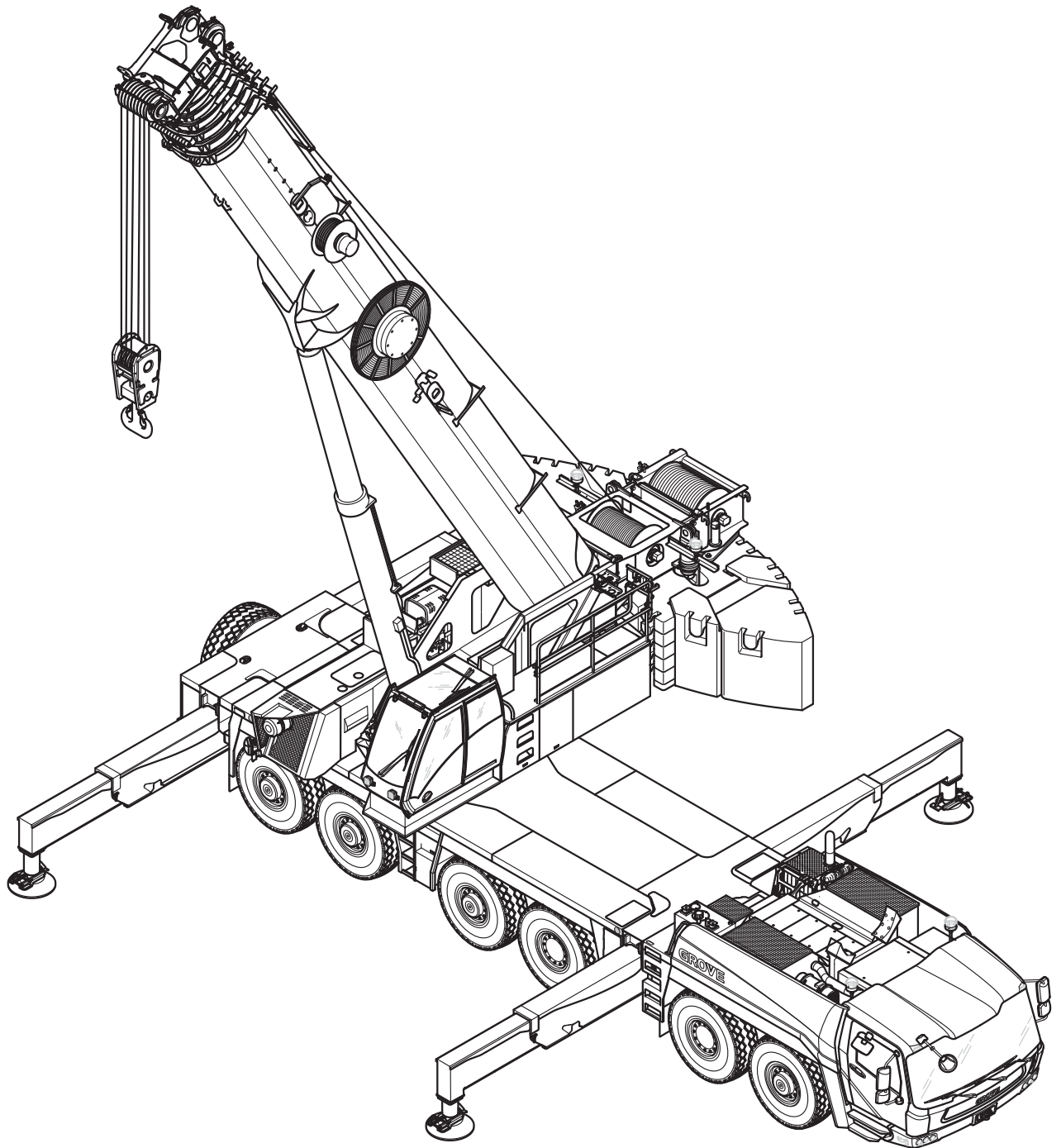


GROVE GMK6300L

Maintenance manual



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13.02.2018

 **Manitowoc**[®]

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Manitowoc Crane Group Germany GmbH

Industriegelände West

D-26389 Wilhelmshaven, Germany

Phone: [+49] (0)44 21 294-0

Fax: +[49] (0) 44 21 294-301

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13.02.2018

1

Additional maintenance work on the rope attachment point

Depending on the equipment of the truck crane, a rope attachment point (1) can be fitted between the lower sheaves on the main boom head.

- Check on both sides whether the rope attachment point (1) is equipped with a grease nipple (2).

1.1

Main boom

1.1.1

Lubricating the rope attachment point

M 3

Grease, tools

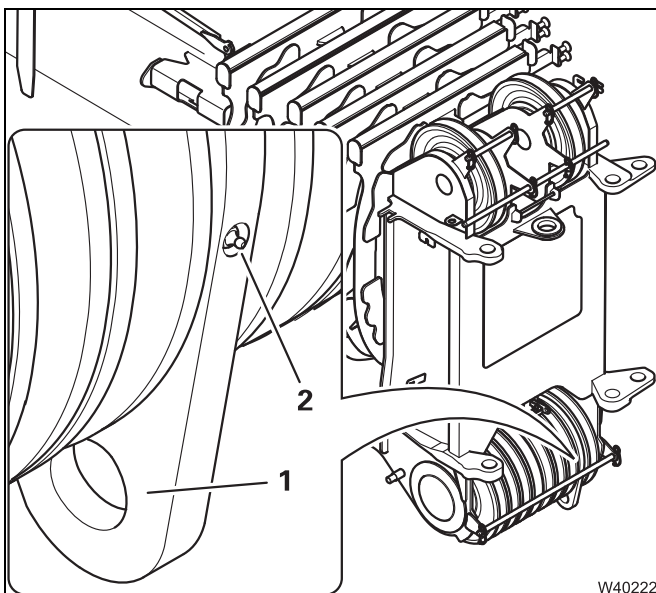
Lubricating grease	Designation to DIN 51502	Specifications Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set; supplied ladder.

Prerequisites

- The main boom must be completely retracted and lowered into horizontal position.
- The hook block must be unreeved.
- The engine must not be running and must be secured against unauthorised use.

Lubrication



- Lubricate the rope attachment point (1) on the grease nipple (2) with the grease gun every three months (M3).
- Check whether the rope attachment point (1) on the axle can be freely rotated.

If you discover any damage

- Have the defective rope attachment point replaced by **Manitowoc Crane Care** or an authorised GROVE dealer.

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1

Protection of the main boom telescopic sections

1.1

Additional monthly maintenance work (M 1)

1.1.1

Checking the guard strips

M 1

The figure shows the main boom on a GMK5250L truck crane. Other GMK models have a similar arrangement of guard strips (1) on the upper surface of the telescopic sections.

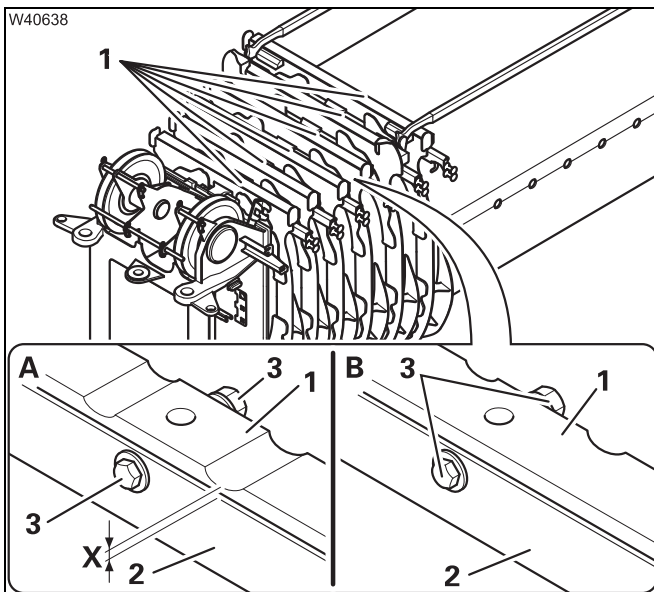
The guard strips (1) are *replaceable parts* that must be checked regularly.



Risk of damage to the telescopic sections and hoist rope!

The hoist rope can form grooves in the guard strips when the crane is used intensively. The hoist rope and telescopic section will be damaged when the groove depth reaches the metal of the telescopic section.

You must therefore turn or replace the guard strips in time (1).



Check

- Check all guard strips (1) on all telescopic sections for damage, wear and formation of grooves by the hoist rope.

Turn if necessary

You can turn the guard strip, but only when the bottom of the groove lies significantly above (X) the telescopic section (2).

- (A) – Remove all screw connections (3).
- Remove the guard strip (1) and clean the guard strip and the top surface of the telescopic section.
- (B) – Turn the guard strip (1) by 90° and fasten all screw connections (3).



When turning three times is no longer sufficient

- Have the damaged guard strips replaced by **Manitowoc Crane Care** or an authorised GROVE dealer or your qualified repair crew.

1.1.2

Conversion from plastic guard strips to steel rollers

GMK 6300L-1

The GMK 6300L-1 truck crane is delivered **as standard** with steel rollers running in ball bearing races.

GMK 5250L and GMK 6300L

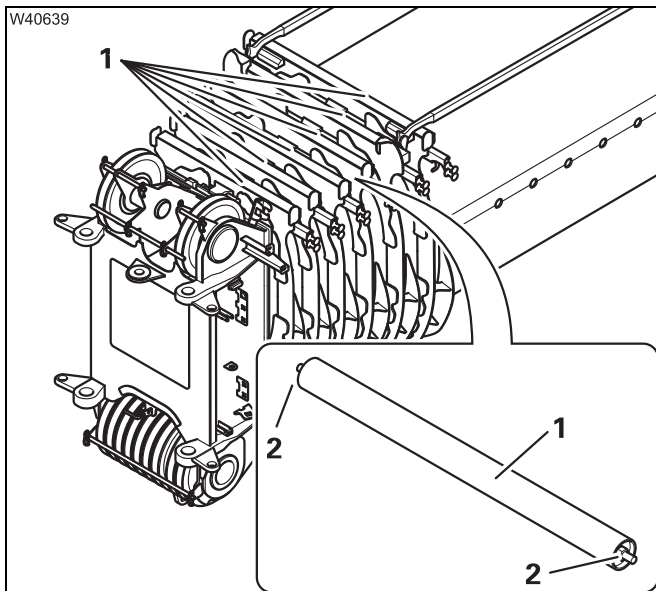
The GMK 5250L and GMK 6300L truck cranes can be delivered with/converted to steel rollers running in ball bearing races as **additional equipment**.

- Contact **Manitowoc Crane Care** for information on the details and cost of a conversion.

1.1.3

Checking the steel rollers

M 1



- Check all steel rollers (1) on all telescopic sections for damage, wear and mobility of the ball bearings (2).
- Have damaged, worn, stiff or extremely steel rollers replaced by **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

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- Appendix**

**This maintenance manual does not replace the operating manual.
Details of operation and standard safety instructions can be found in the
operating manual.**

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1 General instructions

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1 General instructions

1.1

Instructions for using the maintenance manual

This maintenance manual is not designed to replace proper training and instructions.

Maintenance personnel for this truck crane must have the relevant, specialist knowledge and that of proper safety procedures.

Please read Chapters 1 and 2 carefully before beginning maintenance work.



Maintenance work on the lattice extensions is described in the *Lattice extension operating manual*.

1.2

Warnings and symbols

The following designations and symbols are used in the operating manual to highlight particularly important information:



This symbol indicates hazards related to the described operation and which may cause personal injury during execution. The type of danger (e.g. life-threatening, personal injury, risk of crushing or electric shocks) generally precedes the warning sign.



Dangers which could put objects at risk are pointed out here, e.g. damage to the truck crane or the load.



This symbol is to remind you that you are working with substances which pose a risk to the environment. Take particular care. The measures required for the corresponding maintenance work are indicated next to the symbol. You will find more detailed information in Section *Handling substances which are harmful to the environment*, p. 2 - 4.

The vertical line to the left of the text indicates that: This text, regardless of its length, relates to the warning symbol.





The hand with the pointing finger indicates passages that contain additional instructions and tips regarding truck crane operation.



This symbol indicates that the topic is continued on the next page. Turn to the next page.

1.3

Maintenance instructions

This maintenance manual is intended for maintenance personnel. The maintenance manual does not contain information on repair work. Repair work may only be carried out by a qualified repair crew (e.g. **Manitowoc Crane Care**).

Repair work also requires:

- Appropriate workshop equipment
- Special tools and
- Spare parts approved by **Manitowoc Crane Group Germany GmbH**.

It is your responsibility to maintain and service the truck crane regularly and carefully in order to extend its service life and keep it in good working order.

Please note that **Manitowoc Crane Group Germany GmbH** can only uphold the warranty provided for the truck crane if the following conditions are met:

- It is used for the purpose for which it was intended,
- Care and maintenance are carried out as prescribed,
- Repair work/overhauling is carried out by qualified personnel.

Many defects and failures are caused by **improper maintenance** such as:

- Insufficient oil, grease or antifreeze,
- Dirt,
- Damage to the ropes,
- Faulty compressed air and hydraulic systems,
- Damaged hoses or loose screw connections,
- Faulty brakes,
- Faulty tyres or wheel rims,
- Exceeded maintenance intervals.

For your safety and the safety of others, avoid these errors by carrying out maintenance work carefully within the specified intervals. Do not put off maintenance work that is due. If repairs are needed, immediately contact **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew. This work may only be carried out by trained, qualified personnel.

A few **general maintenance instructions**:

- Clean the parts of the truck crane that are to be serviced, particularly the area around the oil filler opening, the oil inspection opening, the oil drain opening and the lubricating nipples.
- When changing the oil, it should run out at operating temperature.
- Ensure that only oils and lubricants specified in the *Lubricants*, p. 6 - 1 are used.
- Replace all filters within the specified period if cleaning is not explicitly permitted.
- Always replace all gaskets before assembly. Clean the sealing surfaces.
- Tighten loose screw connections on hydraulic and compressed air systems only when the system is depressurised.
- Keep brake and clutch linings free of grease.
- Replace hydraulic hoses immediately once damage or moisture penetration becomes visible.
- Cleanliness is imperative when handling hydraulic oil. Even when filling with fresh hydraulic oil, it must be filtered.



- Cleanliness is imperative when handling grease for the central lubrication system. Do not remove the caps from the filling hole and grease gun until immediately before refilling the grease.
- Check fastening and retaining elements (nuts, bolts, lock washers etc.) before re-using them and replace them if necessary.

Torques can be found in Sections p. 10 - 1 and p. 10 - 2.

The training centre at our factory offers specialised training programmes for your qualified personnel.

Please contact **Manitowoc Crane Care**.

The vehicle must meet all current regulations applicable to it before being put into operation and driven on public roads.

1.4

Instructions regarding the electronic controls

The electronic ESX control is designed for a service life of 10 years. In terms of use, the control system's service life can be estimated based on the following limiting factors:

- The service life of the EEPROM allows 10^5 accesses.
- The maximum number of make-and-break cycles for the safety relay is 10^7
- Some conventional capacitors in the ESX have a service life of 10 years.

These devices must be serviced or replaced by **Manitowoc Crane Care** before one of these limits is reached.

1.5

Safety instructions for welding work

To avoid damage, especially to electronic parts, there are certain measures you must take before doing any welding work. You should therefore always consult **Manitowoc Crane Care** before any welding work.

All welding work (especially on load carrying members) may only be performed by qualified professional personnel with the prior written permission from **Manitowoc Crane Group Germany GmbH**.

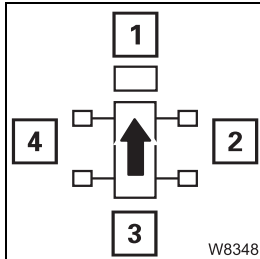
1.6

Definition of direction references

Basic rule

Direction information always depends on whether the carrier or the superstructure is being operated.

On the carrier

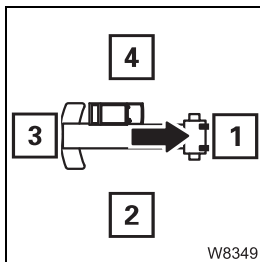


The driver's cab is always at the front, which means that:

- | | |
|----------|----------|
| 1: front | 2: right |
| 3: rear | 4: left |

Forwards always means with the driver's cab leading,
Backwards always means with the rear lights on the carrier leading.

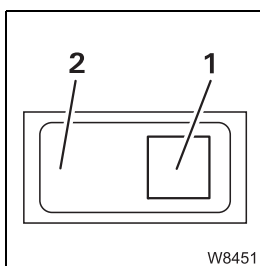
On the superstructure



The main boom head is always at the front, which means that:

- | | |
|----------|----------|
| 1: front | 2: right |
| 3: rear | 4: left |

Switches and buttons



For switches and buttons, the terms **down** and **up** are used.

Regardless of the fitting position (vertical, horizontal, diagonal, perpendicular or turned), the following always applies:

Down: If (1) press – next to the symbol

Up: If (2) press – opposite the symbol

1.7**Conversion table for US measuring units**

The following conversion factors will help you convert from metric to US units when the truck crane is used in countries that use US units of measurement and vice versa.

Converting from	into	Multiply by
mm	in	0.03937
in	mm	25.4
m	ft.	3.28084
ft.	m	0.30479
m ²	ft ²	10.76391
cm ²	in ²	0.155
cm ³	in ³	0.061
l	gal (US)	0.264178
kg	lbs	2.204622
lbs	kg	0.45359
t	lbs	2204.622
lbs	t	0.0004536
kN	lbf	224.809
daN/cm ²	lbf/in ²	14.50378
lbf/in ²	daN/cm ²	0.06895
bar	psi	14.50378
psi	bar	0.06895
m/s	ft/s	3.28084
km/h or km	mph or mi	0.62137
mph or mi	km/h or km	1.60935
Nm	lbf ft	0.7375
°C	°F	1.8 x °C + 32
°F	°C	(°F-32)/1.8
t/m ²	lbs/ft ²	204.8
m ² /t	ft ² /lbs	0.04882
MPa	bar	10
bar	MPa	0.1

2 Safety and environmental protection

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2

Safety and environmental protection

2.1

Safety rules

When carrying out maintenance work, please observe the applicable **accident prevention regulations**.

Observe the following safety rules:

- Familiarise yourself with the truck crane and its operation.
Read the *operating manual* carefully and request guidance from the crane operator
- Do not carry out maintenance work on the truck crane unless you are authorised to do so.
- Observe all safety and warning signs on the truck crane.
- Observe all safety instructions contained in this *maintenance manual*.
- Familiarise yourself with the conditions under which the superstructure may be slewed and the boom may be extended into horizontal position.
- Do not carry out maintenance work unless the truck crane is standing on flat, stable ground and is secured against rolling away.
- Keep all handles, steps, railings and ladders free of dirt, grease, snow and ice.
- Use the provided, safe access aids and working platforms when carrying out work above body height. Wear a safety harness when carrying out maintenance work at a great heights.
- Walk only on those machine parts which are equipped with appropriate tread grids and railings and therefore guarantee safety. During rigging and maintenance work on machine parts above body height which have no apparatus for walking on, always use the supplied extendable ladder (e.g. when lubricating telescopic slide faces).
- Perform maintenance work only after the truck crane has been shut down. Always ensure that the truck crane is well-protected from unauthorised operation before beginning maintenance work. Remove the ignition key and put up warning signs.



If due to exceptional circumstances the truck crane needs be put into operation for certain types of maintenance work, great care must be taken where there are moving parts (superstructure, outriggers, Cardan shafts, slewing bearing, engines, tiltable crane cab). There is a **risk of injury**.

- Ensure that all hydraulic components are returned to their initial positions (e.g. the main boom) or locked (e. g. the outriggers) before starting maintenance work.

Escaping hydraulic fluid or compressed air can cause severe injury. Remember that the hydraulic and compressed air systems of the truck crane are pressurised even when the crane is not in operation. Tighten loose screw connections only when the systems are depressurised. Always depressurise the hydraulic and compressed air systems before opening them.

- Do not allow hot fluids to escape in an uncontrolled manner. Risk of scalding.
- Observe the applicable safety regulations when working with flammable fluids.
- Observe the applicable safety regulations when working with process materials.
- Switch off all electrical consumers and first disconnect the earthing terminal before removing any electrical batteries.
- Keep in mind the corrosive effect of battery acid.
- Note the fire alarm and fire-fighting facilities on site.
- Return the truck crane to proper working order once maintenance work is completed. Inform the crane operator accordingly.

2.1.1

Securing against unauthorised use

- Secure the truck crane against unauthorised use by:
 - Applying the parking brake,
 - Switching the transmission to position **N**,
 - Turning off the engine,
 - Removing the ignition key and
 - Stowing away the hand-held control in the crane cab or in the driver's cab,
 - Locking the driver's cab and the crane cab.



Danger due to unauthorised use.

Always stow away the hand-held control in normally open contact the crane cab or in the driver's cab before leaving the truck crane and lock the doors. hand-held control. In this way you can prevent unauthorised persons from starting the engine with the hand-held control.

- Set up warning signs in the driver's cab and in the crane cab with information about
 - when
 - why
 - and by whom

the truck crane was secured to prevent unauthorised use.

Remove the warning signs from the driver's cab and the crane cab after **completion** of the maintenance work.

2.2

Handling substances which are harmful to the environment

Which substances are harmful to the environment?

When you carry out maintenance work on the truck crane you will occasionally work with consumables which are classified as harmful to the environment by applicable national and regional regulations. These include oil, fuel, grease, used oil and fuel filters, as well as rags which have come into contact with these environmentally harmful substances.

- When handling these substances observe the applicable national and regional regulations as well as the instructions in this chapter.

Using suitable equipment

Substances harmful to the environment can sometimes be corrosive. When doing maintenance work involving these consumables (oils, coolant, fuel) always use receptacles, hoses, pumps, funnels etc. which have sufficient capacity and which are resistant to the consumables.

For oil samples, always use receptacles that can be closed and have sufficient capacity and resistance to the consumables.

The approximate amount of consumables to be expected is specified in the maintenance plans.

Filling and draining

- When filling and draining, make absolutely sure that no substances harmful to the environment seep into the earth, escape into the sewage system or pollute natural waters.
- Collect consumables (e.g. oils, fuels, coolant) in a suitable receptacle when draining.
- Always use a drain hose when draining, and a funnel or a pump with a hose suitable for the respective substance when filling.

Separate collection and storage

Substances which are harmful to the environment should always be collected separately from other waste.

- Ask your local environmental protection authority about the different categories of the substances.
- Also, when collecting substances which are harmful to the environment, keep solid materials (e.g. filter cartridges) separate from fluids. Disposal costs will be reduced if you collect fluids separately according to defined categories.
- Store environmentally harmful substances only in approved receptacles and in locations which meet the requirements of applicable national and regional regulations.

Disposal

- Ask your local environmental protection authority about the prescribed disposal options.
- Once collected, have environmentally harmful substances disposed of only by disposal companies which are approved by the national or regional authority responsible.

2.3

Disposal of the truck crane

Since you are the owner/operator, you can be faced with responsibility for the proper, orderly and final decommissioning, disposal and scrapping of the truck crane.

Before you decide to finally decommission your truck crane and scrap it:

- Allow **Manitowoc Crane Care** to advise you about alternatives.

Proper disposal

- Find out about the applicable official regulations regarding the final de-registration and disposal at the place of registration of the truck crane.
- On site, find out about certified vehicle disposal companies.
- Have the vehicle disposal company issue a disposal certificate for the truck crane.
- Once collected, have all the environmentally harmful substances disposed of only by disposal companies which are approved by the national or regional authority responsible; ■■■► *Handling substances which are harmful to the environment*, p. 2 - 4.

After disposal

- Inform **Manitowoc Crane Care** about the disposal of the truck crane, specifying the serial number.

3 Cleaning

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3

Cleaning

During the first 3 months

The paintwork on the truck crane will continue to harden for the first three months.

- During this period the crane may be cleaned only with cold water.
- Do not use high-pressure or steam jet cleaning equipment during this period.

After the first 3 months

- Avoid water temperatures above 60 °C (140 °F), even after this period.
- Do not use corrosive cleaning agents that might damage the paint.
- Never hold the spray nozzle of your cleaning unit at right angles to the surface you are cleaning, and ensure that it is a sufficient distance from the surfaces to be cleaned.



Risk of accidents from a misdirected high pressure water jet.

When working with high-pressure and steam-jet cleaners, the water jet will be deflected by crane parts and could spray into your face and eyes at high speed and great pressure.

Always wear a face guard when cleaning the truck crane with high-pressure and steam-jet cleaning equipment.

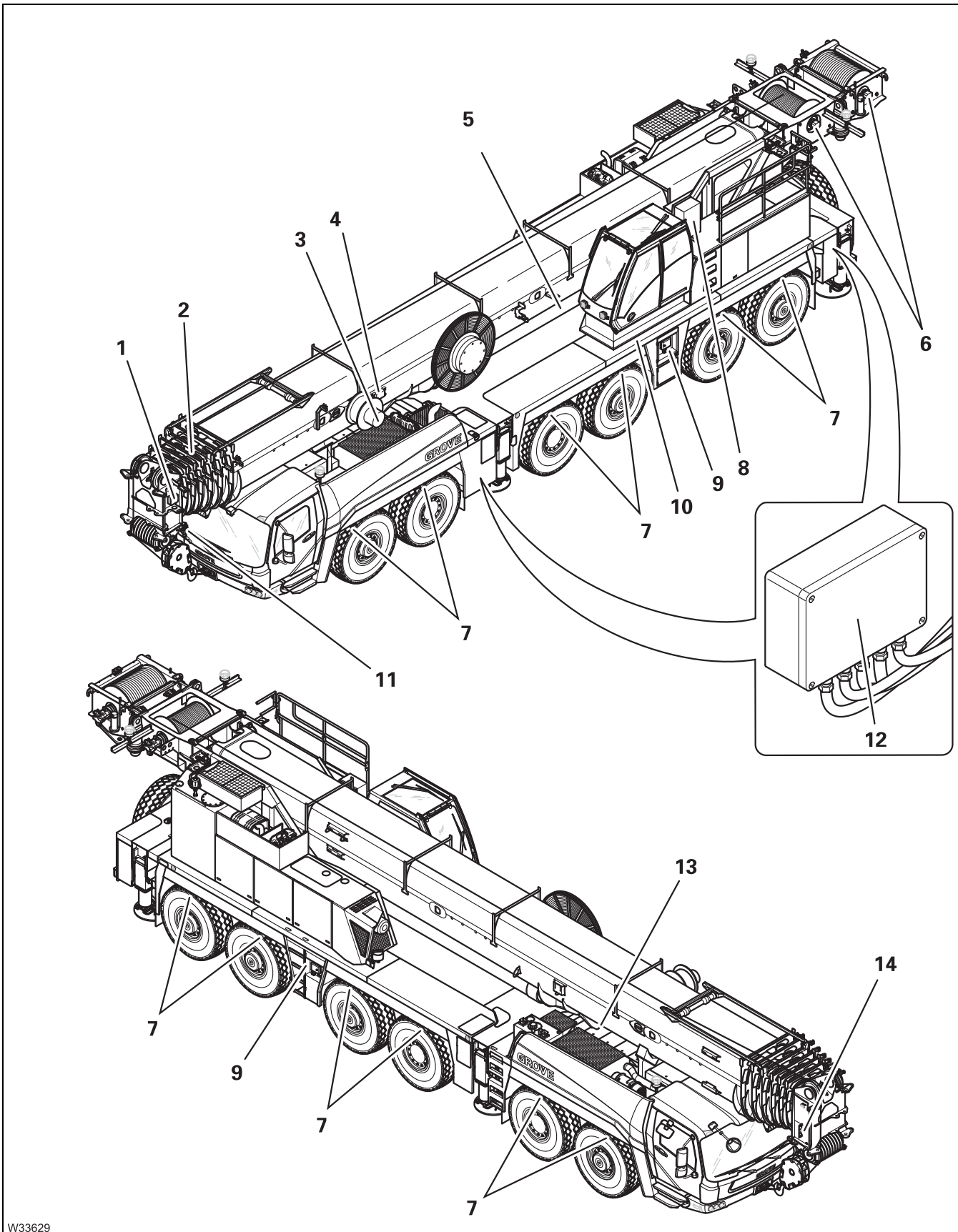
- To prevent damage to the gaskets, never point the spray nozzle directly at them.
- Never point the spray nozzle at electrical equipment, relay and switch boxes, suction and ventilation filters or control elements and lubricated surfaces.
- To prevent corrosion, relubricate all slide faces after cleaning.
- Keep all electric and hydraulic connections free of dirt. Check the connecting points for dust, foreign bodies and moisture before installation. This also applies to protective caps and bridging plugs.

The parts specified in the next section are particularly at risk.

- After cleaning with high-pressure or a steam jet equipment, activate intermediate lubrication on the central lubrication system (▶ *Triggering intermediate lubrication*, p. 7 - 101). Lubricate all remaining lubricating points using a grease gun.

3.1

Overview of assemblies easily damaged when cleaning




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- 1 RCL terminal box
- 2 Telescopic slide faces
- 3 RCL length data transmitter
- 4 Angle data transmitter
- 5 Pressure sensors
- 6 Lowering limit switch
- 7 Suspension struts
- 8 Superstructure switch box
- 9 Control units for outriggers
- 10 Slewing angle sensor
- 11 Lifting limit switch
- 12 Housing of the input-output circuit boards
- 13 Spotlights, pivoting
- 14 RCL connections



Assemblies at risk of damage on the lattice extension;  *Operating Instructions Lattice Extension.*

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4 Running-in regulations

4

Running-in regulations

There are regulations about running in individual parts which must be followed, after:

- **First commissioning** or
- **Replacement of a part** or
- **General overhaul.**

This is why you must carry out **additional maintenance work** on the **carrier** and **superstructure** after specific periods of time have expired:

Operating hours (oper. hrs.)	Driven km (mi)	Additional maintenance work on the CARRIER
	after 50 (30)	Tighten the wheel nuts; ■■■▶ <i>Special torques, p. 10 - 2.</i>
	after 150 (95)	Tighten the wheel nuts; ■■■▶ <i>Special torques, p. 10 - 2.</i>
after 50		Tighten the clips on the coolant hoses; ■■■▶ <i>Special torques, p. 10 - 2.</i>
after 100		Lubricate the outrigger beams; ■■■▶ <i>Lubricating the outrigger beams, p. 7 - 124.</i>
during the first 100		Check the hydraulic oil filter every week, and change it if necessary; ■■■▶ <i>Cleaning the magnetic rods, p. 7 - 83,</i> ■■■▶ <i>Changing the hydraulic oil filter, p. 7 - 95.</i>
after 100	after 1000 (650)	Change the drive oil; ■■■▶ p. 7 - 46 for the transfer case, ■■■▶ p. 7 - 52 for the axle centre drives, ■■■▶ p. 7 - 56 for the final drives.
after 250	after 2500 (1550)	Change the engine oil; ■■■▶ <i>Engine manufacturer's documentation.</i>



Operating hours (oper. hrs.)	Additional maintenance work on the SUPERSTRUCTURE
after 50	Tighten the clips on the coolant hoses; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Special torques</i>, p. 10 - 2.
during the first 100	Check the hydraulic oil filter every week, and change it if necessary; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Oil filter 1 – cleaning the magnetic rod</i>, p. 8 - 68, ▣▣▣▣▶ <i>Changing the hydraulic oil filter</i>, p. 8 - 73.
after 100	Tighten the bolts on the slewing bearing; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Checking the screws</i>, p. 8 - 53, ▣▣▣▣▶ <i>Special torques</i>, p. 10 - 2.
after 100	Hook blocks; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Lubricating</i>, p. 8 - 109.
after 200	First oil change on the hoists; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Changing the oil/checking the oil</i>, p. 8 - 44.
after 1000 or after 12 months at the latest	Second oil change on the hoists; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Changing the oil/checking the oil</i>, p. 8 - 44.
after 200	Change the slewing gear oil; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Changing the oil/checking the oil</i>, p. 8 - 50.
after 250	Change the engine oil; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Engine manufacturer's documentation</i>.

5 Maintenance overview

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5

Maintenance overview

- Maintenance plans **D** (= daily),
- Maintenance plans **W** (= weekly) and
- Maintenance plans **M 1** (= once monthly) to **M 12** (= every 12 months) and
- Maintenance plans **Y 2** (= every 24 months) to **Y 10** (= every 120 months).

The maintenance plans are given in table form, divided into

- Maintenance work on the **carrier** and
- Maintenance work on the **superstructure**.

In the tables, cross references direct you to the sections in which the appropriate maintenance work is described. The cross references consist of the chapter number and the corresponding page number, e.g.

Check the hydraulic oil level; ■■■► p. 7 - 81.

Checking the hydraulic oil level is described in Kapitel 7, the section starts on page 7 - 81.

5.1

Maintenance intervals

The length of the maintenance interval depends on the grade of oil used and operating conditions of the truck crane.

The next maintenance must be carried out after

- a specified **time (maintenance interval)** or
- a specified number of **km driven (mi)** or
- a specified number of **operating hours (oper. hrs.)** or
- a specific **indication** on the *instrument panel*, display, *ECOS display* in the driver's cab; ■■■► p. 7 - 9 or
- an **indicator** on the *ECOS display* in the crane cab; ■■■► p. 8 - 9.



The **maintenance interval which occurs first** determines when the next maintenance is due.

- The **driven km (or mi)** can be taken from the speedometer.
- You can call up the **engine and power unit operating hours (oper. hrs.)** of the superstructure one by one on the *ECOS* display in the crane cab. The operating hours of the engine are equivalent to the total operating hours of the superstructure.

The following table sets out the maintenance intervals for the maintenance plans:

Maintenance plans	Maintenance interval	Driven km (mi) (carrier)	Operating hours (oper. hrs.) of the engine (superstructure)
D	daily/before putting into operation	—	—
W	weekly	—	—
M 1	monthly	approx. 2000 (approx. 1240)	approx. 100
M 3	every three months	5,000 – 6,000 (3,100 – 3,730)	250
M 6	every six months	10,000 – 12,500 (6,210 – 7,770)	500
M 12	every 12 months	20,000 – 25,000 (12,430 – 15,530)	1,000
Y 2	every 24 months	40,000 – 50,000 (25,000 – 31,000)	2,000
Y 3	every 36 months	—	3,000
Y 5	every 60 months	100,000 (62,000)	5,000
Y 6	every 72 months	—	6,000
Y 10	every 120 months	200,000 (124,000)	12,000

Please note that the long-term maintenance plans always include the short-term ones.

5.2

Maintenance plans

The descriptions for certain maintenance work for the maintenance plans **D**, **W**, **M 1** to **M 12** and **Y 2** to **Y 10** are provided for

- the carrier in Kapitel 7 and for
- the superstructure in Kapitel 8.

References (chapter and page number) to the description of this maintenance work can be found after the respective maintenance work for carrier and superstructure.

The section titles

- of Kapitel 7 *Maintenance work on the carrier* and
- of Kapitel 8 *Maintenance work on the superstructure*

contain the symbol (**D** to **Y 10**) of the relevant maintenance plan for better comprehension.

In addition to the **Maintenance work on the carrier** and the **Maintenance work on the superstructure** Kapitel 6 also lists the **Lubricants and consumables**:

- The **designations** of the oils/lubricants in accordance with *Lubricants list*, p. 6 - 2.
- The **amounts** as approximate values for oil amounts in litres (ltr) (and US gallons (gal)) (the exact oil amounts can always be determined by the oil level inspection holes, the oil dipsticks or the oil level indicators) *Lubricant applications list*, p. 6 - 3.



Items that are only available with additional equipment are designated accordingly in Kapitel 7 and Kapitel 8.

Maintenance work on the engines over and above the daily and weekly checks is **only partially** described in this maintenance manual. When carrying out such maintenance work, follow the instructions given in the *Engine manufacturer's documentation*.

5.2.1

Maintenance plan D

D

Maintenance work on the CARRIER: Daily/before putting into operation	
Engine – Checking the oil level – Checking the air filter – Checking the coolant level	<p>▣▣▣▣▶ p. 7 - 11</p> <p>▣▣▣▣▶ p. 7 - 14</p> <p>▣▣▣▣▶ p. 7 - 15</p>
Fuel system – Draining off water from fuel filter 1	▣▣▣▣▶ p. 7 - 26
Exhaust system with exhaust emission control – Checking the AdBlue tank level	▣▣▣▣▶ p. 7 - 32
Transmission – Checking the oil level	▣▣▣▣▶ p. 7 - 37
Wheels – Checking the tyres for damage	▣▣▣▣▶ p. 7 - 61
Steering – Checking for leaks	▣▣▣▣▶ p. 7 - 75
Hydraulic system – Checking the oil level	▣▣▣▣▶ p. 7 - 81
Electrical system – Checking the lighting and indicators	▣▣▣▣▶ p. 7 - 103

Maintenance work on the SUPERSTRUCTURE: Daily/before putting into operation	
Engine – Checking the oil level – Checking the air filter – Checking the coolant level	<p>▣▣▣▣▶ p. 8 - 11</p> <p>▣▣▣▣▶ p. 8 - 14</p> <p>▣▣▣▣▶ p. 8 - 15</p>
Fuel system – Draining off water from fuel filter 1	▣▣▣▣▶ p. 8 - 28
Exhaust system with exhaust emission control – Checking the AdBlue tank level	▣▣▣▣▶ p. 8 - 36
Hydraulic system – Checking the oil level	▣▣▣▣▶ p. 8 - 65
Hoist ropes – Checking the winding	▣▣▣▣▶ p. 8 - 89
Electrical system – Checking the lighting and indicators	▣▣▣▣▶ p. 8 - 111

5.2.2

Maintenance plan W

W

Maintenance work on the CARRIER: Weekly	
Engine – General inspection	▣▣▣▶ p. 7 - 16
Transmission – General inspection	▣▣▣▶ p. 7 - 41
Transfer case – General inspection	▣▣▣▶ p. 7 - 45
Axle lines – General inspection	▣▣▣▶ p. 7 - 49
Wheels – Checking the tyre pressure	▣▣▣▶ p. 7 - 62
Compressed air system – Draining water from the compressed air system – Checking for leaks	▣▣▣▶ p. 7 - 77 ▣▣▣▶ p. 7 - 78
Hydraulic system – Checking the hydraulic hoses – Checking for leaks	▣▣▣▶ p. 7 - 82 ▣▣▣▶ p. 7 - 82
Central lubrication system – Checking the level	▣▣▣▶ p. 7 - 99
Other maintenance work – Checking the windscreen washing system	▣▣▣▶ p. 7 - 123
















W

Maintenance work on the SUPERSTRUCTURE: Weekly	
Engine – General inspection	▣▣▣▣▶ p. 8 - 16
Hoists – Checking the oil level – General inspection – Checking the hoist brake	▣▣▣▣▶ p. 8 - 41 ▣▣▣▣▶ p. 8 - 42 ▣▣▣▣▶ p. 8 - 42
Slewing gear – Checking the oil level – Checking for leaks	▣▣▣▣▶ p. 8 - 47 ▣▣▣▣▶ p. 8 - 48
Hydraulic system – Checking the hydraulic hoses – Checking the ventilation filter – Checking for leaks	▣▣▣▣▶ p. 8 - 66 ▣▣▣▣▶ p. 8 - 66 ▣▣▣▣▶ p. 8 - 67
Hoist ropes – Checking the hoist ropes	▣▣▣▣▶ p. 8 - 90
Central lubrication system – Checking the level	▣▣▣▣▶ p. 8 - 107
Other maintenance work – Checking the windscreen washing system	▣▣▣▣▶ p. 8 - 119

5.2.3

Maintenance plan M 1

M 1
















Maintenance work on the CARRIER: monthly/after approx. 2,000 km (approx. 1,240 mi)	
Engine – Notes;  <i>Engine manufacturer's documentation</i>	 p. 7 - 11
Exhaust system with exhaust emission control – Check the exhaust system for external damage	 p. 7 - 33
Transfer case – Checking the oil level	 p. 7 - 45
Axle lines – Axle centre drives – Checking the oil level – Final drives – Checking the oil level – Lubricating the Cardan shafts in the axle lines	 p. 7 - 49  p. 7 - 55  p. 7 - 58
Wheels – Checking that the wheel nuts are tight	 p. 7 - 63
Suspension – Suspension struts – Checking the oil level – Suspension struts – checking the fastening	 p. 7 - 71  p. 7 - 72
Electrical system – Checking the batteries	 p. 7 - 104
Air conditioning system – Checking the air-conditioning system	 p. 7 - 111
Towbar coupling – Lubricating the towbar coupling	 p. 7 - 115
Other maintenance work – Lubricating the outrigger beams – Checking the functioning of the auxiliary heater	 p. 7 - 124  p. 7 - 125

Maintenance work on the SUPERSTRUCTURE: Monthly/after approx. 100 operating hours	
Engine	
– Notes; ■■■▶ <i>Engine manufacturer's documentation</i>	■■■▶ p. 8 - 11
Exhaust system with exhaust emission control	
– Check the exhaust system for external damage	■■■▶ p. 8 - 37
Main boom	
– Greasing the piston rod of the derricking cylinder	■■■▶ p. 8 - 81
Electrical system	
– Checking the batteries	■■■▶ p. 8 - 112
Air conditioning system	
– Checking the air-conditioning system	■■■▶ p. 8 - 115
Other maintenance work	
– Checking the functioning of the auxiliary heater	■■■▶ p. 8 - 120

5.2.4

Maintenance plan M 3

M 3

Maintenance work on the CARRIER: every three months/after 5,000 - 6,000 km (3,100 - 3,730 mi)	
Engine – Notes;  <i>Engine manufacturer's documentation</i>	 p. 7 - 11
Fuel system – Replacing fuel filter 1	 p. 7 - 27
Vehicle brake – Checking brake lining thickness	 p. 7 - 69
Suspension – Forced lever – checking correct functioning	 p. 7 - 73
Hydraulic system – Cleaning the magnetic rods	 p. 7 - 83
Electrical system – Checking the charge level of the batteries – Charging the batteries using the battery charger – Check the external starting socket	 p. 7 - 106  p. 7 - 108  p. 7 - 109
Towbar coupling – Checking the bearing – Checking the cotter pin – Checking the lower bushing – Checking the initial tension of the springs – Checking the support ring – Checking the function of the coupling jaw/resetting the middle position.	 p. 7 - 117  p. 7 - 118  p. 7 - 119  p. 7 - 119  p. 7 - 120  p. 7 - 120

Maintenance work on the SUPERSTRUCTURE: every three months/after 250 oper. hrs.	
Engine – Notes; ■■■▶ <i>Engine manufacturer's documentation</i>	■■■▶ p. 8 - 11
Fuel system – Replacing fuel filter 1	■■■▶ p. 8 - 29
Slewing bearing – Checking the screws	■■■▶ p. 8 - 53
Hydraulic system – Oil filter 1 – cleaning the magnetic rod	■■■▶ p. 8 - 68
Main boom – Lubricating the telescopic sections – Checking the sheaves	■■■▶ p. 8 - 82 ■■■▶ p. 8 - 86
Hoist ropes – Lubricating the hoist rope	■■■▶ p. 8 - 91
Hook blocks – Checking the sheaves	■■■▶ p. 8 - 109
Electrical system – Checking the charge level of the batteries – Charging the batteries using the battery charger – Check the external starting socket	■■■▶ p. 8 - 112 ■■■▶ p. 8 - 113 ■■■▶ p. 8 - 114

5.2.5

Maintenance plan M 6

M 6

Maintenance work on the CARRIER: every six months/after 10,000 - 12,500 km (6,210 - 7,770 mi)	
Engine – Notes; ■■■▶ <i>Engine manufacturer's documentation</i>	■■■▶ p. 7 - 11
Transfer case – Changing the oil	■■■▶ p. 7 - 46
Axle lines – Lubricating longitudinal Cardan shafts	■■■▶ p. 7 - 59
Wheels – Changing the wheels	■■■▶ p. 7 - 64
Air conditioning system – Checking hoses	■■■▶ p. 7 - 111

Maintenance work on the SUPERSTRUCTURE: every six months/after 500 oper. hrs.	
Engine – Notes; ■■■▶ <i>Engine manufacturer's documentation</i>	■■■▶ p. 8 - 11
Hoists – Lubricating the auxiliary hoist	■■■▶ p. 8 - 43
Slewing gear – Checking the slewing gear brake	■■■▶ p. 8 - 48
Slewing bearing – Lubricating the gear teeth – General inspection – Measuring tilting play	■■■▶ p. 8 - 58 ■■■▶ p. 8 - 60 ■■■▶ p. 8 - 61
Cable drums and slewing angle sensor – Maintenance of the slip ring assemblies	■■■▶ p. 8 - 103
Air conditioning system – Checking hoses	■■■▶ p. 8 - 115

5.2.6

Maintenance plan M 12

M 12

Maintenance work on the CARRIER: every 12 months/after 20,000 - 25,000 km (12,430 - 15,530 mi)	
Engine – Notes; ■■■► <i>Engine manufacturer's documentation</i> – Have the radiator checked/cleaned	■■■► p. 7 - 11 ■■■► p. 7 - 17
Fuel system – Replacing fuel filter 2	■■■► p. 7 - 29
Exhaust system with exhaust emission control – Having the AdBlue system checked	■■■► p. 7 - 35
Axle lines – Axle centre drives – Changing the oil – Final drives – Changing the oil	■■■► p. 7 - 52 ■■■► p. 7 - 56
Suspension – Pressure accumulator – checking the gas pressure	■■■► p. 7 - 74
Steering – Pressure accumulator – checking the gas pressure	■■■► p. 7 - 76
Compressed air system – Replacing the filter cartridge of the compressed air drier	■■■► p. 7 - 79
Hydraulic system – Changing the ventilation filter – Taking oil samples: depending on the oil sample test results: – Changing the hydraulic oil – Changing the hydraulic oil filter	■■■► p. 7 - 85 ■■■► p. 7 - 86 ■■■► p. 7 - 91 ■■■► p. 7 - 95
Air conditioning system – Cleaning the condenser fins – Checking the entire air-conditioning system – Changing the pollen filter	■■■► p. 7 - 112 ■■■► p. 7 - 112 ■■■► p. 7 - 114
Other maintenance work – Lubricating the cab door – Lubricating the connecting and socket pins – Renewing the corrosion protection	■■■► p. 7 - 125 ■■■► p. 7 - 126 ■■■► p. 7 - 127

Maintenance work on the SUPERSTRUCTURE: every 12 months/after 1,000 operating hours	
Engine – Notes; ■■■▶ <i>Engine manufacturer's documentation</i> – Have the radiator checked/cleaned	■■■■▶ p. 8 - 11 ■■■■▶ p. 8 - 17
Fuel system – Changing fuel filters 2 and 3	■■■■▶ p. 8 - 31
Exhaust system with exhaust emission control – Having the AdBlue system checked	■■■■▶ p. 8 - 39
Hoists – Changing the oil/checking the oil	■■■■▶ p. 8 - 44
Slewing gear – Changing the oil/checking the oil	■■■■▶ p. 8 - 50
Slewing bearing – Lubricating the locking of turntable	■■■■▶ p. 8 - 63
Hydraulic system – Changing the ventilation filter – Pressure accumulator – checking the gas pressure – Taking oil samples: depending on the oil sample test results: – Changing the hydraulic oil – Changing the hydraulic oil filter	■■■■▶ p. 8 - 70 ■■■■▶ p. 8 - 71 ■■■■▶ p. 8 - 71 ■■■■▶ p. 8 - 77 ■■■■▶ p. 8 - 73
Main boom – Checking the locking system	■■■■▶ p. 8 - 87
Hook blocks – Lubricating	■■■■▶ p. 8 - 109
Air conditioning system – Cleaning the condenser fins – Checking the entire air-conditioning system	■■■■▶ p. 8 - 116 ■■■■▶ p. 8 - 116
Other maintenance work – Lubricating the crane cab door – Lubricating the step – Lubricating the connecting and socket pins – Renewing the corrosion protection	■■■■▶ p. 8 - 121 ■■■■▶ p. 8 - 122 ■■■■▶ p. 8 - 123 ■■■■▶ p. 8 - 124

5.2.7

Maintenance plan Y 2

Y 2

Maintenance work on the CARRIER: every 24 months/after 40,000 – 50,000 km (25,000 – 31,000 mi)	
Engine – Notes; ■■■► <i>Engine manufacturer's documentation</i> – Changing the oil and oil filter	■■■► p. 7 - 11 ■■■► p. 7 - 21
Transmission – Changing the oil and oil filter	■■■► p. 7 - 41
Other maintenance work – Having the fire extinguisher checked	■■■► p. 7 - 129

Maintenance work on the SUPERSTRUCTURE: every 24 months/after 2,000 oper. hrs.	
Engine – Notes; ■■■► <i>Engine manufacturer's documentation</i> – Changing the oil and the oil filter	■■■► p. 8 - 11 ■■■► p. 8 - 21
Other maintenance work – Having the fire extinguisher checked	■■■► p. 8 - 126

5.2.8

Maintenance plan Y 3

Y 3

Maintenance work on the CARRIER: every 36 months	
Engine – Notes; ■■■► <i>Engine manufacturer's documentation</i> – Changing the coolant	■■■► p. 7 - 11 ■■■► p. 7 - 23

Maintenance work on the SUPERSTRUCTURE: every 36 months/after 3,000 oper. hrs.	
Engine – Notes; ■■■► <i>Engine manufacturer's documentation</i> – Changing the coolant – Change the silicate cartridge	■■■► p. 8 - 11 ■■■► p. 8 - 23 ■■■► p. 8 - 25
Hoists – Having a partial inspection carried out	■■■► p. 8 - 46

5.2.9

Maintenance plan Y 5

Y 5

Maintenance work on the CARRIER: every 60 months / 100,000 km (62,000 mi)	
– Have the Cardan shaft between the transmission on the engine and the transfer case replaced by Manitowoc Crane Care or an authorised GROVE dealer.	

Maintenance work on the SUPERSTRUCTURE: every 60 months/after 5,000 oper. hrs.	
Cable drums and slewing angle sensor – Lubricating the slewing angle sensor	■■■► p. 8 - 105

5.3

Periodic inspections

Your GMK6300L truck crane has been inspected before delivery.

- Truck cranes used in Germany are inspected in accordance with the regulations of the professional trade association as defined by BGV D 6 (VBG 9).
- Truck cranes that are to be used abroad are inspected in accordance with the regulations of the respective country. If such regulations do not exist, they are inspected in accordance with the regulations of the professional trade association as defined by BGV D 6 (VBG 9).

According to German regulations, an inspection must be carried out once a year. The regulations in other countries may prescribe different inspection intervals. If such regulations do not exist, an inspection should be carried out by an *expert* at least once a year.

These periodic inspections are generally visual examinations intended to assess the condition of the truck crane and its components. Their purpose is to detect defects at an early stage and thus prevent accidents.

Inspections must be carried out on the following, if they are not already included in the list of periodic maintenance work:

- the hydraulic and electrical control and safety devices,
- the rated capacity limiter (RCL),
- the fastening and safety devices of all screwed-on parts,
- the hoist ropes,
- the load hooks (▣▣▣▣► *Load hook inspection*, p. 5 - 20),
- the load-bearing steel construction (for cracks, deformation, etc.), including a special check of all welds.

If damage is found on the steel construction, qualified specialists must determine the extent of the damage using the required material examination methods. They should then determine what sort of repair should be carried out.

Prior to carrying out welding work on the truck crane, observe the ▣▣▣▣► *Safety instructions for welding work*, p. 1 - 4.

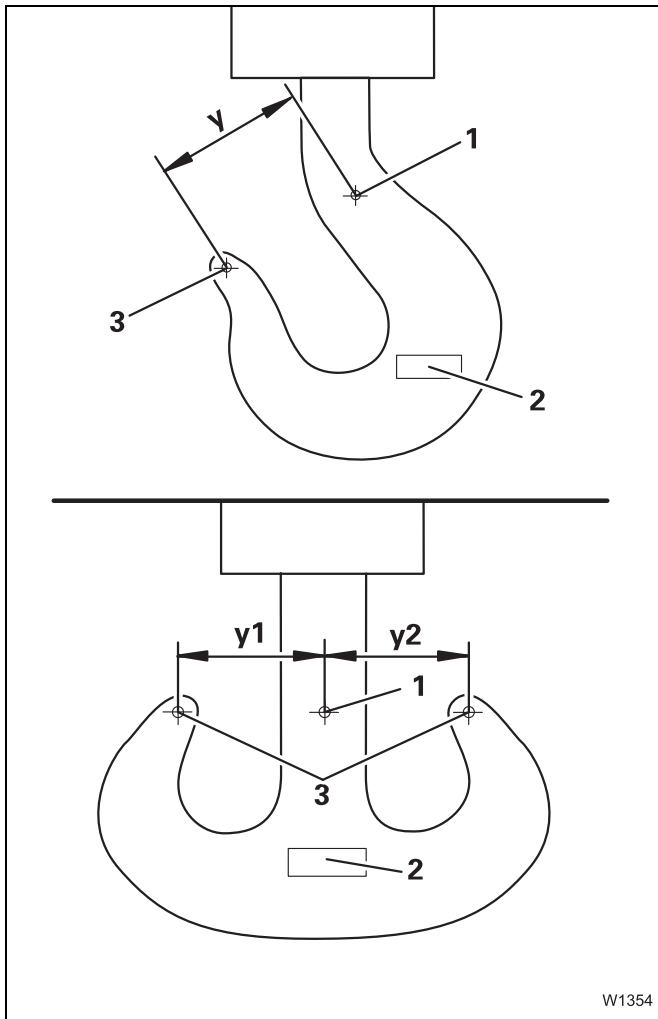
The inspector must write a report containing the result of the annual inspection that was performed and the measures taken to repair any damage.

5.3.1

Load hook inspection

The hook opening on the load hooks must be checked regularly for deformation.

The hook opening must not have increased by more than 10% of the original dimension y , $y 1$, $y 2$.



The original dimensions y , $y 1$, $y 2$ are specified in field (2) on the load hooks.

- To check this, measure the distance between the marked measuring points on the load hook shaft (1) and the tip of the hook (3).

The hook block may no longer be used if the opening has increased by more than 10% of its original dimension.



Risk of accidents due to the load falling.

Hook blocks with deformed load hooks are no longer safe to use. The load hooks could break and drop the load.

Deformed load hooks must always be replaced.

5.4

Measures required for winch monitoring



Also observe the information on the general inspection of the hoists;
▶▶▶▶▶ p. 8 - 46.

These measures for monitoring the winches (hoists) were compiled by the German Machine Builders' Association (VDMA) and are to be used for all truck cranes according to the German *Accident Prevention Regulations for Winches, Hoists and Tractor Machines, BGV D 6 (VGB 9) and BGV D 8 (VGB 8)*.

5.4.1

Theoretical service life

The theoretical service life is determined according to certain operating conditions and a theoretical total operating time assumed by the design engineer when calculating and dimensioning the winches of your truck crane.

The power unit group M 3 and the load spectrum L1 ($K_m = 0.125$) are generally given for truck cranes in assembly mode, resulting in a theoretical service life of 3,200 hrs. (ISO 4301/1, FEM 1.001, DIN calculation basis for power units).



The **theoretical service life** is not the same as the **real (actual) service life** of a winch.



The actual service life of a winch is affected by a number of additional external factors, such as:

1. Overloading caused by improper use of the truck crane.
2. Insufficient maintenance: Oil is not changed at the specified intervals.
3. Operating errors: Extreme acceleration or deceleration of the load,
Load falling into the ropes.
4. Improper maintenance: Wrong oil used,
Incorrect filling quantity,
Contamination during oil change.
5. Improper assembly during maintenance and repair work.
6. Leaks which were ignored.
7. Improper adjustment of safety devices.
8. Latent damage caused by accidents.
9. Extreme environmental conditions: Low or high temperatures,
Aggressive ambient conditions,
Dust and dirt.

5.4.2

Proportion of theoretical service life used

The truck crane operator must perform a truck crane inspection at least once a year (ISO 9927-1 and BGV D 6 (VGB 9) / BGV D 8 (VGB 8)).

This includes determining the proportion of theoretical service life that has been used. If required, the truck crane operator has to appoint an approved inspector for this assessment.

The actual operating conditions (load spectrum) and the hoist operating hours must be determined for each inspection interval when determining the proportion of theoretical service life that has been used. The operating company is responsible for proper documentation in the crane logbook.

Determining the operating conditions (load spectrum)

The truck crane's load spectrum is divided into groups (see also ISO 4301/1, FEM 1.001):



When determining the load spectrum, the existing rope pull is used as the standard, i.e. under certain circumstances, the truck crane can be supporting a small load, whereby the winch is actually supporting a heavy load, e.g. due to insufficient reeving. Therefore, the following graphic representation of the load spectrum refers to the winch's rope pulls.

Load spectrum class	Definition	Proportions of the running time	Factor of the load-spectrum $K_m =$	Graphic representation
Light Q1 L1	Power units or parts thereof that are subject to high stress in exceptional situations, but which are generally subject to only low stress	10% of the running time with greatest load (dead load + 1/1 payload) 40% of the running time with dead load + 1/3 payload 50% of the timing period with dead load only	0.125	<p>W1355</p>
Medium Q2 L2	Power units or parts thereof that are subject to high stress quite frequently, but which are generally subject to only low stress	1/6 of the running time with greatest load (dead load + 1/1 payload) 1/6 of the timing period with dead load + 2/3 payload 1/6 of the timing period with dead load + 1/3 payload 50% of the timing period with dead load only	0.25	<p>W1356</p>
Heavy Q3 L3	Power units or parts thereof that are subject to high stress frequently and medium stress continuously	50% of the running time with greatest load (dead load + 1/1 payload) 50% of the timing period with dead load only	0.5	<p>W1357</p>
Very heavy Q4 L4	Power units or parts thereof that are regularly subjected to the highest stress from adjacent stress sources	90% of the running time with greatest load (dead load + 1/1 payload) 10% of the timing period with dead load only	1	<p>W1358</p>

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One of the load spectrums listed above should be selected on the basis of the actual operating conditions and entered in the crane logbook for the respective testing interval.

Note for truck cranes:

The load spectrum L1 and the load spectrum factor $K_m = 0.125$ are generally applied to truck cranes in assembly mode.

Determining the effective operating hours T_i

The effective winch operating hours must be entered in the crane logbook for the respective inspection interval.

- The effective winch operating hours T_i displayed in the *Operating hours submenu*;  *Manual de instrucciones*.

Determining the proportion of theoretical service life used

For an inspection interval i (max. 1 year according to ISO 9927-1) or BGV D 6 (VBG 9) / BGV D 8 (VBG 8), the proportion of theoretical service life used S_i is calculated using the formula:

$$S_i = \frac{K_{m_i}}{K_m} \times T_i$$


K_m = Load spectrum factor used as the basis for winch calculation.
This factor is given in the operating manual.

K_{m_i} = Load spectrum factor in inspection interval i in accordance with the section "Determining the operating conditions (load spectrum)".

T_i = Effective operating hours in the testing interval i as described in the section "Determining the actual operating hours T_i ".

This used proportion is subtracted from the remaining theoretical service life D_i after every inspection interval (see example in the appendix to this chapter).

If the remaining theoretical service life is not sufficient for the next operating period, then a general overhaul of the winch must be performed.

If theoretical service life D has been reached ( *Theoretical service life*, p. 5 - 21), the winch must not be operated until after a general overhaul has been performed.

A general overhaul must always be performed at least once every 10 years after putting the truck crane into operation.

The general overhaul is to be arranged by the operator and performed by the manufacturer or a representative authorised by the manufacturer. The results are to be entered in the crane logbook.

The manufacturer or an authorised representative will specify a new theoretical service life D upon completion of the general overhaul.

The next general overhaul must be performed within 10 years at the latest.

Alternative provision

If after 10 years the theoretical service life has not been used up the winch can continue to be operated without a general overhaul under the following conditions:

The crane inspector has confirmed that the used proportion of the service life is correct and proper by signing his/her name in the crane logbook after every expert inspection.

In this case the crane inspector must closely inspect the winch. This includes at least:

- a visual examination of the exterior (for leaks, damage, deformation etc.)
- an oil inspection (especially for metallic residues)
- a load inspection with minimum and maximum rope pull and each at maximum possible speed At least one layer must be wound. Investigate any unusual noises during the load inspection.

This inspection must be confirmed in the crane logbook by the approved crane inspector and there must be a statement on continued operation for the winch. The next inspection must take place before the end of the 12th year of operation and must be repeated every year thereafter.

5.4.3

Example

A GMK6300L is equipped with a separate operating hours counter for the hoist and is classified by **Manitowoc Crane Group Germany GmbH** as follows:

Power unit group:	M 3
Load spectrum:	light L1, $K_m = 0.125$
Theoretical service life:	$D = 3200$ h

The used proportion S of theoretical service life is calculated based on the individual inspection intervals as follows:

1. Inspection (1st year)

The truck crane was used for assembly work during the previous year:
Load spectrum L1, i.e. $K_{m1} = 0.125$.

The operating hours counter for the main hoist reads 160 h, i.e. $T_1 = 160$ h.

The used proportion S_1 of theoretical service life after the first inspection therefore is:

$$S_i = \frac{0,125}{0,125} \times 160 \text{ h} = 160 \text{ h}$$

Remaining theoretical service life:

$$D_1 = 3200 \text{ h} - 160 \text{ h} = 3040 \text{ h.}$$

The above values are entered in the table (see table example p. 5 - 28).

2. inspection (2nd year)

The truck crane was used for unloading work on docks: Load spectrum:
L3, i.e. $K_{m2} = 0.5$.

The operating hours counter for the main hoist reads 640 h, i.e. during this period: $640 \text{ hrs.} - 160 \text{ hrs.} = 480 \text{ hrs.}$ (160 hrs. were used during the first year)
 $T_2 = 480$ hrs.

The used proportion S_2 of theoretical service life after the second inspection is therefore:

$$S_i = \frac{0,5}{0,125} \times 480 \text{ h} = 1920 \text{ h}$$

Remaining theoretical service life:

$$D_2 = 3040 \text{ h} - 1920 \text{ h} = 1120 \text{ h}.$$

The above values are entered in the table (see table example p. 5 - 28).

3. inspection (3rd year)

The truck crane was used for assembly work and occasional unloading work on docks: Load spectrum: L2, i.e. $Km_2 = 0.25$.

The operating hours counter for the main hoist reads 940 h, i.e. during this period: $940 \text{ h} - 640 \text{ h} = 300 \text{ h}$. $T_3 = 300 \text{ h}$.

The used proportion S_3 of theoretical service life after the third inspection interval is therefore:

$$S_i = \frac{0,25}{0,125} \times 300 \text{ h} = 600 \text{ h}$$

Remaining theoretical service life:

$$D_3 = 1120 \text{ h} - 600 \text{ h} = 520 \text{ h}.$$

The values are entered in the table (see table example p. 5 - 28).

The remaining theoretical service life is to be documented in a separate table for each winch.

This table is to be attached to the crane logbook. This table is to be found in the maintenance manual's appendix for truck cranes that do not require a crane logbook or similar documentation according to the regulations of the respective country.



Sample table to determine the remaining theoretical service life on winch no. 1 (main hoist winch)

Crane type: **GNMK 3045**
 Factory number: **3045 42 06**
 First commissioned on: **10. 06. 1990**
 Serial number of the winch in accordance with the model plate: **13 301**

Last general overhaul performed on: **.....**
 Winch design data (see operating manual):

Engine group: **M 3**
 Load spectrum: **Q1 (L1)**
 Factor of the load spectrum: **Km = 0.125**
 Theoretical service life: **D = 3,200 h**

Inspection interval no. (max. 1 year)	Date of first commissioning/date of inspection	Operating conditions since the last inspection	Factor of the load spectrum	Operating hours of the entire crane	Operating hours of the superstructure	Operating hours of the superstructure since the last inspection	Winch operating hours	Operating hours T_i of the winch since the last inspection	Used proportion S_i of theoretical service life D_i	Remaining theoretical service life $D_i = D_{i-1} - S_i$	Name of the expert	Signature	Comment	Name of the approved inspector	Signature
0(*)	10. 6. 90	-	-	-	-	-	-	-	0	3200					
1	5. 6. 91	L1	0.125	-	-	-	160	160	160	3040	Müller				
2	20. 5. 92	L3	0.5	-	-	-	640	480	1920	1120	Huber				
3	18. 5. 93	L2	0.25	-	-	-	940	300	600	520	Schmitz				

IMPORTANT:
A general overhaul is to be performed every 10 years.

For alternative provision, refer to section 5.4.2, p. 5 - 25.

General overhaul performed on.....

S_i = Used proportion of theoretical service life since the last inspection
 D_i = Remaining theoretical service life
 D_{i-1} = Remaining theoretical service life after the previous inspection
 Km = Factor of the load spectrum used to calculate the winch. This factor is given in the operating manual.
 Km_i = Factor of the load spectrum in the inspection interval " i " according to section 2.1
 T_i = Effective working hours in the inspection interval " i " according to section 2.2
 (*) Copy the last line of the previous page to the following page.

6 Lubricants and consumables

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6

Lubricants and consumables

6.1

Lubricants

All lubricants that you require for

- *Maintenance work on the carrier, p. 7 - 1* and
- *Maintenance work on the superstructure, p. 8 - 1*

are listed with serial numbers in the lubricants list and the lubricant applications list.

▣▣▣▣▶ *Lubricants list, p. 6 - 2.*
















▣▣▣▣▶ *Lubricant applications list, p. 6 - 3.*

6.1.1

Lubricants list

Consec. no.	GROVE-Part number	Lubricant type	Designation according to DIN 51502	Specification classification	Viscosity
1	03329588	Engine oil	HD - CD	MIL-L 2104 C DB 228.31/.51	SAE 5 W-30
2	6829101690	Gear oil		TranSynd TE295 C4-27403598	synthetic
3	00552891	Gear oil	C - LPF	MIL-L 2105 B API-GL-5	Hyp SAE 90 ISO - VG 220
4	02310863	Gear oil		Rivolta S.K.D. 170	
5	02313611	Gear oil	C - LPF	MIL-L 2105 B API-GL-4/5 (synthetic)	SAE 75 W-90 EP ISO - VG 220
6	04162158	Hydraulic oil	HVLP	Castrol Hyspin AWH-M 32 DIN 51524-3	ISO-VG 32
7	03233369	Lubricating grease	KP - 1K - 50	DIN 51825 Renolit JP 1619	- 50 °C to + 120 °C (- 58 °F to + 248 °F)
8	00554205	Spray		Ceplattyn 300	
9	02314698	Slide paste		PAL 1	
10	03325215	Lubricating grease		RHUS SW 2	
11	01929824	Spray		Berulub spray	
12	03133770	Lubricating grease		Elaskon 30	

6.1.2 Lubricant applications list

Consec. no.	Lubricant type	Usage	Filling quantity in litres (gal)	Maintenance interval
1	Engine oil	Diesel engine for carrier;  p. 7 - 21	42 (11.1)	Y 2
		Diesel engine for superstructure;  p. 8 - 21	29 (7.6)	Y 2
2	Gear oil	Transmission;  p. 7 - 41	46 (12.2)	Y 2
3	Gear oil	Transfer case;  p. 7 - 46	15 (4)	M 6
		1. Axle line axle centre drive;  p. 7 - 52	7.5 (1.9)	M 12
		4. Axle line axle centre drive;  p. 7 - 52	8.0 (2.1)	M 12
		with 12 x 6 x 12 drive: 5. Axle line axle centre drive;  p. 7 - 52	7.5 (1.9)	M 12
		with 12 x 8 x 12 drive: 5. Axle line axle centre drive;  p. 7 - 52	7.7 (2.0)	M 12
		only available with 12 x 8 x 12 drive: 6. Axle line axle centre drive;  p. 7 - 52	7.5 (1.9)	M 12
		6 or 8 x final drives;  p. 7 - 56	4.1 (1.1)	M 12
4	Gear oil	12 x suspension struts;  p. 7 - 71	1.5 (0.4)	M 1
5	Gear oil	2 x hoists;  p. 8 - 44	7 (1.8)	M 12
		3 x slewing gears;  p. 8 - 50	0.9 (0.24)	M 12
6	Hydraulic oil	Carrier hydraulic tank;  p. 7 - 91	230 (61)	M 12
		Superstructure hydraulic tank;  p. 8 - 77	1220 (322)	M 12



Consec. no.	Lubricant type	Usage	Fill quantity in litres (gal)	Maintenance interval
7	Lubricating grease	Carrier central lubrication;  p. 7 - 99		W
		Superstructure central lubrication;  p. 8 - 107		W
		Cardan shafts – transverse;  p. 7 - 58		M 1
		Cardan shafts – longitudinal;  p. 7 - 59		M 6
		Towbar coupling;  p. 7 - 115		M 1
		Outrigger beams;  p. 7 - 124		M 1
		Auxiliary hoist;  p. 8 - 43		M 6
		Turntable lock;  p. 8 - 63		M 12
		Slewing angle sensor;  p. 8 - 105		Y 5
		Hook blocks;  p. 8 - 109		M 12
		Cab door hinges;  p. 7 - 125		M 12
		Carrier pins;  p. 7 - 126		M 12
		Superstructure pins;  p. 8 - 123		M 12
8	Spray	Slewing bearing gear teeth;  p. 8 - 58		M 6
9	Slide paste	Telescopic slide faces;  p. 8 - 82		M 3
10	Lubricating grease	Telescopic locking pins;  p. 8 - 82		M 3
		Derricking cylinder piston rod;  p. 8 - 81		M 1
		Cab door rails;  p. 8 - 121		M 12
		Stair tread rails;  p. 8 - 122		M 12
11	Spray	Outrigger pad/support cylinder;  p. 7 - 124		M 1
		Derricking cylinder piston rod;  p. 8 - 81		M 1
12	Lubricating grease	Lubricating the hoist ropes;  p. 8 - 91		M 3

6.2 Refrigerant

Refrigerant Designation	Usage	Quantity to be filled in kg (lbs)	Maintenance interval
Tetrafluoroethane (R134a) CAS no. 811-97-2 EC no. 212-377-0	Air conditioning system in the driver's cab; ■■■▶ p. 7 - 112	1.0 (2.2)	M 12
	Air-conditioning system in the crane cab; ■■■▶ p. 8 - 116	1.1 (2.4)	M 12

6.3 Consumables

6.3.1 Fuel

The fuels to be used and their respective specifications can be found in the *Engine manufacturer's documentation*.

- Also observe the **signs** on the diesel tank of the truck crane:
"The **use of additives is not permitted** and can damage the engine system."

6.3.2 Engine coolant admixtures

The specifications and admixture ratios can be found in the *Engine manufacturer's documentation*.

The coolant must be renewed every three years (**Y 3**);
■■■▶ *Engine manufacturer's documentation*.

6.3.3 Exhaust gas emission control

Designation	Usage	Filling quantity in litres (gal)
DEF (Diesel Exhaust Fluid) ¹⁾ <i>AdBlue</i> : GROVE part number: 03140555	AdBlue tank on the carrier; ■■■▶ p. 7 - 32	40 (10.5)
	AdBlue tank on the superstructure; ■■■▶ p. 8 - 36	40 (10.5)

- ¹⁾ DEF (Diesel Exhaust Fluid),
Consumable for after-treatment of exhaust gases, e.g. *AdBlue*.
For *AdBlue* there are registered trademarks of the following companies
- Kruse GmbH & Co KG
 - BASF SE,
 - and of the Association of the Automotive Industry e.V.

6.3.4 Windscreen washing system admixtures

Commercial cleansers and antifreeze may be added to the windscreen washing water. Observe the application instructions on the packaging.

6.3.5 Fuel for crane cab heating system

Only if the truck crane is fitted with a separate tank for the auxiliary heater do you have the option of selecting whether to use the same fuel as in Section 6.3.1 or to use EL heating oil.

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7

Maintenance work on the carrier

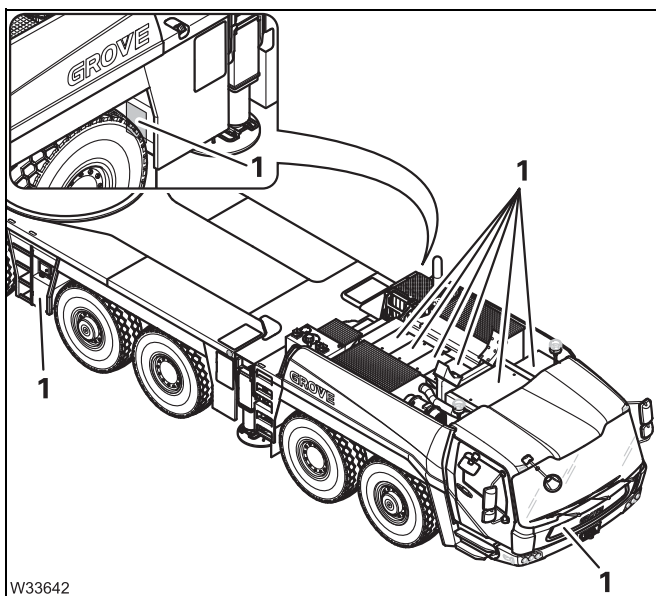
7.1

General instructions

7.1.1

Covers

Various types of work (e.g. oil change) require that covers be removed.



Before maintenance work

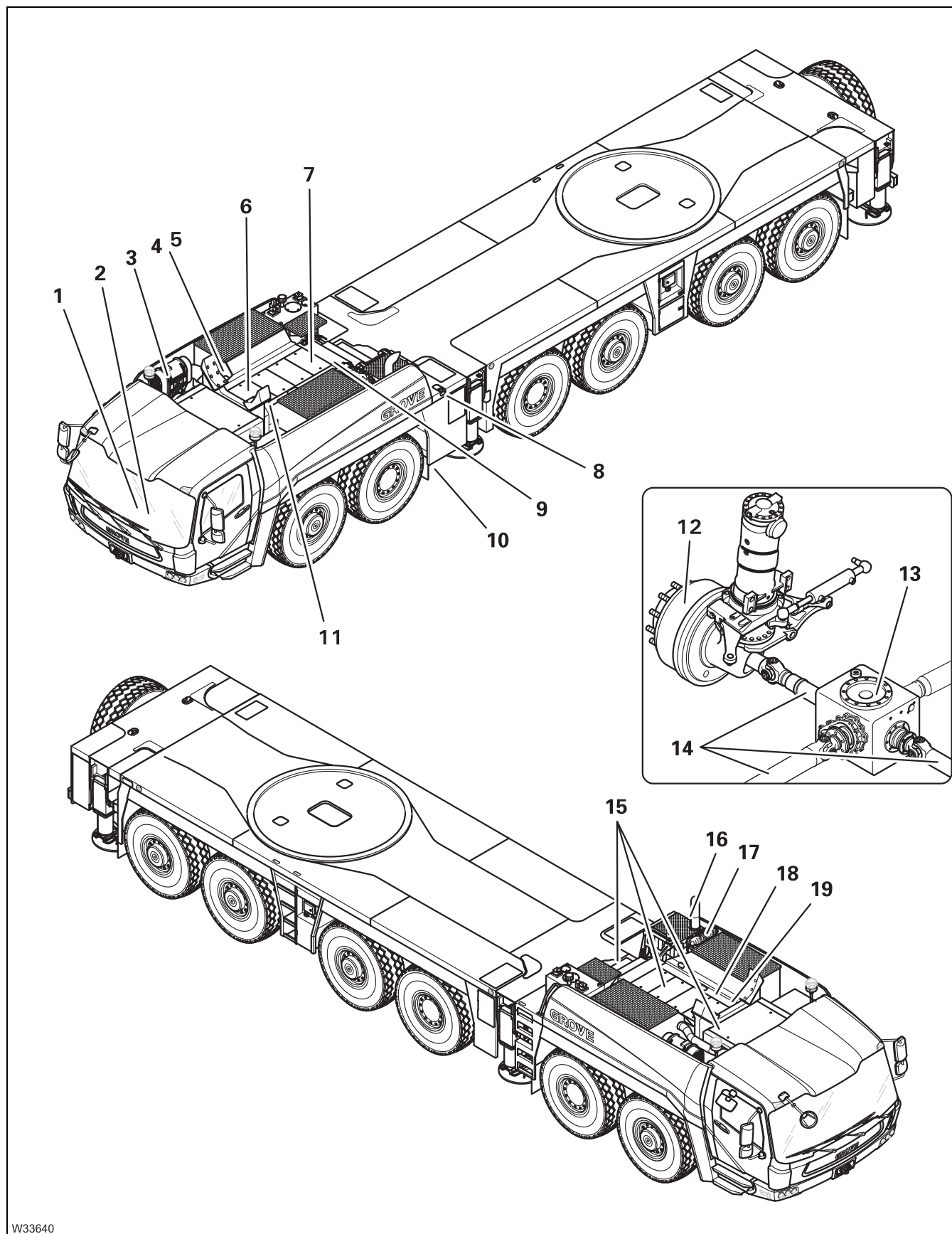
- Remove the covers (1)

After maintenance work

- Fasten the covers (1) with the locks.

7.1.2

Overview of maintenance work on the carrier



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Symbols for maintenance work

- 1 Instrument panel ▶▶▶▶▶ p. 7 - 9
- 2 ECOS display ▶▶▶▶▶ p. 7 - 9

Engine

- 6 Diesel engine ▶▶▶▶▶ p. 7 - 11
- 15 Covers ▶▶▶▶▶ p. 7 - 11
- 4 Dipstick ▶▶▶▶▶ p. 7 - 1
- 5 Oil filler opening ▶▶▶▶▶ p. 7 - 11
- 3 Air filter ▶▶▶▶▶ p. 7 - 13
- 17 Coolant reservoir ▶▶▶▶▶ p. 7 - 14
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Fuel system

- Diesel tank for the carrier engine (on the turntable) ▶▶▶▶▶ p. 7 - 25
- 19 Filter 1 ▶▶▶▶▶ p. 7 - 25
- 18 Filter 2 ▶▶▶▶▶ p. 7 - 26

Exhaust system with exhaust emission control

- 8 AdBlue tank ▶▶▶▶▶ p. 7 - 31
- 16 Exhaust silencer with SCR catalytic converter ▶▶▶▶▶ p. 7 - 32

Transmission

- 7 Dipstick ▶▶▶▶▶ p. 7 - 37
- 9 Oil filter ▶▶▶▶▶ p. 7 - 37

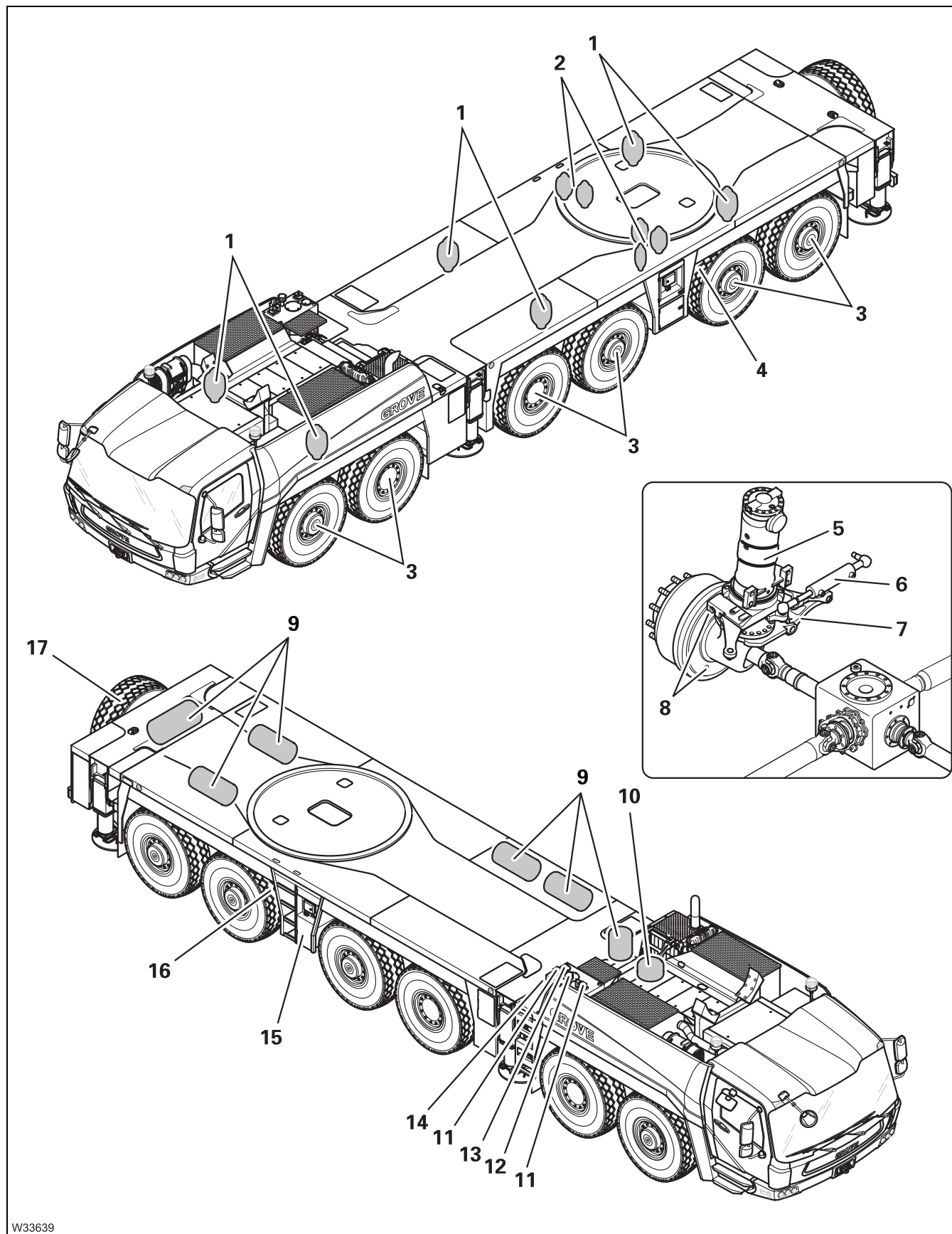
Transfer case

- 10 Oil level plug ▶▶▶▶▶ p. 7 - 41

Axle lines

- 13 Axle centre drives ▶▶▶▶▶ p. 7 - 45
- 12 Final drives ▶▶▶▶▶ p. 7 - 46
- 14 Cardan shafts ▶▶▶▶▶ p. 7 - 49



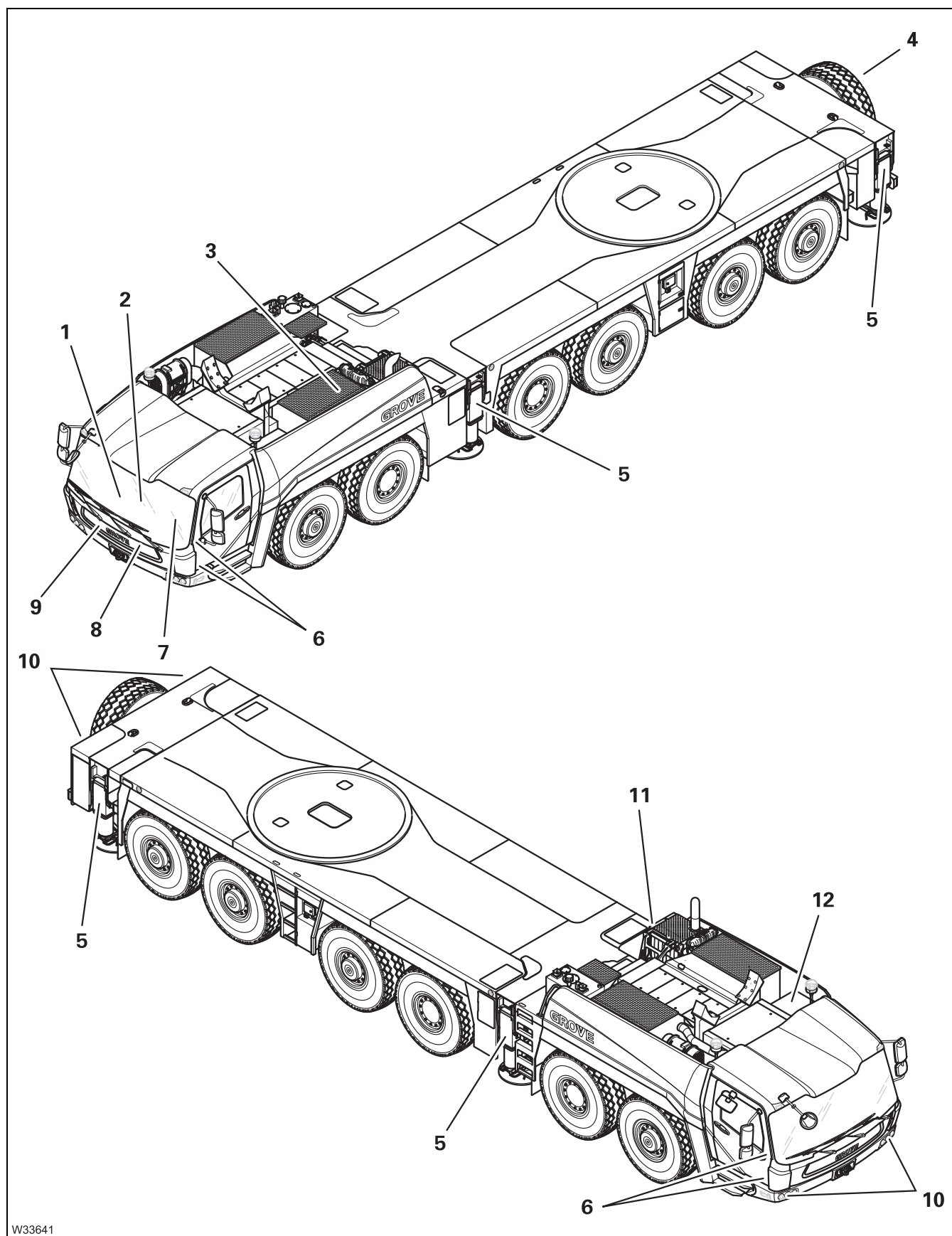


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Wheels	▣▣▣▣▶ p. 7 - 61
3 Wheels	▣▣▣▣▶ p. 7 - 61
17 Spare wheel (alternative: storage box)	
Vehicle brake	▣▣▣▣▶ p. 7 - 69
8 Brake linings	▣▣▣▣▶ p. 7 - 69
Suspension	▣▣▣▣▶ p. 7 - 71
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Steering	▣▣▣▣▶ p. 7 - 75
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Compressed air system	▣▣▣▣▶ p. 7 - 77
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Hydraulic system	▣▣▣▣▶ p. 7 - 81
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13 Oil filler opening	▣▣▣▣▶ p. 7 - 93
Central lubrication system	▣▣▣▣▶ p. 7 - 99
15 Centralised lubrication pump	▣▣▣▣▶ p. 7 - 99





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Electrical system	➡ p. 7 - 103
10 Carrier lighting	➡ p. 7 - 103
12 Battery box	➡ p. 7 - 104
11 External starting socket ¹⁾	➡ p. 7 - 109
Air conditioning system	➡ p. 7 - 111
1 Air-conditioning system in the driver's cab	➡ p. 7 - 111
3 Condenser fins	➡ p. 7 - 112
9 Pollen filter	➡ p. 7 - 114
Towbar coupling	➡ p. 7 - 115
4 Towbar coupling ¹⁾	➡ p. 7 - 115
Other maintenance work	➡ p. 7 - 123
8 Windscreen washing system reservoir	➡ p. 7 - 123
5 Outrigger beams	➡ p. 7 - 124
2 Driver's cab auxiliary heater ¹⁾	➡ p. 7 - 125
6 Cab door hinges	➡ p. 7 - 125
– Various connecting pins and socket pins	➡ p. 7 - 126
– Corrosion protection	➡ p. 7 - 127
7 Fire extinguisher	➡ p. 7 - 129

¹⁾ Additional equipment

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7.2

Symbols for maintenance work

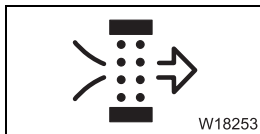
Check the following symbols every day before starting work.

On the instrument panel

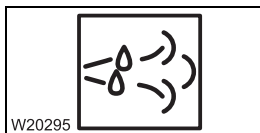


If one of the symbols is displayed in the **driver's cab** you must carry out the corresponding maintenance work:

– Oil pressure; p. 7 - 11

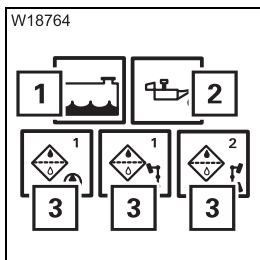


– Air filter; p. 7 - 14



– AdBlue system; p. 7 - 32.

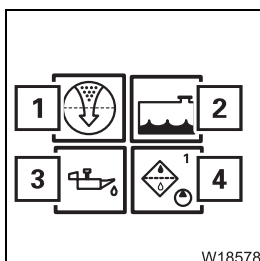
On the ECOS display



- Open the *Warning* submenu in the **driver's cab**;
 Manual de instrucciones.

You must carry out the corresponding maintenance work if a symbol is displayed in **red**:

- 1 Coolant level; p. 7 - 15.
- 2 Oil pressure; p. 7 - 11.
- 3 Hydraulic oil filter; p. 7 - 95.



- Open the *Warning* submenu in the **crane cab**;
 Manual de instrucciones.

You must carry out the corresponding maintenance work if a symbol is displayed in **red**:

- 1 Air filter; p. 7 - 14.
- 2 Coolant level; p. 7 - 15.
- 3 Oil pressure; p. 7 - 11.
- 4 Hydraulic oil filter; p. 7 - 95.

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7.3

Engine

- In addition, carry out further maintenance work specified in the *Engine manufacturer's documentation* supplied.

7.3.1

Checking the oil level

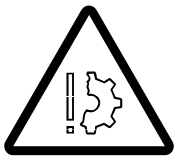
D

Prerequisites

- The truck crane must be level.

Checking the oil level

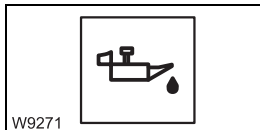
- Start the engine.



Risk of damage to the engine if the oil pressure is too low.

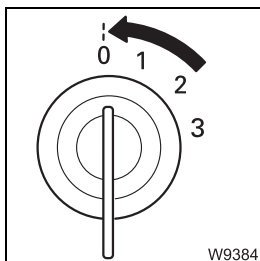
If one of the symbols **STOP** or **Oil can** is displayed and the warning buzzer sounds, switch off the engine immediately.

Running the engine when the oil pressure is too low can damage it.



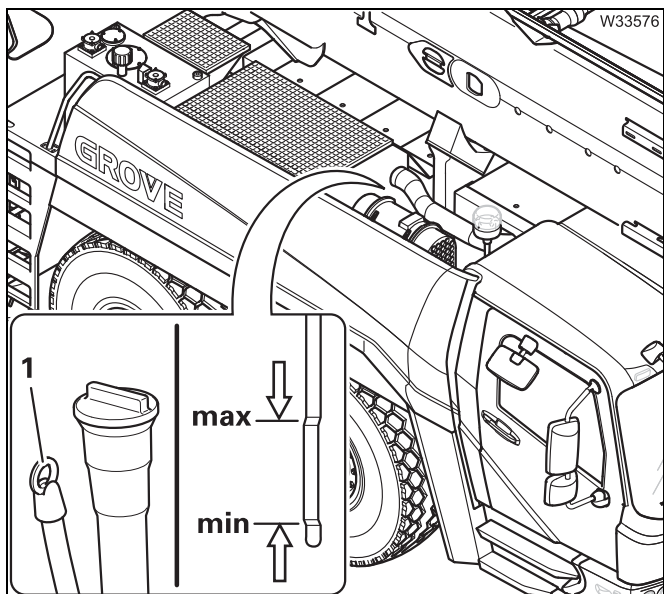
- **Switch off the engine immediately, if**
 - the symbol **STOP** is displayed,
 - the symbol **Oil can** is displayed,
 - and the warning buzzer sounds.

If these symbols are displayed, the oil pressure is too low.



- Allow the engine to run at idling speed for 2-3 minutes.
- Switch the engine off.
- Check the oil level after about 2 minutes.






- On the dipstick (1), check that the oil level is between the **min.** and the **max.** marks (arrow markings).
- After checking the oil level, put the dipstick back in the dipstick tube.

If the oil level is too low

- Top up the oil; ➡ p. 7 - 13.

7.3.2


Topping up the oil

Data on the prescribed oil specification;  *Engine manufacturer's documentation.*

Oil

Engine oil in litres (gal)	Designation according to DIN 51502	Specification classification	GROVE part no.
42 (11.1)	HD - CD	MIL-L 2104 C DB 228.31/51	SAE 5 W-30 03329588


Prerequisites

- The truck crane must be level.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Topping up the oil



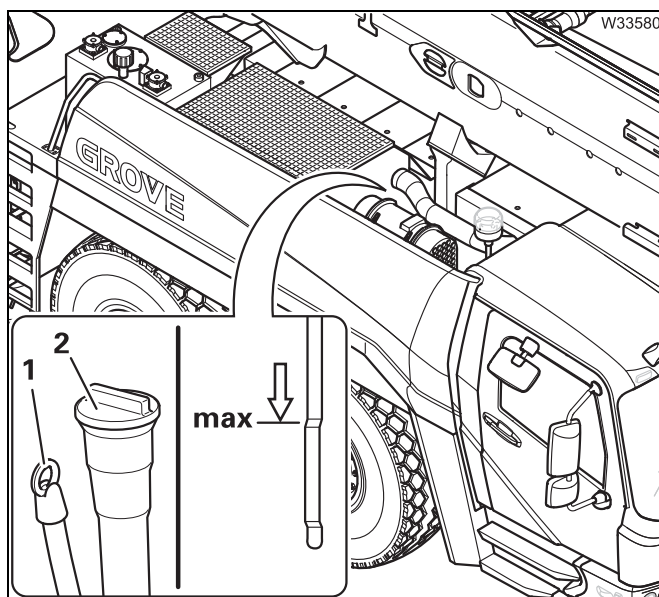
Risk of damage to the engine if the oil level is too high.

Do not overfill with oil; the oil level must not be higher than the **max.** mark (arrow marking). Drain off oil if necessary;  *Engine manufacturer's documentation.*



Risk of burns when the engine is hot.

During operation, the engine and add-on parts reach temperatures up to 400 °C (750 °F). Wear appropriate protective gloves and be careful not to touch hot parts.

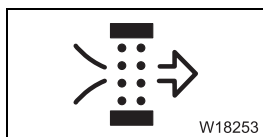


- Add oil through the filler neck (2) up to the **max.** mark.
- Close the filler neck with the cap.
- Put the dipstick (1) into the dipstick tube after checking the oil level.

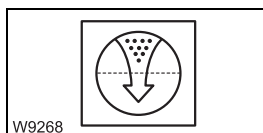
7.3.3

Checking the air filter

D



If the symbol is displayed on the instrument panel **in the driver's cab**, the air filter must be changed.




If the symbol is displayed **in the crane cab** on the ECOS display (*Warning submenu*), the air filter must be changed.

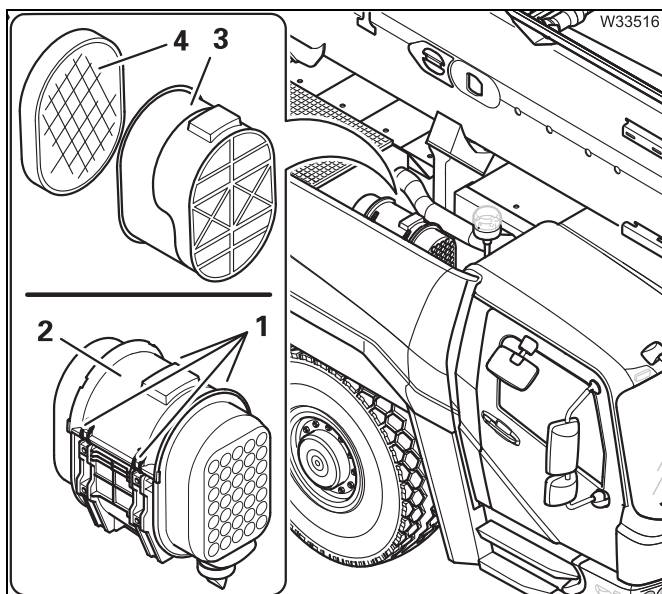
Spare parts and tools

Designation	Quantity	GROVE part no.
Main filter	1	04163882
Back-up filter	1	04163883

Prerequisites

- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Replacing the air filter

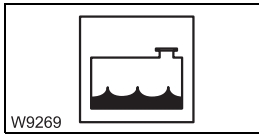


- Undo all the clamps (1) and remove the cover (2).
- Change the main filter (3) and the back-up filter (4).
- Replace the cover and secure it with all the clamps.

7.3.4

Checking the coolant level

D



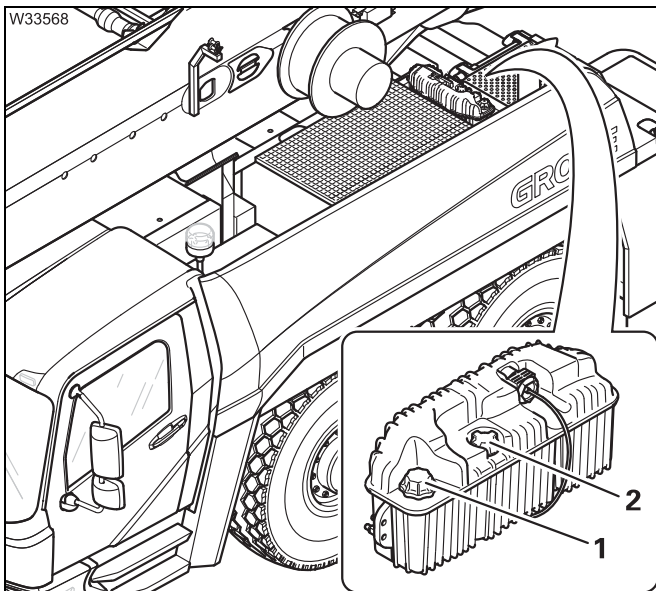
If the symbol appears on the display, you must top up the coolant.

Topping up coolant



There is a risk of scalding when the cooling circuit is hot.

The hot cooling circuit is under pressure. When you open the expansion tank you could be scalded by escaping steam/coolant. Wear suitable protective gloves and cover the cap on the expansion tank with a rag before opening it. Turn the cap slowly to the first detent in order to allow the pressure to be released.



- Do **not** open the pressure relief valves (2).
- Loosen (do not open) the cap (1) to reduce the pressure if the coolant is at operating temperature.
- Open the cover (1).
The coolant level must be at the lower marking in the filler neck.

If the coolant level is too low

- Top up the coolant.
Composition of the coolant; Engine manufacturer's documentation.
- Close the cap (1).



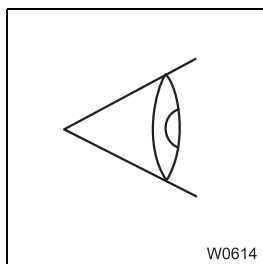
Risk of damage to engine due to lack of coolant.

If the coolant has to be topped up frequently, the cooling system may be leaking. Have the cooling system checked by **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

7.3.5

General inspection

W



- Investigate any unusual running noises from the engine.
- Check the engine and the connections for leaks. If consumables are leaking;
 - ▣▣▣▣▶ *Checking the oil level*, p. 7 - 11,
 - ▣▣▣▣▶ *Checking the coolant level*, p. 7 - 15.
- Check that pipes and hoses are tightly connected and undamaged.

If any damage is found, report it to **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

7.3.6




Have the radiator checked/cleaned

M 12

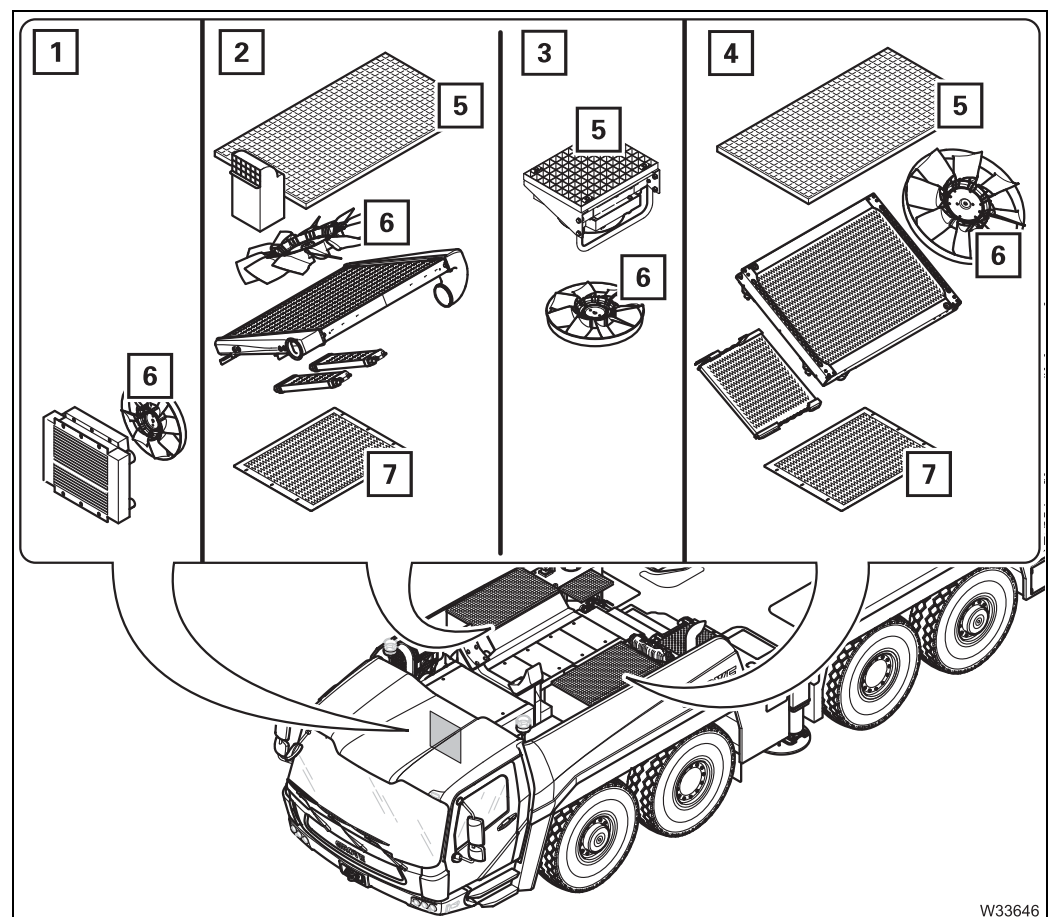
Reducing the interval

- Under difficult operating conditions – at extremely sandy or dusty locations or if there is a heavy density of fallen leaves – you must have the radiator fins cleaned earlier than this.

Prerequisites

- The truck crane must be supported on outriggers and must be level;  *Manual de instrucciones*.
- The main boom must be fully retracted and raised to 75°;  *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The working area on the carrier above the engine covers and between the radiator units must be freely accessible.
- Trained repair crew and repair tools must be available.

Check the level of dirt



W33646

The radiator units are protected by grilles (5) and plates (7). The fan impellers (6) are located under the grilles. When the engine is running, the fan impellers rotate behind the grilles!



Risk of injury due to the fan impellers!

When the fan impellers are rotating they can trap the fingers of your hand and amputate them. Never reach into the fan impellers when they are rotating. Do not push any tools through the grilles to clean them.

Always stop the engine before attempting to clean the fan impellers and radiator fins.

Radiator unit 2 (right)

Radiator for engine charge air, radiator for transmission gear oil, radiator for compressed air system.

Radiator unit 4 (left)

Radiator for engine coolant, condenser for refrigerant for the driver's cab air-conditioning system.

Radiator unit 1

Radiator for hydraulic oil (mounted behind the driver's cab).


Radiator unit 3

Additional radiator for hydraulic oil (mounted on the hydraulic oil tank).

Checking

- If necessary remove leaves, twigs and other debris from the grilles (5).
- View the fan impellers (6) through the grilles from above to check their condition. The impeller blades must be clean and undamaged.



If the radiator fins are heavily soiled have them cleaned, since further soiling can lead to overheating;  *Have them cleaned, p. 7 - 19.*

**Have them
cleaned**



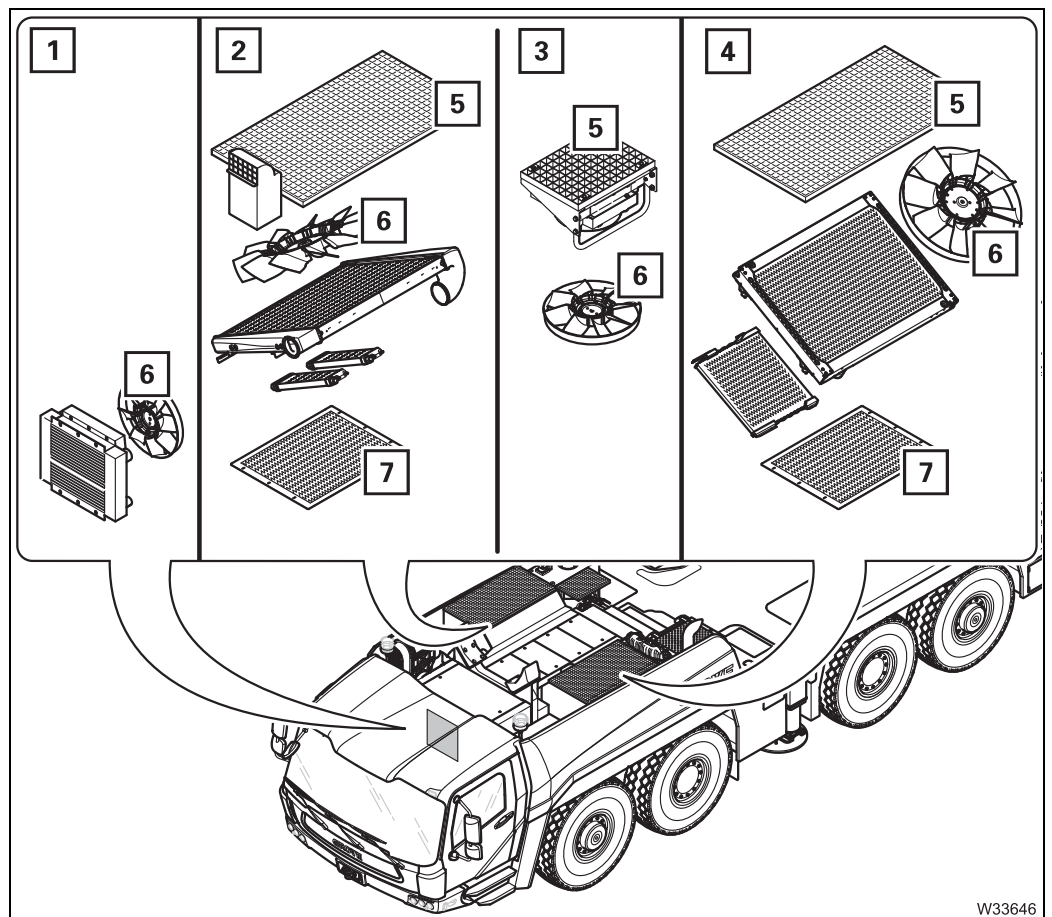
Risk of injury due to the fan impellers!

When the fan impellers are rotating they can trap the fingers of your hand and amputate them. Never reach into the fan impellers when they are rotating. Do not push any tools through the grilles to clean them. Always stop the engine before attempting to clean the fan impellers and radiator fins.




Risk of damaging the radiator fins

Do not use a high pressure cleaner or steam jet cleaner. The powerful jet may damage the fins. Use only suitable cleaning agents air for cleaning.



- Have the radiator units (1), (2), (3) and (4) opened up by the repair crew so that the radiator fins are accessible.
- Have the radiator fins cleaned on both sides, using suitable cleaning agents.
- Have the fan impeller (6) cleaned.
- Have the cooling air baffle (7) cleaned.
- Have the hoses and connections checked for damage and leaks.
- Have any damaged parts replaced.

**After checking/
cleaning**

- Remove all tools and cleaning equipment.
- Check that all the grilles (5) and plates (7) are secure.
- Start the engine and wait until the fan impellers are rotating.
- Check that the fan impellers are running freely.
- Check the respective temperature displays in the driver's cab;  *Manual de instrucciones*.
- Switch off the engine.
- Check the radiator and connections for leaks.

7.3.7



Changing the oil and oil filter

Y 2




Oil, spare parts,
tools

Engine oil in litres (gal)	Designation according to DIN 51502	Specification Classification	GROVE part no.
42 (11.1)	HD - CD	MIL-L 2104 C DB 228.31/51	SAE 5 W-30 03329588

Designation	Quantity	GROVE part no.
Oil filter with gasket	1	04161614

- Receptacle, approx. 50 ltr (14 gal);  p. 2 - 4.
- Torque wrench for a torque of 55 Nm (40.5 lbf ft).
- Connecting piece and hose (tool box);  p. 7 - 92.

Prerequisites

- Find out the prescribed oil specification and about the need to shorten the maintenance interval under special operating conditions;  *Engine manufacturer's documentation.*
- Find out about the safety instructions and the sequence of steps to change the oil and the oil filter;  *Engine manufacturer's documentation.*
- The truck crane must be level.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Changing



Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly. Ask about the applicable regulations.

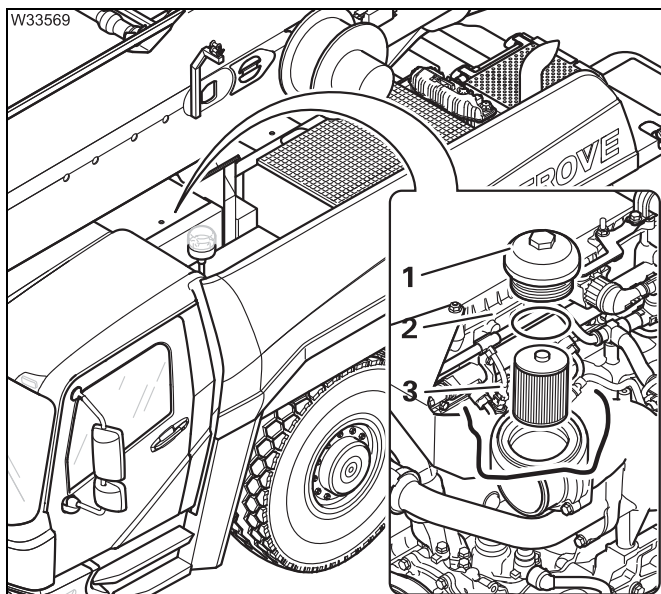
If a valve is already mounted on the oil pan:



Risk of environmental damage due to leaking consumables.

If a valve is mounted on the oil pan, use the delivered connecting piece with hose and a receptacle with adequate capacity to drain the oil.

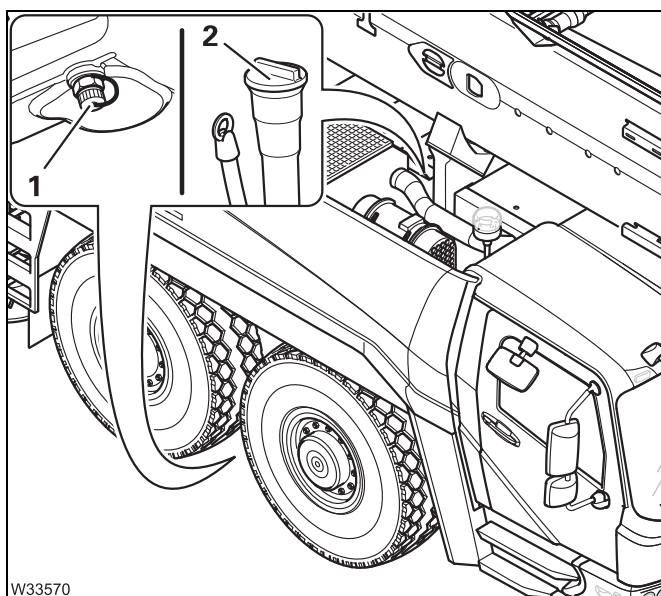




Oil filter

- Place a receptacle underneath the engine.
- Remove the cover (1).
- Remove the oil filter (3) from the housing.
- Place the old filter (3) in the receptacle.
- Insert a new filter (3) and a new gasket (2) into the housing.
- Attach the cover (1) – torque 55 Nm (40.5 lbf ft);
 ▣▣▣▣ Engine manufacturer's documentation.

- Leave the receptacle in place for the oil change.



Draining oil

- Screw the connecting piece and hose onto the valve (1) and drain the oil into the receptacle; ▣▣▣▣ *Handling the valves*, p. 7 - 92.
- Remove the connecting piece and hose from the valve and remove the receptacle.

Topping up oil



- Top up with fresh oil through the filler neck (2); ▣▣▣▣ p. 7 - 13.

7.3.8



Changing the coolant

Y 3

Tools

- Connecting piece and hose (toolbox).
- Receptacle, approx. 40 ltr (10.5 gal);  p. 2 - 4.
- Antifreeze;  *Engine manufacturer's documentation*.

Prerequisites

- Information on the coolant and admixture ratio has been obtained;  *Engine manufacturer's documentation*.
- The truck crane must be level.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The engine has cooled down.



Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly. Ask about the applicable regulations.



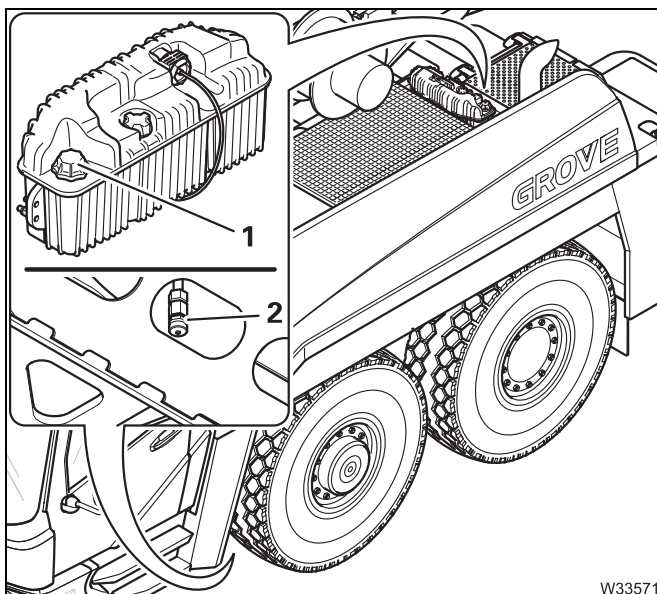
There is a risk of scalding when the cooling circuit is hot.

The hot cooling circuit is under pressure. When you open the expansion tank you could be scalded by escaping steam/coolant.


Wear suitable protective gloves and cover the cap on the expansion tank with a rag before opening it.

Turn the cap slowly to the first detent in order to allow the pressure to be released.

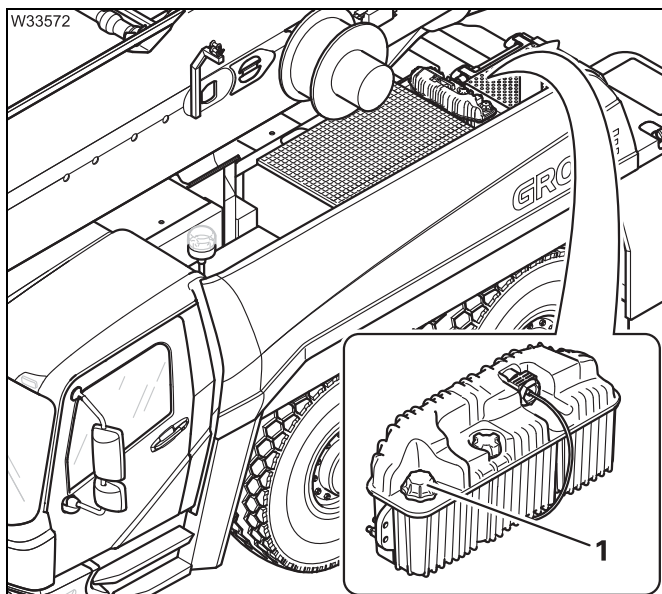
Changing



Draining when the engine is cold

- Open the cap (1) on the expansion tank.
- Place a receptacle under the valve (2) under the cab.
- Screw the connecting piece and hose on to the valve (2) and drain the coolant;  *Handling the valves*, p. 7 - 92.
- Remove the receptacle.





Topping up when the engine is cold

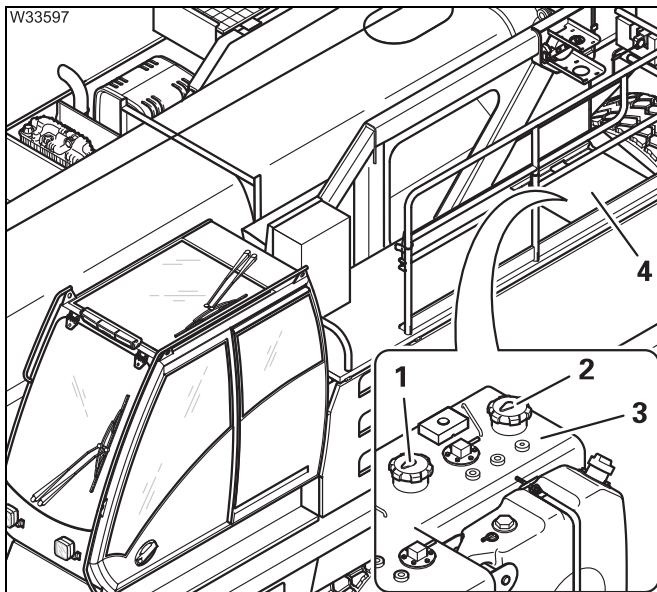
- Slowly top up the expansion tank (1) with coolant until it is filled up to the lower edge in the filler neck.
- Wait about 1 minute. Add more coolant if necessary.
- Close the cover (1).


Check it when the engine is warm

- Start the engine.
- Let the engine run at idling speed for approx. 5 minutes.
- Switch off the engine.
- Check the coolant level when the engine is warm;
 ▣▣▣▣▶ *Checking the coolant level*, p. 7 - 15.

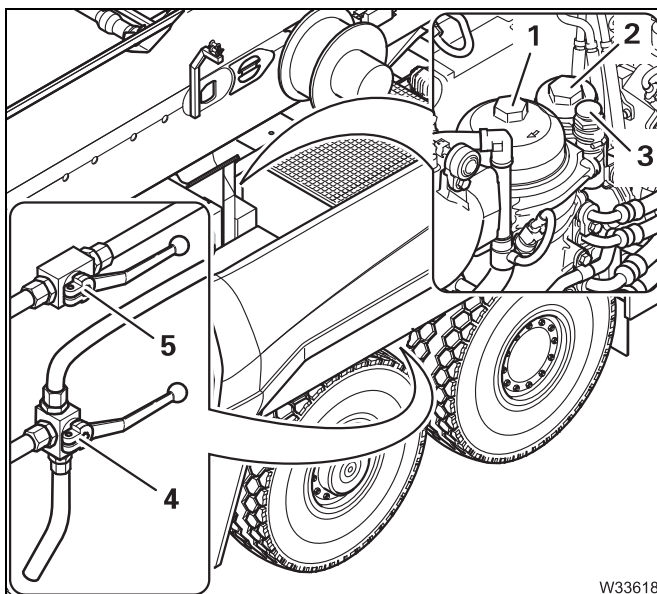
7.4

Fuel system



To fill up with fuel you must open the cover (4) over the 2-chamber fuel tank (3);  *Manual de instrucciones.*

- 1 Fuel tank for the carrier engine 480 litres (126 gal)
- 2 Fuel tank for the superstructure engine 200 litres (52 gal)



The following elements are installed in the **carrier** fuel line:


- 1 Fuel filter 1 (large)
- 2 Fuel filter 2 (small)
- 3 Fuel hand pump
- 4 3-way valve in the return line, for draining the fuel
- 5 Valve in the supply line; for shutting off the supply

7.4.1




Draining off water from fuel filter 1

D

Spare parts and tools

- Receptacle, approx. 5 ltr (1.5 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be standing level and on outriggers;
 *Manual de instrucciones*.
- The main boom must be fully raised;  *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Draining off water

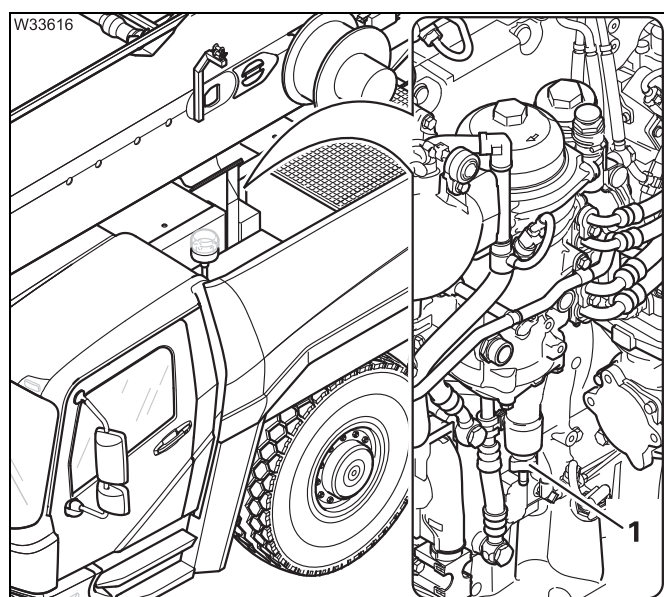


Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.



- Place a receptacle underneath the filter.
- Open the valve (1).
- If the consumable that emerges is clean, close the valve by hand.
- Remove the receptacle and properly dispose of the drained consumable.

7.4.2

Replacing fuel filter 1

M 3

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter (large)	1	04161567
alternatively: Set for both filters 1 + 2 (large + small)	1	04180966

- Receptacle, approx. 5 ltr (1.5 gal); p. 2 - 4.
- Torque wrench for a torque of 55 Nm (40.5 lbf ft).

Prerequisites

- The truck crane must be level and on outriggers; *Manual de instrucciones*.
- The main boom must be fully raised; *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.
- If the fuel is dirty: Reduce the maintenance interval.

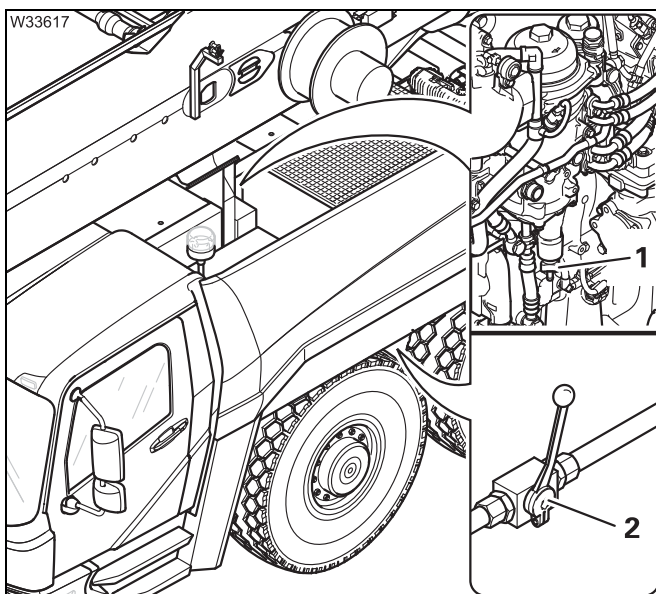
Changing



Risk of environmental damage due to leaking consumables.

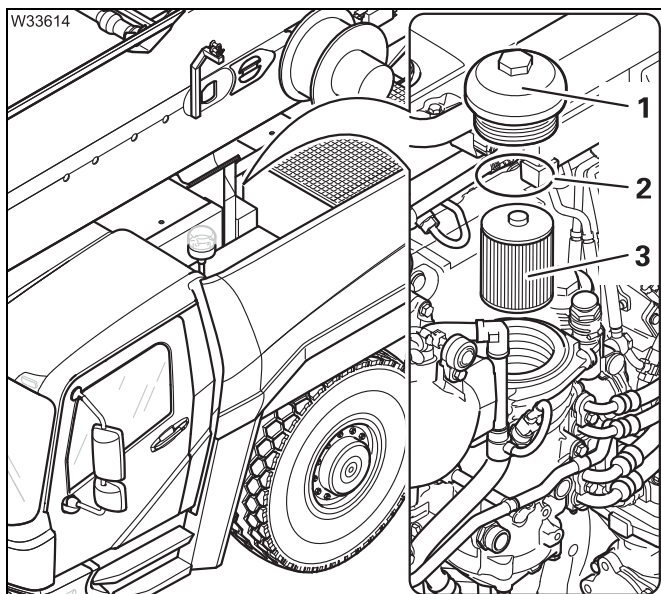
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.


Store/dispose of consumables and any soaked equipment properly. Ask about the applicable regulations.

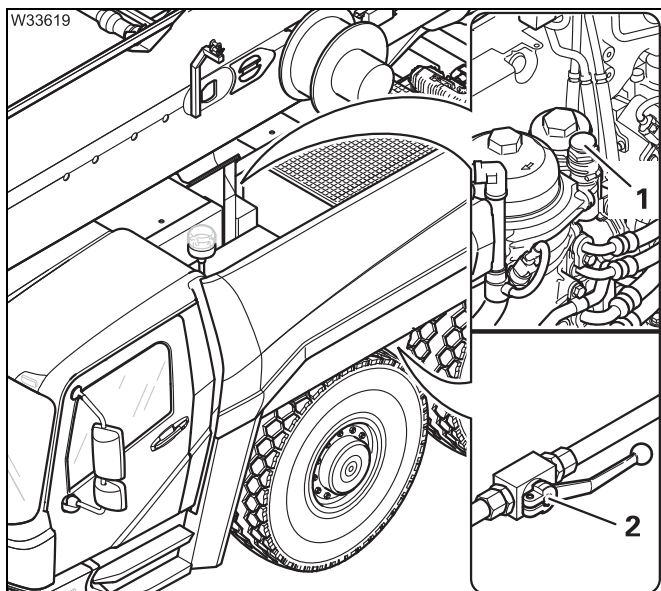



- Place a receptacle underneath the filter.
- Close the valve – lever (2) at right angles to the line.
- Open the valve (1) and let the consumable drain out.





- Remove the cover (1).
- Remove the old filter (3) from the casing.
- Place the old filter (3) in the receptacle.
- Insert a new filter (3) and a new gasket (2) into the housing.
- Attach the cover (1) – torque 55 Nm (40.5 lbf ft);  Engine manufacturer's documentation.
- Remove the receptacle.



- Open the valve (2) – lever parallel to the line.
- Open the tank cover on the fuel tank;  p. 7 - 25.
- Operate the hand pump (1) until you sense definite resistance.
- Close the tank cover on the fuel tank.
- Start the engine and check for leaks.



If you have used a clean receptacle, you can refill the fuel tank with the consumable using a filter. Otherwise dispose of the consumable properly.

7.4.3

Replacing fuel filter 2

M 12

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter (small)	1	04161566
alternatively: Set for both filters 1 + 2 (large + small)	1	04180966

- Receptacle, approx. 5 ltr (1.5 gal); p. 2 - 4.
- Torque wrench for a torque of 15 Nm (11 lbf ft).

Prerequisites

- The truck crane must be level and on outriggers; *Manual de instrucciones*.
- The main boom must be fully raised; *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.
- If the fuel is dirty: Reduce the maintenance interval.

Changing

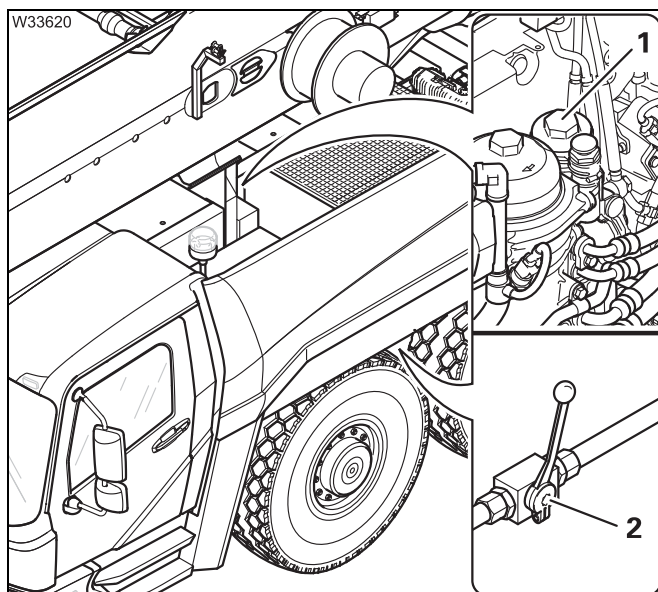


Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

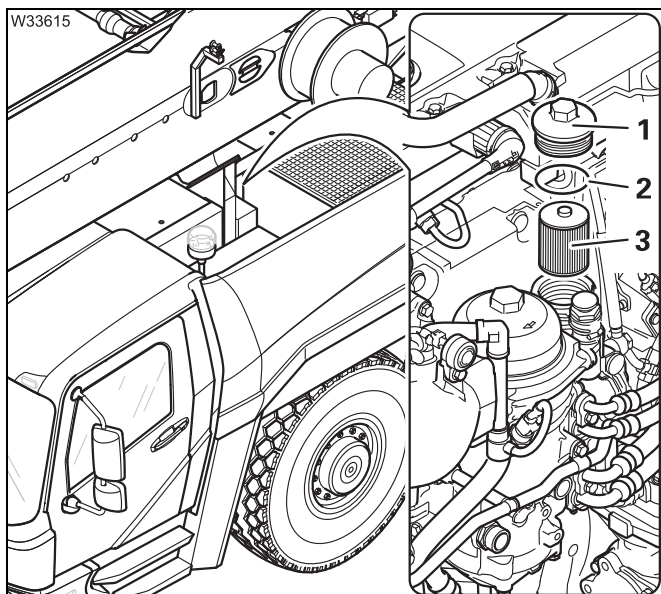
Store/dispose of consumables and any soaked equipment properly.


Ask about the applicable regulations.

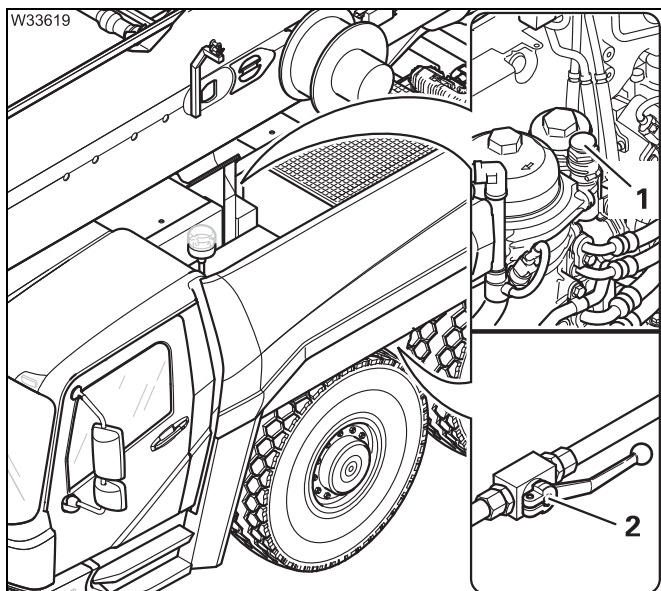



- Place a receptacle under the filter (1).
- Close the valve – lever (2) at right angles to the line.





- Remove the cover (1).
- Remove the old filter (3) from the casing.
- Place the old filter (3) in the receptacle.
- Insert a new filter (3) and a new gasket (2) into the housing.
- Attach the cover (1) – torque 15 Nm (11 lbf ft);  Engine manufacturer's documentation.
- Remove the receptacle.



- Open the valve (2) – lever parallel to the line.
- Open both the tank covers on the fuel tank;  p. 7 - 25.
- Operate the hand pump (1) until you sense definite resistance.
- Close the tank cover on the fuel tank.
- Start the engine and check for leaks.



If you have used a clean receptacle, you can refill the fuel tank with the consumable using a filter. Otherwise dispose of the consumable properly.

7.5

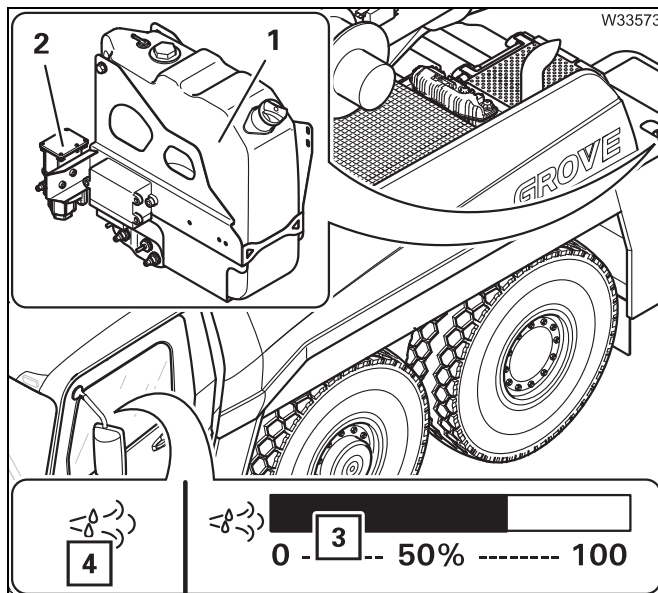
Exhaust system with exhaust emission control

Overview

To comply with the exhaust emission regulations, the truck crane may only be run with the **exhaust system with SCR catalytic converter (SCR = Selective Catalytic Reduction)**.

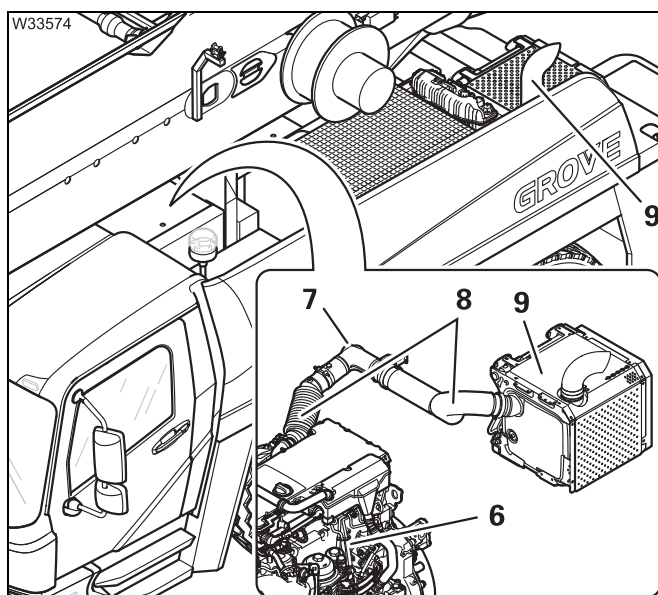
The exhaust gas is cleaned with an **AdBlue system (DEF)**. To do this, **AdBlue (DEF) (Diesel Exhaust Fluid)** from the DEF tank is injected into the exhaust system.

The engine output is automatically sharply reduced when there is not enough AdBlue solution available. Driving with an empty AdBlue tank will invalidate the truck crane's licence for use on public roads; **Manual de instrucciones, Engine manufacturer's documentation.**



AdBlue system

- 1 AdBlue tank
- 2 Pump unit for pumping AdBlue to the dosing unit on the diesel engine and for pumping engine coolant for preheating the AdBlue tank.
- 3 Tank gauge, AdBlue tank
- 4 Warning lamp: AdBlue system fault.
- 6 Diesel engine with dosing unit for AdBlue (compressed air supply) and a solenoid valve for preheating the AdBlue tank using engine coolant.
- 7 Injection nozzle for injecting the AdBlue/compressed air mixture.
- 8 Exhaust pipes
- 9 Exhaust silencer with SCR catalytic converter



7.5.1

Checking the AdBlue tank level

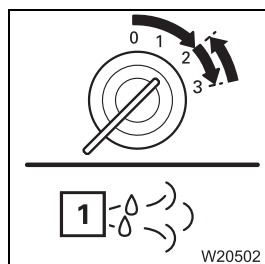
D

Checking

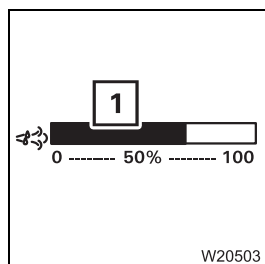
The warning lamp for checking the AdBlue system is located on the instrument panel in the driver's cab, a gauge for checking the AdBlue tank level is located on the ECOS display.



The tank has a maximum filling volume of about 40 ltr (10.5 gal). Depending on where the truck crane is used, it may be sensible to carry additional canisters of AdBlue.



- Start the engine and check the lamp (1) after the engine starts:
 - If the lamp goes out, the AdBlue level in the tank is sufficient.
 - If the lamp lights up, the AdBlue level in the tank is on reserve.
 - If the lamp flashes, the AdBlue tank is empty.



- Check the AdBlue level in the tank via the display (1).
- Refill the tank when the AdBlue level falls below approx. 10 ltr (2.6 gal) at the latest – and/or if the lamp lights up.

7.5.2

Filling up with AdBlue

Consumable and tools


AdBlue in litres (gal)	Specification Classification	GROVE part no.
40 (10.5)	DEF (Diesel Exhaust Fluid) e.g. <i>AdBlue</i> .	03140555

- As required: 2 canisters of about 20 ltr each (5 gal); p. 2 - 4.

Prerequisites

- A service station with a filling pump for AdBlue can be used, or AdBlue can be filled manually from canisters.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.

Filling up

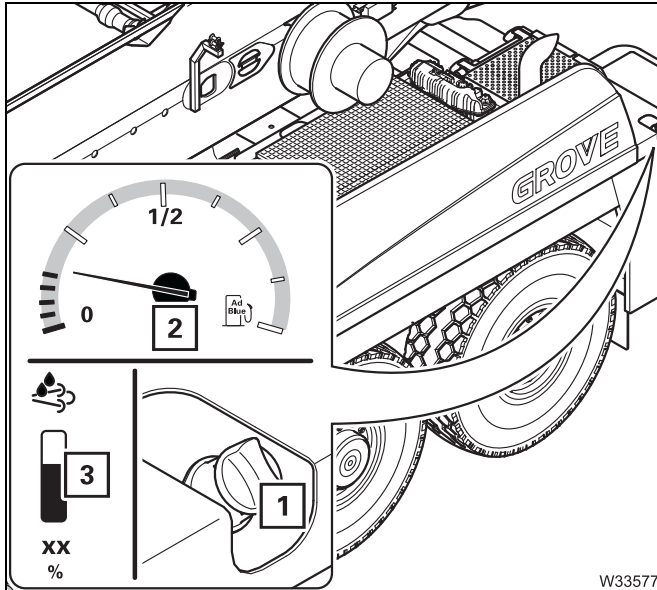
- Find out about filling up in the operating manual and note the warnings;  *Manual de instrucciones.*




Danger of scalding due to ammonia vapours.

Ammonia vapour can escape if the AdBlue tank is opened when the outside temperature is high. Ammonia vapours can irritate mucous membranes, skin and eyes.

Ensure that there is adequate fresh air supply and do not breathe in the escaping ammonia vapours.



- Fill the AdBlue tank via the filler neck (1) and close it using the cap.
- Check the level on the gauges (2) and (3) in the driver's cab;  p. 7 - 32.

7.5.3


Check the exhaust system for external damage

M 1

Spare parts and tools

Designation	Quantity	GROVE part no.
Exhaust silencer with SCR catalytic converter (SCR = S elective C atalytic R eduction)	1	03140048

Prerequisites

- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The engine and the exhaust system must be cool.

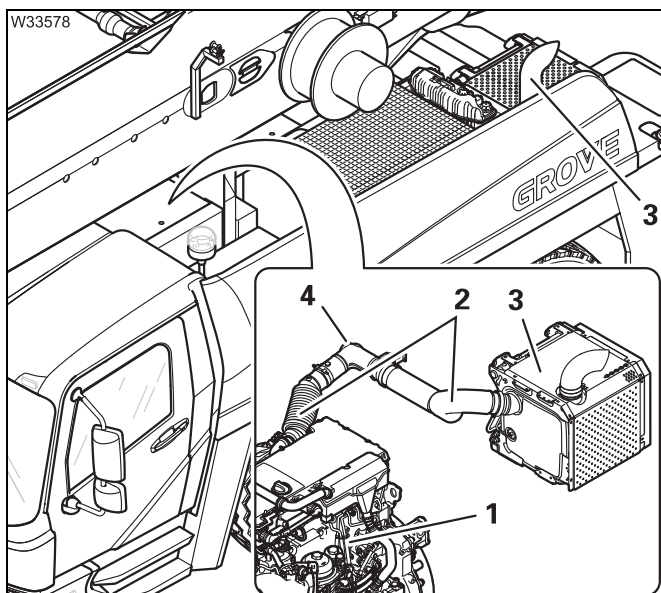


Checking



Risk of burns if the exhaust system is hot

During operation, the exhaust system heats up to 400 °C (750 °F). Wear suitable gloves and wait until the exhaust system has cooled down. Make sure not to touch any hot parts.



- Check the exhaust pipes (2) from the engine (1) to the silencer (3) for damage. The exhaust pipes (2) may not have any holes or cracks.
- Check that the area around the exhaust pipes is free of loose components which could burn by coming into contact with the hot exhaust system.
- Check the AdBlue injection nozzle (4) for outer damage.

After checking

- Start the engine.
- Check the AdBlue system lamp on the instrument panel; ► p. 7 - 32.
- Check whether exhaust gases are leaking from any damaged places in the exhaust system.
- Switch off the engine.

If you discover any damage

Have any damaged parts of the exhaust system replaced immediately by **Manitowoc Crane Care** or an authorised GROVE dealer.

7.5.4

Having the AdBlue system checked

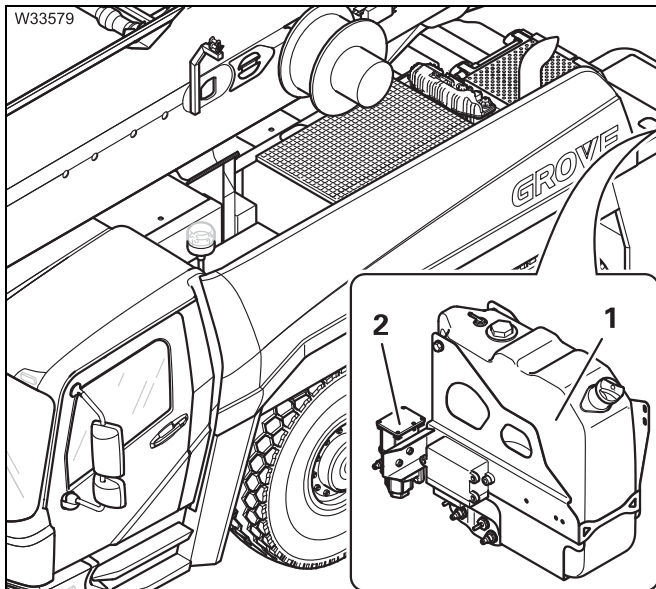
M 12

This inspection may only be performed by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

- Have the entire AdBlue system checked for leaks and correct operation; *Overview, p. 7 - 31.*
- Also observe the information on the components mounted on the engine; **▣▣▣▣** *Engine manufacturer's documentation:*
 - AdBlue dosing unit,
 - Solenoid valve for engine coolant for preheating the AdBlue tank.

Maintenance interval for the pump unit

The engine manufacturer specifies additional maintenance intervals for the pump unit (2); **▣▣▣▣** *Engine manufacturer's documentation.*



AdBlue filter

- Have the AdBlue filter in the pump unit (2) changed:
 - for the first time after one year (**M 12**),
 - after that, every two years (**Y 2**).

Pressure accumulator

- Have the pressure accumulator in the pump unit (2) filled:
 - for the first time after one year (**M 12**),
 - after that, every two years (**Y 2**).


- Have the insulation hood (1) checked for damage and for tight fitting on the AdBlue tank. The insulation hood prevents the AdBlue tank freezing up.
- Have the electrically heated AdBlue cables at the pump unit (2) checked for correct operation.





Risk of damage to the pump unit.

Oil from the compressed air system can damage the pump unit. Therefore, a filter cartridge must be installed in the compressed air drier that removes both water and oil. **Manitowoc Crane Care** recommends the suitable filter cartridge with the GROVE part number 04156032.

- Use only the suitable filter cartridge;  *Replacing the filter cartridge of the compressed air drier, p. 7 - 79.*

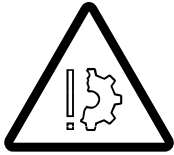
7.6

Transmission

7.6.1

Checking the oil level

D



Risk of damage to the transmission.




If the oil level is too low or too high, this can lead to malfunctions and damage to the transmission.

Carry out the oil level checks in the sequence specified.

Prerequisites

- The truck crane must be level.
- The parking brake must be applied.
- The transmission must be in neutral position **N**.


Sequence of checks

- Check the oil level in the transmission daily in this sequence:
 - prior to starting the engine;  p. 7 - 38.
 - when the gear oil is cold;  p. 7 - 38.
 - when the gear oil is warm;  p. 7 - 39.



To prevent damage to the transmission, the oil level check is always most accurate when the gear oil is warm.



When the engine is running, the gear oil level will continue to be monitored by the oil level sensor;  *Manual de instrucciones*.

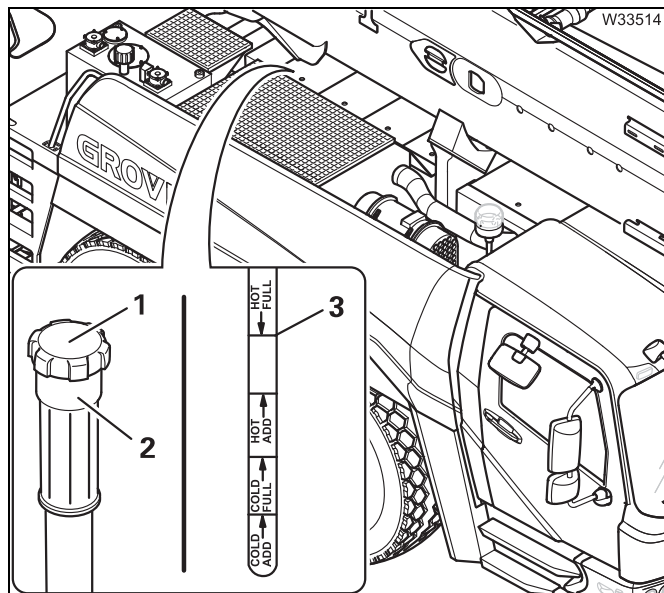


Prior to starting the engine



Risk of damage to the transmission.

The engine must not be started without the gear oil level having been checked beforehand. This prevents damage to the transmission being caused by undetected loss of oil.



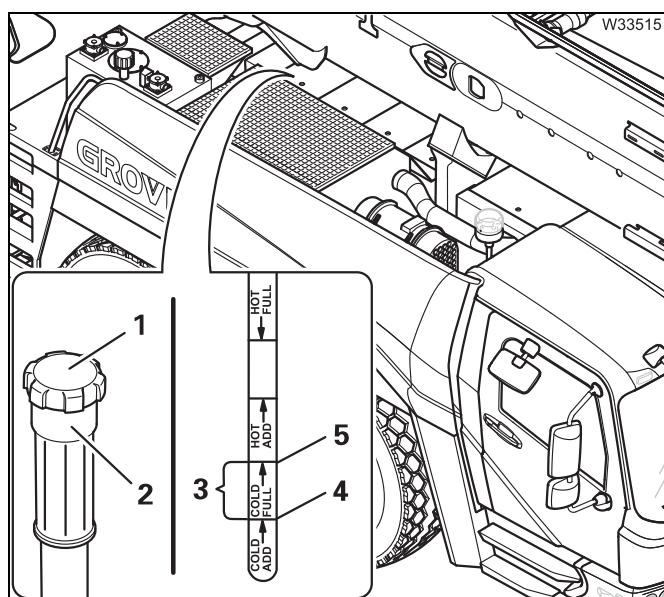
- On the dipstick (1), check whether the oil level is roughly at the mark (3).

If the oil level is too low

- Top up the oil via the dipstick tube (2).
- Insert the dipstick into the dipstick tube.
- Now check the oil level when the gear oil is cold; p. 7 - 38.

When the gear oil is cold

- If necessary, heat up the gear oil to a temperature range between 15 and 50 °C (60 to 120 °F); *Warming up the gear oil*, p. 7 - 39.



- On the dipstick (1), check whether the oil level is around (3).

If the oil level is too high

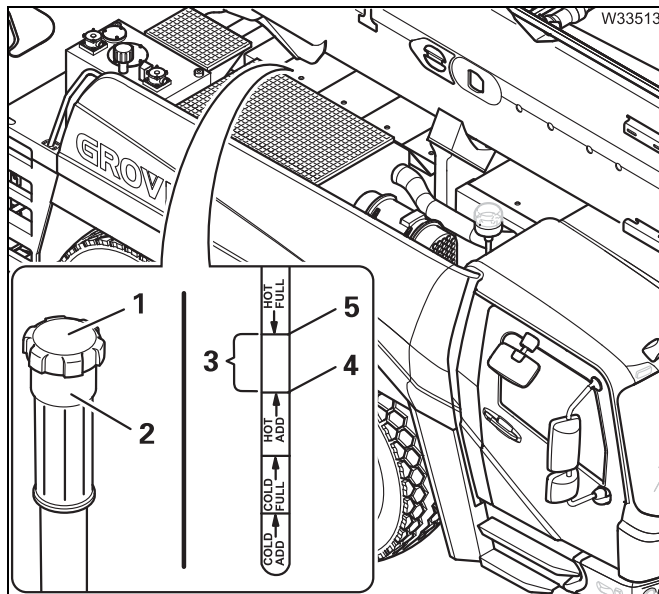
- Drain off oil until it is below the (5) mark; p. 7 - 42.

If the oil level is too low

- Top up the oil via the dipstick tube (2) until the mark (4) is exceeded.
- Insert the dipstick into the dipstick tube.
- Now check the oil level when the gear oil is warm; p. 7 - 39.

When the gear oil is warm

- Heat up the gear oil to a temperature range between 75 and 95 °C (160 to 200 °F); *Warming up the gear oil*, p. 7 - 39.



- On the dipstick (1), check whether the oil level is around (3).

If the oil level is too high

- Drain off oil until it is below the (5) mark; p. 7 - 42.

If the oil level is too low

- Top up the oil via the dipstick tube (2) until the mark (4) is exceeded.
- Insert the dipstick into the dipstick tube.

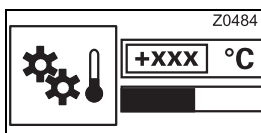
Warming up the gear oil

You warm up the gear oil by

- allowing the truck crane to warm up while the vehicle is stationary or
- by accelerating the truck crane to warm it up while the vehicle is stationary or
- driving the truck crane.

Warming it up when stationary

- Allow the engine to run at idling speed in neutral position **N**.
- Check the gear oil temperature on the *Inspection submenu*; *Manual de instrucciones*.
- Wait until the prescribed temperature range is reached.
- Switch the engine off and check the gear oil level; *When the gear oil is cold*, p. 7 - 38; *When the gear oil is warm*, p. 7 - 39.



Speeding up the warming up procedure

- Allow the engine to run at idling speed in neutral position **N**.
- Fully press the service brake pedal, even if the parking brake is applied.






Risk of damage to the transmission when speeding up the warming up procedure

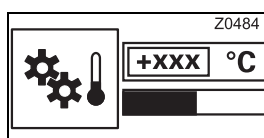
When the wheels are locked, the full engine output may only be applied in transmission mode **D** or **R** for a maximum of 30 seconds. If this duration is exceeded, the transmission could become overheated and be damaged.






Risk of scalding from escaping coolant

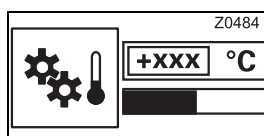
During accelerated warming up, coolant may escape from the expansion tank, before the display shows a coolant temperature of 70 °C (160 °F). The coolant then leaks from the expansion tank.

- Shift first to transmission mode **D** and then to **R** and allow the engine to run briefly at approx. 1200 - 1500 min⁻¹ (rpm) in each transmission mode for a maximum of 30 seconds.
- Shift into neutral position **N** and let the engine run at idling speed.
- Check the gear oil temperature on the *Inspection submenu*;  *Manual de instrucciones*.
- Wait until the prescribed temperature range is reached.
- Switch the engine off and check the gear oil level;  *When the gear oil is cold*, p. 7 - 38;  *When the gear oil is warm*, p. 7 - 39.



Driving the truck crane

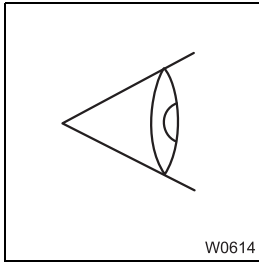
- Check the gear oil temperature on the *Inspection submenu*;  *Manual de instrucciones*.
- Wait until the required gear oil temperature is reached.
- Stop and apply the parking brake.
- Align the truck crane horizontally.
- Shift into the neutral position **N**.
- Switch the engine off and check the gear oil level;  *When the gear oil is cold*, p. 7 - 38;  *When the gear oil is warm*, p. 7 - 39.



7.6.2

General inspection

W



- Pay attention to any unusual running noises from the transmission.
- Check the transmission and the connections for leaks. If consumables are leaking; *Checking the oil level*, p. 7 - 37.
- Check that pipes and hoses are tightly connected and undamaged.

If any damage is found, report it to **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

7.6.3

Changing the oil and oil filter

Y 2

Oil, spare parts and tools

Gear oil in litres (gal)	Specification Classification	GROVE part no.
46 (12.2)	TranSynd TES295; synthetic oil; do not mix with mineral oil.	6829101690

Designation	Quantity	GROVE part no.
Oil filter set with gaskets (contains two filters and one oil drain plug gasket)	1	03141323

- Receptacle, approx. 50 ltr (13 gal); p. 2 - 4.
- Torque wrench for a torque of 25-32 Nm (18-24 lbf ft) and 50-60 Nm (37-44 lbf ft).

Prerequisites

- The gear oil must be at operating temperature (75 to 95 °C (160 to 200 °F)).
- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.



Changing



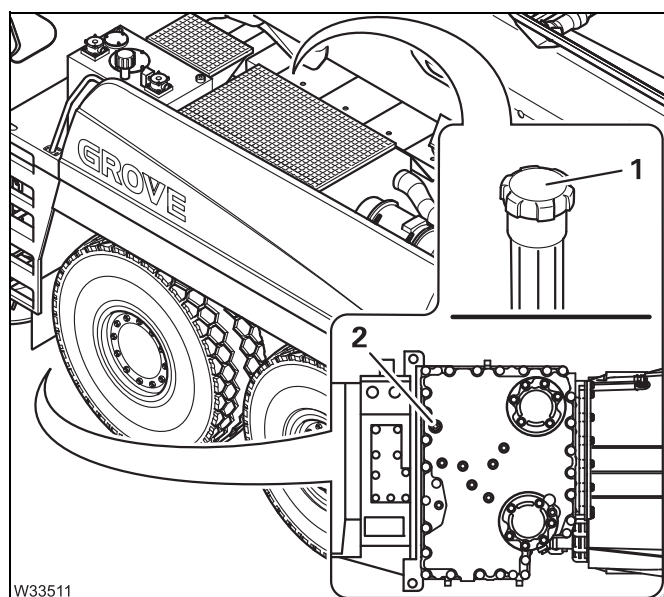
Risk of scalding from gear oil at operating temperature.

You could scald yourself by gear oil escaping in an uncontrolled manner at operating temperature. Wear appropriate protective gloves and take care not to come into contact with the gear oil.



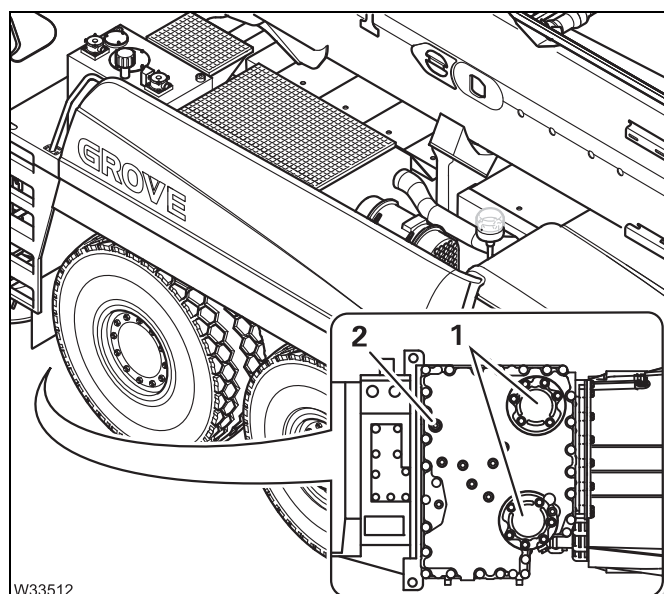
Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape. Store/dispose of consumables and any soaked equipment properly. Ask about the applicable regulations.



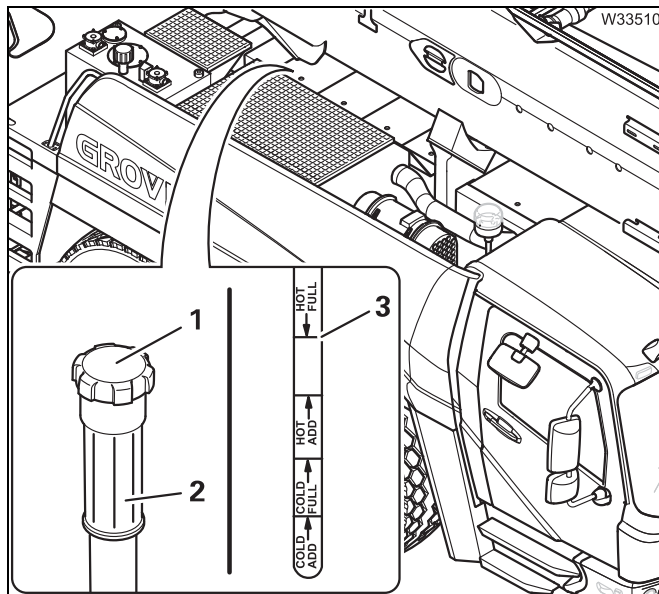
Draining oil

- Pull out the dipstick (1).
- Place a receptacle under the screw (2).
- Remove the screw and let the oil drain out.



Changing the oil filter

- Release the cap (1) and pull out the filters.
- Insert new filters.
- Replace the gaskets and tighten the caps – torque 50-60 Nm (37-44 lbf ft).
- Replace the gasket and tighten the screw (2) – torque 25-32 Nm (18-24 ft lbf).



Topping up oil

- Top up the oil via the dipstick tube (2).
- Wait so that the oil is evenly distributed in the transmission.
- Use the dipstick (1) to check whether the oil level is clearly above the mark (3), otherwise the engine may not be started.
- Insert the dipstick into the dipstick tube.
- Allow the engine to run at idling speed in the neutral position **N** so that the oil can be evenly distributed in the transmission and in the oil cooler.

Checking

- Check the oil level when the gear oil is cold; p. 7 - 38.



Risk of accidents when searching for leaks under the truck crane!

Ensure that the parking brake is engaged before you go underneath the truck crane to search for leaks.


Keep away from rotating parts.

- Check the transmission for leaks on the caps of the oil filters and at the oil drain plug.
- Check the oil level when the gear oil is warm; p. 7 - 39.

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7.7

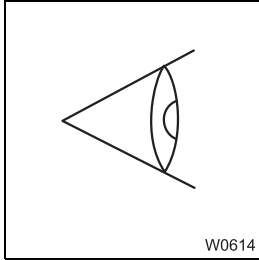
Transfer case


- Comply also with the  *Running-in regulations*, p. 4 - 1.

7.7.1

General inspection

W



- Investigate any unusual noises made by the transfer case.
- Check the transfer case and the connections for leaks. If consumables are leaking;  *Checking the oil level*, p. 7 - 45.
- Check that pipes and hoses are tightly connected and undamaged.

If any damage is found, report it to **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.


7.7.2

Checking the oil level


M 1

Spare parts and tools

Designation	Quantity	GROVE part no.
Gasket 30 x 36 Cu DIN 7603	2	00117151

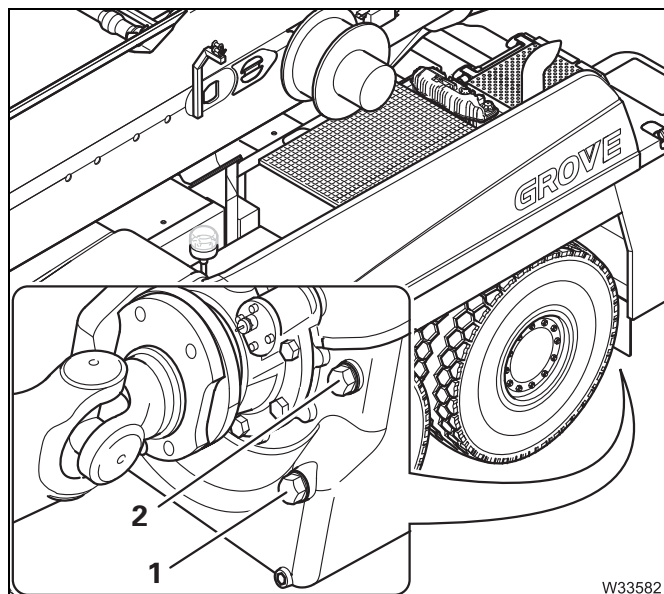
- Clean receptacle, approx. 5 ltr (1.3 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.



Checking the oil level



- Place a clean container under the screw (1).
- Remove the drain plug (1).
About 3 litres (0.8 gal) of oil will then flow from the opening (1) (the oil radiator is mounted above).
- Check that the oil reaches the lower edge of the opening (1).
- Fit a new gasket and tighten the drain plug (1).
- Remove the drain plug (2).
- Top up with fresh oil if necessary to achieve an oil quantity of about 3 litres (0.8 gal) in the container.

- Pour the oil from the container into the opening (2).
- Fit a new gasket and tighten the drain plug (2).

7.7.3

Changing the oil

M 6

Oil, spare parts, tools

Gear oil in litres (gal)	Designation according to DIN 51502	Specification Classification	GROVE part no.
15 (4) (with oil cooler)	C - LPF	MIL-L 2105 B API-GL-5 Viscosity: Hyp SAE 90 ISO - VG 220	00552891
12 (3.2) (without oil cooler)			

Designation	Quantity	GROVE part no.
Gasket 16 x 20 Cu DIN 7603	1	00117134
Gasket 30 x 36 Cu DIN 7603	2	00117151

– Receptacle, approx. 20 ltr (5,0 gal); p. 2 - 4.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.

Changing the oil



Risk of scalding from gear oil at operating temperature.

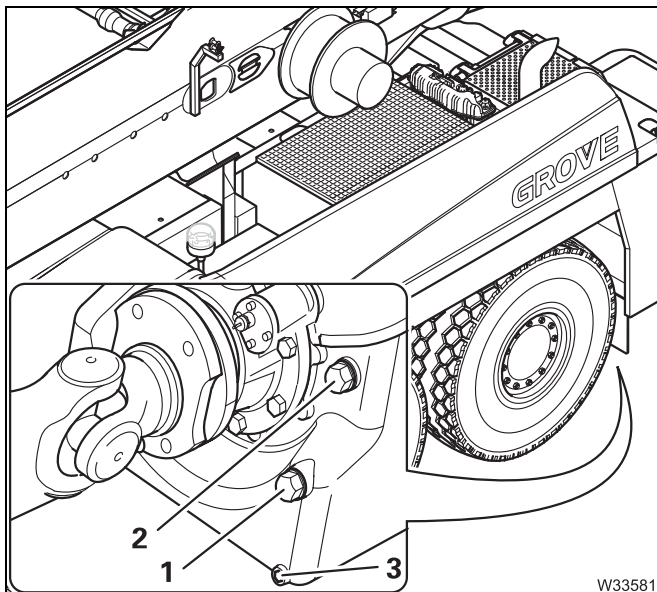
You could scald yourself by gear oil escaping in an uncontrolled manner at operating temperature. Wear appropriate protective gloves and take care not to come into contact with the gear oil.



Risk of environmental damage due to leaking consumables.

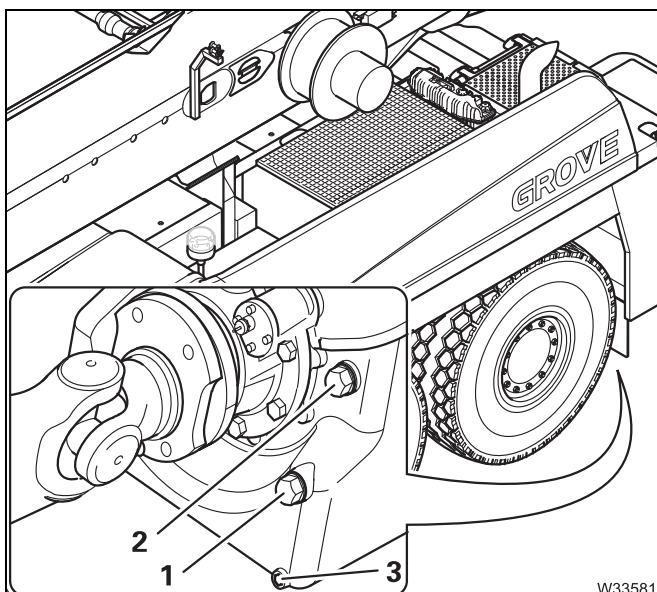
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly. Ask about the applicable regulations.



- Place a container under the screw (3).
- Unscrew the plugs (1),(2) and (3) and allow the oil to drain.
- Fit a new gasket and tighten the drain plug (3).
- Fill the oil up to the lower edge of the opening (1).
- Fit a new gasket and tighten the drain plug (1).
- Add a further 3 litres (0.8 gal) oil through the hole (2).
- Fit a new gasket and tighten the drain plug (2).

Inspections after an oil change




- Go for a test drive.
- Switch the engine off and wait for about 5 minutes.
- Check the screw plugs (1), (2) and (3) for leak-tightness.

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7.8

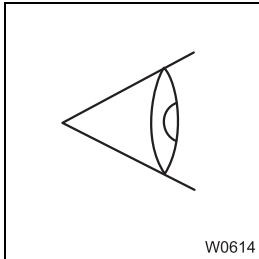
Axle lines



- Comply also with the  *Running-in regulations*, p. 4 - 1.

7.8.1

General inspection

W



- Investigate any unusual running noises from the axle centre drives and the final drives.
- Check the axle centre drives/final drives and the connections for leaks.
If consumables are leaking;
 -  *Axle centre drives – Checking the oil level*, p. 7 - 49,
 -  *Final drives – Checking the oil level*, p. 7 - 55.
- Check that pipes and hoses are tightly connected and undamaged.

If any damage is found, report it to **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

7.8.2

Axle centre drives – Checking the oil level


M 1

Spare parts and tools

For drive	Designation	Quantity	GROVE part no.
12 x 6 x 12	Gasket 30 x 36 Cu DIN 7603	3	00117151
12 x 8 x 12 ¹⁾	Gasket 30 x 36 Cu DIN 7603	4	00117151

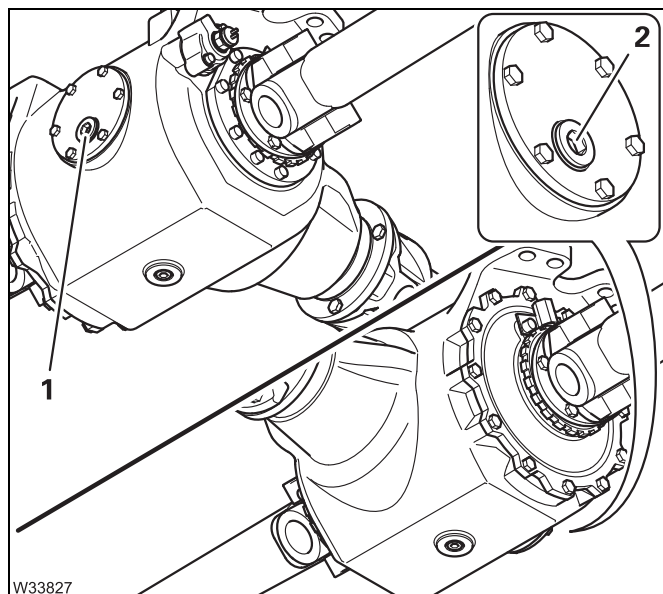
¹⁾ Additional equipment (6th driven axle line)

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must be switched off and secured against unauthorised use;
 -  p. 2 - 3.




1.+ 5./6. axle lines In case of drive 12 x 6, this axle centre drive is on the 1st and 5th axle line.
In case of drive 12 x 8, this axle centre drive is on the 1st and 6th axle line.

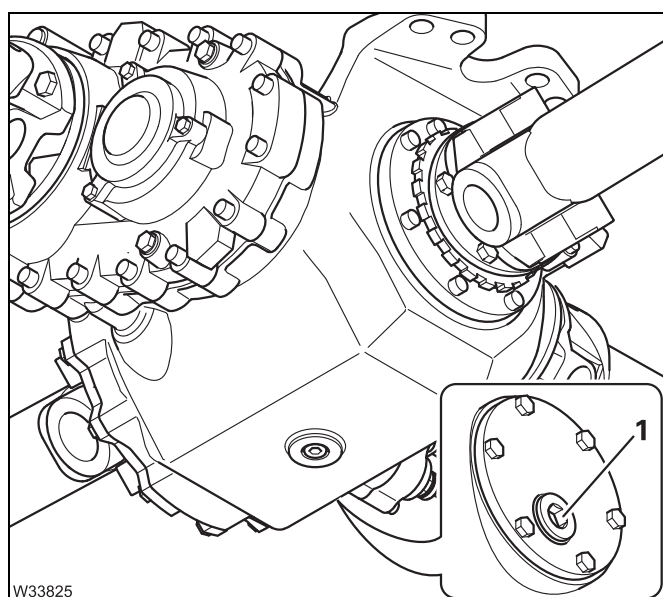


- Remove the screws (1) and (2).
- Check that the oil reaches the lower edge of the openings.
- Fit new gaskets and tighten the screws.

If the oil level is too low


- Top up the oil;  p. 7 - 53.

5th axle line - drive 12 x 8 In case of drive 12 x 8, the 5th axle line is fitted with this axle centre drive.

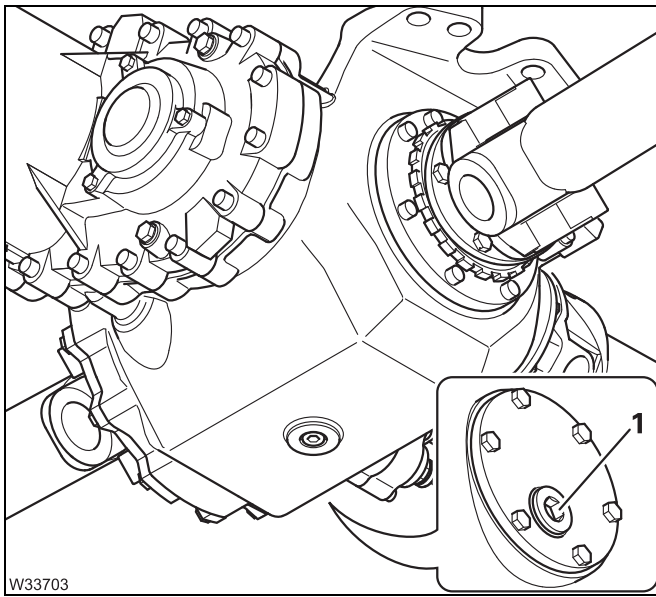


- Remove the drain plug (1).
- Check that the oil reaches the lower edge of the opening.
- Fit a new gasket and tighten the screw.

If the oil level is too low

- Top up the oil;  p. 7 - 53.


4. axle lines



W33703

- Remove the drain plug (1).
- Check that the oil reaches the lower edge of the opening.
- Fit a new gasket and tighten the screw.

If the oil level is too low

- Top up the oil;  p. 7 - 54.

7.8.3

Axle centre drives – Changing the oil


M 12

Oil, spare parts,
tools


Gear oil in litres (gal)	Designation according to DIN 51502	Specification Classification	GROVE part no.
Axle line 1+5/6: each 7.5 (1.9) Axle line 5 ¹⁾ : 7.7 (2.0) Axle lines 4: 8.0 (2.1)	C - LPF	MIL-L 2105 B API-GL-5 Viscosity: Hyp SAE 90 ISO - VG 220	00552891

For drive	Designation	Quantity	GROVE part no.
12 x 6 x 12	Gasket 30 x 36 Cu DIN 7603	3	00117151
	Gasket 16 x 20 Cu DIN 7603	5	00117134
12 x 8 x 12 ¹⁾	Gasket 30 x 36 Cu DIN 7603	4	00117151
	Gasket 16 x 20 Cu DIN 7603	8	00117134

¹⁾ Additional equipment (6th driven axle line)

– Receptacle, approx. 20 ltr (5.0 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.



Risk of environmental damage due to leaking consumables.

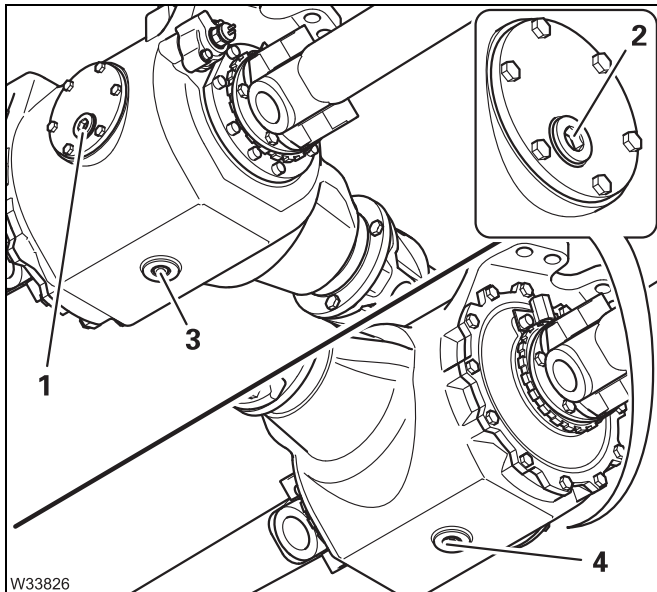
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.

**1st + 5th/6th
axle line**

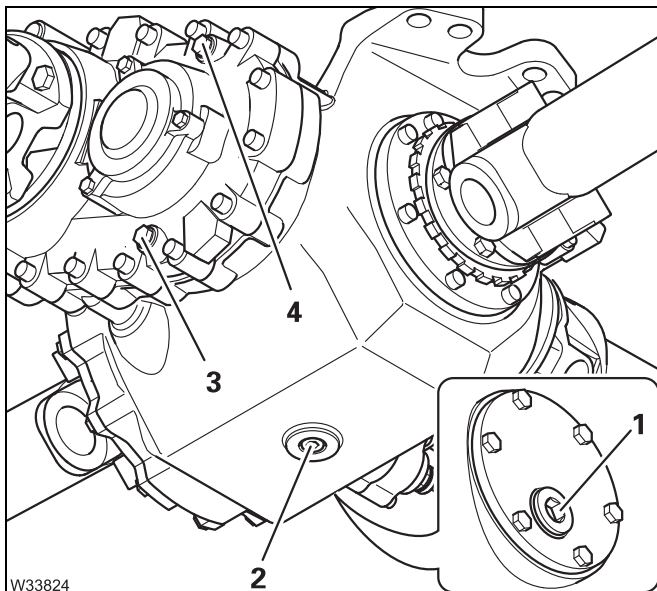
In case of drive 12 x 6, this axle centre drive is on the 1st and 5th axle line.
In case of drive 12 x 8, this axle centre drive is on the 1st and 6th axle line.



- Place a receptacle under screws (3) and (4).
- Remove screws (1), (2), (3) and (4) and let the oil drain off.
- Fit new gaskets and tighten the screws (3) and (4).
- Fill the oil up to the lower edge of the openings.
- Fit new gaskets and tighten the screws (1) and (2).

**5th axle line -
drive 12 x 8**

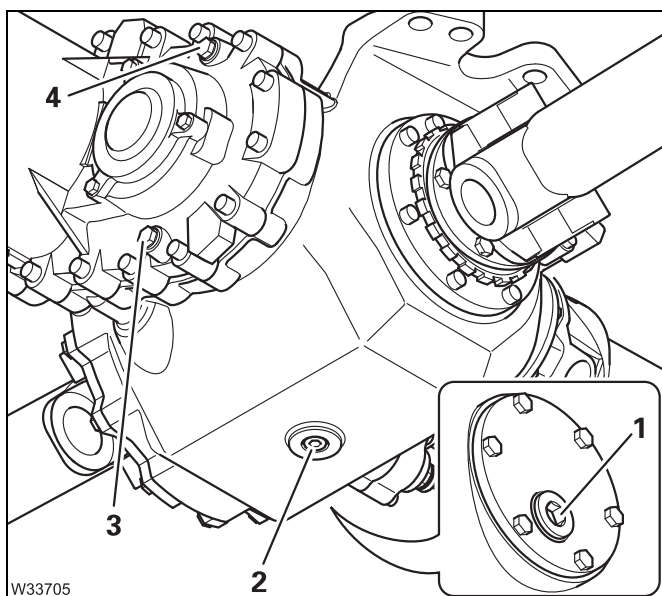
In case of drive 12 x 8, the 5th axle line is fitted with this axle centre drive.



- Place a receptacle under screws (2) and (3).
- Remove screws (1), (2), (3) and (4) and let the oil drain off.
- Fit new gaskets and tighten the screws (2) and (3).
- Fill the oil up to the lower edge of the opening (1).
- Fit new gaskets and tighten screws (1) and (4).



4th axle line



- Place a receptacle under screws (2) and (3).
- Remove screws (1), (2), (3) and (4) and let the oil drain off.
- Fit new gaskets and tighten the screws (2) and (3).
- Fill the oil up to the lower edge of the opening (1).
- Fit new gaskets and tighten screws (1) and (4).

7.8.4

Final drives – Checking the oil level


M 1

Spare parts and tools

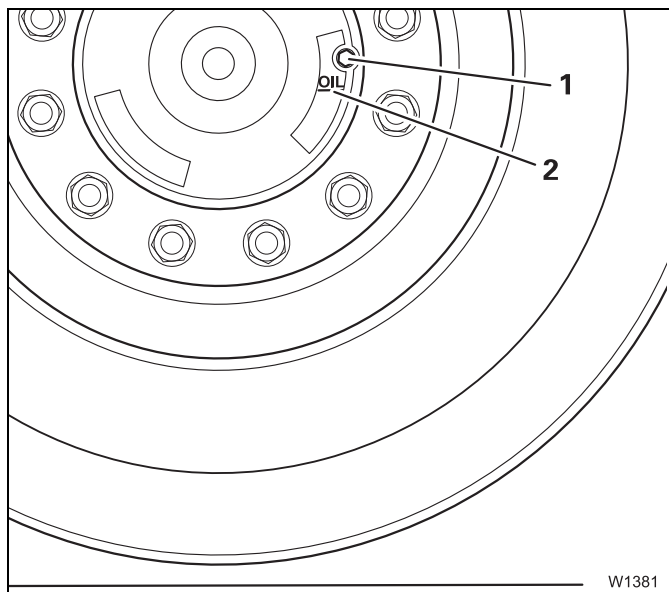
For drive	Designation	Quantity	GROVE part no.
12 x 6 x 12	Gasket 24 x 29 Cu DIN 7603	6	00117145
12 x 8 x 12 ¹⁾	Gasket 24 x 29 Cu DIN 7603	8	00117145


¹⁾ Additional equipment (6th driven axle line)

Prerequisites

- The truck crane must be raised on outriggers and must be level.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The parking brake must be released.

Checking the oil level



- Check the oil level at all other final drives in the same way.
 - Turn the wheel until the marking (2) is horizontal and is on the right, next to the centre of the axle.
 - Remove the drain plug (1).
 - Check that the oil level is at the mark (2).
 - Fit a new gasket and tighten the screw.
- If the oil level is too low**
- Top up the oil;  p. 7 - 57.

7.8.5

Final drives – Changing the oil


M 12

Oil, spare parts, tools


Gear oil in litres (gal)	Designation according to DIN 51502	Specification Classification	GROVE part no.
for each final drive: 4.1 (1.1)	C - LPF	MIL-L 2105 B API-GL-5 Viscosity: Hyp SAE 90 ISO - VG 220	00552891

For drive	Designation	Quantity	GROVE part no.
12 x 6 x 12	Gasket 24 x 29 Cu DIN 7603	6	00117145
12 x 8 x 12 ¹⁾	Gasket 24 x 29 Cu DIN 7603	8	00117145

¹⁾ Additional equipment (6th driven axle line)

- Drain channel.
- Receptacle, approx. 5 ltr (1.5 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be raised on outriggers.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The parking brake must be released.



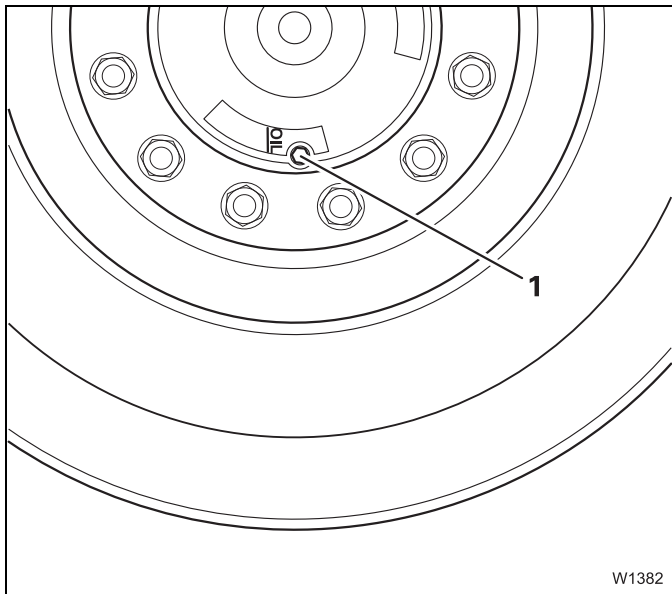
Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly.

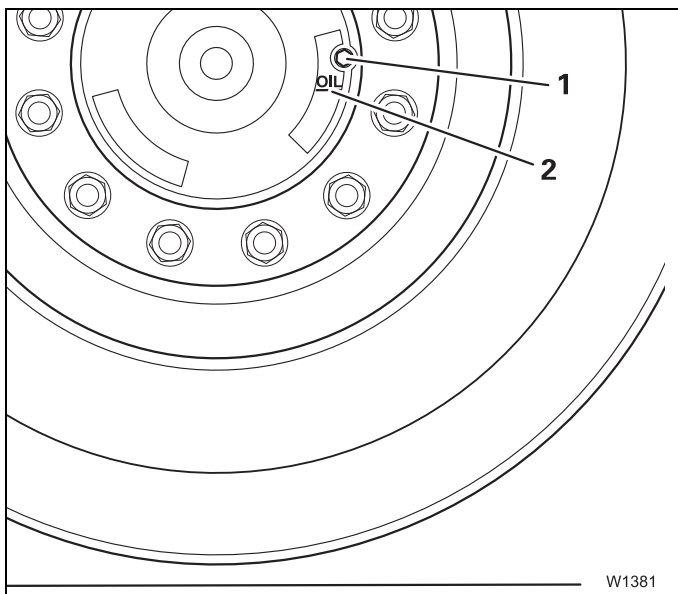
Ask about the applicable regulations.

Draining oil



- Change the oil on all final drives in the same way.
- Turn the wheel until the screw (1) is at the bottom.
- Use a drain channel and place a receptacle under the screw.
- Remove the screw and let the oil drain out.

Topping up the oil



- Turn the wheel until the marking (2) is horizontal and is on the right, next to the centre of the axle.
- Top up the oil through the opening.
- Fit a new gasket and tighten the drain plug (1).

7.8.6

Lubricating the Cardan shafts in the axle lines

M 1




Check all Cardan shafts to see if they have grease nipples. Cardan shafts with grease nipples must be serviced, Cardan shafts without grease nipples are maintenance-free.

Grease, spare parts, tools

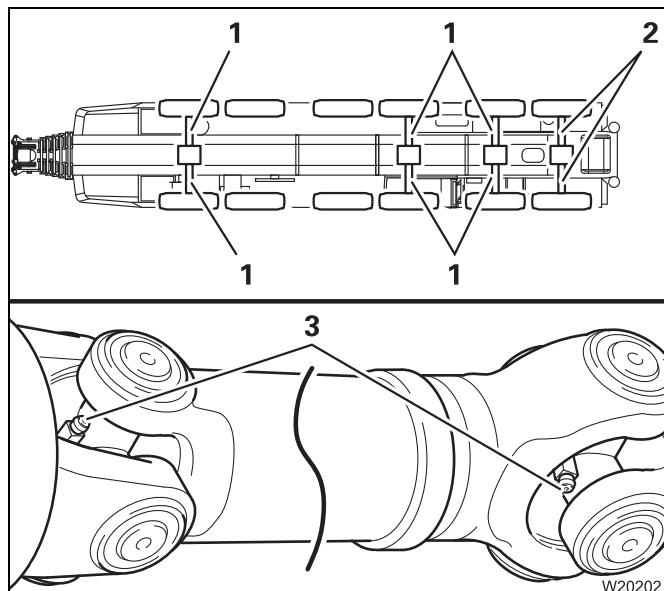
Lubricating grease	Designation according to DIN 51502	Specification Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The wheels must be turned as far as they will go, so that the lubricating nipples on the sides of the final drives are more easily accessible.

Lubricating



Cardan shafts (2) are fitted only to the 12 x 8 x 12 drive.

- Check which Cardan shafts (1) and (2) have lubricating nipples (3).
- Clean the grease nipples (3).
- Inject grease into the grease nipples until grease escapes from the bearing points. Do not inject grease with excessive force, otherwise the lip seals may be damaged.
- Remove the excess grease.

7.8.7

Lubricating longitudinal Cardan shafts

M 6




Check all Cardan shafts to see if they have grease nipples. Cardan shafts with grease nipples must be serviced, Cardan shafts without grease nipples are maintenance-free.

Grease, spare parts, tools

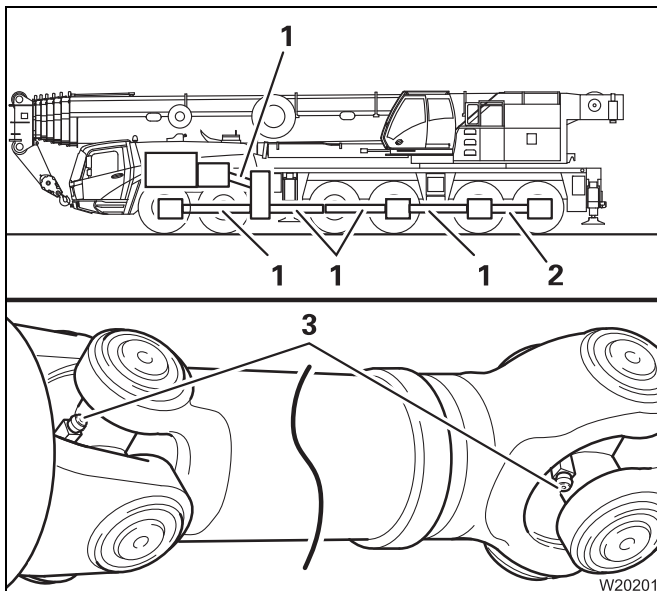
Lubricating grease	Designation according to DIN 51502	Specification Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Lubricating



The Cardan shaft (2) is fitted only to the 12 x 8 x 12 drive.

- Check which Cardan shafts (1) and (2) have lubricating nipples (3).
- Clean the grease nipples (3).
- Inject grease into the grease nipples until grease escapes from the bearing points. Do not inject grease with excessive force, otherwise the lip seals may be damaged.
- Remove the excess grease.

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7.9

Wheels

7.9.1

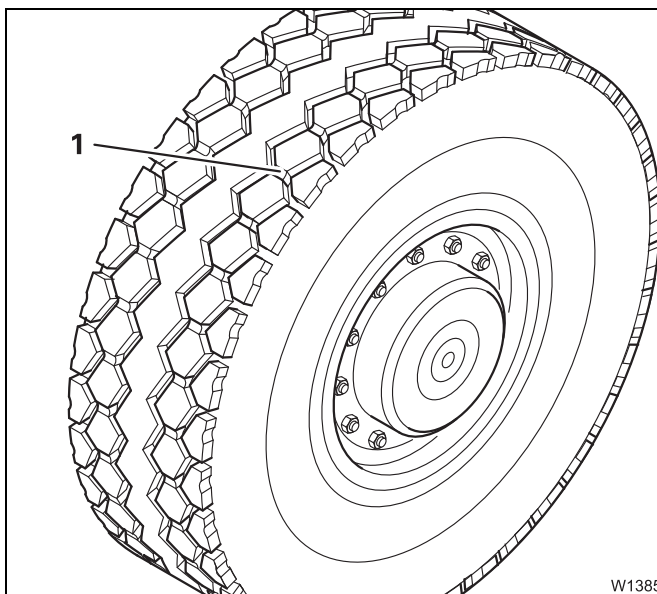
Checking the tyres for damage

D

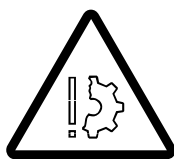
Prerequisites

- The truck crane must be raised on outriggers.
- The engine must be switched off and secured against unauthorised use;
 ▣▣▣▣▶ p. 2 - 3.
- The parking brake must be released.

Checking



- Check all tyres for:
 - Broken off tread blocks
 - Dents
 - Areas of uneven wear
 - Whether the wear mark (1) has been reached
- Replace any damaged tyres.
- If the tyres show varying degrees of wear, change the wheels; ▣▣▣▣▶ *Changing the wheels*, p. 7 - 64.



Risk of accidents due to uneven braking.

When replacing the tyres, only use the same quality of tyres as those originally fitted (dimensions, load bearing capacity, air pressure) so that the driving characteristics are maintained.

Always replace all the tyres on an axle line.

7.9.2

Checking the tyre pressure

W



Risk of damage to the tyres.

The tyre pressure increases during operation. Never release the increased air pressure of tyres at operating temperature.

Always check the tyre pressure in on-road driving mode with cold tyres.

- Check the tyre pressure using the following table.

Tyres	Air pressure of cold tyres in bar (psi)
14.00 R 25	10.0 (145)
14.00 R 25 X Crane	9.0 (131)
16.00 R 25	9.0 (131)
17.50 R 25	7.0 (102)
20.50 R 25	7.0 (102)
385/95 R25	10.0 (145)
445/80 R25	7.0 (102)
445/95 R25	9.0 (131)
525/80 R 25	7.0 (102)

7.9.3

Checking that the wheel nuts are tight

M 1

Spare parts and tools

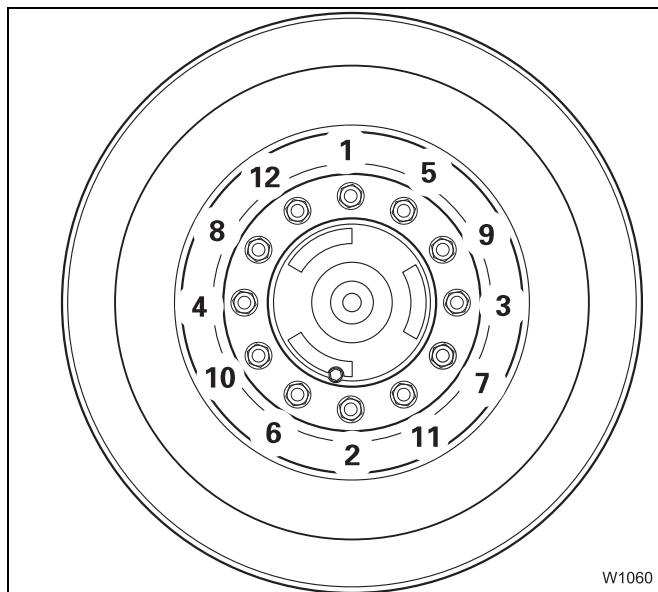
Designation	Quantity per wheel	GROVE part no.
Wheel nut with pressure plate for steel rims	12	01207756
Wheel nut with pressure plate for aluminium rims	12	7659100000

– Torque wrench for 650 Nm (480 lbf ft).

Prerequisites

– The engine must be switched off and secured against unauthorised use;
 ■■■▶ p. 2 - 3.

Check the wheel nuts



- Check the wheel nuts and the pressure plates for damage.
- Replace any damaged wheel nuts or pressure plates.
- Check the wheel nuts in the sequence (1-12) for a tight fit – torque 650 Nm (480 ft lbf).

7.9.4

Changing the wheels

M 6

The wear on tyres varies depending on whether the axle

- is driven/not driven,
- is steered/not steered,
- is braked/not braked,
- and whether it is subject to more or less load.

To achieve even wear, you must swap the wheels to different positions regularly.


This will have a positive effect on tyre life and performance.

Spare parts and tools

Designation	Quantity per wheel	GROVE part no.
Wheel nut with pressure plate for steel rims	12	01207756
Wheel nut with pressure plate for aluminium rims	12	7659100000

- Torque wrench for 650 Nm (480 lbf ft).

Prerequisites

- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Changing the wheels



Risk of accidents if the procedure is not carried out correctly.

This section only shows the sequence to be followed when changing wheels.


When removing/installing the wheels, observe all the safety instructions and the procedure stated in the operating manual.

- Remove the wheels from the axles.

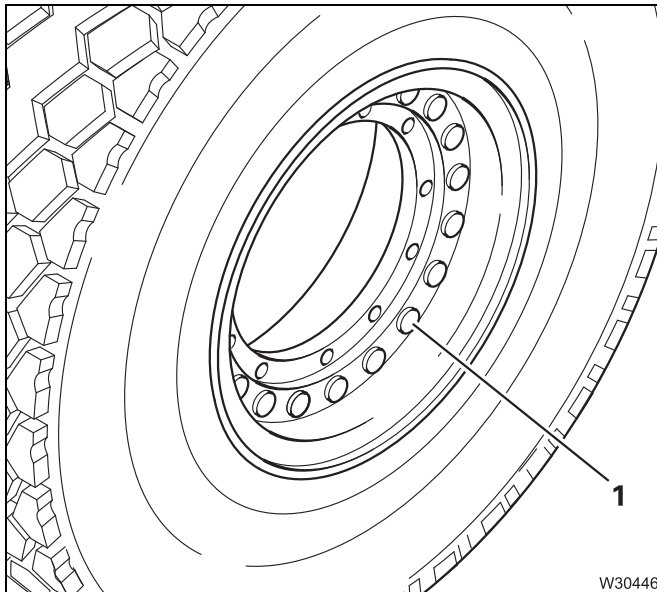
Only for two-piece aluminium rims

- Have a specialist workshop check the bolts on the two-piece aluminium rims, using the appropriate special tool.

Depending on the manufacturer, there are 20 or 22 bolts visible on the outer face of the rim. On the inner face of the rim there are 20 or 22 nuts. It is the torque of these that you must have checked in a specialist workshop;

 *Recognising two-piece aluminium rims*, p. 7 - 65.

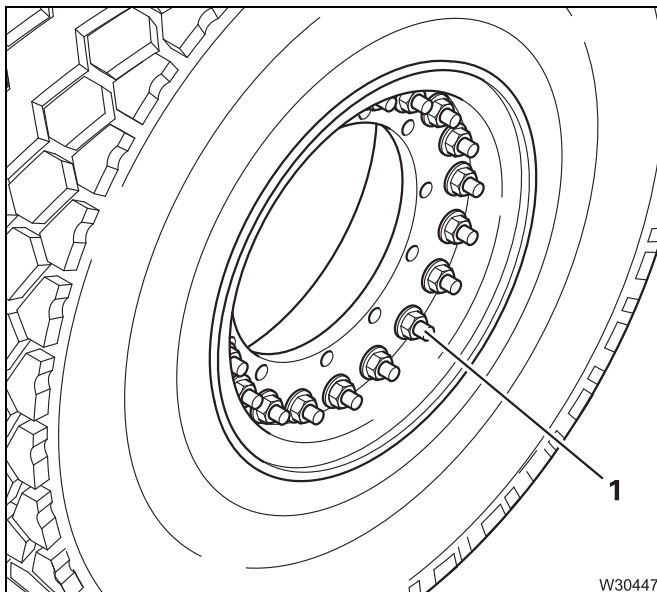
Recognising two-piece aluminium rims



The round-head bolts (1) are on the outer face of the rim.

The round heads must be free of cracks, and the bolts must be seated securely in the bores.

Around the edge of the aluminium rim there are impressed marks and safety instructions which must be complied with by the specialist workshop.



The nuts (1) are on the inner face of the rim.

The round heads must be free of cracks and securely seated on the bolts. The torque must be checked within the specialist workshop.


Aluminium rims with 20 nuts:

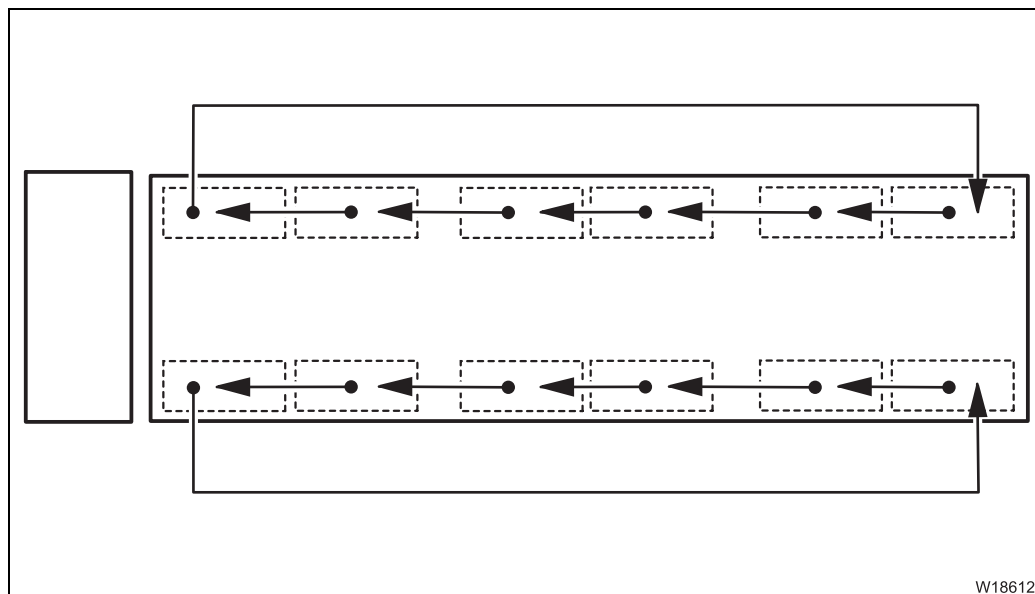
550 Nm (406 lbf ft)

Aluminium rims with 22 nuts:

385 Nm (284 lbf ft)



- Mount the wheels on another axle, as shown in the diagram. Replace any damaged parts. Tighten the wheel nuts;  p. 7 - 63.



Optimised wheel changes

To ensure even more even wear on all tyres, you can also rotate the tyres on the wheel rim and mount them on the other side of the vehicle.



Risk of accidents if the procedure is not carried out correctly.

This section only shows the sequence to be followed when changing wheels.

When removing/installing the wheels, observe all the safety instructions and the procedure stated in the operating manual.



Risk of accidents due to errors when mounting aluminium wheel rims.

Only have tyres fitted to aluminium wheel rims in an authorised workshop with the correct special tool.


This will prevent tyre damage caused by assembly errors.

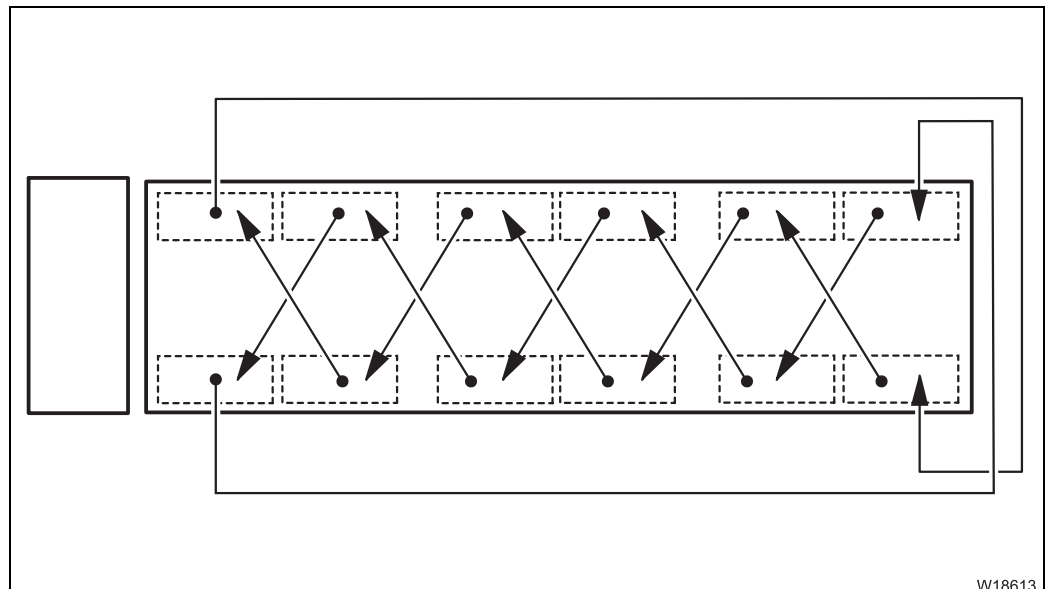


Risk of tyre damage caused by the tyres running in a different direction.

Turn the tyres on the wheel rims before you put the wheels on the other side of the vehicle.

This will prevent tyre damage caused by the tyres running in a different direction.

- Remove the wheels from the axles.
- Turn the tyre on the rim if the wheel is to be used on the other side of the crane.
- Mount the wheels on another axle, as shown in the diagram. Replace any damaged parts. Tighten the wheel nuts;  p. 7 - 63.



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7.10 Vehicle brake

7.10.1 Checking brake lining thickness


M 3

Spare parts and tools

Designation	Quantity per axle line	GROVE part no.
1. and 2nd axle line (duplex brake)		
Brake shoe with brake lining	4	03322112
Spring	4	03322110
Brake drum	2	01925703
3. to 6th axle line (simplex brake)		
Brake shoe with brake lining	4	03322121
Spring	4	02315393
Brake drum	2	01925703


- Measuring tool for brake linings.

Prerequisites

- The truck crane must be parked over an inspection pit.
- The truck crane must be raised on outriggers.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The parking brake must be released.

Safety instructions



- **Do not perform repair work** on the vehicle brakes;  *Maintenance instructions*, p. 1 - 2.

Risk of accidents due to incorrect work on the vehicle brakes.

Incorrect work on the vehicle brakes can lead to failure of the brakes causing severe accidents.

Incorrect work invalidates the operating licence of the truck crane and no claims of liability for damage can then be accepted.

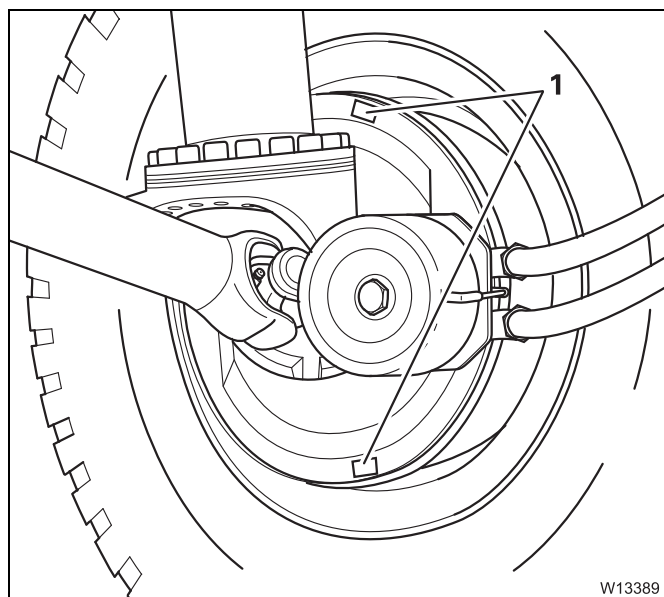
All repair work on the vehicle brakes may only be performed by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop with specially trained repair crew.

- **Perform only maintenance work**;  *Checking*, p. 7 - 70.



Checking

- Check the thickness of the brake linings on all axle lines.



- Check the brake lining thickness from the inside at the openings (1).

If the brake lining thickness has worn down to the wear marks (stepped edges or grooves) or if the brake lining thickness has worn down to only 6 mm (0.25 in):

- Have the brake lining replaced; ▣▣▣▣▣ *Having it repaired*, p. 7 - 70.
- Close the openings using the covers.

Having it repaired

- **Do not perform repair work** on the vehicle brakes; ▣▣▣▣▣ *Safety instructions*, p. 7 - 69.
- All repair work on the vehicle brakes may only be performed by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop with specially trained repair crew.
- Make sure that only original spare parts are used; ▣▣▣▣▣ *Spare parts and tools*, p. 7 - 69.



Risk of accidents due to uneven braking

If the brake linings are only replaced on one side of the axle line then the wheels have an uneven braking force.

Always have the brake linings replaced on both ends of the axle line.

Allow the brakes to run in

New brake linings do not provide optimal braking and must therefore be run in by periodic braking.



Risk of damage to the brakes when running them in

Constant or heavy braking at high speeds can overheat the brakes and damage them.

The brakes must only be run in through periodic braking.

This must first be done at low speed and then later at medium speed.

- Perform a test drive to make sure that the new brake pads are sufficiently run in before putting the truck crane into normal operation.

7.11 Suspension

7.11.1 Suspension struts – Checking the oil level



M 1

Oil, spare parts, tools

Oil in litres (gal)	Designation	GROVE part no.
for each suspension strut: 1.5 (0.4)	Gear oil Rivolta S.K.D. 170	02310863

- Press with connected hose (from the toolbox).

Prerequisites

- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- Immediately before the inspection, the truck crane must be completely lowered and returned to *on-road level*;  *Manual de instrucciones*.



Risk of damage due to faulty suspension struts.

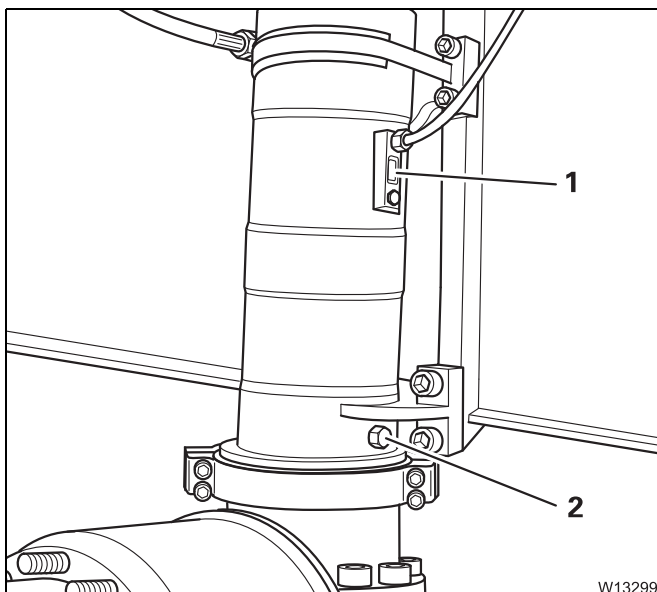
If the oil level is above the upper marking on the sight glass, the suspension strut is faulty and must be replaced.

Notify **Manitowoc Crane Care** or an authorised GROVE dealer.



Risk of damage to the suspension struts due to insufficient lubrication.

It is difficult to inject the oil. Do not fill oil through the inspection glass connections. If you do this, the oil will not reach all the lubricating points.



- Check whether oil is visible in the middle of the inspection glass (1) on each suspension strut.

If the oil level is too low

- Open the connection (2) – oil escapes – and quickly connect the press with the hose.
- Inject oil until it reaches the middle of the sight glass.
- Remove the hose and quickly close the connection (2).

7.11.2



Suspension struts – checking the fastening

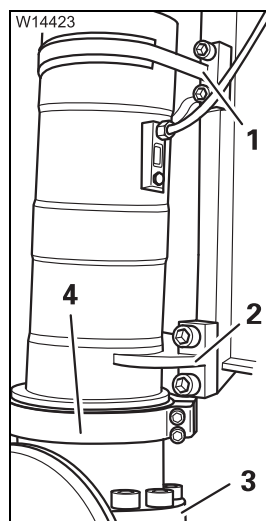
M 1


Spare parts and tools

- Torque wrench for torques up to 900 Nm (664 lbf ft).

Prerequisites

- The truck crane must be raised on outriggers;  *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The wheels must have been removed.



- Check that the screws on all suspension struts are securely seated;
 *Special torques*, p. 10 - 2:
 - 1 on the upper bracket,
 - 2 on the lower bracket,
 - 3 on the lower flange,
 - 4 on the half shells for the steering lever.

7.11.3

Forced lever – checking correct functioning

M 3

On suspension struts with forced levers, the forced levers must be checked for proper functioning when the suspension is switched on and off.



Risk of crushing when releasing the suspension locking system.

When the suspension is switched on, the wheels drop down suddenly. Ensure that nobody is in close proximity to the wheels when you switch on the suspension.

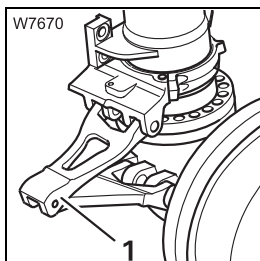
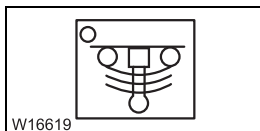


Risk of damage to the tyres.

Remove sharp-edged or pointed objects from below the wheels before switching on the suspension.

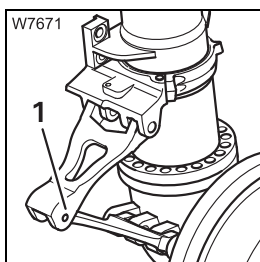
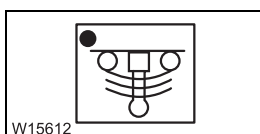
In this way you prevent the tyres from bursting or being damaged when the wheels come down.

- Start the engine.
- Lower the truck crane to the lowest level with the level adjustment system; *Manual de instrucciones*.
- Switch off the suspension; *Manual de instrucciones*.



The suspension struts and the forced levers (1) are brought together.

- Raise the truck crane with the outriggers; *Manual de instrucciones*.
- Switch on the suspension; *Manual de instrucciones*.



- Check whether all suspension struts are extended and the forced levers (1) are slackened.

If the suspension struts are not extended or only partially extended, the forced lever is faulty.

- Faulty forced levers should be replaced as soon as possible by **Manitowoc Crane Care** or an authorised GROVE dealer or your qualified repair crew.

7.11.4

Pressure accumulator – checking the gas pressure

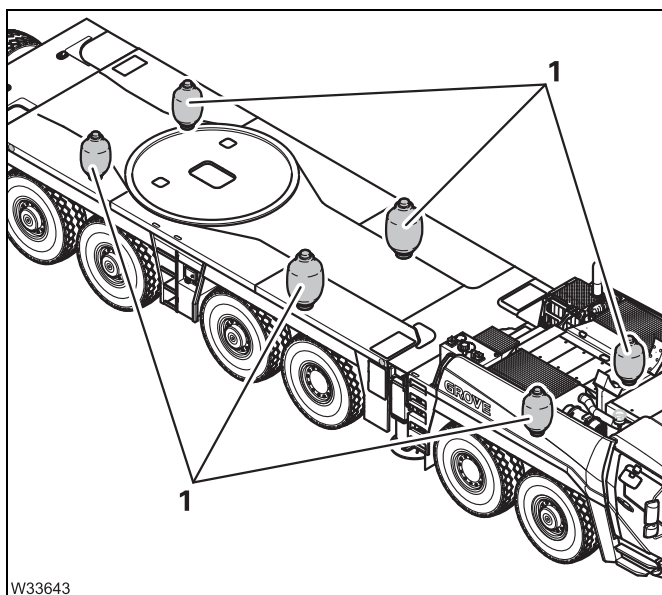
M 12

The gas pressure must be checked every 3000 operating hours, but in any case no less frequently than every 12 months.



Risk of accidents due to incorrect inspection.

The gas pressure test may be carried out only by an authorised official inspector of pressure tanks or under his/her supervision or instructions.



The suspension features integrated pressure accumulators that contain nitrogen (1).

The filling pressure at 20 °C (68 °F) is 40 bar (580 psi).

- Have the filling pressure checked, and if necessary corrected, by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

7.12

Steering

7.12.1

Checking for leaks

D

- Check the hydraulic system of the steering (steering cylinders, pipes and hose lines and their connections) for leaks.



Risk of accidents from hydraulic oil spraying out.

Never tighten leaking connections when the system is under pressure. Change pipes and hose lines only when the system is depressurised.

- Top up the oil if necessary;  *Checking the oil level*, p. 7 - 81.

After changing pipes and hose lines

- Bleed the hydraulic system;  *Bleeding the hydraulic system*, p. 7 - 94.

If damage cannot be rectified immediately or further damage is likely

- Notify **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

7.12.2

Pressure accumulator – checking the gas pressure

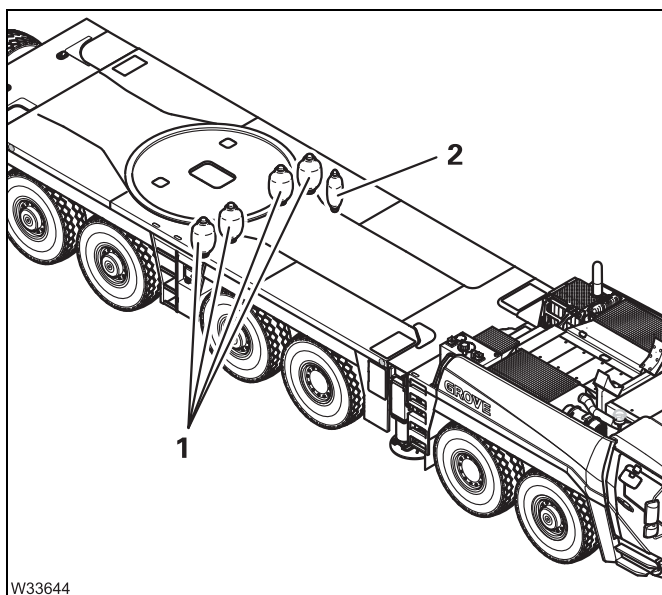
M 12

The gas pressure must be checked every 3000 operating hours, but in any case no less frequently than every 12 months.



Risk of accidents due to incorrect inspection.

The gas pressure test may be carried out only by an authorised official inspector of pressure tanks or under his/her supervision or instructions.



Nitrogen filled pressure accumulators (1) and (2) are fitted for steering the axle lines.

The filling pressure at 20 °C (68 °F) is:

- | | |
|---|--------------------|
| 1 | 89 bar (1290 psi) |
| 2 | 100 bar (1450 psi) |

- Have the filling pressure checked, and if necessary corrected, by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

W33644

7.13 Compressed air system



7.13.1 Draining water from the compressed air system

W

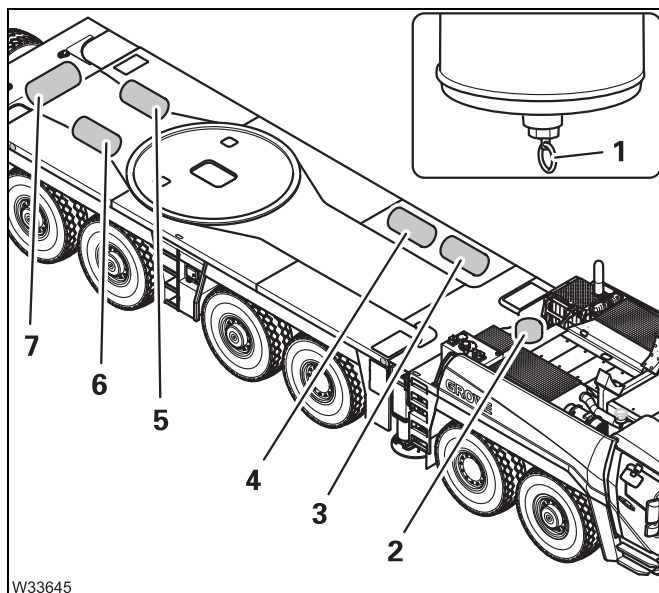
Spare parts and tools

Designation	Quantity	GROVE part no.
Valve	6	01570750
Gasket 22 x 27 Cu DIN 7603	6	00117142

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The compressed-air supply is completely full;  *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Draining water from the compressed air system



- Actuate the valves (1) on the air reservoirs (2) to (7).

If a great deal of water escapes

- Have the compressed air drier checked or replaced by **Manitowoc Crane Care** or an authorised GROVE dealer or your qualified repair crew.

W33645

7.13.2

Checking for leaks

W

- Start up the compressed air system.
- Check for any possible leaks in the compressed air system (connections, pipes, hose lines and valves).



Risk of accidents due to escaping compressed air.

Never tighten connections when the system is under pressure. Only change gaskets, pipes and hose lines when the system is depressurised.

If damage cannot be rectified immediately or further damage is likely:

- Notify **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

7.13.3

Replacing the filter cartridge of the compressed air drier



M 12

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter cartridge	1	04156032

- Strap wrench.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The covers have been removed;  p. 7 - 1.
- The engine, transmission and transfer case have cooled down.

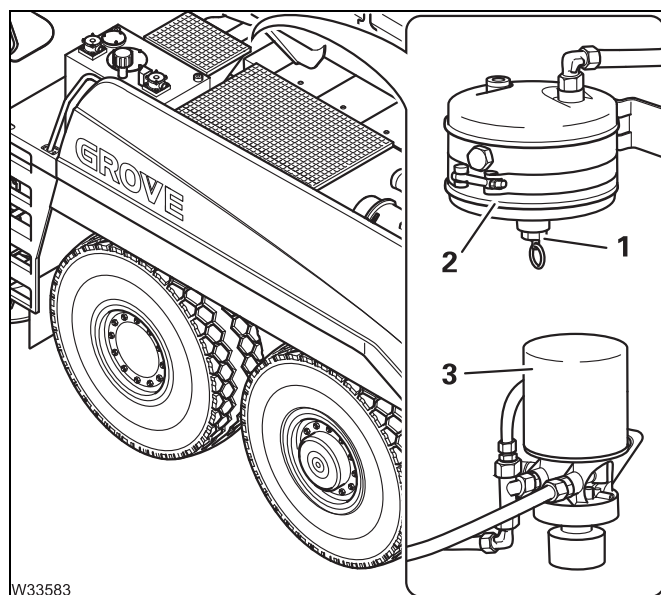
Changing the filter cartridge



Risk of injury from escaping compressed air.

If the reservoir (2) is not completely vented, the compressed air drier will be under pressure.

Bleed the reservoir until air no longer escapes from the valve.



- Using the valve (1), release all the air from the reservoir (2).
- Replace the filter cartridge (3) using the strap wrench (lubricate gasket slightly).

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7.14

Hydraulic system



Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.

7.14.1

Checking the oil level

D

Prerequisites

- The truck crane must be aligned horizontally at on-road level; *Manual de instrucciones*.
- The outriggers must be retracted; *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.

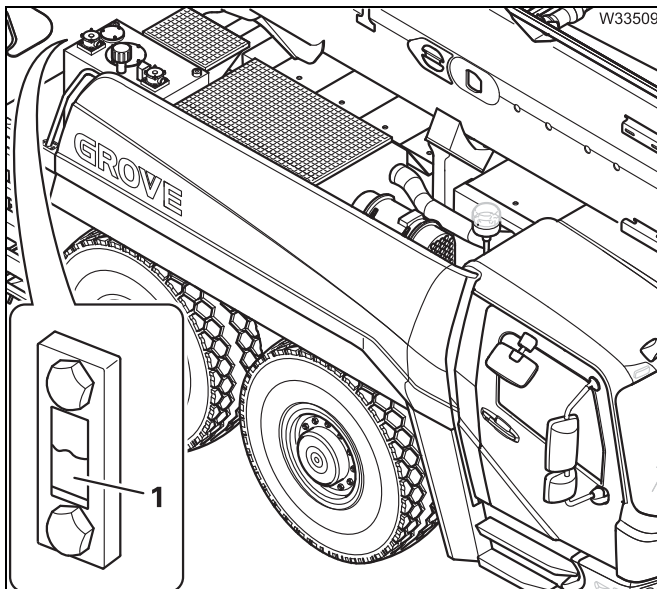
Checking the oil level



Risk of damage to the hydraulic system

When working with hydraulic oil, cleanliness is imperative.

Even fresh hydraulic oil should be filtered.



- Check that oil is visible in the middle of the sight glass (1) before starting work.

If the oil level is too low

- Top up the oil; p. 7 - 93.

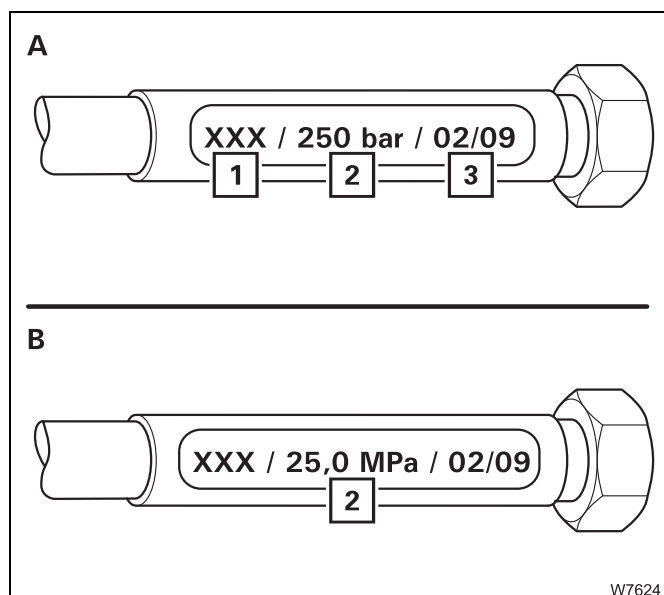
7.14.2

Checking the hydraulic hoses

W

Hydraulic hoses are also subject to ageing as well as internal and external strain.

- Check the hydraulic hoses for
 - external damage (tears, abrasion, heat damage, chemical damage),
 - leaks and moist areas,
 - blistering or unevenness of hose casing,
 - signs of ageing (porous surface, rust on hose fittings).



Hydraulic hoses should not be used for longer than 72 months from date of manufacture. The date of manufacture and the permitted operating pressure are marked on the hose fitting:

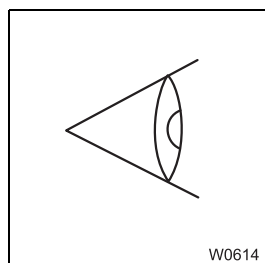
- 1 Manufacturer's designation.
- 2 Maximum operation pressure and unit of measurement (**A**) (e.g. 250 bar (3,626 psi)).
Maximum operation pressure and unit of measurement (**B**) (e.g. 25.0 MPa (3,626 psi)).
- 3 Month and year of manufacture.



- Always ensure that the corresponding parts of the hydraulic system are depressurised.
- Damaged or old hydraulic hoses must be replaced immediately.

7.14.3

Checking for leaks

W



- When the engine is running, carry out a visual inspection for leaks on the hydraulic system (pumps, drives, cylinders, control blocks, valves, pipe and hose lines and connections).
- Check the hydraulic oil cooler for dirt;  *Have the radiator checked/cleaned, p. 7 - 17.*
- Check the oil level if there are leaks;  *Checking the oil level, p. 7 - 81.*



Risk of accidents from hydraulic oil spraying out.

Never tighten any leaking connections when the system is under pressure. Change pipes and hose lines only when the system is depressurised.



Risk of environmental damage due to leaking consumables.

Immediately repair or have leakages in the hydraulic system repaired to ensure that no hydraulic oil escapes, seeps into the ground or reaches waterways when the crane is being used.

After parts have been changed

- Bleed the carrier's hydraulic system; *Bleeding the hydraulic system*, p. 7 - 94.

If damage cannot be rectified immediately or further damage is likely

- Notify **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

7.14.4

Cleaning the magnetic rods

M 3

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	2	03329152
Packing set	2	03135778

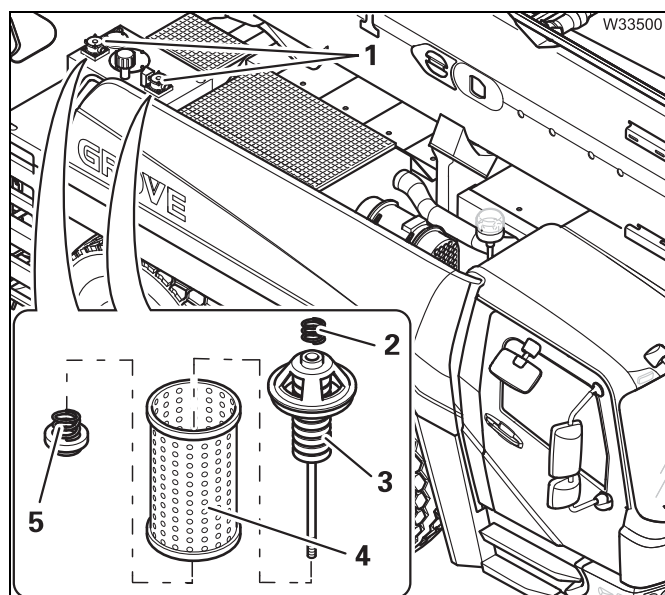
- Receptacle, approx. 5 ltr (1.5 gal); p. 2 - 4.

Prerequisites

- The truck crane must be standing on a level surface.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.
- During the first 100 operating hours: Clean the magnetic rods weekly.



Cleaning the magnetic rods

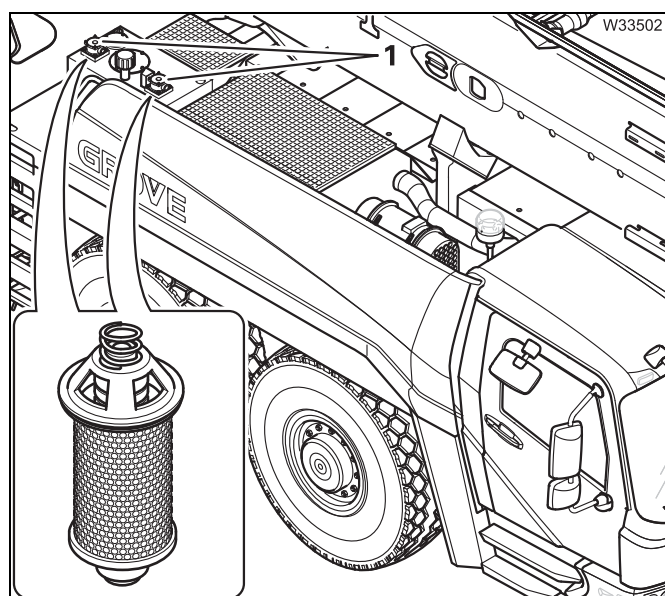


- Release the cap (1) and pull out the filters.
- Place the filters in a receptacle.
- Remove the spring (2).
- Undo the nut (5).
- Take the magnetic rod (3) out of the filter cage (4) and clean it.
- Replace any damaged parts, where necessary.



Risk of damage to the hydraulic system

Large amounts of metal particles are a sign of damage in the hydraulic system. Have the hydraulic system checked by **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.



- Assemble the filters and install them.
- Replace the gaskets if necessary and fasten the cap (1).
- Start the engine and check for leaks.

7.14.5

Changing the ventilation filter

M 12


Reducing the interval

- Under difficult operating conditions – at extremely sandy or dusty locations – you must change the ventilation filters earlier than normal.

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	03324588

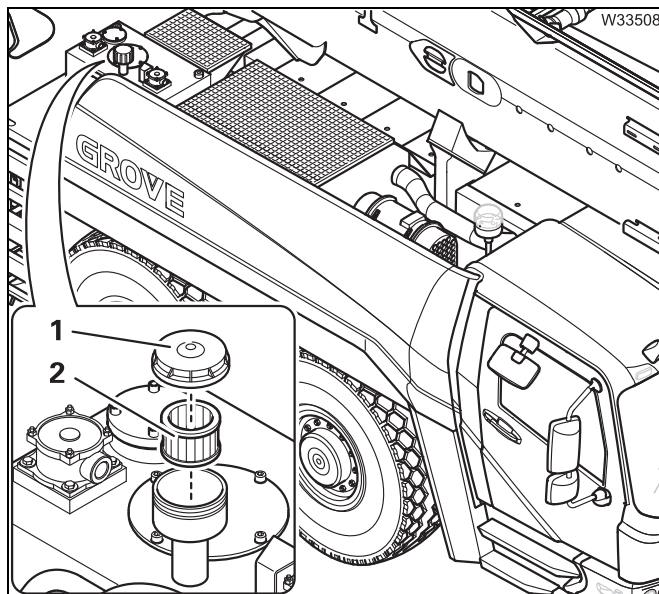
Prerequisites

- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.



Risk of damage to the environment from filter residues

Store used hydraulic oil filter inserts in suitable receptacles and have them disposed of properly by qualified personnel.



- Remove the cover (1).
- Change the filter (2) and fasten the cover.

7.14.6

Taking oil samples

M 12

Reducing the interval

- Under difficult operating conditions – at tropical or very hot locations – you must halve the oil change interval.

Spare parts and tools

- A hose with a connecting piece for a gauge port.



Hose lengths	GROVE part no.
1 m (3.3 ft)	01923003
2 m (6.6 ft)	00551941
4 m (13.2 ft)	01923139

- A sample container 0.3 litres (0.08 gal)).

	GROVE part no.
A set of sample containers with protective mailing bag and delivery note to the contracted laboratory	03141012

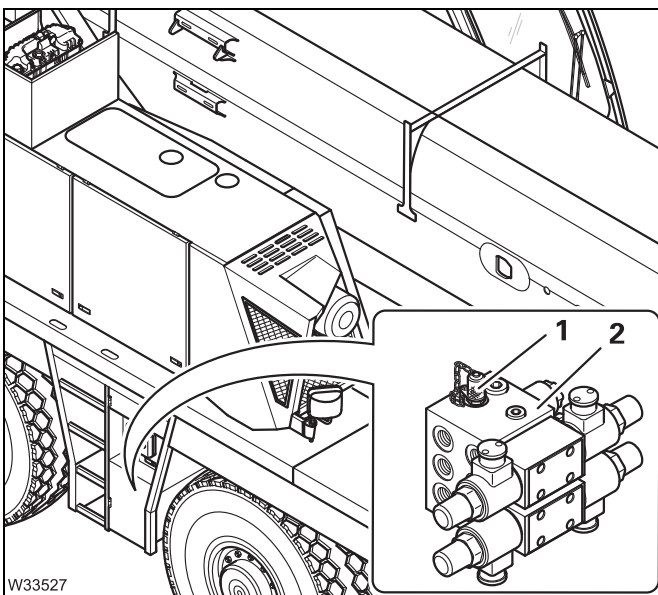
- Receptacle, approx. 5 litres (1.5 gal);  p. 2 - 4.

Prerequisites

- The engine must have run for an adequate time **beforehand**, in order to fill the pressure accumulator for the steering;  p. 7 - 76.
- During the oil test the engine must be switched off and be secured against unauthorised use;  p. 2 - 3.

Select the sampling location

To determine the usability of the oil, you must take a sample from the hydraulic system. To do that you must connect the hose with the connecting piece to a gauge port.



The gauge port (1) is located on the control block (2) for the steering.

- Clean the gauge port before connecting the hose.

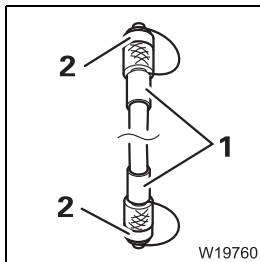
Protecting the hose from dirt



Danger of contamination of the oil sample

If the hose with the connecting piece is dirty, the dirt can contaminate the oil sample in the sample container during the sampling process. The laboratory analysis would then be incorrect.

For flushing, always allow 2 litres (0.5 gal) of oil to flow through the hose into a receptacle before filling the sample container.



When storing the hose

- Close the hose ends (1) with the caps (2).

Connecting the hose

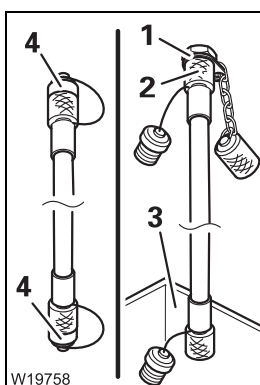


Danger due to escaping hydraulic oil

When you screw the connecting piece on to the gauge port, the gauge port opens and oil flows out of the hose. Put the hose end into a receptacle before screwing on the connecting piece.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

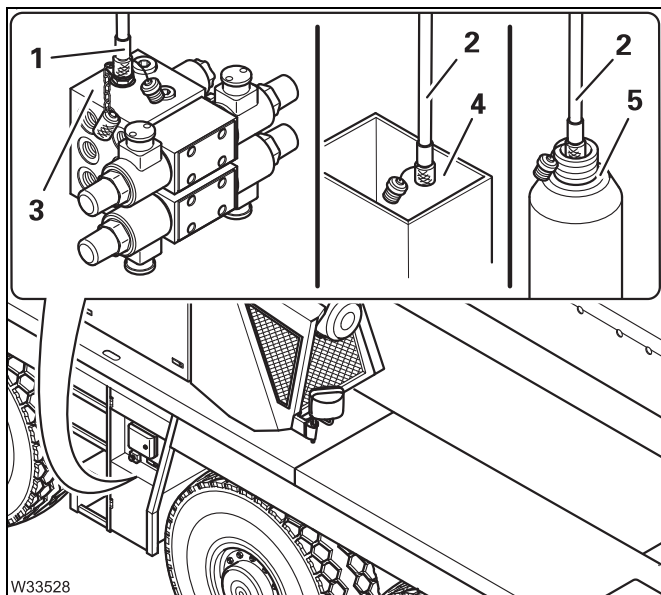
Store/dispose of consumables and any soaked equipment properly. Ask about the applicable regulations.



- Only use a hose with a connecting piece.
- Remove the caps (4).
- Put the hose end into the receptacle (3).
- Remove the cap from the gauge port (1) and screw the connecting piece (2) on to the gauge port – the gauge port opens.



Taking an oil sample

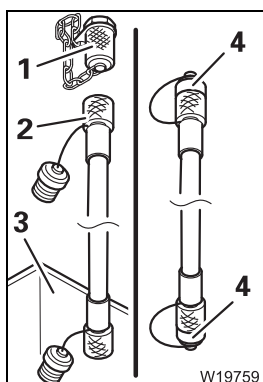


The hose end (1) is connected to the control block (3).

The hose end (2) is in receptacle (4).

- Allow 2 litres (0.5 gal) of oil to flow into the receptacle.
- Put the hose end (2) into the sample container (5).
- Allow 0.3 litres (0.08 gal) of oil to flow into the sample container.
- Put the hose end back into the receptacle.
- Seal the sample container.

Disconnecting the hose



- Disconnect the hose (2) – the gauge port (1) closes.
- Close the gauge port with the cap.
- Allow the oil to flow out of the hose into the receptacle (3).
- Close the hose ends with the caps (4).
- Remove the receptacle and properly dispose of the oil.

Dispatch the oil sample to the laboratory

Manitowoc Crane Care gives you the opportunity to have the oil sample analysed at our contracted laboratory. A delivery note and a protective mailing bag are available along with the sample containers (GROVE part no. 03141012). You will get the laboratory analysis via the Internet in a short time.

- Label the sample container prior to dispatch with
 - the truck crane serial number,
 - the date of sampling,
 - the number of operating hours since the last oil change and
 - the sampling location (e.g. gauge port on a control block).
- Have the following properties of the oil sample determined by the laboratory
 - the viscosity,
 - the viscosity index,
 - the contamination,
 - the water content.


Determining the quality of the oil

- Compare the laboratory analysis with the **limit values** and carry out the specified measures if necessary.

Viscosity limit values

- Viscosity ISO-VG 32 as per DIN 51524 Part 2.
- Viscosity index $V_i \geq 150$.


If one of these limit values has been reached/fallen short of:

- Carry out an oil change;  p. 7 - 91.

Contamination limit value

- Contamination according to NAS 1638 Class 7 or ISO 4406:1999 Code 18/16/13 (cleanliness class).

If this limit value has been reached/exceeded:

- Replace the filters of the hydraulic system;  p. 7 - 95.
- Have the hydraulic oil cleaned with a mobile filter unit until the required cleanliness class is achieved.

Water content limit value

- Water content ≤ 100 ppm.

If this limit value has been reached/exceeded:

- Have the hydraulic oil cleaned with a mobile water separator until the water content is clearly below the limit value.

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7.14.7

Changing the hydraulic oil

The oil only needs to be changed if the laboratory analysis indicates the need for it; *Determining the quality of the oil*, p. 7 - 89.

Oil, spare parts,
tools

Hydraulic oil in litres (gal)	Designation according to DIN 51502	Specification Classification	GROVE part no.
230 (61)	HVLP	DIN 51524-3 Viscosity: ISO-VG 32	04162158 Castrol Hyspin AWH-M 32

Designation	Quantity	GROVE part no.
Cover gasket 140 / 90 x 3	1	02313899

- Connecting piece and hose (toolbox).
- One or more receptacles, approx. 230 l (61 gal); p. 2 - 4.

Prerequisites

- The outriggers must be retracted; *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.

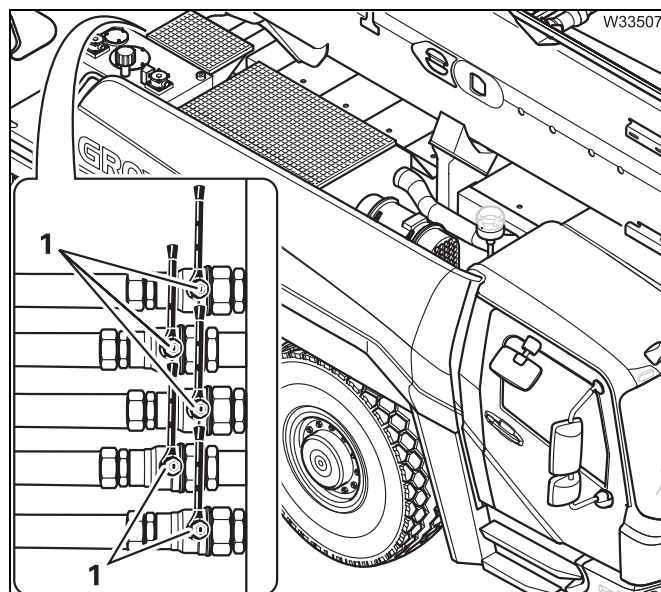
Close the valves



Risk of damage to the hydraulic pumps

Be sure to secure the engine against unauthorised use.

If the engine is started while the valves in the suction line are closed, the hydraulic pumps will be damaged.



- Close the valves – lever (1) at right angles to the line.

Handling the valves

The valves can only be opened and closed using the connecting piece and hose. The connecting piece is available in the toolbox.



Risk of environmental damage due to leaking consumables.

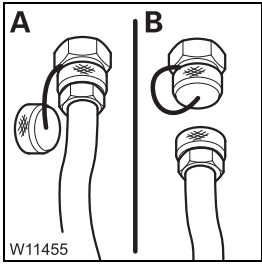
Use the supplied connecting piece and hose and a receptacle with sufficient capacity to drain the hydraulic oil.



Danger due to escaping hydraulic oil

When the connecting piece is screwed on to the valve, the valve opens and the hydraulic oil immediately flows out of the connecting piece. Holding it by the connecting piece, place the hose into a suitable receptacle before screwing on the connecting piece.

- Fit the hose on to the connecting piece and put the other end of the hose into a receptacle.



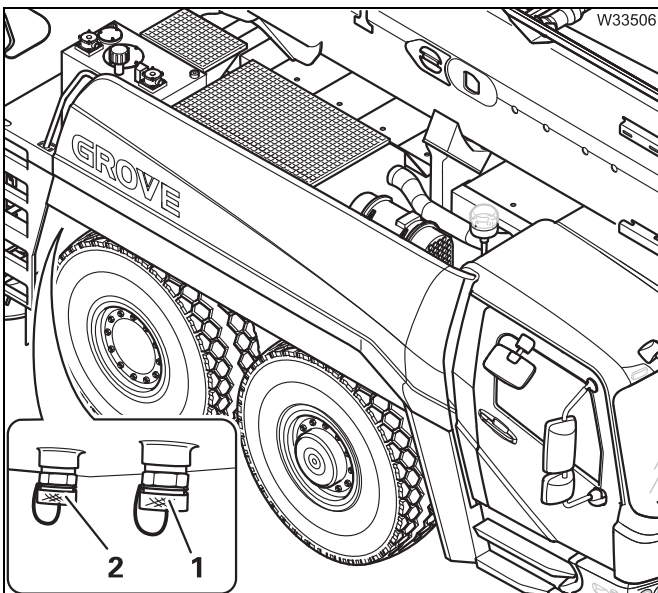
- **A** – Remove the cap and screw the connecting piece and hose on to the valve – the valve will open.
- Drain the oil.
- **B** – Remove the connecting piece and hose – the valve will close.
- Screw the cap on to the valve.

Draining oil



Risk of environmental damage due to leaking consumables.

Use the supplied connecting piece and hose and a receptacle with sufficient capacity to drain the hydraulic oil.



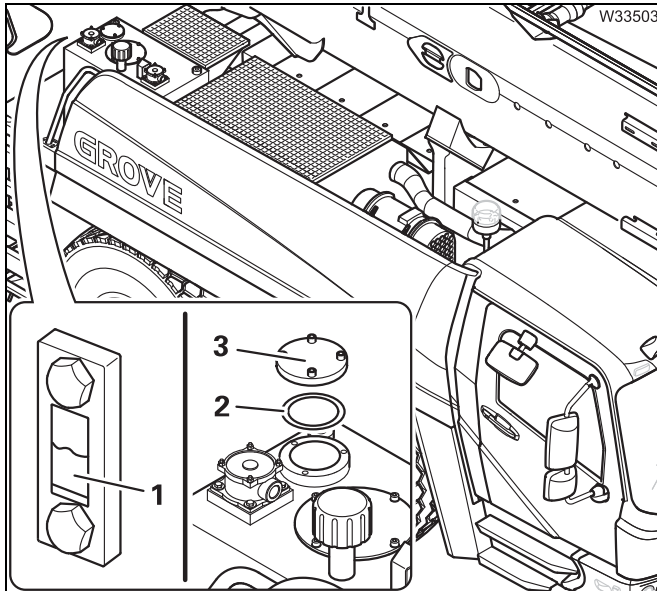
- Place a receptacle underneath the valves.
- One after the other, screw the connecting piece and hose onto the valves (1) and (2);
▣▣▣▣ Handling the valves, p. 7 - 92.
- Change the filters; ▣▣▣▣ p. 7 - 95.

Topping up the oil



Risk of damage to the hydraulic system

Cleanliness is of the utmost importance when handling hydraulic oil. Even fresh hydraulic oil must be filtered before it is added to the tank.



- Remove the cover (3).
- Add new oil through a filter until the level reaches the centre of the sight glass (1).
- Replace the gasket (2) if necessary and fasten the cap (3).

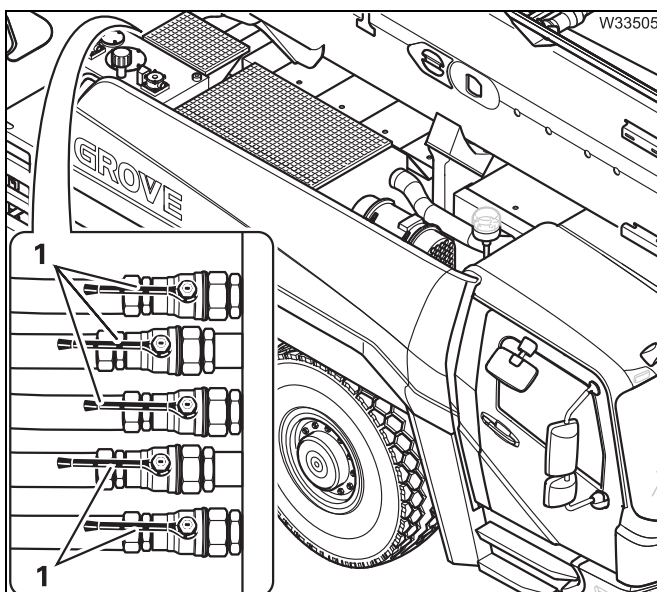
Establishing the operating conditions



After having changed the oil filters and topping up the oil, you must re-establish the operating conditions.

Risk of damage to the hydraulic pumps


Open the valves prior to starting the engine. This prevents damage to the hydraulic pumps.



Opening the valves

- Open the valves – lever (1) parallel with the line.




- Start the engine.
- Carry out all hydraulic functions several times to remove any air in the system.
- Test drive the truck crane, turning the steering wheel several times to its fullest extent.
- Check the oil level through the sight glass on the hydraulic oil tank. Top up oil, if necessary;  *Checking the oil level*, p. 7 - 81.

Bleeding the hydraulic system

If the steering is “spongy” during the test run, you must bleed the hydraulic system at the steering cylinders.

Preparations

- The truck crane must be raised on outriggers;  *Manual de instrucciones*.
- The parking brake must be applied.



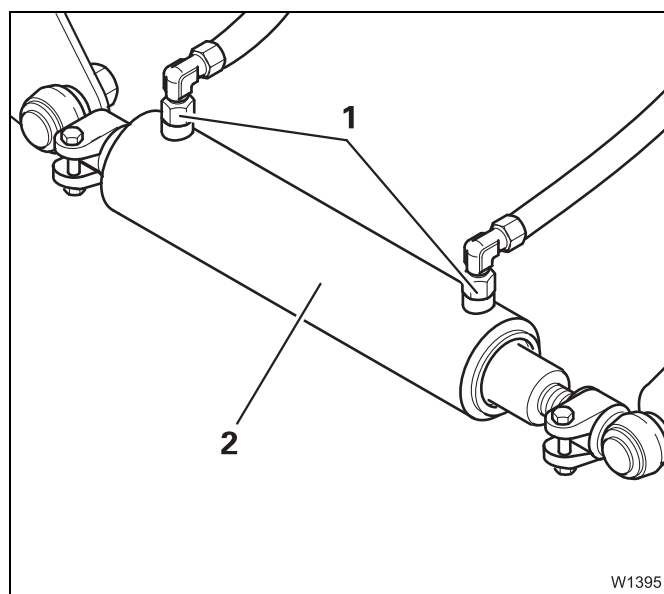
Risk of crushing from turning wheels.

When working between the wheels ensure that the steering wheel cannot be turned by an unauthorised person. The wheels turn when the steering wheel is operated.



Risk of accidents from high oil pressure

Never undo the hose connections completely. The hydraulic system is under pressure, even when the steering wheel is not turned.



Bleed the steering cylinders individually, one after the other

- Start the engine.
- Bleed each steering cylinder (2) by loosening each of the collar nuts (1) in turn, until the oil coming out no longer contains air bubbles.

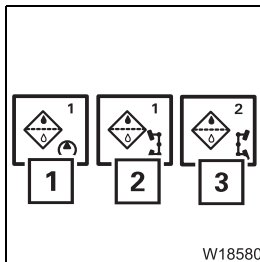
If the steering system is still not operating properly

- Notify **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

7.14.8

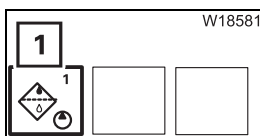
Changing the hydraulic oil filter

Oil filters must be replaced when changing the oil.



In case of a warning message on the ECOS display in the driver's cab

- the symbol (1) in the *Warning* submenu shows that you need to change filters 1 and 2,
- the symbol (2) in the *Warning* submenu shows that you need to change filter 3 (left),
- the symbol (3) in the *Warning* submenu shows that you need to change filter 4 (right).



In the case of a warning message on the ECOS display in the crane cab

- the symbol (1) in the *Warning* submenu shows that you need to change filters 1 and 2.

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter (for filters 1 and 2)	2	03329152
Packing set	2	03135778
Filter (for filters 3 and 4)	2	03140253
Repair set	2	03135867

- Receptacle, approx. 5 ltr (1.5 gal); p. 2 - 4.

Prerequisites

- The engine must be switched off and secured against unauthorised use; p. 2 - 3.

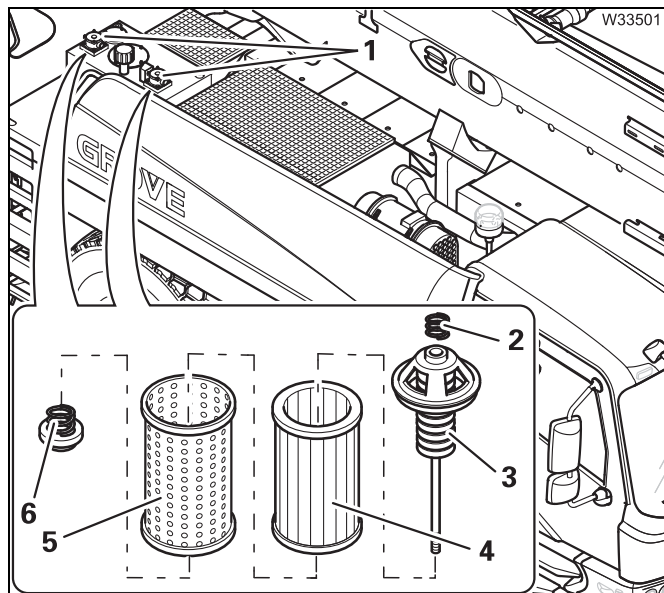


Changing filters 1 and 2



Risk of damage to the environment from filter residues

Store used hydraulic oil filter inserts in suitable receptacles and have them disposed of properly by qualified personnel.



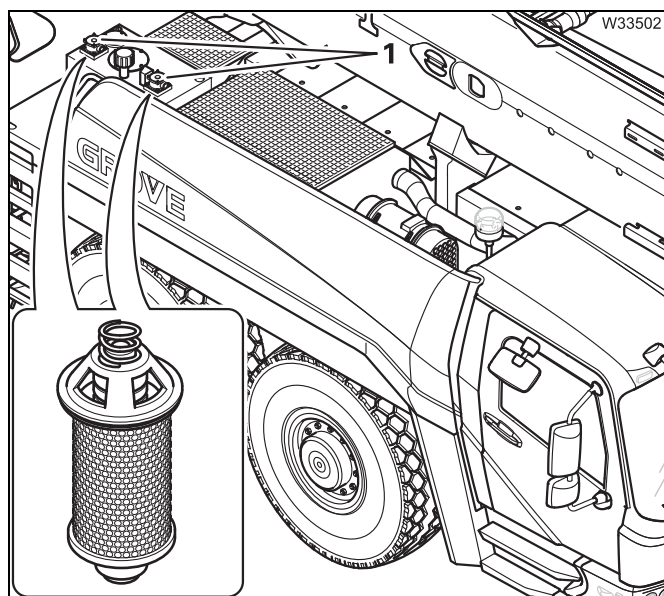
- Release the cap (1) and pull out the filters.
- Place the filters in a receptacle.
- Remove the spring (2).
- Undo the nut (6).
- Take the magnetic rod (3) and filter (4) out of the filter cage (5).
- Clean the magnetic rod (3) and filter cage (5).
- Insert a new filter (4) into the filter cage (5).
- Replace any damaged parts, where necessary.



Risk of damage to the hydraulic system.

Large amounts of metal particles are a sign of damage in the hydraulic system.

Have the hydraulic system checked by **Manitowoc Crane Care** or an authorised GROVE dealer or your qualified repair crew.



- Assemble the filters and install them.
- Replace the gaskets and fasten the caps (1).
- Start the engine and check for leaks.

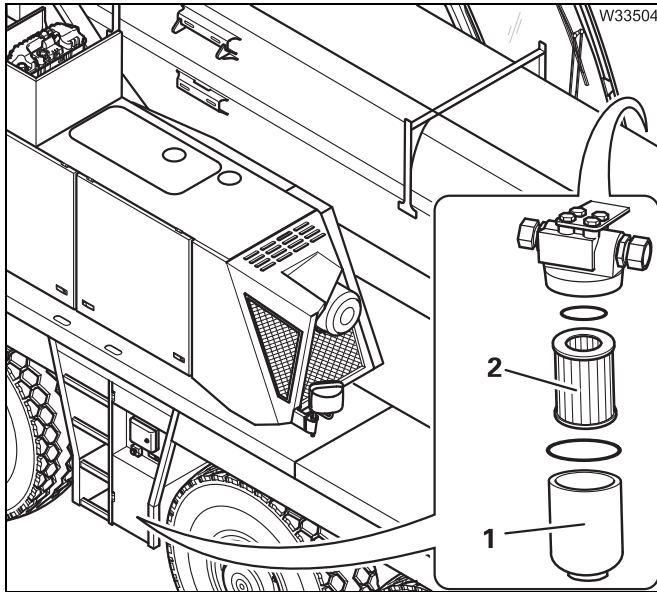
Changing filters 3 and 4

Filter 3 is installed on the left side and filter 4 is on the right side.



Risk of damage to the environment from filter residues

Store used hydraulic oil filter inserts in suitable receptacles and have them disposed of properly by qualified personnel.



- Remove the receptacle (1).
- Place the filter in a receptacle.
- Change the filter (2).
- If necessary, replace any defective parts (repair set).
- Fill the receptacle with clean oil.
- Put the receptacle on and tighten it.

- Change the filter on the opposite side in the same way.

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7.15 Central lubrication system

The central lubrication system supplies the steering lever and all the axle lines.

7.15.1 Checking the level

W

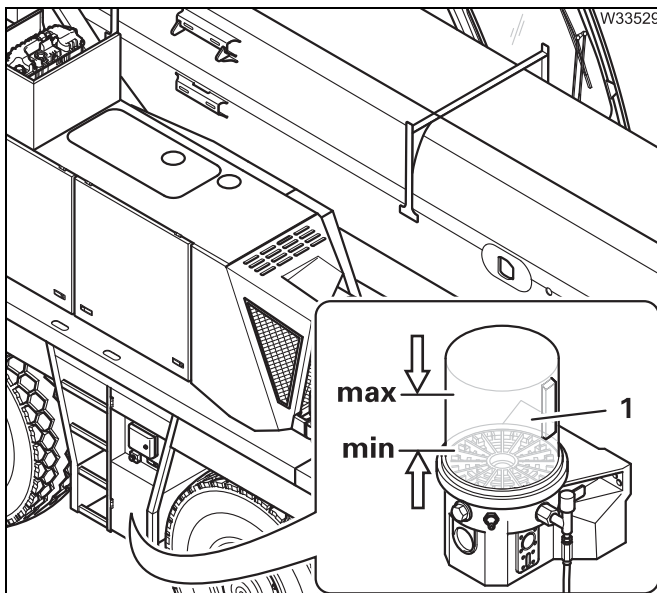
Grease, spare parts, tools

Lubricating grease	Designation according to DIN 51502	Specification Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

– Filling pump from the tool set.

Prerequisites – The parking brake must be applied.

Checking the level



- Check the level in the grease container (1). The grease level must be near the **max.** marking. If it is below the **min.** marking, the level is too low.

If the level is too low

- Add more grease; → p. 7 - 100.



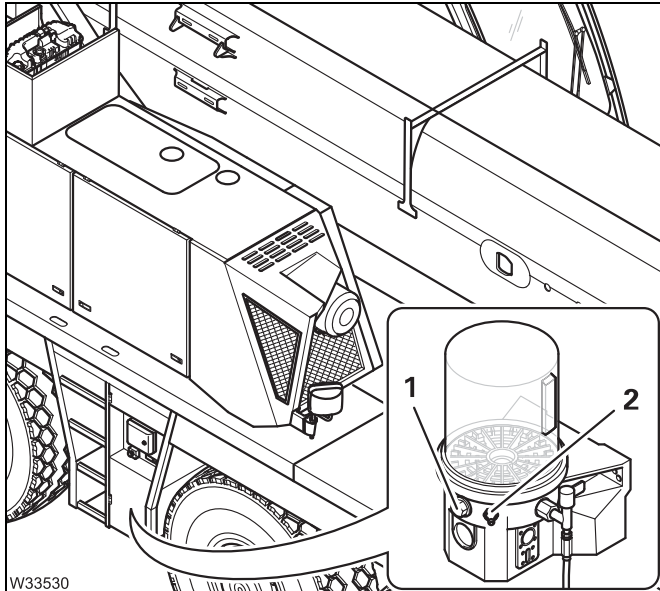
Topping up



Risk of damage to the central lubrication system.

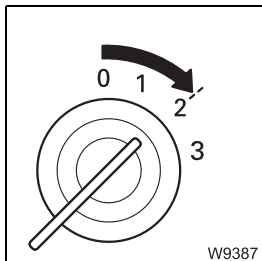
Cleanliness is of the utmost importance when handling grease and filling pumps.

Do not remove the caps from the opening and filling pump until immediately before refilling the grease. This prevents dirt particles from getting into the grease and damaging the central lubrication system.

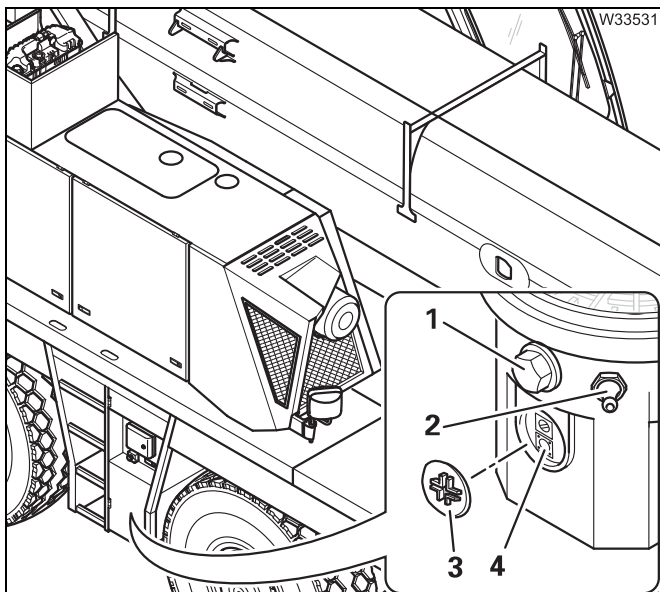


Fill the grease container as follows:

- 1 Filling pump tool set:
You must install the connector from the toolbox.
- 2 Filling pumps for lubrication nipples



- Switch on the ignition.



- Remove the cap (3).
- Attach the filling pump to connection (1) or (2).
- Press the button (4) for approx. 2 seconds once.

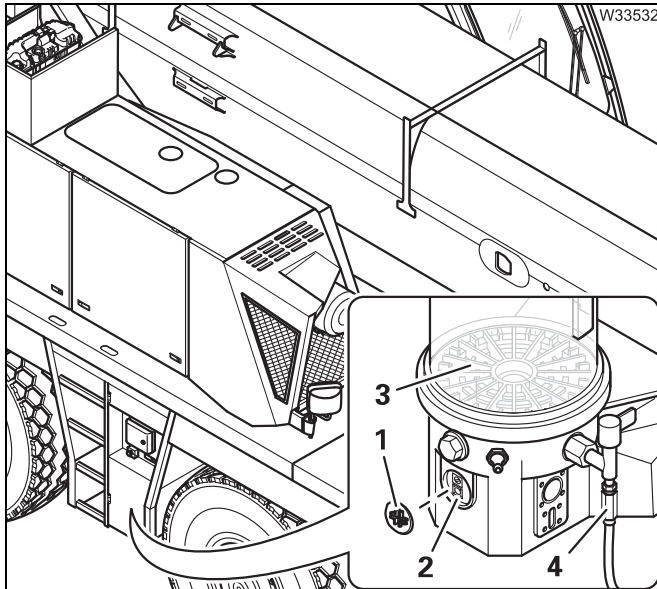
Intermediate lubrication will be triggered.

- Fill the grease container up to the **max.** marking.
- Remove the filling pump, wipe away any excess grease and close the holes.

7.15.2

Bleeding the central lubrication system

If the grease container is empty or contains bubbles, you must bleed the central lubrication system.



The grease container (3) must be full.

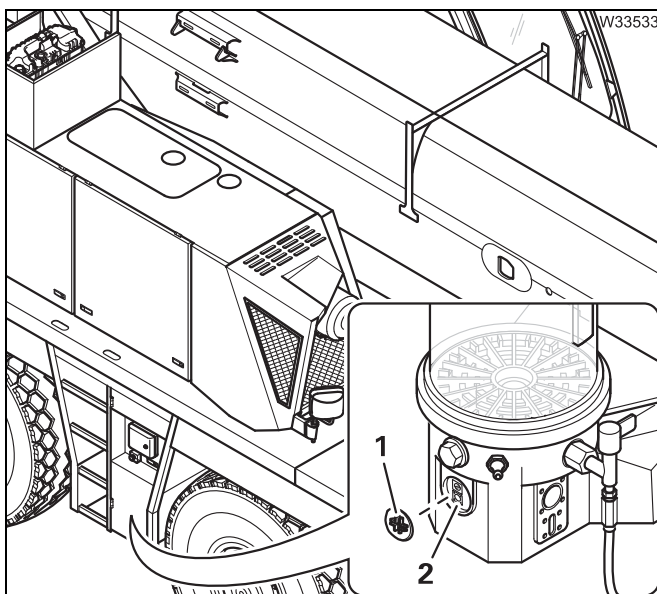
- Undo the connection (4).
- Switch on the ignition.
- Remove the cap (1) and press button (2) once for approx. 2 seconds. Repeat the procedure until the grease flowing from the connection no longer contains any bubbles.
- Attach the connection and the cap.
- Remove any grease that emerges.

7.15.3

Triggering intermediate lubrication

Intermediate lubrication should be triggered,

- after high pressure cleaning,
- to check the lubrication system at all lubricating points.



- Switch on the ignition.
- Remove the cap (1) and press button (2) once for approx. 2 seconds.

An intermediate lubrication cycle will be triggered which lasts approximately 3 minutes. Check whether grease oozes from all the lubricating points (steering lever on all axle lines).

- Switch off the ignition and remove any excess grease.
- Fasten the cap.

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7.16 Electrical system

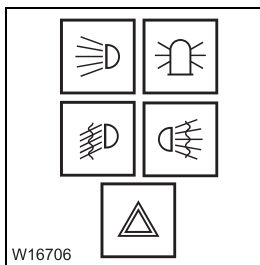
7.16.1 Checking the lighting and indicators

D

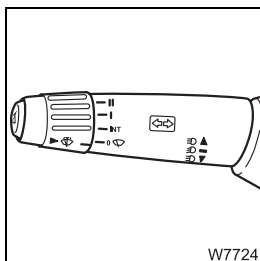


Risk of accidents if the safety devices are faulty!

Have faulty lights and indicators repaired by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.



- Check the following functions every day before operating or driving the truck crane, and have faulty parts repaired:
 - Parking light/headlight, marker lights, rotating beacons, fog tail light, fog light, outrigger lights,
 - Hazard warning system,
 - Brake lights,
 - Reversing lights,
 - Warning buzzer,
 - Reversing lamp (additional equipment).



- Full-beam headlight,
- Turn signal indicators,
- Horn,
- Windscreen wipers,
- Windscreen washing system.

7.16.2

Checking the batteries

M 1



Risk of poisoning from batteries containing lead

Battery poles, terminals and parts inside the battery contain lead. Residue containing lead can stick to your hands and may not be allowed to enter your body – e.g. by touching food.

Wash your hands after working on batteries.



Risk of explosion from escaping hydrogen.

Do not place tools on the battery and keep naked lights away from it.



Risk of explosion from static charge.

Use only antistatic cloths to clean the batteries.

This prevents the build-up of static charges which could cause hydrogen mixtures to explode.



Risk of burns from battery acids

Battery acid is highly caustic. Wear safety glasses and protective gloves.

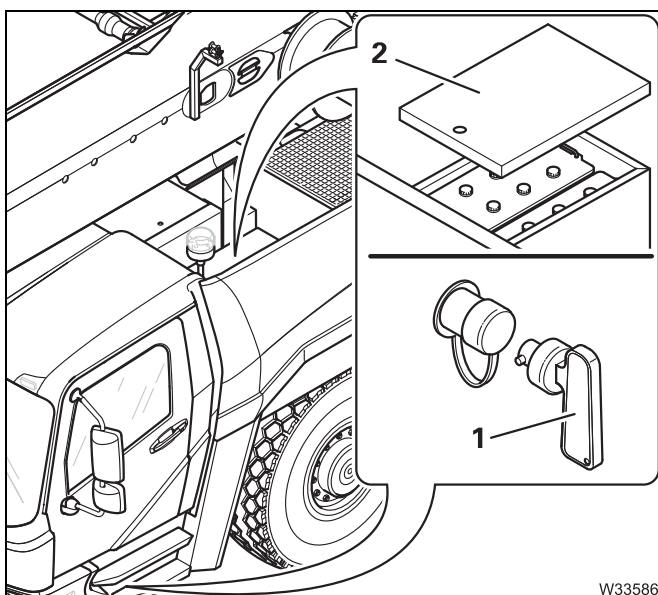
Do not tilt the battery. Rinse off or wash out any acid spray on the skin or clothing using soap suds.



Risk of damage to the crane's electrical system.

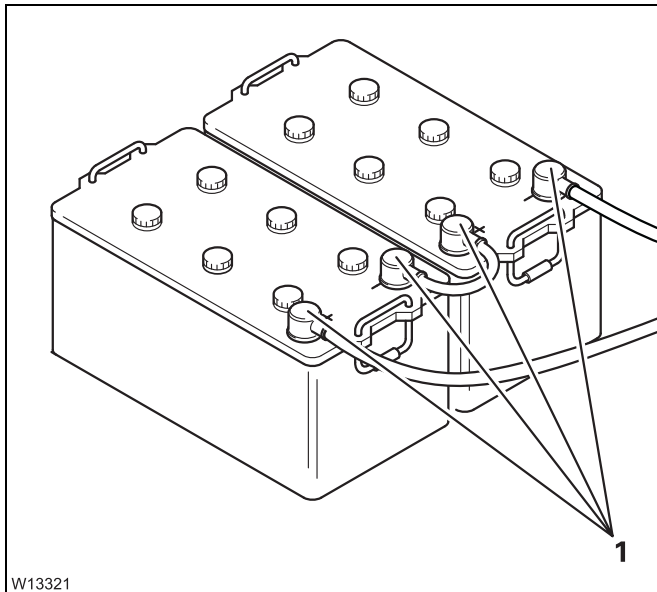
Always switch off the battery master switches before commencing work on the truck crane's electrical system.

This prevents short circuits and resulting damage to the electrical system.



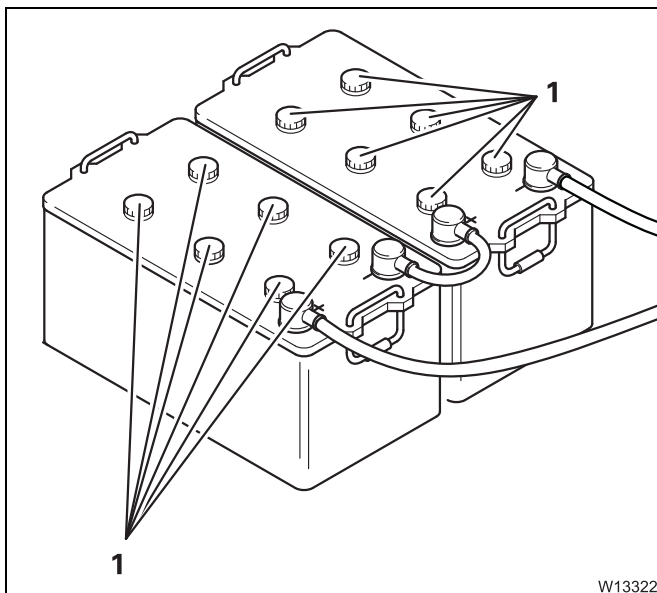
Before checking

- Switch the battery master switch (1) off and remove the selector handle.
- Open the cover (2) on the battery box.



Checking the connecting terminals

- Keep the batteries clean and dry.
- Remove any dirty connecting terminals (1) and clean them.
- Fasten any loose connecting terminals.
- Grease the connecting terminals and poles lightly with a special battery terminal grease.



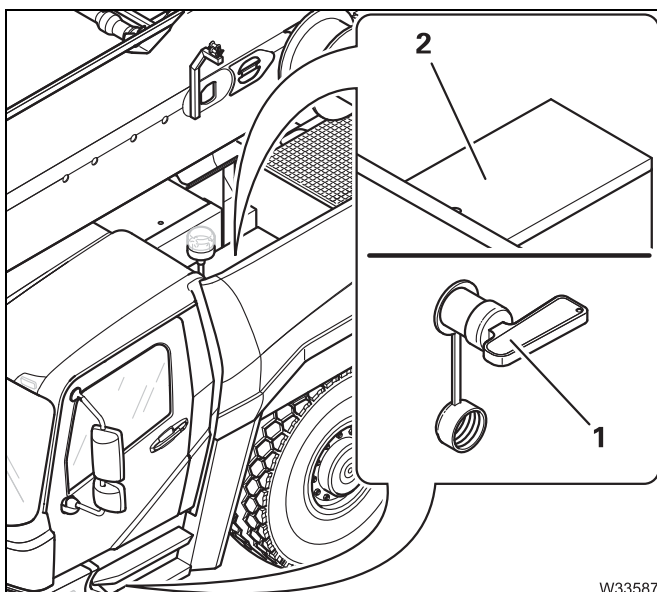
Checking the acid level

Batteries without covers (1) are maintenance-free.

- Remove all caps (1).
The acid level must be above the plates.

If the acid level is too low

- Top it up using only distilled water until the plates are covered.
- Tightly bolt on all covers (1).



After checking


- Shut the cover (2) on the battery box.
- Attach the selector handle and switch on the battery master switch (1).
- Check the timers on the tachograph and on the auxiliary heater; **▶▶▶▶▶** *Manual de instrucciones.*
- Enter the code for the radio; **▶▶▶▶▶** *Separate engine operating instructions, provided by the manufacturer.*

7.16.3

Checking the charge level of the batteries

M 3

Spare parts and tools

- Battery testing device;  *Separate engine operating instructions, provided by the manufacturer, or*
- Acid siphon.

Charge level table

The measurement of the acid concentration with the acid siphon will give you an indication of the charge level of the batteries. The acid siphon can have a scale in g/cm³, for example. Observe the special scale on your acid siphon.

Acid concentration (g/cm ³)	Charge level
1.28	good
1.20	half-charged; recharge
1.12	flat; recharge immediately



Risk of poisoning from batteries containing lead

Battery poles, terminals and parts inside the battery contain lead. Residue containing lead can stick to your hands and may not be allowed to enter your body – e.g. by touching food.
Wash your hands after working on batteries.



Risk of explosion from escaping hydrogen.

Do not place tools on the battery and keep naked lights away from it.



Risk of explosion from static charge.

Use only antistatic cloths to clean the batteries.
This prevents the build-up of static charges which could cause hydrogen mixtures to explode.



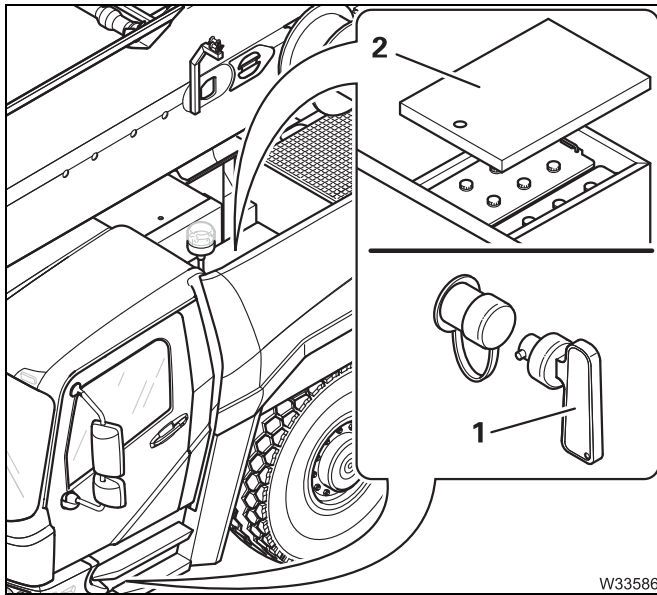
Risk of burns from battery acids

Battery acid is highly caustic. Wear safety glasses and protective gloves.
Do not tilt the battery. Rinse off or wash out any acid spray on the skin or clothing using soap suds.



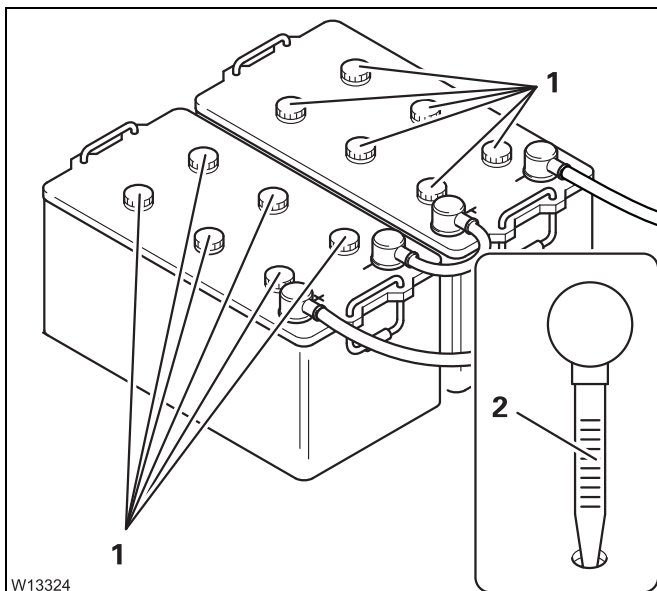
Risk of damage to the crane's electrical system.

Always switch off the battery master switches before commencing work on the truck crane's electrical system.
This prevents short circuits and resulting damage to the electrical system.




Before checking

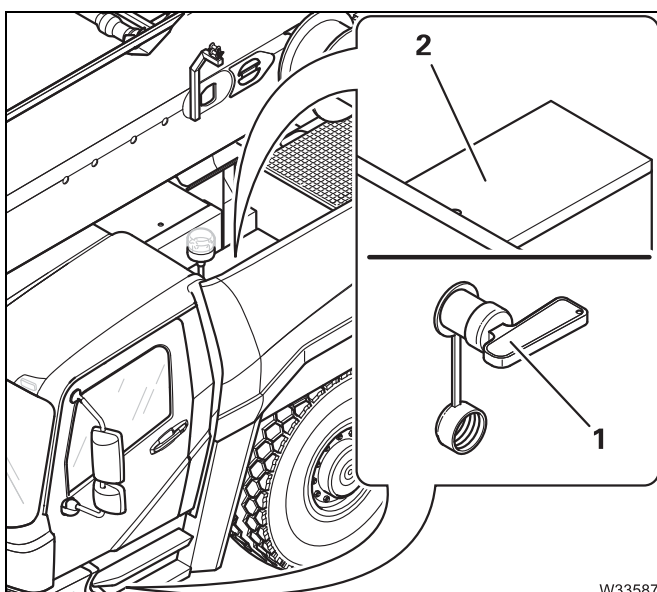
- Switch the battery master switch (1) off and remove the selector handle.
- Open the cover (2) on the battery box.





Checking the acid concentration

Batteries without covers (1) are maintenance-free.

- Remove all caps (1).
- Read off the cell value on the acid siphon (2) and compare the value with that in the table;  *Charge level table, p. 7 - 106.*
- Check all cells in the same way.
- Tightly bolt on all covers (1).



After checking


- Shut the cover (2) on the battery box.
- Attach the selector handle and switch on the battery master switch (1).
- Check the timers on the tachograph and on the auxiliary heater;  *Manual de instrucciones.*
- Enter the code for the radio;  *Separate engine operating instructions, provided by the manufacturer.*

7.16.4


Charging the batteries using the battery charger

M 3

Prerequisites

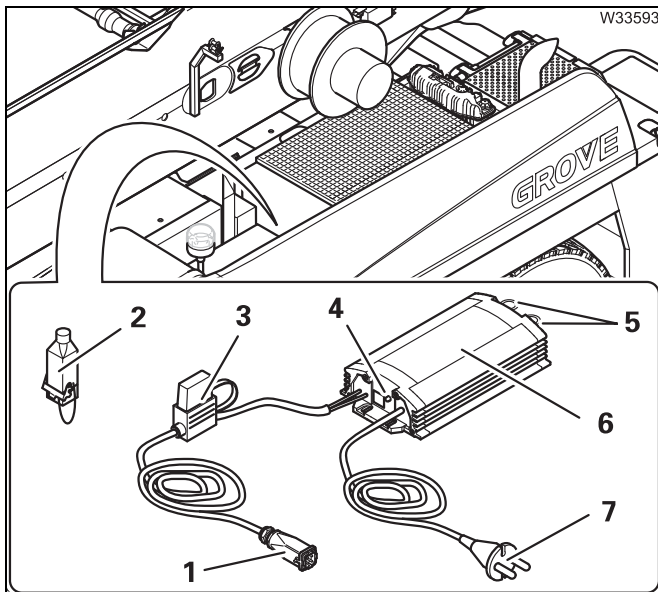
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- An external 230 V mains power supply must be available at the location.
- The battery charger (GROVE part no. 03320239; additional equipment) must be available.
- The location must be well ventilated and protected against moisture. The battery charger may not be used at locations where there is risk of a gas or dust explosion.

Battery charger

- Familiarise yourself with the correct operation of the battery charger;  *Separate engine operating instructions, provided by the manufacturer.*

Connecting

- Take the battery charger out of its storage compartment in the driver's cab.



- Insert the plug (1) into the socket (2) on the battery box.
- Place the battery charger (6) in a protected place where you can see the indicator lamp (4).
The battery charger can be suspended from the ring eyes (5).
- Insert the plug (7) into the socket on the mains supply 230 V at the location.
The indicator lamp (4) flashes – the charging process starts.
- If the indicator lamp (4) does not flash, check the fuse (3).

Charging

- Check the charging process at the indicator lamp (4).

Indicator lamp flashing:	The batteries are being charged.
Indicator lamp lit continuously:	The batteries are fully charged.

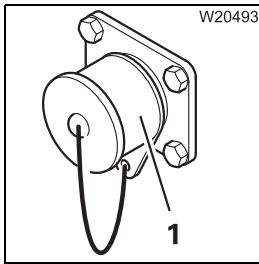
After completion of charging

- Remove the plug (6) from the 230 V mains supply.
- Remove the plug (1) from the battery box.
- Return the battery charger to the storage compartment in the driver's cab.

7.16.5

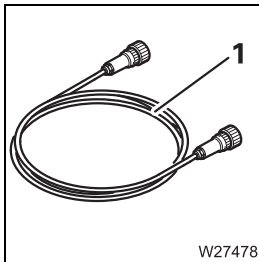
Check the external starting socket

M 3



The battery box can be equipped with an external starting socket (1) as additional equipment.


Accessories



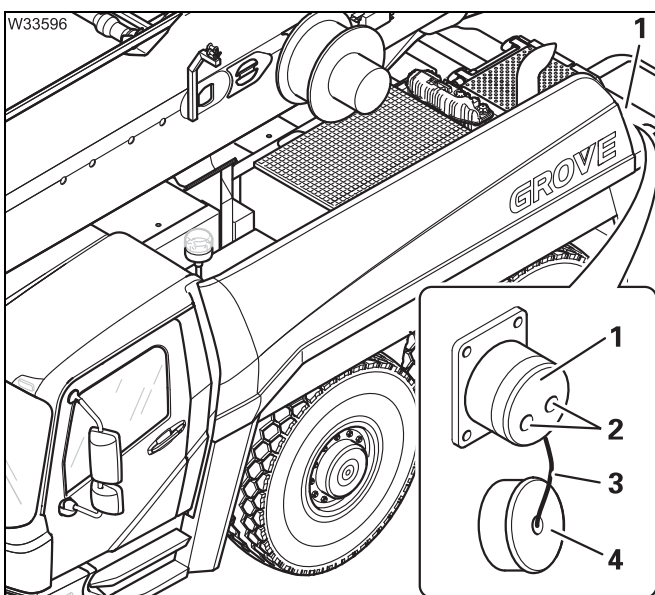
A connection cable (1) for the external starting socket is supplied with the truck crane (tool set).

Designation	GROVE part no.
Connecting cable with two plugs; Length 12 m	03143281

The battery box can also be equipped with a battery charger as **additional equipment**.

- Consult the operating instructions supplied with the battery charger and regularly check that all components are functioning correctly to ensure that the external starting socket, connecting cable and battery charger are ready for operation if needed;  *Manual de instrucciones*.

Checking



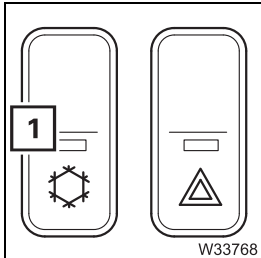
- Remove the cap (4) from the socket (1).
- Check that the cap is not damaged and is secured with the chain (3).
- If necessary, clean the poles (2).
- Attach the cap – the cap must be fitted tightly and compactly on the socket.


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7.17 Air conditioning system

7.17.1 Checking the air-conditioning system

M 1



- Switch the air conditioning system (1) on;  *Manual de instrucciones*.
- Check that cooling takes place. If it does not, the air-conditioning system is defective.
- Switch the air conditioning system (1) off.

If the air-conditioning system is defective

- Do not start it up again to avoid further damage.

Have the air-conditioning system repaired as soon as possible by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

7.17.2 Checking hoses

M 6



Risk of burns due to escaping refrigerant.

Wear suitable safety glasses and gloves when checking the hoses and connections.

This will prevent injury from suddenly escaping refrigerant. Seek medical attention if the skin or eyes come into contact with the refrigerant.

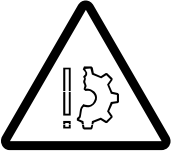
- Check all refrigerant hoses for damage and areas of wear.

Have damaged hoses checked by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop only.

7.17.3

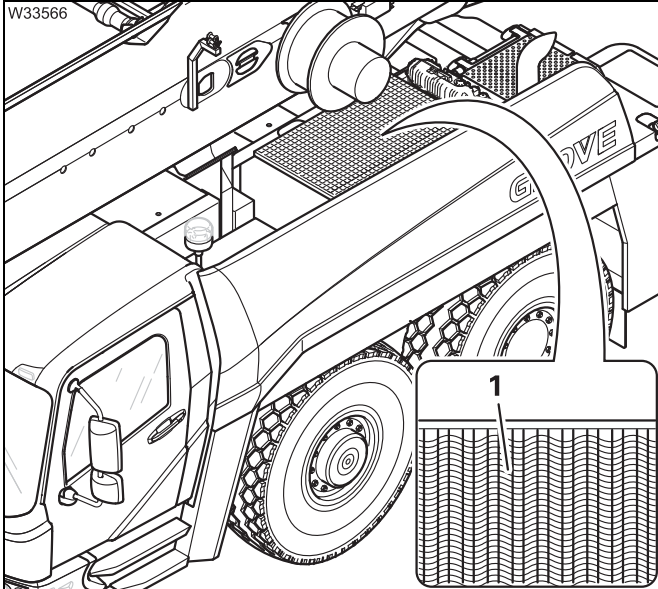
Cleaning the condenser fins


M 12



Risk of damage to the condenser.

Do not use a high pressure cleaner or steam jet cleaner. The powerful jet may damage the fins. Use only compressed air for cleaning.



- Switch the air-conditioning system off.
- Clean the condenser fins (1) with compressed air;  Have the radiator checked/cleaned, p. 7 - 17.

7.17.4

Checking the entire air-conditioning system

M 12



This inspection may only be performed by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.



Risk of burns due to escaping refrigerant.

Wear suitable safety glasses and gloves when checking the hoses and connections.

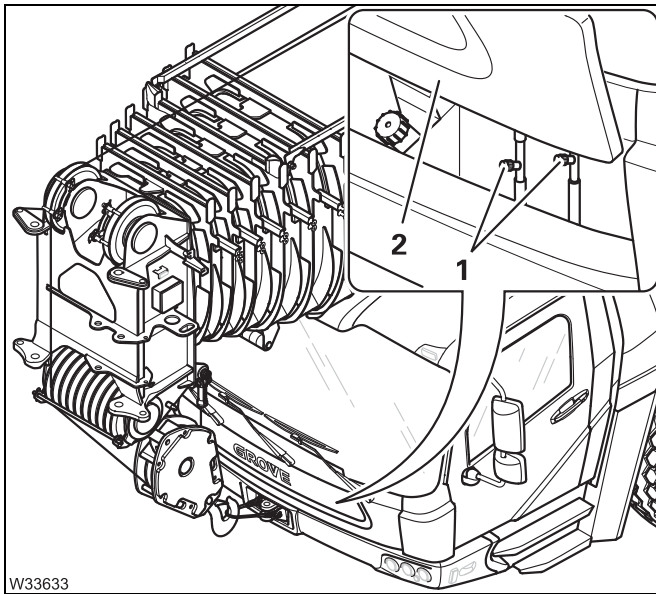
This will prevent injury from suddenly escaping refrigerant. Seek medical attention if the skin or eyes come into contact with the refrigerant.

- Have the entire air-conditioning system checked for leaks and proper functioning.
The inspection of the air-conditioning system particularly includes the inspection of
 - the refrigerant collector, in accordance with the pressure container regulations (test group II) and
 - the refrigerant compressor.
- Only allow the system to be topped up with suitable refrigerant.

Refrigerant

Fill quantity in kg (lbs)	Designation	CAS no. EC no.
1.0 (2.2)	Tetrafluoroethane (R134a)	811-97-2 212-377-0

Filler connections



The filler connections (1) for the refrigerant are behind the front flap (2) in the driver's cab.

7.18 Towbar coupling

Depending on the equipment fitted to your truck crane, it may have towbar couplings (additional equipment) from different manufacturers.

The wear values for other manufacturers may vary from those specified;
 ■■■► *Separate engine operating instructions, provided by the manufacturer.*

7.18.1 Lubricating the towbar coupling

M 1

This maintenance work is not required if the towbar coupling is connected to the central lubrication system.

Grease, spare parts, tools

Lubricating grease	Designation according to DIN 51502	Specification Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

– Grease gun from the tool set.



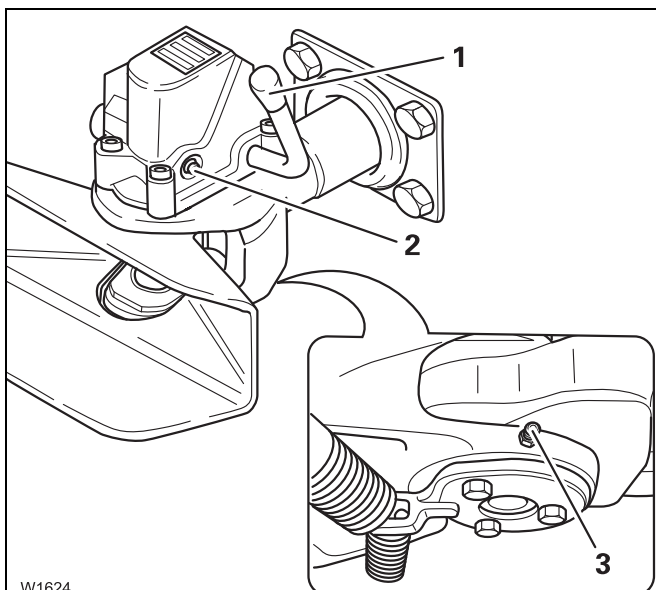
Risk of injury when the automatic closing device is triggered.

Do not put your hand into the coupling jaw when the towbar coupling is open.

This may trigger the automatic closing device, make the cotter pin move down and seriously injure your hand.



To avoid over-lubrication, the towbar coupling may be lubricated only when it is open.



- Clean the grease nipples (2) and (3).
- Open the towbar coupling. To do this, move the lever (1) up.
- Press grease into the grease nipples (2) and (3).
- Close the towbar coupling.



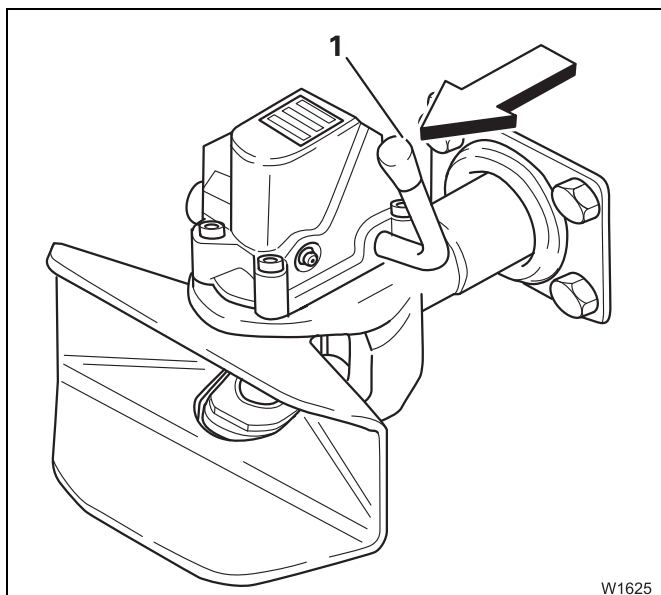
Closing the towbar coupling



Risk of injury when manually closing the towbar coupling

When closing, the lever moves down with great force in the direction of the coupling jaw. Start the closing process only by moving the lever briefly in the direction of the coupling jaw with the ball of your hand.

If you hold the lever and move it down, it may carry your hand with it and crush it.



After lubrication you must close the towbar coupling.

- Move the lever (**1**) briefly in the direction of the coupling jaw (observe the arrow).
- Remove any grease that emerges.


W1625

7.18.2

Checking the bearing

M 3

Prerequisites

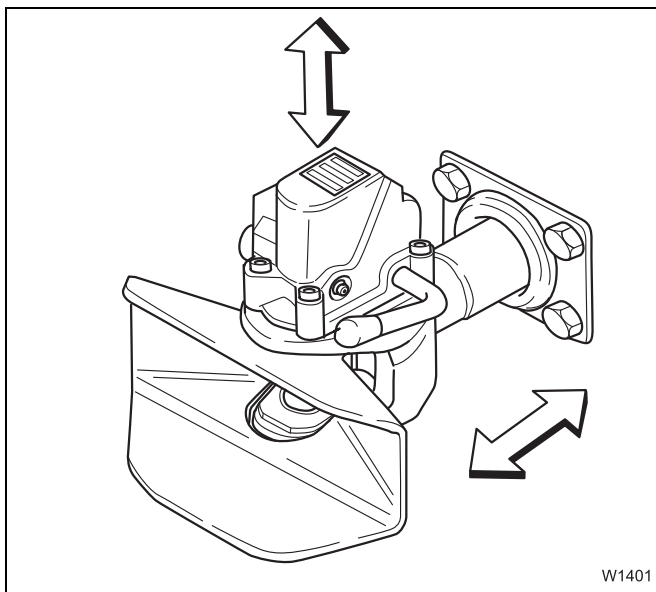
– The coupling must be closed;  p. 7 - 116.

Checking the bearing



Risk of injury!

Ensure that the towbar coupling is closed for the following work (lever points downwards). The lever may otherwise come down with great force and cause serious injury to your hand.



- Check the bearing of the towbar coupling by vigorously shaking it up and down and in the longitudinal direction (arrows). Hold the towbar coupling at the top and bottom of the coupling head and not by the coupling jaw.


The vertical play at the coupling head must be no more than 3 mm (0.1 in).

7.18.3

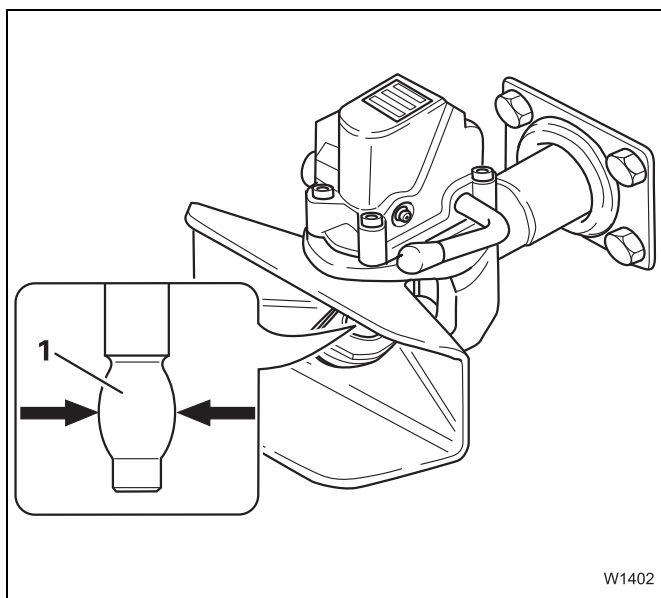
Checking the cotter pin

M 3

Prerequisites

– The coupling must be closed;  p. 7 - 116.

Checking the cotter pin

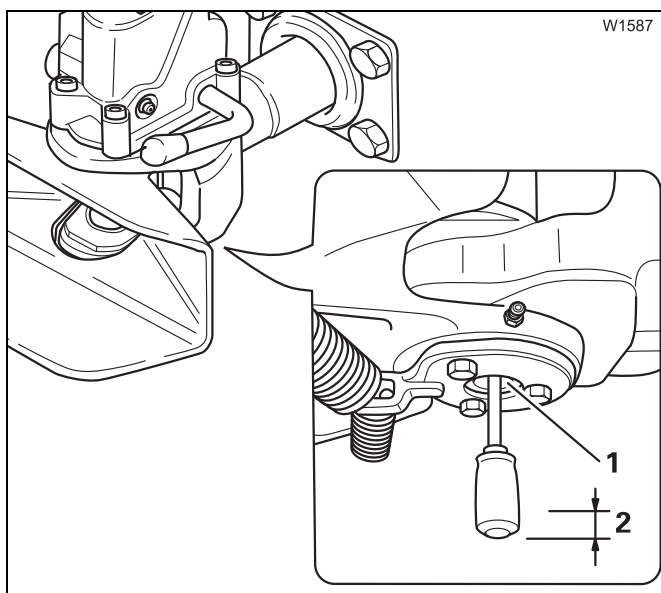


- Check the wear on the cotter pin (1). The diameter of the crowned section (arrows) must not be less than the following values:

Model series 400: **36.5 mm (1.44 in)**

Model series 700: **46.0 mm (1.81 in)**

If the dimension is smaller than that given above, have the cotter pin replaced by **Manitowoc Crane Care** or an authorised GROVE dealer or your qualified repair personnel.




- Also check the cotter pin for the correct vertical play. Take a screwdriver and press the pin (1) upwards. The vertical play (2) of the pin must not exceed 4 mm (0.15 in).

7.18.4

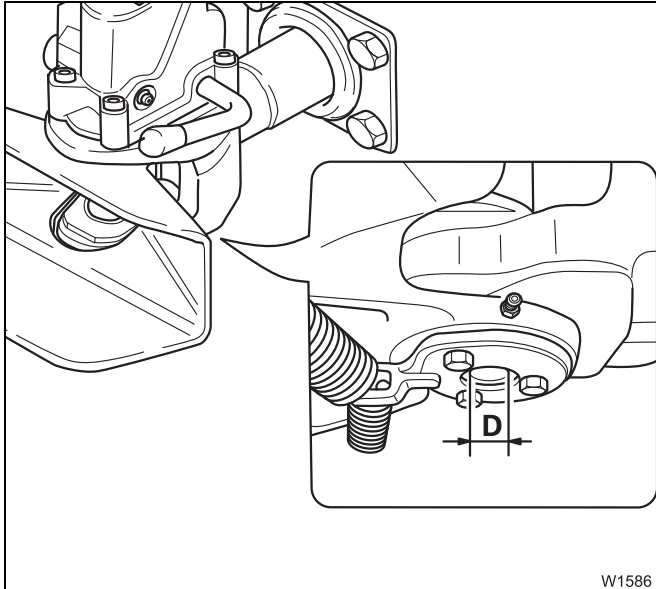
Checking the lower bushing

M 3

Prerequisites

– The coupling must be closed;  p. 7 - 116.

Checking the bushing



- Check the internal diameter of the lower bushing. The dimension **D** must not exceed the following values:

Model series 400: **31.5 mm (1.25 in)**

Model series 700: **34.2 mm (1.35 in)**

If the dimension is larger than that given above, have the bushing replaced by **Manitowoc Crane Care** or an authorised GROVE dealer or your specialist repair crew.

7.18.5

Checking the initial tension of the springs

M 3

The coupling head should require physical force to twist it when checking the torque.


- Twist the coupling head clockwise and anticlockwise to check the initial tension of the rubber springs.

7.18.6

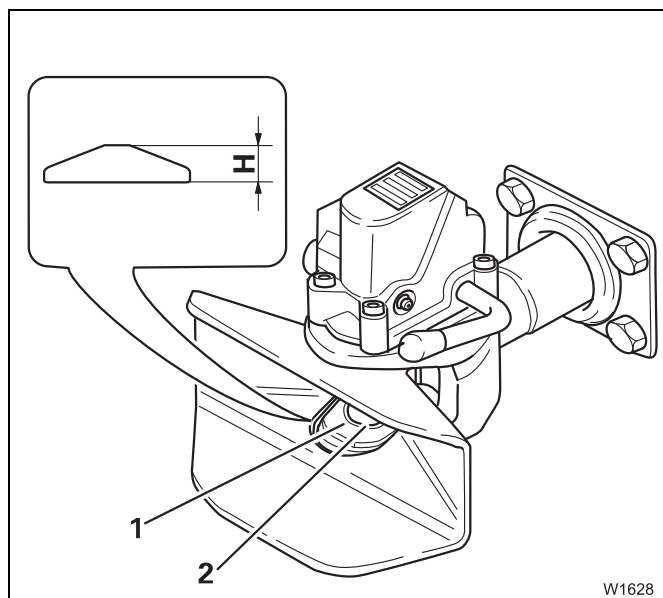
Checking the support ring

M 3

Prerequisites

- The coupling must be closed;  p. 7 - 116.

Checking the support ring



- Check the support ring (1) at the bottom of the coupling jaw. When the trailer is coupled, the draw eyelet of the trailer must not be in contact with the lower bushing (2).

Have the support ring changed if:

- The trailer's draw eyelet touches the lower bushing because of wear or
- The support ring has reached its wear limit of **H = 14 mm (0.55 in)**

7.18.7


Checking the function of the coupling jaw/resetting the middle position.

M 3

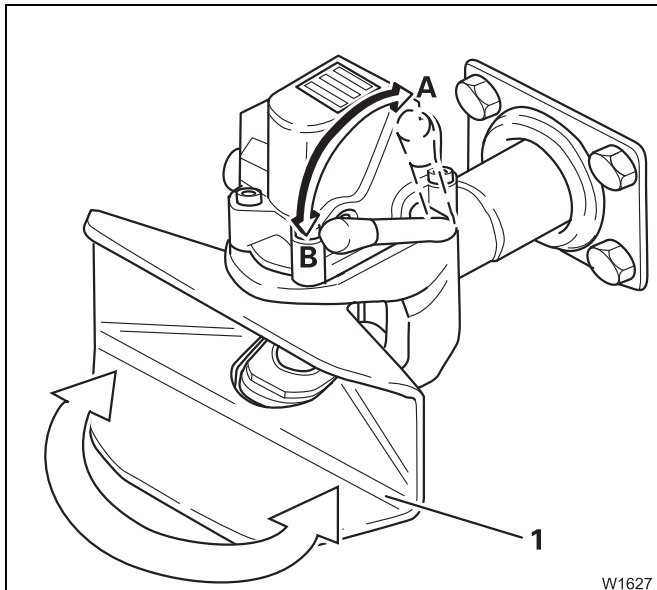
Spare parts and tool

- Torque wrench for a torque of 58 Nm (42.7 lbf ft).

Prerequisites

- The coupling must be closed;  p. 7 - 116.

Checking for correct functioning




The coupling jaw must be able to move easily in both directions.

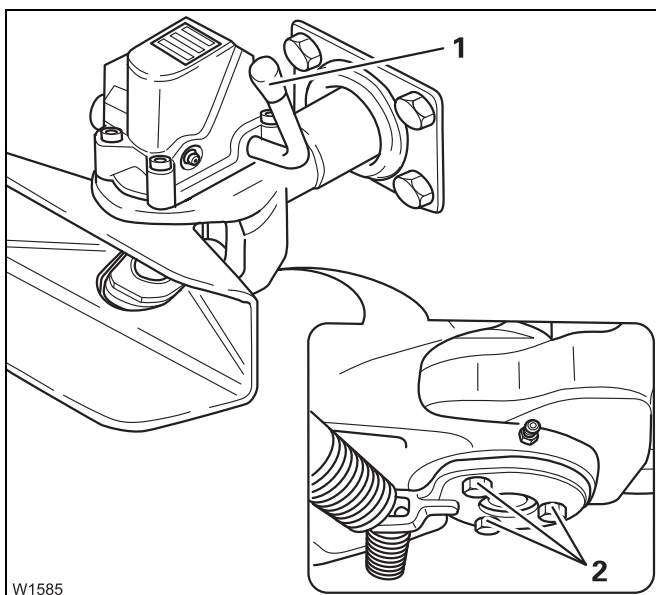
- Hold the coupling jaw (1) pressed slightly to the left or right.
- Open the coupling (position A) and let the coupling jaw go.


The lever must automatically lock the coupling jaw in the middle position. The coupling jaw is locked when the coupling can no longer move to the side.



If the lever does not automatically engage with the coupling jaw, the central position must be re-adjusted;  p. 7 - 121.

Resetting the middle position



- Open the coupling (lever (1) pointing upwards) and loosen the screws (2).
- Push the coupling jaw to the side until the lever engages.
- Tighten the screws – torque 58 Nm (42.7 lbf ft).
- Check the functioning of the coupling jaw;  p. 7 - 120.

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7.19 Other maintenance work

7.19.1 Checking the windscreen washing system

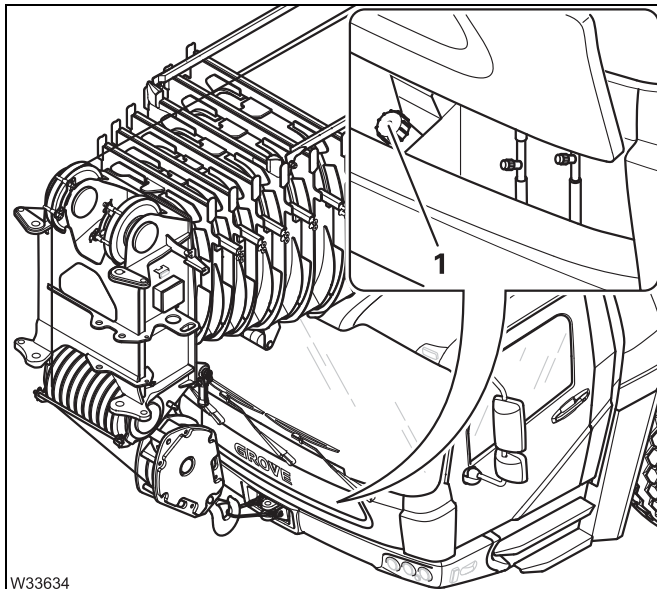
W

Water, spare parts, tool

Designation	Quantity	GROVE part no.
Wiper blades	3	02311858

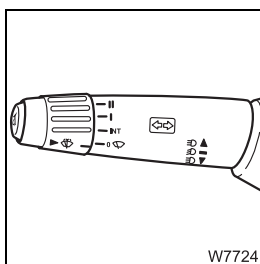
- Water; add commercially available detergent and antifreeze to it.
- A can for mixing and filling.

Topping up



- Open the cap (1) on the filler neck.
- Top up the windscreen washing fluid through the filler neck.
- Close the filler neck with the cap.

Wiping



- Press the multipurpose switch of the windscreen wiper/washing system; *Manual de instrucciones*.

- Check all the wiping stages (slow, fast, intermittent).

If the windscreen does not wipe clean

- Change the wiper blades.

7.19.2

Lubricating the outrigger beams

M 1

- Comply also with the  *Running-in regulations*, p. 4 - 1.

Grease, spare parts, tools

Lubricating grease	Designation according to DIN 51502	Specification classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369
Spray	Spray on Berulub; 0.5 litres (spray-on)		01929824

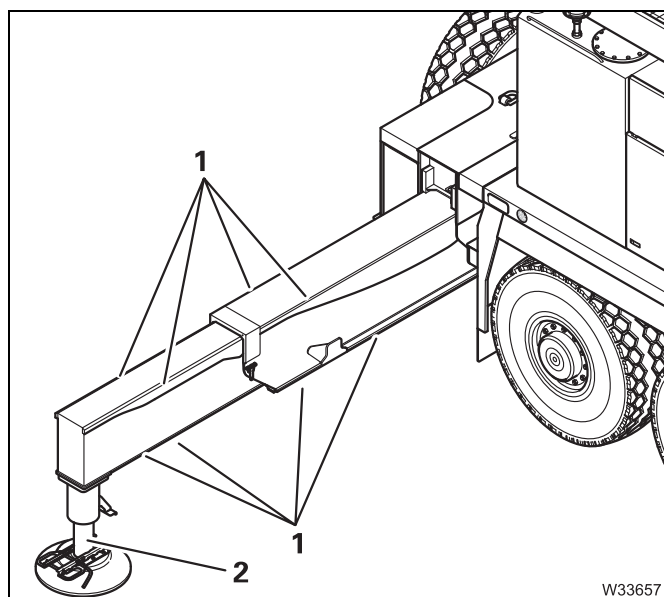
– Brush or roller.




Danger of crushing from extending outrigger beams.

Ensure that there is sufficient room around the crane. Warn any persons nearby before extending the outrigger beams.

Observe the safety instructions in the operating manual.



- Fully extend all outrigger beams;  *Manual de instrucciones*.
- Apply the grease to both sides of the slide faces (1) on all the outrigger beams.
- Extend and retract the outrigger beams several times.
- Remove any excess grease.
- Clean the uncovered end (2) of the outrigger cylinder and bearing surfaces on the outrigger pad by removing old grease, dirt particles and rust.
- Spray the uncovered end (2), making sure the grease coating is evenly distributed.

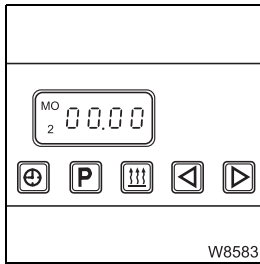
After every high-pressure cleaning operation on the truck crane

- Lubricate the outrigger beams.

7.19.3

Checking the functioning of the auxiliary heater

M 1



Depending on the equipment, your truck crane has been fitted with an auxiliary heater.

Even during the warm summer months, run the auxiliary heater for 20 to 30 minutes; *Manual de instrucciones*.

- Check that the system is working properly. Also perform a functional check of the controls.
- If the heating system is not working correctly, report it to **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

7.19.4

Lubricating the cab door

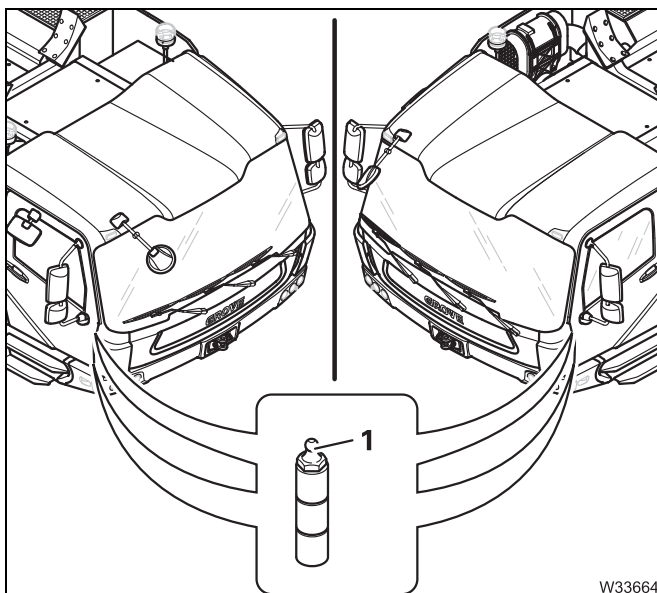
M 12

Grease, tools

Lubricating grease	Designation according to DIN 51502	Specification Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set.

Lubricating



- Open the doors on the driver and passenger side.
- Clean the grease nipples (1) on the door hinges.
- Press grease into the grease nipples.
- Close and open the doors several times – the doors should move easily.
- Remove any grease that emerges.

- In case the doors are stiff or do not close properly after lubrication, have them adjusted by **Manitowoc Crane Care** or by an authorised GROVE dealer.

7.19.5

Lubricating the connecting and socket pins

M 12

Grease, tools

Lubricating grease	Designation according to DIN 51502	Specification Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

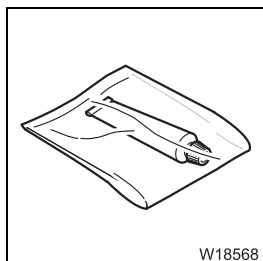
- Brush.

Checking

Depending on the equipment, there are various connecting and socket pins on the carrier such as:

- Fastenings to hold the hook block on the bumper while driving on the road
 - Clamps for ladders on the carrier
 - Hinged warning panels under the bumper,
 - Fastenings for the outrigger pads and socket pins on the outrigger,
 - Locks on the removable covers,
 - Hinges on the doors and covers of the storage box.
- Check the pins for wear such as rust, deformation, broken clips, chains and pin-type keepers.
 - If the pins are damaged, have them replaced by **Manitowoc Crane Care** or an authorised GROVE dealer or your qualified repair crew.
 - Use only authentic replacement pins.

Lubricating



- Clean the pins.
- Lubricate the pins with a brush.

7.19.6

Renewing the corrosion protection


M 12

Protective agent, tools

Protective agent	GROVE part no.
Corrosion protection	03140192

- Spray gun with spray extension.
- Brush.
- Protective clothing, protective goggles.

Prerequisites

- The undercarriage of the truck crane must be thoroughly cleaned.
- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Checking

At the factory, the underside of the carrier was sprayed with corrosion protection for the first time.

The corrosion protection is solvent-free and is water soluble while being sprayed on. A transparent, waxy, protective film is formed after a drying time of one hour.

- Check the condition of the original protective film.
- If required, remove any rust and touch up the paintwork before you spray on a new protective film.

Processing instructions

- Observe the processing instructions for corrosion protection:
 - Processing temperature: above 10 °C (50 °F).
 - Removability before drying: With water.
 - Removability after drying: With solvent naphtha.
 - Drying time: 1 hour.

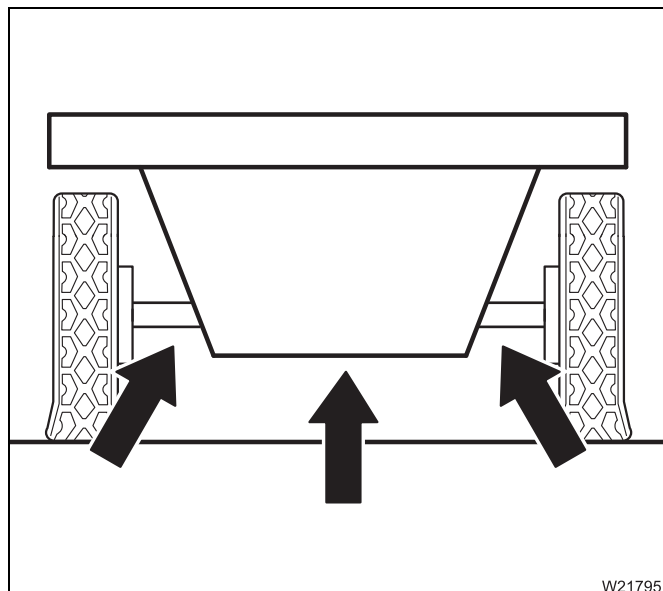


Spraying



Risk of injury to the eyes.

While working with the spray extension you could be hit by the spray jet or spray droplets. Wear protective goggles, protective clothing and gloves.



W21795

- Spray the corrosion protection agent on the underside of the carrier using a spray extension.
- Clean surfaces sprayed by accident immediately with water.
- Let the corrosion protection dry for one hour.
- Check that a transparent waxy protective film has covered the entire surface.

7.19.7

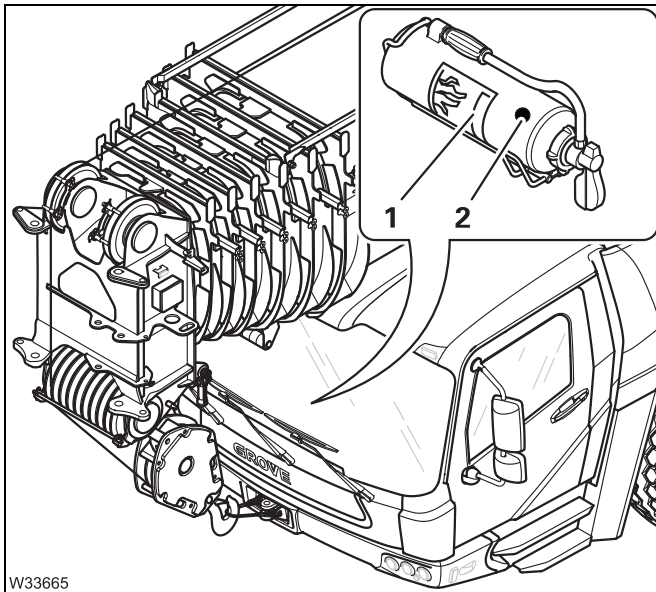
Having the fire extinguisher checked

Y 2

Depending on your truck crane's equipment, it can be fitted with fire extinguishers.



The maintenance interval may even be shorter, depending on the respective national regulations and the operating location. Ask the local fire safety officer about the national and local regulations.



- Observe the instructions (1) on the fire extinguisher.
- Have the fire extinguisher serviced by trained personnel in good time before the maintenance interval specified on the label (2) expires.



Danger due to the fire extinguisher not working.

There is no guarantee that the fire extinguisher will still work properly once the maintenance interval on the label has expired.

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8 Maintenance work on the superstructure

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8

Maintenance work on the superstructure

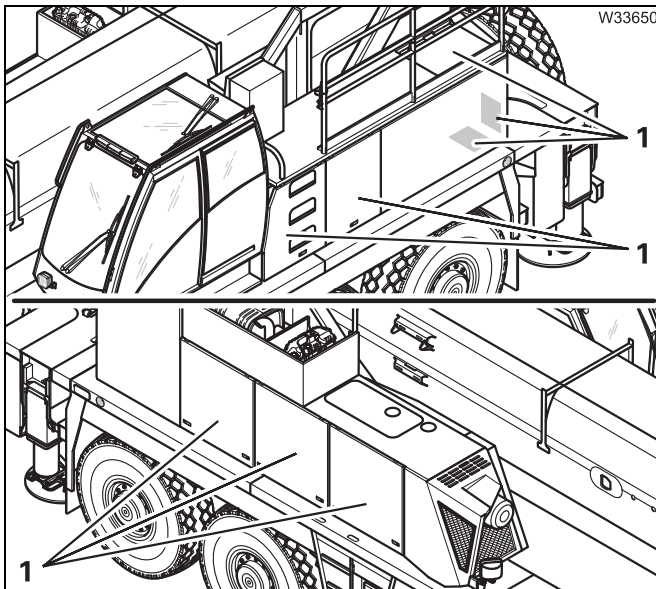
8.1

General instructions

8.1.1

Covers

For various jobs (e.g. on the slewing gear, storage batteries, engine or for refuelling) you must remove/fold back the covers.



Before maintenance work

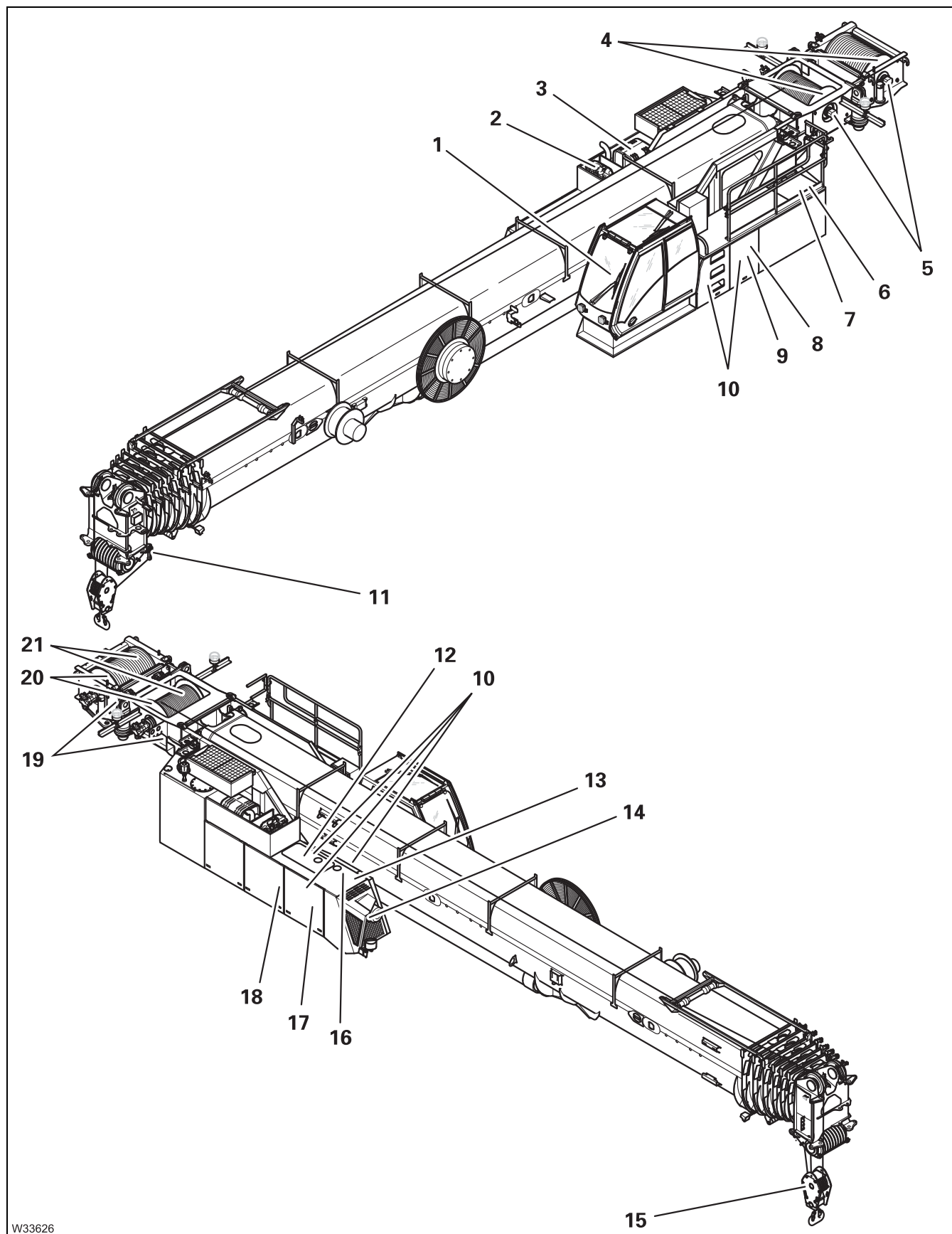
- Remove the covers (1)

After maintenance work

- Fasten the covers (1) with the locks.

8.1.2

Overview of maintenance work on the superstructure



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Symbols for maintenance work

1 ECOS display

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▣▣▣ p. 8 - 9

Engine

18 Diesel engine

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12 Oil filler opening

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Exhaust system with exhaust emission control

6 AdBlue tank

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Hoists

21 Hoist ropes

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4 Rope wedges

▣▣▣▣ p. 8 - 90

20 Rope drums

▣▣▣▣ p. 8 - 89

19 Oil inspection glasses

▣▣▣▣ p. 8 - 41

15 Hook block

▣▣▣▣ p. 8 - 109

11 Rope end fitting

▣▣▣▣ p. 8 - 90

5 Lowering limit switch

▣▣▣▣ p. 8 - 101

Slewing gear

9 Oil inspection glasses

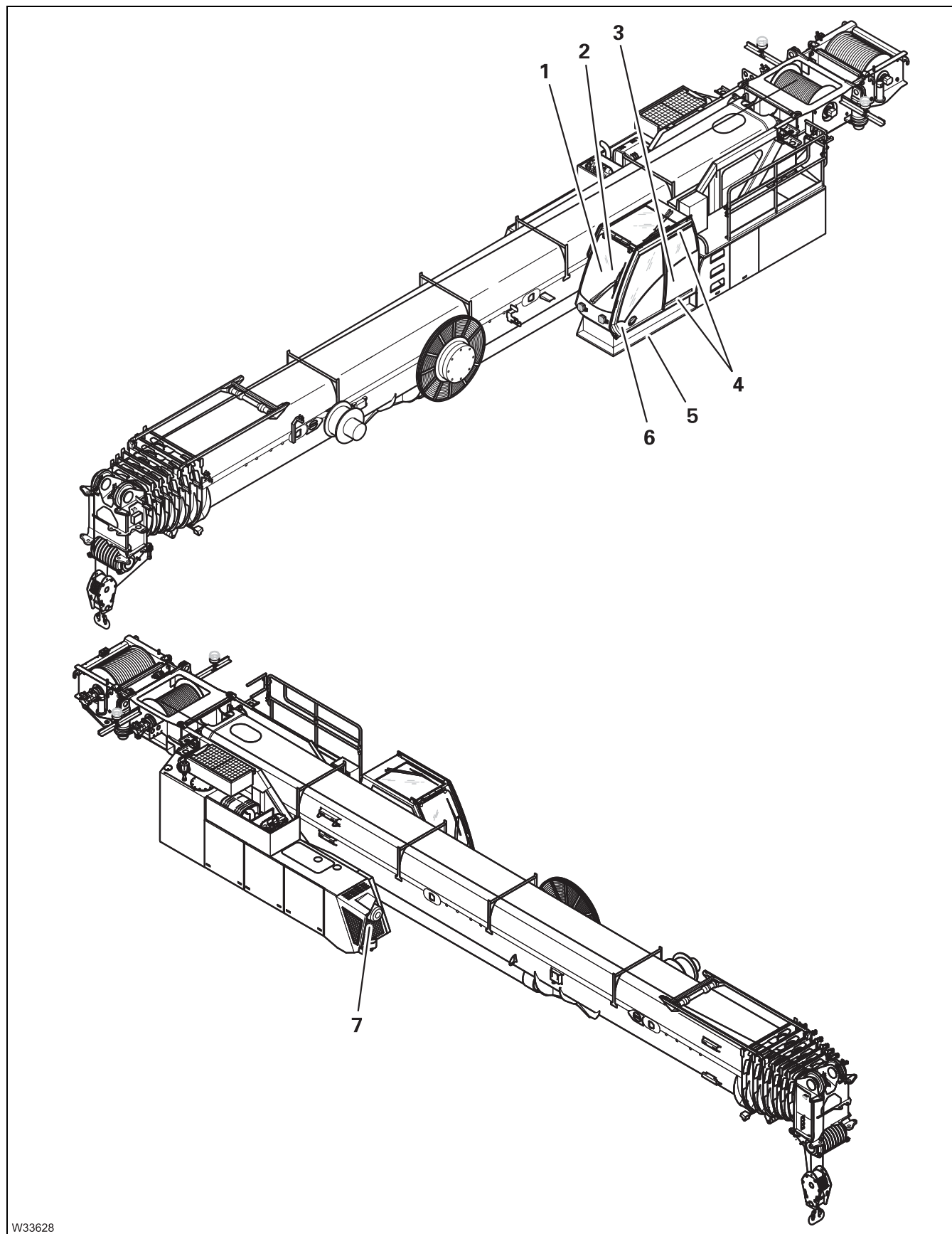
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▣▣▣▣ p. 8 - 47



Hydraulic system	▣▣▣▣▶ p. 8 - 65
19 Oil tank with sight glass	▣▣▣▣▶ p. 8 - 65
13 Oil cooler	▣▣▣▣▶ p. 8 - 17
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18 Pressure accumulator	▣▣▣▣▶ p. 8 - 71
20 Oil filter 1	▣▣▣▣▶ p. 8 - 74
16 Oil filter 2	▣▣▣▣▶ p. 8 - 75
17 Oil filter 3	▣▣▣▣▶ p. 8 - 75
Main boom	▣▣▣▣▶ p. 8 - 81
1 Telescopic sections 1 to 6 and basic section	▣▣▣▣▶ p. 8 - 82
9 Derricking cylinder	▣▣▣▣▶ p. 8 - 81
14 Sheaves	▣▣▣▣▶ p. 8 - 86
Cable drums and slewing angle sensor	▣▣▣▣▶ p. 8 - 103
10 Cable drum 1	▣▣▣▣▶ p. 8 - 103
3 Cable drum 2	▣▣▣▣▶ p. 8 - 103
7 Slewing angle sensor	▣▣▣▣▶ p. 8 - 105
Central lubrication system	▣▣▣▣▶ p. 8 - 107
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2 Spotlights on the crane cab	▣▣▣▣▶ p. 8 - 111
11 Spotlights on the telescopic boom	▣▣▣▣▶ p. 8 - 111
12 Anemometer, air traffic control light	▣▣▣▣▶ p. 8 - 111
5 Battery box	▣▣▣▣▶ p. 8 - 112
6 External starting socket ¹⁾	▣▣▣▣▶ p. 8 - 114





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Air conditioning system	▣▣▣▣▶ p. 8 - 115
1 Crane cab air conditioning system ¹⁾	▣▣▣▣▶ p. 8 - 115
7 Condenser fins ¹⁾	▣▣▣▣▶ p. 8 - 116
Other maintenance work	▣▣▣▣▶ p. 8 - 119
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2 Crane cab auxiliary heater ¹⁾	▣▣▣▣▶ p. 8 - 120
4 Cab door rails	▣▣▣▣▶ p. 8 - 121
5 pull-out step ¹⁾	▣▣▣▣▶ p. 8 - 122
– Various connecting pins and socket pins	▣▣▣▣▶ p. 8 - 123
– Corrosion protection	▣▣▣▣▶ p. 8 - 124
3 Fire extinguisher ¹⁾	▣▣▣▣▶ p. 8 - 126

¹⁾ Additional equipment

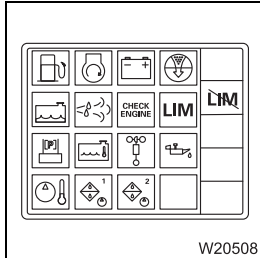
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
8.2

Symbols for maintenance work

Check the following symbols every day before starting work.


On the ECOS display

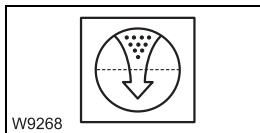


- Open the *Warning* submenu in the crane cab;  *Manual de instrucciones*.

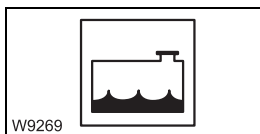
You must carry out the corresponding maintenance work if a symbol is **red**:



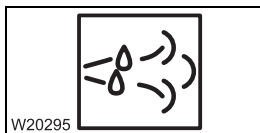
- Oil pressure;  p. 8 - 11




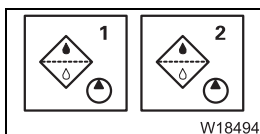
- Air filter;  p. 8 - 14



- Coolant level;  p. 8 - 15,



- AdBlue system;  p. 8 - 36,



- Hydraulic oil filter;  p. 8 - 73.

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8.3

Engine

- In addition, carry out further maintenance work specified in the *Engine manufacturer's documentation* supplied.

8.3.1

Checking the oil level

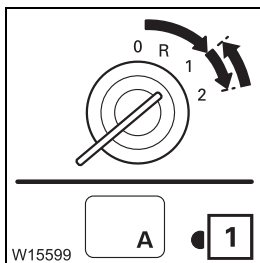
D

Prerequisites

- The truck crane must be level.

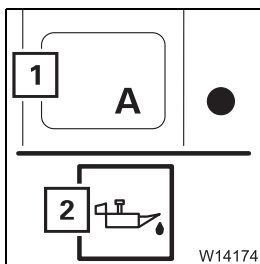
Checking the oil level

- Start the engine.
- Check the lamp (1) on the *ECOS* control unit immediately after starting the engine.
The lamp (1) must go out approx. 10 seconds after starting the engine.

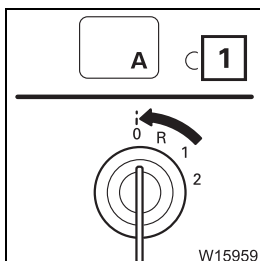


Risk of damage to the engine if the oil pressure is too low.

If the lamp (1) does not go out after about 10 seconds, perform the following check and switch off the engine immediately.
Running the engine when the oil pressure is too low can damage it.

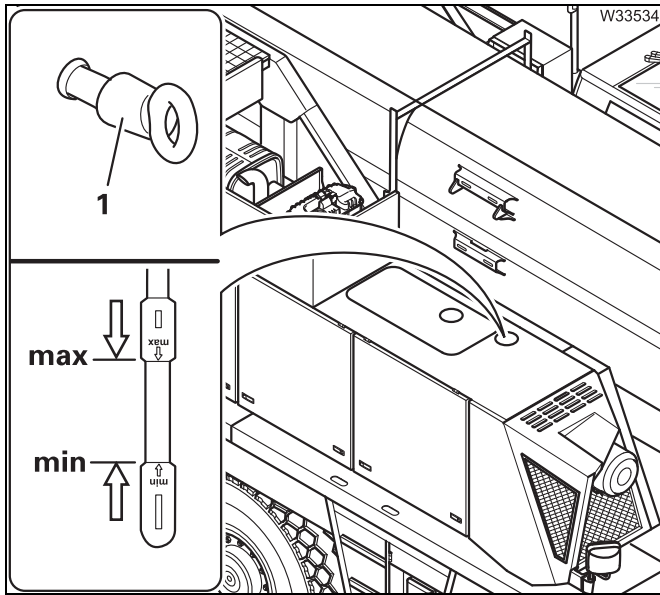


- Press the button (1) once. This opens the *Warning* submenu.
- If the symbol (2) is **red**, switch off the engine immediately.




- After the lamp (1) has gone out following the engine start, allow the engine to idle for 2 - 3 minutes.
- Switch off the engine.
- Check the oil level after about 2 minutes.






- On the dipstick (1), check that the oil level is between the **min.** and the **max.** marks (arrow markings).
- After checking the oil level, put the dipstick back in the dipstick tube.

If the oil level is too low

- Top up the oil;  p. 8 - 13.

8.3.2


Topping up the oil

Data on the prescribed oil specification;  *Engine manufacturer's documentation.*

Oil

Engine oil in litres (gal)	Designation according to DIN 51502	Specification Classification	GROVE part no.
29 (7.6)	HD - CD	MIL-L 2104 C DB 228.31/51	SAE 5 W-30 03329588


Prerequisites

- The truck crane must be level.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Topping up the oil



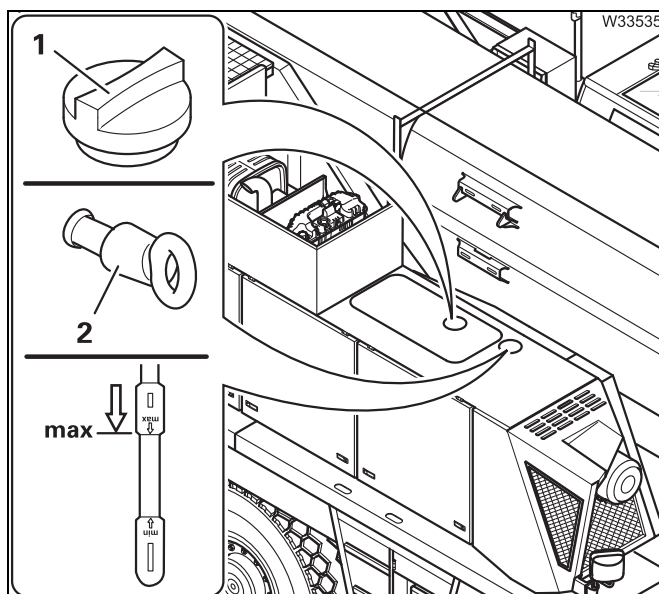
Risk of damage to the engine if the oil level is too high.

Do not overfill with oil; the oil level must not be higher than the **max.** mark (arrow marking). Drain off oil if necessary;  *Engine manufacturer's documentation.*



Risk of burns when the engine is hot.

During operation, the engine and add-on parts reach temperatures up to 400 °C (750 °F). Wear appropriate protective gloves and be careful not to touch hot parts.

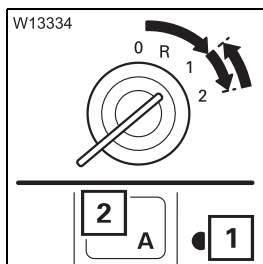


- Add oil through the filler neck (1) up to the **max.** mark.
- Close the filler neck with the cap.
- Put the dipstick (2) into the dipstick tube after checking the oil level.

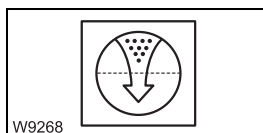
8.3.3

Checking the air filter

D



- Start the engine. On the *ECOS* display, check whether the lamp (1) next to the button (2) lights up.
- Press the button (2) once. This opens the *Warning* submenu.




You must change the air filter if the symbol is red.

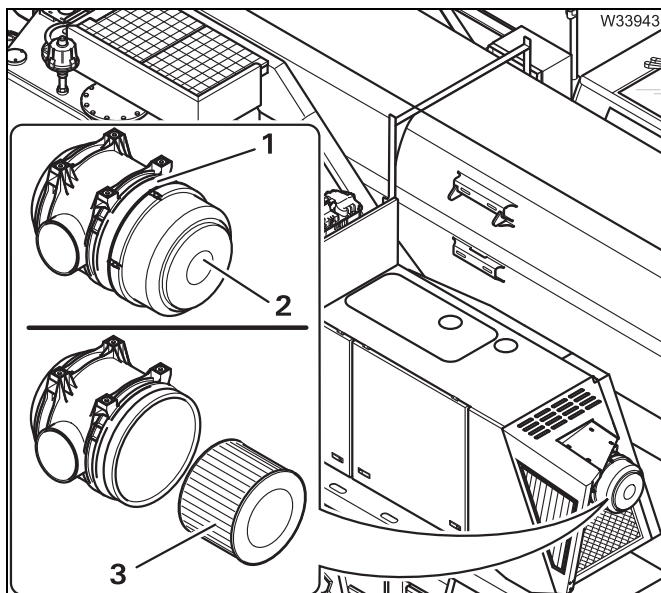
Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	04183736

Prerequisites

- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Replacing the air filter

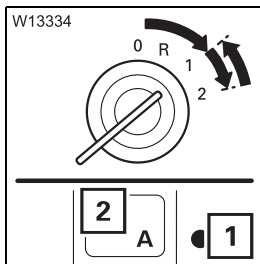


- Undo all the clamps (1) and remove the cover (2).
- Change the filter (3).
- Replace the cover and secure it with all the clamps.

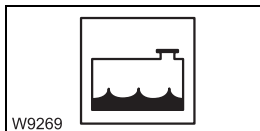
8.3.4

Checking the coolant level

D



- Start the engine. On the *ECOS* display, check whether the lamp (1) next to the button (2) lights up.
- Press the button (2) once. This opens the *Warning* submenu.



You must top up the coolant if the symbol is **red**.

Topping up coolant

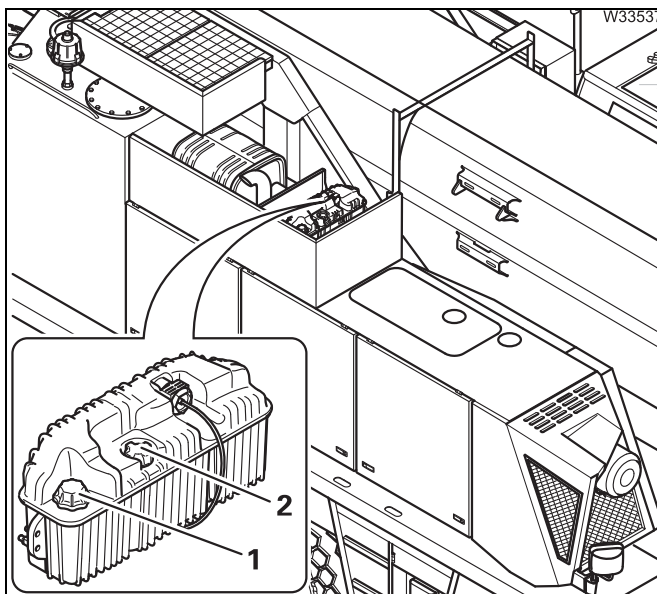


There is a risk of scalding when the cooling circuit is hot.

The hot cooling circuit is under pressure. When you open the expansion tank, you could be scalded by escaping steam/coolant.

Wear suitable protective gloves and cover the cap on the expansion tank with a rag before opening it.

Turn the cap slowly to the first detent in order to allow the pressure to be released.



- Do **not** open the pressure relief valve (2).
- Loosen (do not open) the cap (1) to reduce the pressure if the coolant is at operating temperature.
- Open the cover (1).
The coolant level must be at the lower marking in the filler neck.

If the coolant level is too low

- Top up the coolant.
Composition of the coolant; Engine manufacturer's documentation.
- Close the cap (1).



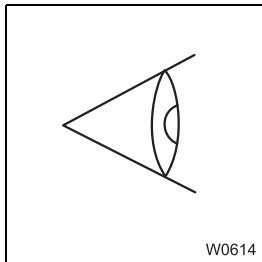
Risk of damage to engine due to lack of coolant.

If the coolant has to be topped up frequently, the cooling system may be leaking. Have the cooling system checked by **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

8.3.5

General inspection

W



- Investigate any unusual running noises from the engine.
- Check the engine and the connections for leaks. If consumables are leaking;
 - ▣▣▣▣▶ *Checking the oil level*, p. 8 - 11,
 - ▣▣▣▣▶ *Checking the coolant level*, p. 8 - 15.
- Check that pipes and hoses are tightly connected and undamaged.

If any damage is found, report it to **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

8.3.6




Have the radiator checked/cleaned

M 12

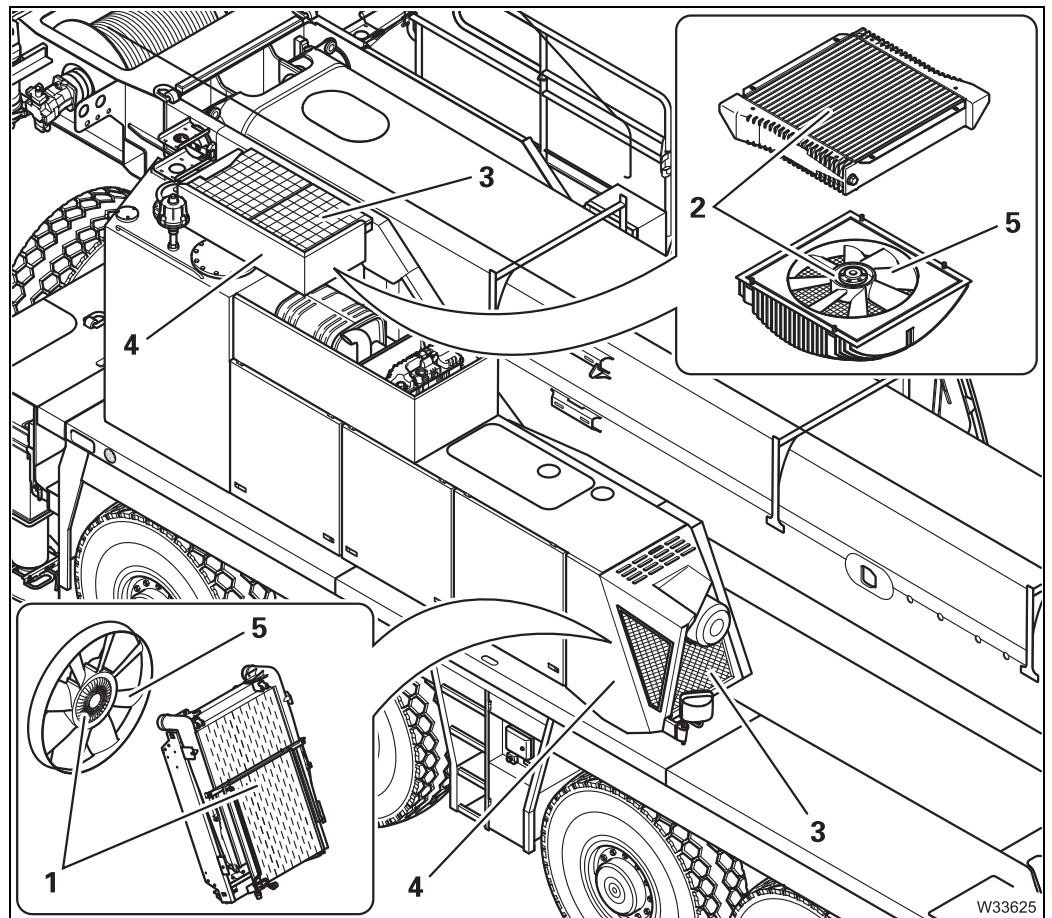
Reducing the interval

- Under difficult operating conditions – at extremely sandy or dusty locations or if there is a heavy density of fallen leaves – you must have the radiator fins cleaned earlier than this.

Prerequisites

- The truck crane must be supported on outriggers and must be level;  *Manual de instrucciones.*
- The main boom must be fully retracted and raised to 75°;  *Manual de instrucciones.*
- The superstructure must be turned so that it is at right angles to the carrier – the working area around the radiator is then accessible from all sides.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- Trained repair crew and repair tools must be available.

Check the level of dirt



The two radiator units (1) and (2) are protected by grilles (3) and plates (4).
When the engine is running, the fan impellers rotate (5).



Risk of injury at the fan impeller!

When the fan impellers are rotating they can trap the fingers of your hand and amputate them. Never reach into the fan impellers when they are rotating. Do not push any tools through the grilles to clean them. Always stop the engine before attempting to clean the fan impellers and radiator fins.

Radiator unit (1)

Radiator for the engine cooling water, radiator for the engine charge air, condenser for refrigerant for the crane cab air-conditioning system.


Radiator unit (2)

Radiator for the hydraulic oil (mounted above the oil tank).
Standard equipment: 1 radiator; Additional equipment: 2 radiators.

Checking

- If necessary remove leaves, twigs and other debris from the grilles (3).
- Check the condition of the fan impellers (5). The impeller blades must be clean and undamaged.



If the radiator fins are heavily soiled have them cleaned, since further soiling can lead to overheating;  *Have them cleaned*, p. 8 - 19.

**Have them
cleaned**



Risk of injury at the fan impeller!

When the fan impeller is rotating it can trap the fingers of your hand and amputate them. Never reach into the fan impeller when it is rotating. Do not push any tools through the impeller to clean it.

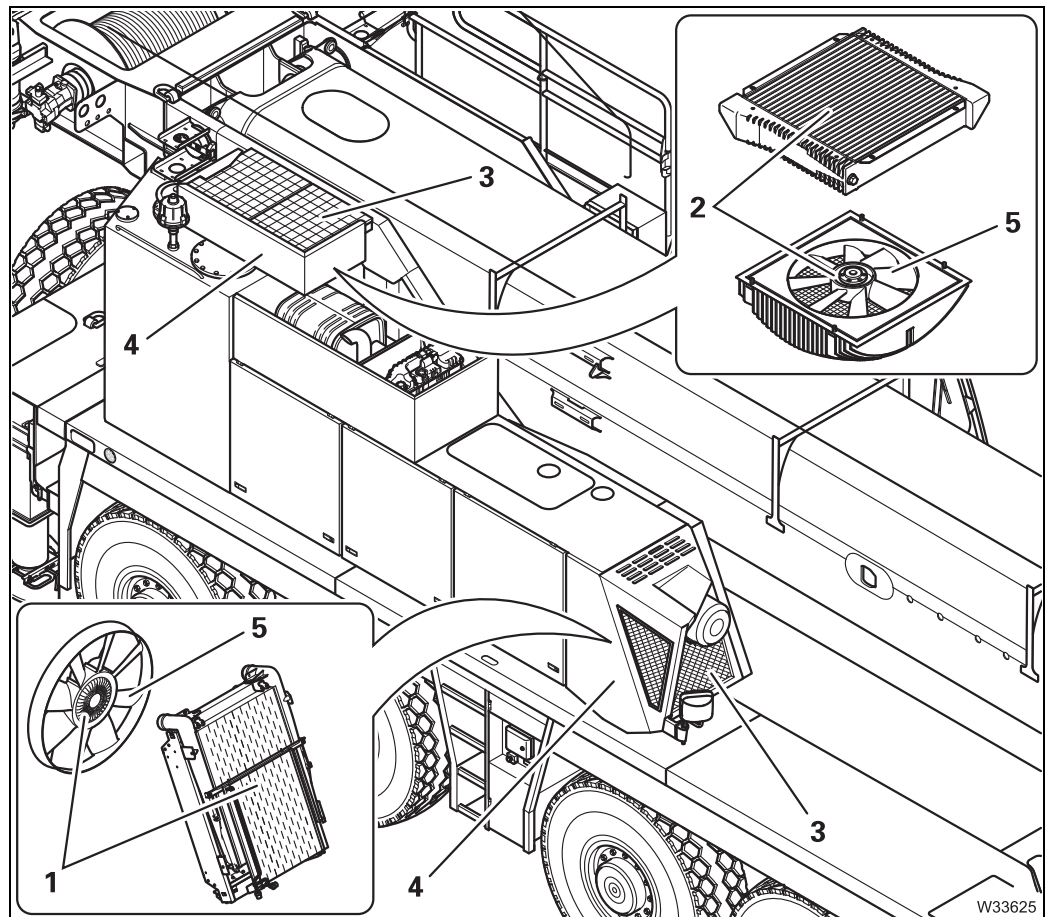
Always stop the engine before attempting to clean the fan impeller and radiator fins.



Risk of damaging the radiator fins


Do not use a high pressure cleaner or steam jet cleaner. The powerful jet may damage the fins.

Use only suitable cleaning agents air for cleaning.



- Have the radiator units (1) and (2) opened up by the repair specialists, so that the radiator fins are accessible.
- Have the radiator fins cleaned on both sides, using suitable cleaning agents.
- Have the fan impellers (5) and the fan hood (6) cleaned.
- Have the grille (3) and the plates (4) cleaned.
- Have the hoses and connections checked for damage and leaks.
- Have any damaged parts replaced.

**After checking/
cleaning**

- Remove all tools and cleaning equipment.
- Check that all the grilles (3) and plates (4) are secure.
- Start the engine and from a safe distance monitor the free running of the fan impellers (5).
- Check the respective temperature displays in the driver's cab;  *Manual de instrucciones*.
- Switch off the engine.
- Check the radiator and connections for leaks.

8.3.7

Changing the oil and the oil filter

Y 2

Oil, spare parts, tools

Engine oil in litres (gal)	Designation according to DIN 51502	Specification Classification	GROVE part no.
29 (7.6)	HD - CD	MIL-L 2104 C DB 228.31/51	SAE 5 W-30 03329588

Designation	Quantity	GROVE part no.
Oil filter with gasket	1	04165291

- Receptacle, approx. 30 ltr (8 gal); ■■■► p. 2 - 4.
- Torque wrench for a torque of 50 Nm (36 lbf ft).
- Connecting piece and hose (tool box); ■■■► p. 7 - 92.

Prerequisites

- Find out the prescribed oil specification and about the need to shorten the maintenance interval under special operating conditions; ■■■► *Engine manufacturer's documentation*.
- Find out about the safety instructions and the sequence of steps to change the oil and the oil filter; ■■■► *Engine manufacturer's documentation*.
- The truck crane must be level.
- The main boom must be raised; ■■■► *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use; ■■■► p. 2 - 3.

Changing



Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

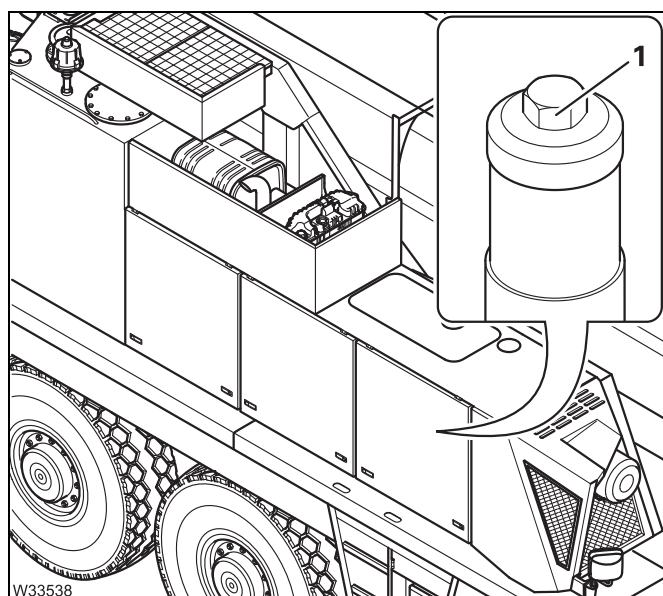
Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.



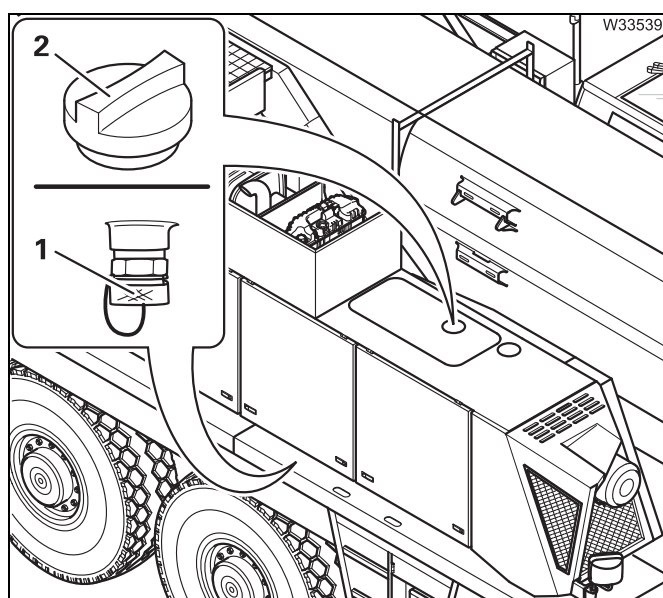
Risk of environmental damage due to leaking consumables.

Use the supplied connecting piece and hose and a receptacle with sufficient capacity to drain the oil.



Oil filter

- Place a receptacle underneath the engine.
- Change the oil filter (1) with the socket wrench – torque 50 Nm (36 lbf ft); *Engine manufacturer's documentation.*
- Leave the receptacle in place for the oil change.



Draining oil

- Screw the connecting piece and hose onto the valve (1) and drain the oil into the receptacle; *Handling the valves, p. 7 - 92.*
- Remove the connecting piece and hose from the valve and remove the receptacle.

Topping up oil



- Top up with fresh oil through the filler neck (2); p. 8 - 13.

8.3.8





Changing the coolant

Y 3

Tools

- Connecting piece and hose (toolbox).
- Receptacle, approx. 45 ltr (12 gal);  p. 2 - 4.
- Antifreeze;  *Engine manufacturer's documentation*.

Prerequisites

- Information on the coolant and admixture ratio has been obtained;  *Engine manufacturer's documentation*.
- The truck crane must be adequately supported on outriggers and must be level;  *Manual de instrucciones*.
- The main boom must be fully retracted and raised to 75°;  *Manual de instrucciones*.
- The superstructure must be turned so that it is at right angles to the carrier
 - the working area around the radiator is then accessible from all sides.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The engine has cooled down.
- Trained repair crew and repair tools must be available.



Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.



There is a risk of scalding when the cooling circuit is hot.

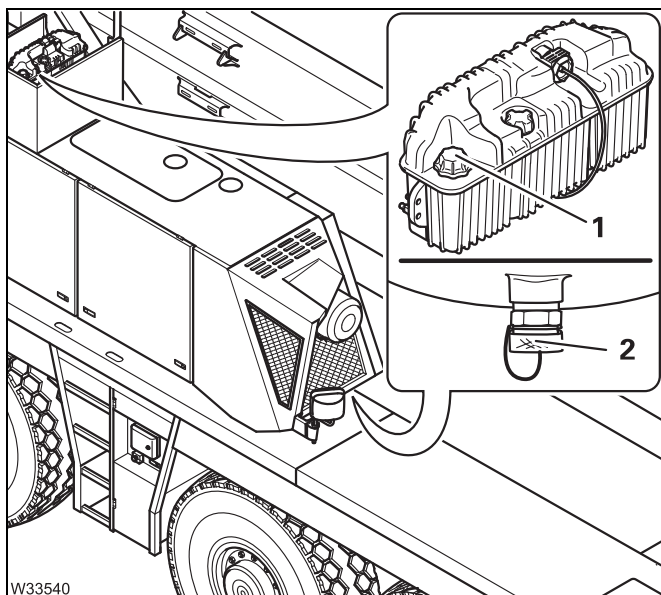
The hot cooling circuit is under pressure. When you open the expansion tank, you could be scalded by escaping steam/coolant.

Wear suitable protective gloves and cover the cap on the expansion tank with a rag before opening it.



Turn the cap slowly to the first detent in order to allow the pressure to be released.

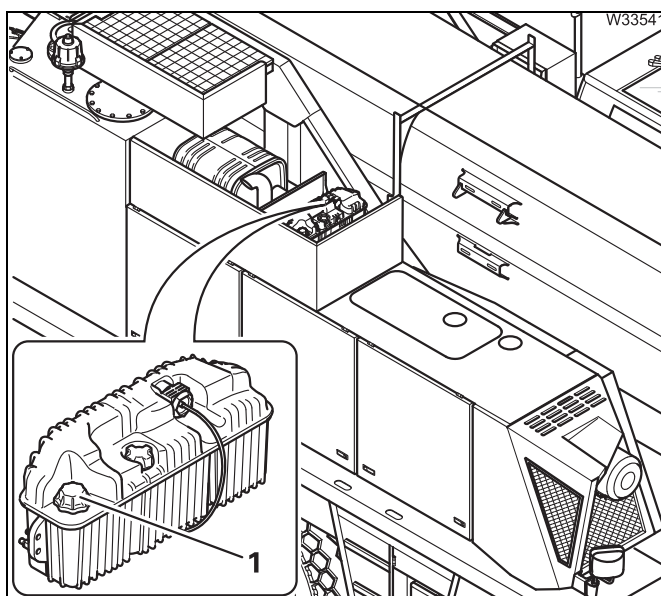


Changing



Draining when the engine is cold


- Open the cap (1) on the expansion tank.
- Place a receptacle under the valve (2) in the cooling circuit.
- Screw the connecting piece and hose on to the valve (2) and drain the coolant;  *Handling the valves*, p. 7 - 92.
- Remove the receptacle.
- Change the silicate cartridge;  p. 8 - 25.



Topping up when the engine is cold

- Slowly top up the expansion tank (1) with coolant until it is filled up to the lower edge in the filler neck.
- Wait about 1 minute. Add more coolant if necessary.
- Close the cover (1).

Check it when the engine is warm

- Start the engine.
- Let the engine run at idling speed for approx. 5 minutes.
- Switch off the engine.
- Check the coolant level when the engine is warm;  *Checking the coolant level*, p. 8 - 15.

8.3.9

Change the silicate cartridge


Y 3

Spare parts and tools

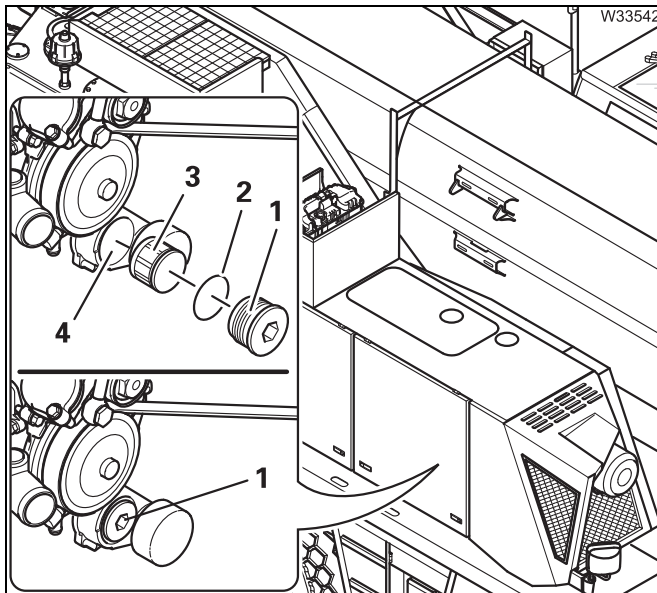
Designation	Quantity	GROVE part no.
Silicate cartridge with O-ring	1	04165276

- Torque wrench for a torque of 50 Nm (36 lbf ft).



Prerequisites

- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The coolant must be drained;  *Changing the coolant*, p. 8 - 23.

Changing



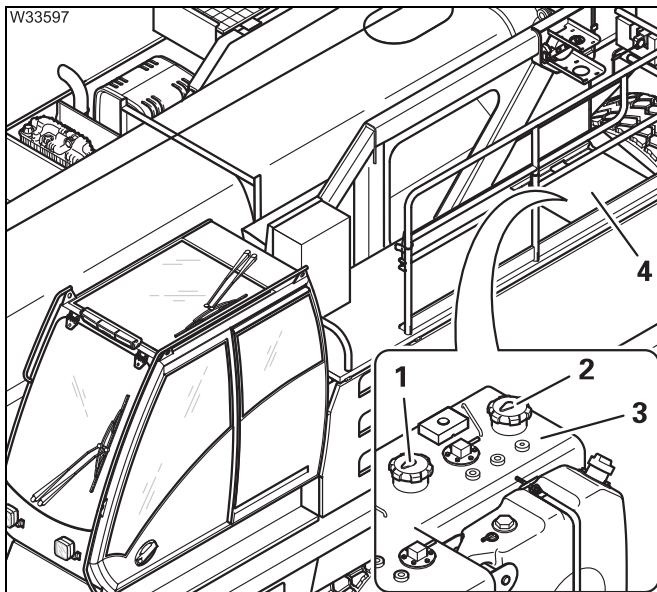
At the coolant pump

- Remove the cover (1).
- Remove the used silicate cartridge (3) from the housing (4).
- Clean the housing, if necessary (3).
- Insert the new silicate cartridge (3) with the new O-ring (2).
- Tighten the cover (1) – torque 50 Nm (36 lbf ft);  *Engine manufacturer's documentation*.
- Top up the coolant;  *Changing the coolant*, p. 8 - 23.
- Check that the cover on the housing is leak-tight.

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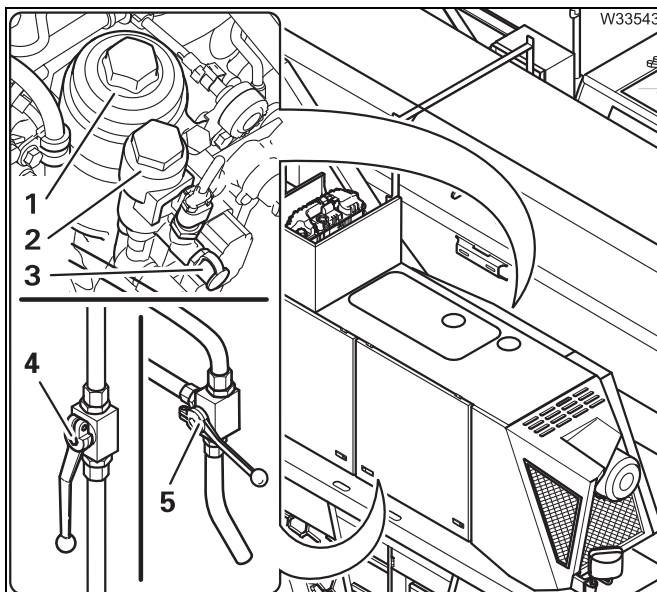
8.4

Fuel system



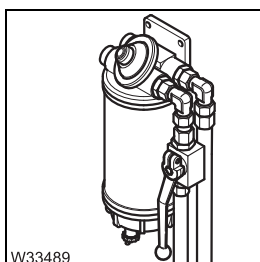
To fill up with fuel you must open the cover (4) over the 2-chamber fuel tank (3); *Manual de instrucciones.*

- 1 Fuel tank for the carrier engine
480 litres (126 gal)
- 2 Fuel tank for the superstructure engine
200 litres (52 gal)



The following elements are installed in the **superstructure** fuel line:

- 1 Fuel filter 3 (large)
- 2 Fuel filter 2 (small)
- 3 Spigot for connecting the fuel hand pump; supplied separately; Grove part no. 04162464; for venting the fuel line.
- 4 Valve in the supply line; for shutting off the supply.
- 5 3-way valve in the return line, for draining the fuel



Option

As an option, the truck crane GMK6300L can be fitted with the fuel filter 1 (GROVE part number 04170515). This allows water to be removed from the fuel more easily.

8.4.1


Draining off water from fuel filter 1

D


Optional

As an option, the truck crane GMK6300L can be fitted with the fuel filter 1. This allows water to be removed from the fuel more easily.

Spare parts and tools

– Receptacle, approx. 5 ltr (1.5 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be level.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Draining off water

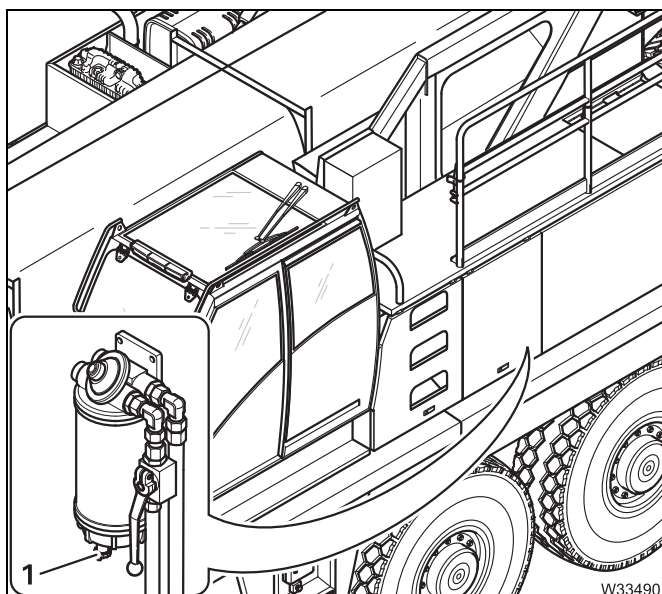


Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.



- Place a receptacle underneath the filter.
- Open the valve (1).
- If the consumable that emerges is clean, close the valve by hand.
- Remove the receptacle and properly dispose of the drained consumable.

8.4.2

Replacing fuel filter 1


M 3

Optional


Note the option;  p. 8 - 28.

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter cartridge	1	04181165
Filter element	1	04181166

– Receptacle, approx. 5 ltr (1.5 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be level.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- If the fuel is dirty: Reduce the maintenance interval.

Changing

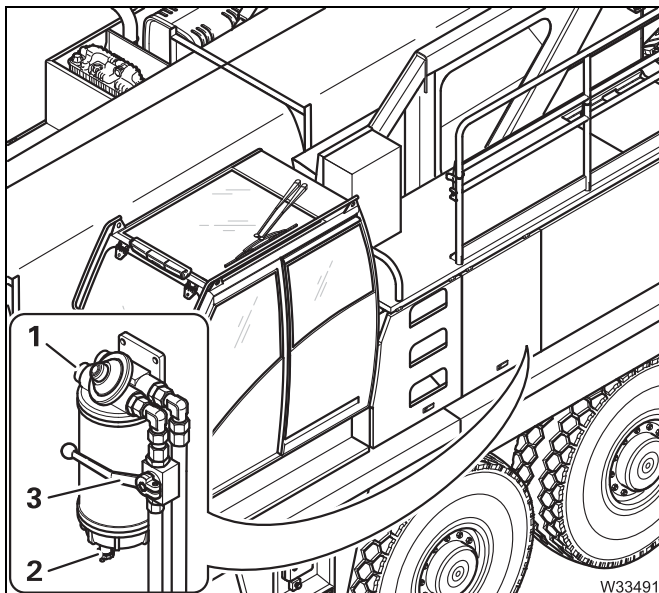


Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

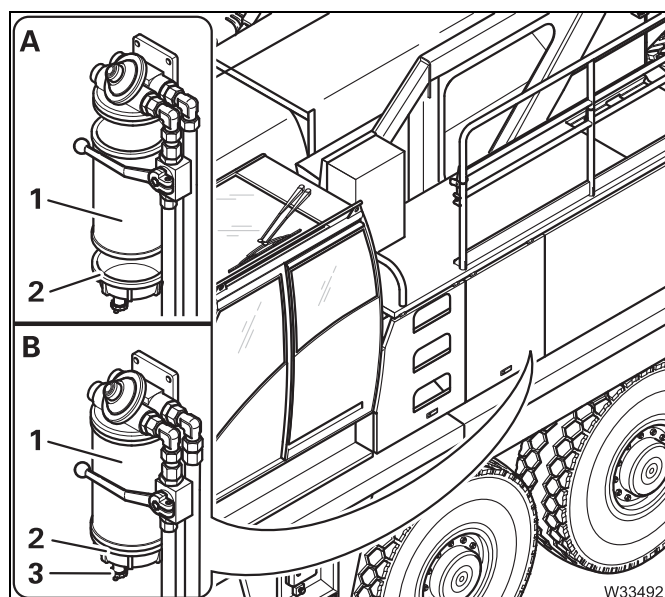
Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.

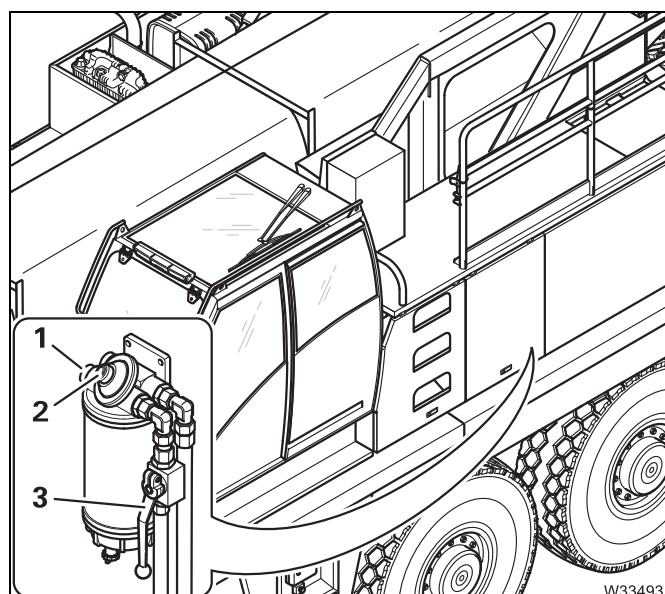


- Place a receptacle underneath the filter.
- Close the valve – lever (3) at right angles to the line.
- Open the screw (1) and the valve (2) and drain the consumable.





- **(A)** – Remove the filter element **(2)** and the filter **(1)**.
If necessary, replace any damaged parts.
- **(B)** – Screw on a new filter **(1)** and the filter element **(2)**.
- Close the valve **(3)** manually.



- Open the valve – lever **(3)** parallel to the line.
- Actuate the pump **(2)** until the fluid flowing out of the screw plug **(1)** no longer contains any bubbles.
- Tighten the screw.
- Start the engine and check for leaks.
- Remove the receptacle.



If you have used a clean receptacle, you can refill the fuel tank with the consumable using a filter.
Otherwise dispose of the consumable properly.

8.4.3

Changing fuel filters 2 and 3

M 12

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter (small)	1	04165265
Filter (large)	1	04165266

- Receptacle, approx. 5 ltr (1.5 gal); p. 2 - 4.
- Torque wrenches for torques of 15 Nm (11 ft lbf) and 55 Nm (40.5 ft lbf).

Prerequisites

- The truck crane must be level and on outriggers; *Manual de instrucciones*.
- The main boom must be fully raised; *Manual de instrucciones*. This enables access to the engine, is also possible from the inner side.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.



Risk of environmental damage due to leaking consumables.

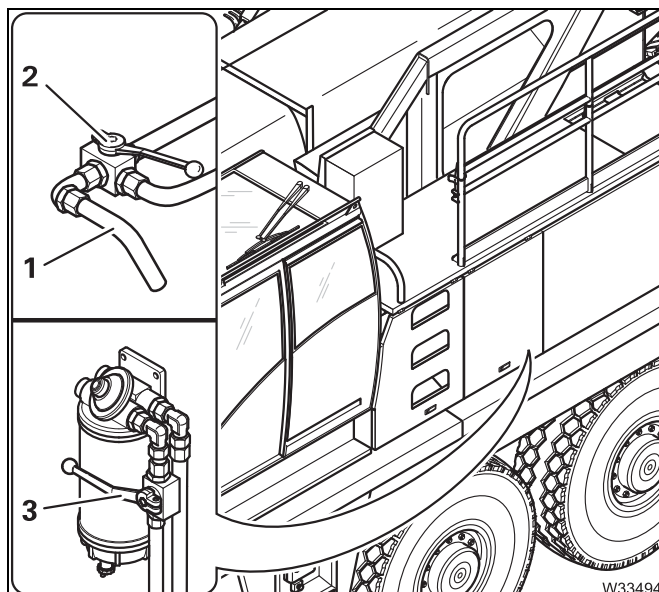
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.

Emptying the fuel line

Note the option; p. 8 - 28.



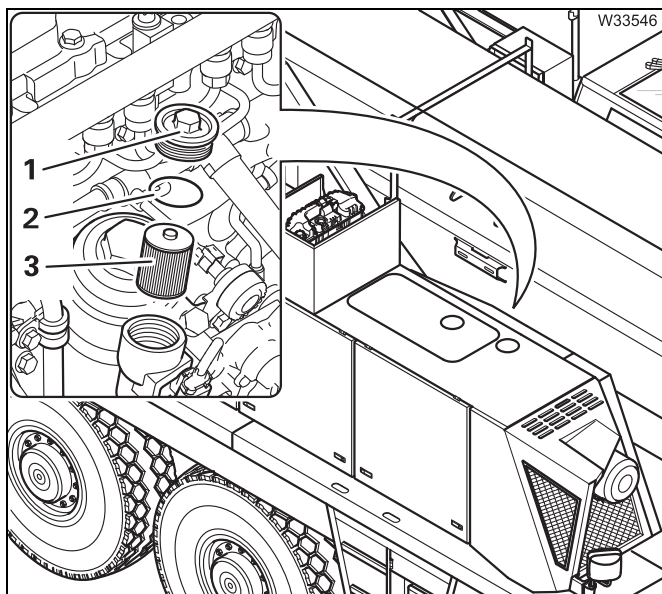
- Close the valve – lever (3) at right angles to the line.
- Place a receptacle under the end of the hose (1).
- Turn the valve – lever (2) parallel with the end of the hose (1).
- Let the consumable drain into the receptacle.

Leave the receptacle under the end of the hose. More consumable will run out when you bleed the fuel line.



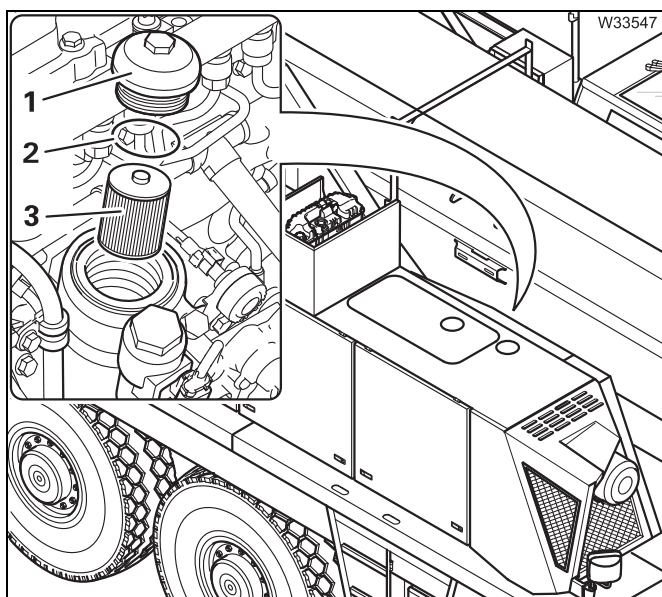
Changing filters 2 and 3

The filters 2 and 3 are on the inner side of the engine behind the rectangular opening.



Changing filter 2


- Unscrew the cap (1) and remove the filter (3) so that the consumable can drain.
- Clean the cover (1) and insert a new filter (3).
- Replace the gasket (2) (grease slightly).
- Screw the cap on and tighten it – torque 15 Nm (11 lbf ft).

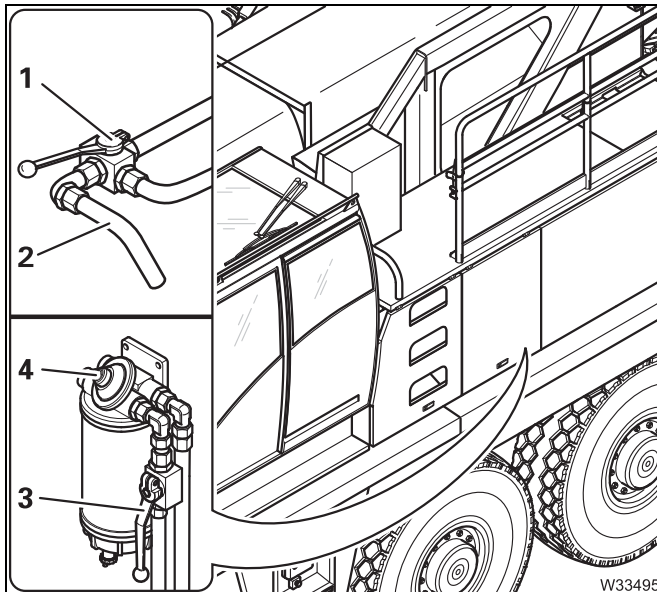


Changing filter 3

- Unscrew the cap (1) and remove the filter (3) so that the consumable can drain.
- Clean the cover (1) and insert a new filter (3).
- Replace the gasket (2) (grease slightly).
- Screw the cap on and tighten it – torque 55 Nm (40.5 lbf ft).

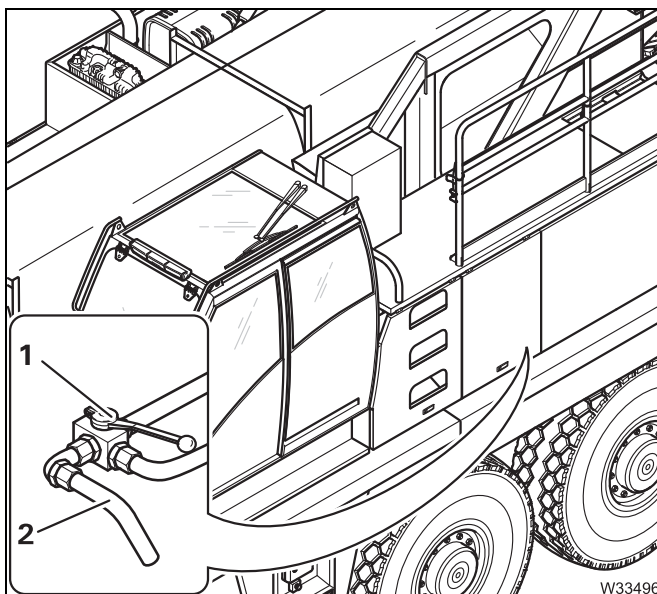
Bleeding the fuel line

Note the option;  p. 8 - 28.



A receptacle is under the end of the hose (2). The lever (1) is parallel with the end of the hose.

- Open the valve – lever (3) parallel to the line.
- Actuate the pump (4) until the consumable flowing through the end of the hose (2) no longer contains any bubbles.



- Turn the valve – lever (1) at right angles to the end of the hose (2).
- Start the engine and check that the fuel filters are not leaking.
- Remove the receptacle under the end of the hose.



If you have used a clean receptacle, you can refill the fuel tank with the consumable using a filter. Otherwise dispose of the consumable properly.

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8.5

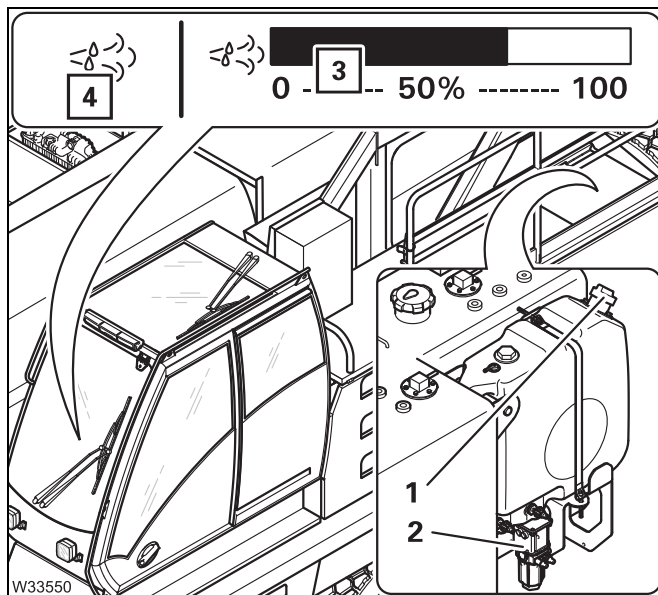
Exhaust system with exhaust emission control

Overview

To comply with the exhaust emission regulations, the truck crane may only be run with the **exhaust system with SCR catalytic converter (SCR = Selective Catalytic Reduction)**.

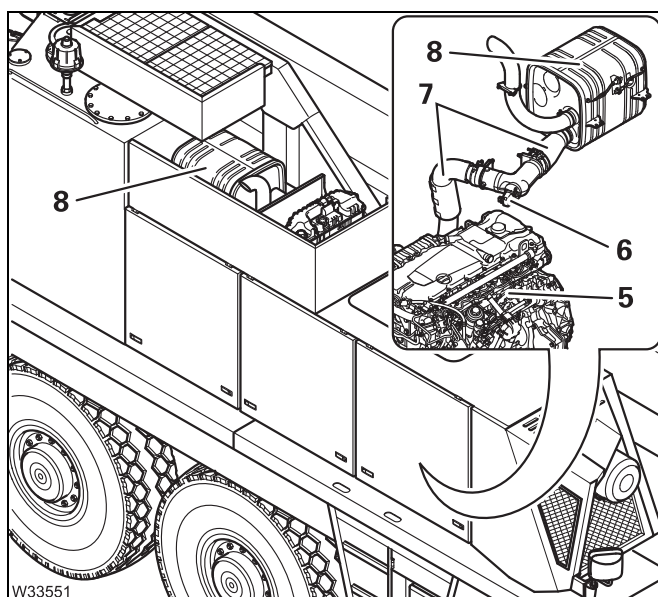
The exhaust gas is treated using an **AdBlue system**. **AdBlue** For this, **(DEF) (Diesel Exhaust Fluid)** from the AdBlue tank is injected into the exhaust system.

The engine output is automatically sharply reduced when there is not enough AdBlue solution available. Driving with an empty AdBlue tank will cause the engine to malfunction;  *Manual de instrucciones*,  *Engine manufacturer's documentation*.



AdBlue system

- 1 AdBlue tank
- 2 Pump unit for pumping AdBlue to the dosing unit on the diesel engine and for pumping engine coolant for preheating the AdBlue tank.
- 3 Tank gauge, AdBlue tank
- 4 Warning lamp: AdBlue system fault.
- 5 Diesel engine with dosing unit for AdBlue (compressed air supply) and a solenoid valve for preheating the AdBlue tank using engine coolant.
- 6 Injection nozzle for injecting AdBlue.
- 7 Exhaust pipes
- 8 Exhaust silencer with SCR catalytic converter



8.5.1

Checking the AdBlue tank level

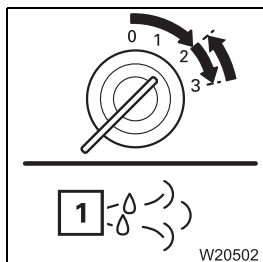
D

Checking

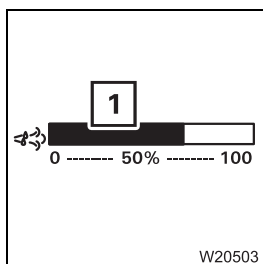
The warning lamp for checking the AdBlue system and a display for the AdBlue level in the tank is on the ECOS display in the crane cab.



The tank has a maximum filling volume of about 40 ltr (10.5 gal). Depending on where the truck crane is used, it may be sensible to carry additional canisters of AdBlue.



- Start the engine and check the lamp (1) after the engine starts:
 - If the lamp goes out, the AdBlue level in the tank is sufficient.
 - If the lamp lights up, the level in the AdBlue tank is on reserve.
 - If the lamp flashes, the AdBlue tank is empty.



- Check the AdBlue level in the tank via the display.
- Refill the tank when the AdBlue level falls below approx. 10 ltr (2.6 gal) at the latest – and/or if the lamp lights up.

8.5.2

Filling up with AdBlue

Consumable and tools

AdBlue in litres (gal)	Specification Classification	GROVE part no.
40 (10.5)	DEF (Diesel Exhaust Fluid) e.g. <i>AdBlue</i> .	03140555

- As required: 2 canisters of about 20 ltr each (5 gal); p. 2 - 4.

Prerequisites

- A service station with a filling pump for AdBlue can be used, or AdBlue can be filled manually from canisters.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.

Filling up

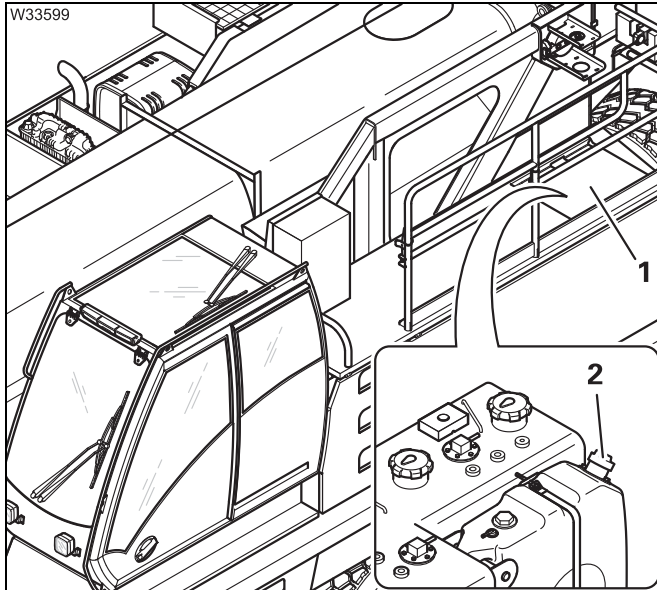
- Find out about filling up in the operating manual and note the warnings;
 ■■■► *Manual de instrucciones.*



Danger of scalding due to ammonia vapours.

Ammonia vapour can escape if the AdBlue tank is opened when the outside temperature is high. Ammonia vapours can irritate mucous membranes, skin and eyes.

Ensure that there is adequate fresh air supply and do not breathe in the escaping ammonia vapours.



- Open the cover (1).
- Fill the AdBlue tank via the filler neck (2) and close it using the cap.
- Close the cover (1).
- Check the filling level on the display in the crane cab; ■■■► p. 8 - 36.

8.5.3

Check the exhaust system for external damage

M 1

Spare parts and tools

Designation	Quantity	GROVE part no.
Exhaust silencer with SCR catalytic converter (SCR = S elective C atalytic R eduction)	1	03293335

Prerequisites

- The engine must be switched off and secured against unauthorised use;
 ■■■► p. 2 - 3.
- The engine and the exhaust system must be cool.

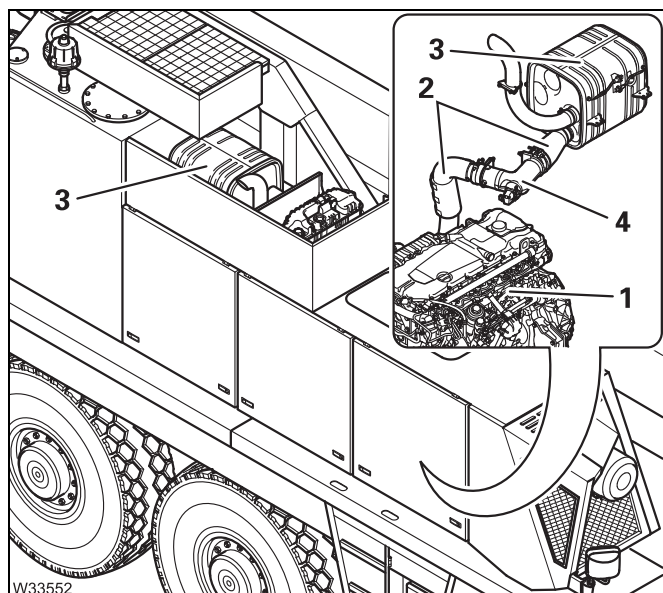


Checking



Risk of burns if the exhaust system is hot

During operation, the exhaust system heats up to 400 °C (750 °F).
Wear suitable gloves and wait until the exhaust system has cooled down.
Make sure not to touch any hot parts.



- Check the exhaust pipes (2) from the engine (1) to the silencer (3) for damage. The exhaust pipes (2) may not have any holes or cracks.
- Check that the area around the exhaust pipes is free of loose components which could burn by coming into contact with the hot exhaust system.
- Check the AdBlue injection nozzle (4) for outer damage.

After checking

- Start the engine.
- Check the AdBlue system display on the ECOS display in the crane cab;
 ▶ p. 8 - 36.
- Check whether exhaust gases are leaking from any damaged places in the exhaust system.
- Switch off the engine.

If you discover any damage


Have any damaged parts of the exhaust system replaced immediately by **Manitowoc Crane Care** or an authorised GROVE dealer.

8.5.4


Having the AdBlue system checked

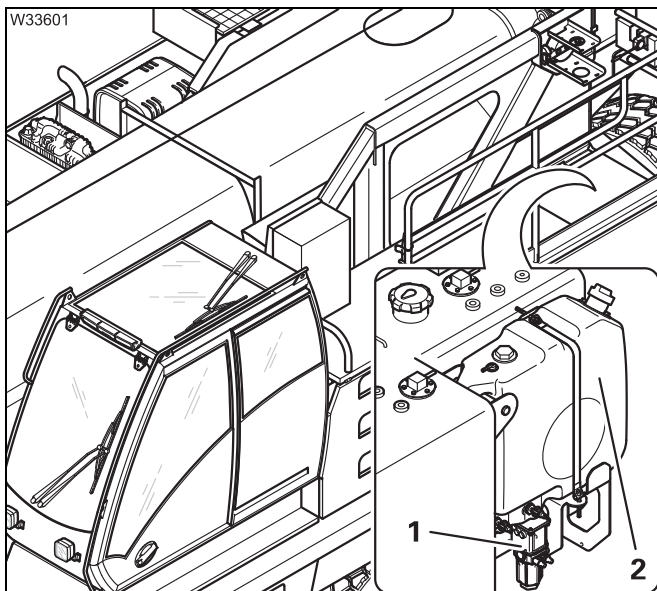
M 12

This inspection may only be performed by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

- Have the entire AdBlue system checked for leaks and correct operation; *Overview*, p. 8 - 35.
- Also observe the information on the components mounted on the engine;  *Engine manufacturer's documentation*:
 - AdBlue dosing unit,
 - Solenoid valve for engine coolant for preheating the AdBlue tank.

Maintenance interval for the pump unit

The engine manufacturer specifies additional maintenance intervals for the pump unit (1);  *Engine manufacturer's documentation*.



AdBlue filter

- Have the AdBlue filter in the pump unit (1) changed:
 - for the first time after one year (M 12),
 - after that, every two years (Y 2).

Pressure accumulator

- Have the pressure accumulator in the pump unit (1) filled:
 - for the first time after one year (M 12),
 - after that, every two years (Y 2).

- Have the insulation hood (2) checked for damage and for tight fitting on the AdBlue tank. The insulation hood prevents the AdBlue tank freezing up.
- Have the electrically heated AdBlue cables at the pump unit (1) checked for correct operation.

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8.6

Hoists

8.6.1

Checking the oil level

W

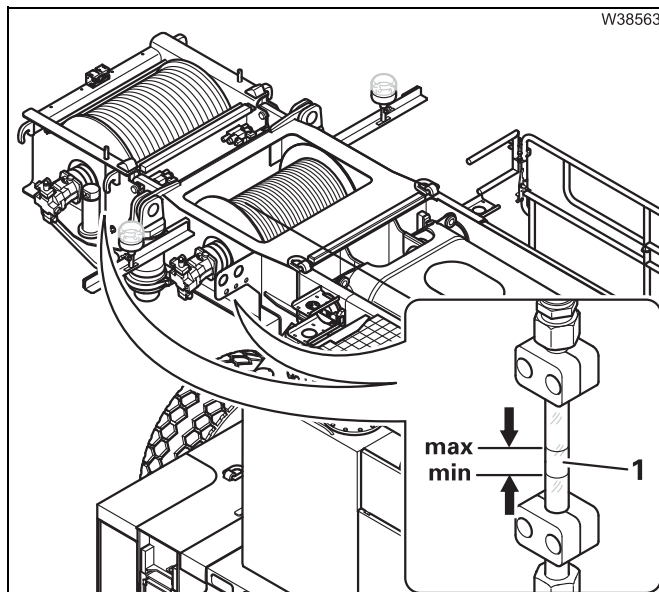
Spare parts and tools

Designation	Quantity	GROVE part no.
Oil inspection glass; complete	2	04161717

Prerequisites

- The truck crane must be level and in on-road mode; *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.

Checking the oil level



- Check that the oil level is visible between the **min.** and the **max.** marks (1).

If the oil level is too low

- Top up the oil; p. 8 - 44.

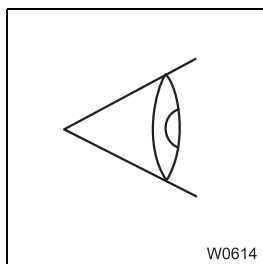



The oil level in the hoist gear must be 16 mm below the centre of rotation of the hoist. If the sight glass is loose in the clamps, or a new sight glass has been fitted, you must adjust this difference in height before you adjust the clamps.

8.6.2

General inspection

W



- Pay attention to any unusual running noises from the hoists.
- Check the hoists and the connections for leaks. If consumables are leaking;  *Checking the oil level*, p. 8 - 41.
- Check that pipes and hoses are tightly connected and undamaged.

If any damage is found, report it to **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

8.6.3

Checking the hoist brake

W

Check that the hoist brake is working correctly on the main hoist and the auxiliary hoist.

- Attach the hook block to the hoist rope, reeved once.
- Lift a load of approx. 10.5 t (23148 lbs) to approx. 30 cm (1.0 ft) above the ground.
- Measure the distance to the ground when the load is hanging completely still.
- Switch the engine off.

If the load has not lowered after approx. 2 minutes, the brake is currently in working order.

If the load lowers, notify **Manitowoc Crane Care** or an authorised GROVE dealer.

8.6.4

Lubricating the auxiliary hoist


M 6

Grease, spare parts, tools

Lubricating grease	Designation according to DIN 51502	Specification Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set.

Prerequisites

- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

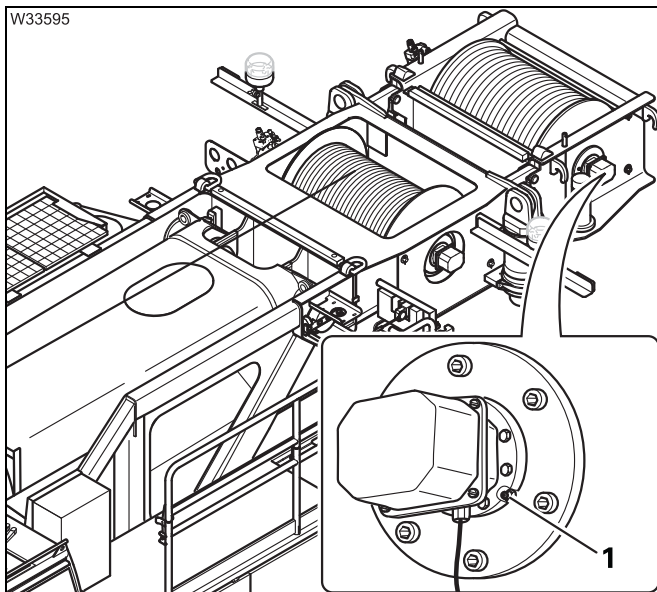
Lubricating



Risk of damage to the auxiliary hoist.

The auxiliary hoist drum bearing is **not** automatically lubricated by the centralised lubrication pump on the turntable.

Lubricate the auxiliary hoist drum bearing with the grease gun at the lubricating nipple.




- Clean the lubricating nipple (1) and lubricate the hoist at the lubricating nipple.
- Remove any grease that emerges.

8.6.5

Changing the oil/checking the oil


M 12

- Comply also with the  *Running-in regulations*, p. 4 - 1.



Oil, spare parts, tools

Gear oil in litres (gal)	Designation according to DIN 51502	Specification Classification	GROVE part no.
7 (1.8) for each hoist	C - LPF	MIL-L 2105 B API-GL-4/5 Viscosity: SAE 75 W-90 EP ISO - VG 220	02313611 Synthetic oil; do not mix this with mineral-based oils.

Designation	Quantity	GROVE part no.
Oil inspection glass; complete	2	04161717

- Receptacle, approx. 7 ltr (1.8 gal);  p. 2 - 4.


Prerequisites

- The truck crane must be level and in on-road mode;  *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Changing the oil at the hoist



Risk of damage to the hoist gears.

The waste oil must be checked for abrasion particles. This test is used to detect any damage at an early stage;  p. 8 - 45.

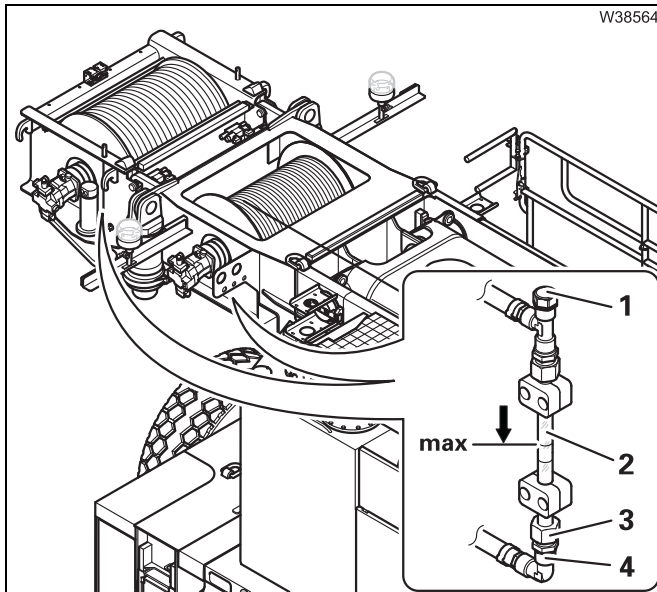


Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.
Store/dispose of consumables and any soaked equipment properly.
Ask about the applicable regulations.



During filling, the oil spreads only slowly in the hoist. The oil level therefore rises quickly in the standpipe at first, then drops slightly and then eventually rises again to its true level.



Draining oil

- Place a receptacle under the pipe (2).
- Remove the venting neck (1).
- Disconnect the screw fastening (3) and allow the oil to drain out of the hose (4) and the pipe (2).
- Replace the gasket if necessary.
- Reconnect the hose (4) to the screw fastening (3) at the pipe (2).

Topping up oil

- Add oil at the top through the pipe up to the **max.** mark.
- Secure the venting neck (1).

Checking the oil



Risk of accidents from falling load.

If this inspection is not performed, there is a risk of damage to the hoist gear which could lead to the load falling.



Check the waste oil for abrasion particles or have it tested in a laboratory:

- Pour the waste oil through a clean filter mat.
- Examine the oil, i.e. the residues on the filter mat using a magnifying glass.

If you find abrasion particles or solid materials on the mat, the hoist gear must be dismantled and inspected by the manufacturer.



Some abrasion particles may appear in the first oil filled. If you notice such particles during the first oil change (after 200 oper. hrs.), first consult **Manitowoc Crane Care** before introducing any specific measures.

8.6.6

Having a partial inspection carried out

Y 3

Only suitably trained specialists should carry out a partial inspection of

- the multiple-disc brake,
- the plug connections between the hydraulic motor and the multiple-disk brake,
- the plug connections between the multiple-disk brake and transmission unit

and be permitted to exchange parts with signs of wear.

8.6.7

Having a general inspection carried out


Y 6



When carrying out the general inspection of the hoists, also observe the information contained in *Measures required for winch monitoring*, p. 5 - 21.

The general inspection involves removing the transmission and sending it to the manufacturer to be examined.



For transmissions that have undergone a general overhaul, an oil change must be carried out after 200 and 1000 operating hours;  *Running-in regulations*, p. 4 - 1.

8.7

Slewing gear

8.7.1



Checking the oil level

W

Spare parts and tools

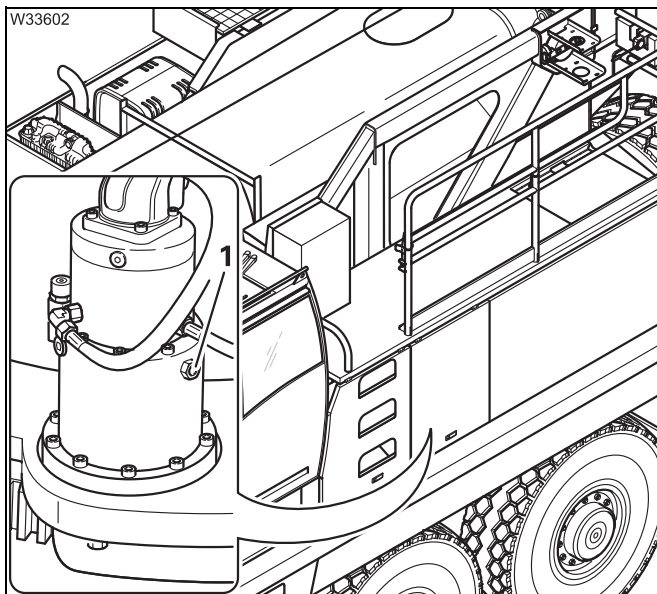
Designation	Quantity	GROVE part no.
Gasket 10 x 14 Cu DIN 7603	3	00117125

Prerequisites

- The truck crane must be level and in on-road mode;  *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.


Checking the oil level

Always check the oil level prior to using the crane.



- Check that oil is visible in the sight glass (1).
- Always check the oil level for all the slewing gears.

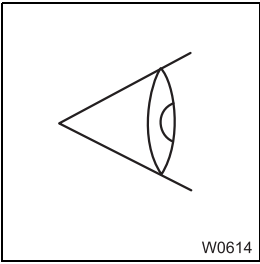
If the oil level is too low


- Top up the oil;  p. 8 - 50.

8.7.2

Checking for leaks

W



- Pay attention to any unusual running noises from the slewing gears.
- Check the slewing gears and the connections for leaks. If consumables are leaking;  *Checking the oil level*, p. 8 - 47.
- Check that pipes and hoses are tightly connected and undamaged.





If any damage is found, report it to **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

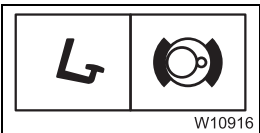
8.7.3

Checking the slewing gear brake

M 6

Prerequisites

- The truck crane is rigged with an outrigger span of at least **8.70 x 8.50 m (28.5 x 27.9 ft)** and is level;  *Manual de instrucciones*.
- **No** counterweight has been rigged;  *Manual de instrucciones*.
- The RCL code for the current rigging mode must be entered;  *Manual de instrucciones*.
- The current load must not exceed **1 t (2,200 lbs)** – if necessary unreeve the hook block.
- The slewing range 360° around the truck crane must be secured.
- The *brake pedal* function must be activated;  *Manual de instrucciones*.
- The main boom must be raised to 65° and fully retracted.



Risk of overturning while slewing!

Always set a rigging mode for the slewing range of 360° in accordance with the *lifting capacity table* and enter the corresponding RCL code. Do not override the rated capacity limiter (RCL).

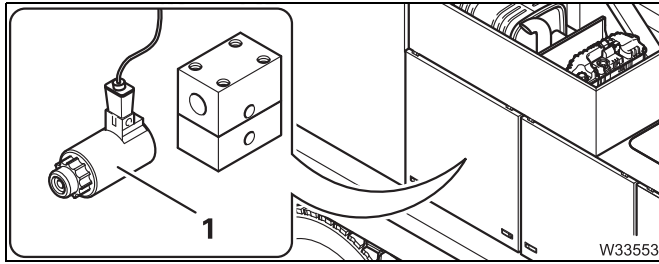


Risk of injury due to swinging hook block

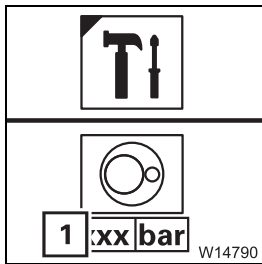
If a faulty slewing gear brake slips, the superstructure can accidentally, suddenly turn and the hook block can suddenly swing. People standing within the slewing range could be injured.
Secure the slewing range 360°, before you check the slewing gear brake.

Checking

When checking the slewing gear brake you must perform the slewing movement against the slewing gear brake.

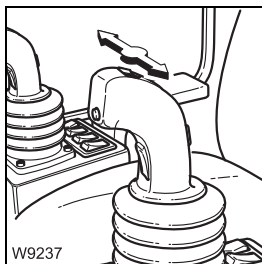


- Switch off the engine.
- Remove the coil (1) from the valve Y 2304. The slewing gear brake will now not be released when the slewing gear is switched on.



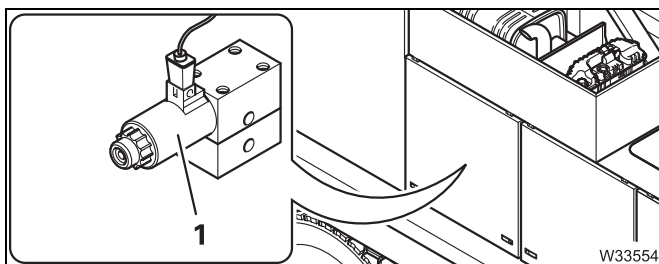
- Start the engine and switch on the slewing gear.
- Open the *Settings* submenu.

Display (1) will show the pressure in the slewing gear's hydraulic circuit.



- Move the control lever slowly to the stop and wait until the pressure in the hydraulic circuit has risen to approx. 200 bar (approx. 2 900 psi).
 - If the superstructure still does **not** slew, the braking force of the slewing gear brake is adequate.
 - If the superstructure does slew, the slewing gear brake is defective and must be repaired immediately by **Manitowoc Crane Care** or an authorised GROVE dealer.

- Switch the slewing gear off and switch the engine off.




- Fasten the coil (1) to the valve Y 2304 using the nut.
- Start the engine and check the slewing gear for correct operation.

8.7.4

Changing the oil/checking the oil


M 12

- Comply also with the  *Running-in regulations*, p. 4 - 1.



Oil, spare parts, tools

Gear oil in litres (gal)	Designation according to DIN 51502	Specification Classification	GROVE part no.
0.9 (0.24) for each slewing gear	C - LPF	MIL-L 2105 B API-GL-4/5 Viscosity: SAE 75 W-90 EP ISO - VG 220	02313611 Synthetic oil; do not mix this with mineral-based oils.

Designation	Quantity	GROVE part no.
Gasket 10 x 14 Cu DIN 7603	3	00117125
Gasket 14 x 20 Cu DIN 7603	3	00117132

- Receptacle, approx. 5 ltr (1.5 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be level and in on-road mode;  *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

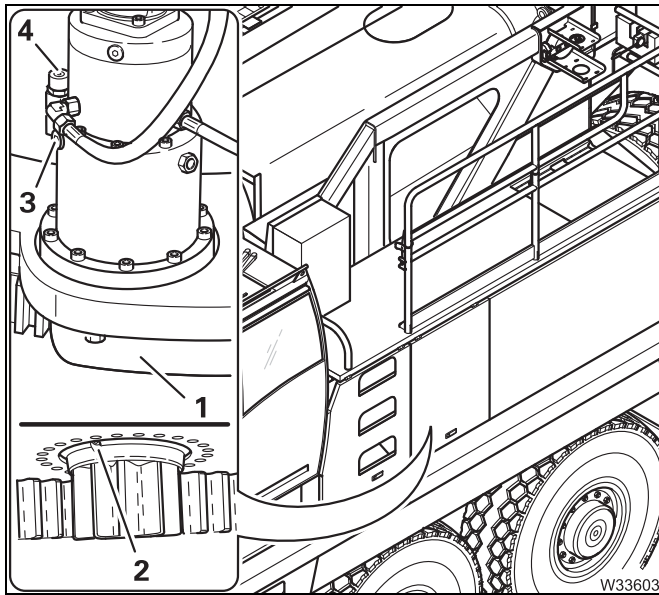
Changing the oil



Risk of environmental damage due to leaking consumables.

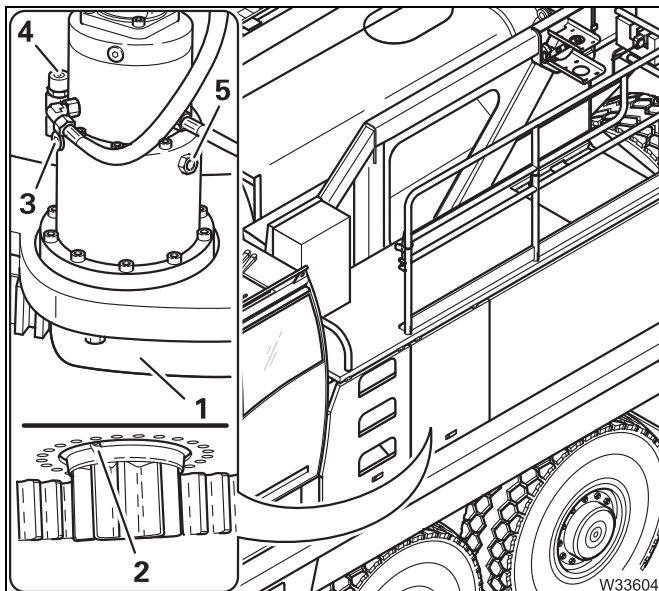
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.
Store/dispose of consumables and any soaked equipment properly.
Ask about the applicable regulations.

- Always change the oil in all slewing gears.



Draining oil

- Remove the plate (1).
- Place a receptacle under the screw (2).
- Unscrew the filter (4) and screws (3) and (2).
- Drain the oil.



- Replace the gasket and screw the screw (2) back in.

Topping up oil

- Top up the oil through the filler neck (4) until oil is visible in the sight glass (5).
- Replace the seal and screw in the plug (3) and the filter (4).
- Replace the plate (1).

Checking the oil

Check the waste oil that was drained from the slewing gears for abrasion particles, or have it tested at a laboratory.

- Pour the waste oil through a clean filter mat.
- Examine the oil, i.e. the residues on the filter mat using a magnifying glass.

If you find abrasion particles or solid materials on the mat, the slewing gear transmission must be removed and inspected by the manufacturer.

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8.8

Slewing bearing

8.8.1

Checking the screws

M 3

- Comply also with the  *Running-in regulations*, p. 4 - 1.

Check the serial number


- Check the **serial number** of your truck crane.

The following description applies only to truck cranes GMK6300L with **serial numbers from 6300 5010**.




For truck cranes GMK6300L with **serial numbers from 6300 5001 to 6300 5009** please refer to the applicable additional sheet 3 302 522 for these truck cranes. More far-reaching disassembly is necessary in order to achieve free access.

- For information please contact **Manitowoc Crane Care**.

Tools

- Torque wrench.
- Auxiliary tools for the torque wrench;  p. 8 - 55.

Prerequisites

- The crane must be rigged with an outrigger span of at least **8.70 x 8.50 m (28.5 x 27.9 ft)** and be level;  *Manual de instrucciones*.
- The counterweight combination **35.5 t (78,200 lbs)** must be rigged according to the *lifting capacity table* and equipment on the truck crane.
- In addition, the tyres on the 4th and 5th axle lines should be removed so that freedom of movement under the slewing bearing is improved.
- The main boom must be fully retracted and raised to 75°;  *Manual de instrucciones*.
- The current load must not exceed **1 t (2,200 lbs)** – if necessary unreeve the hook block.
- The slewing range 360° around the truck crane must be secured.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.



Safety Instructions



Risk of damage to the screws on the slewing bearing.

All screws were tightened at the factory with a certain torque, and this should be checked during maintenance. Only slight tightening of the screws is permissible, if required.

You may **not** slacken the screws and re-tighten them, or completely unscrew and then reuse them.

If the superstructure has to be removed from the carrier, only a completely **new set of screws** may be used to reinstall the superstructure. **Only original screws** should be used, which were manufactured according to the factory specifications.

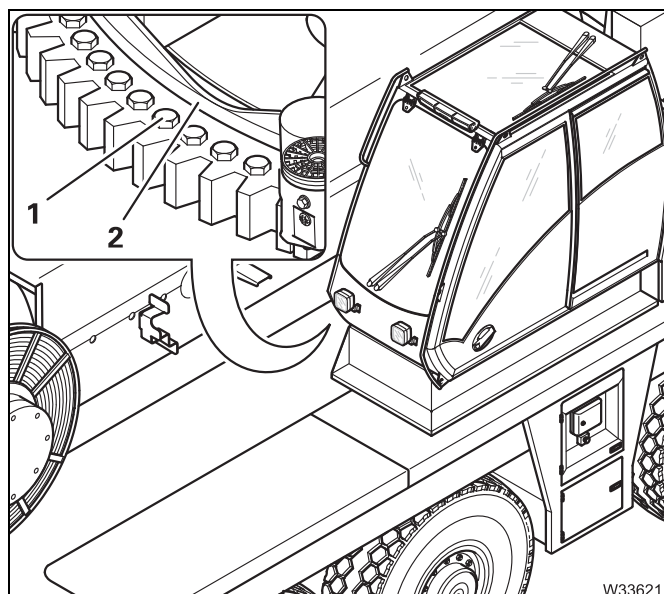


Danger of the slewing bearing being ripped off.

If while checking you notice very loose, broken or missing screws, then the slewing bearing has been overloaded and is no longer safe to use. During crane operation, the slewing bearing may rip off suddenly and thus cause fatal accidents.

Do not put the truck crane back into operation and have the slewing bearing repaired by **Manitowoc Crane Care**.

Access to the outer ring

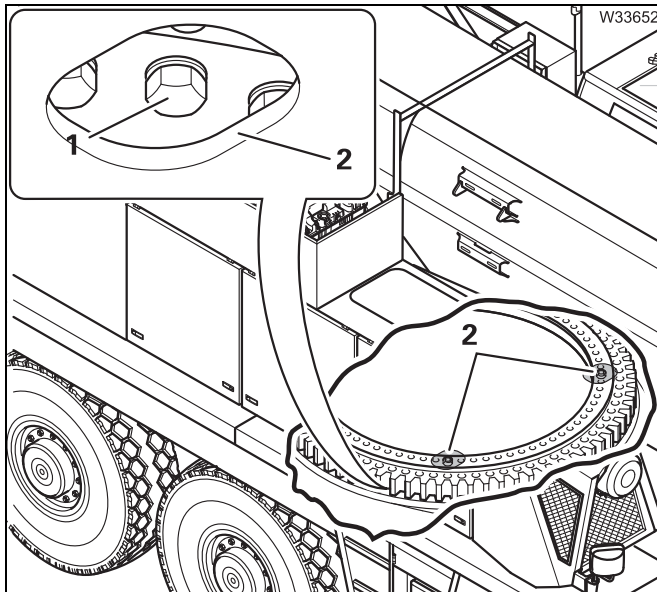


The **outer ring** is attached to the carrier by the bolts (1).

- Check all 88 bolts (1) from **above**.

To do this, you must move the clear area (2) on the turntable round step by step to allow all the bolts (1) to be checked.

Access to the inner ring

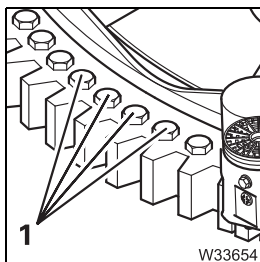


The **inner ring** is attached to the turntable by the bolts (1).

- Check all 87 bolts (1) from **below**.

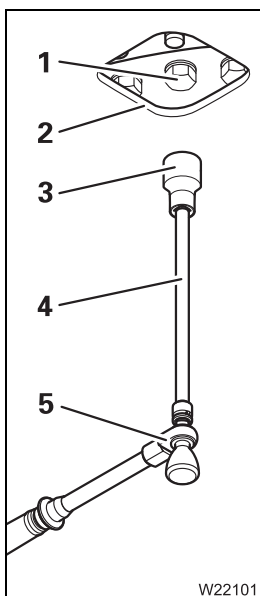
To do this, you must rotate the turntable gradually to gain access to a pair of bolts (1) opposite one another, through the openings (2) in the carrier.

Selecting the tools



Outer ring

The screw heads (1) are easily accessible for fitting a socket wrench. Therefore, you can use **manual or mechanical torque tools** (electric or hydraulic drivers).



Inner ring

The screw head (1) is accessible only via the opening (2). An extension (4) is required for fitting a socket wrench (3).

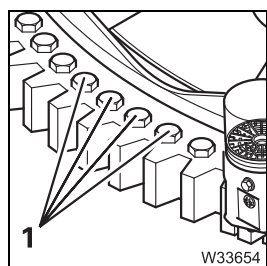
A **manual torque tool** (5) is recommended so that it can be tightened gently, and slipping from the screw head (1) is avoided.



Torques

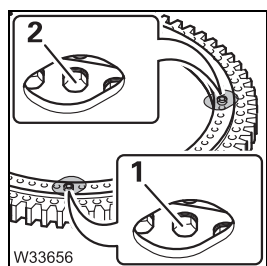
Screw type	GROVE part number	Torque Nm (lbf ft)
Roller slewing bearing Bearing type: RDV, three rows	03295952 Model plate: Inside the inner ring.	
M27 x 150: 88 pieces on the outer ring	03227567	1150 (848)
M27 x 180: 87 pieces on the inner ring	03140904	1150 (848)

Checking the outer ring



- Divide the checking of the 88 screws into 22 working steps of 4 screws each (1).
Between each of the 22 operation steps you need to rotate the turntable to the next group of 4 screws on the opposite side.
- Switch the engine off after every rotation and secure the truck crane against unauthorised use; ■■■► p. 2 - 3.
- Check the tightness of the first group of 4 adjoining screws (1); ■■■► *Torques*, p. 8 - 56.
- Once they have been checked, mark the screws to avoid subsequent confusion.
- Remove the tool.
- Start the engine (from the crane cab) and turn the turntable by 180° – the second group on the opposite side is now accessible.
- Switch off the engine.
- Check all other groups in the same way.

Checking the inner ring



- Divide the inspection of the 87 screws into 43 work steps with 2 screws each and 1 work step with 1 screw.
Between each of the 43 operation steps you need to rotate the turntable to the next pair of screws on the opposite side.
- Switch the engine off after every rotation and secure the truck crane against unauthorised use; ■■■► p. 2 - 3.
- Check the tightness of the first pair of screws (1) and (2) on the opposite side; ■■■► *Torques*, p. 8 - 56.
- Mark the screws that have been checked, to avoid confusion later.
- Remove the tool.

- Start the engine (from the crane cab) and turn the turntable by 90° – the second pair of screws on the opposite side is now accessible.
- Switch off the engine.
- Check all other screws in the group in the same way.

8.8.2

Lubricating the gear teeth

M 6




Grease

Designation	Quantity	GROVE part no.
Adhesive lubricating grease (spray can)	1	00554205



Observe the instructions and safety instructions on the adhesive lubricating grease packaging.

Prerequisites

- The truck crane must be level and on outriggers;  *Manual de instrucciones*.
- The main boom must be fully raised;  *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

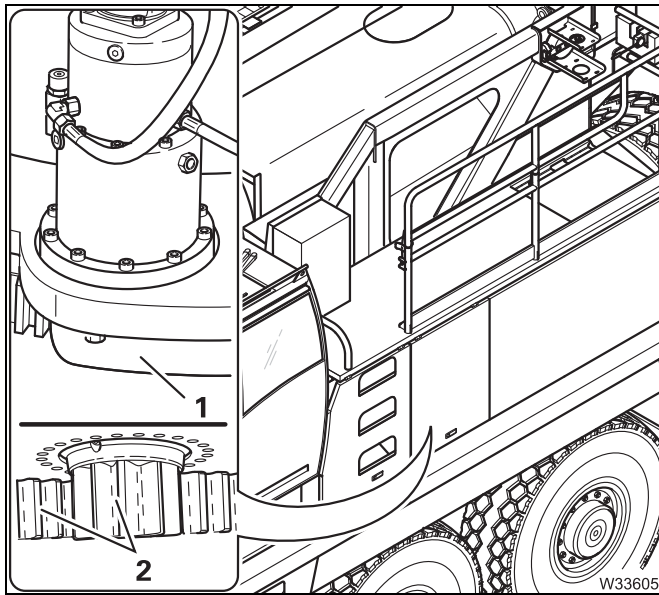
Lubricating



Risk of crushing from the gear teeth.

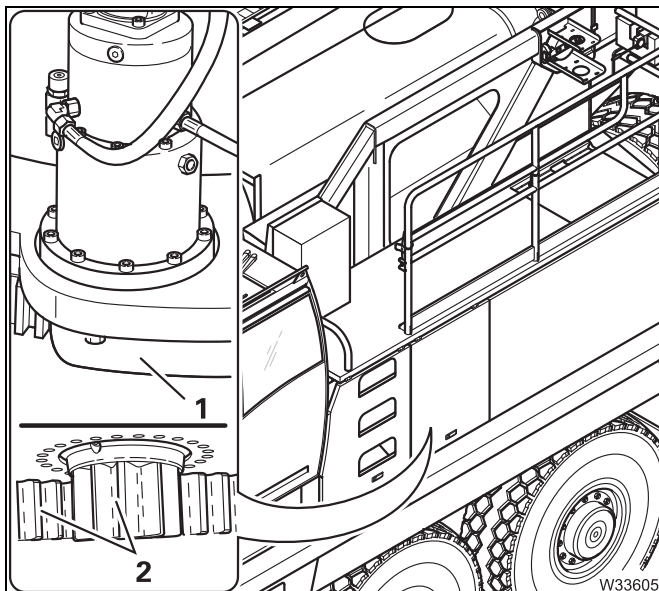
Fingers may be crushed or clothing can be drawn into the open, rotating pinion. For this reason, be sure to remount the plate after lubricating.

A distinction is made between initial lubrication and subsequent lubrications:



First lubrication

- Remove the plate (1).
- Remove the old grease from all the gear teeth (2).
- Apply a thin layer of new grease to all the gear teeth and allow it to penetrate for about 10 minutes.
- Apply a second, thicker layer of grease and allow it to penetrate for about 30 minutes.
- Attach the plate.



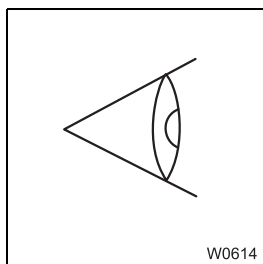
Subsequent lubrication

- Remove the plate (1).
- Apply new grease to all the gear teeth (2).
- Allow it to penetrate for about 30 minutes.
- Attach the plate.

8.8.3

General inspection

M 6



- Pay attention to any unusual running noises from the slewing bearing.
- If unusual noises occur, take a sample of the grease that has escaped. Have **Manitowoc Crane Care** examine the sample for metal residue.
- Check the slewing bearing for damage (e.g. gaskets).

If any damage is found, report it to **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.



The maintenance interval specified here must be reduced if the slewing bearing was subjected to heavy blows (falling load, load slipping).

8.8.4


Measuring tilting play

M 6



Reducing the interval

- When after several years of intensive crane operation, half of the value for the maximum permissible tilting play is reached, then you must reduce the maintenance interval.
- Measure the tilting play from then on every three months (**M 3**).

Spare parts and tools

- Dial gauge (precision 0.01 mm (0.00039 in)) with tripod.
- Measurement report from when the truck crane was put into operation;  *Delivery receipt.*

Prerequisites

- The slewing bearing must have been previously checked for tightness;  *Checking the screws*, p. 8 - 53.
- The truck crane must be rigged with an outrigger span of at least **8.70 x 5.00 m (28.5 x 16.4 ft)** and must be level;  *Manual de instrucciones.*
- The counterweight combination **35.5 t (78,200 lbs)** must be rigged according to the *lifting capacity table* and equipment on the truck crane.
- The lattice extension must be removed.
- The auxiliary hoist must be removed.
- The main boom must be telescoped to 0-0-1-0-0-0.
- The current load must not exceed **1 t (2,200 lbs)** – if necessary unreeve the hook block.

Type

The truck crane GMK6300L is equipped with a slewing bearing of the bearing type: RDV, three rows.

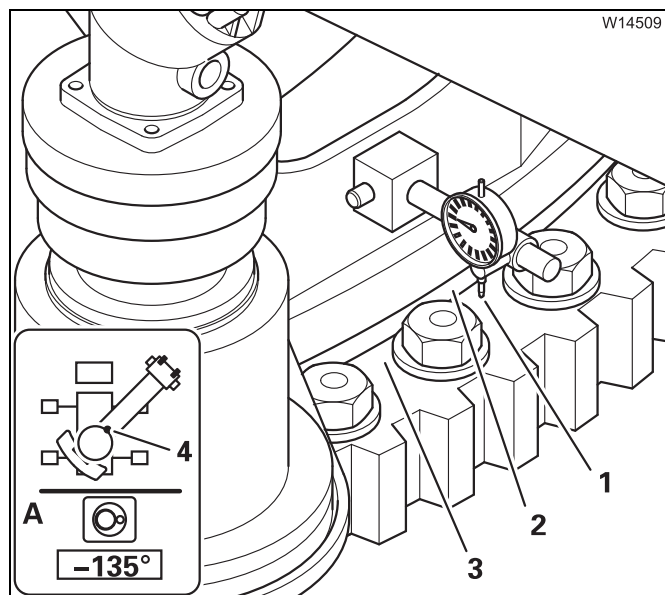
Type of slewing bearing	GROVE part number
Roller slewing bearing Bearing type: RDV, three rows	03295952 Model plate: Inside the inner ring.



Measuring tilting play

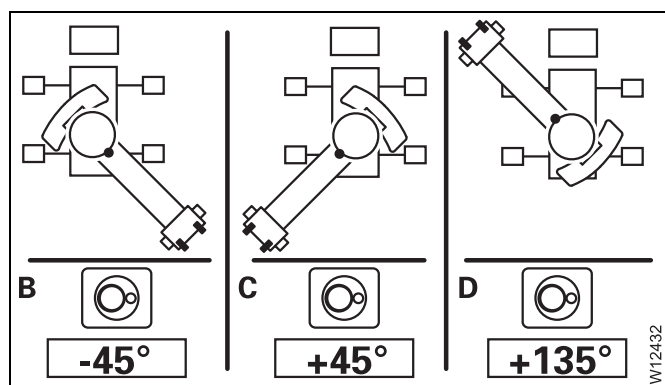
The base value of the tilting play is determined and documented by **Manitowoc Crane Care** or an authorised GROVE dealer when the ball slewing bearing is put into operation or replaced.
The maximum permissible wear is 0,7 mm (0,028 in).
This results in the maximum permissible tilting play.

	Base value + max. permissible wear =	max. permissible tilting play
Example:	0.35 mm (0.014 in) + 0.7 mm (0.028 in)	1.05 mm (0.042 in)



Measuring current tilting play

- Raise the main boom to 80° and slew to -135° – display (A).
- Fasten a dial gauge on the front on the turntable (4) and place the button (1) on the lower ring (3) as close as possible to the gasket (2).
- Slowly lower the main boom to 0°. The hook block may not touch the ground.
- Read off from the dial gauge how far the turntable is inclined and record this value as the current tilting play; ➡ *Appendix – Tilting play measurement report.*
- Remove the dial gauge.



- Repeat the measurement with the slewing angles
 - B** -45°
 - C** +45°
 - D** +135°

If the **current tilting play** is greater than the **max. permissible tilting play**, you must have the slewing bearing replaced by **Manitowoc Crane Care** or an authorised GROVE dealer.

If the **current tilting play** is half as great as the **max. permissible tilting play**, you must reduce the maintenance interval; ➡ *Reducing the interval*, p. 8 - 61.

8.8.5

Lubricating the locking of turntable



M 12

Grease, spare parts, tools

Lubricating grease	Designation according to DIN 51502	Specification Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

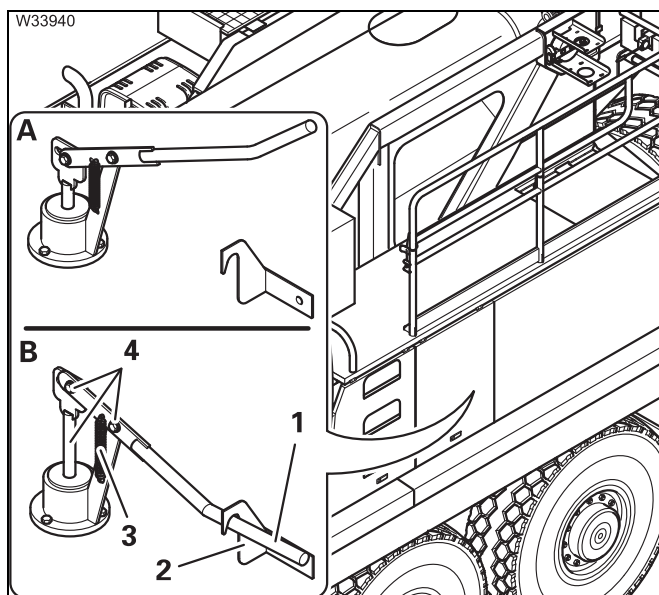
- Brush.

Prerequisites

- The truck crane must be level and in on-road mode;  *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The turntable must be at one of the locking points (0° or 180°).

Lubricating

- Familiarize yourself with the operation of the turntable locking and observe the safety instructions;  *Manual de instrucciones*.



- Use a brush to lubricate the lubrication points (4).
- Check the lever linkage (1), the retainer (2) and the spring (3) for damage and correct operation in both conditions:
 - (A) – turntable locked;
 - (B) – turntable unlocked.

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8.9

Hydraulic system



Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.

8.9.1

Checking the oil level

D

Prerequisites

- The truck crane must be level and in on-road mode; *Manual de instrucciones*.
- The telescoping cylinder must be locked in telescopic section 1; *Manual de instrucciones*.
- The truck crane must be standing on a level surface.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.

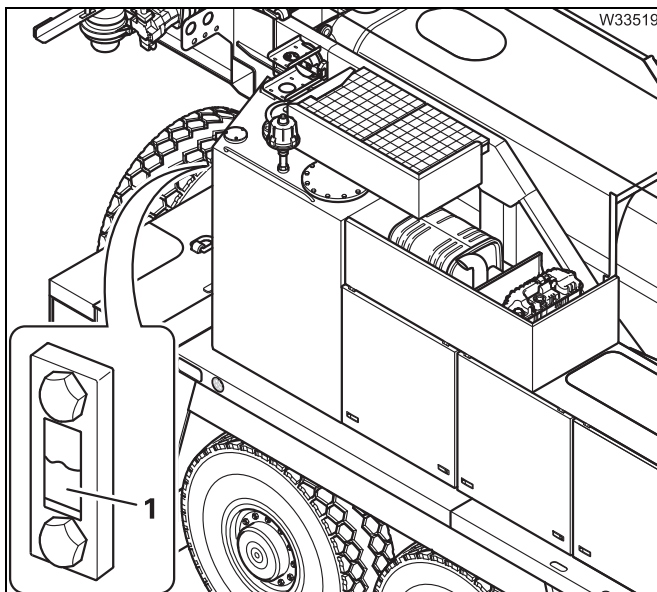
Checking the oil level



Risk of damage to the hydraulic system

Cleanliness is imperative when handling hydraulic oil.

Even fresh hydraulic oil must be filtered before it is added to the tank.



- Check whether oil is visible in the middle of the sight glass (1).

If the oil level is too low

- Top up the oil; p. 8 - 78.

8.9.2

Checking the hydraulic hoses

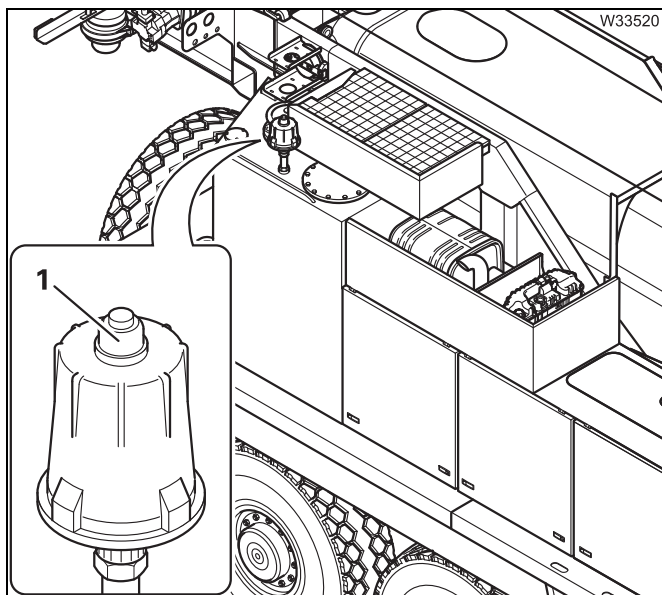
W

The inspection work is described in section *Checking the hydraulic hoses*, p. 7 - 82.

8.9.3

Checking the ventilation filter

W



- Check the display (1) on the ventilation filter.

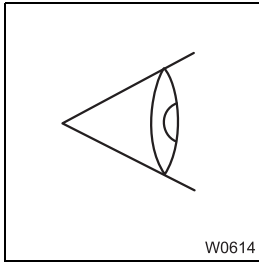
If the indicator is coloured

- Replace the filter;  p. 8 - 70.

8.9.4

Checking for leaks

W



- When the engine is running, carry out a visual inspection for leaks on the hydraulic components (tank, pumps, drives, cylinders, control blocks, valves, pipe and hose lines and connections).
- If leaks are detected, check the oil level and top up if necessary;
 ▣▣▣▣▶ *Checking the oil level*, p. 8 - 65.



Risk of accidents from hydraulic oil spraying out.

Never tighten any leaking connections when the system is under pressure. Change pipes and hose lines only when the system is depressurised.



Risk of environmental damage due to leaking consumables.

Immediately repair or have leakages in the hydraulic system repaired to ensure that no hydraulic oil escapes, seeps into the ground or reaches waterways when the crane is being used.

After hydraulic components have been changed

- Bleed the hydraulic system; ▣▣▣▣▶ *Establishing the operating conditions*, p. 8 - 79.

If damage cannot be rectified immediately or further damage is likely

- Notify **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.


8.9.5

Oil filter 1 – cleaning the magnetic rod


M 3

Spare parts and tools

Designation	Quantity	GROVE part no.
For oil filter 1:		
Filter	1	03325700
Packing set	1	03135853

– Receptacle, approx. 5 ltr (1.5 gal);  p. 2 - 4.

Prerequisites

-
- The engine must be switched off and secured against unauthorised use;
 p. 2 - 3.
-



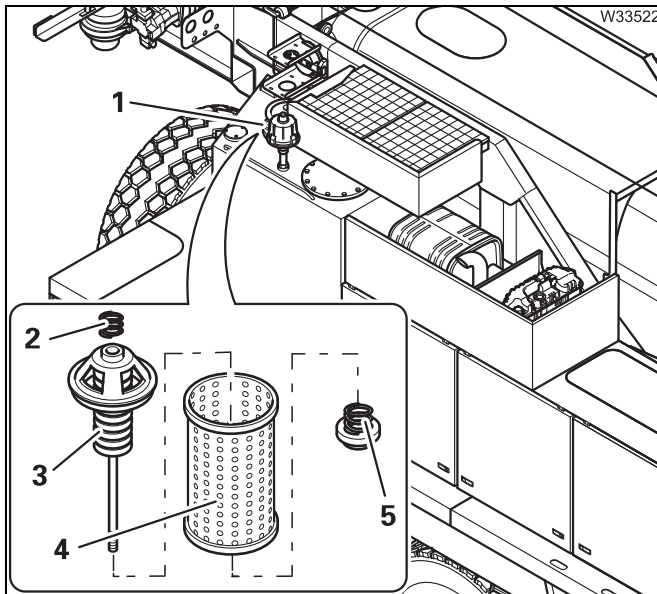
Risk of environmental damage due to leaking consumables.

Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.

Cleaning oil filter 1



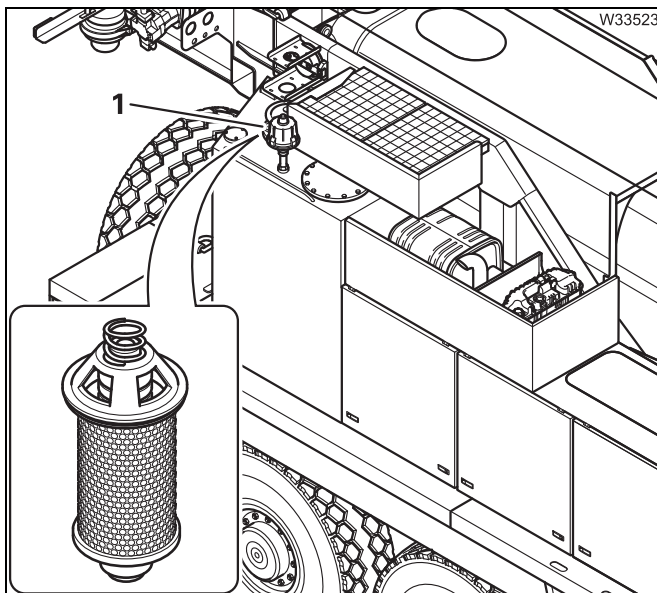
- Take off the cap (1) and pull out the filter.
- Place the filter in a receptacle.
- Remove the spring (2).
- Take off the nut (5).
- Take the magnetic rod (3) out of the filter (4) and clean the magnetic rod.
- Replace any damaged parts, where necessary.



Risk of damage to the hydraulic system.

Large amounts of metal particles are a sign of damage in the hydraulic system.

Have the hydraulic system inspected by **Manitowoc Crane Care** or by your qualified repair crew.



- Replace the gaskets (packing set) if necessary.
- Assemble the filter and insert it.
- Bolt the cover (1) on.

8.9.6

Changing the ventilation filter

M 12

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	03319602

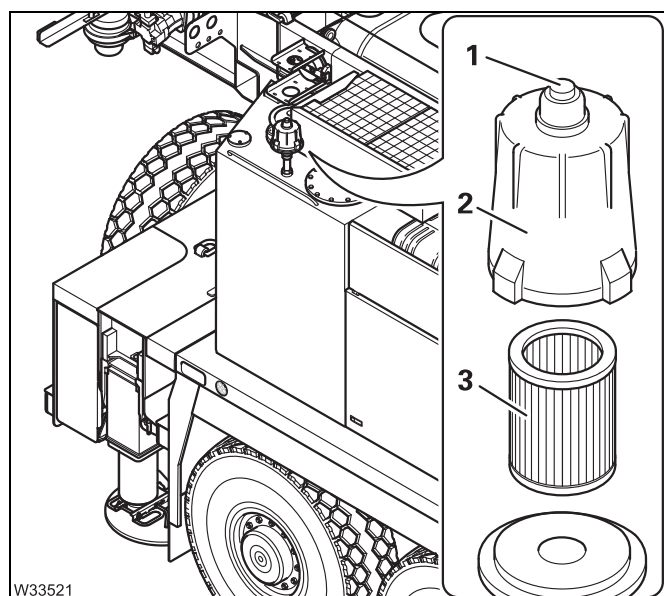
Prerequisites

- The engine must be switched off and secured against unauthorised use;
 ▶ p. 2 - 3.



Risk of damage to the environment from filter residues

Store used hydraulic oil filter inserts in suitable receptacles and have them disposed of properly by qualified personnel.



- Remove the cap (2).
- Change the filter (3) and fasten the cap.
- Reset the display by pressing the pin (1) down.

8.9.7

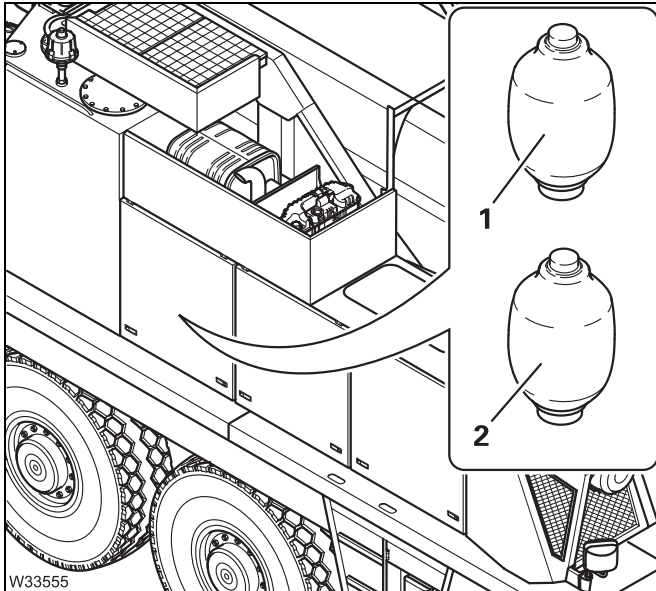
Pressure accumulator – checking the gas pressure

M 12



Risk of accidents due to incorrect inspection.

The gas pressure test must be carried out only by an authorised official inspector of pressure tanks or under his/her supervision or instructions.



The superstructure is equipped with pressure accumulators.

The filling pressure at 20 °C (68 °F) is:

- 1 Pressure accumulator** 20 bar (290 psi)
- 2 Pressure accumulator** 180 bar (2610 psi)


- Have the filling pressure checked and if necessary corrected by **Manitowoc Crane Care** or an authorised GROVE dealer.

8.9.8


Taking oil samples

M 12

The oil sample from the superstructure hydraulic system is taken in a way similar to that for the carrier hydraulic system.

Information for taking samples with the hose and for the laboratory analysis;  *Taking oil samples*, p. 7 - 86.

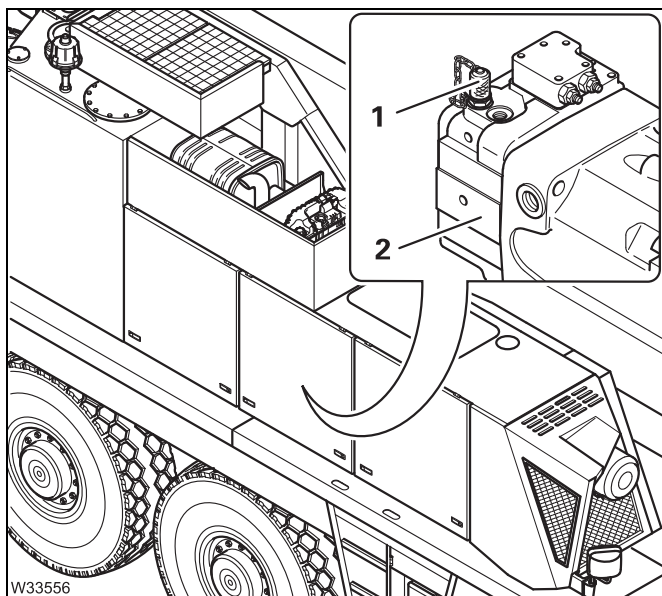
Prerequisites

- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Select the sampling location

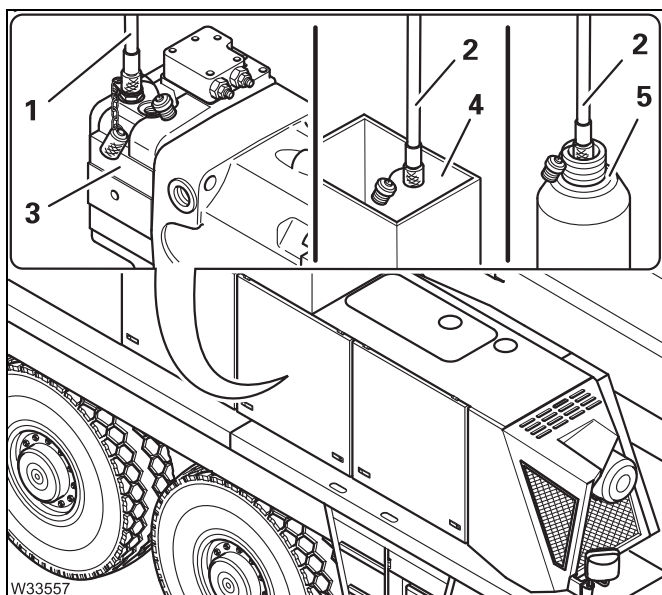
To determine the usability of the oil, you must take a sample from the hydraulic system. To do that you must connect the hose with the connecting piece to a gauge port.





There is a gauge port (1) on the pump (2). When a hydraulic function is run, e.g. *tilting the crane cab*, oil can then be taken at the gauge port.

Taking oil samples



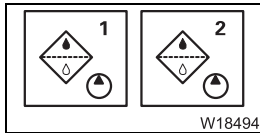
- Clean the gauge port and connect the hose (1) to the pump (3); *Connecting the hose*, p. 7 - 87.
- Put the hose end (2) into the receptacle (4).
- Start the engine.
- Tilt the crane cab.
- Allow 2 litres (0.5 gal) of oil to flow into the receptacle.
- Switch the engine off and put the hose end (2) into the sample container (5).
- Start the engine.
- Tilt the crane cab.
- Allow 0.3 litres (0.08 gal) of oil to flow into the sample container.
- Switch off the engine.
- Remove the hose; *Disconnecting the hose*, p. 7 - 88.
- Seal the sample container and dispatch it; *Dispatch the oil sample to the laboratory*, p. 7 - 89.
- Determine the quality of the oil; *Determining the quality of the oil*, p. 7 - 89.

8.9.9

Changing the hydraulic oil filter

All oil filters must be replaced when changing the oil.

In the event of a warning message, the red symbols in the *Warning* submenu indicate which oil filters you have to change.



1 Red – Changing oil filter 2

2 Red – Changing oil filter 1

Spare parts and tools

Designation	Quantity	GROVE part no.
For oil filter 1:		
Filter	1	03325700
Packing set	1	03135853
For oil filter 2:		
Filter	1	03142356
Housing packing set	1	03326049
For oil filter 3:		
Filter	1	03249527

- Torque wrench for 60 Nm (44 lbf ft).
- Receptacle, approx. 10 ltr (3 gal); p. 2 - 4.

Prerequisites

- The truck crane must be level and in on-road mode; *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.



Risk of damage to the environment from filter residues

Store used hydraulic oil filter inserts in suitable receptacles and have them disposed of properly by qualified personnel.



Changing oil filter 1

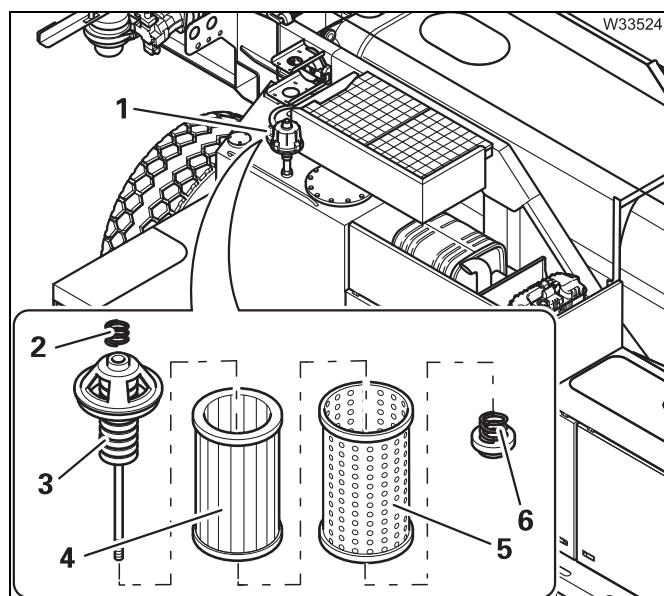


Risk of environmental damage due to leaking consumables.

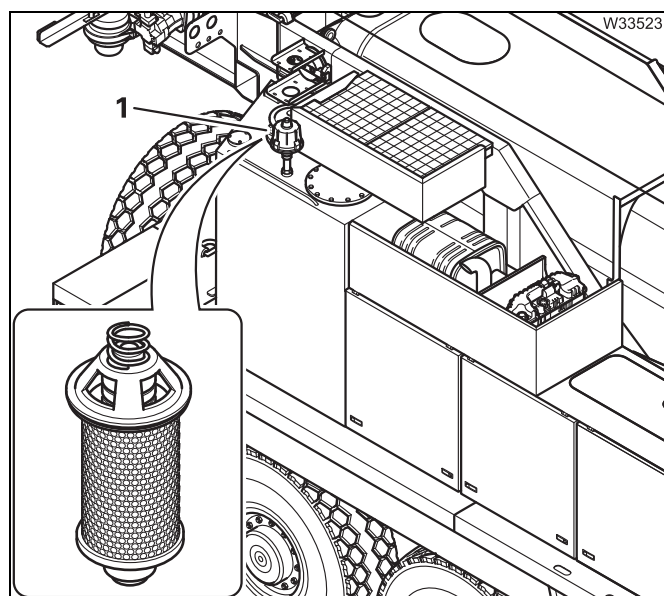
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.

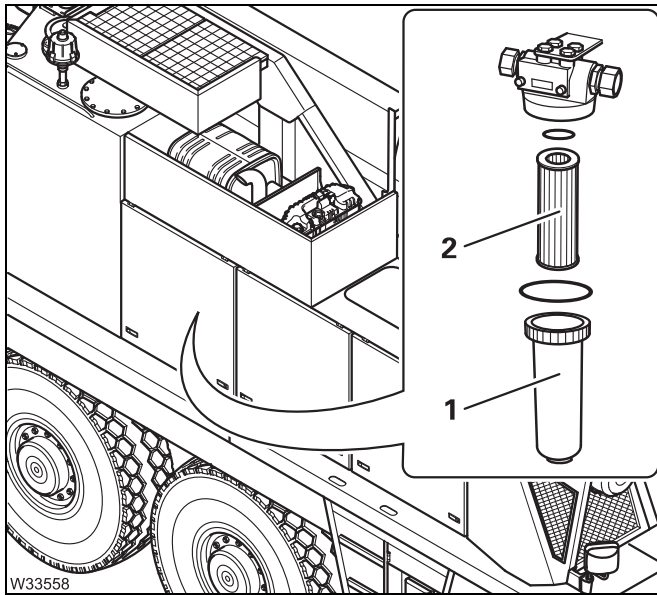


- Take off the cap (1) and pull out the filter.
- Place the filter in a receptacle.
- Remove the spring (2).
- Take off the nut (6).
- Take the magnetic rod (3) and filter (4) out of the filter cage (5).
- Clean the magnetic rod (3) and filter cage (5).
- Insert a new filter (4) into the filter cage (5).
- Replace any damaged parts, where necessary.



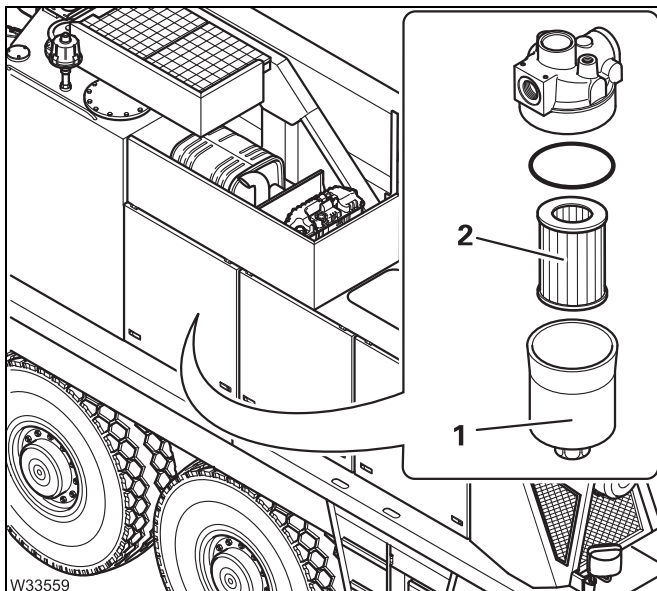
- Replace the gaskets (packing set) if necessary.
- Assemble the filter and insert it.
- Bolt the cover (1) on.

Changing oil filter 2



- Release the receptacle (1) at the hexagon.
- Change the filter (2).
- Replace the gaskets.
- Fill the receptacle with clean oil and tighten it – torque 25 Nm (18.5 lbf ft).

Changing oil filter 3



- Release the receptacle (1) at the hexagon.
- Change the filter (2).
- Replace the gaskets.
- Fill the receptacle with clean oil and tighten it – torque 60 Nm (44 lbf ft).





After changing the filter



Risk of damage to the hydraulic pumps

The engine may only be started if the valve in the suction line of the hydraulic pumps is open and there is enough hydraulic oil in the hydraulic oil tank.

- Check the valve on the hydraulic oil tank. Open the valve, if necessary;  p. 8 - 79.
- Check the oil level. Top up the oil, if necessary;  p. 8 - 78.
- To bleed the system, start the engine and let it idle for 3 minutes.
- Check that none of the oil filters is leaking.

8.9.10 Changing the hydraulic oil

The oil only needs to be changed if the laboratory analysis results indicate this; *Taking oil samples*, p. 8 - 71.

Oil, spare parts,
tools

Hydraulic oil in litres (gal)	Designation according to DIN 51502	Specification Classification	GROVE part no.
1220 (322)	HVLP	DIN 51524-3 Viscosity: ISO-VG 32	04162158 Castrol Hyspin AWH-M 32

Designation	Quantity	GROVE part no.
Cover gasket 140 / 90 x 3	1	03328286

- Connecting piece and hose (tool box); p. 7 - 92.
- One or more receptacles, approx. 1220 l (322 gal); p. 2 - 4.

Prerequisites

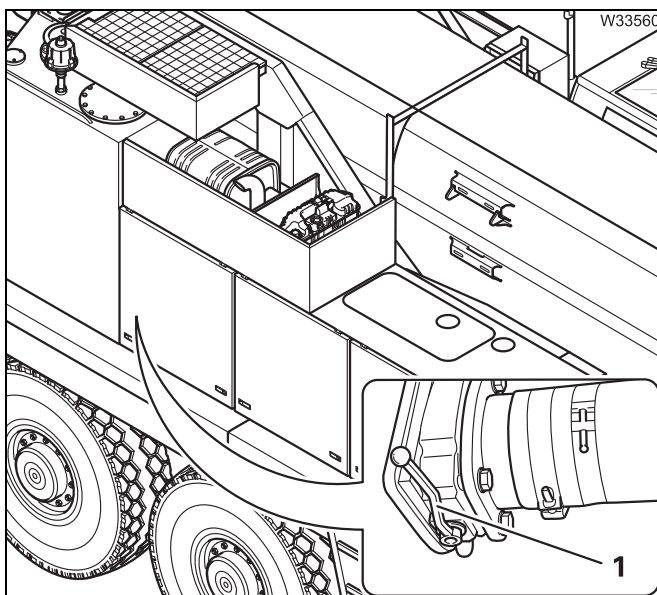
- The truck crane must be level and in on-road mode; *Manual de instrucciones*.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.
- The oil filters must be removed; *Changing the hydraulic oil filter*, p. 8 - 73.

Closing the valve



Risk of damage to the hydraulic pumps

Be sure to secure the engine against unauthorised use.
If the engine is started while the valve in the suction line is closed, the hydraulic pumps will be damaged.



- Close the valve – lever (1) at right angles to the line.

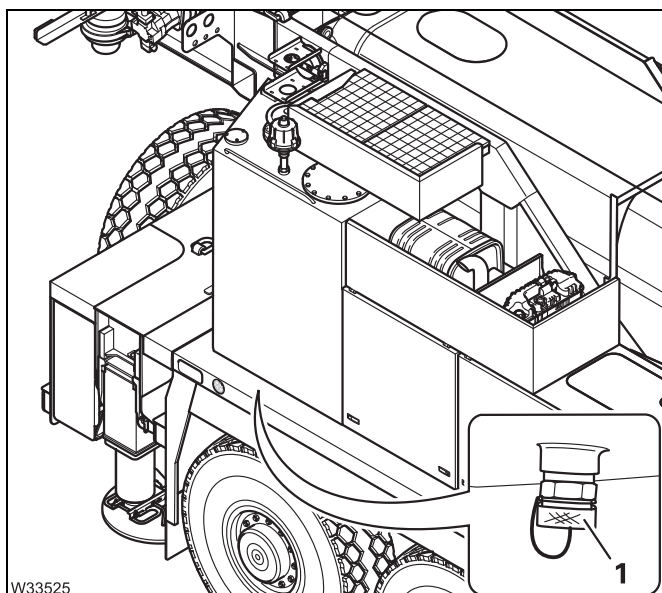


Draining oil



Risk of environmental damage due to leaking consumables.

Use the supplied connecting piece and hose and a receptacle with sufficient capacity to drain the hydraulic oil.



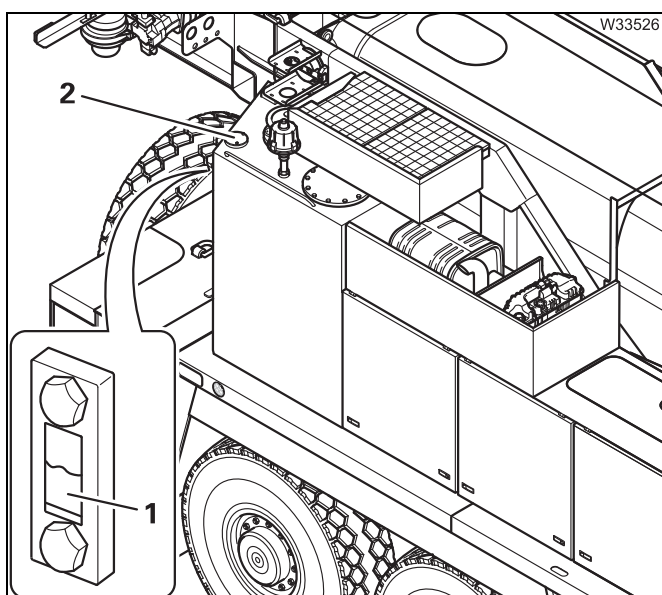
- Place a receptacle underneath the valve.
- Screw the connecting piece and hose on to the valve (1) and drain the oil; Handling the valves, p. 7 - 92.
- Change the filters; p. 8 - 73.

Topping up the oil



Risk of damage to the hydraulic system

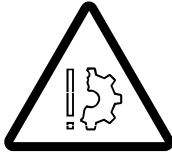
Cleanliness is of the utmost importance when handling hydraulic oil. Even fresh hydraulic oil must be filtered before it is added to the tank.



- Remove the cover (2).
- Add the new oil through a strainer until it reaches the middle of the inspection glass (1).
- Replace the gasket if necessary and fasten the cover.

Establishing the operating conditions

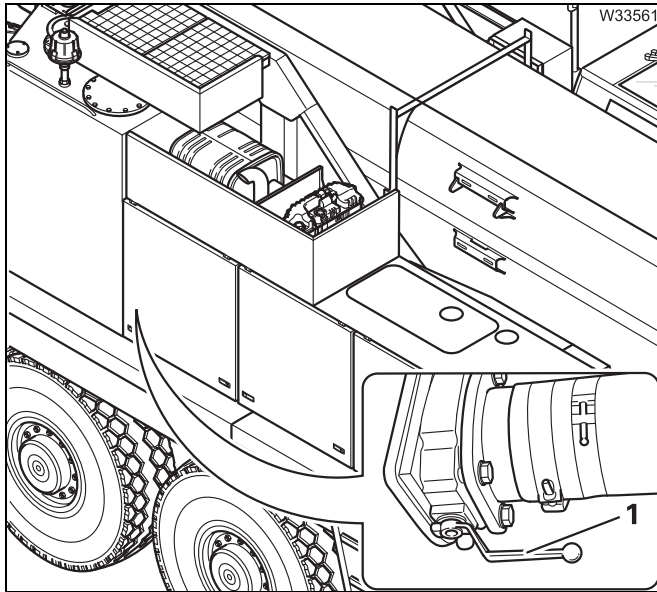
After having changed the oil filters and topping up the oil, you must re-establish the operating conditions.



Risk of damage to the hydraulic pumps


Open the valve prior to starting the engine.

This prevents damage to the hydraulic pumps.



Opening the valve

- Open the valve – lever (1) parallel to the line.

- Start the engine.
- Carry out all hydraulic functions several times to remove any air in the system.
- Check that none of the oil filters is leaking.
- Check the oil level through the sight glass on the hydraulic oil tank. Top up oil, if necessary;  p. 8 - 78.

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8.10 Main boom

8.10.1 Greasing the piston rod of the derricking cylinder

M 1

Grease, spare parts and tools

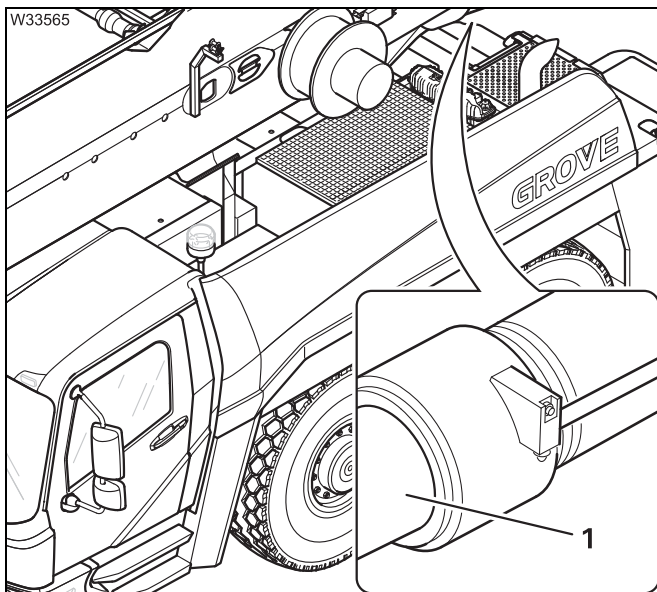
Designation	GROVE part no.
Lubricant RHUS 2 AF; 1 kg (Apply the grease with a brush)	03325215
or	
Spray on Berulub; 0.5 litres (spray-on)	01929824

– Brush.



Risk of damage to the derricking cylinder's gasket due to rust.

Ensure that the uncovered end of the piston rod is always kept covered with a layer of grease. In this way you can avoid rust which damages the seal in the derricking cylinder head when fully lowered.



- Clean the uncovered end (1) of the piston rod by removing old grease, dirt particles and rust.
- Grease the uncovered end, making sure the grease coating is evenly distributed.

After every high-pressure cleaning operation on the truck crane

- Grease the piston rod.



You can hinder the formation of rust if you turn the main boom to the side between maintenance intervals and completely lower it.

8.10.2

Lubricating the telescopic sections

M 3

Reducing the interval

Under difficult operating conditions – at extremely sandy or rainy locations – you must change them earlier than normal.

Grease, spare parts, tools

Designation	GROVE part no.
Lubricant for the locking pins: RHUS 2 AF, 1 kg can	03325215
Slide paste for the telescopic slide faces: PAL1, 25 kg bucket	02314698

- A grease gun for the grease nipples on the locking pins.
- A brush or roller for the outer, upper and lower telescopic slide faces.
- A compressed air grease spray gun with a spray extension for the inner telescopic slide faces.
- Torch.

Designation	GROVE part no.
Grease spray gun, complete: Mobile, external compressed air connection required	03325445
Manual grease spray gun for cartridge: Via the tyre inflator connection on the truck crane	03329027
25 m hose for manual grease spray gun:	03329072
Slide paste for the telescopic slide faces: PAL1, 400 ml cartridge, refillable	03329071

Prerequisites

- The truck crane must be level.
- The hook block must be unreeved.
- The main boom must be completely retracted and lowered into horizontal position.
- A rigging mode must have been set up using the telescope positions required for maintenance as specified in the lifting capacity table;
 - ▣▣▣▣ *Lifting capacity table.*
- The RCL code for the current rigging mode must be entered.



If initially you set up a rigging mode under which the telescope statuses 49/100/0/0/0/0 are available in the context of the associated lifting capacity table, this rigging mode allows you to perform the complete maintenance work on the main boom.

Information



Risk of overturning when telescoping if the RCL is overridden.

Do not override the rated capacity limiter (RCL) when telescoping is switched off. Select a suitable lifting capacity table which contains the required telescoping. Set the associated rigging mode and enter the RCL code.



Risk of accidents from slipping off the main boom.

There is grease residue on the telescopic sections. For this reason, you must not walk on the main boom.

Use the extendable ladders provided with your crane.



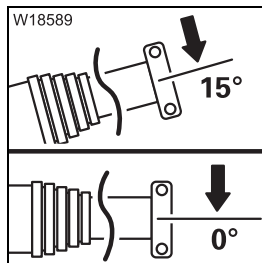
Risk of injury due to openings on the telescopic unit.

Your fingers/hands could get crushed at the openings in the case of unintentional telescoping.

Secure the main boom against accidental telescoping before you remove or replace the plates on the openings.

If you are carrying out this operation with the help of someone else, communicate with the person in the crane cab by means of clear hand signals.

Do not put your hand in the opening while lubricating, only use the spray extension. Protect your eyes from the spray nozzle and wear safety glasses.



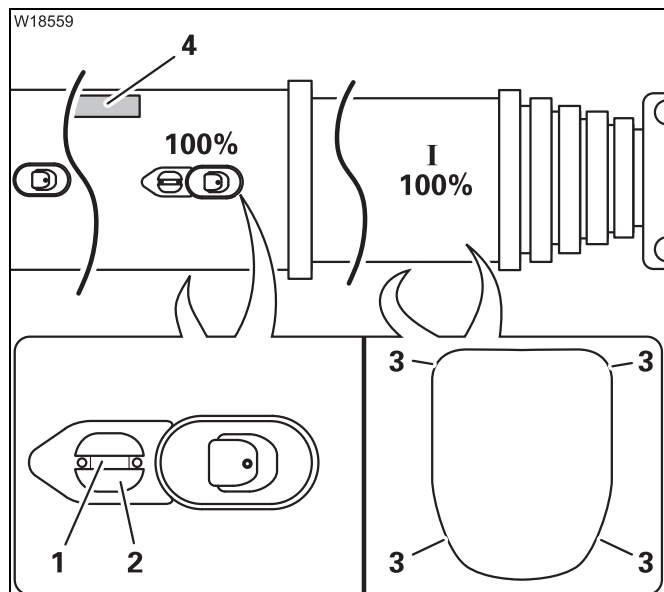
If the main boom has been telescoped **several** times, the telescoping mechanism and derricking gear can be so heavily loaded that the main boom can be neither telescoped nor derricked. Therefore note the following instructions:

- Before retracting the boom, raise it to approximately 15°.
- Do not lower the main boom below 0°.



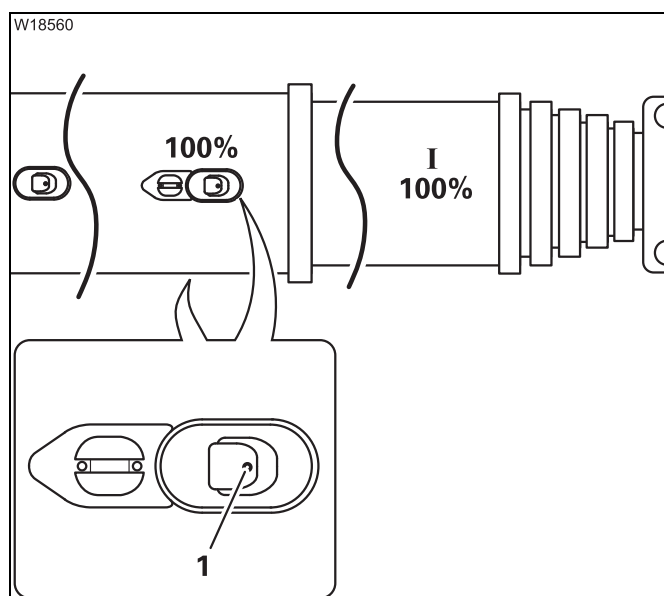
Telescopic section I

- Observe the following instructions regarding maintenance work.
- Extend the telescopic section I to 100%.



Lubricate the slide faces

- Use a brush or a roller (PAL1) to lubricate the outer, upper and outer, lower slide faces (3).
- Remove the plates (1) from both sides of the openings (2).
- With a torch, have a helper illuminate the inside through an opening, while you insert the spray extension in the other opening on the other side.
- Use the spray extension (PAL1) to lubricate the inner, upper slide faces (4) on both sides.
- Fasten the plates (1) on both sides of the openings (2).



Lubricating the locking pins

- Use the grease gun (RHUS 2 AF) to lubricate the locking pins at the grease nipples (1) on both sides.
- Lock and unlock the telescopic section I several times, so that the grease is distributed over the locking pins.

- Fully retract telescopic section I.
- Fully extend and retract telescopic section I again so that the grease is distributed over the slide faces.



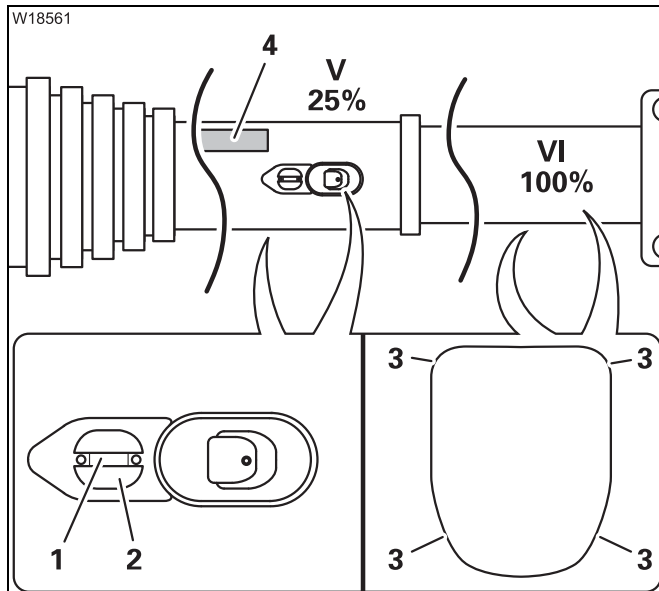
In case the grease has **not** covered the slide faces sufficiently, you must carry out the lubrication operation again.

Telescopic section VI - II

- Observe the following instructions regarding maintenance work.

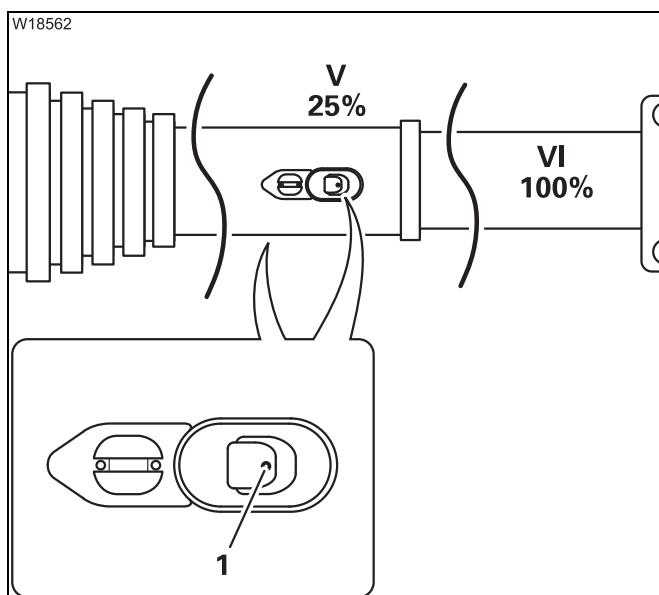
The following diagrams show the lubrication of the telescopic section **VI**. The telescope sections **V**, **IV**, **III** and **II** are lubricated in the same way.

- Extend the telescopic section **VI** 100% and the telescopic section **V** approx. 25%.



Lubricate the slide faces

- Use a brush or a roller (PAL1) to lubricate the outer, upper and outer, lower slide faces (3).
- Remove the plates (1) from both sides of the openings (2).
- With a torch, have a helper illuminate the inside through an opening, while you insert the spray extension in the other opening on the other side.
- Use the spray extension (PAL1) to lubricate the inner, upper slide faces (4) on both sides.
- Fasten the plates (1) on both sides of the openings (2).



Lubricating the locking pins

- Use the grease gun (RHUS 2 AF) to lubricate the locking pins at the grease nipples (1) on both sides.
- Derrick the main boom to 15°.
- Fully retract telescopic section **V**.
- Fully retract telescopic section **VI**.
- Lock and unlock the telescopic section **VI** several times, so that the grease is distributed over the locking pins.
- Fully extend and retract the telescopic section **VI** again so that the grease is distributed over the slide faces.
- Lower the main boom to 0°.

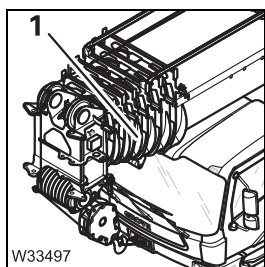


In case the grease has **not** covered the slide faces sufficiently, you must carry out the lubrication operation again.

- Lubricate the telescopic sections **V**, **VI**, **III** and **II** in the same way.



Before driving the truck crane



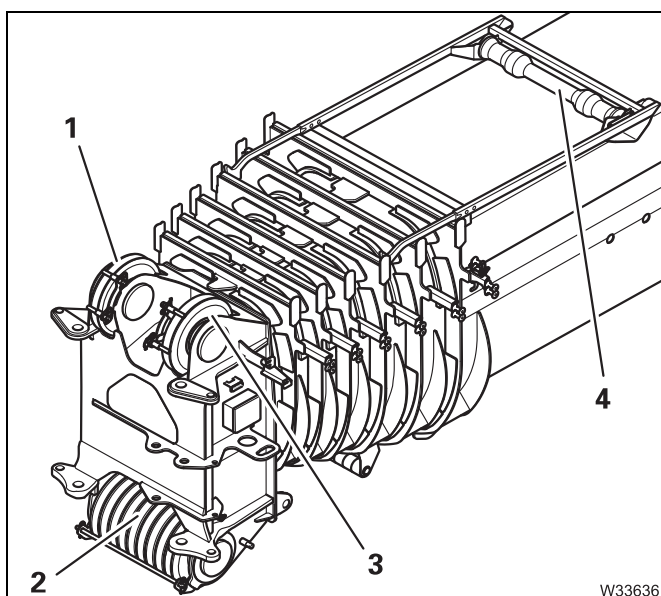
Fully retracting all telescopic sections of the main boom after greasing may result in excess lubricant paste emerging at the collar (1).

- Remove any excess lubricant paste from the collar (1). This is to prevent any lumps dropping off on to the windscreen and suddenly obstructing the view when driving.

8.10.3

Checking the sheaves

M 3



- Check all the sheaves (1) to (4) on the main boom head and on the bracket for damage, wear, mobility and for excessive dirt.

Have damaged, worn, stiff or extremely soiled sheaves replaced by **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

8.10.4

Checking the locking system

M 12



Risk of accidents if maintenance work is not carried out.

Have the maintenance work on the main boom locking system performed regularly by **Manitowoc Crane Care** or an authorised GROVE dealer.

This prevents the complete unlocking of a telescopic section in emergency operation/emergency program mode, which could cause serious accidents and damage to the truck crane.

- Have the main boom locking system checked regularly by **Manitowoc Crane Care** or an authorised GROVE dealer.

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8.11 Hoist ropes

8.11.1 Checking the winding

D



Risk of accidents when the rope drum is turning.

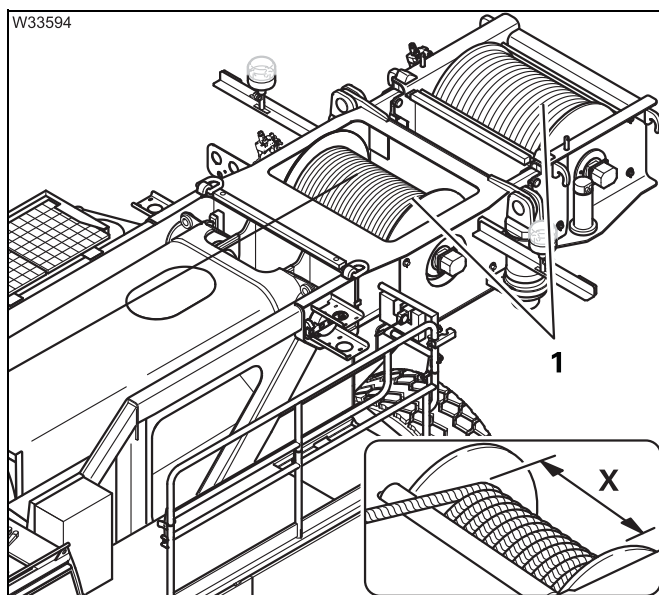
Keep away from the rope drum while it is turning.

This will prevent your limbs from being drawn in and getting crushed.

Prerequisites

- Camera monitoring of the hoists from the crane cab must be switched on; *Manual de instrucciones*.
- One hook block must be reeved; *Manual de instrucciones*.
- The main boom must be raised to about 30°; *Manual de instrucciones*.
- The engine must be started.

Checking



Always check the entire length of the winding of the ropes (1).

- Slowly perform the *lowering* movement until the rope has moved over the complete width (X) of the rope drum.
 - The rope must be evenly wound.
 - The rope turns on the drum must be evenly spaced at a distance of 0 to 2 mm (0 to 0.08 in).
 - The cross-over points must be offset by approximately 180°.



The ropes of the top layer lie over the ropes of the bottom layer at the cross-over points.

8.11.2




Checking the hoist ropes

W


Spare parts and tools


- Torque wrench for 78 Nm (57.5 lbf ft).

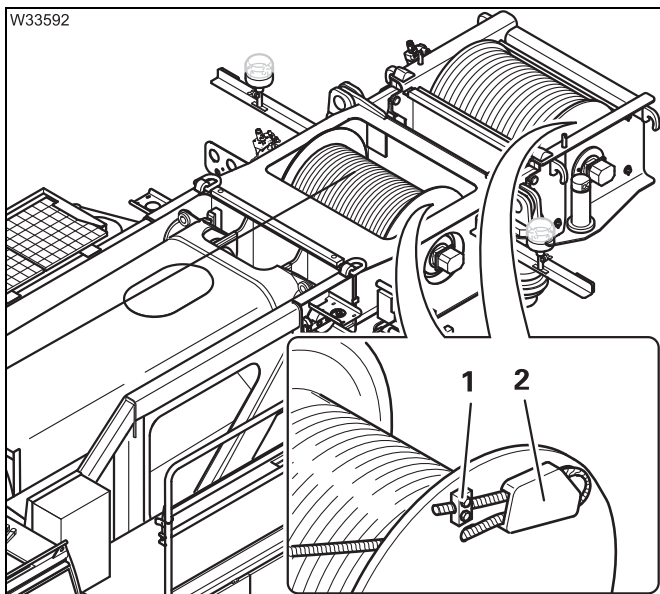
Prerequisites

- Establish a rigging mode in accordance with the *Lifting capacity table* and enter the RCL;  *Manual de instrucciones*.
- A hook block must be reeved 4-fold;  *Manual de instrucciones*.
- The main boom must be raised and fully extended;  *Manual de instrucciones*.

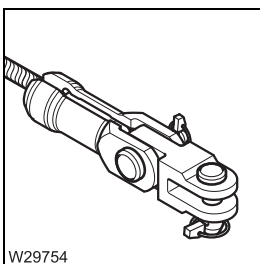
Checking the ropes


- Start the engine.
- Unreel the rope and check the rope and the rope spooling;  *Assessing the condition of the hoist rope*, p. 8 - 92. When 5 turns are left on the rope drum, the lowering limit switch must switch off.

If the lowering limit switch does not switch off or switches off too late, it must be reset;  *Setting the lowering limit switch*, p. 8 - 101.



- Check the clamp (1) for damage and firm seating – torque to 78 Nm (57.5 lbf ft).
- The free end of the rope must not project above the flanged wheel.
- The rope wedge must be in the pocket (2).
- The rope end on the rope wedge must not show any signs of wear.
- Reel in the rope. At the same time, the rope may not show any signs of kinking or being flattened.



- Check the end of the rope and the rope end fitting for damage.
- Make sure the rope end is correctly fitted in the rope end fitting;  *Manual de instrucciones*.

8.11.3

Lubricating the hoist rope

M 3

Grease, spare parts and tools

Designation	Quantity	GROVE part no.
Grease	1	03133770

- Brush, roller, spray gun, tray or pressure pump.

Lubricating the rope

- lubricating the rope
- significantly prolongs its service life and
- keeps the friction between the rope, the sheaves and the hoist drum as low as possible.

The lubricant is applied to the rope by

- spraying, brushing, rolling or
- by running it through a tray filled with lubricant or
- by means of high-pressure lubrication with a pressure pump.



The **Manitowoc Crane Group Germany GmbH** recommends high-pressure lubrication with a pressure pump (GROVE part no. 90018525) for reasons of sustainability, efficiency and environmental protection.

When lubricating the hoist ropes, observe the instructions concerning the lubricant.

When using the pressure pump, observe the manufacturer's separate operating instructions.

For further information, contact **Manitowoc Crane Care** or an authorised GROVE dealer.

8.11.4

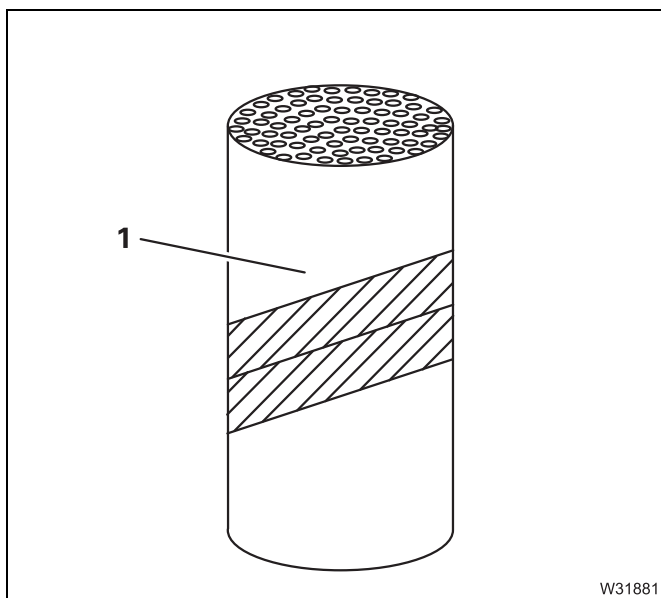
Assessing the condition of the hoist rope



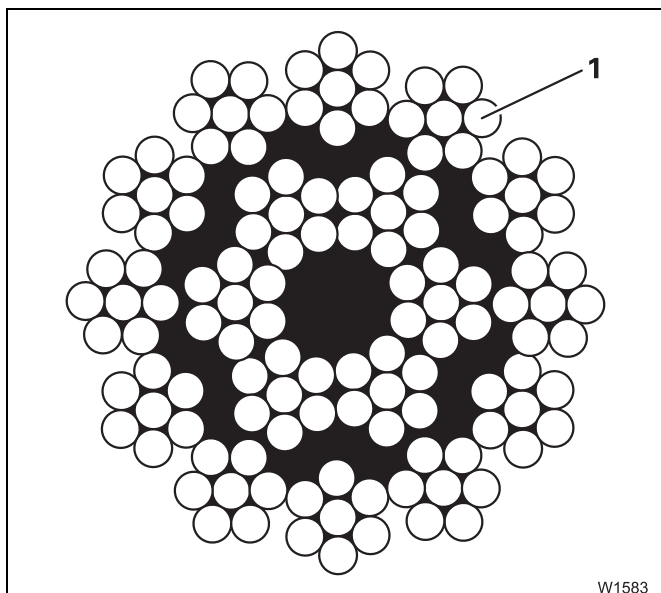
If in doubt about damage assessment, always consult an official inspector.

To assess the condition of the rope, you must be familiar with the following:

- the type of rope (lang lay rope)
- the number of load-bearing wires in the outer strands
- the rope diameter (☐☐☐☐ *Manual de instrucciones*).



In a lang lay rope (1) the wires run at an angle of approximately 45° to the longitudinal direction of the rope.



The number of load-bearing outer wires (1) is found by counting the number of outer strands of the rope and multiplying by 7.



If there are multiple layers of strands, only the outer layer is counted.

The **tables** show by rope diameter the number of wire breaks in a length 6 times and 30 times the rope diameter which if reached would require replacement of the rope.

- Familiarise yourself with DIN ISO 4309:2013-06 (rotation-resistant ropes).

This table applies only to the **hoist ropes** fitted as initial equipment and original replacement ropes.

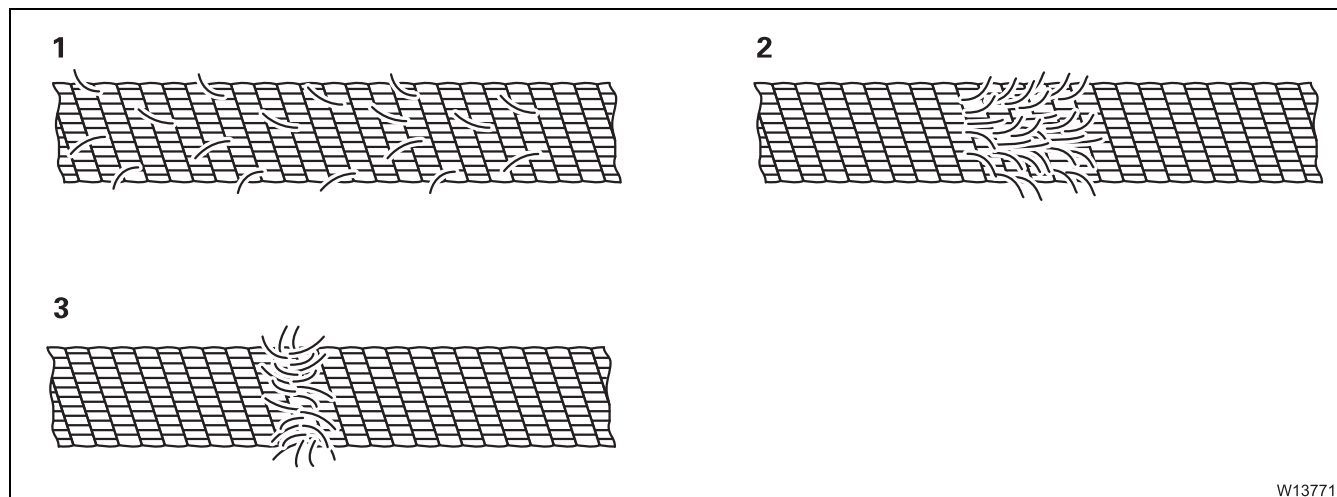
Number of visible wire breaks on a rotation-resistant hoist rope						
The rope section runs over a rope disc or on a drum wound as a single layer						
Number of load-bearing outer wires	Ø 13 mm		Ø 16 mm		Ø 17 mm	
	to 78 mm	to 390 mm	to 96 mm	to 480 mm	to 102 mm	to 510 mm
101-120	3	5	3	5	3	5
121-140	3	5	3	5	3	5
	Ø 19 mm		Ø 22 mm		Ø 24 mm	
	to 114 mm	to 570 mm	to 132 mm	to 660 mm	to 144 mm	to 720 mm
101-120	3	5	3	5	3	5
121-140	3	5	3	5	3	5
The rope section is running on a drum wound as multiple layers						
	Ø 13 mm		Ø 16 mm		Ø 17 mm	
	to 78 mm	to 390 mm	to 96 mm	to 480 mm	to 102 mm	to 510 mm
101-120	5	10	5	10	5	10
121-140	6	11	6	11	6	11
	Ø 19 mm		Ø 22 mm		Ø 24 mm	
	to 114 mm	to 570 mm	to 132 mm	to 660 mm	to 144 mm	to 720 mm
101-120	5	10	5	10	5	10
121-140	6	11	6	11	6	11





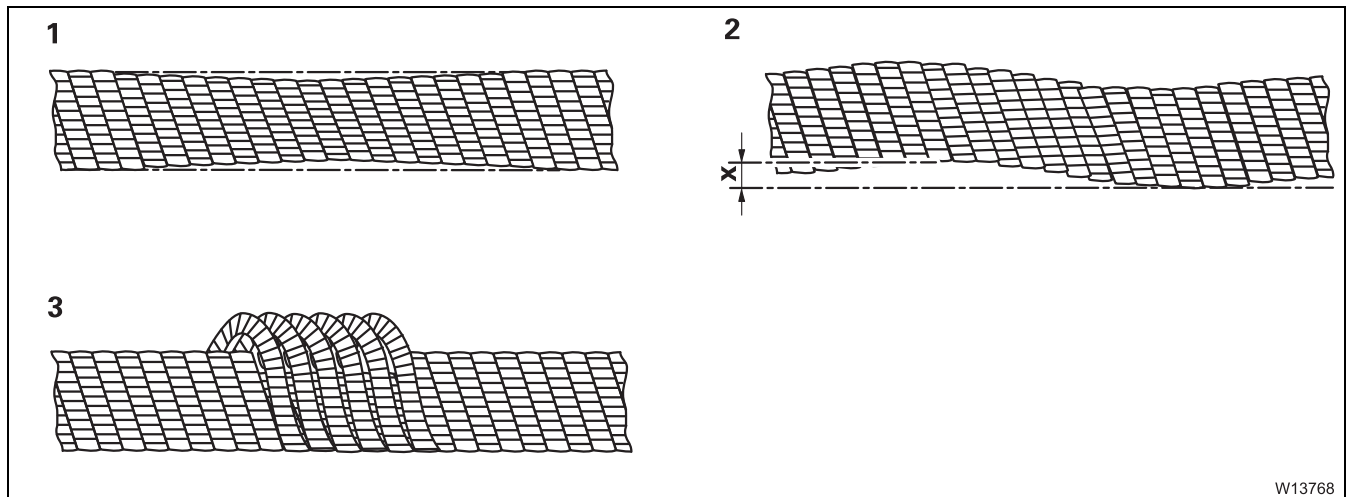
Risk of accidents due to reduced load bearing capacity.

Remember that other factors may also make it necessary to replace a rope before the number of wire breaks requiring rope replacement has been reached (age of rope, frequency of use or exceptional loading).



W13771

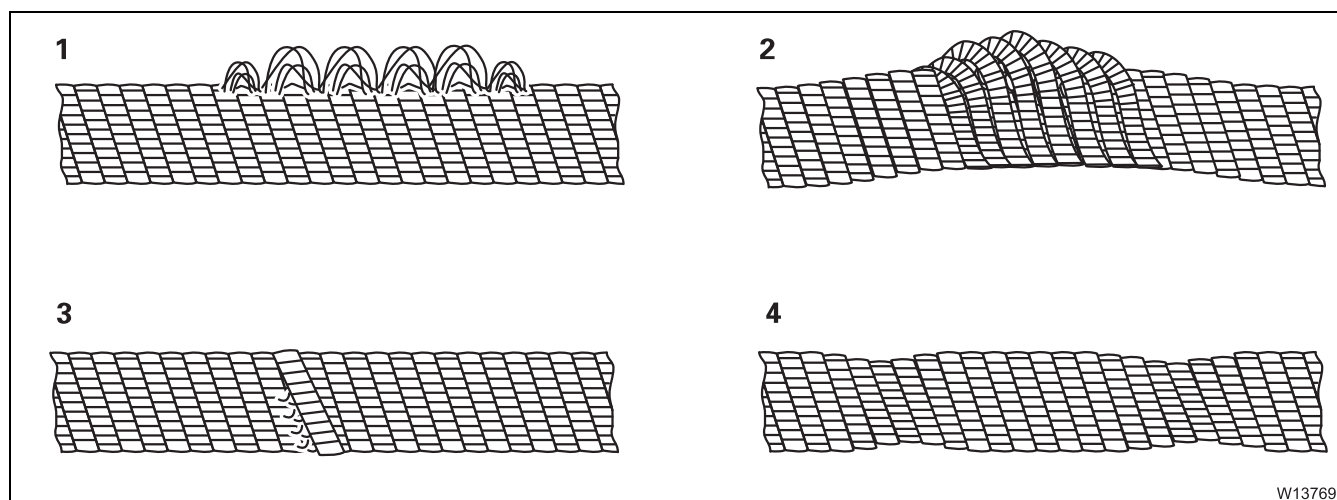
Damage	Description	Cause	Replacement
Wire break (1)	Individual wires are broken; the broken ends of the wires are protruding from the rope.	General wear caused by ageing of the rope or consequential damage as a result of damage to the rope.	Replace the rope at the latest when the maximum permissible number of wire breaks according to the table are visible externally. Replace the rope immediately if wire breakage clusters or strand breakages occur. The frequency of wire breaks increases with a rope's age. For reasons of safety, it is advisable to replace the rope while the number of wire breaks is still low.
Wire breakage cluster (2)			
Strand breakage (3)			
Effect of heat	Tarnishing colour is visible externally on the rope.	Rope has been subjected to excessive heat.	Replace the rope immediately .



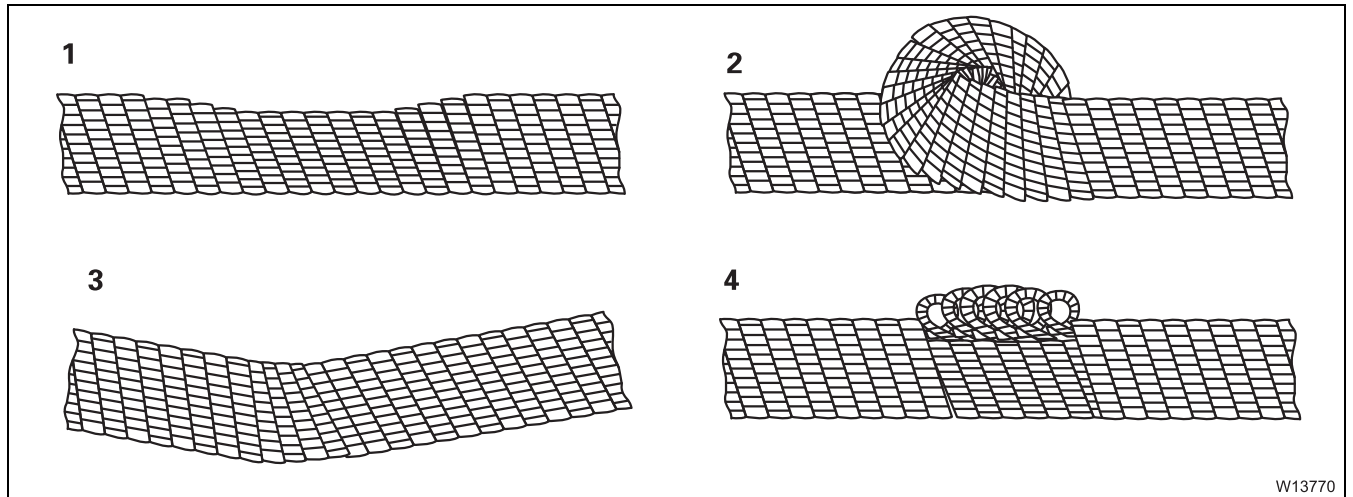
W13768

Damage	Description	Cause	Replacement
Reduced diameter (1)	The diameter of the rope has become smaller along large sections.	Structural changes	Replace the rope immediately if the diameter has decreased by 15% or more compared to the nominal diameter.
		Corrosion or abrasion.	Replace the rope immediately if the diameter has decreased by 10% or more compared to the nominal diameter.
Corkscrew-type rope deformation (2)	The rope winds its way along its longitudinal axis in a way that is similar to a corkscrew. Deformation is measured with suspended hook block.	Damage resulting from overloading.	Even a small amount of deformation leads to increased abrasion, wire breaks and rough operation of the rope drive. If deformation 'x' at a position on the rope is greater than a third of the rope diameter, the rope must be replaced immediately .
Basketlike deformation (3)	Wires of the outer layer protrude. In other areas of the rope, the insert has buckled or is protruding from the rope.	Outer and inner layers have been displaced in relation to each other.	Replace the rope immediately .





Damage	Description	Cause	Replacement
Loop formation (1)	Outer layer wires in the form of hair pins are protruding from the rope away from the sheave.	General wear due to ageing of the rope or consequential damage as a result of damage to the rope.	Immediately replace rope if the rope structure has been substantially altered by the loop formations.
Loosening of wires or strands (2)	Outer wires or strands have become loose. Only the inner strands continue to bear the load.	Corrosion or abrasion.	Replace the rope immediately .
		Other causes.	The number of wire breaks determines when the rope must be replaced.
Knot formation (3)	If there is repeatedly occurring knot-like thickening of the rope; the insert comes out frequently. Strands bear on each other at thin points; increased frequency of wire breaks.	General wear due to ageing of the rope or consequential damage as a result of damage to the rope.	Determine number of wire breaks; replace rope immediately if serious knot formation occurs.
Constriction (4)	Diameter reduction over short sections.	General wear caused by ageing of the rope.	Replace rope immediately if serious constrictions are detected.




Damage	Description	Cause	Replacement
Flattening (1)	Crushed areas, mostly with wire breaks.	Mechanical damage, e. g. due to driving over the rope.	Determine number of wire breaks; replace rope immediately if serious crushing has occurred.
Kinks (2)	Rope deformation with twists and wire breaks.	Rope in the eyelets was pulled straight while twisted.	Replace the rope immediately .
Buckling (3)	Buckled section in the rope.	Mechanical damage.	Replace the rope immediately .
Crinkling (4)	Crinkling rope deformation.	Loaded rope was pulled over an edge.	Replace the rope immediately .

8.11.5

Replacing the hoist rope

Spare parts and tools


- An authentic replacement rope;  *Rope certificate*.
- A reel stand with braking block.
- Torque wrench for 78 Nm (57.5 lbf ft).





Risk of accidents from falling load.

Use only a replacement rope that has the same technical specifications as the defective rope, or an authentic replacement rope.

Prerequisites

- The truck crane must be level.
- The main boom is set down on the boom rest.
- The hook block must be unreeved;  *Manual de instrucciones*.

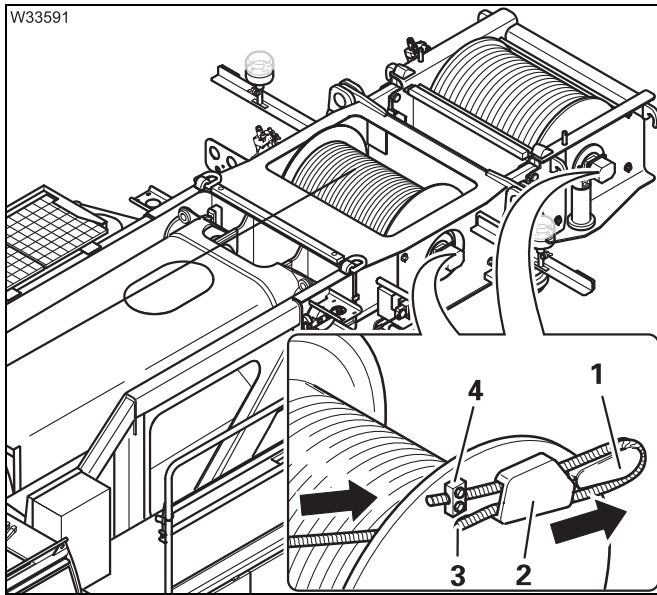
Replacing the old rope

- Unreel the hoist rope until it switches off.
- Adjust the lowering limit switch so that you can unreel the rope completely;  *Setting the lowering limit switch*, p. 8 - 101.
- Unreel the remaining layers from the hoist drum.
- Protect the truck crane from unauthorised use;  p. 2 - 3.



Risk of accidents due to the rotating rope drum

Switch the engine off and remove the ignition key so that no unauthorised operation of the hoist can occur.

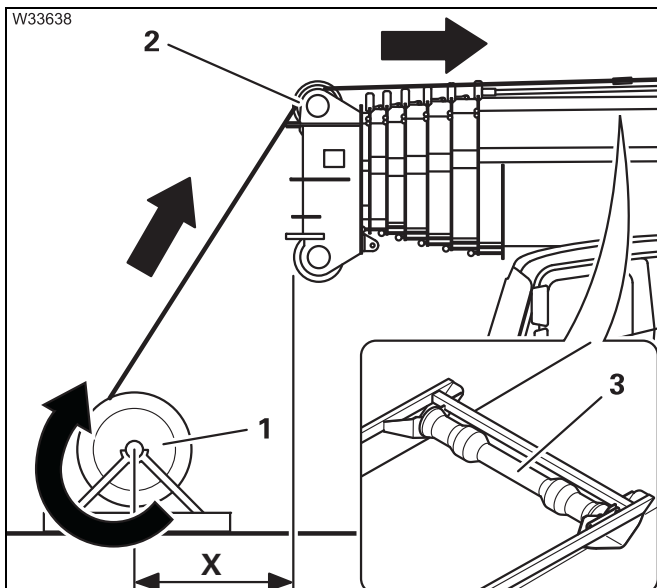


- Remove the clamp (4).
- Push the rope through the bore (3) until the rope wedge (1) slides out of the pocket (2).
- Remove the rope wedge and place the old rope away from the truck crane.

Inserting a new rope

The service life of a rope can be significantly affected by the insertion procedure. Errors can significantly reduce the service life, therefore:

- Make sure the rope is not twisted when it is inserted.
- Avoid soiling and damage when fitting.
- Wind the rope up in the same direction in which the rope is reeled on to the reel.
- Tense the rope slightly while winding it up.



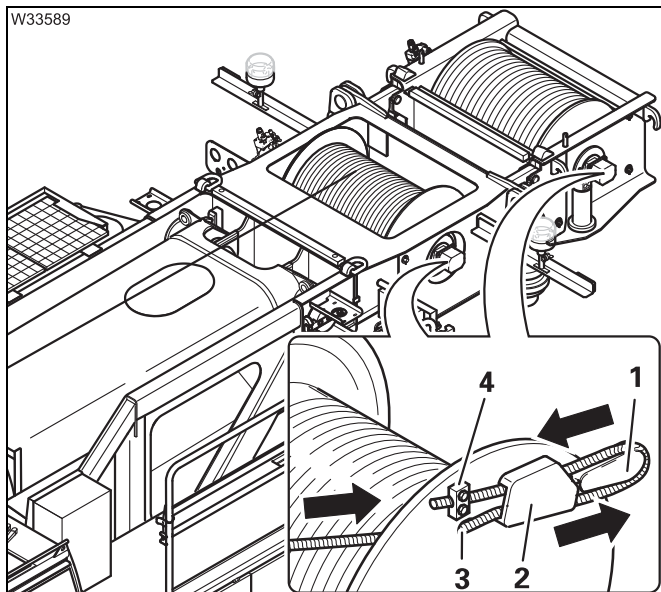
- Place the reel stand (1) with the new rope in front of the main boom head.

The distance (X) between the reel stand (1) and the head sheave (2) must be at least 30 m so that the rope runs over the head sheave as straight as possible.

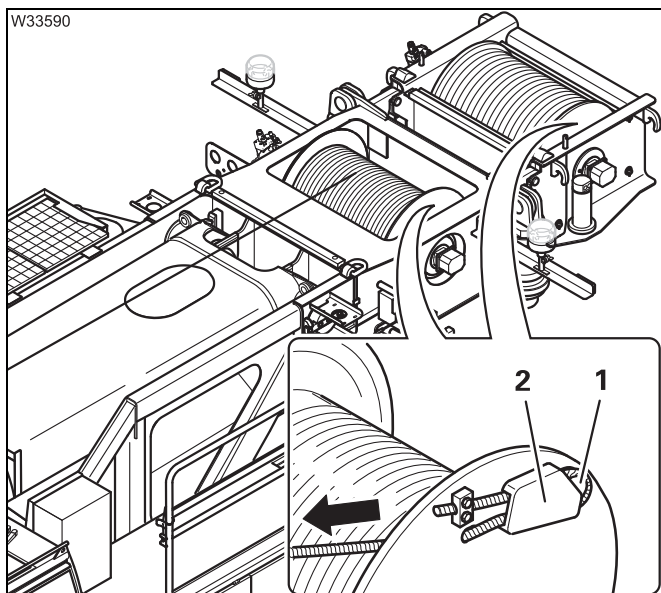
Ensure that the rope is being rolled on to the drum with the right slewing direction.

- Guide the rope over the head sheave (2) and under the bracket (3) up to the hoist drum.






- Guide the rope through the hole (3) until it protrudes about 1.5 m (5.0 ft) beyond the pocket (2).
- Feed the free end of the rope back through the pocket.
- Secure the clamp (4) and tighten it – torque to 78 Nm (57.5 lbf ft).
- Place the rope wedge (1) in the loop.



- Push the rope back until the rope wedge (1) is fully in the pocket (2).
- Ensure that the rope wedge, loop and rope end do not protrude beyond the flanged wheel. This will prevent damage.

- Start the engine.
- Hold the rope taut and wind up the rope slowly.
- Reeve a hook block - reeve it at least 4 times;  *Manual de instrucciones*.
- Raise the main boom to a steep position and extend it fully.
- Unwind the rope until only five turns remain on the rope drum.



Observe the hook block when unreeling.
The hook block must not rotate.



Risk of accidents if the lowering limit switch is set incorrectly.

After inserting a new rope, the lowering limit switch must always be reset. In this way you avoid the lowering limit switch switching off too late or not at all, the rope being damaged and the load being dropped.

- Set the lowering limit switch; p. 8 - 101.
- Run in the new rope with small loads so that the rope can settle on the hoist drum.

8.11.6

Setting the lowering limit switch

A lowering limit switch is mounted both on the main hoist and on the auxiliary hoist.

Spare parts and tools

Designation	Quantity	GROVE part no.
Cover gasket	2	02315305

Prerequisites

- A hook block must be reeved 4-fold; *Manual de instrucciones*.
- The main boom is fully raised and extended; *Manual de instrucciones*.
- The hook block is lowered until only five turns of the rope remain on the hoist drum.

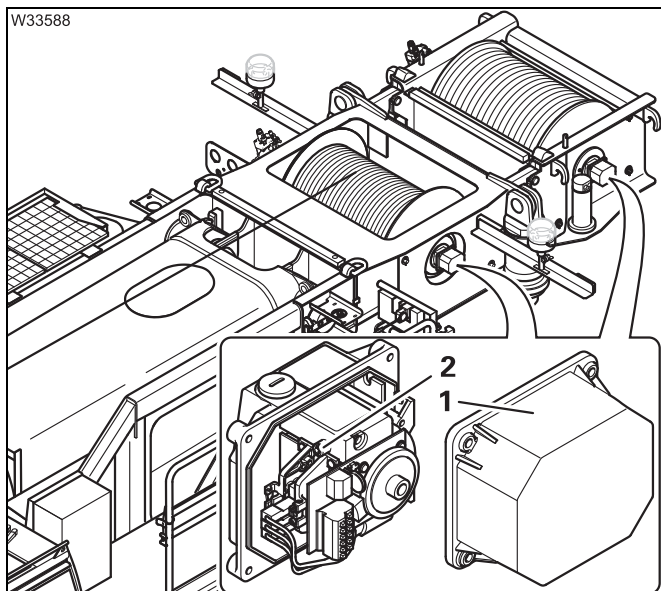


Setting the lowering limit switch



Risk of accidents if the rope end fitting is overloaded

The lowering limit switch must always be reset after repair work on the hoist and after rope replacement. A faulty lowering limit switch must always be replaced.



- Remove the cover (1).
- Turn the screw (2) until you hear the switch activate.
- Screw the cover on again.
Replace the gasket if necessary.
- Check that the lowering limit switch switches off the hoist correctly.

Checking switch-off

- Raise the hook block until there are approx. 10 turns on the hoist drum.
- Lower the hook block and check whether the lowering limit switch switches off properly.

The lowering limit switch must switch off the hoist while five rope turns are still on the hoist drum.

- Correct the setting of the lowering limit switch if necessary.

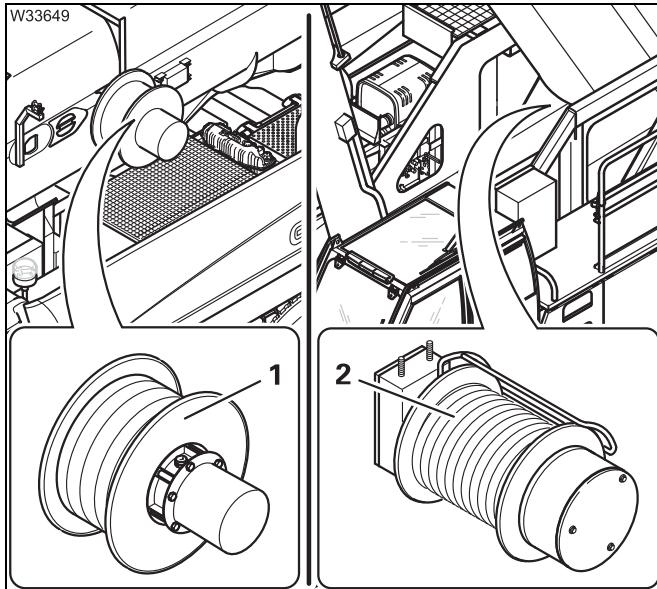
8.12

Cable drums and slewing angle sensor

8.12.1

Maintenance of the slip ring assemblies

M 6



The slip ring assemblies are located in:

- 1 Cable drum 1
- 2 Cable drum 2


Spare parts and tools

Designation	Quantity	GROVE part no.
Cover gasket for cable drum 1	1	03325575
Cover gasket for cable drum 2	1	03137971


- Clean, lint-free cloth.
- Dry, oil-free compressed air.

Prerequisites


For cable drum 1

- The main boom must be set down on the support;  *Manual de instrucciones*.

For cable drum 2

- The main boom must be fully raised;  *Manual de instrucciones*.
- The cover plate in front of the cable drum 2 is removed.

For cable drums 1 and 2

- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The selector handle must be removed from the battery master switch.





Risk of damage to the RCL.

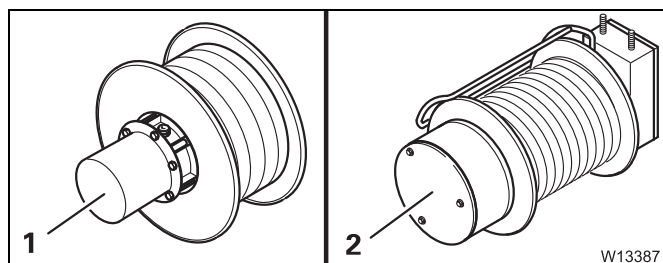
Before maintenance work on the slip ring assemblies, always switch off the battery master switch so that the cable drum is without power. This prevents short circuits which may lead to damage to the rated capacity limiter (RCL).



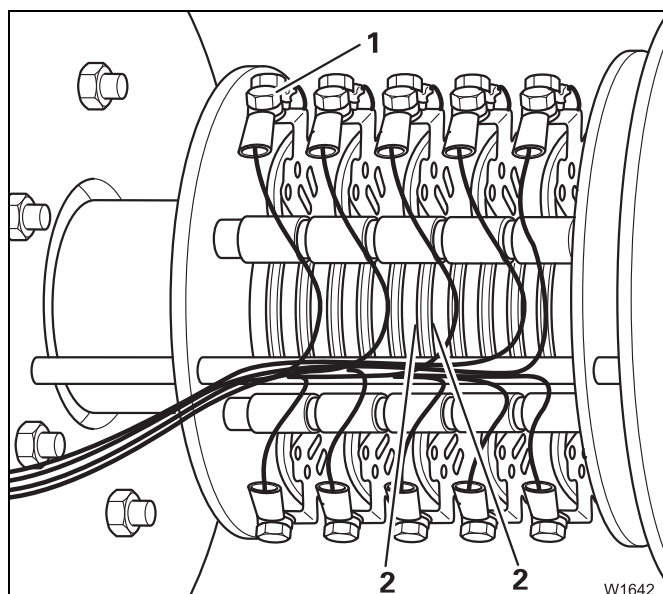
Risk of crushing from movement of the main boom.

Perform maintenance work only after the truck crane has been shut down. Always ensure that the truck crane is protected from unauthorised use before beginning maintenance work. Remove the keys from the crane cab and put up warning signs.

Maintenance of the slip ring assemblies



- Remove the cover (1) or (2).
- Clean and dry the cover.
- Replace the gasket if necessary.



- Only use a cloth and compressed air to remove any dirt on the slip rings (2).
- Do **not** use spray oil.
- Check to make sure all screws (1) are tight.
- Attach the cover to the cable drum.

8.12.2

Lubricating the slewing angle sensor

Y 5


Grease, spare parts, tools

Lubricating grease	Designation according to DIN 51502	Specification Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

Designation	Quantity	GROVE part no.
Gasket 16 x 20 Cu DIN 7603	1	00117134

- Grease gun from the tool set.
- Sealing agent (e.g. Hylomar).
- Torque wrench for 25 Nm (18.5 lbf ft).

Prerequisites

- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

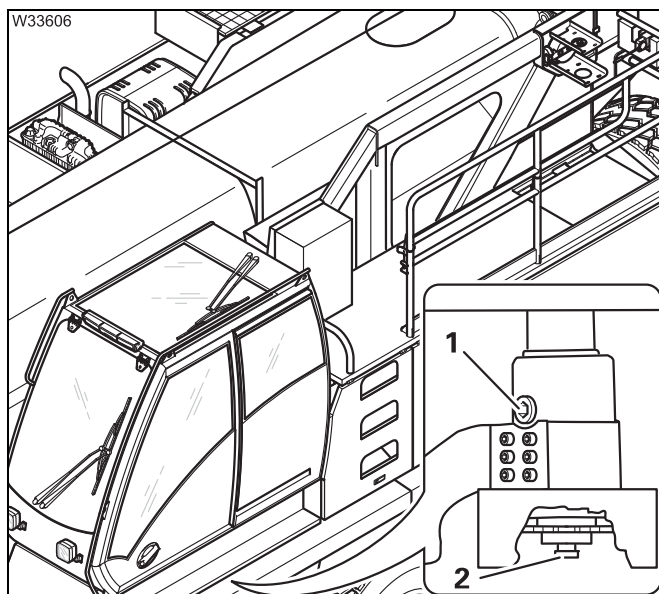


Risk of damage to the slewing angle sensor.

Before lubricating, always remove the screw from the slewing angle sensor.

This prevents the slewing angle sensor from damage.

Lubricating



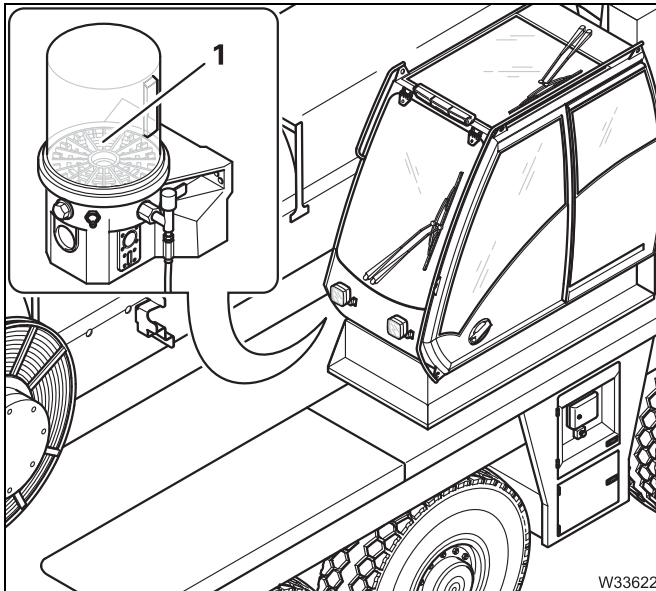
- Remove the drain plug (1).
- Clean the grease nipple (2) and inject about 5 cm³ (0.3 in³) of grease.
- Remove any excess grease, and close the grease nipple.
- Tighten the bolt with a new gasket and sealing agent – torque 25 Nm (18.5 lbf ft).

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8.13 Central lubrication system

8.13.1 Checking the level

W



The maintenance of the pump (1) is the same as the maintenance on the carrier; ■■■► *Central lubrication system*, p. 7 - 99.

Connected lubricating points

- Main hoist drum,
- Slewing bearing,
- Telescopic unit – pivot pins,
- Derricking cylinder – pivot pins

Lubricating points not connected

- Auxiliary hoist drum; ■■■► p. 8 - 43.

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8.14 Hook blocks

8.14.1 Checking the sheaves


M 3

- Check the sheaves in the hook blocks for damage, wear, mobility and extreme soiling.

Have damaged, worn, stiff or extremely soiled sheaves replaced by **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

8.14.2 Lubricating

M 12


- Comply also with the  *Running-in regulations*, p. 4 - 1.

Grease, spare parts, tools

Lubricating grease	Designation according to DIN 51502	Specification Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set.

Prerequisites

- The hook block has been reeved at least twice;  *Manual de instrucciones*.

Lubricating

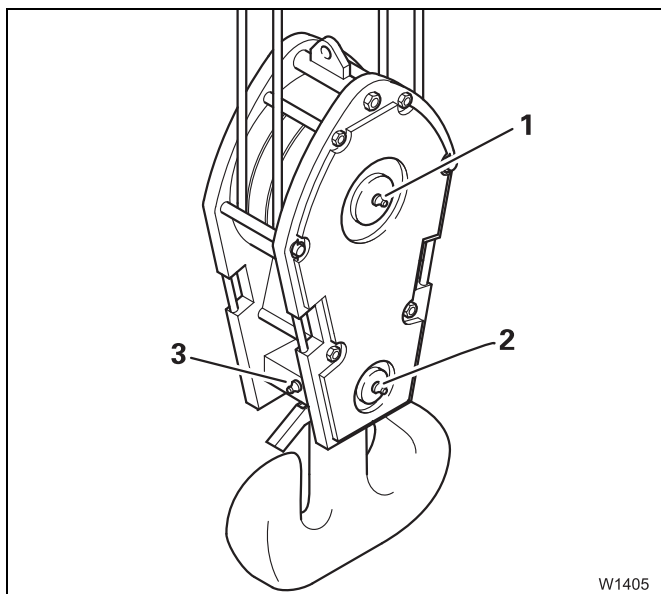
On the hook blocks supplied, the sheaves, crossheads and load hooks of the axial bearings are greased.



The sheaves on the hook block often have no grease nipple and are maintenance-free.

- Check all hook blocks for grease nipples. Hook blocks with grease nipples must be serviced, hook blocks without grease nipples are maintenance-free.





The diagram gives an example of the arrangement of the grease nipples (1), (2) and (3) on a hook block.

There are more grease nipples on the other side.

- Clean the grease nipples on all hook blocks and grease them using a grease gun.

Having them dismantled

Depending on the manufacturer, there are different maintenance intervals for the dismantling of the hook blocks. The maintenance-free sheaves are also greased at this time. Some manufacturers recommend dismantling every 4 years or after 500 operating hours.

- Ask **Manitowoc Crane Care** about the maintenance intervals for the hook blocks supplied to you.
- Have the hook blocks dismantled by **Manitowoc Crane Care** or an authorised GROVE dealer or your qualified repair crew.

8.15

Electrical system

8.15.1

Checking the lighting and indicators

D

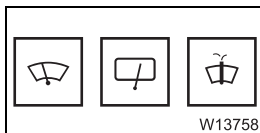


Risk of accidents if the safety devices are faulty!

Have faulty lights and indicators repaired by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

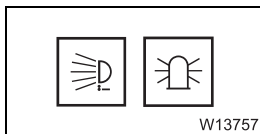
- Check the lamps and displays on the *ECOS* and *RCL* control units;
 ▣▣▣▣▶ *Manual de instrucciones*.

- Check the following functions:



W13758

- Windscreen wipers, windscreen washing system



W13757

- Spotlight on the crane cab, air traffic control light
- Spotlight on the main boom (xenon light)
- Horn, anemometer
- Camera lights on the main and auxiliary hoists.



Risk of accidents from exploding glass bodies and high voltage.

The glass bodies of gas discharge lamps (xenon lights) are pressurised. If the lamp breaks, the glass splinters explosively and shards scatter. Xenon lights operate at high voltage. While changing the lamp, there is still a danger of residual voltage discharging (electric shock) even when the battery master switch is switched off.

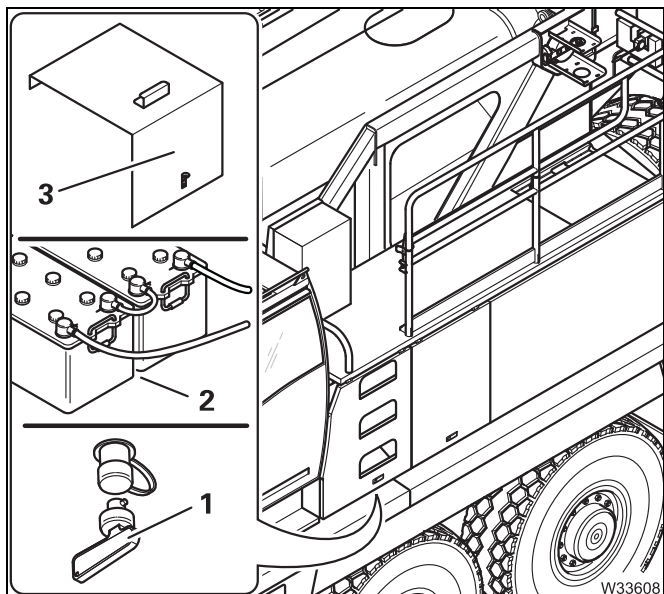
Have faulty lamps replaced only by properly qualified personnel who use the relevant protective equipment.

- Have faulty lamps in the spotlights replaced only by qualified personnel.

8.15.2

Checking the batteries

M 1



- Switch the battery master switch (1) off and remove the selector handle.
- Remove the cap (3) from the battery box.
- Check the batteries (2) in the same way as when checking them on the carrier;
 ▣▣▣▣▶ *Checking the batteries*, p. 7 - 104.
- Screw the cap on the battery box again.

8.15.3

Checking the charge level of the batteries

M 3


- Check the charge level in the same way as when checking it on the carrier;
 ▣▣▣▣▶ *Checking the charge level of the batteries*, p. 7 - 106.

8.15.4


Charging the batteries using the battery charger

M 3

Prerequisites

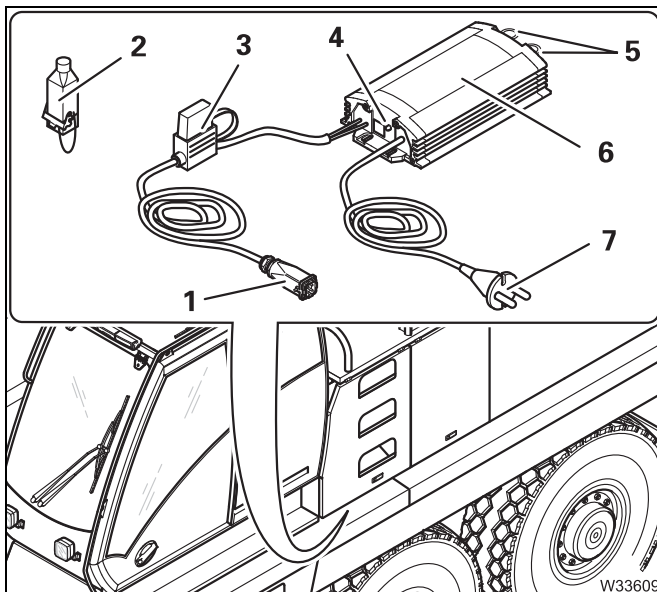
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- An external 230 V mains power supply must be available at the location.
- The battery charger (GROVE part no. 03320239; additional equipment) must be available.
- The location must be well ventilated and protected against moisture. The battery charger may not be used at locations where there is risk of a gas or dust explosion.

Battery charger

- Familiarise yourself with the correct operation of the battery charger;  *Separate engine operating instructions, provided by the manufacturer.*

Connecting

- Take the battery charger out of its storage compartment in the driver's cab.



- Insert the plug (1) into the socket (2) on the battery box.
- Place the battery charger (6) in a protected place where you can see the indicator lamp (4). The battery charger can be suspended from the ring eyes (5).
- Insert the plug (7) into the socket on the mains supply 230 V at the location. The indicator lamp (4) flashes – the charging process starts.
- If the indicator lamp (4) does not flash, check the fuse (3).

Charging

- Check the charging process at the indicator lamp (4).

Indicator lamp flashing: The batteries are being charged.

Indicator lamp lit continuously: The batteries are fully charged.

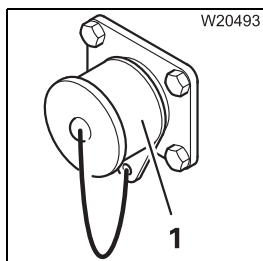
After completion of charging

- Remove the plug (6) from the 230 V mains supply.
- Remove the plug (1) from the battery box.
- Return the battery charger to the storage compartment in the driver's cab.

8.15.5

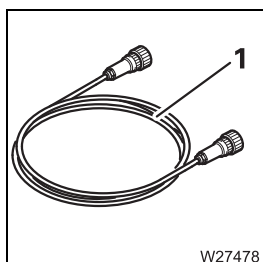
Check the external starting socket

M 3



The battery box can be equipped with an external starting socket (1) as additional equipment.


Accessories



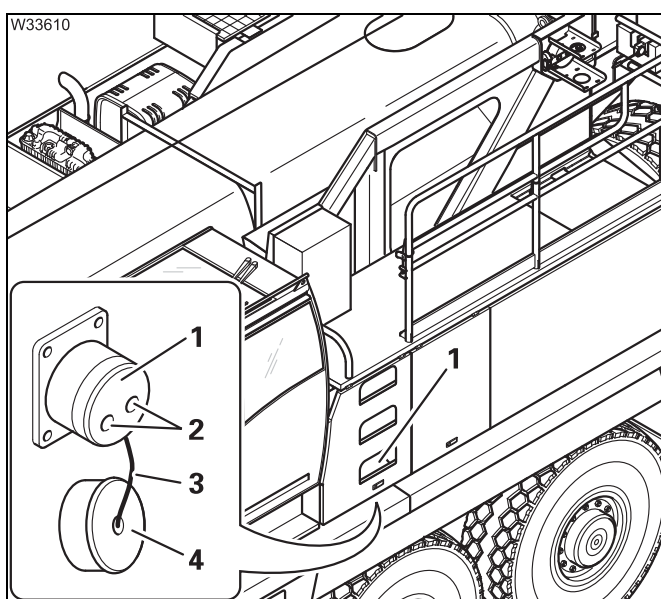
A connection cable (1) for the external starting socket is supplied with the truck crane (tool set).

Designation	GROVE part no.
Connecting cable with two plugs; Length 12 m	03143281

The battery box can also be equipped with a battery charger as **additional equipment**.

- Consult the operating instructions supplied with the battery charger and regularly check that all components are functioning correctly to ensure that the external starting socket, connecting cable and battery charger are ready for operation if needed;  *Manual de instrucciones*.

Checking

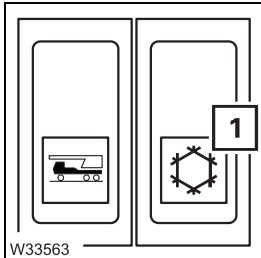


- Remove the cap (4) from the socket (1).
- Check that the cap is not damaged and is secured with the chain (3).
- If necessary, clean the poles (2).
- Attach the cap – the cap must be fitted tightly and compactly on the socket.

8.16 Air conditioning system

8.16.1 Checking the air-conditioning system

M 1



- Check the air-conditioning system (1) in the same way you check it on the carrier; → *Checking the air-conditioning system*, p. 7 - 111.

8.16.2 Checking hoses

M 6



Risk of burns due to escaping refrigerant.

Wear suitable safety glasses and gloves when checking the hoses and connections.

This will prevent injury from suddenly escaping refrigerant. Seek medical attention if the skin or eyes come into contact with the refrigerant.

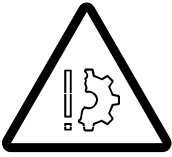
- Check all refrigerant hoses for damage and areas of wear.

Have damaged hoses checked by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop only.

8.16.3

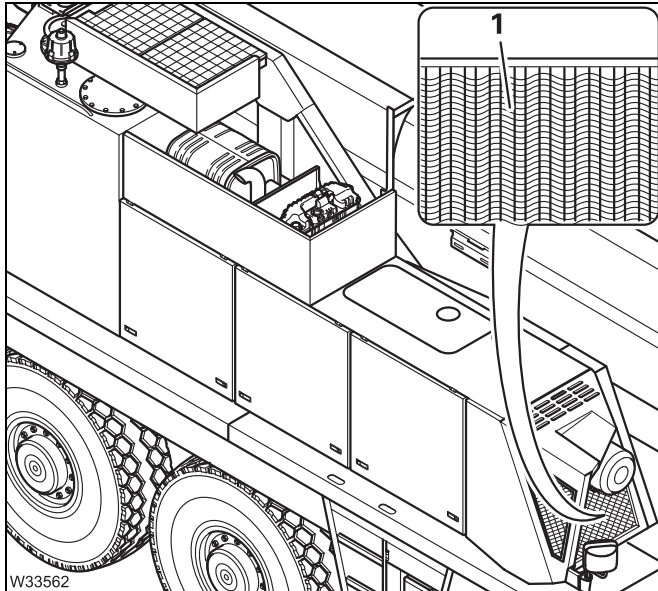
Cleaning the condenser fins


M 12



Risk of damage to the condenser.

Do not use a high pressure cleaner or steam jet cleaner. The powerful jet may damage the fins. Use only compressed air for cleaning.



- Switch the air-conditioning system off.
- Clean the condenser fins (1) with compressed air;  Have the radiator checked/cleaned, p. 8 - 17.

8.16.4

Checking the entire air-conditioning system

M 12



This inspection may only be performed by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.



Risk of burns due to escaping refrigerant.

Wear suitable safety glasses and gloves when checking the hoses and connections.

This will prevent injury from suddenly escaping refrigerant. Seek medical attention if the skin or eyes come into contact with the refrigerant.

- Have the entire air-conditioning system checked for leaks and proper functioning.

The inspection of the air-conditioning system particularly includes the inspection of

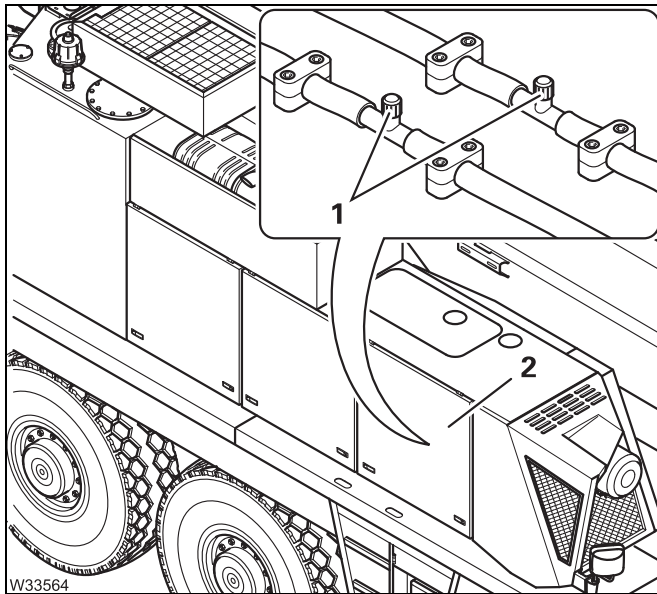
- the refrigerant collector, in accordance with the pressure container regulations (test group II) and
- the refrigerant compressor.

Only allow the system to be topped up with suitable refrigerant.

Refrigerant

Fill quantity in kg (lbs)	Designation	CAS no. EC no.
1.1 (2.4)	Tetrafluoroethane (R134a)	811-97-2 212-377-0

Filler connections



The filler connections (1) for the refrigerant are behind the flap (2).

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8.17 Other maintenance work

8.17.1 Checking the windscreen washing system

W

Water, spare parts, tool

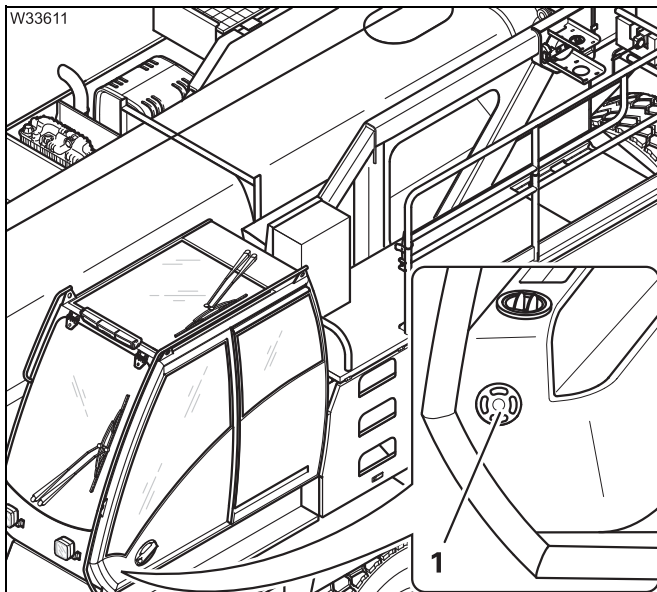
Designation	Quantity	GROVE part no.
Windscreen wiper blade	1	03326121
Roof wiper blade	1	03326121

- Water; add commercially available detergent and antifreeze to it.
- A can for mixing and filling.

Prerequisites

- The crane cab door is pushed back - the filler neck with the cap (1) is accessible.

Topping up




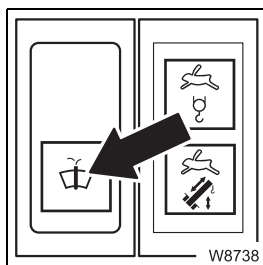
If the tank is empty

- Open the cap (1) on the filler neck.
- Top up the windscreen washing fluid through the filler neck.
- Close the filler neck with the cap.

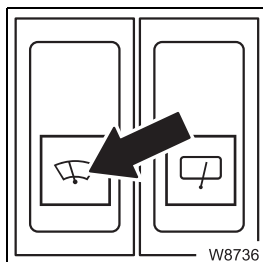


Wiping

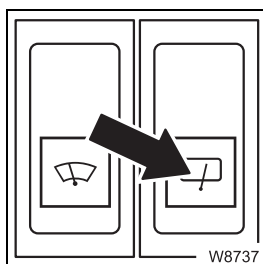
The wiping/washing system operation is described in the accompanying operating instructions;  *Manual de instrucciones*.



- Spray water on the **windscreen** – press **down** on the switch.
- Spray water on the **skylight** – press **up** on the switch.



- Switch on the **windscreen wiper** – press the switch **down** for continuous operation.
- Also check intermittent operation – push the switch in the middle position.
- Switch off the **windscreen wiper** – press the switch **up**.



- Switch on the **roof window wiper** – press the switch **down** for continuous operation.
- Also check intermittent operation – push the switch in the middle position.
- Switch off the **roof window wiper** – press the switch **up**.

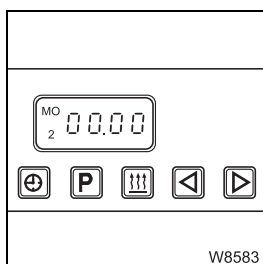
In case the windscreen/skylight is not wiped clean:


- Change the wiper blade.

8.17.2

Checking the functioning of the auxiliary heater

M 1



Check the auxiliary heater in the same way you check it on the carrier;
 *Checking the functioning of the auxiliary heater*, p. 7 - 125.

8.17.3

Lubricating the crane cab door


M 12

Grease, spare parts, tools

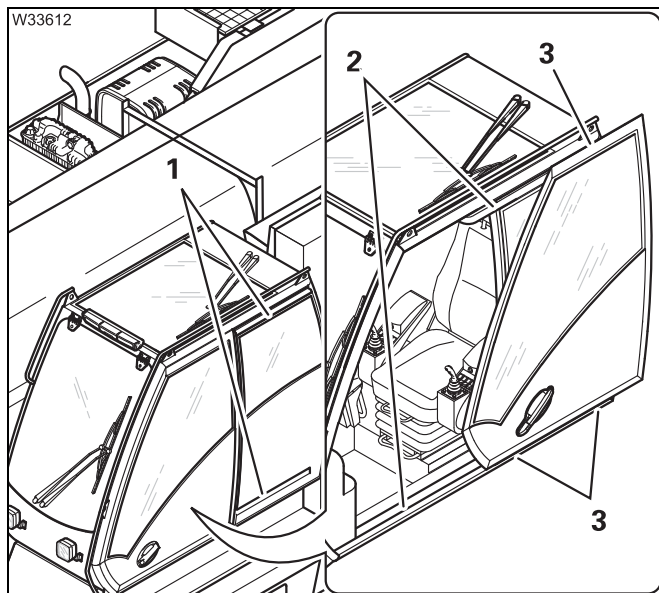
Designation	GROVE part no.
Grease: RHUS 2 AF, 1 kg can	03325215

- Brush.

Prerequisites

- The turntable is locked.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Lubricating



- With the door closed, clean the rails (1) outside.
- Lubricate the rails (1) lightly with a brush.
- Open the door completely using the handle – the door locks in place.
- Clean the rails (2).
- Lubricate the rails (2) and the rollers (3) lightly with a brush.
- Check if the door moves smoothly on the rails and if it locks easily.

If the door is sluggish or does not close properly, have it reset by **Manitowoc Crane Care** or an authorised GROVE-dealer.

8.17.4

Lubricating the step

M 12


As additional equipment, the truck crane GMK6300L can be fitted with a pull-out step on the crane cab.

Grease, spare parts, tools


Designation	GROVE part no.
Lubricant RHUS 2 AF; 1 kg (Apply the grease with a brush)	03325215

- Brush.

Prerequisites

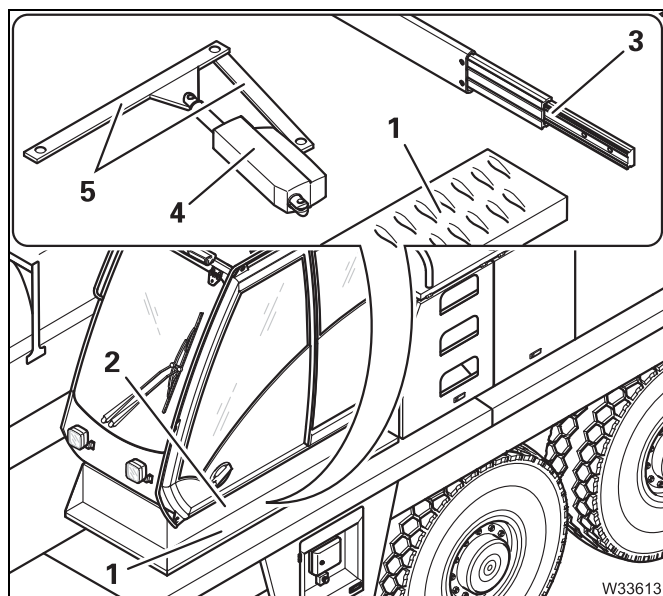
- The turntable must be locked.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Retracting/ extending

- Familiarise yourself with the description in the operating instructions of retracting/extending the step (from the crane cab or at the outrigger control unit);  *Manual de instrucciones*.

Lubricating

- Fully extend the step.



- Remove the step (1) and the grille (2) – the rails (3) are now exposed.
- Clean the rails (3) and the linkage (5).
- Lubricate the rails (3) and the linkage (5) lightly with a brush.
- Retract and extend the step several times. Whilst doing so, check that the step is moving easily on the rails.
- Check that the electric spindle motor (4) is running smoothly and without jerking.
- Attach the step (1) and the grille (2).

- Fully retract the step.

If the step is stiff, bent or does not retract completely, have the step aligned and adjusted by **Manitowoc Crane Care** or an authorised GROVE dealer.

8.17.5

Lubricating the connecting and socket pins

M 12

Grease, tools

Lubricating grease	Designation according to DIN 51502	Specification Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

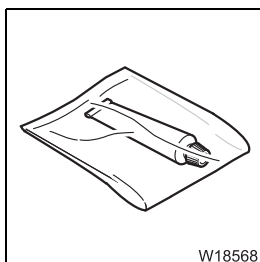
- Brush.

Checking

On the **superstructure**, depending on the equipment, there are various connecting pins and socket pins such as:

- Hinged or fold out railings
 - Locks and supports on the covers
 - Hinges on the covers in front of the diesel tanks
 - Hinges on the crane cab's front and the rear window,
 - Retaining rods for the rope discs at the head of the main boom
- Check the pins for wear such as rust, deformation, broken clips, chains and pin-type keepers.
 - If the pins are damaged, have them replaced by **Manitowoc Crane Care** or an authorised GROVE dealer or your qualified repair crew.
 - Use only authentic replacement pins.

Lubricating



- Clean the pins.
- Lubricate the pins with a brush.

8.17.6

Renewing the corrosion protection

M 12

Protective agent, tools

Protective agent	GROVE part no.
Corrosion protection	03140192

- Spray gun with spray extension.
- Brush.
- Protective clothing, protective goggles.

Prerequisites

- The superstructure must be thoroughly cleaned.
- The engine must be switched off and secured against unauthorised use;
 ▶ p. 2 - 3.

Checking

Some particular parts of the superstructure were sprayed for corrosion protection for the first time in the factory itself.

These are pumps, valve blocks, controls and fittings, pipes, screw connections, hose fittings of the hydraulic system of the superstructure;
 ▶ p. 8 - 125.

The corrosion protection is solvent-free and is water soluble while being sprayed on. A transparent, waxy, protective film is formed after a drying time of one hour.

- Check the condition of the original protective film.
- If required, remove any rust and touch up the paintwork before you spray on a new protective film.

Processing instructions

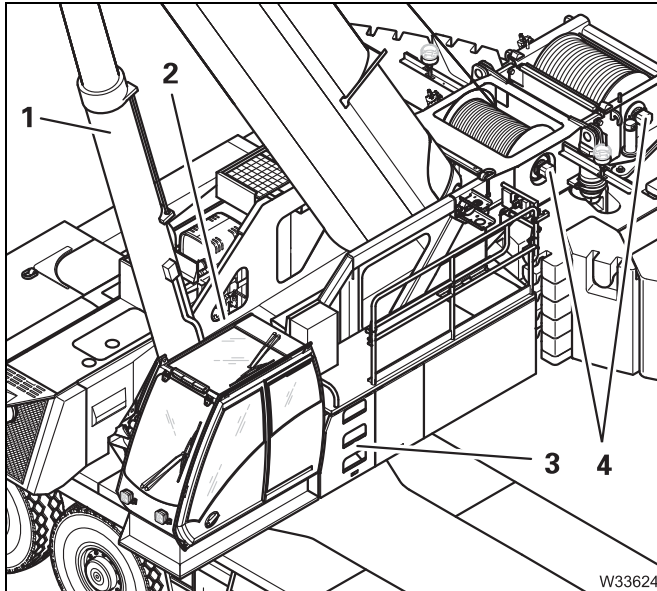
- Observe the processing instructions for corrosion protection;
 ▶ *Processing instructions*, p. 7 - 127.

Spraying



Risk of injury to the eyes.

While working with the spray extension you could be hit by the spray jet or spray droplets. Wear protective goggles, protective clothing and gloves.



- Make sure that you do not spray running surfaces. There is a risk of slipping.
- Spray the corrosion protection with a spray gun aimed only at the pumps, valve blocks, screw connections, pipes, hoses of the hydraulic system of the superstructure:
 - On the derricking cylinder (1)
 - On the slewing gears (3)
 - On the slewing duct (2)
 - On the hoists (4)
- Clean surfaces sprayed by accident immediately with water.

- Let the corrosion protection dry for one hour.
- Check that a transparent waxy protective film has covered the entire surface.

8.17.7

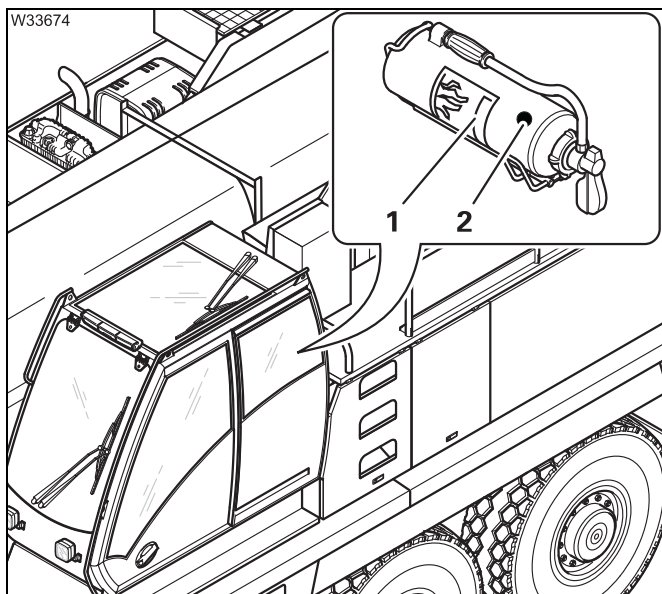
Having the fire extinguisher checked

Y 2

Depending on your truck crane's equipment, it can be fitted with fire extinguishers.



The maintenance interval may even be shorter, depending on the respective national regulations and the operating location. Ask the local fire safety officer about the national and local regulations.



- Observe the instructions (1) on the fire extinguisher.
- Have the fire extinguisher serviced by trained personnel in good time before the maintenance interval specified on the label (2) expires.



Danger due to the fire extinguisher not working.

There is no guarantee that the fire extinguisher will still work properly once the maintenance interval on the label has expired.

9 Longer out of service periods

9

Longer out of service periods

Carry out the following jobs if the truck crane is going to be out of service for a long period (months).

Putting the truck crane out of service

- Clean the truck crane thoroughly on the inside and outside.
- Remove any rust and touch up the paintwork.
- Parts that are not painted must be lubricated with an acid-free grease or oil.

If more than half of the oil change interval has passed:

- Change the oil according to the maintenance plans **M 3** to **M 12**.
- Seal all the air filters.
- Increase the tyre pressure by 10% and mark the tyre positioning, or support the truck crane and leave it standing on the outriggers.
- Observe the specifications on preservation in the *Engine manufacturer's documentation*.

Checks

- Check the levels in the fuel tanks. Always keep the tanks filled.
- Check the batteries every week and recharge them if necessary.
- Check the tyre pressure every week and correct it if necessary.
- Perform a full functional test on the truck crane every two weeks. (Open all air filters beforehand)
- Run the hydraulic systems up to a fluid temperature of approx. 50 °C (122 °F) and then check all functions of the carrier and superstructure hydraulic systems.



- Ensure that the tyre positioning is different each time the crane is parked (without outriggers).
- Seal all air filters again.

If the truck crane is going to be out of service for more than 12 months:

- Carry out all maintenance work in accordance with the maintenance plan **M 12**.
- Observe the specifications on preservation in the *Engine manufacturer's documentation*.

Putting the truck crane into operation

- Open all air filters.
- Inflate the tyres up to the prescribed pressure.
- Carry out periodic maintenance work in accordance with the maintenance plans in Chapter 5.
- Observe the specifications on preservation and putting the truck crane back into service in the *Engine manufacturer's documentation*.

10 Torques

10.1	Torques for the retaining bolts	10 - 1
10.2	Special torques	10 - 2

10 Torques

10.1 Torques for the retaining bolts

Metric standard screw thread Metric fine thread			Guide values		
Thread size (mm)	Size across flats (mm)		Torques (maximum permissible pre-tensioning for bolts) for oiled bolts (Nm)		
	Hexagon-head bolt	Socket screw	Bolt quality		
			8.8	10.9	12.9
M 8 M 8 x 1	13	6	23 24	32 34	36 41
M 10 M 10 x 1.25	17	8	44 47	62 66	75 79
M 12 M 12 x 1.5	19	10	78 81	110 113	130 135
M 14 M 14 x 1.5	22	12	120 135	170 189	210 225
M 16 M 16 x 1.5	24	14	165 203	190 284	320 342
M 18 M 18x 1.5	27	14	260 293	365 414	435 495
M 20 M 20 x 1.5	30	17	370 414	520 576	620 693
M 22 M 22 x 1.5	32	17	500 549	700 774	840 945
M 24 M 24 x 1.5	36	19	640 702	900 990	1080 1170
M 30	46	22	1300	1800	2160
M 33	50	24		2700	
M 36	55	27		3300	

10.2 Special torques

Name	Thread size (mm)	Size across flats (mm)		Torque (Nm)
		Hexagon-head bolt	Socket screw	
Suspension strut:				
– Bracket for the vehicle chassis, top	M 16	—	14	265
– Bracket for the vehicle chassis, bottom	M 24	—	19	900
– Suspension strut flange, bottom	M 20		17	520
– Half shell steering lever	M 16		14	265
Steering linkage:				
– Ball-and-socket joints and steering track rods	M 10 x 1 M 12 x 1.5 M 14 x 1.5 M 24 x 1.5 M 30 x 1.5			45 - 55 70 - 85 140 - 160 250 - 280 450 - 500
Others:				
– Coolant hose clamps				4
– Wheel nuts	M 22 x 1.5	32		650
– Rim connection bolts (only for aluminium rims)		Aluminium rims with 20 nuts		550
		Aluminium rims with 22 nuts		385
– Retaining bolts for the Slewing bearing	M 27		—	1150
– Hoist drum rope clamp	M 14	2 nuts		78

11 Spare parts required for maintenance

11.1	General information	11 - 1
11.2	Lighting	11 - 1
11.3	Spare parts for the carrier.....	11 - 5
11.4	Spare parts for the superstructure	11 - 8

11

Spare parts required for maintenance

11.1

General information

The spare parts required for maintenance are divided into

- lighting,
- spare parts for the carrier and
- spare parts for the superstructure.

The only spare parts listed here are those required for the maintenance work described.

A more detailed spare parts document can be found in the *Spare parts list* supplied.

An overview of the required lubricants can be found in:

- *Lubricants list*, p. 6 - 2,
- *Lubricant applications list*, p. 6 - 3.

11.2

Lighting

Lamps are listed according to the installation point. The list includes standard and additional lighting equipment for the truck crane.

Lighting specific to certain countries can be found in the accompanying *Spare parts list*, in the section on country-specific packages.



Risk of accidents from exploding glass bodies and high voltage.

The glass bodies of gas discharge lamps (xenon lights) are pressurised. If the lamp breaks, the glass splinters explosively and shards scatter. Xenon lights operate at high voltage. While changing the lamp, there is still a danger of residual voltage discharging (electric shock) even when the battery master switch is switched off.

Have faulty lamps replaced only by properly qualified personnel who use the relevant protective equipment.



Installation point	GROVE part number	Designation	Power (W)
CARRIER LIGHTING:			
Front spotlights: (integrated in the bumper)			
– Daytime driving light	03328445	P21W 24 V	21
– Low-beam + full-beam headlights	03134828	H7 24 V	70
– Low-beam + full-beam headlights (USA)	03143584	H9 12 V	65
– Indicator light	03327578	PY21W 24 V	21
– Parking light (in the direction indicator light)	03140908	LED	
– Yellow side marker light	03320937	LED	
Front, side indicator lights: (at the access ladder to the driver's cab)			
– Indicator light	03327578	8GA 006841241	24 V / 21 W
Tail lights: (at the rear of the chassis and on the removable outrigger box)			
– Marker light	03137450	R5W 24 V	5
– Number plate light	03137450	R5W 24 V	5
– Rear light	03137450	R5W 24 V	5
– Brake light	03328445	P21W 24 V	21
– Indicator light	03137451	PY21W 24 V	21
– Fog tail light	03328445	P21W 24 V	21
– Reverse light	03328445	P21W 24 V	21
Licence plate lamp, external: (at the rear of the chassis)			
– LED licence plate light	04163112	LED	
Yellow side marker lights: (at the sides, along the chassis)			
– Side marker light	03323568	LED	
White rear marker lights: (at the rear of the chassis)			
– Left marker light	03327625	LED	
– Right marker light	03327626	LED	
Reversing lamp: (at the rear of the chassis)			
– Reversing lamp; complete	03143180	LED	

Installation point	GROVE part number	Designation	Power (W)
Red triple light strip for USA: (at the rear of the chassis)			
– Triple light strip	7581100056	LED	
White front marker lights: (at the top on the driver's cab)			
– Marker light	03138527	LED	
Yellow additional lights for USA: (at the top on the driver's cab)			
– Yellow side marker light	03320937	LED	
Outrigger beam spotlights: (above the front and rear outrigger beams)			
– LED spotlight; complete	03143786	M70 LED	
or:			
– Filament lamp	02316460	8GH 002090251	70
Yellow rotating beacons: (on the driver's cab)			
– Rotating beacon; complete	04156048		
Inside lights: (in the driver's cab)			
– Filament lamp	00550434	K 24 V	10
Dashboard light: (in the driver's cab; socket 12V)			
– Filament lamp	04159964	Xenon	12V / 6W



Installation point	GROVE part number	Designation	Power (W)
SUPERSTRUCTURE LIGHTING:			
Marker lights, yellow: (on the main boom head)			
– Marker light; complete	03329569	LED	
Red rear marker lights: (on the turntable)			
– Marker light	03329492	FPL 98 CKS	
Yellow rotating beacon: (on the turntable)			
– Rotating beacon; complete	04156048		
White camera lights: (lighting for the hoist cameras)			
– Marker light	03143474		
Inside light: (in the crane cab)			
– Cab light	01207144	R10W 24 V	10
– Reading light	00439055	P25-1 24 V	21
Spotlight, angular-shaped, permanently installed: (at the front of the crane cab)			
– Filament lamp	01573349	H3 24 V	70
Spotlight, electrically adjustable: (at the front of the main boom)			
– Spotlight; complete	04160078		

11.3 Spare parts for the carrier

Assemblies and spare parts Carrier	GROVE- part number	Quantity, in single parts For maintenance interval				
		W	M 1	M 3	M 6	M 12
Engine						
Air filter – main filter	04163882	1 item when the symbol lights up				
Air filter – back-up filter	04163883					
Fuel system						
Filter (filter 1; large)	04161567			1		
Filter (filter 2; small)	04161566					1
Set with both filters 1 + 2	04180966	Alternative				
Transfer case						
Gasket 30 x 36 Cu DIN 7603	00117151		2		2	
Gasket 16 x 20 Cu DIN 7603	00117134				1	
Axle lines axle centre drive (for max. 12 x 8 x 12)						
Gasket 30 x 36 Cu DIN 7603	00117151		4			4
Gasket 16 x 20 Cu DIN 7603	00117134					8
Axle lines Final drive (for max. 12 x 8 x 12)						
Gasket 24 x 29 Cu DIN 7603	00117145		8			8
Wheels						
Wheel nuts for steel rims	01207756	In case of damage; 12 each per wheel				
Wheel nuts for aluminium rims	7659100000					



Assemblies and spare parts Carrier	GROVE- part number	Quantity, in single parts For maintenance interval					
		W	M 1	M 3	M 6	M 12	
Vehicle brake (per axle line)							
1. and 2 nd axle line (duplex brake):		only in the case of wear on the drum brakes					
Brake shoe with brake lining	03322112						4
Spring	03322110						4
Brake drum	01925703						2
3. to 6 th axle line (simplex brake):							
Brake shoe with brake lining	03322121						4
Spring	02315393	4					
Brake drum	01925703	2					
Compressed air system							
Valve (if defective)	01570750	(6)					
Gasket 22 x 27 Cu DIN 7603	00117142	(6)					
Filter cartridge	04156032					1	
Hydraulic system							
Filters 1 and 2 (only clean)	03329152			(2)			
Packing set	03135778			2			
Filters 1 and 2	03329152	at every oil change and when the symbol lights up				2	
Packing set	03135778					2	
Filters 3 and 4	03140253					2	
Repair set	03135867					2	
Oil tank cover gasket 140 / 90 x 3	02313899	1 item for every oil change (if damaged)					
Ventilation filter	03324588					1	
Air conditioning system							
Driver's cab pollen filter	03134974					1	
Other maintenance work							
Driver's cab wiper blades	02311858	(3)	(if damaged)				

Assemblies and spare parts Carrier	GROVE- part number	Quantity, in single parts For maintenance interval				
		Y 2	Y 3	Y 5	Y 6	Y 10
Engine						
Oil filter with gasket	04161614	1				
Transmission						
Oil filter set with gaskets (contains two filters and one oil drain plug gasket)	03141323	1				

11.4 Spare parts for the superstructure

Assemblies and spare parts Superstructure	GROVE- part number	Quantity, in single parts For maintenance interval				
		W	M 1	M 3	M 6	M 12
Engine						
Air filter	04183736	1 item when the symbol lights up				
Fuel system						
Filter (filter 1)	04181165			1		
Filter element (if damaged)	04181166			1		
Filter with gasket (small; filter 2)	04165265					1
Filter with gasket (large; filter 3)	04165266					1
Hoists						
Sight glass with hoses; complete	04161717	(2)	(if damaged)			(2)
Slewing gear						
Gasket 10 x 14 Cu DIN 7603	00117125	(3)	(if damaged)			
Gasket 10 x 14 Cu DIN 7603	00117125					3
Gasket 14 x 20 Cu DIN 7603	00117132					3
Hydraulic system						
Filter 1 (only clean it)	03325700			(1)		
Packing set	03135853			1		
Ventilation filter	03319602					1
Filter 1	03325700	Change the oil filter at every oil change and if a warning message is displayed.				1
Packing set	03135853					1
Filter 2	03142356					1
Housing packing set	03326049					1
Filter 3	03249527					1
Oil tank cover gasket 140 / 90 x 3	03328286	1 item for every oil change (if damaged)				

Assemblies and spare parts Superstructure	GROVE- part number	Quantity, in single parts For maintenance interval				
		W	M 1	M 3	M 6	M 12
Hoist ropes						
Cover gasket for the lowering limit switch	02315305	1 (if damaged)				for every rope change on the hoist
Cable drums						
Cover gasket for cable drum 1	03325575	(if damaged)			(1)	
Cover gasket for cable drum 2	03137971				(1)	
Other maintenance work						
Windscreen wiper blade	03326121	(1)	(if damaged)			
Roof wiper blade	03326121	(1)				

Assemblies and spare parts Superstructure	GROVE- part number	Quantity, in single parts For maintenance interval				
		Y 2	Y 3	Y 5	Y 6	Y 10
Engine						
Oil filter with gasket	04165291	1				
Silicate cartridge with O-ring	04165276		1			
Slewing angle sensor						
Gasket 16 x 20 Cu DIN 7603	00117134			1		

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Appendix

Appendix

Table to determine the remaining theoretical service life on winch no.

Crane type:
 Work no.:
 First put into operation on:
 Winch serial number in accordance with the model plate:
 Last general overhaul performed on:
 Winch design data (see operating manual):
 Engine group:
 Load spectrum:
 Load spectrum factor:
 Theoretical service life:

Inspection interval no. (max. 1 year) "i"	Date of first commissioning/date of inspection	Operating conditions since the last inspection	Factor of the load spectrum Km_i	Operating hours of the entire crane	Operating hours of the superstructure	Operating hours of the superstructure since the last inspection	Operating hours of the winch	Winch operating hours since the last inspection	Used proportion of theoretical service life D: $S_i = \frac{Km_i}{Km} \times T_i$ [h]	Remaining theoretical service life $D_i = D_{i-1} - S_i$ [h]	Name of the expert	Signature	Comment	Name of the approved inspector	Signature	
(*)																

IMPORTANT:

A general overhaul must be performed every 10 years.
 For alternative provision, refer to section 5.4.2, p. 5 - 25.

General overhaul performed on.....

- S_i = Used proportion of theoretical service life since the last inspection
- D_i = Remaining theoretical service life
- D_{i-1} = Remaining theoretical service life after the previous inspection
- Km = Factor of the load spectrum used to calculate the winch.
This factor is given in the operating manual.
- Km_i = Factor of the load spectrum in the inspection interval "i" according to section 2.1
- T_i = Effective working hours in the inspection interval "i" according to section 2.2
- (*) Copy the last line of the previous page to the following page.

