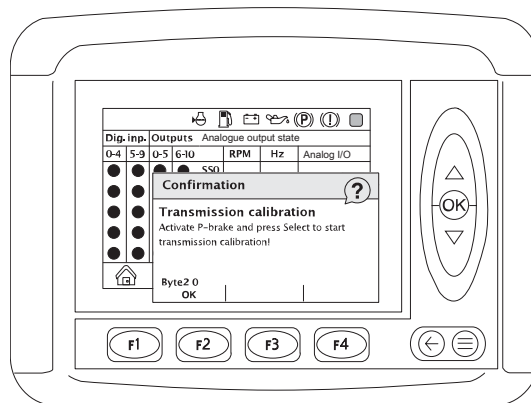
## Activating the DANA transmission calibration

The transmission calibration determines the amount of oil that is required to fill the clutch until the clutch starts to transfer torque.

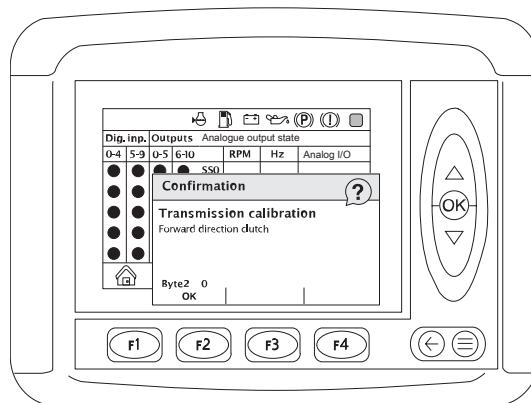
To activate the transmission calibration, the following conditions are required:

- Parking brake must be activated and work properly
- Transmission oil temperature must exceed 60°C (140°F)
- Engine RPM must be 800 RPM  $\pm$  200 RPM

1. Go to the Diagnostic page by pressing  button in the Transmission page.
2. Go to the request code menu by pressing  button again.
3. Select Transmission calibration.  
A confirmation message appears.
4. Press F2 to confirm the message "OK".



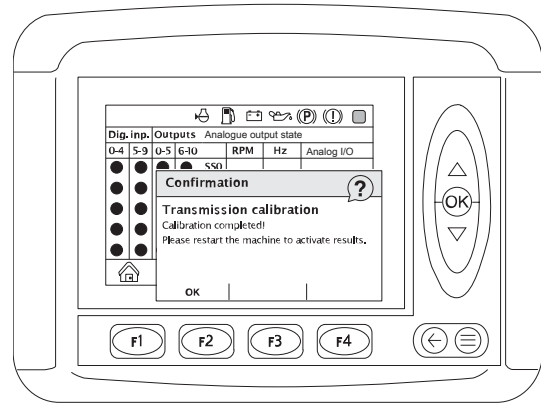
5. To activate transmission calibration, press F3.  
If the temperature is above 60°C (140°F), calibration starts automatically.
6. The calibration automatically calibrates all the clutches in the transmission.  
The calibration takes about 20 min to perform.  
There are totally 5 clutches in TE17 and 6 clutches in TE27/32 transmissions.



7. After finishing the calibration, turn off the ignition and wait for 5–10 s, and then turn on the ignition.  
After the restart, the new settings for gear shifting are activated.

**NOTE**

**Remember to select "OFF" in the request code menu when you are finished with the calibration.**



### 3.16 Maintaining the ZF transmissions

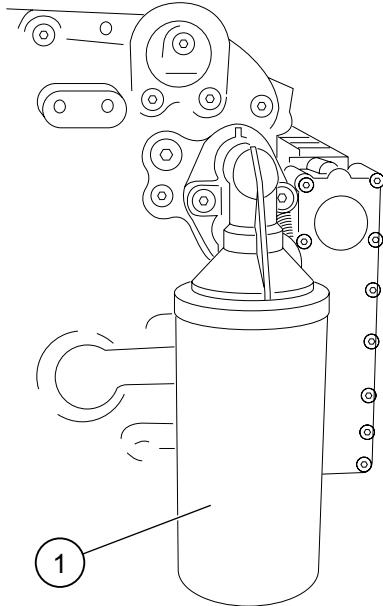
#### 3.16.1 Changing the ZF transmission oil filter

**RISK OF PROPERTY DAMAGE**
**NOTICE**

Handle the filter with care. Do not fit a damaged filter. Make sure that no dirt or sludge penetrates into the transmission.

#### Changing the ZF 171/191 transmission oil filter

1. Clean the outside of the filter unit.
2. Place a receptacle underneath the filters (1) to collect any oil.



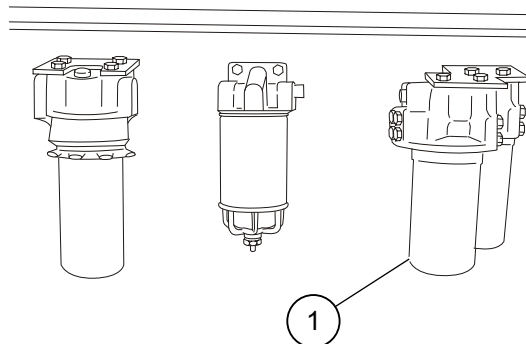
3. Loosen the filters by hand or with a filter wrench.
4. Remove the filters.
5. Check the new filters and the seals.
6. Lightly lubricate the seals with oil.
7. Screw on the filters until the seal is in contact with the filter housing, tighten the filter one half turn by hand at the most.
8. Start the engine and check that there are no leaks.

9. Check the oil level with the dipstick.
10. Switch off the engine.

### Changing the ZF 261/311 transmission oil filter

#### Changing the ZF 261/311 transmission oil filter

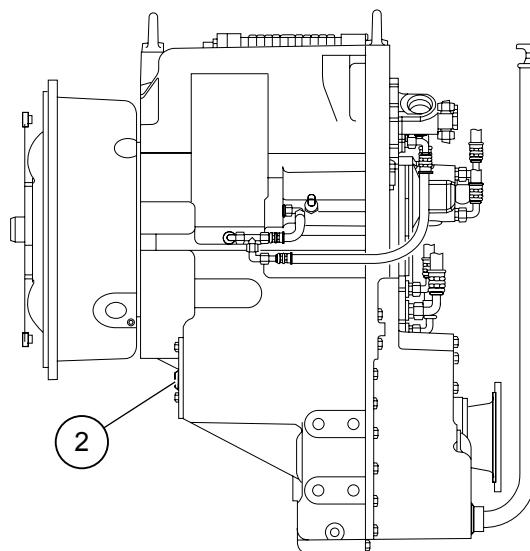
1. Clean the outside of the filter unit.
2. Place a receptacle underneath the filters (1) to collect any oil.



3. Loosen the filters by hand or with a filter wrench.
4. Remove the filters.
5. Check the new filters and the seals.
6. Lightly lubricate the seals with oil.
7. Screw on the filters until the seal is in contact with the filter housing, tighten the filter one half turn by hand at the most.

#### Cleaning the ZF 261/311 transmission oil strainer

8. Clean the transmission oil strainer, if available.
9. Carefully clean the outside of the oil strainer unit.
10. Place a receptacle under the oil strainer (2) to collect any oil.



11. Loosen the oil strainer.  
Make sure that no larger particles (metal pieces or similar) are stuck to the oil strainer.
12. Clean the oil strainer.
13. Slightly lubricate the oil strainer.

14. Fit the oil strainer.
15. Start the engine and check that there are no leaks.
16. Check the oil level with the dipstick.
17. Switch off the engine.

### 3.16.2 Changing the ZF transmission oil

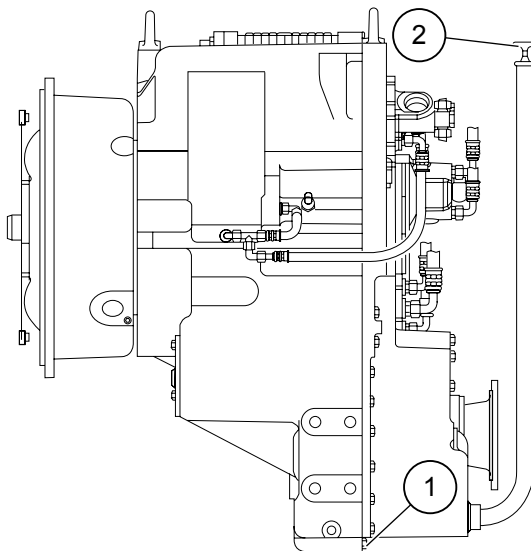
#### **WARNING**



#### **HOT FLUID HAZARD**

**Risk of serious personal injury.**

**To avoid burns, remove the drain plug carefully.**



*Figure 51. Changing the transmission oil*

1. Clean around the drain plug (1).
2. Place a suitable container under the drain plug.
3. Remove the drain plug and allow the oil to drain.
4. Clean the drain plug.
5. Replace the O-ring on the drain plug.
6. Change the transmission oil filter.  
For more information, see [Changing the ZF transmission oil filter \(page 86\)](#).
7. Remove the filler cap (2).
8. Fill with the recommended oil to the maximum level indicator on the dipstick (2).
9. Run the engine on idle for 1 min to fill the torque converter and pipes.
10. Check the oil level when the engine has run for 1 min and then refill to the minimum indicator level.
11. Check the oil level again when the transmission has reached operating temperature and fill to the maximum indicator level.  
See maintenance data for volume.
12. Return the dipstick and the filler cap (2).

### 3.16.3 Calibrating the ZF transmission

#### Heating up the ZF transmission with MDL2

Heat up the transmission before the calibration procedure.

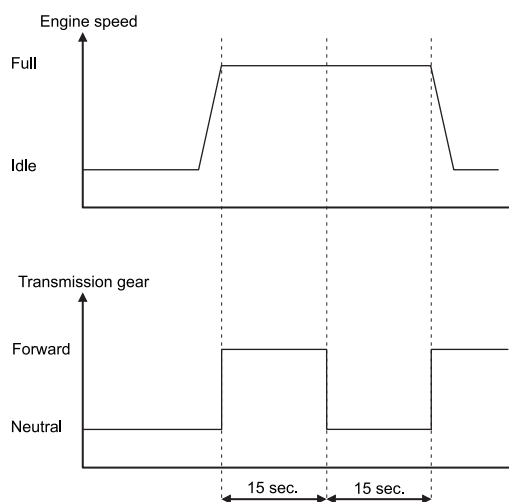
1. Go to the Transmission page by pressing F2 in the Home page.
2. Select manual gear shifting.
3. Select the highest gear.
4. Apply the service brake by using the brake pedal in the cabin.
5. Release the parking brake.



#### WARNING! UNCONTROLLED MOVEMENT HAZARD

**Risk of personal injury or damage to the machine. Only the service brake is in use. Use chocks to block the wheels.**

6. Select driving direction forward.
7. Run the engine at maximum RPM.
8. After about 15 s at maximum RPM, select neutral.
9. Continue at maximum RPM.
10. Keep the transmission in neutral at maximum RPM for another 15 s. The figure shows the heating cycle for the transmission.



11. Release the speed pedal and allow the engine to slow down to idle.
12. Repeat the procedure from step 6 until the transmission has reached a temperature of 80°C...90°C (176°F...190°F).
13. You can now calibrate the transmission.

**NOTE** *When the converter output temperature exceeds 125°C (257°F), the engine is reduced to half RPM.*

#### Heating up the transmission with MD3

Heat up the transmission before the calibration procedure.

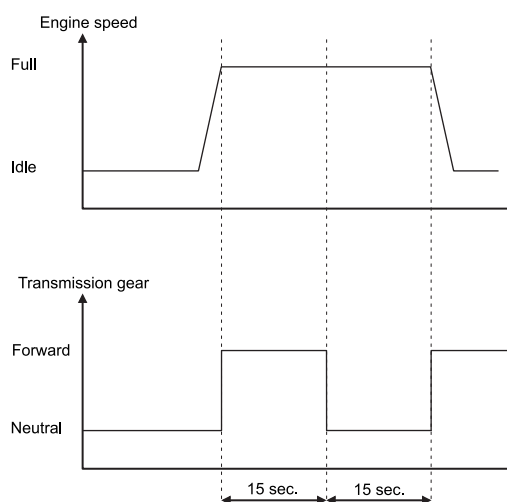
1. Go to the Transmission page by pressing F2 in the Home page.
2. Select manual gear shifting.
3. Select the highest gear.

4. Apply the service brake by using the brake pedal in the cabin.
5. Release the parking brake.


**WARNING! UNCONTROLLED MOVEMENT HAZARD**

**Risk of personal injury or damage to the machine. Only the service brake is in use. Use chocks to block the wheels.**

6. Select driving direction forward.
7. Run the engine at maximum RPM.
8. After about 15 s at maximum RPM, select neutral.
9. Continue at maximum RPM.
10. Keep the transmission in neutral at maximum RPM for another 15 s. The figure shows the heating cycle for the transmission.



11. Release the speed pedal and allow the engine to slow down to idle.
12. Repeat the procedure from step 6 until the transmission has reached a temperature of 80°C...90°C (176°F...190°F).
13. You can now calibrate the transmission.

**NOTE** *When the converter output temperature exceeds 125°C (257°F), the engine is reduced to half RPM.*

### Activating the ZF transmission calibration with MD3

The transmission calibration determines the amount of oil that is required to fill the clutch until the clutch starts to transfer torque.

To activate the transmission calibration, the following conditions are required:

- Parking brake must be activated and work properly
- Transmission oil temperature must exceed 70°C (158°F)
- Engine RPM must be 800 RPM ± 100 RPM

## ! WARNING


**UNCONTROLLED MOVEMENT HAZARD**

**If the parking brake fails the machine can start moving, causing injury.**

**Never leave your seat during calibration. Use the foot brake if the parking brake fails.**

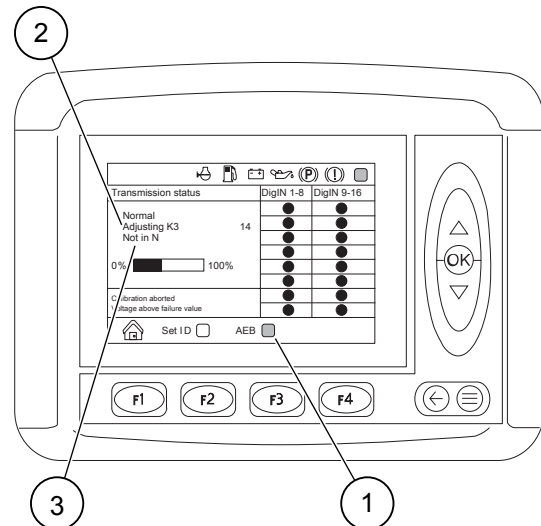
1. To go to the Diagnostic page, press F4 on the Transmission page.

2. To start AEB, press F3.  
The box next to AEB turns green (1), meaning that calibration has started. The display shows what clutch is being adjusted. The AEB main code (2) displays the following options:

- Not selected
- Adjusting K1, K2, K3, K4, KV and KR
- Adjust complete
- AEB canceled
- Abort. while K1, K2, K3, K4 and KV

The AEB sub code (3) displays the following additional information:

- Default
- Fault present
- Not in N
- Apply P-brake
- Speed not 0
- Low oil temp
- High oil temp
- High engine RPM
- Low engine RPM



3. When calibration adjustment is complete, stop AEB by pressing F3.

### 3.16.4 Checking the ZF transmission breather

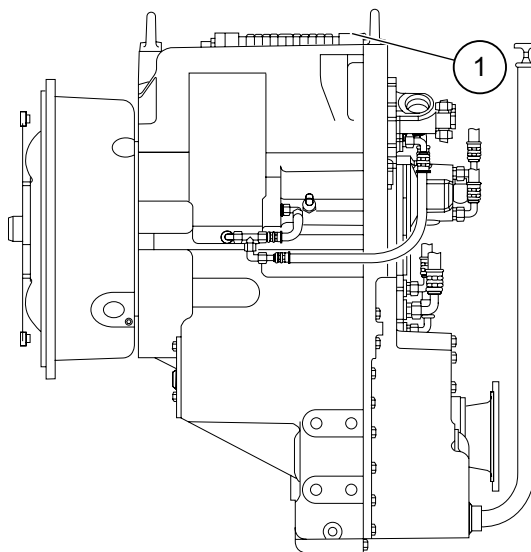


Figure 52. ZF

1. Check that the transmission breather is not clogged.
2. Replace if necessary.  
Unscrew the transmission breather (1) and replace with a new transmission breather.

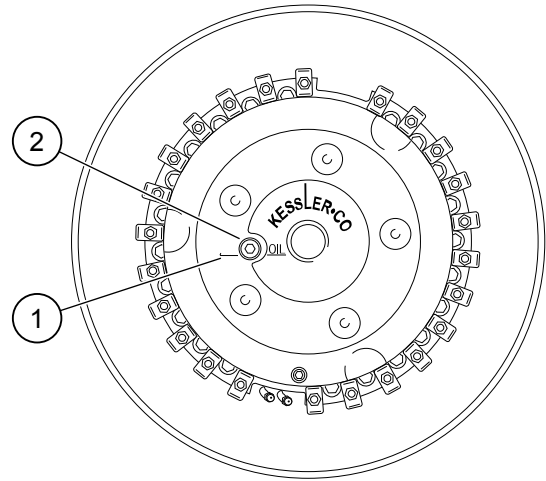
## 3.17 Maintaining the drive axle

### 3.17.1 Checking the drive axle oil level

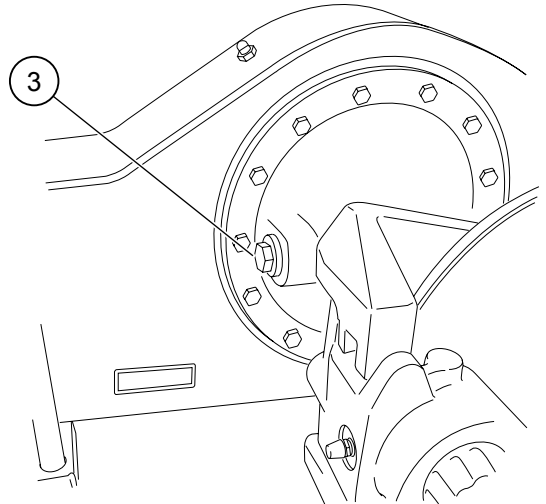
**NOTE** Check the oil level in both hubs and the differential.

1. Park the machine on level ground.

2. Place the machine so that the hub level mark (1) is horizontal.



3. Open the filling and level plugs (2 and 3) and check the oil level.
  - If oil comes out of the filling and level plugs, there is enough oil
  - If oil does not come out of the filling and level plugs, there is not enough oil
4. If there is not enough oil, fill the drive axle through the filling and level plugs (2 and 3).



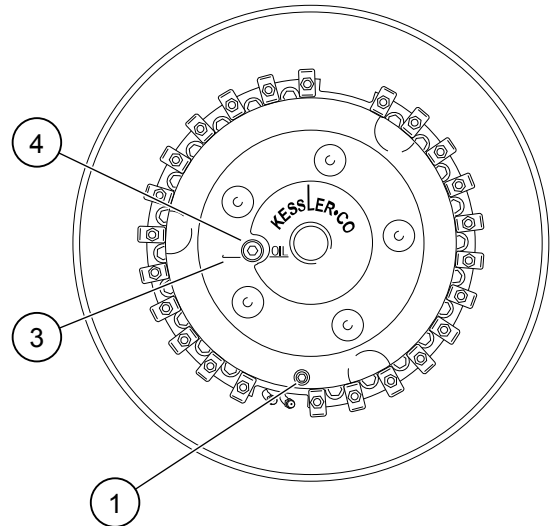
5. Refit the filling and level plugs (2 and 3).

### 3.17.2 Changing the drive axle oil

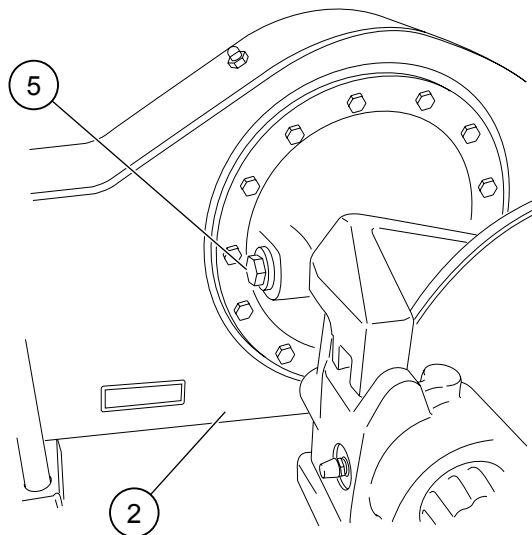
**NOTE** *Change the oil in both hubs and the differential.*

1. Park the machine on level ground.

2. Make a drain hose using a thread which fits through the drain hole (1).

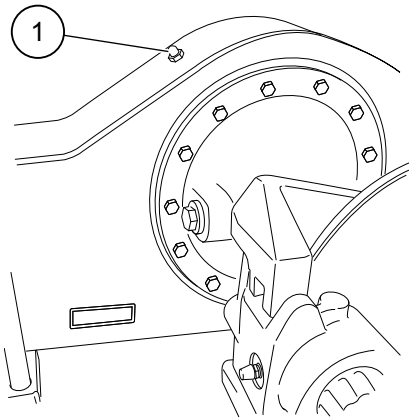


3. Fix the hose in the drain hole while the drain plug is in its uppermost position.
4. Carefully drive the machine forwards or in reverse so that the drain plug returns to its lowest position.
5. Allow the oil to run out through the hose into a receptacle.
6. Repeat the procedure on the other side.
7. Drain the differential through the drain plug (2).  
Because the oil is of high viscosity, drain the oil at operating temperature or over night.



8. Refit all drain plugs (4 and 5).
9. Place the machine so that the hub level mark (3) is horizontal.
10. Fill the drive axle through the filling and level plugs (4 and 5).
11. Refit the filling and level plugs (4 and 5).

### 3.17.3 Checking the drive axle breather



1. Check that the drive axle breather is not clogged.
2. Replace if necessary.  
Unscrew the drive axle breather (1) and replace with a new drive axle breather.

### 3.17.4 Adjusting the parking brake

Adjusting the parking brake is required after installing new brake pads or brake disc, after all repairs, and to improve braking performance. Adjust the parking brake when it is cold. The parking brake must be in the released condition while adjusting.

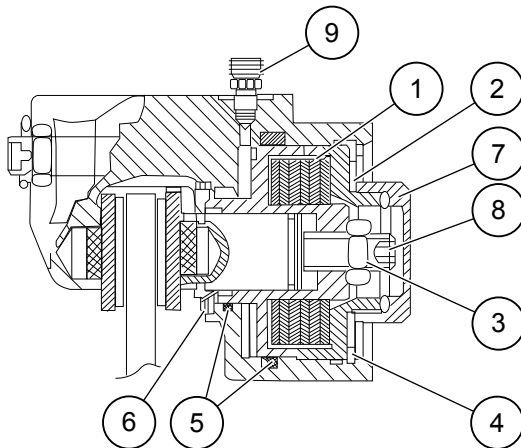


Figure 53. Parking brake

- |                   |                    |
|-------------------|--------------------|
| 1. Spring         | 6. Dust cap        |
| 2. Lock ring      | 7. Screw cap       |
| 3. Locknut        | 8. Adjusting screw |
| 4. Seal           | 9. Bleeder screw   |
| 5. Piston sealing |                    |

1. Park the machine on a level surface.

**NOTE** To prevent the vehicle from moving, block the wheels.

2. To release the parking brake, press the parking brake switch.

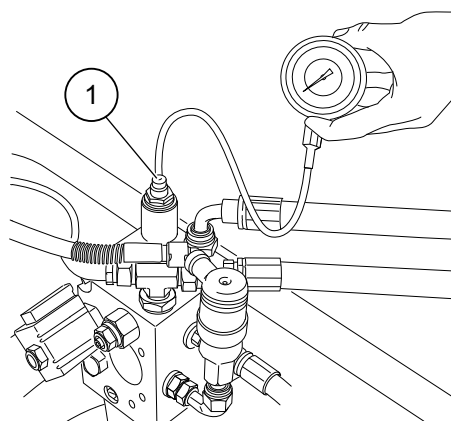
**NOTE** The parking brake pressure must be correct and the ignition must be on.

3. Remove the screw cap (7).
4. Loosen the locknut (3). Turn the adjusting screw (8) clockwise until both brake pads contact the brake disc.

5. Turn the adjusting screw counterclockwise to set the total clearance to 1–0.5 mm (0.04–0.02 in).
6. Tighten the locknut (3).
7. Recheck the clearance.

### 3.17.5 Measuring the parking brake pressure

1. Connect a pressure gauge (0–300 bar or 0–5000 psi) to the measuring point (1) marked PRM on the accumulator charging valve.



2. Start the engine and let it idle.
3. Read the pressure. Check according to the machine card.

### 3.17.6 Manually releasing the parking brake

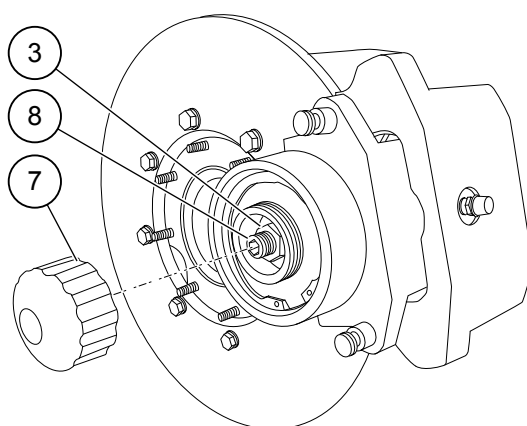
#### **DANGER**



#### **RUN OVER HAZARD**

If the engine is running, the service brake is working. If the engine is not running, only the parking brake is working. If it is released, the machine has no brakes. Risk of serious personal injury or death.

To prevent the machine from moving, block the wheels.



*Figure 54. Manually releasing the parking brake*

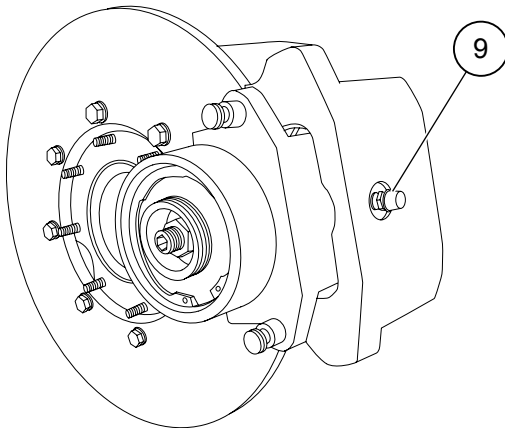
If hydraulic pressure is not available, the parking brake can be manually released as follows:

1. To prevent the machine from moving, block the wheels.
2. Remove the screw cap (7).
3. Loosen the locknut (3).

4. Turn the adjusting bolt (8) counterclockwise until the brake is released.
5. Tighten the locknut (3). Install and hand-tighten the screw cap.
6. Before you return the machine to service, adjust the parking brake as in [Adjusting the parking brake \(page 94\)](#).

### 3.17.7 Bleeding the parking brake

When you loosen the hydraulic hose of the parking brake, bleed the parking brake to remove the air from the system. The parking brake cylinder must be filled with hydraulic oil, so no air can be sucked into the system.



*Figure 55. Bleeding the parking brake*

1. Attach a clear tube to the bleeder screw (9). Insert the other end of the tube in a receptacle that is filled with hydraulic oil.
2. Apply hydraulic pressure to the parking brake.
3. Loosen the bleeder screw (9).
4. Continue to apply pressure until no air bubbles appear in the hydraulic oil in the receptacle.
5. Tighten the bleeder screw and release the pressure.

## 3.18 Maintaining the steer axle

### 3.18.1 Checking the steer axle bearings

Check the wheel and spindle bearings regularly and always when the tires are replaced. It is important to check the steer axle bearings during running in. As the steer axle bearings are exposed to high loads and chocks, it is important that there is no play in these bearings. Any play results sooner or later in bearing breakdown. Bearings are adjustable. For more information, see [Adjusting the wheel bearings \(page 97\)](#). Play in link bearings are acceptable to 1–2 mm (0.04–0.08 in) per each bearing. Link bearings are not adjustable.

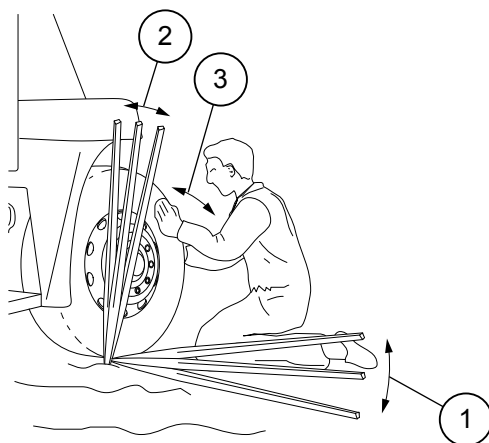


Figure 56. Checking the steer axle bearings

1. To lift each side, use a jack.  
For more information, see [Positioning the jack \(page 28\)](#).
2. Check the plays when the wheel rises from the ground.  
To lift the wheel and locate the gap, use a crowbar.
3. Check the spindle bearings by lifting the wheel with a crowbar (1).
4. Check the wheel bearings by prying the wheel vertically (2).
5. Check the link bearings by turning the wheels in the steering direction (3).

### 3.18.2 Adjusting the wheel bearings

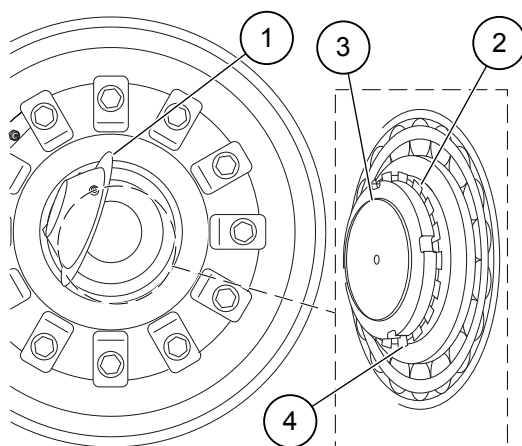


Figure 57. Wheel bearings

1. Remove bearing cover (1).
2. Check that the grease is clean and free from particles.  
If it is not, the reason for the play may be a damaged bearing.

3. Loosen the outer nut (3) and remove the lock washer (2).
4. Tighten the inner nut (4).  
First tighten the nut to 500 Nm (368.78 lbf ft).
5. Rotate the hub ten revs anti-clockwise.  
The hub should only offer light resistance when rotating. A noise or irregular rotation means that the bearings are damaged. If so, the bearings must be replaced.
6. Repeat steps 4 and 5 once.
7. Repeat steps 4 and 5 a second time.
8. Tighten the inner nut (4) again to achieve the correct torque of 500 Nm (368.78 lbf ft).
9. Mount the lock washer (2).
10. Tighten the outer nut (3).  
The correct tightening torque is 300 Nm (162.3 lbf ft).
11. Lock the outer nut (3) using the lock washer (2).
12. Refit the bearing cover (1).

### 3.18.3 Adjusting the spindle bearings

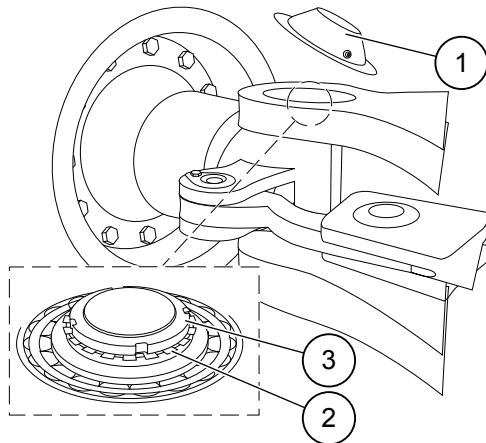


Figure 58. Spindle bearings

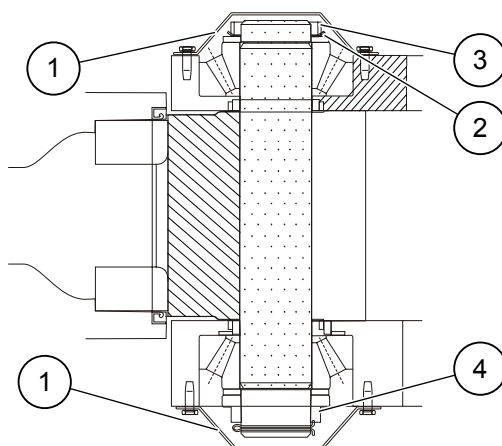


Figure 59. Spindle bearings cross section

1. Remove the steering link.
2. Remove the bearing cover (1).
3. Check that the grease is clean and free from particles.  
If it is not, the reason for the play may be a damaged bearing.

4. Loosen the lock washer (2).
5. Unscrew the nut (3) a few turns.
6. Check that the lower nut (4) is tightened.  
The correct torque is 1000 Nm (737.6 lbf ft).

**NOTE** *The nut (4) is not used to preload the bearing. All bearing preload is adjusted with the upper nut (3).*

7. Tighten the upper nut (3).  
The correct torque for KM12 and KM17 is 300 Nm (221.3 lbf ft), and for KM22 is 350 Nm (258.1 lbf ft).
8. Rotate or swing the spindle ten times to the end positions (left-right-left-right and so on).
9. Tighten the upper nut (3) again. The spindle should only offer light resistance when turning. A noise or irregular rotation means that the bearing is broken. Replace the bearing.
10. Lock the upper nut (3) with the lock washer (2).
11. Refit the bearing cover (1).

## 3.19 Maintaining the hydraulic system

### 3.19.1 Changing the hydraulic oil

The hydraulic oil is changed when the filter is changed.

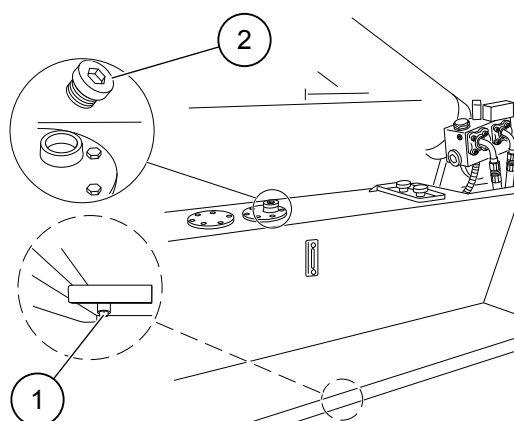


Figure 60. Changing the hydraulic oil

1. Drain out the oil through the drain plug (1), using a receptacle.  
If the filters have been removed, suck up the oil through the filter housings.
2. Inspect the bottom of the tank for any deposits.
3. Assemble the filters and covers if they have been removed.
4. Fill up the hydraulic oil (2) through the filling cap in the filter cover, thus filtering the oil through the filters.  
To make sure that the oil goes through the filters quickly, connect the oil pump to the filling cap.

### 3.19.2 Starting the hydraulic pumps

The machine is equipped with variable pumps. After servicing pumps or other parts of the hydraulic system the pumps are started as follows.

#### RISK OF DAMAGE TO THE MACHINE

#### NOTICE

Air in the system may damage the hydraulic system.  
Never start the machine if the pumps are not air-bled.

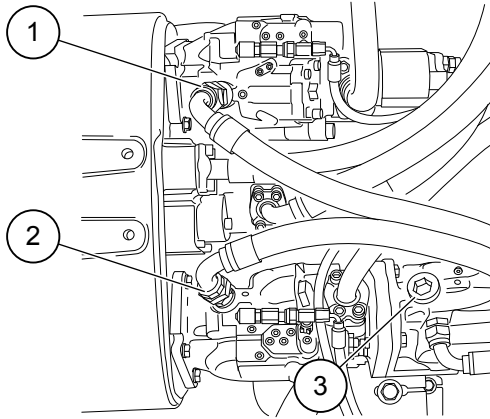


Figure 61. Hydraulic pump

1. Disconnect hoses (1) and (2).
2. Unscrew pump plug (3).
3. Fill the pump housings with the recommended hydraulic oil.
4. Refit the hoses (1), (2) and the pump plug (3).
5. Start the engine and lift the boom.  
Any noise disappears after a few seconds. If not, stop the engine and check the hydraulic system.

### 3.19.3 Changing the hydraulic oil filter

The hydraulic oil filters are in the hydraulic tank. In smaller forklifts, the tank is located under the steps, in bigger ones, the tank is next to the steps.

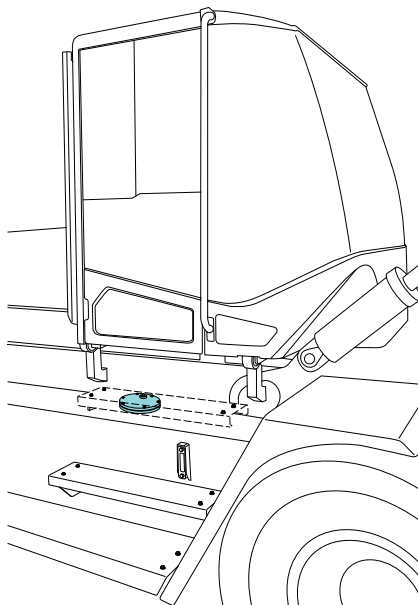


Figure 62. Location of hydraulic tank for smaller forklifts

#### RISK OF DAMAGE TO THE MACHINE

#### NOTICE

Changing the hydraulic oil filter without following these instructions may damage the hydraulic system.

Always follow these instructions when changing the hydraulic oil filter.

1. Filter cover
2. Filter housing
3. Hydraulic oil filter
4. Overflow valve

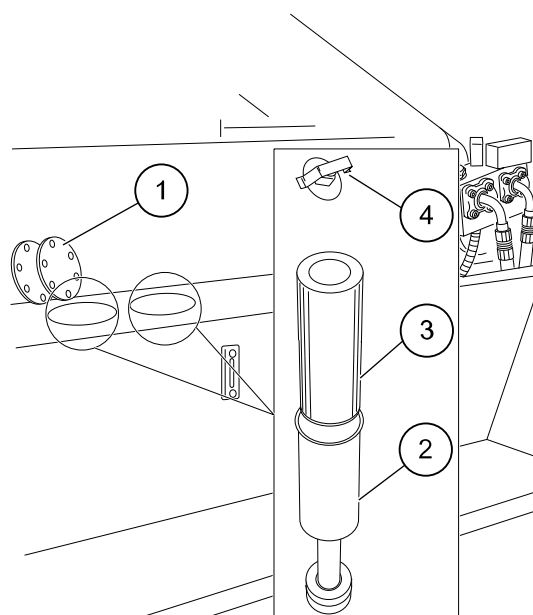
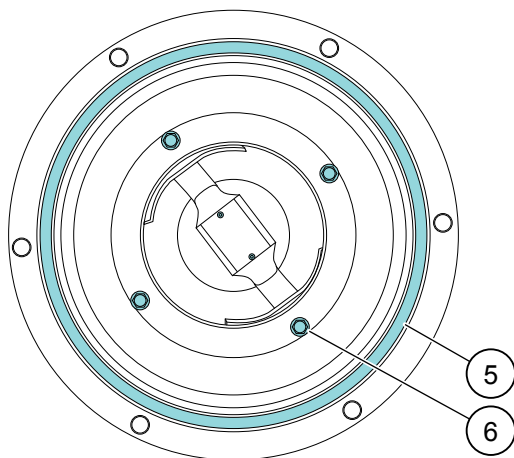


Figure 63. Hydraulic oil filter components

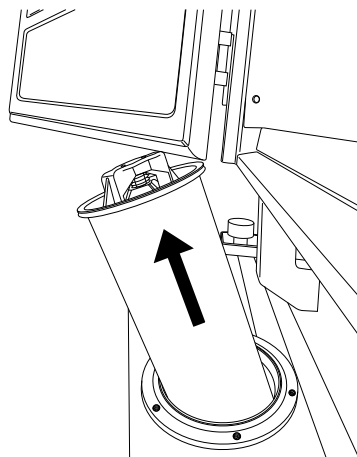
1. With smaller forklifts, remove the top step to access the hydraulic tank.

2. Clean around the filter cover (1).
3. Remove the filter cover (1).
4. Check the condition of the seal (5).
5. Remove the four screws (6) of the filter housing in the return chamber.

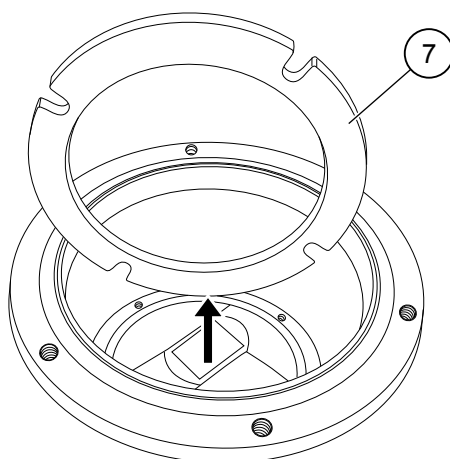


6. Lift the complete filter housing from the hydraulic tank before disassembling it.

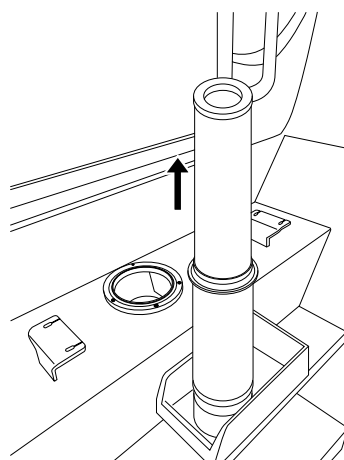
**NOTE** *With smaller forklifts, open the cabin door before you remove the filter housing.*



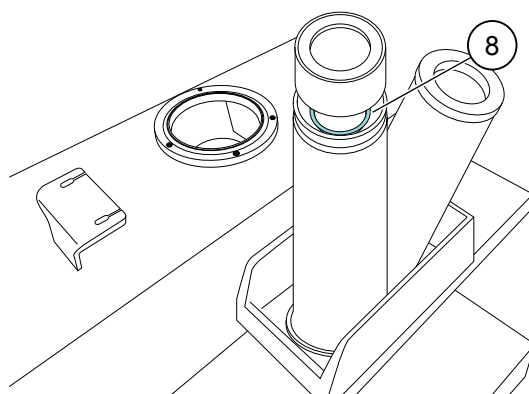
7. After you have removed the filter housing, check the filter area for any deposits.
8. Remove the overflow valve (4) by pressing and turning it.
9. Remove the rim (7) of the filter housing.

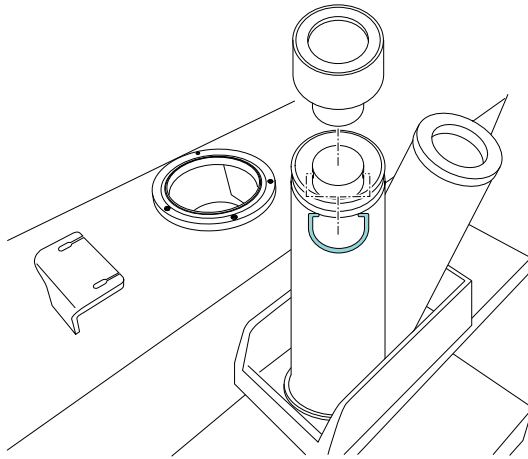


10. Take the filter from the filter housing.

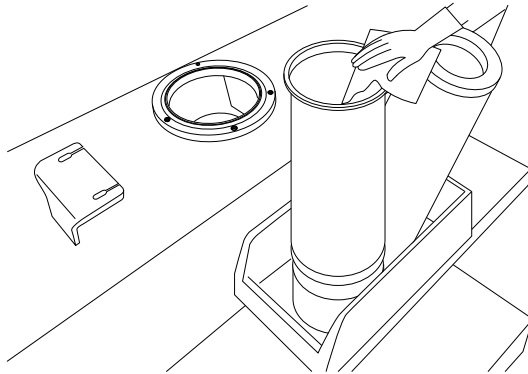


11. Remove the hydraulic filter spring (8).





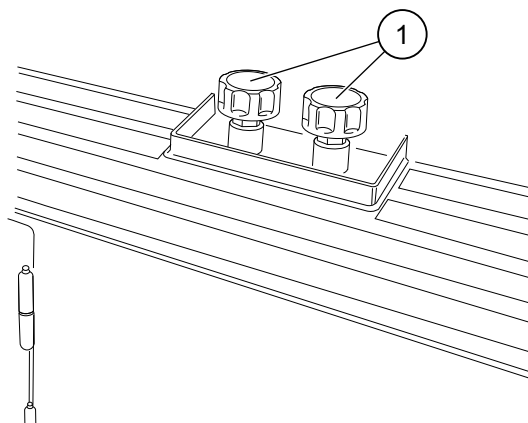
12. Remove the filters.
13. Check the filters for any deposits. Remove the deposits.
14. Clean the filter housing.



15. Fit new filters and close with the overflow valve (4).  
Press and turn to the correct position.
16. Fit the filter housing in the tank.
17. Put back the screws of the filter housing.
18. Fit the filter covers.
19. Fill with oil if the oil has been drained.
20. Start the engine and check for leakage.
21. Turn off the engine and check the oil level.  
For more information, see [Starting the hydraulic pumps \(page 100\)](#).

### 3.19.4 Changing the hydraulic tank breathing filter

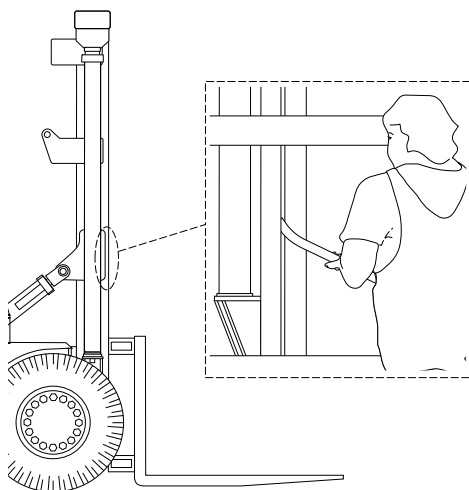
1. Unscrew the breathing filters (1).



2. Replace with a new breathing filter.

### 3.20 Maintaining the mast and fork carriage

#### 3.20.1 Checking the mast and fork carriage



*Figure 64. Checking the mast and fork carriage*

Using a crowbar or a lever:

1. Check the play between the carriage and the inner mast.
2. Check the play between the inner and the outer mast.  
If there is a play exceeding 5 mm (0.2 in), seek the advice of the nearest authorized dealer.

### 3.20.2 Checking the fork arms

#### NOTICE

##### RISK OF PROPERTY DAMAGE

Do not rectify surface cracks and wear by welding.

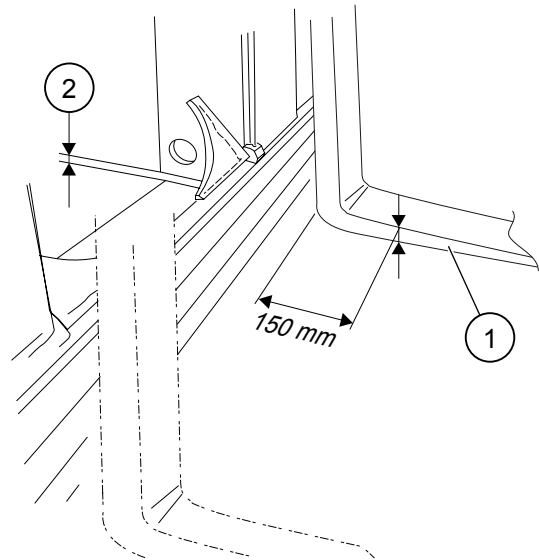
#### NOTE

*Only specially trained personnel can inspect the forks for cracks. The inspection interval is one year.*

1. Check the fork arms for the thickness of the fork blade, crack formation, and deformation.

The wear on the fork blade must not exceed 10%, based on the stamped dimension on the fork and measures 150 mm (6 in) from the heel of the fork (1).

Do not use the fork if it has any cracks that are visible to the naked eye.



2. Check for crack formation in the fork heel. Surface cracks are generally not longer than 5 mm (0.2 in).
3. If you find surface cracks, grind off about 0.5 mm (0.02 in) and use magnetic powder to check if the crack is still visible.

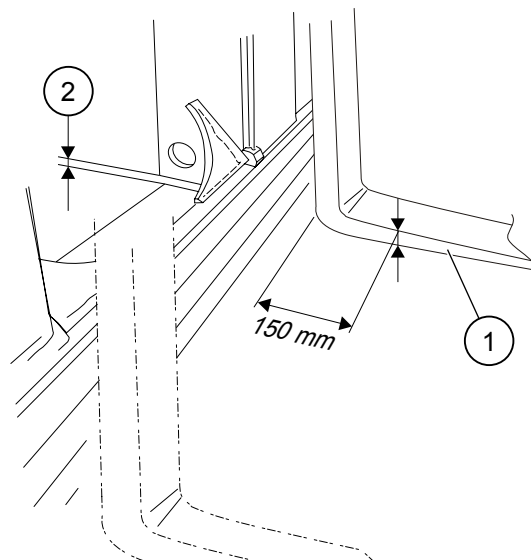
**NOTE** *Only a company that is certified to do fork inspections must perform this step.*

4. Check the fork suspension for play. If the forks are in need of repair, contact an authorized dealer, that can evaluate if it is possible to repair the forks.

### 3.20.3 Checking the clearance between the mast and fork carriage

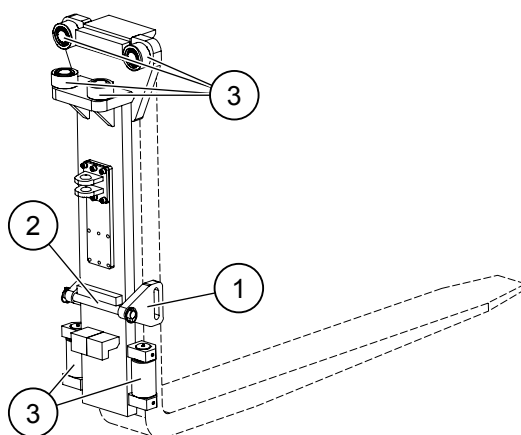
1. Lower the mast and carriage to their lowest position. Keep the mast in vertical position.

2. Check that there is a space of 10 mm (0.4 in) between the base plate and the fork carriage (2).



3. If the space is not 10 mm (0.4 in), readjust the lift chains equally.

#### 3.20.4 Checking the fork shaft system



*Figure 65. Fork shaft system*

Check the fork shaft system as follows:

1. Check that the welding on the locking mechanism (1) is undamaged.
2. Check that the locking pin (2) is undamaged.
3. Check that the ball bearings (3) are undamaged.

### 3.20.5 Checking the lift chains



#### WARNING! FALLING LOAD HAZARD

If a chain breaks, the load may fall uncontrollably and cause personal injury or damage to the machine.

If in doubt, replace the chain. Always replace the full chain. Do not splice or rerivet lift chains.

Before inspection, clean the chains in their entire length. Always check the chains when without a load.

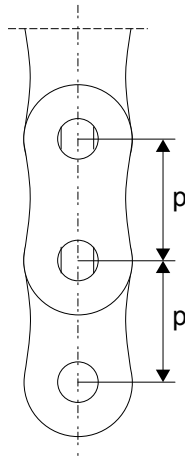


Figure 66. Lift chains

For inspection intervals, see [Regular service \(page 115\)](#).

1. Check that the length of the chain has not increased by more than 3% compared to its original length.  
Measure the 25 links that are lifted first and that most often break on the chain wheel. The 25 links are the part of the chain where the extension is the greatest.
2. Compare with the value for the given chain sizes in the table below.
3. If the 3% limit is exceeded, replace the chain.

**NOTE** *Local regulations may require that the chain must be replaced when the length increases by 2%. The same applies if safety depends on a single chain.*

Table 11. Length of 25 links of chain

| Parting (p)      | Length of 25 links for new chain | Length of 25 links at 2% extension | Length of 25 links at 3% extension |
|------------------|----------------------------------|------------------------------------|------------------------------------|
| 38.1 mm (1.5 in) | 952.5 mm (37.5 in)               | 971 mm (38.2 in)                   | 981 mm (38.6 in)                   |
| 50.8 mm (2 in)   | 1270 mm (50 in)                  | 1295 mm (51 in)                    | 1308 mm (51.5 in)                  |
| 63.5 mm (2.5 in) | 1587.5 mm (62.5 in)              | 1619 mm (63.7 in)                  | 1635 mm (64.37 in)                 |
| 76.2 mm (3 in)   | 1905 mm (75 in)                  | 1943 mm (76.5 in)                  | 1962 mm (77.2 in)                  |

4. Check the state of the lift chains. Make sure that there are:
  - No loose pins in the outside washers
  - No visible cracks in any washer (link section)
  - No visible mechanical damage

- No jarring noise when the chain moves
- No corrosion in the chain
- No resistance when the chain bends over the return wheel

5. Lubricate the chains after inspection using a thin oil or lubrication spray.

## 3.21 Maintaining the machine

### 3.21.1 Cleaning the machine

|  <b>WARNING</b> |                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 | <p><b>HARMFUL SUBSTANCE HAZARD</b></p> <p><b>Risk of serious injury.</b></p> <p><b>Hot steam or aggressive degreasing agents must be used with great care. Protective clothing and eye protection must be worn.</b></p> |

The length of time between cleaning sessions depends on the type of work that the machine carries out. If the machine is used in aggressive environments where it is exposed to elements such as salt water, fertilizers, chemicals, or cement, the machine must be thoroughly cleaned when the work is finished.

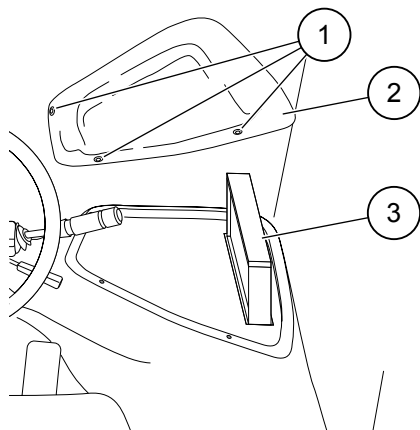


*Figure 67. Cleaning the machine*

1. Protect all electrical components and the air intake filter from steam, water, and so on, during cleaning.
2. Clean the areas around the oil top-up and lubrication places before servicing.
3. If a degreasing agent is used in cleaning, allow sufficient time for it to penetrate and then rinse with a powerful jet of water.
4. After cleaning the engine, run the engine warm so that it dries. Check that no water that has penetrated has caused any faults.
5. All materials that are used in cleaning must be disposed of in an environmentally friendly manner.
6. Always lubricate the machine after steam cleaning. For more information, see [Lubricating the machine \(page 43\)](#).

### 3.21.2 Changing the cabin air filter

The filter for the cabin air intake is under the right-hand dashboard.



*Figure 68. Replacing the cabin air filter*

1. Loosen the screws (1)
2. Remove the cover (2)
3. Pull up the filter cassette (3) gently to avoid dust in the climate unit and cabin.
4. Remove the steel net.
5. Replace the filter element in the cassette.
6. Fit the steel net back in its place.
7. Insert the cassette back into the cabin ventilation system.
8. Fit the cover on the cabin ventilation system.

### 3.21.3 Checking the battery



**WARNING! CORROSIVE SUBSTANCE HAZARD**

The battery contains corrosive acid that may cause a risk for serious injury or death. Always use the necessary protective equipment.



**WARNING! ELECTRICAL HAZARD**

The main disconnect does not cut the power to the alternator.



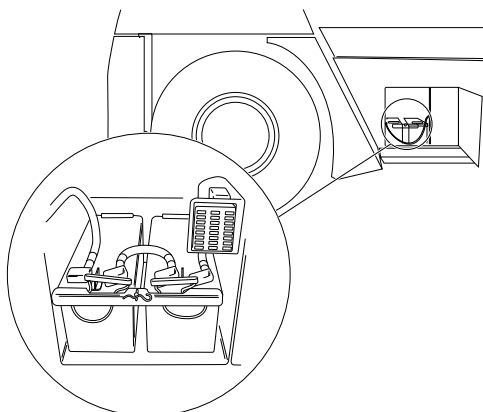
To reduce the risks of electric shock and personal injury always remove jewelry and conductive material before working on the electrical system. Always disconnect the ground (minus) cable at the battery when working near or on the alternator.



**WARNING! TIPPING OVER HAZARD**

Turning off the battery main switch while the machine is moving applies the parking brake and the machine may tip over. The software in the control unit can get damaged. Do not turn off the battery main switch while the engine is running.

The batteries are in the battery compartment.



*Figure 69. Battery compartment*

1. Keep the batteries clean.
2. Remove corrosion from the battery connections and check that the cable connections are tightened.
3. Lubricate the battery terminals using acid-free grease.
4. Check the battery acid level. If necessary, fill with distilled battery water.

### 3.21.4 Checking the weld constructions

To see if there are any visible signs of damage, deformation, metal fatigue, and so on, check the mast, chassis, and all welded parts. Check them at least once a year, more often if the machine is used in shift work. If you have any doubts, contact your Konecranes Lifttrucks authorized dealer.

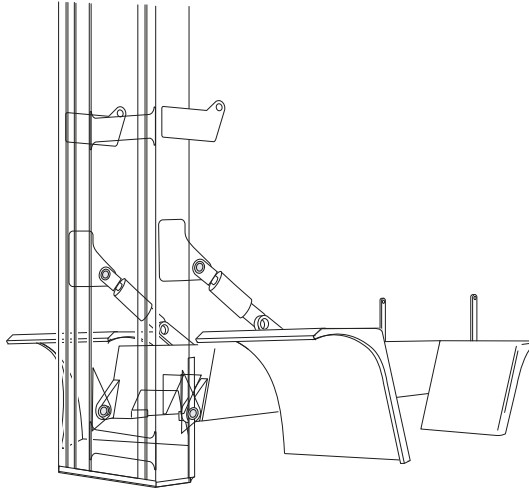


Figure 70. Weld constructions

### 3.21.5 Changing the windshield wipers

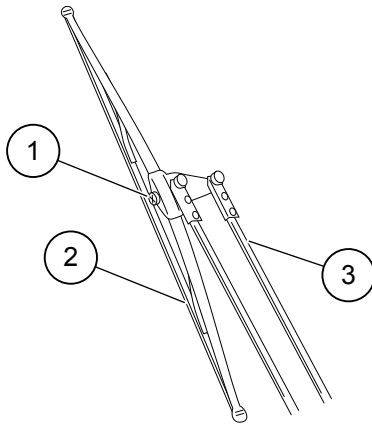


Figure 71. Windshield wipers

1. Remove the nut (1).
2. Remove the blade (2) from the arm (3).
3. Insert the new blade (2) into the arm (3).
4. Refit the nut.
5. Lower the wiper back onto the windshield.

## 4 MAINTENANCE SCHEDULE

### 4.1 Commissioning inspection

Always perform maintenance, lubrication, inspection, and daily maintenance according to the instructions in this manual. Before starting up the machine, check the inspection points according to the warranty commissioning report.

The warranty commissioning report must be filled in and returned to Konecranes Lifttrucks within one week from starting up the machine to make the warranty valid from the commissioning date.

If the warranty commissioning report is not returned within one week, the warranty is valid from the day the machine was delivered by Konecranes Lifttrucks.

### 4.2 Commissioning service

1. *Clean the machine.*
2. *Tighten the wheel nuts according to correct torque.*
3. *Check the pressure and condition of the tires.*
4. *Check the windshield washer level and fill up the washer fluid container.*
5. *Check the fuel level.*
6. *Check the coolant level.*
7. *Check the transmission oil level.*
8. *Check the engine oil level.*
9. *Check the hydraulic oil level.*
10. *Check the functioning of the service and parking brake.*
11. *Check the functioning of the steering system.*
12. *Lubricate according to the lubrication chart*
13. *Check the functioning and the condition of the electrical system, lighting, instruments, switches, and safety system.*
14. *Check the functioning of the hydraulic system.*
15. *Check the drive axle oil level.*
16. *Check the condition of batteries.*
17. *Check the safety and condition of the operator's cabin, fuel and oil tanks, chassis, counterweights, lifting equipment, and attachment.*
18. *Check the condition of the paintwork and windows.*
19. *Compare the specifications with the customer's acceptance of order.*
20. *Check the ID and warning signs.*
21. *Check that the operator's manual is delivered with the machine.*

### 4.3 Maintenance points after the first 150 operating hours

1. *Change the engine oil.*
2. *Change the engine oil filter.*
3. *Change the transmission oil.*
4. *Change the transmission oil filter.*
5. *Lubricate the machine.*
6. *Check the drive axle oil level.*
7. *Check the coolant level.*
8. *Check the coolant freezing point.*
9. *Check the engine drive belt.*
10. *Check the hydraulic oil level.*
11. *Check the battery condition.*
12. *Check the exhaust system.*
13. *Check (clean if necessary) the engine air filter and air intake.*
14. *Check the mast and carriage.*
15. *Check pressure and condition of the tires.*
16. *Tighten the wheel nuts to the correct torque.*
17. *Check the steer axle bearings.*
18. *Check and tighten the bolted joints.*
19. *Check the condition and functioning of the electrical system, lighting, instrumentation, switches, and safety system.*
20. *Check the safety and condition of the cabin, tanks, chassis, counterweights, lifting equipment, and attachments.*
21. *Check the condition of the paintwork and windows.*
22. *Check the functioning of the service and parking brake.*
23. *Check the functioning of the steering system.*
24. *Check the functioning of the hydraulic system.*

## 4.4 Regular service

Table 12. Engine maintenance Volvo TAD 560, 561, 620, 660, 722, 760, 762 VE

| Maintenance points                                                  | As necessary                              | 500 h            | 1000 h | 2000 h | 4000 h |
|---------------------------------------------------------------------|-------------------------------------------|------------------|--------|--------|--------|
| Changing the engine oil 1)                                          |                                           | X                | X      | X      | X      |
| Changing the engine oil filter 1)                                   |                                           | X                | X      | X      | X      |
| Draining the fuel prefilter                                         | X                                         | X                | X      | X      | X      |
| Changing the fuel filter                                            |                                           |                  | X      | X      | X      |
| Changing the fuel prefilter                                         |                                           |                  | X      | X      | X      |
| Cleaning and draining the fuel tank 1)                              | X                                         |                  |        |        | X      |
| Changing the AdBlue filter and the AdBlue strainer (AdBlue engines) |                                           |                  |        | X      | X      |
| Cleaning and changing the engine air filter                         | X                                         |                  | X      | X      | X      |
| Changing the safety cartridge                                       | X                                         |                  |        |        | X      |
| Checking the coolant level                                          |                                           | X                | X      | X      | X      |
| Checking the anti-corrosion and freezing point of the coolant 1)    | X                                         |                  |        | X      | X      |
| Changing coolant filter 3)                                          |                                           | Every six months |        |        |        |
| Cleaning the radiator, intercooler, and oil coolers                 |                                           | X                | X      | X      | X      |
| Cleaning the cooling system<br>Changing the coolant                 | At 5000 hours or at least every two years |                  |        |        |        |
| Checking the air intake system                                      |                                           |                  | X      | X      | X      |
| Checking the drive belts                                            |                                           | X                | X      | X      | X      |
| Checking the belt tensioner                                         |                                           |                  |        |        | X      |
| Replacing the drive belt                                            |                                           |                  |        |        | X      |
| Checking for leaks                                                  |                                           |                  |        | X      | X      |
| Checking and adjusting the valve clearance 2)                       | Every 1500 hours                          |                  |        |        |        |
| Pressure testing the fuel injectors                                 | Every 3000 hours                          |                  |        |        |        |
| Checking the exhaust system                                         |                                           | X                | X      | X      | X      |

1) More often if necessary

2) First time after the first 500 hours

3) Coolant filter (if fitted). Do not change the coolant filter at the same time when you change the coolant.

Table 13. Engine maintenance Volvo TAD 1340, 1360, 1361 VE

| Maintenance points                                                  | As necessary                               | 500 h | 1000 h | 2000 h | 4000 h |
|---------------------------------------------------------------------|--------------------------------------------|-------|--------|--------|--------|
| Changing the engine oil 1)                                          |                                            | X     | X      | X      | X      |
| Changing the engine oil filter 1)                                   |                                            | X     | X      | X      | X      |
| Draining the fuel prefilter                                         | X                                          | X     | X      | X      | X      |
| Changing the fuel filter                                            |                                            |       | X      | X      | X      |
| Changing fuel prefilter                                             |                                            |       | X      | X      | X      |
| Cleaning and draining the fuel tank 1)                              | X                                          |       |        |        | X      |
| Changing the AdBlue filter and the AdBlue strainer (AdBlue engines) |                                            |       |        | X      | X      |
| Cleaning and changing the engine air filter                         | X                                          |       | X      | X      | X      |
| Changing the safety cartridge                                       | X                                          |       |        |        | X      |
| Checking the coolant level                                          |                                            | X     | X      | X      | X      |
| Checking the anti-corrosion and freezing point of the coolant 1)    | X                                          |       |        | X      | X      |
| Changing coolant filter 3)                                          |                                            |       | X      | X      | X      |
| Cleaning the radiator, intercooler, and oil coolers                 |                                            | X     | X      | X      | X      |
| Cleaning the cooling system                                         | At 8000 hours or at least every four years |       |        |        |        |
| Cleaning the cooling system                                         |                                            |       | X      | X      | X      |
| Checking the drive belts                                            |                                            | X     | X      | X      | X      |
| Checking the belt tensioner                                         |                                            |       |        |        | X      |
| Replacing the drive belt                                            |                                            |       |        |        | X      |
| Checking for leaks                                                  |                                            |       |        | X      | X      |
| Checking and adjusting the valve clearance 2)                       |                                            |       |        | X      | X      |
| Checking the exhaust system                                         |                                            | X     | X      | X      | X      |

1) More often if necessary

2) First time after the first 1000 hours

3) Coolant filter (if fitted). Do not change the coolant filter at the same time when you change the coolant.

Table 14. Engine maintenance Scania DC13-77A, 81A, Scania DC13 - 084-384A, 087-387A, Scania DC13-74A, 76A

| Maintenance points                                               | As necessary                               | 500 h | 1000 h | 2000 h | 4000 h |
|------------------------------------------------------------------|--------------------------------------------|-------|--------|--------|--------|
| Changing the engine oil: 1)                                      |                                            | X     | X      | X      | X      |
| Cleaning the centrifugal oil cleaner: 1)                         |                                            | X     | X      | X      | X      |
| Changing the engine oil filter 1)                                |                                            | X     | X      | X      | X      |
| Changing the fuel filter (AdBlue engines)                        |                                            |       | X      | X      | X      |
| Cleaning and draining the fuel tank 1)                           | X                                          |       |        |        | X      |
| Changing the AdBlue filter (AdBlue engines)                      |                                            |       | X      | X      | X      |
| Cleaning and changing the engine air filter                      | X                                          |       | X      | X      | X      |
| Changing the safety cartridge                                    | X                                          |       |        |        | X      |
| Checking the coolant level                                       |                                            | X     | X      | X      | X      |
| Checking the coolant level sensor                                |                                            |       |        | X      | X      |
| Checking the anti-corrosion and freezing point of the coolant 1) | X                                          |       |        | X      | X      |
| Cleaning the radiator, intercooler, and oil coolers              | X                                          |       | X      | X      | X      |
| Cleaning the cooling system                                      | At 6000 hours or at least every five years |       |        |        |        |
| Checking the air intake system, all engines                      |                                            |       | X      | X      | X      |
| Checking the drive belts, all engines                            |                                            | X     | X      | X      | X      |
| Checking the belt tensioner                                      |                                            |       |        |        | X      |
| Replacing the drive belt                                         |                                            |       |        |        | X      |
| Checking for leaks                                               |                                            |       |        | X      | X      |
| Checking and adjusting the valve clearance 2)                    |                                            |       |        | X      | X      |
| Checking the exhaust system                                      |                                            | X     | X      | X      | X      |

1) More often if necessary

2) First time after the first 500 hours

Table 15. Engine maintenance Cummins QSB 6,7-C260, Cummins QSM 11-C335

| Maintenance points                                               | As necessary                               | 500 h | 1000 h | 2000 h | 4000 h |
|------------------------------------------------------------------|--------------------------------------------|-------|--------|--------|--------|
| Changing the engine oil                                          |                                            | X     | X      | X      | X      |
| Changing the engine oil                                          |                                            | X     | X      | X      | X      |
| Changing the fuel filter                                         |                                            | X     | X      | X      | X      |
| Cleaning and draining the fuel tank 1)                           | X                                          |       |        |        | X      |
| Cleaning and changing the engine air filter                      | X                                          |       |        | X      | X      |
| Changing the safety cartridge                                    | X                                          |       |        |        | X      |
| Checking the coolant level<br>Checking the coolant level         |                                            | X     | X      | X      | X      |
| Checking the coolant level sensor                                |                                            |       |        | X      | X      |
| Checking the anti-corrosion and freezing point of the coolant 1) | X                                          |       |        | X      | X      |
| Cleaning the radiator, intercooler, and oil coolers              | X                                          |       | X      | X      | X      |
| Cleaning the cooling system<br>Changing the coolant              | At 6000 hours or at least every five years |       |        |        |        |
| Checking the air intake system                                   |                                            |       | X      | X      | X      |
| Checking the drive belts                                         |                                            | X     | X      | X      | X      |
| Checking the belt tensioner                                      |                                            |       |        |        | X      |
| Replacing the drive belt                                         |                                            |       |        |        | X      |
| Checking for leaks                                               |                                            |       |        | X      | X      |
| Checking and adjusting the valve clearance 2)                    |                                            |       |        | X      | X      |
| Checking and adjusting the unit fuel injectors 2)                |                                            |       |        | X      | X      |
| Checking the exhaust system                                      |                                            | X     | X      | X      | X      |

1) More often if necessary

2) First time after the first 500 hours

Table 16. Transmission maintenance

| Maintenance points                                                                        | As necessary | 500 h | 1000 h | 2000 h | 4000 h |
|-------------------------------------------------------------------------------------------|--------------|-------|--------|--------|--------|
| Changing the transmission oil                                                             |              |       | X      | X      | X      |
| Changing the transmission oil filter                                                      |              |       | X      | X      | X      |
| Cleaning the transmission oil cooler: Cleaning the radiator, intercooler, and oil coolers | X            |       | X      | X      | X      |
| Checking the transmission breather                                                        | X            | X     | X      | X      | X      |
| Calibrating the transmission                                                              |              | X     | X      | X      | X      |

Table 17. Drive axle maintenance

| Maintenance points                               | As necessary | 500 h | 1000 h | 2000 h | 4000 h |
|--------------------------------------------------|--------------|-------|--------|--------|--------|
| Changing the drive axle oil                      |              |       |        |        | X      |
| Checking the drive axle oil level                |              | X     | X      | X      | X      |
| Checking the drive axle breather                 | X            | X     | X      | X      | X      |
| Checking the condition and pressure of the tires | X            | X     | X      | X      | X      |
| Tightening the wheel nuts                        | X            | X     | X      | X      | X      |
| Adjusting the parking brake                      |              | X     | X      | X      | X      |

Table 18. Steer axle maintenance

| Maintenance points                               | As necessary | 500 h | 1000 h | 2000 h | 4000 h |
|--------------------------------------------------|--------------|-------|--------|--------|--------|
| Lubricating the steer axle                       |              | X     | X      | X      | X      |
| Checking the steer axle bearings                 |              |       | X      | X      | X      |
| Checking the condition and pressure of the tires | X            | X     | X      | X      | X      |
| Tightening the wheel nuts                        | X            | X     | X      | X      | X      |

Table 19. Hydraulic system maintenance

| Maintenance points                                                                             | As necessary | 500 h | 1000 h | 2000 h | 4000 h |
|------------------------------------------------------------------------------------------------|--------------|-------|--------|--------|--------|
| Changing the hydraulic oil                                                                     | X            |       |        |        | X      |
| Changing the hydraulic oil filter                                                              | X            |       |        | X      | X      |
| Changing the hydraulic tank breathing filter                                                   | X            |       |        |        | X      |
| Changing the brake cooling oil (machines with brake cooling oil)                               | X            |       |        |        | X      |
| Changing the brake cooling oil filter (machines with brake cooling oil)                        | X            |       |        |        | X      |
| Changing the breathing filter for the brake cooling oil tank (machines with brake cooling oil) | X            |       |        |        | X      |

Table 20. Mast and forks maintenance

| Maintenance points                  | As necessary | 500 h | 1000 h | 2000 h | 4000 h |
|-------------------------------------|--------------|-------|--------|--------|--------|
| Lubricating the mast                |              | X     | X      | X      | X      |
| Lubricating the fork shaft system   |              | X     | X      | X      | X      |
| Checking the mast and fork carriage |              | X     | X      | X      | X      |
| Checking the fork arms              |              | X     | X      | X      | X      |
| Checking the fork shaft system      |              | X     | X      | X      | X      |

Table 21. Machine maintenance

| Maintenance points                                                                                                | As necessary | 500 h | 1000 h | 2000 h | 4000 h |
|-------------------------------------------------------------------------------------------------------------------|--------------|-------|--------|--------|--------|
| Cleaning the machine                                                                                              | X            |       |        |        |        |
| Lubricating hinges                                                                                                |              | X     | X      | X      | X      |
| Changing the cabin air filter<br>Changing the internal cabin air filter<br>Changing the external cabin air filter | X            |       | X      | X      | X      |
| Tightening the bolted joints                                                                                      | X            | X     | X      | X      | X      |
| Checking the battery                                                                                              |              | X     | X      | X      | X      |
| Checking the condition of paintwork and windows                                                                   |              | X     | X      | X      | X      |
| Checking the safety and condition of the cabin, tanks, body, counterweights, lifting equipment, and attachment    |              | X     | X      | X      | X      |
| Checking the ID-plate and the warning stickers                                                                    |              | X     | X      | X      | X      |
| Checking the weld constructions                                                                                   |              |       |        | X      | X      |

Table 22. Functional test

| Testing points                                            | As necessary | 500 h | 1000 h | 2000 h | 4000 h |
|-----------------------------------------------------------|--------------|-------|--------|--------|--------|
| Checking the functioning of the electrical system         |              | X     | X      | X      | X      |
| Checking the functioning of the steering system           |              | X     | X      | X      | X      |
| Checking the functioning of the hydraulic system          |              | X     | X      | X      | X      |
| Checking the functioning of the service and parking brake |              | X     | X      | X      | X      |

## 4.5 Maintenance data

| Unit                                | Material/oil/lubricant   | Volume                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Engine                              | Engine oil               | VOLVO 560, 561, 762: 29 l (7.7 US gal)<br>VOLVO 620: 16 l (4.2 US gal)<br>VOLVO 722: 23 l (6.1 US gal)<br>VOLVO 660: 15.5 l (4.1 US gal)<br>VOLVO 760: 21.5 l (5.7 US gal)<br>VOLVO 1340: 36 l (9.5 US gal)<br>VOLVO 1360, 1361: 36 l (9.5 US gal)<br>Scania:<br>• Max. 45 l (11.9 US gal)<br>• Min. 39 l (10.3 US gal)<br>CUMMINS QSM 11-C335: 37 l (9.8 US gal)<br>CUMMINS QSM 6,7: 16,7 l (4,41 US gal) |
| Fuel tank                           | Diesel                   | 130–700 l (114–184.9 US gal)                                                                                                                                                                                                                                                                                                                                                                               |
| AdBlue tank                         | AdBlue                   | 30–60 l (7.9–15.8 US gal)                                                                                                                                                                                                                                                                                                                                                                                  |
| Cooling system                      | Glycol and water mixture | 50–60 l (13.2–15.9 US gal)                                                                                                                                                                                                                                                                                                                                                                                 |
| Hydraulic oil system (total volume) | Hydraulic oil            | 150–900 l (39–237.8 US gal)                                                                                                                                                                                                                                                                                                                                                                                |
| Brake cooling oil tank              | Brake cooling oil        | 110 l (29 US gal)                                                                                                                                                                                                                                                                                                                                                                                          |

| Unit         | Material/oil/lubricant    | Volume                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Drive axle   | Drive axle oil            | <p>D81 PL475: each hub 1.5 l (0.4 US gal), differential 38 l (10 US gal)</p> <p>D81 PL488: each hub 2 l (0.5 US gal), differential 45 l (11.9 US gal)</p> <p>D91 PL448: each hub 2.5 l (0.7 US gal), differential 26 l (6.9 US gal)</p> <p>D91 PL408: each hub 4 l (1 US gal), differential 35 l (9.2 US gal)</p> <p>D102 PL341: each hub 9 l (2.4 US gal), differential 72 l (19 US gal)</p> <p>D106 PL341: each hub 9 l (2.4 US gal), differential 80 l (21.1 US gal)</p> <p>D111 PL351: each hub 34 l (9 US gal), differential 80 l (21.1 US gal)</p> |
| Transmission | See fluid recommendations | <p>DANA TE27/TE32: 60–70 l (15.9–18.5 US gal)</p> <p>DANA TE17: 25–30 l (6.6–7.9 US gal)</p> <p>DANA TE30: 55 l (14.5 US gal)</p> <p>ZF 191: 25–30 l (6.6–7.9 US gal)</p> <p>ZF 261/311: 40–50 l (10.6–13.2 US gal)</p> <p>Always check with dipstick</p>                                                                                                                                                                                                                                                                                                |
| Tires        | Air                       | See manufacturer's recommendations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## APPENDIX I: FUEL AND OIL RECOMMENDATIONS

### Quality of the engine oil

The engine oil must comply with one of the following classifications for oil:

- ACEA E7
- API CH-4
- API CI-4
- Volvo VDS-3
- Volvo VDS-4

Check with your oil supplier that your oil meets these demands.

For engines that do not use fuel with low sulphur content, the TBN (Total Base Number) value should be at least 12 according to ASTM 2896. Check with your oil supplier that your oil meets these demands.

Since the oil wear depends on operating conditions, and the quality of the oil and fuel, the intervals between changing the oil may vary in length.

The engine oil must be replaced after a maximum of one year's operation.

The viscosity of the oil varies according to the temperature. Therefore the ambient temperature is vital to the choice of the engine oil viscosity range (see figure below).

Changing the oil due to a change in season may be avoided by using multi-grade oils. Specified intervals for changing the oil also apply to multi-grade oils.

**NOTE** *No oil additives should be added to the recommended oils. Using such additives may invalidate the engine warranty.*

Avoid mixing different brands of oil.

The temperature ranges for adjacent SAE classes overlap, so you do not need to replace the oil when short-term temperature changes occur.

**NOTE** *To ensure trouble-free cold starts, select the SAE class according to the ambient temperature.*

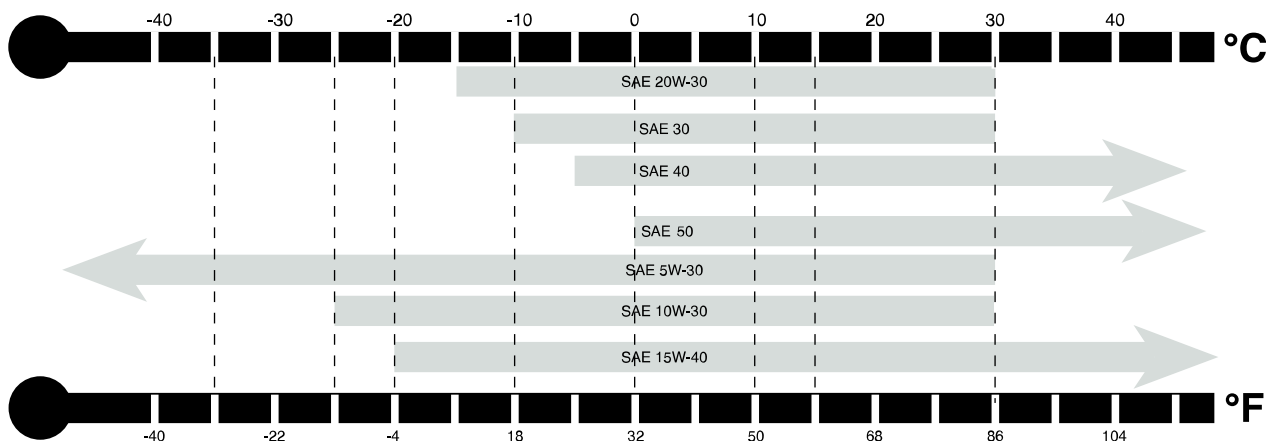


Figure 72. Oil temperature ranges

## Extended oil change interval

Extended oil service life may result when using synthetic fluids. Appropriate change intervals should be determined for each engine by measuring oil oxidation and wear metals over time, to determine a baseline. Wear metals analysis can provide useful information, but an engine should not be removed from service that is based solely on this analysis.

## Recommended fluids and lubricants

### Diesel fuel

The diesel fuel must comply with one of the following classifications:

- EN 590
- ASTM D 975 No 1-D and 2-D

**NOTE** *As the ambient temperature falls, the flow characteristics of the diesel fuel are reduced and paraffin begins to precipitate. Use the correct diesel quality according to the ambient temperature.*

**NOTE** *Using additives to improve the flow is not recommended. Additives may reduce the capacity to start from cold.*

### Biodiesel (FAME)

Vegetable oil esters (Fatty Acid Methyl Esters, FAME), also called "biodiesel", are increasingly available as a blending component in diesel fuels.

The engine manufacturer accepts the same FAME content as in major on-road fuels EN590 and ASTM D975. The maximum FAME content is 7%, without any specific additional service requirements. Contact the engine manufacturer for further information.

**NOTE** *Higher FAME blends negatively impact performance, emissions, and fuel consumption. It also affects negatively the function of the SCR engines exhaust after treatment system.*

### AdBlue solution

Only use an AdBlue solution that fulfills the ISO 22241 standard. The AdBlue solution consists of deionized water that is mixed with 32.5% urea.

Table 23. Engines using AdBlue solution

| Engine family | Engine                           |
|---------------|----------------------------------|
| VOLVO         | VOLVO TAD 560, 561, 762 VE       |
|               | VOLVO TAD 1360, 1361 VE          |
| SCANIA        | SCANIA DC13 - 77A, 81A           |
|               | SCANIA DC13 - 084-384A, 087-387A |

### Transmission oil

DANA transmission: ATF Dexron III

ZF transmission: Mineral oil -based engine oil (API CD/CE/CF-4/CF/CG-4/CH-4/CI-4/SF/SG/SH/SJ/SL or ACEA, categories A, B, E). Viscosity degrees: SAE 20W-20 / 30 / 10W-30 / 10W-40 / 15W-30 / 15W-40 / 20W-40. For more information, see the ZF recommended oil list TE-ML 03.

**Oil change interval**

Drain and refill the system every 1000 h for average environmental and duty cycle conditions. Severe or sustained high operating temperature or dusty environments cause accelerated deterioration or contamination. Judgment must be used to determine the required change intervals for extreme conditions.

**Drive axle oil**

API GL.5 SAE 80 W-140

**NOTE**

*The above are strictly recommendations. If you have any doubts, contact your Konecranes Lifttrucks authorized dealer for advice.*

**Brake cooling oil**

Universal Tractor Transmission Oil (UTTO)

The oil must comply with one of the following classifications:

- John Deere: JD20C
- Massey Ferguson: MF1141/MF1135/ MF1143
- ZF: TE-ML 03E/TE-ML 05F/TE-ML 06K

It is also possible to use a hydraulic oil according to specification below in addition with 1.5% Lubrizol.

**Hydraulic oil**

DIN 51524 Part 2 HLP and Part 3 HVLP

Use hydraulic oil from a well-known oil company for mobile applications.

| Viscosity | Temperature range             |
|-----------|-------------------------------|
| SHS 32    | -30°C...+10°C (-22°F...+50°F) |
| SHS 46    | -20°C...+50°C (-4°F...+122°F) |
| SHS 68    | ±0°C...+50°C (+32°F...+122°F) |

**Grease**

Multipurpose type E.P. according to NLGI Grade 2.

## Coolant

Use only ethylene glycol-based coolants with an additive that prevents corrosion. Do not mix different coolant types with each other. Do not mix the coolant with antifreeze that contains ethanolamine.



### **WARNING! HARMFUL SUBSTANCE HAZARD**

**Using wrong coolant may damage the machine.**

**Use the recommended coolant and never mix different coolants.**



### **WARNING! TOXIC SUBSTANCE HAZARD**

**It is highly dangerous to drink ethylene glycol. It can cause skin irritation and eye damage.**

**Do not drink ethylene glycol and avoid contact with skin.**

*Table 24. Coolants for Volvo engines*

| Engine                          | Coolant                                              |
|---------------------------------|------------------------------------------------------|
| VOLVO TAD 560, 561, 762 VE      | Havoline Extended Life Antifreeze Coolant (green)    |
| VOLVO TAD 620, 722, 660, 760 VE | Havoline Extended Life Antifreeze Coolant (green)    |
| VOLVO TAD 1340 VE               | Havoline Extended Life Antifreeze Coolant (green)    |
| VOLVO TAD 1360, 1361 VE         | Havoline Extended Life Antifreeze Coolant (green)    |
| VOLVO TAD 541 VE                | Volvo Penta Coolant VCS and VCS Ready Mixed (yellow) |
| VOLVO TAD 841 VE                | Volvo Penta Coolant VCS and VCS Ready Mixed (yellow) |
| VOLVO TAD 851 VE                | Volvo Penta Coolant VCS and VCS Ready Mixed (yellow) |
| VOLVO TAD 1141, 1151 VE         | Volvo Penta Coolant VCS and VCS Ready Mixed (yellow) |

*Table 25. Coolants for Scania engines*

| Engine                                   | Coolant                                           |
|------------------------------------------|---------------------------------------------------|
| SCANIA DC13 - 74A, 76A                   | Havoline Extended Life Antifreeze Coolant (green) |
| SCANIA, AdBlue DC13 - 77A, 81A           | Havoline Extended Life Antifreeze Coolant (green) |
| SCANIA, AdBlue DC13 - 084-384A, 087-387A | Havoline Extended Life Antifreeze Coolant (green) |

*Table 26. Coolants for Cummins engines*

| Engine               | Coolant                                           |
|----------------------|---------------------------------------------------|
| CUMMINS QSB 6,7-C260 | Havoline Extended Life Antifreeze Coolant (green) |
| CUMMINS QSM 11-C335  | Havoline Extended Life Antifreeze Coolant (green) |

---

| Liquid antifreeze at the lowest temperature | Percentage of volume mixture liquid antifreeze | Mixture of antifreeze and water |
|---------------------------------------------|------------------------------------------------|---------------------------------|
| -12°C (10.4°F)                              | 25                                             | 1:3                             |
| -18°C (-0.4°F)                              | 30                                             | 1:2                             |
| -25°C (-13°F)                               | 40                                             | 1:1.5                           |
| -37°C (-34.6°F)                             | 50                                             | 1:1                             |
| -60°C (-76°F)                               | 66                                             | 2:1                             |

## APPENDIX II: FUSES AND RELAYS

### Fuses

Fuses are located to the left below the console and in the battery compartment on the right side of the machine.

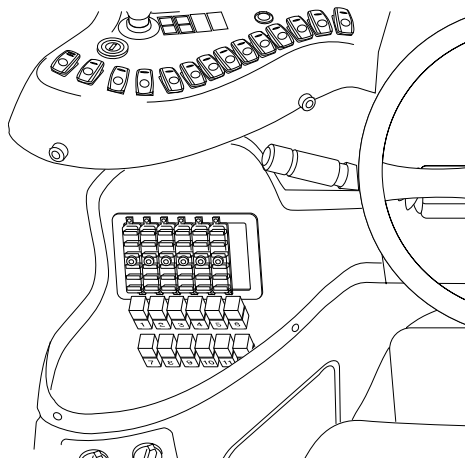


Figure 73. Location of fuses

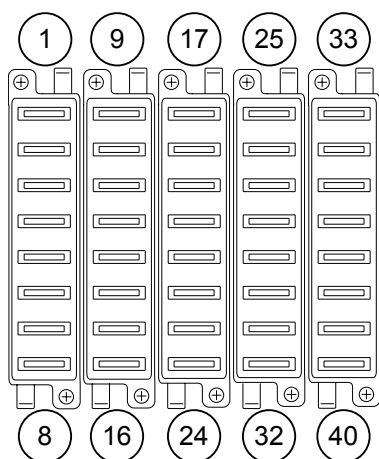


Figure 74. Numbering order of the fuses

Table 27. Fuses and their function. Options are in *italics*.

| Number | Size  | Function                                                                    |
|--------|-------|-----------------------------------------------------------------------------|
| F1     | 10 A  | Engine ECU, <i>alternator charging lamp</i> , working lights control        |
| F2     | 7.5 A | Brake lights, side marker lights, interior light, switch illumination       |
| F3     | 15 A  | Heating, ventilation, <i>air conditioning</i>                               |
| F4     | 5 A   | <i>Fuel shut-off solenoid valve, central lubrication pump</i> , seat buzzer |
| F5     | 7.5 A | <i>Condenser fan motors</i>                                                 |
| F6     | 7.5 A | Road lights, high beam                                                      |
| F7     | 7.5 A | Road lights, low beam                                                       |
| F8     | 10 A  | IQAN display                                                                |
| F9     | 10 A  | <i>IQAN-XS2-A0, cabin option</i>                                            |

| Number | Size  | Function                                                           |
|--------|-------|--------------------------------------------------------------------|
| F10    | 10 A  | <i>IQAN-XA2-B0, chassis option</i>                                 |
| F11    | 10 A  | <i>IQAN-XA2-B1, paper handling option</i>                          |
| F12    | 7.5 A | Hazard and heating, ventilation, <i>air conditioning</i>           |
| F13    | 7.5 A | Power supply ignition switch                                       |
| F14    | 15 A  | Power supply to road lights switch                                 |
| F15    | 7.5 A | <i>Entrance lights</i>                                             |
| F16    | 10 A  | Windshield wiper, windshield washer, and horn                      |
| F17    | 7.5 A | Directionals, <i>seat heater</i>                                   |
| F18    | 10 A  | <i>Seat suspension air compressor</i>                              |
| F19    | 7.5 A | <i>Working lights extra</i>                                        |
| F20    | 7.5 A | <i>Beacon, rearview mirror heater, map light, and search light</i> |
| F21    | 7.5 A | Reverse lights, <i>reverse alarm</i>                               |
| F22    | 7.5 A | <i>Converter 24/12 V, reverse camera, communication radio</i>      |
| F23    | 15 A  | 24 V-outlet                                                        |
| F24    | 3 A   | IQAN display (+RTC), <i>timer for diesel pre-heater</i>            |
| F25    | 3 A   | Left side marker light                                             |
| F26    | 3 A   | Right side marker light                                            |
| F27    | 7.5 A | Working lights mast, right                                         |
| F28    | 7.5 A | Working lights mast, left                                          |
| F29    | 5 A   | <i>Working lights roof</i>                                         |
| F30    | 5 A   | <i>Working lights roof</i>                                         |
| F31    | 10 A  | <i>Elme attachment</i>                                             |
| F32    | 5 A   | <i>Rearview mirror heater</i>                                      |
| F33    | -     | <i>Extra</i>                                                       |
| F34    | -     | <i>Extra</i>                                                       |
| F35    | -     | <i>Extra</i>                                                       |
| F36    | -     | <i>Extra</i>                                                       |
| F37    | 10 A  | <i>Customer equipment</i>                                          |
| F38    | 10 A  | <i>Customer equipment</i>                                          |
| F39    | 15 A  | <i>Reserved for seat air compressor</i>                            |
| F40    | 3 A   | <i>Reverse camera 12 V</i>                                         |

### Fuses and relays in the battery compartment

**WARNING! EXPLOSION HAZARD**

Short-circuiting the battery may cause a fire or explosion, which cause a risk for serious injury or death.

**WARNING! CORROSIVE SUBSTANCE HAZARD**

The battery contains corrosive acid that may cause a risk for serious injury or death.



Always use the necessary protective equipment.

**WARNING! EXPLOSION HAZARD**

Batteries generate explosive hydrogen when charged, which may cause a risk for serious injury or death.

Always use the necessary protective equipment. Ensure that there is good ventilation and avoid sparking.

**WARNING! ELECTRICAL HAZARD**

The main disconnect does not cut the power to the alternator.

To reduce the risks of electric shock and personal injury always remove jewelry and conductive material before working on the electrical system. Always disconnect the ground (minus) cable at the battery when working near or on the alternator.

**WARNING! TIPPING OVER HAZARD**

Turning off the battery main switch while the machine is moving applies the parking brake and the machine may tip over. The software in the control unit can get damaged.

Do not turn it off while the engine is running.

Fuses F51–F78 and relays K31, K32, K33, and K35 are in the battery compartment on the right side of the machine.

- |              |                  |
|--------------|------------------|
| 1. Relay K33 | 4. Relay K35     |
| 2. Relay K31 | 5. Fuses F51–F78 |
| 3. Relay K32 |                  |

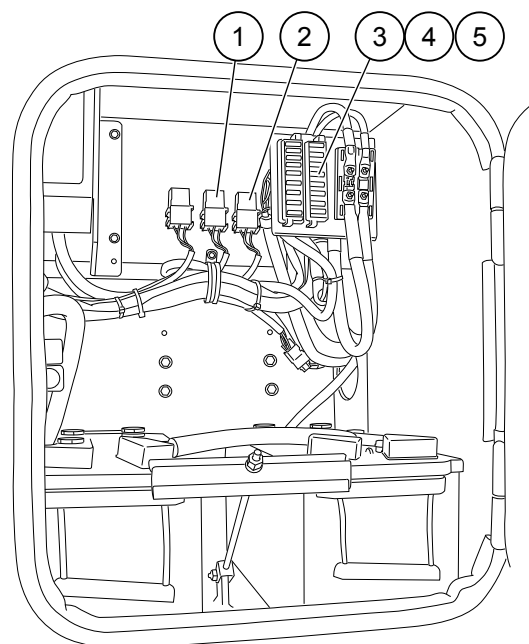


Figure 75. Fuses location

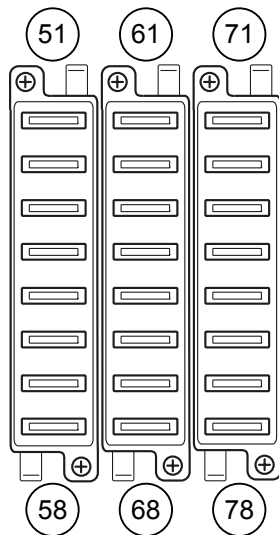


Figure 76. Numbering order of the fuses

Table 28. Fuses and their function. Options are in *italics*.

| Number | Size  | Function                                              |
|--------|-------|-------------------------------------------------------|
| F51    | 10 A  | Main fuse for fuses F12, F13, and F24                 |
| F52    | -     | <i>Extra</i> (relay K31, starter relay Volvo 620/722) |
| F53    | -     | <i>Extra</i>                                          |
| F54    | 15 A  | <i>Diesel pre-heater</i>                              |
| F55    | 15 A  | <i>Diesel pre-heater</i>                              |
| F56    | 7.5 A | Transmission ECU                                      |
| F57    | 15 A  | Engine ECU                                            |
| F58    | 15 A  | Engine ECU                                            |
| F61    | 100 A | Main fuse KL. 15 (after ignition)                     |
| F62    | 60 A  | Main fuse KL. 30 (battery power)                      |
| F71    | 10 A  | <i>Elme attachment</i>                                |
| F72    | 10 A  | <i>Extra, fuel shut-off valve</i>                     |
| F73    | 10 A  | <i>Extra</i>                                          |
| F74    | 10 A  | Engine ECU                                            |
| F75    | 7.5 A | Transmission ECU                                      |
| F76    | 30 A  | <i>Extra, oil cooler fan</i>                          |
| F77    | -     | <i>Extra</i>                                          |
| F78    | -     | <i>Extra</i>                                          |
| F80    | 70 A  | Cummins supply starter relay                          |

## Relays

K1–K14 are mounted in the electrical main compartment. K31, K32, K33, K34, and K35 are mounted next to the main fuses in the battery compartment.

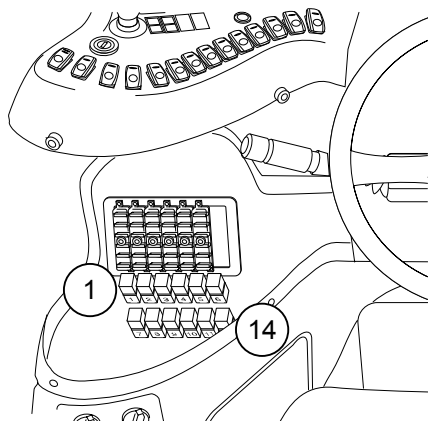


Figure 77. Relay location

Table 29. Relay functions. Options are in *italics*.

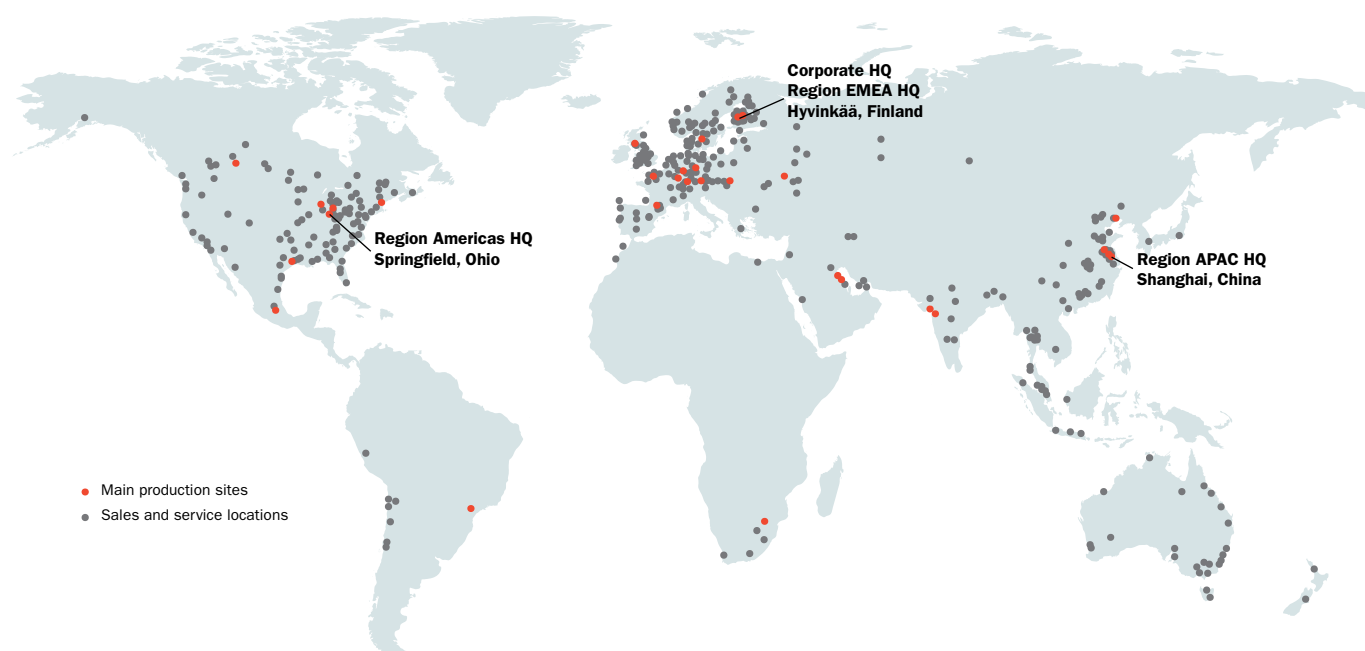
| Number | Function                                                                           |
|--------|------------------------------------------------------------------------------------|
| K1     | -                                                                                  |
| K2     | -                                                                                  |
| K3     | -                                                                                  |
| K4     | Working lights mast                                                                |
| K5     | <i>Working lights roof</i>                                                         |
| K6     | <i>Working lights extra</i>                                                        |
| K7     | Reverse lights, <i>reverse alarm</i>                                               |
| K8     | Power supply for direction selector (lever steering)                               |
| K9     | -                                                                                  |
| K10    | <i>Intermittent windshield wiper rear</i>                                          |
| K11    | <i>Intermittent windshield wiper roof</i>                                          |
| K12    | <i>Intermittent windshield wiper front</i>                                         |
| K13    | Directional lights                                                                 |
| K14    | -                                                                                  |
| K15    | <i>Switching indicator light, rotating operator's seat</i>                         |
| K16    | <i>Switching brake light, reverse warning, rotating operator's seat</i>            |
| K17    | <i>Switching road lights, reverse lights, rotating operator's seat</i>             |
| K19    | <i>Shut-off relay for main relay K32 in the event of automatic engine shut-off</i> |
| K20    | Horn                                                                               |
| K31    | K31 starter relay Volvo 620, 722                                                   |

| Number | Function                                        |
|--------|-------------------------------------------------|
| K32    | Main relay                                      |
| K33    | Hold relay for K31 at start-up                  |
| K35    | <i>Starter relay Cummins QSB 6.7 and QSM 11</i> |





[www.konecranes.com](http://www.konecranes.com)



This document and the information contained herein, is the exclusive property of Konecranes Lifftrucks and represents a non-public, confidential and proprietary trade secret that may not be reproduced, disclosed to other parties, altered or otherwise employed in any manner whatsoever without the express written consent of Konecranes Lifftrucks. © 2016 Konecranes Lifftrucks. All rights reserved. 'Konecranes', 'Lifting Businesses' and C are either registered trademarks or trademarks of Konecranes Lifftrucks. Copyright © (2016) Konecranes Lifftrucks. All rights reserved.