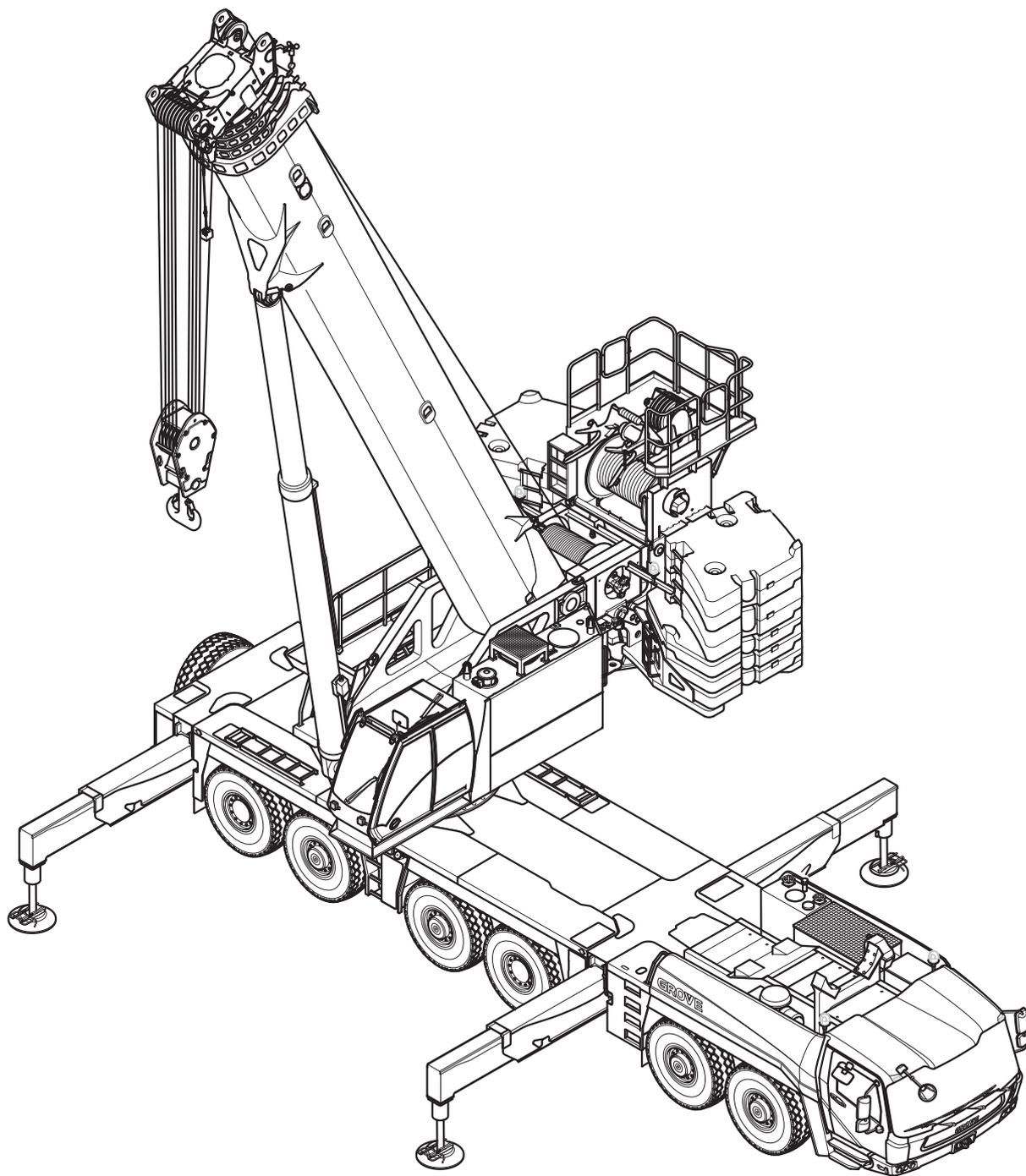


GROVE GMK6400

Maintenance manual



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16.11.2018

 **Manitowoc**

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16.11.2018

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This maintenance manual does not replace the operating manual.

**Details of operation and standard safety instructions
can be found in the operating instructions.**

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1 General instructions

1.1 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 definitions and symbols are used in the operating instructions to highlight particularly important information:



This symbol indicates hazards related to the described operation, which can endanger persons. 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. Exercise special caution. The measures required for the corresponding maintenance work are indicated next to the symbol. More detailed information is provided 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. So turn the 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 when 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 professionals

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

- Insufficient oil, grease or antifreeze
- Dirt
- Rope damage
- Faulty compressed air and hydraulic systems
- Hose damage 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 openings, oil inspection openings, oil drain openings 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 fresh hydraulic oil 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 (bolts, nuts, 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 EEPROM allows 10^6 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.

The device 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. Before any welding work, you should therefore always consult **Manitowoc Crane Care**.

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

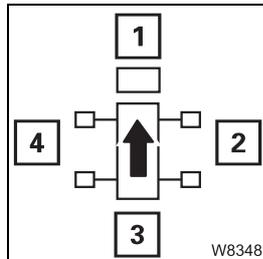
1.6

Definition of direction information

Basic rule

Directions always depend on whether the carrier or the superstructure is being operated.

On the carrier



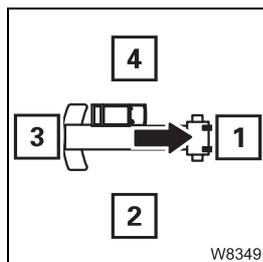
The driver's cab is always at the front, which means that:

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

Forwards always means the driver's cab is to the front.

Backwards always means the rear lights on the carrier are leading.

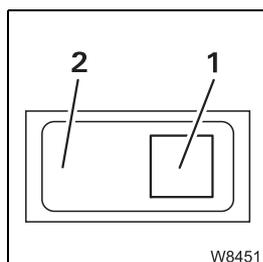
On the superstructure



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 at the **bottom** and **top** are used.

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

Down: press (1) – next to the symbol

Up: press (2) – opposite the symbol

1.7**Conversion table for US measuring units**

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

Converting from	in	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	2,204.622
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

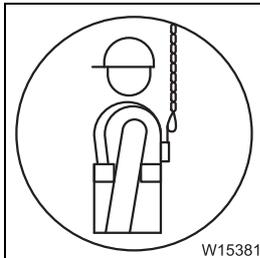
2.1

Safety rules

When carrying out maintenance work, 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.
Use your personal fall protection equipment to secure yourself from falling from the truck crane.
All locations on the truck crane designed for fastening a fall prevention safety system are marked with a *symbol*.
- 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 **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).

Escaping hydraulic fluid or compressed air can cause severe injuries. Remember that the hydraulic and compressed air systems of the truck crane are pressurised even when the truck crane is not in operation. Only tighten loose screw connections 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 inflammable 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
 - 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 the crane cab or in the driver's cab before leaving the truck crane and lock the doors.

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 on
 - 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 waterways.
- 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 prescribed disposal options.
- 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 containers and in locations which meet the requirements of current 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 that are approved by the national or regional authority responsible.

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3 Cleaning

3.1 Overview of assemblies easily damaged when cleaning 3 - 2

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 only be cleaned 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 a right angle to the surface you are cleaning and ensure that you are standing at a sufficient distance away from the surface you are cleaning.



Risk of accidents from a misdirected high pressure water jet!

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

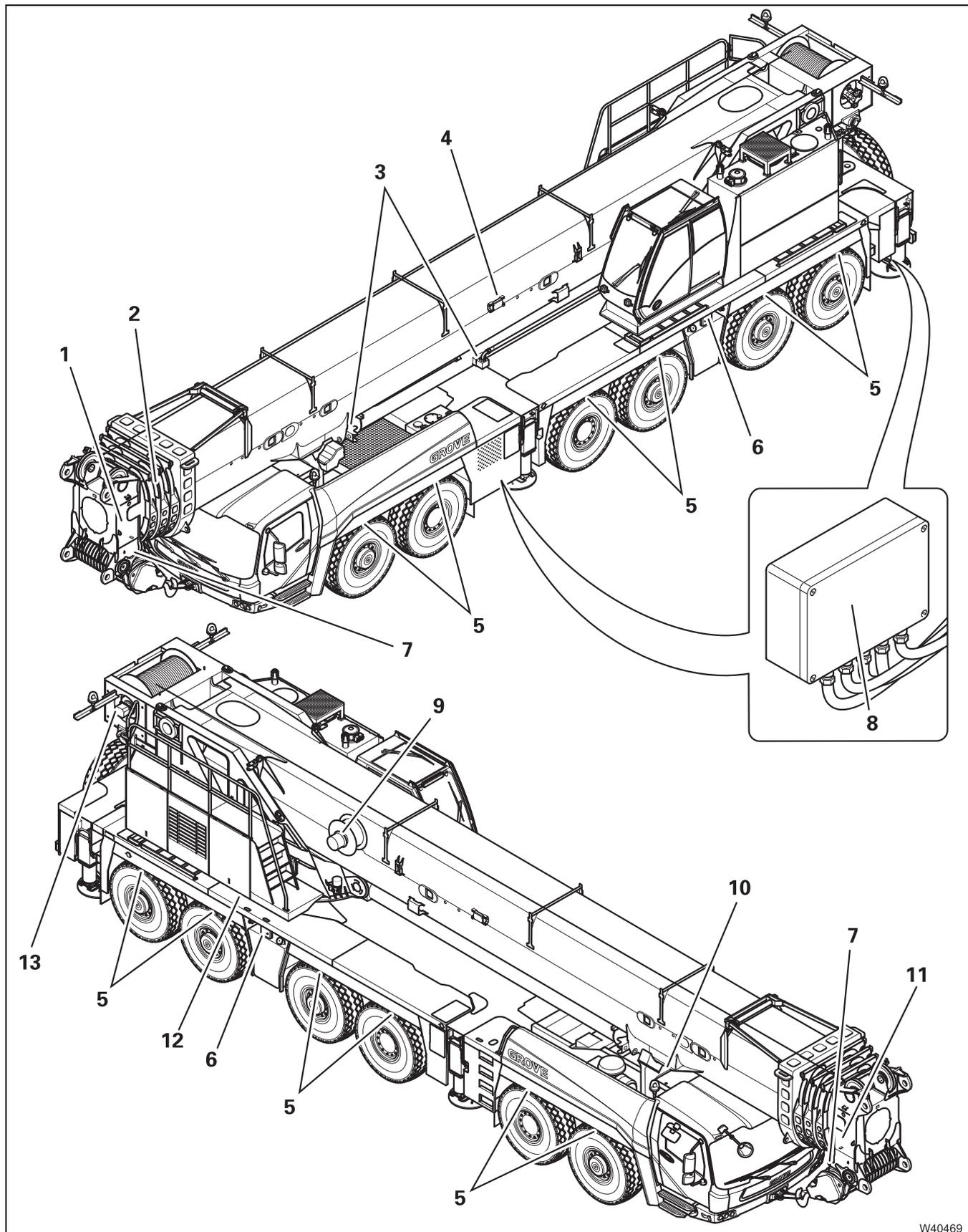
Always wear a face guard when cleaning the truck crane with high-pressure and steam jet cleaning equipment!

- To prevent damage to the seals and gaskets, never point the spray nozzle directly at seals and gaskets.
- 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 - 109). 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 Pressure sensors on the derricking cylinder
- 4 Angle data transmitter
- 5 Suspension struts
- 6 Control units for outriggers
- 7 Lifting limit switch
- 8 Housing of the input-output circuit boards on the carrier
- 9 RCL length data transmitter
- 10 Spotlights, slewable
- 11 RCL connections
- 12 Slewing angle sensor on the superstructure
- 13 Lowering limit switch



Assemblies at risk of damage on the lattice extension;
▣▣▣▣▶ *Lattice extension operating manual.*

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4 Run-in regulations

4

Run-in regulations

There are regulations regarding running in individual parts that must be followed, after:

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

This is why you must carry out **additional maintenance work** on the **carrier** and **superstructure** at specific intervals:

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 - 132.</i>
during the first 100		Check the hydraulic oil filter every week, and change it if necessary;  <i>Cleaning the magnetic rods, p. 7 - 91,</i>  <i>Changing the hydraulic oil filter, p. 7 - 103.</i>
after 100	After 1,000 (650)	Change the drive oil;  p. 7 - 54 for the transfer case,  p. 7 - 61 for the axle centre drives,  p. 7 - 64, for the final drives.
after 250	After 2,500 (1,550)	Change the engine oil;  <i>Engine manufacturer's documentation.</i>



Operating hours (oper. hrs.)	Additional maintenance work on the SUPERSTRUCTURE
during the first 100	Check the hydraulic oil filter every week, and change it if necessary; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Cleaning the magnetic rods</i>, p. 8 - 46, ▣▣▣▣▶ <i>Changing the hydraulic oil filter</i>, p. 8 - 53.
after 100	Tighten the screws on the slewing bearing; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Checking the bolts</i>, p. 8 - 23, ▣▣▣▣▶ <i>Special torques</i>, p. 10 - 2.
after 100	Hook blocks; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Lubricating</i>, p. 8 - 91.
after 200	Change the oil for the pump transfer case; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Changing the oil</i>, p. 8 - 37.
after 200	First oil change on the hoists; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Changing the oil/checking the oil</i>, p. 8 - 14.
after 1,000 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 - 14.
after 200	Change the slewing gear oil; <ul style="list-style-type: none"> ▣▣▣▣▶ <i>Changing the oil/checking the oil</i>, p. 8 - 20.

5 Maintenance overview

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5

Maintenance overview

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

The maintenance plans are provided in tabular 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 - 89.

Checking the hydraulic oil level is described in Chapter 7, the section starts on page 7 - 89.

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 **driven km (mi)** or
- a specified number of **operating hours (oper. hrs.)** or
- a specific **indication** on the *instrument panel*, *ECOS* display in the driver's cab; ■■■► p. 7 - 11 or
- an **indicator** on the *ECOS* display in the crane cab; ■■■► p. 8 - 9.



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

- You can read the **driven km (or mi)** on the speedometer.
- You can call up the individual **engine and power unit operating hours (oper. hrs.)** of the superstructure 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	about 2,000 (about 1 240)	about 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 twelve 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 longer-term maintenance plans always incorporate the shorter-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 Chapter 7 and for
- the superstructure in Chapter 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 Chapter 7 *Maintenance work on the carrier* and
- of Chapter 8 *Maintenance work on the superstructure*

contain the abbreviation (**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** Chapter 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 (l) (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 Chapter 7 and Chapter 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 accompanying *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 - 13</p> <p>▣▣▣▣▶ p. 7 - 17</p> <p>▣▣▣▣▶ p. 7 - 18</p>
Fuel system – Draining water from fuel filter 1	▣▣▣▣▶ p. 7 - 28
Exhaust system with exhaust emission control ¹⁾ – Checking the AdBlue tank level ¹⁾	▣▣▣▣▶ p. 7 - 36
Wheels – Checking the tyres for damage	▣▣▣▣▶ p. 7 - 69
Steering – Checking for leaks	▣▣▣▣▶ p. 7 - 83
Hydraulic system – Checking the oil level	▣▣▣▣▶ p. 7 - 89
Electrical system – Checking the lighting and indicators	▣▣▣▣▶ p. 7 - 111

¹⁾ *AdBlue system* additional equipment

Maintenance work on the SUPERSTRUCTURE: Daily/before putting into operation	
Pump transfer case – Checking the oil filter	▣▣▣▣▶ p. 8 - 35
Hydraulic system – Checking the oil level	▣▣▣▣▶ p. 8 - 43
Hoist ropes – Checking the winding	▣▣▣▣▶ p. 8 - 71
Electrical system – Checking the lighting and indicators	▣▣▣▣▶ p. 8 - 95

5.2.2

Maintenance plan W

W

Maintenance work on the CARRIER: Weekly	
Engine – General inspection	➡ p. 7 - 19
Transmission – General inspection	➡ p. 7 - 42
Transfer case – General inspection	➡ p. 7 - 53
Axle lines – General inspection	➡ p. 7 - 58
Wheels – Checking the tyre pressure	➡ p. 7 - 70
Compressed air system – Draining water from the compressed air system – Checking for leaks	➡ p. 7 - 85 ➡ p. 7 - 86
Hydraulic system – Checking the hydraulic hoses – Checking for leaks	➡ p. 7 - 90 ➡ p. 7 - 90
Central lubrication system – Checking the filling level	➡ p. 7 - 107
Other maintenance work – Checking the windscreen washing system	➡ p. 7 - 131

W

Maintenance work on the SUPERSTRUCTURE: Weekly	
Hoists – Checking the oil level – General inspection – Checking the hoist brake	<p>▮▮▮▮ p. 8 - 11</p> <p>▮▮▮▮ p. 8 - 12</p> <p>▮▮▮▮ p. 8 - 12</p>
Slewing gear – Checking the oil level – Checking for leaks	<p>▮▮▮▮ p. 8 - 17</p> <p>▮▮▮▮ p. 8 - 18</p>
Pump transfer case – General inspection	▮▮▮▮ p. 8 - 35
Hydraulic system – Checking the hydraulic hoses – Checking the ventilation filters – Checking for leaks	<p>▮▮▮▮ p. 8 - 44</p> <p>▮▮▮▮ p. 8 - 44</p> <p>▮▮▮▮ p. 8 - 45</p>
Hoist ropes – Checking the hoist ropes	▮▮▮▮ p. 8 - 72
Central lubrication system – Checking the filling level	▮▮▮▮ p. 8 - 89
Other maintenance work – Checking the windscreen washing system	▮▮▮▮ p. 8 - 99

5.2.3

Maintenance plan M 1

M 1

Maintenance work on the CARRIER: Monthly/after 2,000 km (about 1,240 mi)	
Engine – Notes; ■■■► <i>Engine manufacturer's documentation</i>	■■■► p. 7 - 13
Exhaust system with exhaust emission control ¹⁾ – Checking the exhaust system for external damage ¹⁾	■■■► p. 7 - 37
Transfer case – Checking the oil level	■■■► p. 7 - 53
Axle lines – Axle centre drives – checking the oil level – Checking the hydraulic drives – Final drives – Checking the oil level – Lubricating the drive shafts in the axle lines	■■■► p. 7 - 58 ■■■► p. 7 - 60 ■■■► p. 7 - 63 ■■■► p. 7 - 67
Wheels – Checking the tightness of wheel nuts	■■■► p. 7 - 71
Suspension – Suspension struts – Checking the oil level – Suspension struts – checking the fastening	■■■► p. 7 - 79 ■■■► p. 7 - 80
Electrical system – Checking the batteries	■■■► p. 7 - 112
Air-conditioning system – Checking the air conditioning system	■■■► p. 7 - 119
Towbar coupling – Lubricating the towbar coupling	■■■► p. 7 - 123
Other maintenance work – Lubricating the outrigger beams – Checking the functioning of the auxiliary heater	■■■► p. 7 - 132 ■■■► p. 7 - 133

¹⁾ *AdBlue system* additional equipment

M 1

Maintenance work on the SUPERSTRUCTURE: Monthly / after 100 oper. hrs.	
Pump transfer case – Checking the oil level	▣▣▣▣▶ p. 8 - 36
Main boom – Greasing the piston rod of the derricking cylinder	▣▣▣▣▶ p. 8 - 65
Air-conditioning system – Checking the air conditioning system	▣▣▣▣▶ p. 8 - 97
Other maintenance work – Checking the functioning of the auxiliary heater	▣▣▣▣▶ p. 8 - 101

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 - 13
Fuel system – Changing fuel filter 1	■■■► p. 7 - 29
Vehicle brake – Checking the brake lining thickness	■■■► p. 7 - 77
Suspension – Forced lever - checking correct functioning	■■■► p. 7 - 81
Hydraulic system – Cleaning the magnetic rods	■■■► p. 7 - 91
Electrical system – Checking the charge level of the batteries – Charging the batteries using the battery charger ¹⁾ – Checking the external starting socket ¹⁾	■■■► p. 7 - 114 ■■■► p. 7 - 116 ■■■► p. 7 - 117
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 central position	■■■► p. 7 - 125 ■■■► p. 7 - 126 ■■■► p. 7 - 127 ■■■► p. 7 - 127 ■■■► p. 7 - 128 ■■■► p. 7 - 128

¹⁾ Additional equipment

Maintenance work on the SUPERSTRUCTURE: Monthly / after 250 oper. hrs.	
Hoists – Support for block – Checking the sheaves	▣▣▣▣▶ p. 8 - 13
Slewing bearing – Checking the bolts	▣▣▣▣▶ p. 8 - 23
Hydraulic system – Cleaning the magnetic rods	▣▣▣▣▶ p. 8 - 46
Main boom – Lubricating the telescopic sections – Checking the sheaves	▣▣▣▣▶ p. 8 - 66 ▣▣▣▣▶ p. 8 - 70
Hoist ropes – Lubricating the hoist rope	▣▣▣▣▶ p. 8 - 73
Hook blocks – Checking the sheaves	▣▣▣▣▶ p. 8 - 91

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 - 13
Transfer case – Changing the oil	■■■■▶ p. 7 - 54
Axle lines – Lubricating the longitudinal drive shafts	■■■■▶ p. 7 - 68
Wheels – Changing the wheels	■■■■▶ p. 7 - 72
Air-conditioning system – Checking hoses	■■■■▶ p. 7 - 119

M 6

Maintenance work on the SUPERSTRUCTURE: Every six months / after 500 oper. hrs.	
Slewing gear – Checking the slewing gear brake	▣▣▣▣▶ p. 8 - 18
Slewing bearing – Lubricating the gear teeth – General inspection – Measuring tilting play	▣▣▣▣▶ p. 8 - 27 ▣▣▣▣▶ p. 8 - 29 ▣▣▣▣▶ p. 8 - 30
Cable drums and slewing angle sensor – Maintenance of the slip ring assemblies	▣▣▣▣▶ p. 8 - 85
Air-conditioning system – Checking hoses	▣▣▣▣▶ p. 8 - 97

5.2.6

Maintenance plan M 12

M 12

Maintenance work on the CARRIER: Every twelve 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 - 13 ■■■► p. 7 - 20
Fuel system – Changing fuel filter 2	■■■► p. 7 - 31
Exhaust system with exhaust emission control ¹⁾ – Having the AdBlue system checked ¹⁾	■■■► p. 7 - 39
Transmission – Checking the transmission oil level – Checking the oil level – power take-off	■■■► p. 7 - 43 ■■■► p. 7 - 44
Axle lines – Axle centre drives – changing the oil – Final drives – Changing the oil	■■■► p. 7 - 61 ■■■► p. 7 - 64
Suspension – Pressure accumulator – checking the gas pressure	■■■► p. 7 - 82
Steering – Pressure accumulator – checking the gas pressure	■■■► p. 7 - 84
Compressed air system – Replacing the compressed air dryer filter cartridge	■■■► p. 7 - 87
Hydraulic system – Changing the ventilation filters – Taking oil samples: depending on the oil sample test results: – Changing the hydraulic oil – Changing the hydraulic oil filter	■■■► p. 7 - 93 ■■■► p. 7 - 94 ■■■► p. 7 - 99 ■■■► p. 7 - 103
Air-conditioning system – Cleaning the condenser fins – Checking the entire air-conditioning system – Changing the pollen filter	■■■► p. 7 - 120 ■■■► p. 7 - 120 ■■■► p. 7 - 122
Other maintenance work – Lubricating the cab door – Lubricating the connecting pins and socket pins – Renewing the corrosion protection	■■■► p. 7 - 133 ■■■► p. 7 - 134 ■■■► p. 7 - 135

¹⁾ *AdBlue system* additional equipment

Maintenance work on the SUPERSTRUCTURE: Every twelve months/after 1,000 oper. hrs.	
Hoists – Changing the oil/checking the oil	▣▣▣▣▶ p. 8 - 14
Slewing gear – Changing the oil/checking the oil	▣▣▣▣▶ p. 8 - 20
Slewing bearing – Lubricating the turntable lock	▣▣▣▣▶ p. 8 - 32
Pump transfer case – Changing the oil – Changing the oil filter	▣▣▣▣▶ p. 8 - 37 ▣▣▣▣▶ p. 8 - 41
Hydraulic system – Changing the ventilation filters – Taking oil samples: depending on the oil sample test results: – Changing the hydraulic oil – Changing the hydraulic oil filter – Have the radiator checked/cleaned	▣▣▣▣▶ p. 8 - 49 ▣▣▣▣▶ p. 8 - 51 ▣▣▣▣▶ p. 8 - 57 ▣▣▣▣▶ p. 8 - 53 ▣▣▣▣▶ p. 8 - 60
Main boom – Checking the locking system	▣▣▣▣▶ p. 8 - 70
Hook blocks – Lubricating	▣▣▣▣▶ p. 8 - 91
Air-conditioning system – Checking the entire air-conditioning system	▣▣▣▣▶ p. 8 - 97
Other maintenance work – Lubricating the crane cab door – Lubricating the step ¹⁾ – Lubricating the connecting pins and socket pins – Renewing the corrosion protection	▣▣▣▣▶ p. 8 - 102 ▣▣▣▣▶ p. 8 - 103 ▣▣▣▣▶ p. 8 - 104 ▣▣▣▣▶ p. 8 - 105

¹⁾ Additional equipment

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 - 13 ■■■■► p. 7 - 24
Other maintenance work – Having the fire extinguisher checked	■■■■► p. 7 - 137

Maintenance work on the SUPERSTRUCTURE: Every 24 months / after 2,000 oper. hrs.	
Other maintenance work – Having the fire extinguisher checked	■■■■► p. 8 - 107

5.2.8

Maintenance plan Y 3

Y 3

Maintenance work on the CARRIER: every 36 months	
Transmission – Changing the oil and oil filter – Transmission – Changing the oil and oil filter – Power take-off	■■■■► p. 7 - 45 ■■■■► p. 7 - 49

Maintenance work on the SUPERSTRUCTURE: Every 36 months / after 3,000 oper. hrs.	
Hoists – Having a partial inspection carried out	■■■■► p. 8 - 16

5.2.9

Maintenance plan Y 5

Y 5

Maintenance work on the CARRIER: Every 60 months / 100,000 km (62,000mi)	
– Have the Cardan shaft between the transmission on the engine and the transfer case replaced by Manitowoc Crane Care or an authorised GROVE dealer.	
– Have the two drive shafts between the engine and the hydraulic pumps 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 - 87

5.2.10

Maintenance plan Y 6

Y 6

Maintenance work on the CARRIER: every 72 months	
No maintenance work in this period. The longer-term intervals always include the shorter-term intervals!	

Maintenance work on the SUPERSTRUCTURE: Every 72 months / after 6,000 oper. hrs.	
Hoists – Having a general inspection carried out	➡ p. 8 - 16

5.2.11

Maintenance plan Y 10

Y 10

Maintenance work on the CARRIER: Every 120 months / after 200,000 km (124,000 mi)	
Steel structures – Check the load-bearing steel structures. For more information contact Manitowoc Crane Care.	

Maintenance work on the SUPERSTRUCTURE: Every 120 months / after 12,000 oper. hrs.	
Steel structures – Check the load-bearing steel structures. For more information, please contact Manitowoc Crane Care.	
Rated capacity limiter (RCL) – Have the RCL checked by Manitowoc Crane Care.	

5.3

Periodic inspections

Your GMK6400 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 are to be carried out on the following, where these 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 structures (for cracks, deformation, etc.), including a special check of all welds

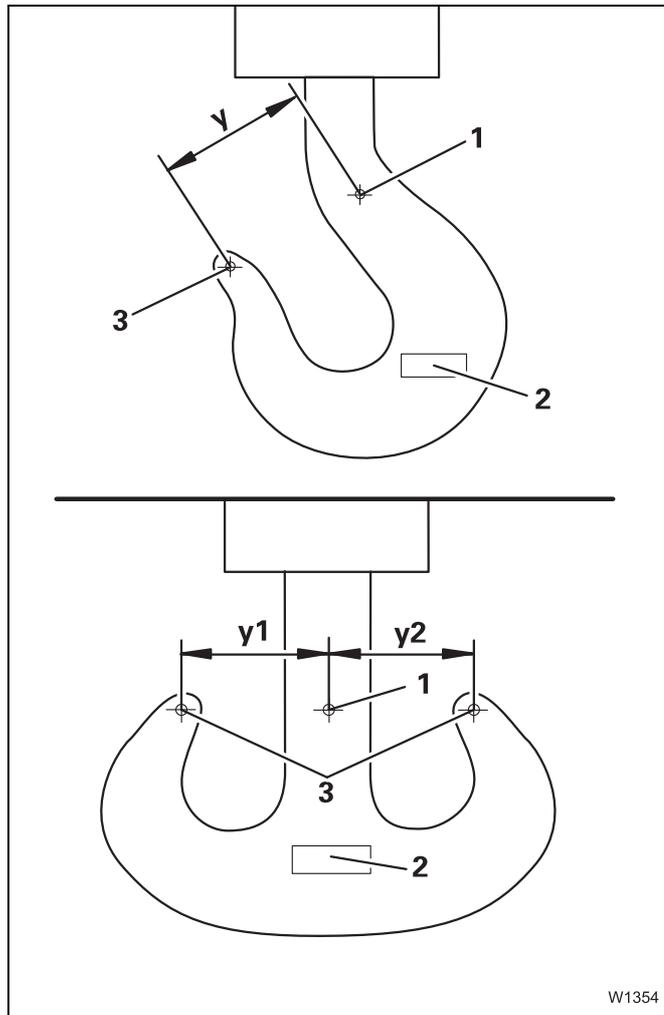
If damage is found on the steel structure, qualified specialists must determine the extent of the damage using the required material examination methods and must then determine the type of repair necessary. Prior to carrying out welding work on the truck crane, observe the ▣▣▣▣► *Safety instructions for welding work*, p. 1 - 4.

The inspector is to write a report containing the result of the annual inspection carried out 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 may not have expanded by more than 10% of the original dimension y , $y1$, $y2$.



The original dimensions y , $y1$, $y2$ are specified in field (2) on the load hooks.

- To check, 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 enlarged 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 monitoring the winches



Also observe the information on the general inspection of the hoists;
▶▶▶ p. 8 - 16.

These measures for monitoring the winches (hoists) were compiled by the German Machine Builders' Association (VDMA) and are to be used for all mobile 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 real 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. Concealed damage caused by accidents.
9. Extreme environmental conditions: Low or high temperatures
Aggressive atmosphere
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 operating hours of the hoists are to 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 Q 1 L 1	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 running time with dead load	0.125	W1355
Medium Q 2 L 2	Power unit or parts thereof that are subject to high stress quite often, but which are generally subject to only minimal stress	1/6 of the running time with greatest load (dead load + 1/1 payload) 1/6 of the running time with dead load + 2/3 payload 1/6 of the running time with dead load + 1/3 payload 50% of the running time with dead load	0.25	W1356
heavy Q 3 L 3	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 running time with dead load	0.5	W1357
very heavy Q 4 L 4	Power unit or parts thereof that are regularly subjected to high stress from neighbouring stress sources	90% of the running time with greatest load (dead load + 1/1 payload) 10% of the running time with dead load	1	W1358

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

Determining the effective operating hours T_i

The effective operating hours of the winches need to be entered in the crane logbook for the respective inspection interval.

- The effective operating hours T_i of the winches are displayed in the *Operating hours submenu*;  *Operating manual*.

Determining the used portion of the theoretical service life

For an inspection interval i (max. 1 year according to ISO 9927-1 or BGV D 6 (VGB 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 = Factor of the load spectrum used as the basis for winch calculation. This factor is given in the operating manual.

K_{m_i} = K_{m_i} = Load spectrum factor in the inspection interval “ i ” according to 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 expert has confirmed that the used proportion of the service life is correct and useful by signing his/her name in the crane test book after every 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. Pay attention to 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 occurs before expiry of the 12th operating year and must be repeated annually after this.

5.4.3**Example**

A GMK6400 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 L 1, $K_m = 0.125$
Theoretical service life:	$D = 3,200$ h

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

1st inspection (1st year)

The truck crane was used for assembly work during the previous year:
Load spectrum L 1, 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 at the 1st inspection is thus:

$$S_i = \frac{0.125}{0.125} \times 160 \text{ h} = 160 \text{ h}$$

Remaining theoretical service life:

$$D_1 = 3,200 \text{ h} - 160 \text{ h} = 3,040 \text{ h.}$$

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

2nd inspection (2nd year)

The truck crane was used for unloading work on docks:
Load spectrum: L 3, 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)
 $T_2 = 480 \text{ hrs.}$

The used proportion S_2 of theoretical service life at the 2nd inspection is therefore:

$$S_i = \frac{0.5}{0.125} \times 480 \text{ h} = 1,920 \text{ h}$$

Remaining theoretical service life:

$$D2 = 3,040 \text{ h} - 1,920 \text{ h} = 1,120 \text{ h.}$$

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

3rd inspection (3rd year)

The truck crane was used for assembly work and occasional unloading work on docks: Load spectrum: L 2, i.e. $Km_3 = 0.25$.

The operating hours counter for the main hoist reads 940 h, i.e. during this period: $940 \text{ h} - 640 \text{ h} = 300 \text{ h}$. $T3 = 300 \text{ h}$.

The used proportion S_3 of theoretical service life at the 3rd inspection is therefore:

$$S_i = \frac{0.25}{0.125} \times 300 \text{ h} = 600 \text{ h}$$

Remaining theoretical service life:

$$D3 = 1,120 \text{ h} - 600 \text{ h} = 520 \text{ h.}$$

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 hoisting winch)

Type of crane: GMK 3045
 Serial number: 3045 42 06
 Commissioned on: 10. 06. 1990
 13 301
 Last general overhaul performed on:

Winch design data (see operating manual):
 Power unit group: M 3
 Load spectrum: Q 1 (L1)
 Load spectrum factor: 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	Operating hours of the winch	Operating hours T_1 of the winch since the last inspection	Used portion S_1 of the theoretical service life D:	Remaining theoretical service life $D_1 = D - S_1$	Name of the expert	Signature	Comment	Name of the approved inspector	Signature
0(*)	10. 6. 90	-	-	-	-	-	-	-	0	3,200					
1	5. 6. 91	L 1	0.125	-	-	-	160	160	160	3,040	Müller				
2	20. 5. 92	L 3	0.5	-	-	-	640	480	1,920	1,120	Huber				
3	18. 5. 93	L 2	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_1 = Used proportion of theoretical service life since the last inspection
 D_1 = Remaining theoretical service life

D_{1-1} = Remaining theoretical service life after the previous inspection

K_m = Factor of the load spectrum used to calculate the winch.
 This factor is given in the operating manual.

K_{m1} = Factor of the load spectrum in the inspection interval "i" according to section 2.1

T_1 = Effective operating 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

Con-sec. No.	GROVE Part number	Lubricant type	Designation according to DIN 51502	Specifications Classification	Viscosity
1	03329588	Engine oil	HD - CD	MIL-L 2104 C DB 228.5	SAE 5 W-30
2	03325153	Gear oil		ZF TE-ML02 Ecofluid M ZF (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	03143502	Gear oil		Omala S4 GX 150	
6	02313611	Gear oil	C - LPF	MIL-L 2105 B API-GL-4/5 (synthetic)	SAE 75 W-90 EP ISO - VG 220
7	04162158	Hydraulic oil	HVLP	Castrol Hyspin AWH-M 32 DIN 51524-3	ISO - VG 32
8	03233369	Lubricating grease	KP - 1K - 50	DIN 51825 Renolit JP 1619	- 50 °C to +120 °C (-58 °F to +248 °F)
9	00554205	Spray		Ceplattyn 300	
10	02314698	Slide paste		PAL 1	
11	03325215	Lubricating grease		RHUS SW 2	
12	01929824	Spray		Berulub spray	
13	03133770	Lubricating grease		Elaskon 30	

6.1.2 Lubricant applications list

Con-sec. No.	Lubricant type	Usage	Fill quantity in litres (gal)	Maintenance interval
1	Engine oil	Carrier diesel engine;  p. 7 - 24	27 (7.1)	Y 2
2	Gear oil	Transmission without Intarder;  p. 7 - 45	15 (4.0)	Y 3
		Transmission with Intarder;  p. 7 - 45	25 (6.6)	Y 3
		Power take-off;  p. 7 - 49	4.5 (1.2)	Y 3
3	Gear oil	Transfer case;  p. 7 - 54	8 (2.1)	M 6
		1. Axle centre drive axle line;  p. 7 - 61	14.0 (3.7)	M 12
		2. Axle centre drive axle line;  p. 7 - 61	15.0 (4.0)	M 12
		1. + 2nd axle line: 4x final drives;  p. 7 - 64	3.8 (1.0)	M 12
		4th + 5th axle line: 4x final drives;  p. 7 - 64	6.0 (1.6)	M 12
4	Gear oil	12x suspension struts;  p. 7 - 79	1.5 (0.4)	M 1
5	Gear oil	Pump transfer case;  p. 8 - 37	4.6 (1.2)	M 12
6	Gear oil	Main hoist;  p. 8 - 14	7 (1.9)	M 12
		Auxiliary hoist;  p. 8 - 14	11.5 (3.0)	M 12
		3x slewing gears;  p. 8 - 20	0.9 (0.24)	M 12
7	Hydraulic oil	Carrier hydraulic tank;  p. 7 - 99	230 (61)	M 12
		Superstructure hydraulic tank;  p. 8 - 57	1,320 (349)	M 12



Con-sec. No.	Lubricant type	Usage	Fill quantity in litres (gal)	Maintenance interval
8	Lubricating grease	Carrier central lubrication; ■■■▶ p. 7 - 107		W
		Superstructure central lubrication; ■■■▶ p. 8 - 89		W
		Cardan shafts – transverse; ■■■▶ p. 7 - 67		M 1
		Cardan shafts – longitudinal; ■■■▶ p. 7 - 68		M 6
		Towbar coupling; ■■■▶ p. 7 - 123		M 1
		Outrigger beams; ■■■▶ p. 7 - 132		M 1
		Turntable lock; ■■■▶ p. 8 - 32		M 12
		Slewing angle sensor; ■■■▶ p. 8 - 87		Y 5
		Hook blocks; ■■■▶ p. 8 - 91		M 12
		Cab door hinges; ■■■▶ p. 7 - 133		M 12
		Carrier pins; ■■■▶ p. 7 - 134		M 12
		Superstructure pins; ■■■▶ p. 8 - 104		M 12
9	Spray	Slewing bearing gear teeth; ■■■▶ p. 8 - 27		M 6
10	Slide paste	Telescope slide faces; ■■■▶ p. 8 - 66		M 3
11	Lubricating grease	Telescopic locking pins; ■■■▶ p. 8 - 66		M 3
		Derricking cylinder piston rod; ■■■▶ p. 8 - 65		M 1
		Cab door rails; ■■■▶ p. 8 - 102		M 12
		Stair tread rails; ■■■▶ p. 8 - 103		M 12
12	Spray	Outrigger pad/supporting cylinder; ■■■▶ p. 7 - 132		M 1
		Derricking cylinder piston rod; ■■■▶ p. 8 - 65		M 1
13	Lubricating grease	Lubricate the hoist ropes; ■■■▶ p. 8 - 73		M 3

6.2 Refrigerant

Refrigerant Designation	Usage	Fill quantity in kg (lbs)	Maintenance interval
Tetrafluoroethane (R134a) CAS no. 811-97-2 EC no. 212-377-0	Air-conditioning system; ►►► p. 7 - 120	2.60 (5.73)	M 12
	Air-conditioning system; ►►► p. 7 - 120 (with <i>Fuel Saver</i> additional equipment)	2.85 (6.28)	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*.

6.3.3 After-treatment of exhaust gases

Only with *AdBlue* system additional equipment;  p. 7 - 1.

Designation	Usage	Fill quantity in litres (gal)
DEF (D iesel E xhaust F luid) ¹⁾ <i>AdBlue</i> : GROVE part number: 03140555	AdBlue tank on the carrier;  p. 7 - 36	40 (10.5)

- 1) DEF (**D**iesel **E**xhaust **F**luid),
Consumable for exhaust gas emission control, 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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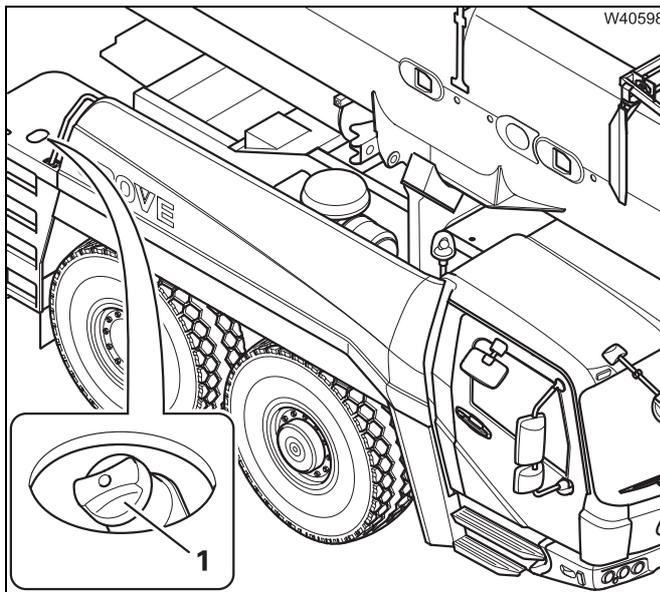
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7

Maintenance work on the carrier

7.1

General instructions



When the tank (1) is present, then the truck crane is equipped with the *AdBlue system*¹⁾ additional equipment.

The *AdBlue-System* is only present in truck cranes that comply with the exhaust emissions in TIER4i or Euromot 3B.

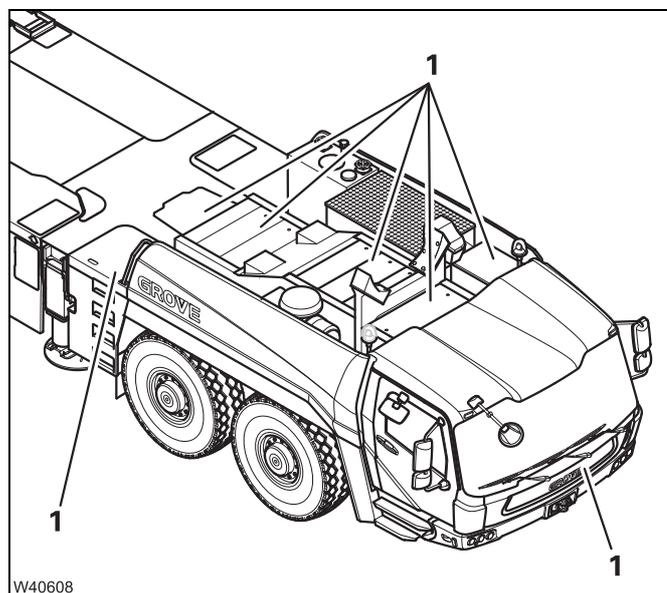
This requires additional maintenance work, which is marked appropriately.

- ¹⁾ DEF (**D**iesel **E**xhaust **F**luid),
Consumable for exhaust gas emission control, 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.

7.1.1

Covers

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



Before maintenance work

- Remove the covers (1).

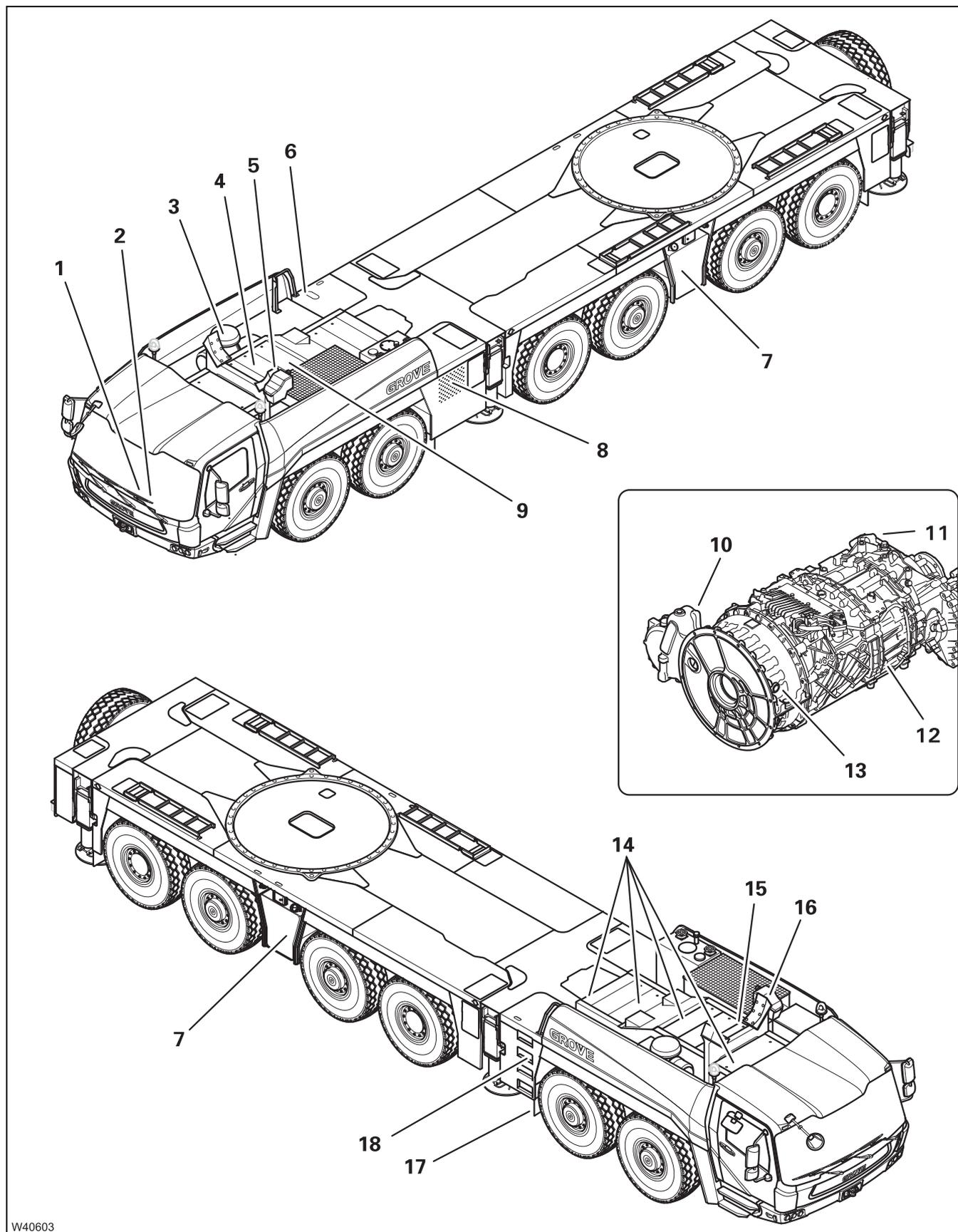
After maintenance work

- Fasten the covers (1) with the locks.

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7.1.2

Overview of maintenance work on the carrier

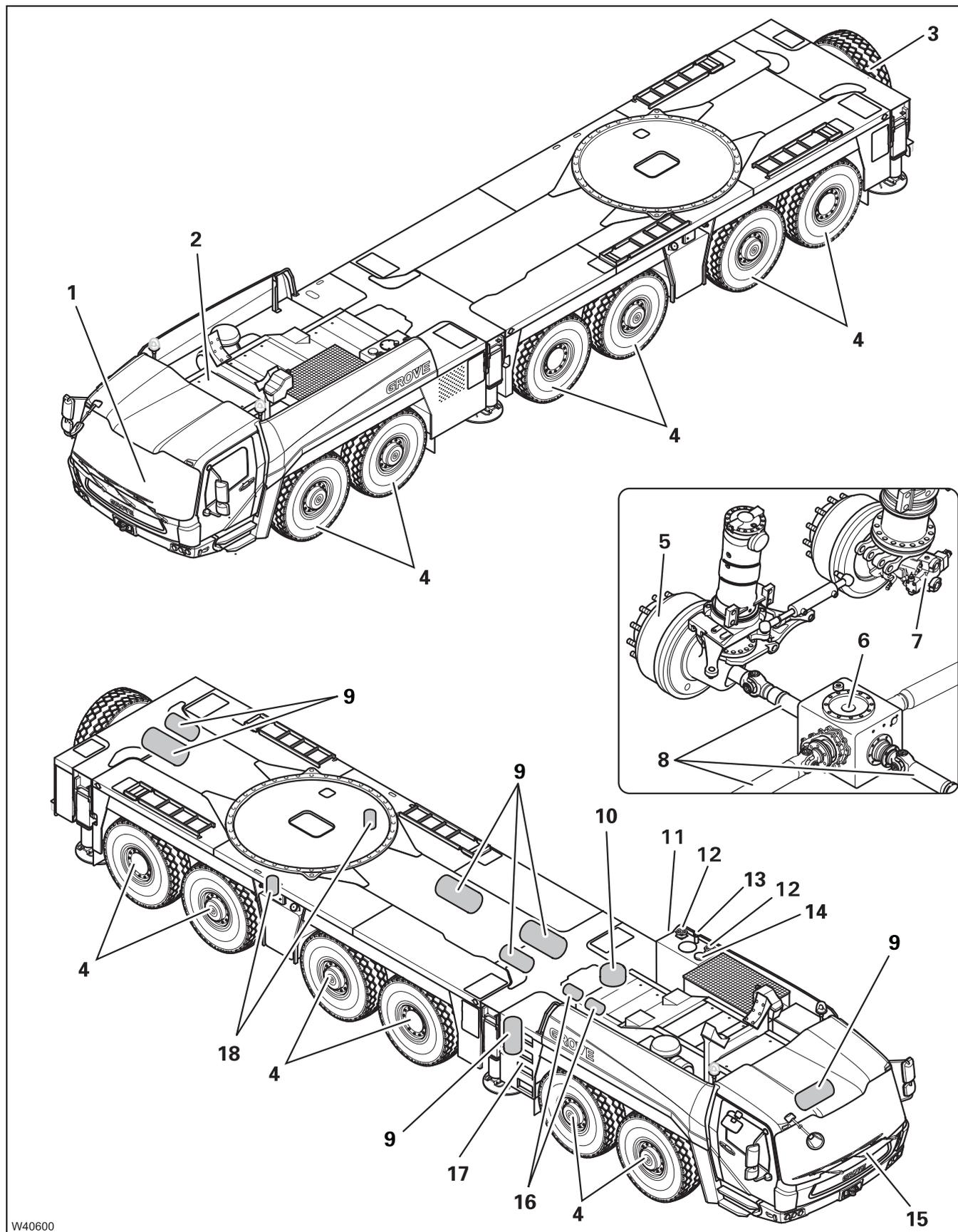


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14 Covers	▣▣▣▣ p. 7 - 2
5 Dipstick	▣▣▣▣ p. 7 - 13
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10 Oil filter on the power take-off	▣▣▣▣ p. 7 - 49
Transfer case	▣▣▣▣ p. 7 - 53
17 Oil inspection plug	▣▣▣▣ p. 7 - 53
¹⁾ Additional equipment	
²⁾ <i>AdBlue system</i> additional equipment	





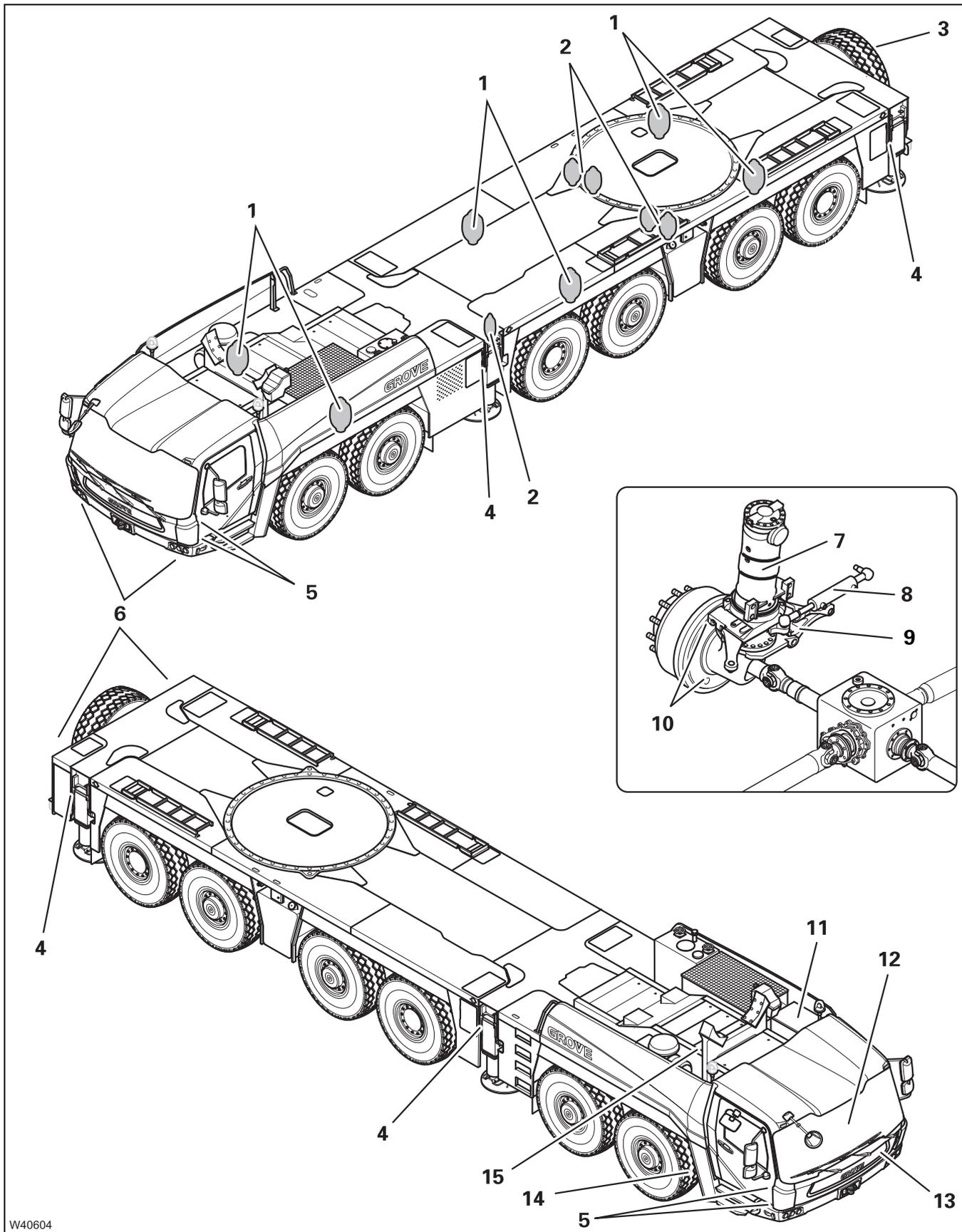
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Compressed air system	➡ p. 7 - 85
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¹⁾ Additional equipment





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6 Carrier lighting	▣▣▣▣ p. 7 - 111
11 Battery box	▣▣▣▣ p. 7 - 112
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Towbar coupling	▣▣▣▣ p. 7 - 123
3 Towbar coupling ¹⁾	▣▣▣▣ p. 7 - 123
Other maintenance work	▣▣▣▣ p. 7 - 131
13 Windscreen washing system reservoir	▣▣▣▣ p. 7 - 131
4 Outrigger beams	▣▣▣▣ p. 7 - 132
14 Driver's cab auxiliary heater ¹⁾	▣▣▣▣ p. 7 - 133
5 Cab door hinges	▣▣▣▣ p. 7 - 133
– Various connecting pins and socket pins	▣▣▣▣ p. 7 - 134
– Corrosion protection	▣▣▣▣ p. 7 - 135
12 Fire extinguisher	▣▣▣▣ p. 7 - 137

¹⁾ Additional equipment

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7.2

Symbols for maintenance work

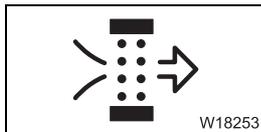
Check the following symbols every day before starting work.

On the Instrument panel

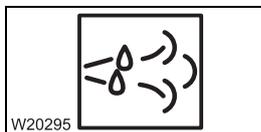
If one of the symbols is displayed in the **driver's cab** you must carry out the corresponding maintenance work:



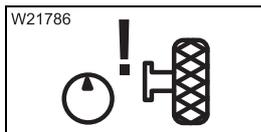
– Oil pressure;  p. 7 - 13



– Air filter;  p. 7 - 17

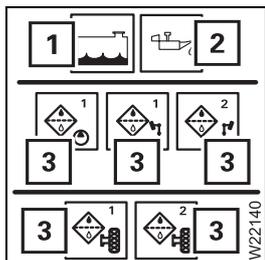


– AdBlue system;  p. 7 - 36



– Hydraulic drives;  p. 7 - 60

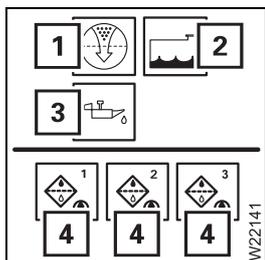
On the *ECOS* display



- Open the *Warning* submenu in the **driver's cab**;
 ▶▶▶▶▶ *Operating manual*.

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

- 1 Coolant level; ▶▶▶▶▶ p. 7 - 18
- 2 Oil pressure; ▶▶▶▶▶ p. 7 - 13
- 3 Hydraulic oil filter in the carrier; ▶▶▶▶▶ p. 7 - 103.



- Open the *Warning* submenu in the **crane cab**;
 ▶▶▶▶▶ *Operating manual*.

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

- 1 Air filter; ▶▶▶▶▶ p. 7 - 17
- 2 Coolant level; ▶▶▶▶▶ p. 7 - 18
- 3 Oil pressure; ▶▶▶▶▶ p. 7 - 13
- 4 Hydraulic oil filter in the superstructure; ▶▶▶▶▶ p. 8 - 53.

7.3

Engine

- Also carry out additional maintenance work specified in the *Engine manufacturer's documentation* supplied. Pay attention to the information relating to use of bio-diesel fuel – the oil change interval must be halved.
- At the first oil change, fit a drain valve in place of the drain plug;
 ▶ p. 7 - 16.

7.3.1

Checking the oil level

D

Prerequisites

- The truck crane must be level.

Check 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.

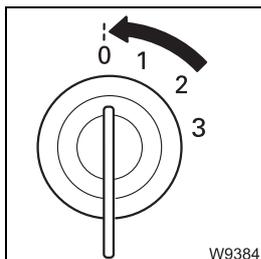
Running the engine when the oil pressure is too low can damage it.



- **Switch off the engine immediately** when:

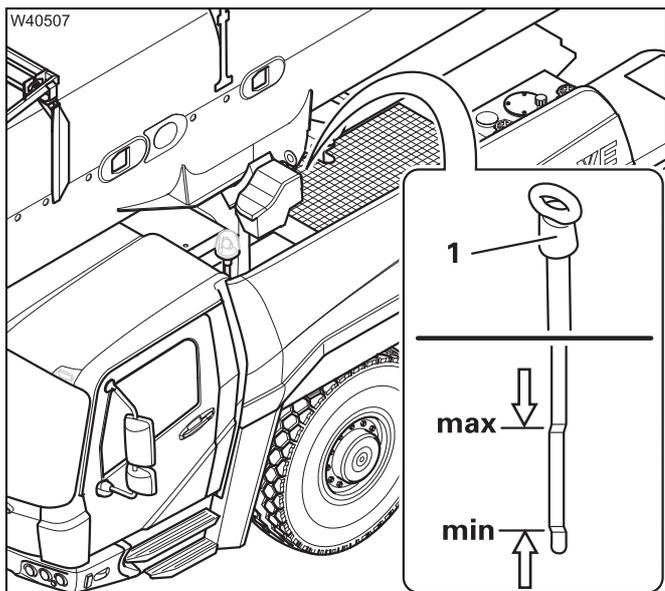
- The **STOP** symbol is displayed
- The **Oil can** symbol is displayed
- The warning buzzer sounds

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 **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 - 15.

7.3.2

Topping up the oil

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

Oil

Engine oil in litres (gal)	Designation to DIN 51502	Specifications Classification	GROVE part no.
27 (7.1)	HD - CD	MIL-L 2104 C DB 228.5	SAE 5 W-30 03329588

Prerequisites

- The truck crane must be level.
- The engine must not be running and must be secured against unauthorised use; ■■■► p. 2 - 3.

Topping up the oil



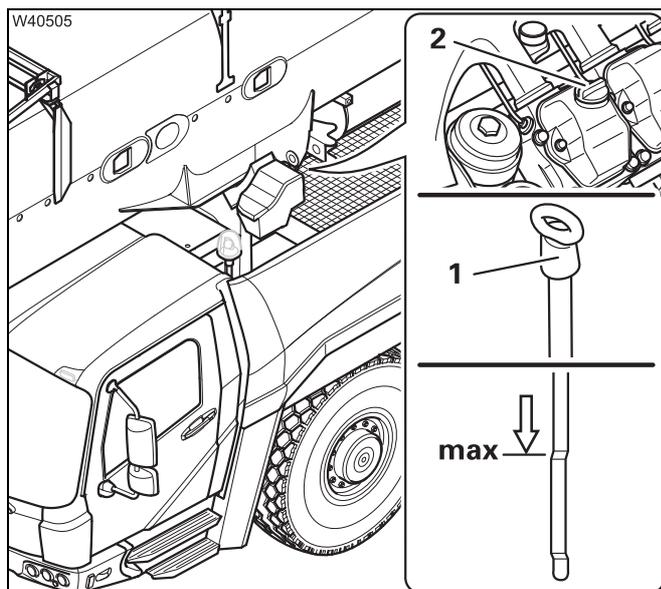
Risk of damage to the engine if the oil level is too high!

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.
- Insert the dipstick (1) into the dipstick tube after checking the oil level.

7.3.3

Installing the drain valve

You can replace the drain plug on the oil pan with a valve.
This makes it easier to check the draining oil during subsequent oil changes.

Spare parts and tools

Designation	Quantity	GROVE part no.
Valve M 20 x 1.5	1	03041579
Gasket 20 x 24 Cu DIN 7603	1	00117139
or:		
Valve M 26 x 1.5	1	03046878
Gasket 26 x 31 Cu DIN 7603	1	00117147

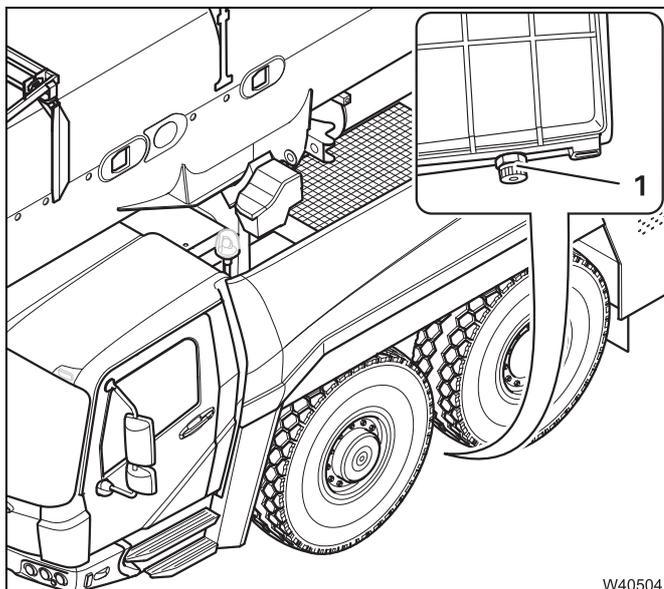
- Drain channel.
- Torque wrench for a torque of 80 Nm (59 lbf ft).

Prerequisites

- The truck crane must be level.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Installing the valve

- Check the thread size (M 20 or M 26).



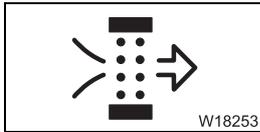
- Use a drain channel when draining the oil.
- Drain the oil as described in the *Engine manufacturer's documentation*.
- Fit a new gasket and tighten the valve (1).
M 20 Torque 60 Nm (44.25 lbf ft)
M 26 Torque 80 Nm (59.00 lbf ft)
- Check the valve for leaks after filling the oil.

For the next oil change, you can drain the oil as done for the hydraulic tank;
 *Handling the valves*, p. 7 - 100.

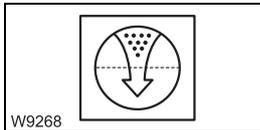
7.3.4

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.

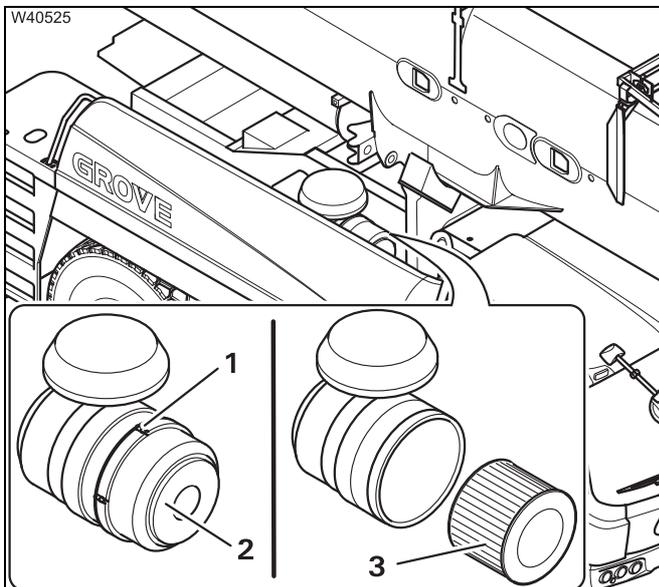
Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	03328262

Prerequisites

- The engine must not be running and must be secured against unauthorised use; p. 2 - 3.

Replacing the air filter

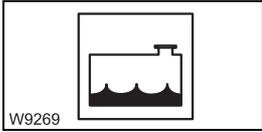


- Undo all the clamps (1) and remove the cover (2).
- Change the filter (3).
- Replace the cover and secure it with all the clamps.

7.3.5

Checking the coolant level

D



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

Topping up the coolant

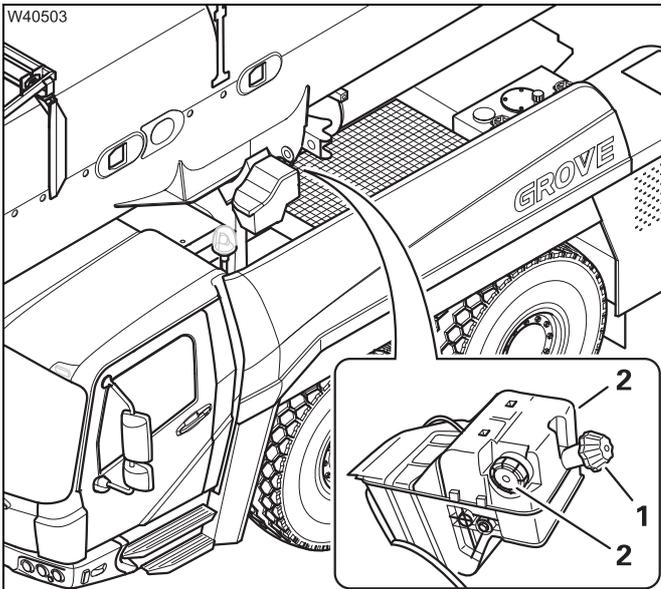


Danger of being scalded due to hot cooling circuit!

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

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

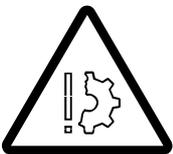
Turn the cap slowly to the first detent in order to allow the pressure to be released.



- 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 cap (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.

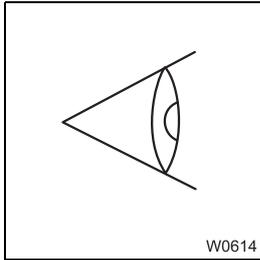


The cooling circuit also feeds the heat exchanger on the transmission with Intarder (additional equipment); ▣▣▣▣ *Transmission variants, p. 7 - 41.*

7.3.6

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 - 13,*
 - ▶▶▶▶ *Checking the coolant level, p. 7 - 18.*

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

7.3.7

Have the radiator checked/cleaned

M 12

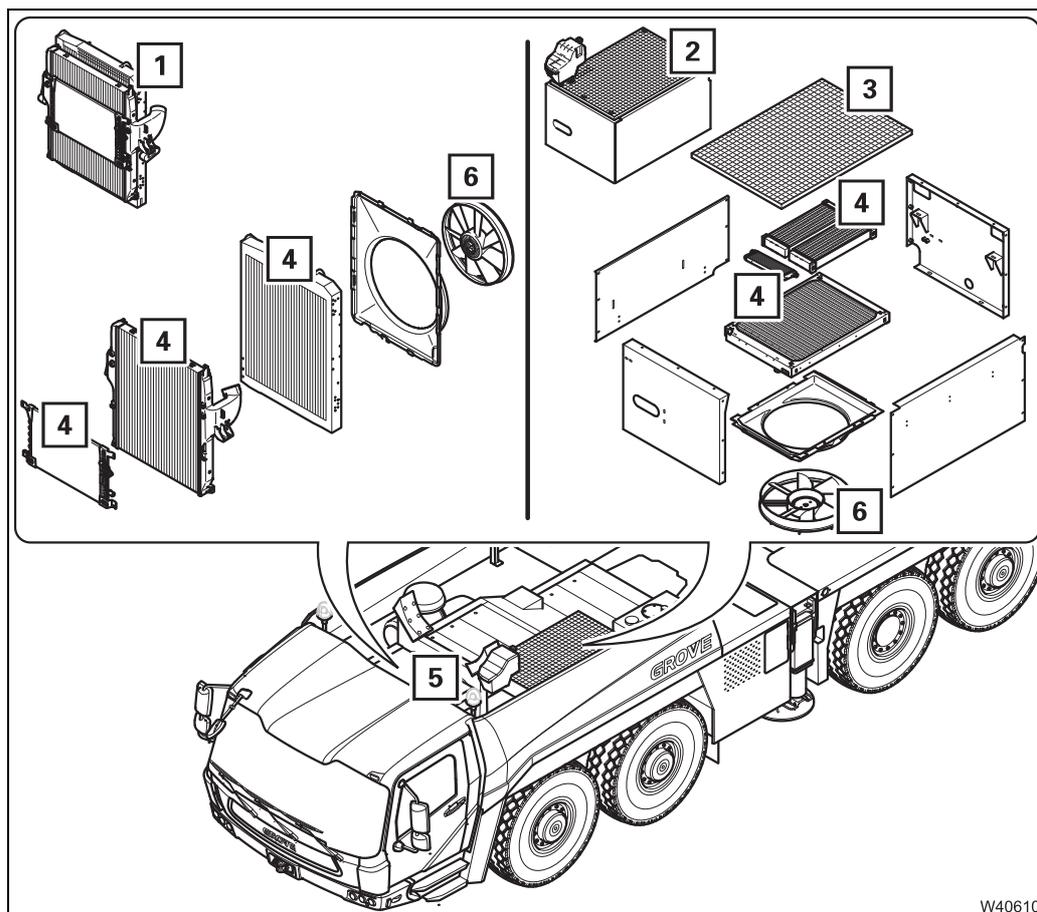
Reducing the interval

- 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;  *Operating manual*.
- The main boom is fully retracted and raised to 75°;  *Operating manual*.
- The engine must not be running and must be 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



The two radiator units (1) and (2) consist of different radiators (4). These are located under the griller (3) or the plate (5). The fan impellers (6) are located under the radiators. The fan impellers rotate when the engine is running!



Risk of injury due to the fan impellers!

Rotating fan impellers can trap your fingers 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 (vertical)

Radiator for the engine cooling water, radiator for the engine charge air, condenser for the air-conditioning refrigerant.

Radiator unit 2 (horizontal)

Additional radiator for the engine cooling water, two radiators for the carrier hydraulic oil, radiator for the compressed air system.

- If necessary remove leaves, twigs and other debris from the grilles (3).
- Inspect 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 - 22.

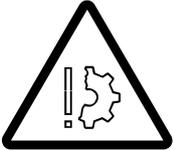


**Have them
cleaned**



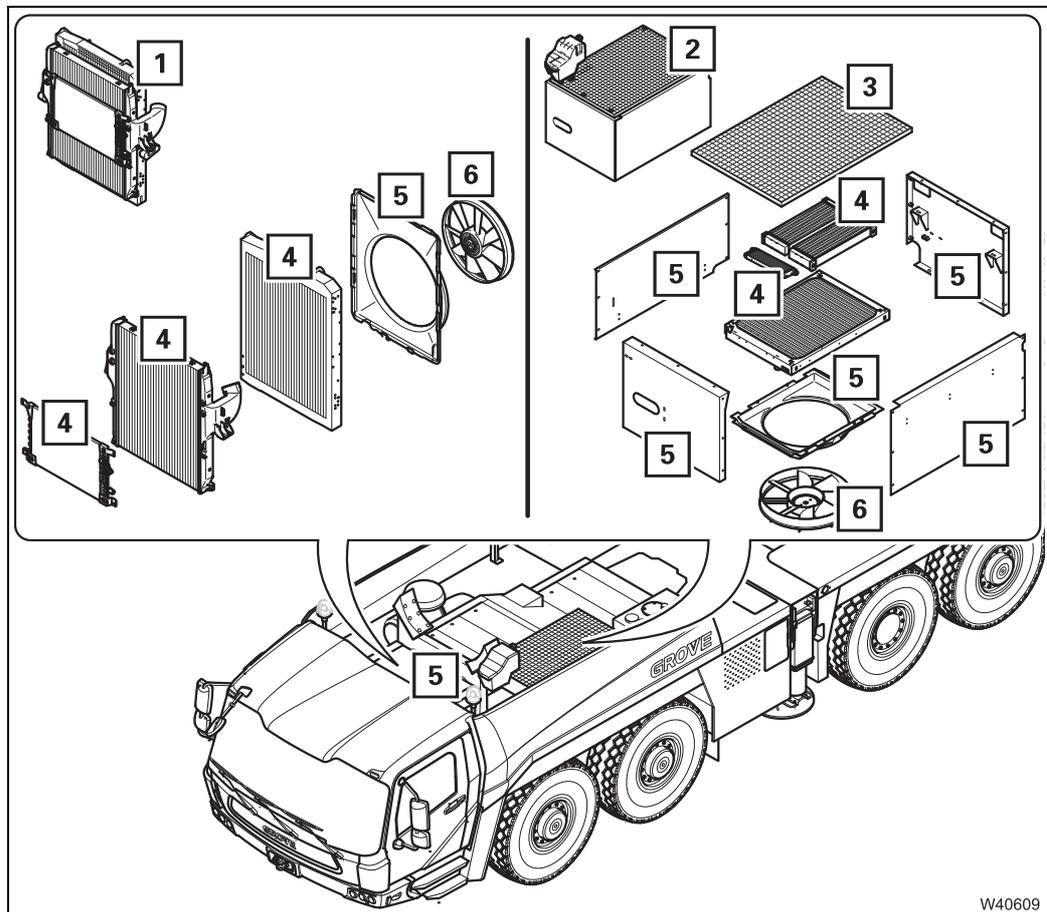
Risk of injury due to the fan impellers!

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.



W40609

- Have the radiator units (1) and (2) opened up by the repair specialists, so that the radiator fins are accessible.
- Have the radiator fins (4) cleaned on both sides, using suitable cleaning agents.
- Have the fan impellers (6) cleaned.
- Have the cooling baffles (5) 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 (5) are securely fastened.
- Start the engine and wait until the fan impellers (6) rotate.
- Check that the fan impellers run freely (6).
- Check the respective temperature displays in the driver's cab;
 ▣▣▣▣► *Operating manual*.
- Switch the engine off.
- Check the radiator and connections for leaks.

7.3.8

Changing the oil and oil filter

Y 2

Oil, spare parts,
tools

Engine oil in litres (gal)	Designation to DIN 51502	Specifications Classification	GROVE part no.
27 (7.1)	HD - CD	MIL-L 2104 C DB 228.5	SAE 5 W-30 03329588

Designation	Quantity	GROVE part no.
Oil filter with gasket	1	03328365
Gasket for oil drain plug for diesel engine with AdBlue system	1	03329824
Gasket for oil drain plug for diesel engine without AdBlue system	1	03329825

- Receptacle, about 30 l (8 gal);  p. 2 - 4.
- Torque wrench for a torque of 40 Nm (29.5 lbf ft).
- Socket wrench SW 36.
- Connecting piece and hose (toolbox);  p. 7 - 100.

Prerequisites

- Find out the prescribed oil specification and the necessity of shortening the maintenance interval under special operating conditions;  *Engine manufacturer's documentation.*
- Find out about the safety instructions and the sequence of steps for changing the oil and oil filter;  *Engine manufacturer's documentation.*
- The truck crane must be level.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Changing



Risk of environmental damage due to leaking consumables!

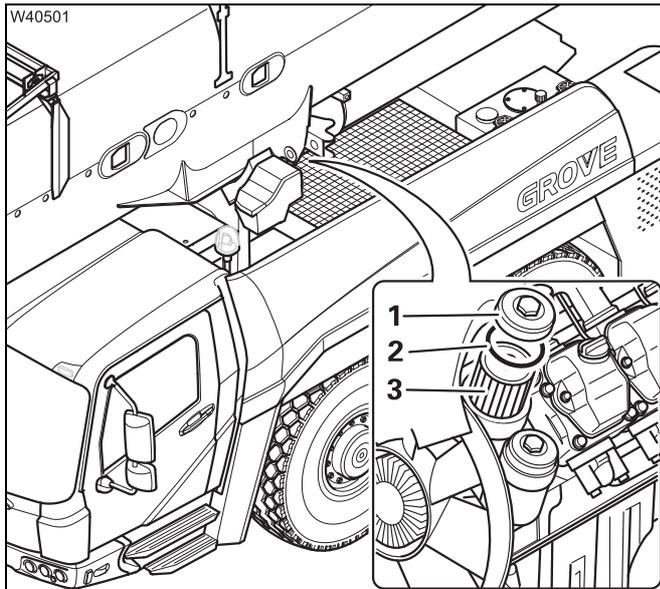
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.
Store/dispose of consumables and any soaked equipment properly.
Ask about the applicable regulations.

If a valve is already mounted on the oil pan:



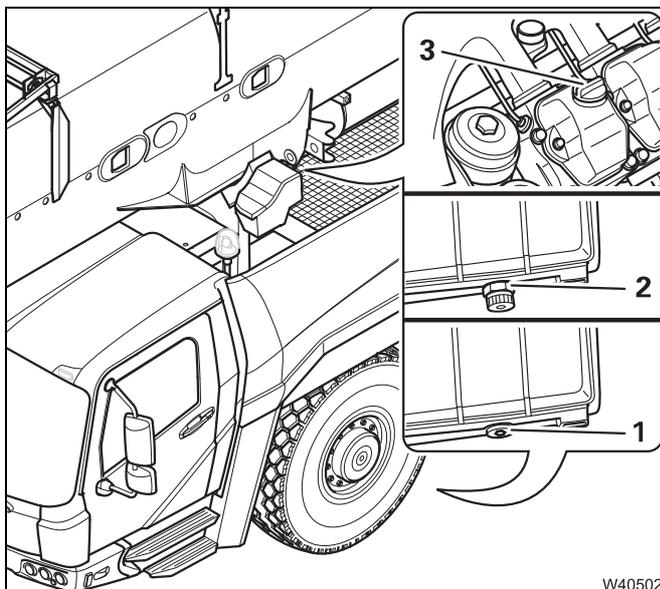
Risk of environmental damage due to leaking consumables!

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) and pull out the filter (3).
- Insert a new filter (3).
- Replace the gasket (2).
- Screw on the cover (1) using the socket wrench – torque 40 Nm (29.5 lbf ft);
▣▣▣▣ *Engine manufacturer's documentation.*
- Leave the receptacle in place for the oil change.



Draining oil

- Unscrew the drain plug (1) **or** screw the connecting piece with hose onto the valve (2) and drain the oil into the receptacle;
▣▣▣▣ *Handling the valves, p. 7 - 100.*

If required, you may replace the drain plug with a valve; ▣▣▣▣ p. 7 - 16.

- Tighten the drain plug (1) – observe the tightening torques for M 20/M 26;
▣▣▣▣ p. 7 - 16 **or** remove the connecting piece with hose from the valve (2) and remove the receptacle.

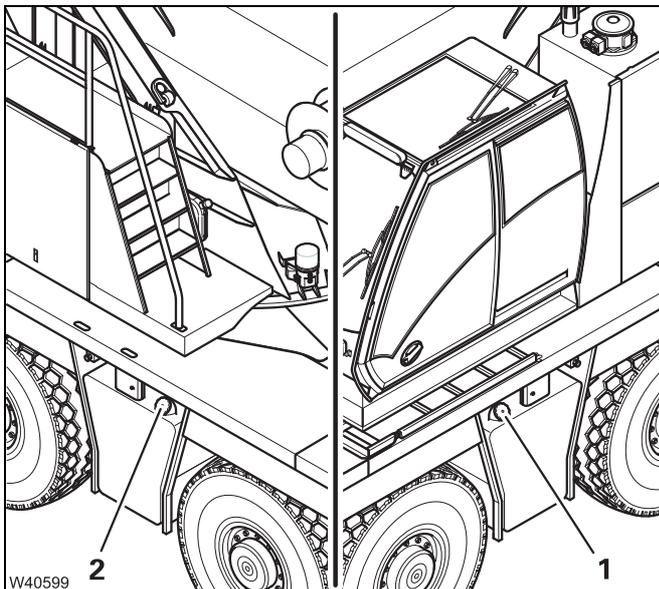
Topping up the oil

- Top up with fresh oil through the filler neck (3); ▣▣▣▣ p. 7 - 15.

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7.4

Fuel system

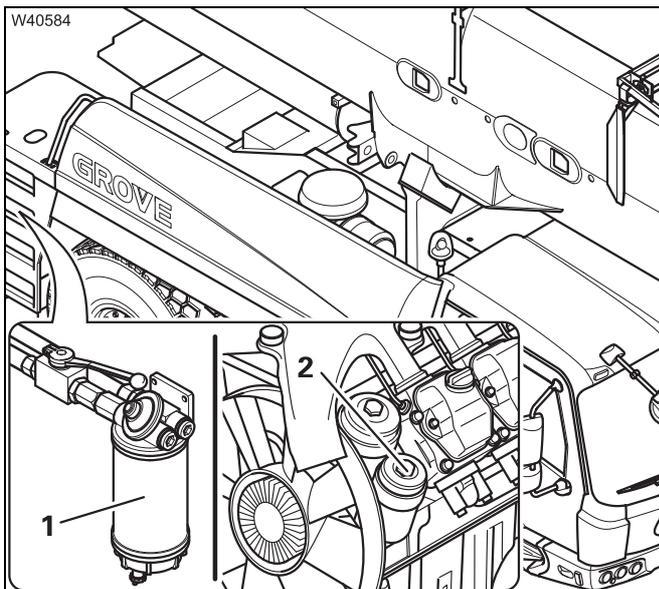


This section describes the maintenance work for the **standard fuel system** with two connected fuel tanks, (1) and (2), which may only be filled with a single type of fuel.

For **additional equipment** with a **dual tank system**, the fuel tanks (1) and (2) are separate and are filled with different types of fuel;

▣▣▣▣ *Operating manual.*

- Ask **Manitowoc Crane Care** about the additional fuel filter required for the **dual tank system**.



As **standard**, the following elements are installed in the fuel line:

- 1 Fuel filter 1
- 2 Fuel filter 2

7.4.1

Draining water from fuel filter 1

D

Spare parts and tools

- Receptacle, about 5 l (1.5 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be level.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Draining off water

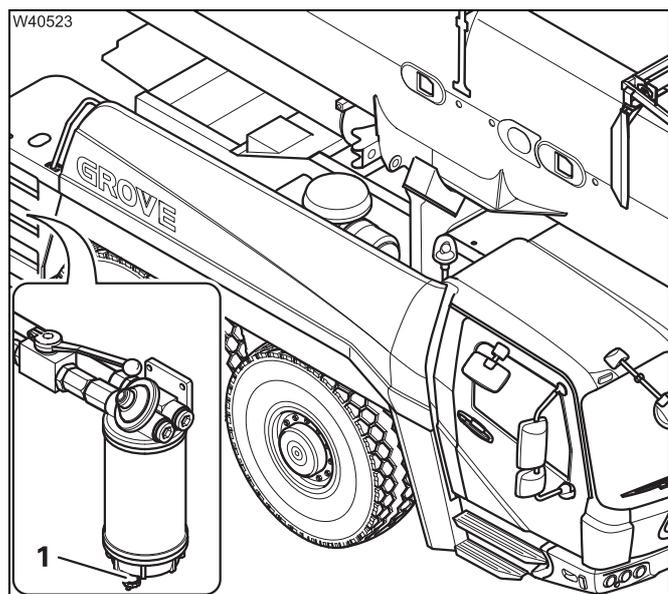


Risk of environmental damage due to leaking consumables!

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).
- When consumables escape, close the valve by hand.
- Remove the receptacle and dispose of the drained consumable in a proper manner.

7.4.2

Changing fuel filter 1

M 3

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	03322877
Gasket	1	03322879
Filter element	1	03328656

- Receptacle, about 5 l (1.5 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be level.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.
- If the fuel is dirty: Reduce the maintenance interval.

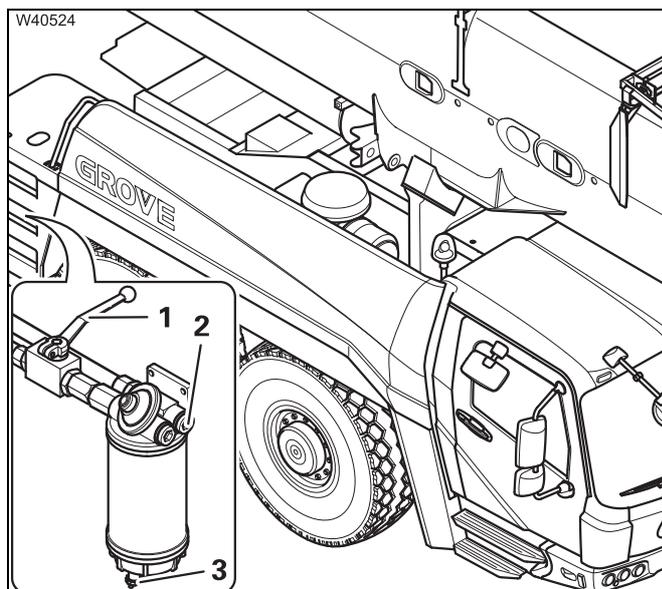
Changing



Risk of environmental damage due to leaking consumables!

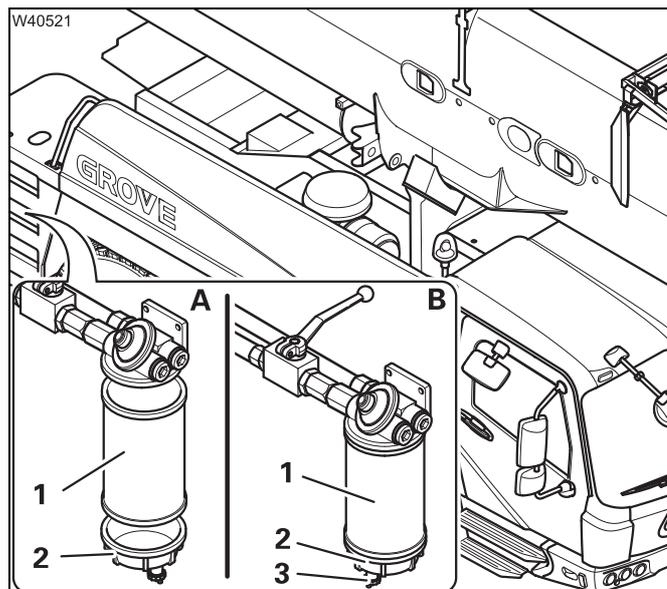
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

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

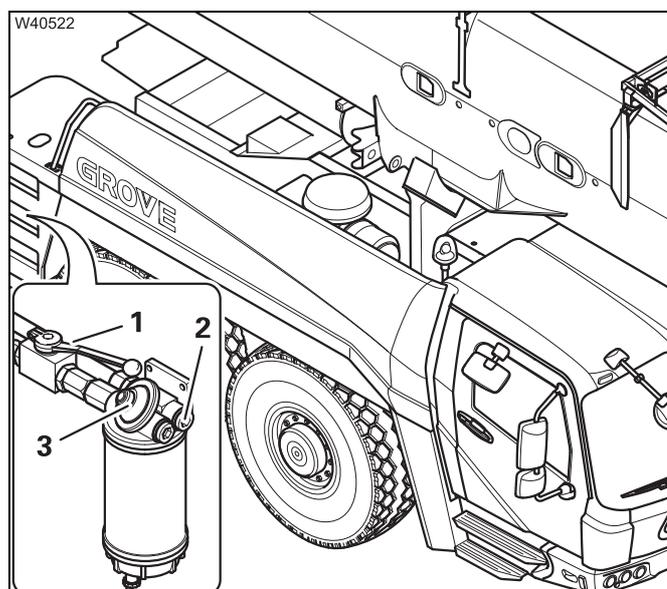


- Place a receptacle underneath the filter.
- Close the valve – lever (1) at right angles to the line.
- Open the screw (2) and the valve (3) and drain the consumable.





- **(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 **(1)** – lever parallel to the line.
- Operate the pump **(3)**, until the flowing out of the screw **(2)** 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.

7.4.3

Changing fuel filter 2

M 12

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter with gasket	1	03319653

- Receptacle, about 5 l (1.5 gal); p. 2 - 4.
- Torque wrench for a torque of 25 Nm (18.4 lbf ft).

Prerequisites

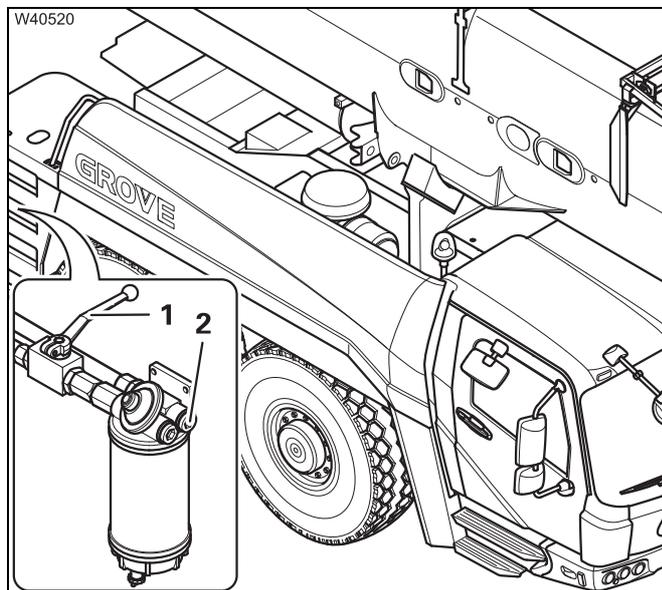
- The truck crane must be level and on outriggers; *Operating manual*.
- The main boom must be fully raised; *Operating manual*.
- The engine must not be running and must be secured against unauthorised use; p. 2 - 3.



Risk of environmental damage due to leaking consumables!

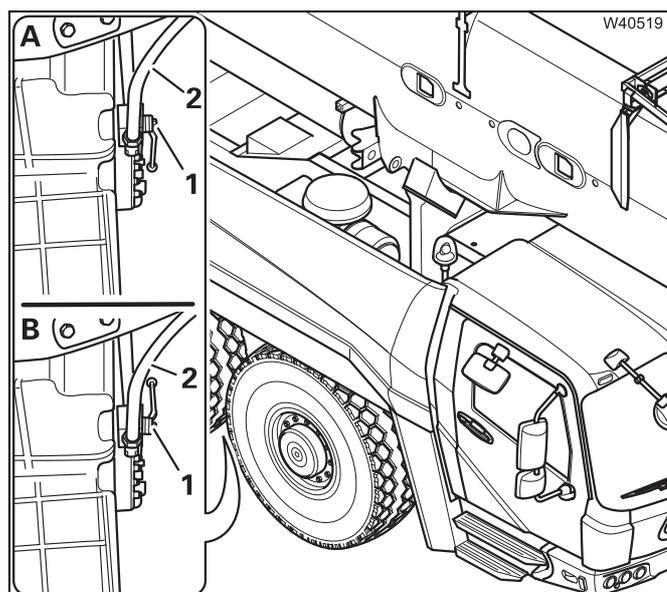
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.
Store/dispose of consumables and any soaked equipment properly.
Ask about the applicable regulations.

Emptying the fuel line



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

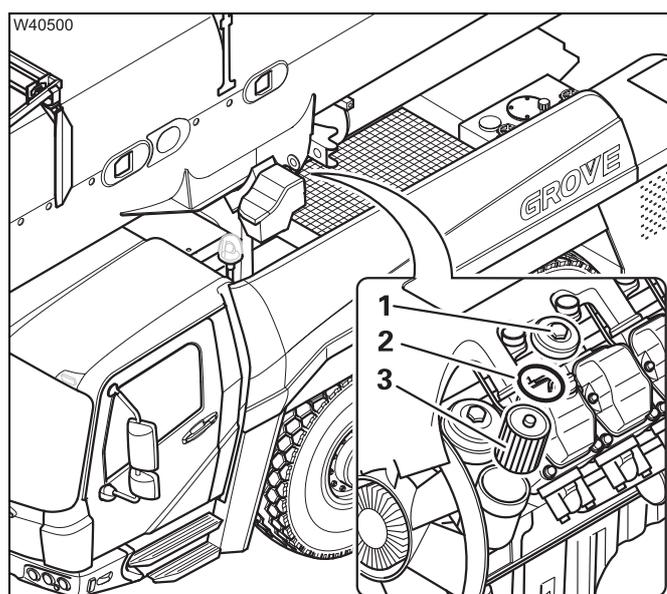




- Place a receptacle underneath the end of the hose (2).
- (A)– Turn the valve – lever (1) horizontal.
- Let the consumable drain.
- (B)– Turn the valve – lever (1) vertical.

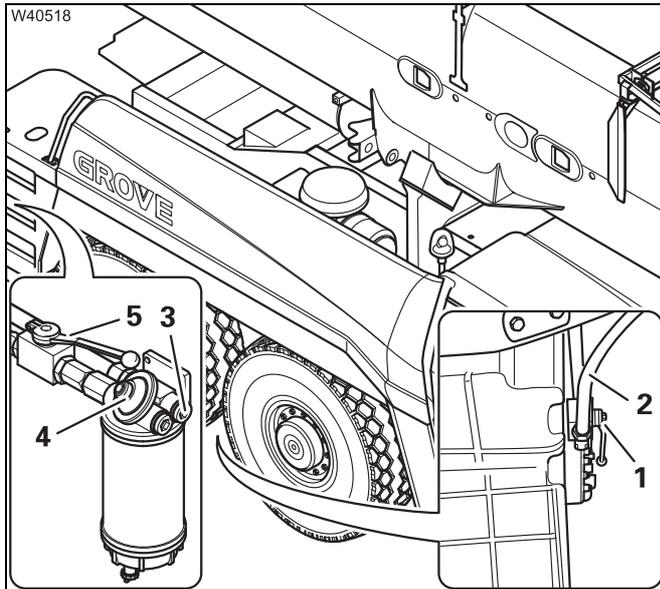
Leave the receptacle under the hose. More consumable will run out during bleeding.

Changing the filter



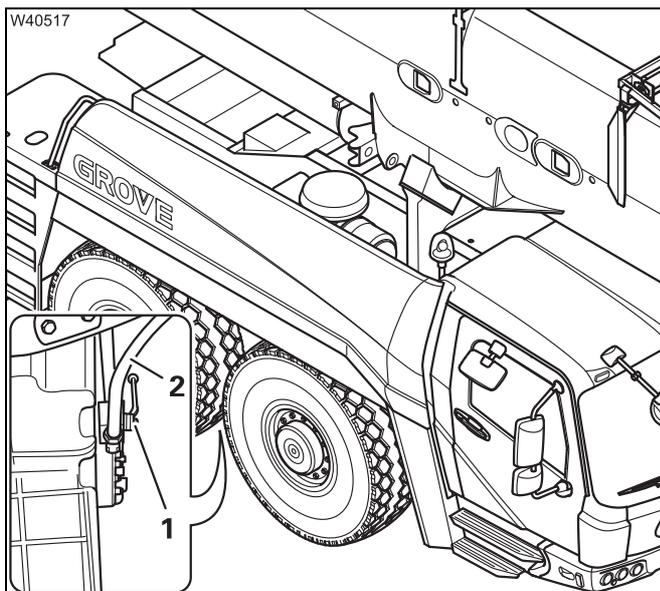
- Unscrew the cap (1) and remove the filter (3).
Let the remaining consumable drain away.
- Remove the cap and unclip the filter by applying pressure to the sides of its lower edge.
- Replace the seal (2) (lubricate slightly) and clip a new filter into the lid.
- Screw the lid and filter into the housing and tighten it – Torque 25 Nm (18.5 lbf ft).

Bleeding the fuel line



A receptacle is under the end of the hose (2).

- Close the drain plug (3).
- Open the valve – lever (1) parallel to the line.
- Open the valve – lever (5) horizontal.
- Operate the pump (4), until the consumable flowing through the end of the hose no longer contains any bubbles.



- Turn the valve – lever (1) vertical.
- Start the engine and check the filter for leaks.
- Remove the receptacle underneath the hose end (2).



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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7.5

Exhaust system with exhaust emission control

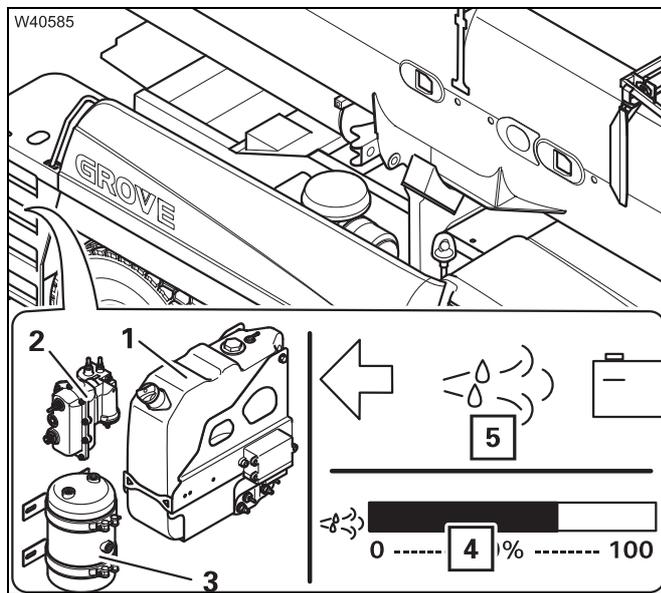
Overview

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.

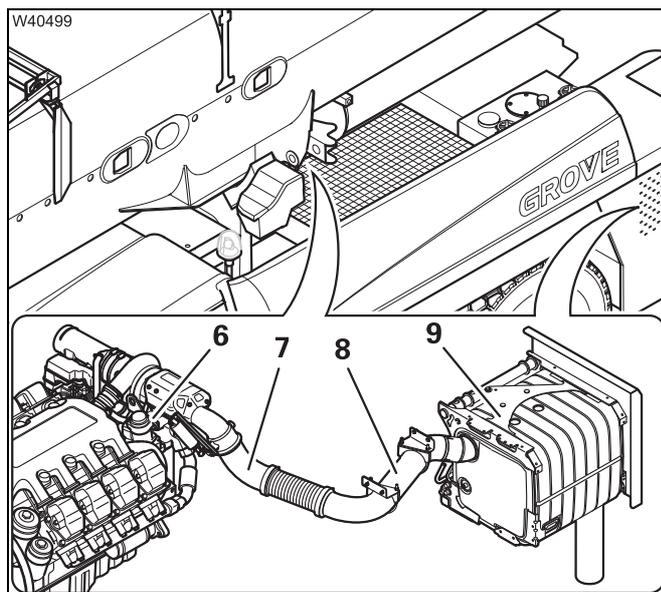
The engine output is automatically sharply reduced when there is not enough AdBlue solution available. Driving with an empty AdBlue tank will invalidate the truck crane's licence for use on public roads;

▣▣▣▣ *Operating manual*, ▣▣▣▣ *Engine manufacturer's documentation*.



AdBlue system

- 1 AdBlue tank
- 2 Pump unit for delivering AdBlue to the dosing unit on the diesel engine and for pumping engine coolant for preheating the AdBlue tank.
- 3 Air reservoir
- 4 Tank gauge, AdBlue tank
- 5 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 mixture of AdBlue and compressed air.
- 8 Exhaust pipes
- 9 Exhaust silencer with SCR catalytic converter.

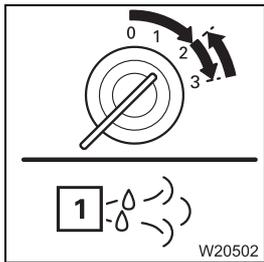
7.5.1 **Checking the AdBlue tank level** **D**

Checks

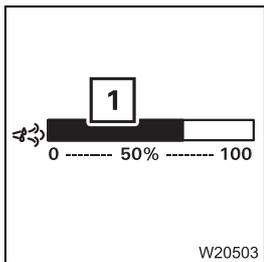
The warning lamp for checking the AdBlue system is located on the instrument panel in the driver's cab, a gauge for checking the AdBlue tank level is located on the ECOS display.



The tank has a maximum filling volume of about 40 l (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 starting the engine:
 - 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 (1).
- Refill the tank when the AdBlue level falls below about 10 l (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)	Specifications Classification	GROVE part no.
40 (10.5)	DEF (Diesel Exhaust Fluid); e.g. <i>AdBlue</i> .	03140555

– As required: 2 canisters of about 20 l (5 gal) each; 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 not be running and must be secured against unauthorised use; p. 2 - 3.

Refuelling

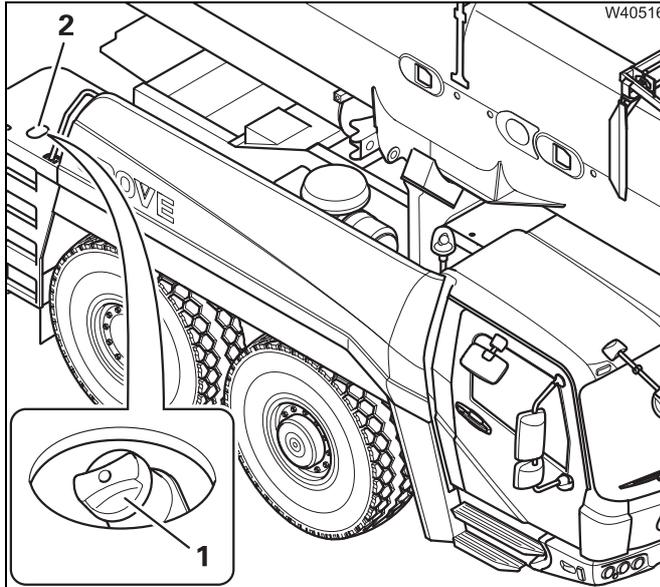
- Find out about refuelling in the operating manual and note the warnings;
 ▣▣▣▣► *Operating manual.*



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 plate (2) above the filler neck (1).
- Fill the AdBlue tank via the filler neck (1) and close it using the cap.
- Close the plate (2).
- Check the filling level on the display in the driver's cab; ▣▣▣▣► p. 7 - 36.

7.5.3

Checking 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	03140912

Prerequisites

- The engine must not be running and must be secured against unauthorised use; ▣▣▣▣► p. 2 - 3.
- The engine and the exhaust system have cooled down.

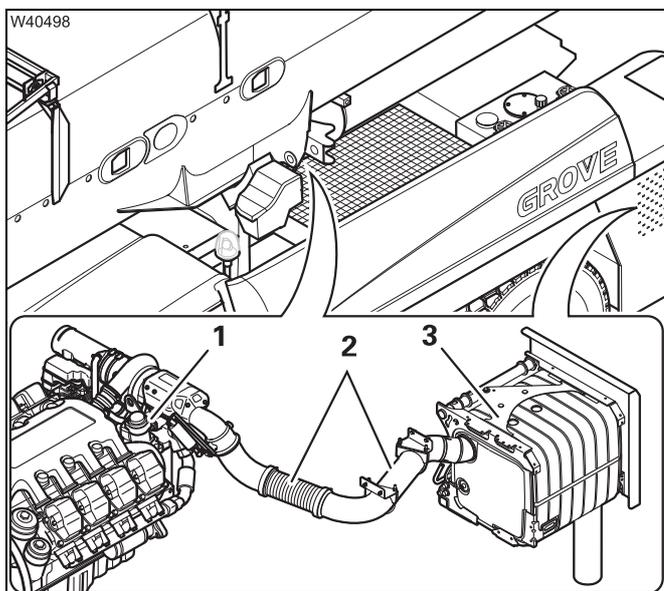


Checks



Risk of burns when 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. Take care 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 vicinity of the exhaust pipes is free of loose components that could burn by coming into contact with the hot exhaust system.
- Check the nozzles (4) for injecting AdBlue for external damage.

After checking

- Start the engine.
- Check the Adblue system lamp on the instrument panel;  p. 7 - 36.
- Check if exhaust gases are leaking from any damaged places in the exhaust system.
- Switch the engine off.

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

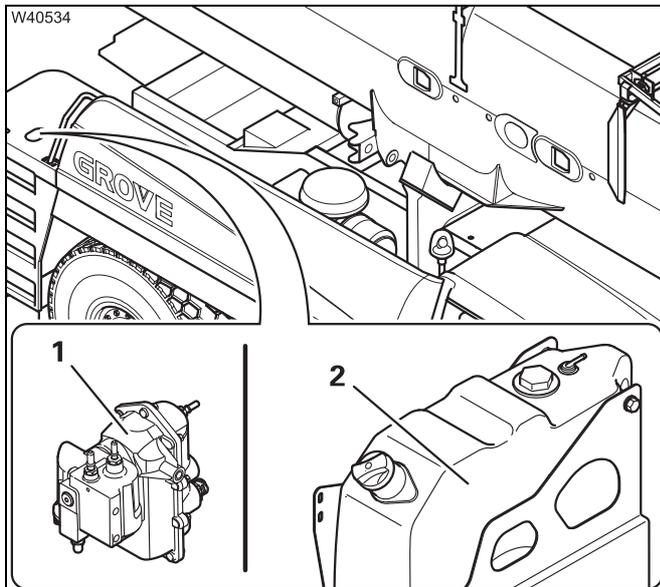
M 12

This inspection may only be carried out 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 - 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

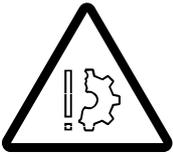
- Have the AdBlue filter in the pump unit (1) changed:
 - for the first time after one year (**M 12**),
 - after that, every two years (**Y 2**).

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) (additional equipment) 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.





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 a compressed air drier that removes both water and oil.

Manitowoc Crane Care recommends the suitable filter cartridge with the GROVE part number 04156032.

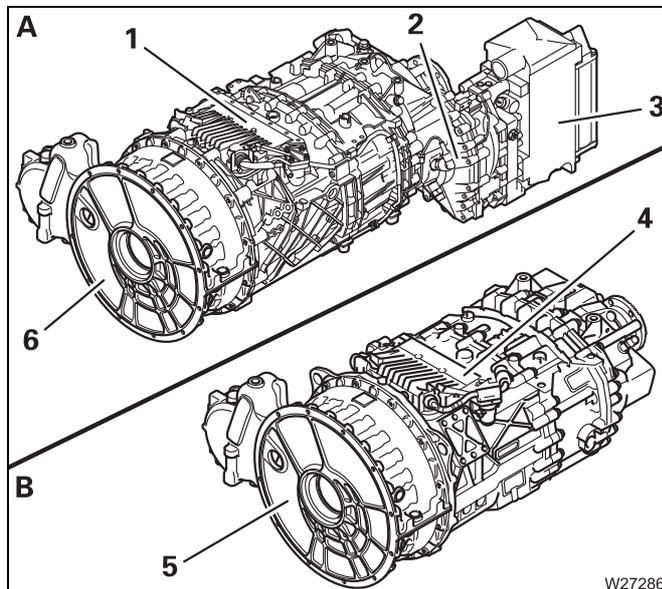
- If necessary, change to the suitable filter cartridge;
 - ▣▣▣▣➔ *Replacing the compressed air dryer filter cartridge, p. 7 - 87.*

7.6

Transmission

Transmission variants

The truck crane can be equipped with an **Intarder** (integrated Retarder) as additional equipment; ■■■► *Operating manual*.



(A) – Transmission with Intarder

The Intarder (2) is an additional brake integrated into the transmission (1) and shares the oil chamber with the transmission. The Intarder has a heat exchanger (3) for cooling the oil via the engine coolant; ■■■► p. 7 - 18.

The power take-off (6) has a separate oil chamber; ■■■► p. 7 - 49.

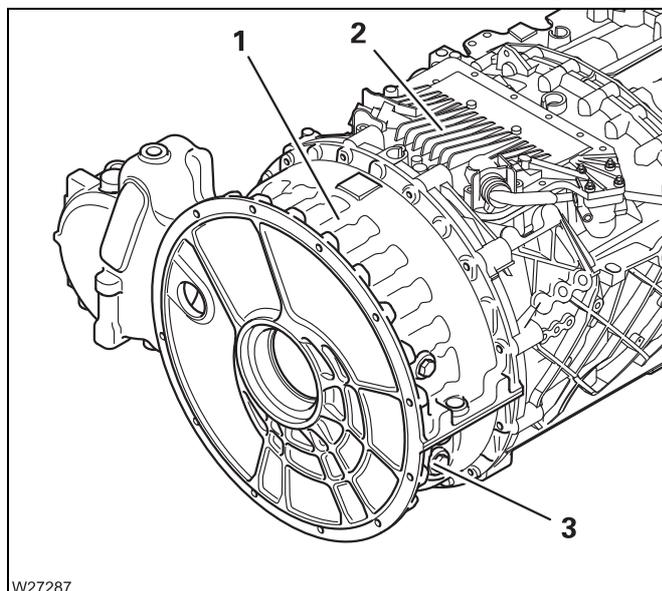
(B) – Transmission without Intarder

The transmission (4) without Intarder has a smaller filling quantity of oil; ■■■► p. 7 - 45.

The power take-off (5) has a separate oil chamber; ■■■► p. 7 - 49.

Power take-off

The **power take-off** is located between the engine and transmission (In German: **Nebenantrieb Motor Vorgebaut: NMV**).



The power take-off (1) can be switched in and out under load via a disc clutch.

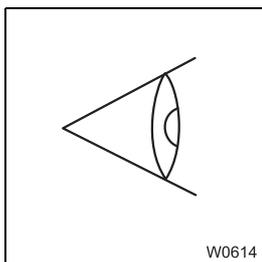
The transmission (2) and power take-off (1) have separate oil sumps; ■■■► *Changing the oil and oil filter – Transmission*, p. 7 - 45, ■■■► *Changing the oil and oil filter – Power take-off*, p. 7 - 49.

The power take-off (3) has a sight glass for checking the oil level; ■■■► *Checking the oil level – power take-off*, p. 7 - 44.

7.6.1

General inspection

W



- Pay attention to any unusual running noises from the transmission and power take-off.
- Check the transmission and the connections for leaks. In the event of leaking consumables;
 - ▣▣▣▣▶ *Checking the transmission oil level, p. 7 - 43,*
 - ▣▣▣▣▶ *Checking the oil level – power take-off, p. 7 - 44.*
- Check if the heat exchanger or the connections on the Intarder are leaking;
 - ▣▣▣▣▶ *Checking the coolant level, p. 7 - 18.*
- 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.

7.6.2

Checking the transmission oil level

M 12

Spare parts and tools

Designation	Quantity	GROVE part no.
O-ring 21 x 2	1	04155708

- Receptacle, about 5 l (1.5 gal);  p. 2 - 4.
- Torque wrench for a torque of 60 Nm (44.2 lbf ft).

Prerequisites

- The Intarder has **not** been actuated before checking the oil level (lever on the steering column).
- The truck crane must be raised on outriggers or parked over an inspection pit.
- The truck crane must be level.
- The transmission oil has cooled down to a temperature below 40 °C (104 °F).
- The truck crane is not running and is secured against unauthorised use;  p. 2 - 3.

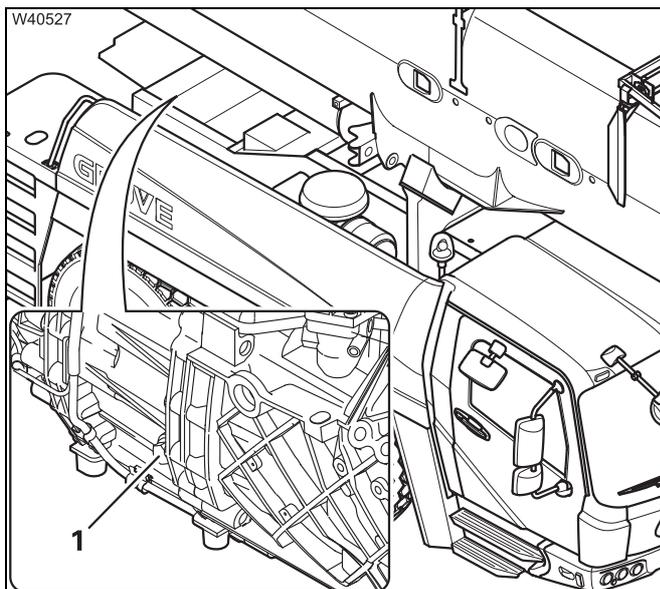
Oil level type



Risk of damage to the transmission!

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

Check the oil level at the correct intervals. Do **not** actuate the Intarder immediately before you check the oil level. The oil level in the housing cannot be correctly adjusted in this case.



- Unscrew the screw (1).
- Check the oil level – it must reach to the lower edge of the opening.
- Replace the seal and tighten the drain plug – torque 60 Nm (44.2 lbf ft).

If the oil level is too low

- Top up the oil;  p. 7 - 45.

7.6.3

Checking the oil level – power take-off

M 12

Spare parts and tools

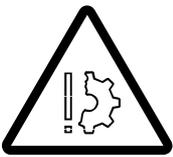
Designation	Quantity	GROVE part no.
Gasket 26 x 31 Cu DIN 7603	1	00117147

- Receptacle, about 5 l (1.5 gal);  p. 2 - 4.
- Mirror on a rod.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The truck crane must be level.
- The transmission oil has cooled down to a temperature below 40 °C (104 °F).
- The truck crane is not running and is secured against unauthorised use;  p. 2 - 3.

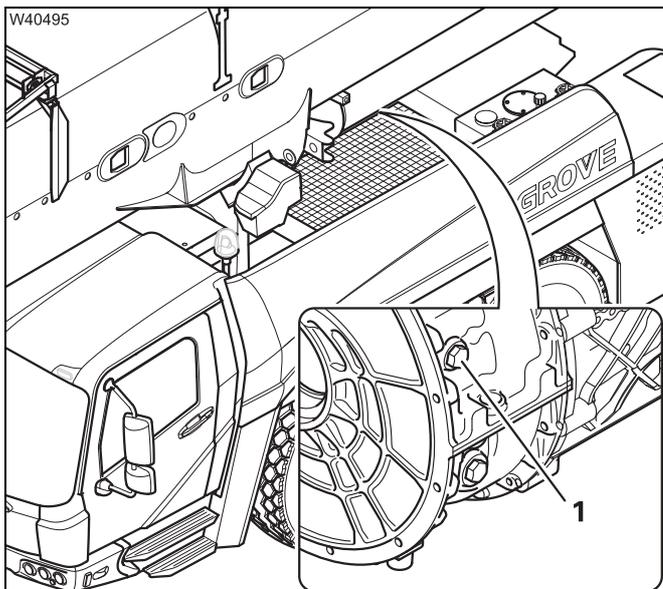
Oil level type



Risk of damage to the transmission!

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

Check the oil level at the correct intervals.



- Use a mirror on a rod to provide a better view of the sight glass (1).
- Check that oil is visible in the middle of the inspection glass (1).

If the oil level is too low

- Top up the oil;  p. 7 - 49.

7.6.4

Changing the oil and oil filter – Transmission

Y 3

Oil, spare parts and tools

Gear oil in litres (gal)	Specifications Classification	GROVE part no.
without Intarder 15 (4.0)	ZF TE-ML02 Ecofluid M ZF synthetic	03325153
with Intarder 25 (6.6)		

Designation	Quantity	GROVE part no.
Transmission without Intarder:		
O-ring 21 x 2	2	04155708
Transmission with Intarder:		
O-ring 21 x 2	2	04155708
Oil filter	1	04155134
O-ring 70 x 3	1	04155135
Magnet	1	04159255

- Receptacle, about 30 l (8 gal);  p. 2 - 4.
- Torque wrench for a torque of 60 Nm (44.2 lbf ft).

Prerequisites

- The Intarder has **not** been actuated before checking the oil level (lever on the steering column).
- The gear oil must be at operating temperature (70 to 95 °C (160 to 200 °F)).
- The truck crane must be raised on outriggers or parked over an inspection pit.
- The truck crane must be level.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.



Draining oil



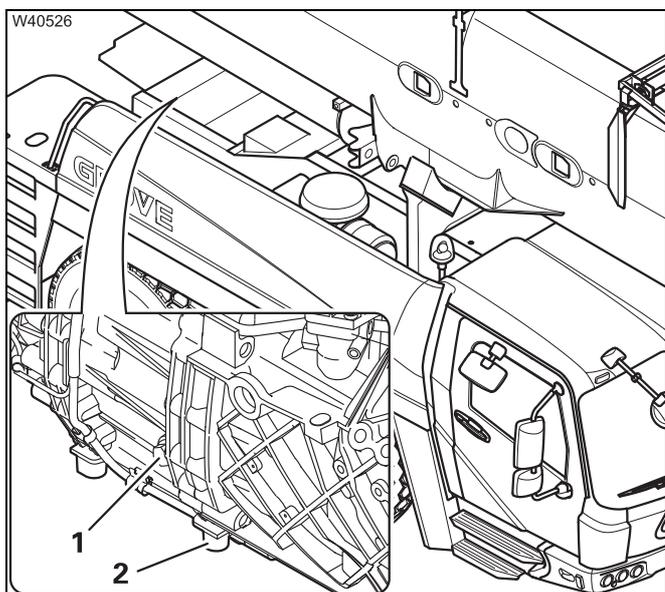
Risk of scalding from gear oil at operating temperature!

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!

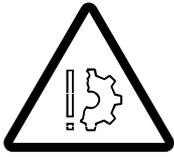
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape. Store/dispose of consumables and any soaked equipment properly. Ask about the applicable regulations.



- Place a receptacle underneath the screw (2) on the transmission.
- Unscrew bolts (1) and (2) and allow the oil to drain.
- Clean the drain plugs.
- Replace the seal and tighten the drain plug (2) to a torque of 60 Nm (44.2 lbf ft).

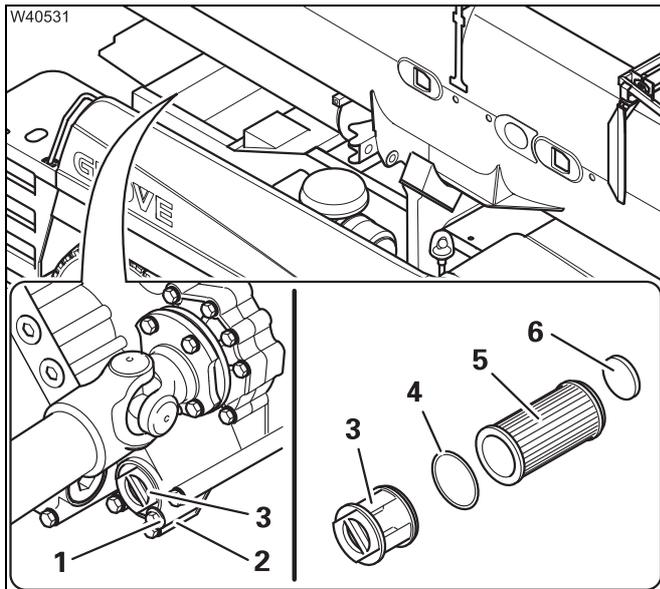
Changing the oil filter

The oil filter is **only present in transmissions with an Intarder**.
Transmissions without an Intarder do not have an oil filter.

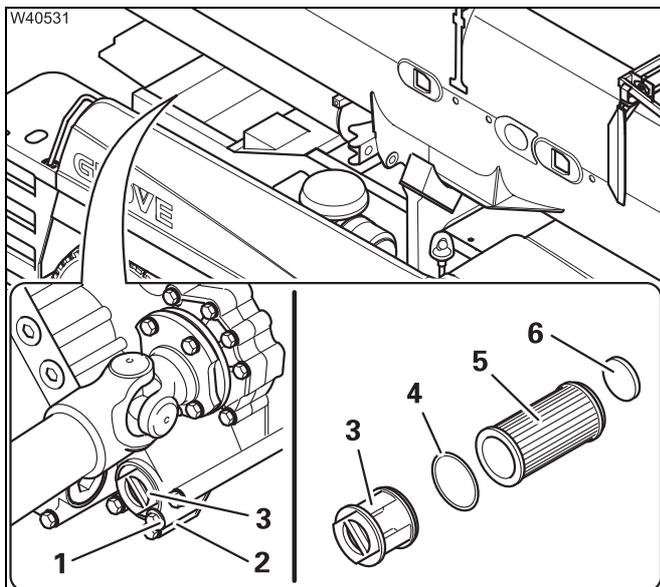


Risk of damage to the transmission!

Clogged oil filters can damage transmissions with an Intarder. You must fit a new oil filter at each oil change.



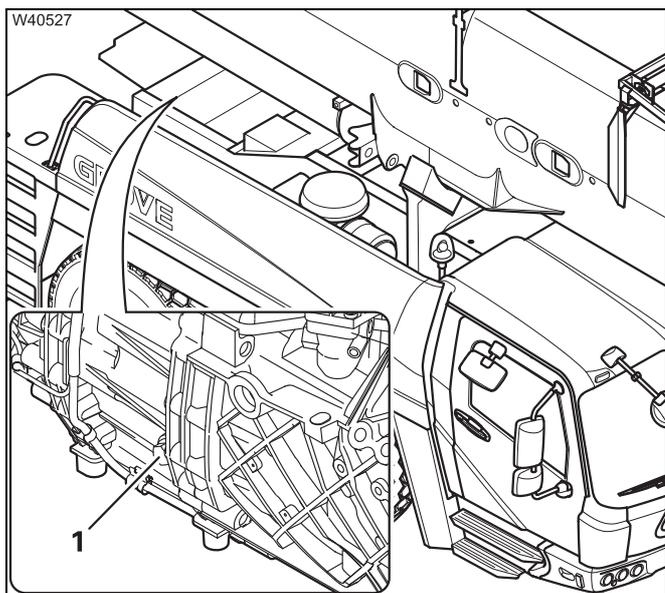
- Place a receptacle under the Intarder oil filter (3).
- Remove the screw (1) and the washer (2).
- Pull out the cover (3) together with the filter (5).
- Remove the cover (3) and the magnet (6) from the filter (5).
- Place the filter in a receptacle.
- Clean all parts.



- Replace the gasket (4).
- Fit the cover (3) onto the new filter (5).
- Fit the magnet (6) onto the new filter (5).
- Fit the fully assembled Filter into the housing.
- Secure the cover (3) with the washer (2) and tighten the bolt (1) – torque 23 Nm (16.9 lbf ft).



Topping up the oil



- Fill the oil up to the lower edge of the opening.
- Replace the seal and tighten the drain plug (1) to a torque of 60 Nm (44.2 lbf ft).

- Perform a test drive and then check the oil level;  *Test drive*, p. 7 - 52.

7.6.5

Changing the oil and oil filter – Power take-off

Y 3

Oil, spare parts and tools

Gear oil in litres (gal)	Specifications Classification	GROVE part no.
4.5 (1.2)	ZF TE-ML02 Ecofluid M ZF synthetic	03325153

Designation	Quantity	GROVE part no.
Seal 18 x 24 Cu DIN 7603 (drain)	1	01377793
Seal 26 x 31 Cu DIN 7603 (filler)	1	00117147
Oil filter	1	04155134
O-ring 78 x 3	1	03143694

- Receptacle, about 5 l (1.5 gal);  p. 2 - 4.
- Torque wrench for a torque of 60 Nm (44.2 lbf ft).

Prerequisites

- The gear oil must be at operating temperature (70 to 95 °C (160 to 200 °F)).
- The truck crane must be raised on outriggers or parked over an inspection pit.
- The truck crane must be level.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Draining 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.

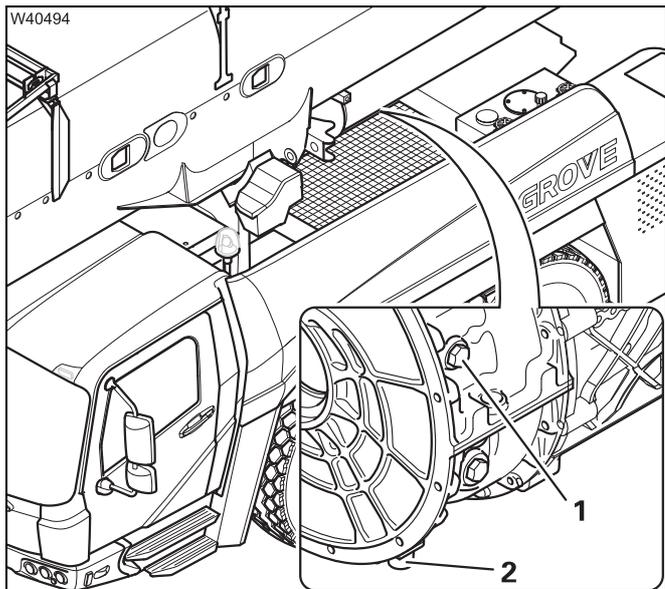


Risk of environmental damage due to leaking consumables!

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.





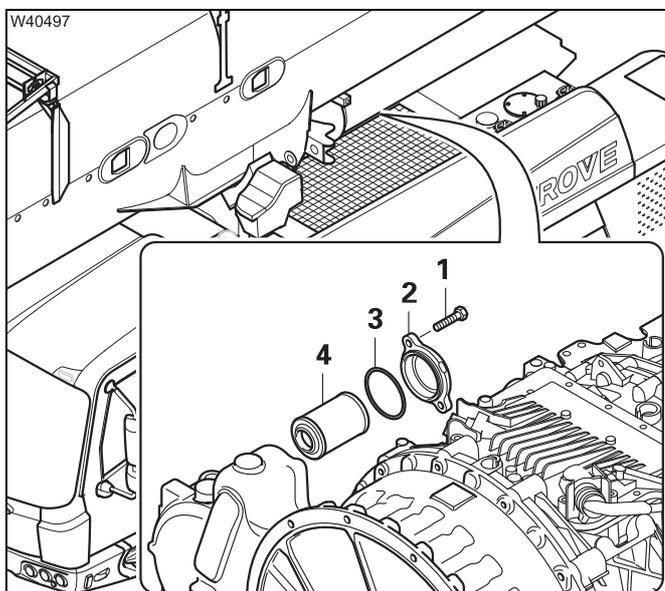
- Place a receptacle underneath the Screw (2) on the power take-off.
- Unscrew bolts (1) and (2) and allow the oil to drain.
- Clean the drain plugs.
- Replace the seal and tighten the drain plug (2) to a torque of 60 Nm (44.2 lbf ft).

Changing the oil filter



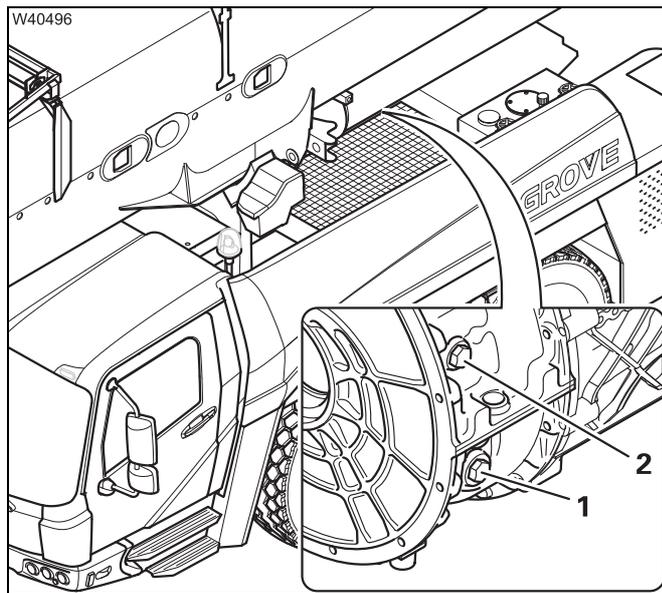
Risk of damage to the transmission!

Clogged oil filters lead to transmission damage. You must fit a new oil filter at each oil change.



- Remove the screw (1) and cover (2).
- Pull out the filter (4).
- Place the filter in a receptacle.
- Clean all parts.
- Insert a new filter (4) into the housing.
- Replace the gasket (3).
- Fit the cover (2).
- Tighten the screws (1) – Torque 46 Nm (34 lbf ft).

Topping up the oil



- Top up the oil through the opening (2) until oil is visible in the sight glass (1).
- Replace the seal and tighten the drain plug (2) to a torque of 60 Nm (44.2 lbf ft).

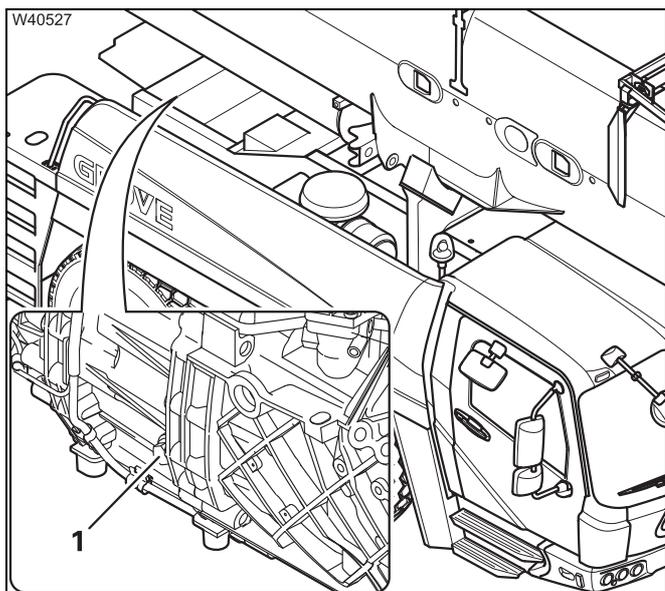
- Perform a test drive and then check the oil level;  *Test drive*, p. 7 - 52.

7.6.6

Test drive

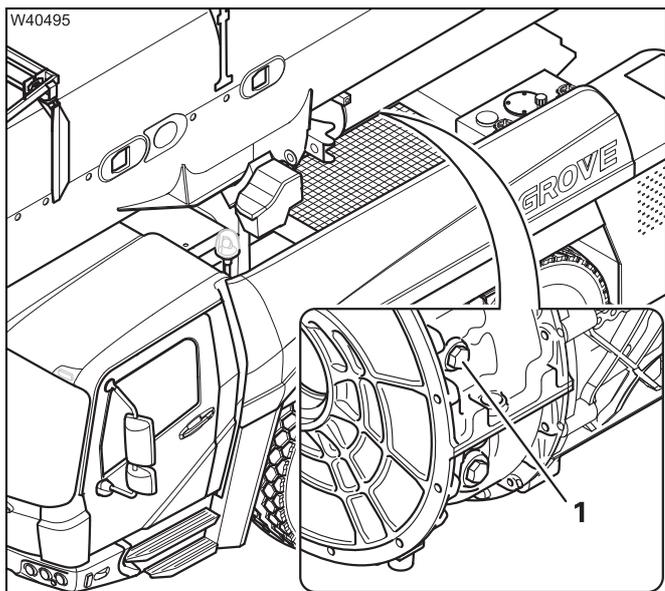
- Drive the truck crane for a distance of about 5 km (3 mi).
- Do **not** actuate the Intarder (lever on the steering column).
- Switch the engine off.

Checking the oil level again



On the transmission

- After the test drive, check the oil level again at the screw (1); *Checking the transmission oil level*, p. 7 - 43.
- Top up the oil, if necessary; *Topping up the oil*, p. 7 - 48.
- Replace the seal and tighten the drain plug (1) to a torque of 60 Nm (44.2 lbf ft).



At the power take-off

- After the test drive, check the oil level again at the sight glass (1); *Checking the oil level – power take-off*, p. 7 - 44.
- Top up the oil, if necessary; *Topping up the oil*, p. 7 - 51.

7.7

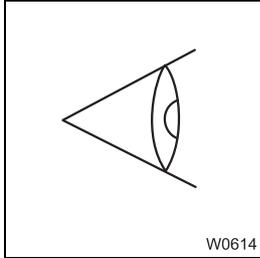
Transfer case

- 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. In the event of leaking consumables;  *Checking the oil level*, p. 7 - 53.
- 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

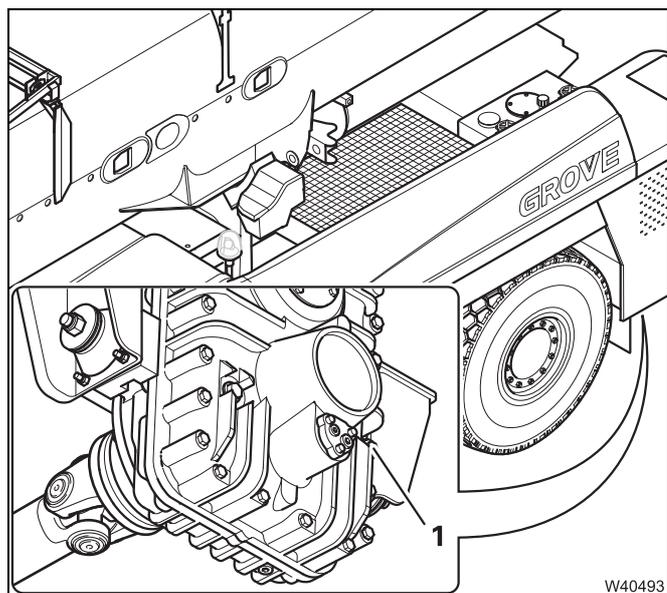
Designation	Quantity	GROVE part no.
Gasket 30 x 36 Cu DIN 7603	1	00117151

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.



Checking



- Unscrew the screw (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 - 55.

W40493

7.7.3

Changing the oil

M 6

Oil, spare parts, tools

Gear oil in litres (gal)	Designation to DIN 51502	Specifications Classification	GROVE part no.
8 (2.1)	C - LPF	MIL-L 2105 B API-GL-5 Viscosity: Hyp SAE 90 ISO - VG 220	00552891

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

- Receptacle, about 20 l (5.0 gal); ▮▮▮▮ p. 2 - 4.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must not be running and must be secured against unauthorised use; ▮▮▮▮ p. 2 - 3.

Changing the oil



Risk of scalding from gear oil at operating temperature!

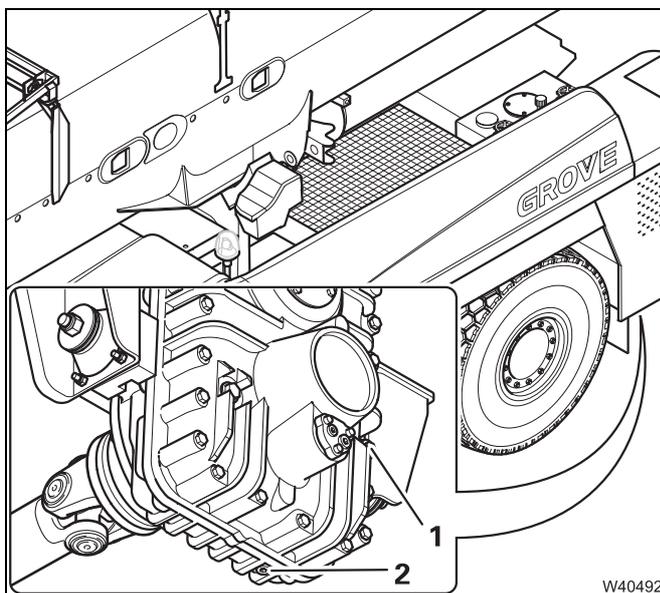
You could scald yourself by gear oil escaping in an uncontrolled manner at operating temperature. Wear appropriate protective gloves and take care not to come into contact with the gear oil.



Risk of environmental damage due to leaking consumables!

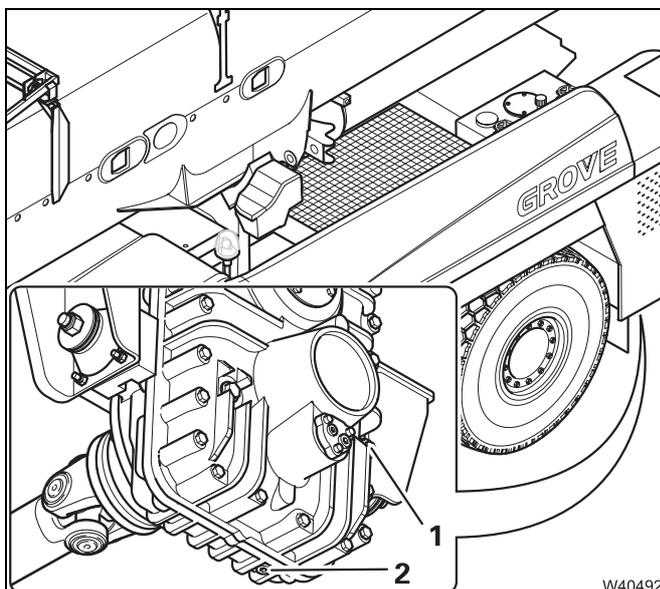
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

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



- Place a receptacle underneath the screws (2).
- Unscrew bolts (1) and (2) and allow the oil to drain.
- Replace the seal and tighten the screws (2).
- Fill the oil up to the lower edge of the opening.
- Replace the seal and tighten the screws (1).

Inspections after an oil change



- Go for a test drive.
- Switch the engine off and wait about 5 minutes.
- Check the oil level;  p. 7 - 53.
- Check drain plugs (1) and (2) for leaks.

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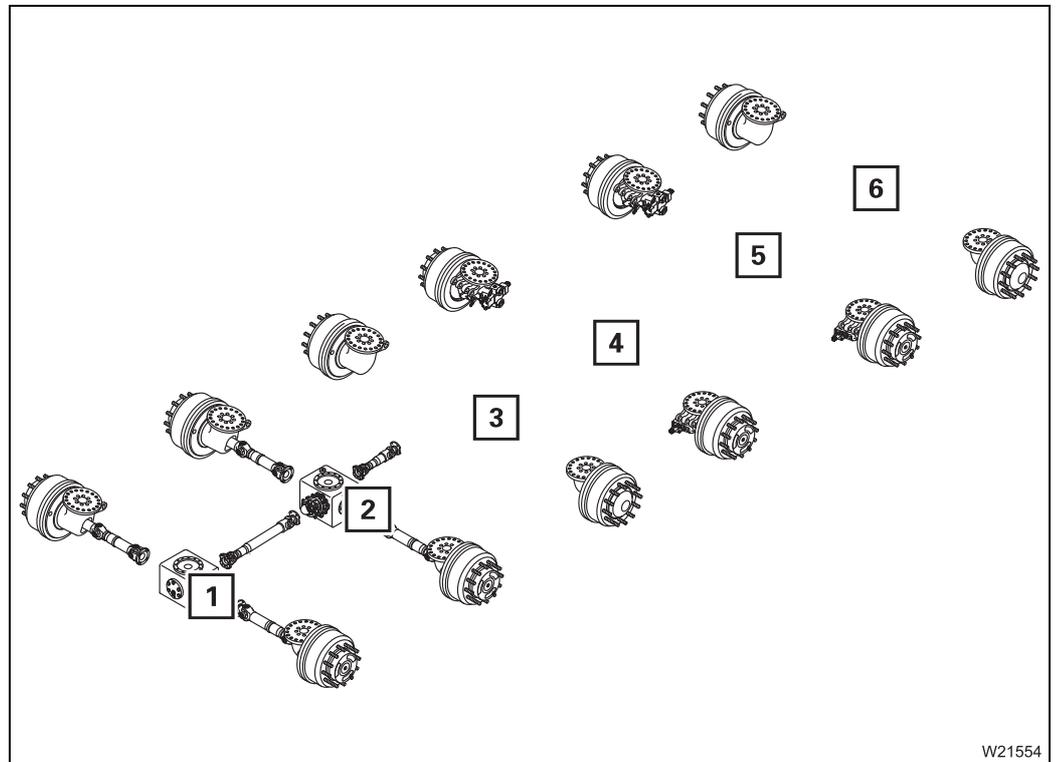
7.8

Axle lines

- Comply also with the running-in regulations; ▮▮▮▮▶ p. 4 - 1.

Overview

There are different **drive systems** on the 6 axle lines.



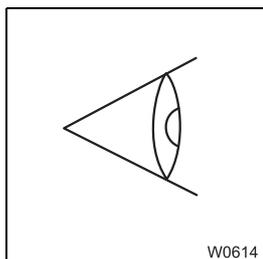
W21554

Driven	axle lines	Drive system
1st	Yes; permanent	Axle centre drive, drive shafts, final drives
2nd	Yes; permanent	Axle centre drive, drive shafts, final drives
3rd	No	–
4th	Yes; connectable	Hydraulic drives, Final drives
5.	Yes; connectable	Hydraulic drives, Final drives
6.	No	–

7.8.1

General inspection

W



- Pay attention to any unusual running noises from all axle lines.
- Check that the axle centre drives, hydraulic drives, final drives and the connections are free of leaks. In the event of leaking consumables;
 - ▣▣▣▣▶ *Axle centre drives – checking the oil level, p. 7 - 58,*
 - ▣▣▣▣▶ *Checking the hydraulic drives, p. 7 - 60,*
 - ▣▣▣▣▶ *Final drives – Checking the oil level, p. 7 - 63.*
- 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

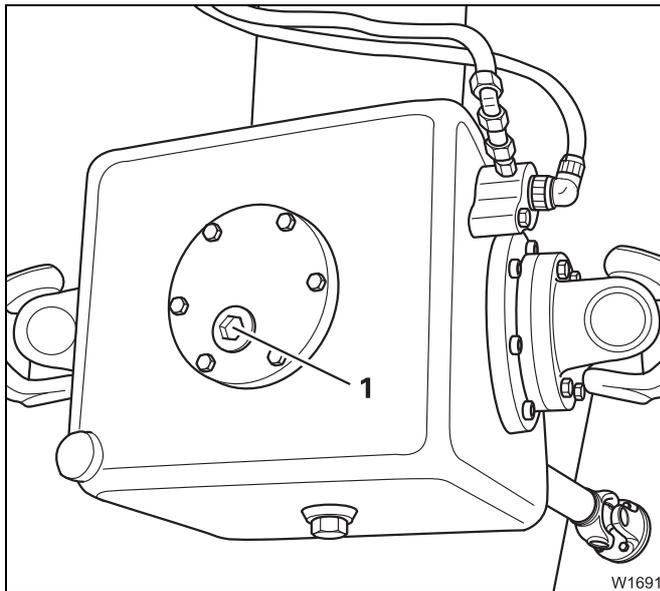
Spare parts and tools

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

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must not be running and must be secured against unauthorised use; ▣▣▣▣▶ p. 2 - 3.

1st axle line

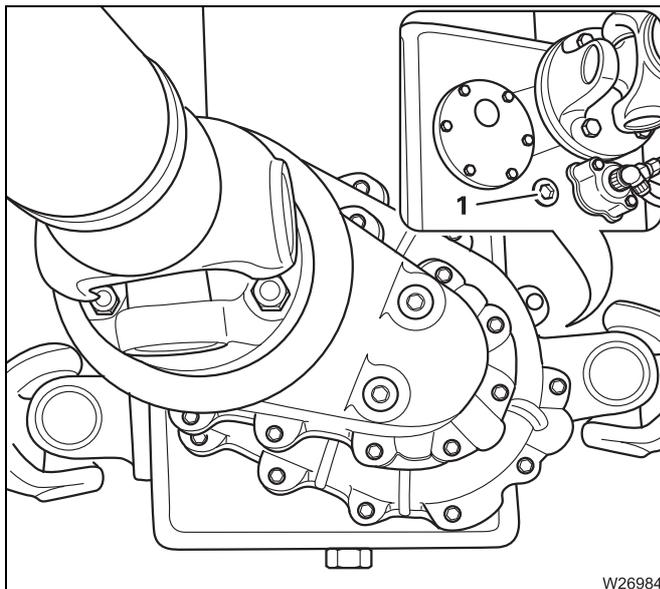


- Unscrew the screw (1).
- Check that the oil reaches the lower edge of the opening.
- Fit a new gasket and tighten the screw.

If the oil level is too low

- Top up the oil; ►►► p. 7 - 62.

2nd axle line



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

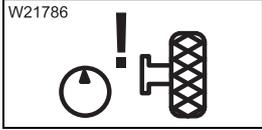
If the oil level is too low

- Top up the oil; ►►► p. 7 - 62.

7.8.3

Checking the hydraulic drives

M 1



If the symbol appears on the display, then the disconnection/connection of the hydraulic drives is faulty.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

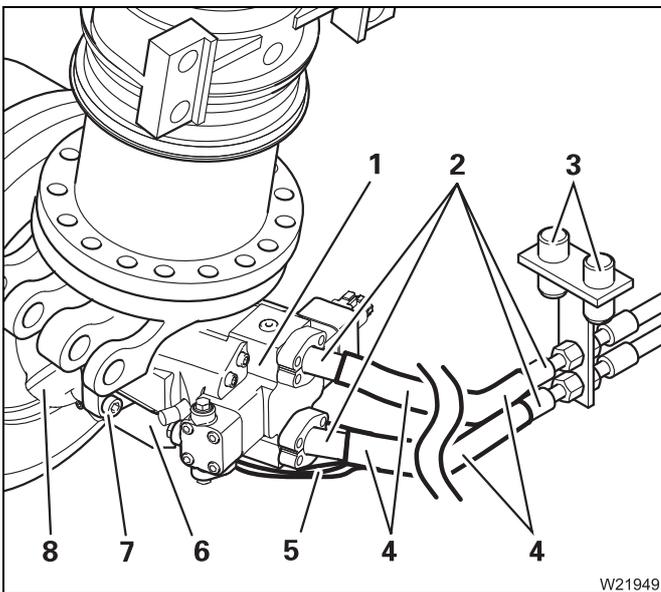
Checks

The hydraulic drives drive the final drives on the 4th and 5th axle lines. At higher speeds, the hydraulic drives are disconnected from the final drives using a coupling.



Danger of tearing off the hoses!

In uneven terrain with protruding obstacles, the hydraulic hoses and the electrical cables can be abraded through or torn off. Check that the hoses and the electric lines do not sag or are damaged.



- Check the fastening of the hydraulic drives (1) in the final drives (8) – the bolts (7) should be tight.
- Check the suspension of the hydraulic hoses (2) in the flexible buffers (3).
- Check that the hydraulic hoses (2) do not leak and are not damaged. If hydraulic oil has leaked, you must check the oil level;  *Checking the oil level*, p. 7 - 89.
- Check the electrical cables and plugs (5) for tightness and undamaged.
- Check the guard (6) and the cable cover (4) for damage.

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

7.8.4

Axle centre drives – changing the oil

M 12

**Oil, spare parts,
tools**

Gear oil in litres (gal)	Designation to DIN 51502	Specifications Classification	GROVE part no.
Axle line 1: 14.0 (3.7)	C - LPF	MIL-L 2105 B API-GL-5 Viscosity: Hyp SAE 90 ISO - VG 220	00552891
Axle line 2: 15 (4.0)			

Designation	Quantity	GROVE part no.
Gasket 30 x 36 Cu DIN 7603	2	00117151
Gasket 24 x 29 Cu DIN 7603	2	00117145
Gasket 36 x 42 Cu DIN 7603	2	01371208

– Receptacle, about 20 l (5.0 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

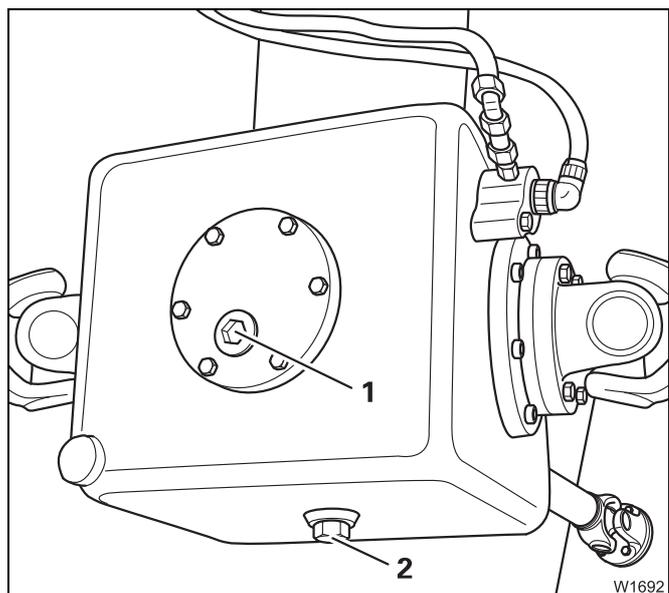


Risk of environmental damage due to leaking consumables!

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.

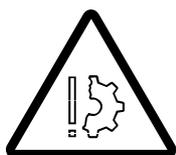


1st axle line



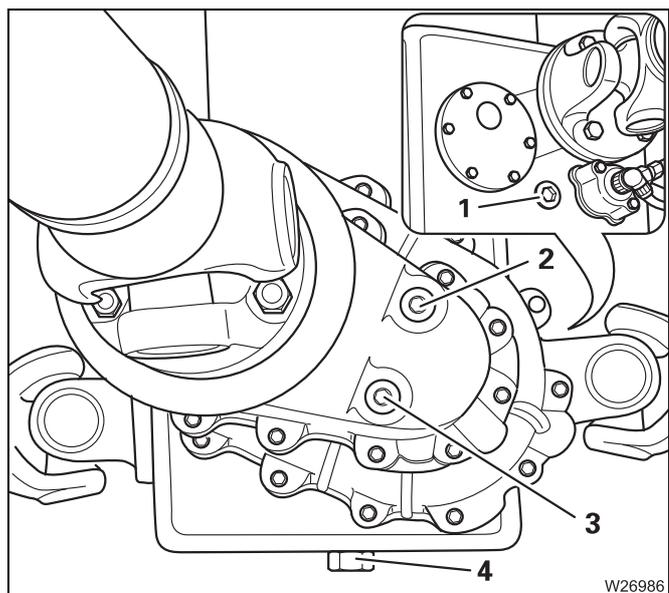
- Place a receptacle underneath the screw (2).
- Unscrew bolts (1) and (2) and allow the oil to drain.
- Fit a new seal and tighten the screw (2).
- Fill the oil up to the lower edge of the opening.
- Fit a new seal and tighten the screw (1).

2nd axle line



Risk of oil overheating!

When topping up the oil, both openings must be opened so that both oil tanks are filled equally. This prevents the sumps from being overfilled and thus the oil from overheating.



- Place a receptacle underneath the screws (3) and (4).
- Remove the drain plugs (1), (2), (3) and (4) and let the oil drain off.
- Replace the seals and tighten the screws (3) and (4).
- Fill the oil up to the lower edge of the opening (1).
- Replace the seals and tighten the screws (1) and (2).

7.8.5

Final drives – Checking the oil level

M 1

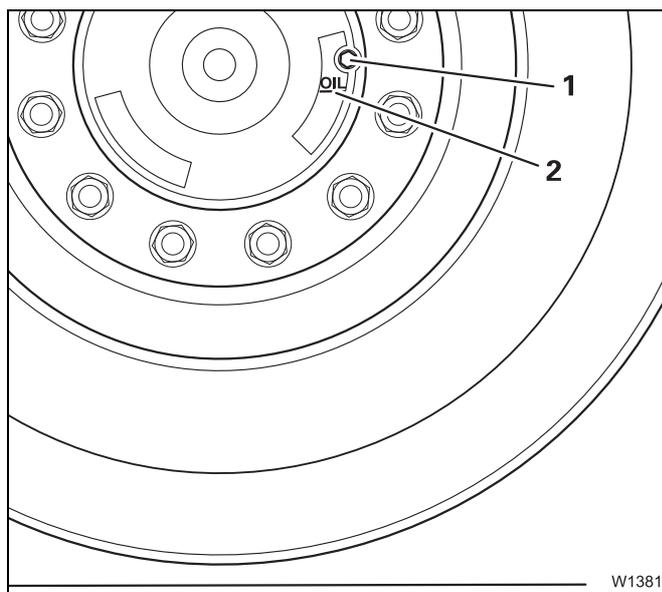
Spare parts and tools

Designation	Quantity	GROVE part no.
Gasket 24 x 29 Cu DIN 7603	8	00117145

Prerequisites

- The truck crane must be raised on outriggers and must be level.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.
- The parking brake is released.

Checking the oil level



- Check the oil level at all 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.
- Unscrew the screw (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 - 66.

7.8.6

Final drives – Changing the oil

M 12

Oil, spare parts, tools

Gear oil in litres (gal)	Designation to DIN 51502	Specifications Classification	GROVE part no.
Axle lines 1 + 2: for each final drive: 3.8 (1.0)	C - LPF	MIL-L 2105 B API-GL-5 Viscosity: Hyp SAE 90 ISO - VG 220	00552891
Axle lines 4 + 5: for each final drive: 6.0 (1.6)			

Designation	Quantity	GROVE part no.
Gasket 24 x 29 Cu DIN 7603	8	00117145
Gasket 30 x 36 Cu DIN 7603	4	00117151

- Drain channel.
- Receptacle, about 10 l (2.5 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be raised on outriggers.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.
- The parking brake is released.



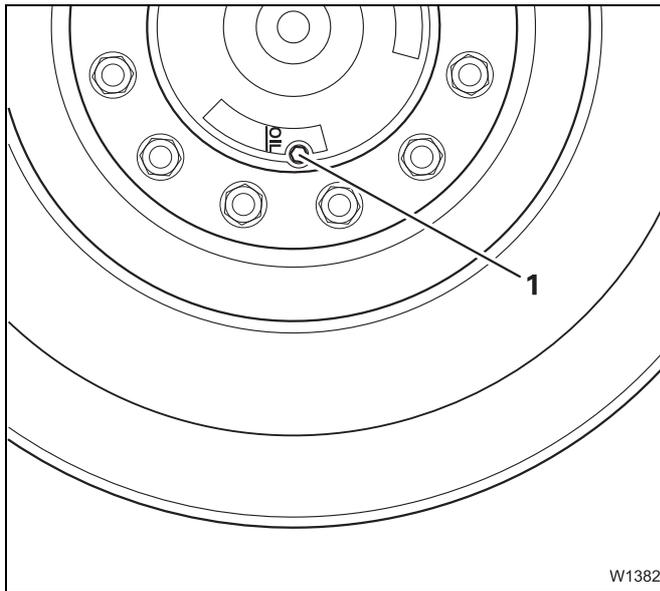
Risk of environmental damage due to leaking consumables!

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

Store/dispose of consumables and any soaked equipment properly.

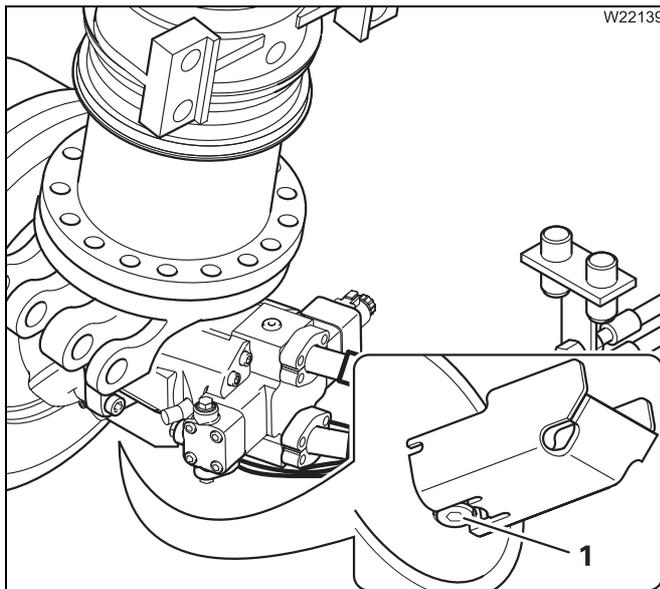
Ask about the applicable regulations.

Draining oil



On the axle line 1, 2, 4 and 5

- Turn the wheel until the bolt (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.

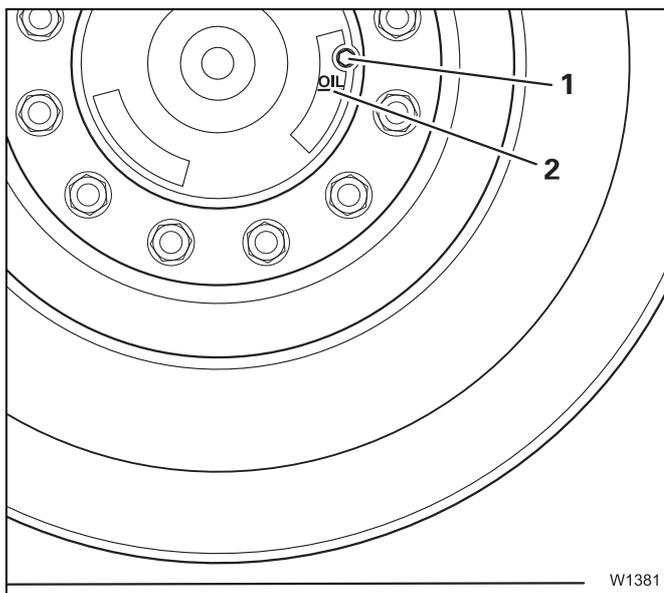


Additionally on the axle line 4 and 5

- Place a receptacle underneath the screw (1).
- Remove the screw and let the oil drain out.
- Fit a new gasket and tighten the screw.



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.
- Find out about the different quantities of oil required for the axle lines;  p. 7 - 64.
- Top up the oil through the opening.
- Fit a new seal and tighten the screw (1).

7.8.7

Lubricating the drive shafts in the axle lines

M 1



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

Grease, spare parts, tools

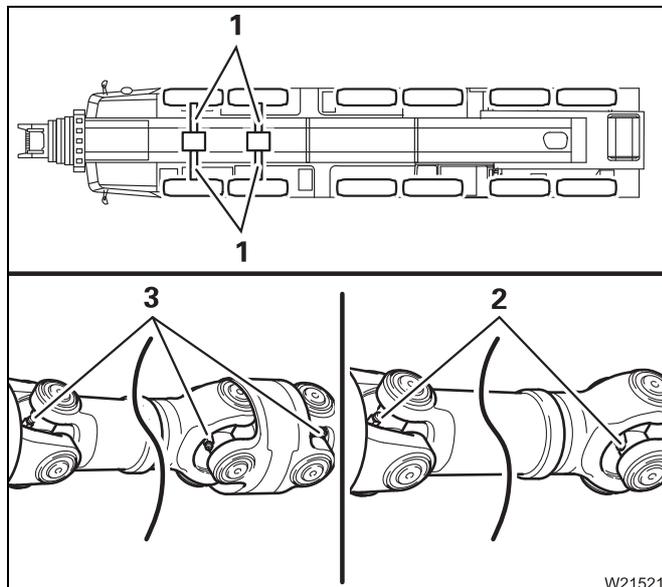
Lubricating grease	Designation to DIN 51502	Specifications Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must not be running and must be 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.

Lubrication



- Check which drive shafts (1) have lubricating nipples (2) and (3).
- Clean the lubricating nipples (2) and (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 any grease that has escaped.

7.8.8

Lubricating the longitudinal drive shafts

M 6



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

Grease, spare parts, tools

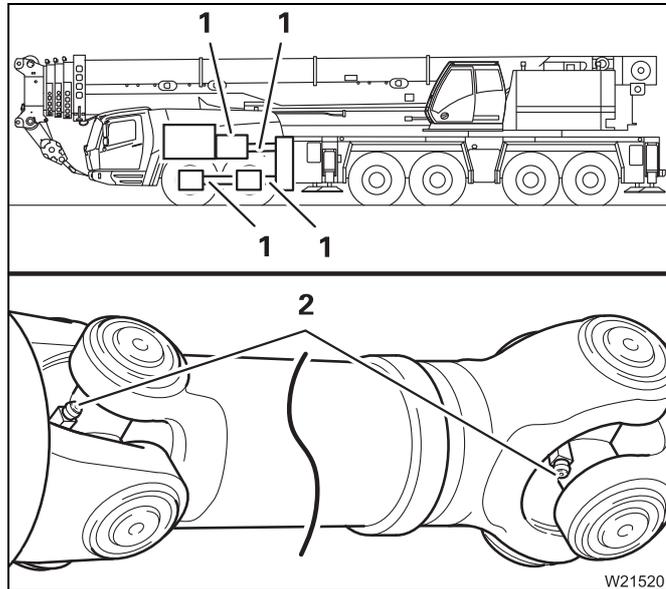
Lubricating grease	Designation to DIN 51502	Specifications Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must not be running and must be secured against unauthorised use; ►► p. 2 - 3.

Lubrication



- Check which drive shafts (1) have grease nipples (2).
- Clean the grease nipples (2).
- 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 any grease that has escaped.

7.9

Wheels

7.9.1

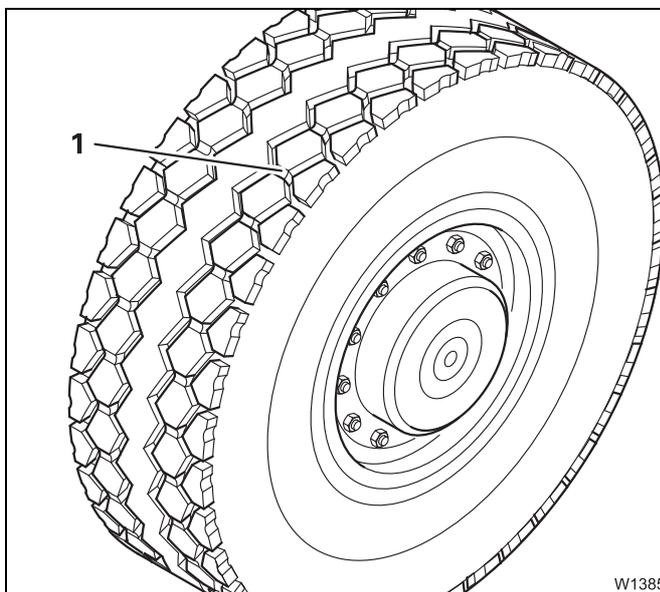
Checking the tyres for damage

D

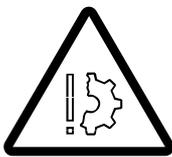
Prerequisites

- The truck crane must be raised on outriggers.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.
- The parking brake is released.

Checking



- Check all tyres for:
 - Broken off tread blocks
 - Bulges
 - Areas of uneven wear
 - Wear marks (1) that have been reached
- Replace any damaged tyres.
- If the tyres show varying degrees of wear, change the wheels;  *Changing the wheels*, p. 7 - 72.



Risk of accidents due to uneven braking!

When replacing the tyres, only use tyres of original equipment quality (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 air pressure increases when the tyres are warm. Never release the increased air pressure of tyres at operating temperature!
Always check the tyre pressure with cold tyres in on-road driving mode.

- Check the tyre pressures using the following table.

Tyres	Air pressure in bar (psi) with cold tyres
14.00 R 25 385/95 R25	9.0 (131)
16.00 R 25 445/95 R25	9.0 (131)
20.50 R 25 525/80 R 25	7.0 (102)

7.9.3

Checking the tightness of wheel nuts

M 1

Spare parts and tools

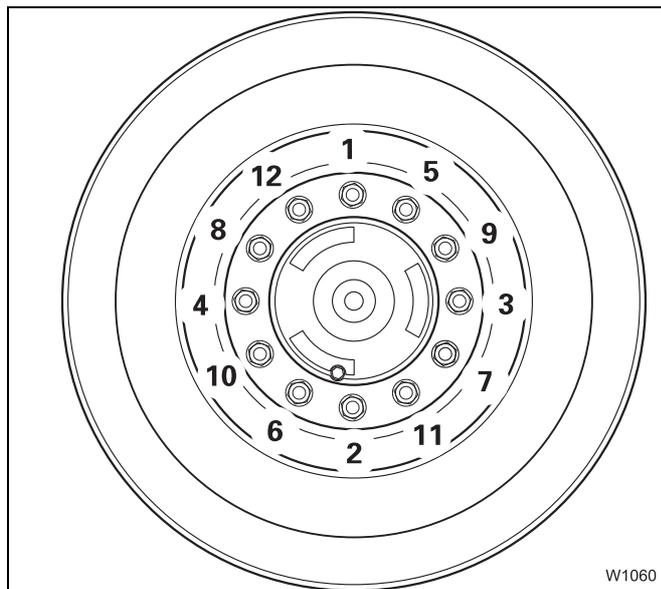
Designation	Quantity per wheel	GROVE part no.
Wheel nut with pressure plate for steel rims	12	01207756
Wheel nut with pressure plate for aluminium rims	12	7659100000

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

Prerequisites

- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Checking the wheel nuts



- Check the wheel nuts and pressure plates for damage.
- Replace any damaged wheel nuts or pressure plates.
- Check the tightness of the wheel nuts in the sequence (1-12) – Torque 650 Nm (480 lbf ft).

W1060

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 not be running and must be secured against unauthorised use;  p. 2 - 3.

Wheel change



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

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

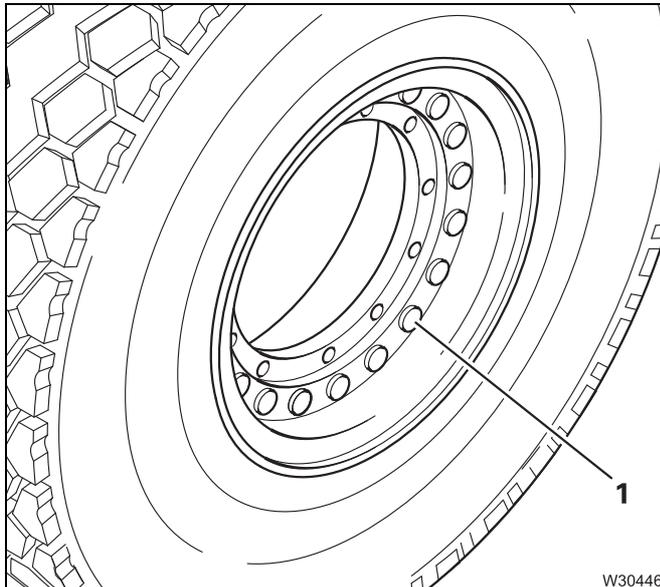
When removing/installing the wheels, observe all the safety instructions and the procedure stated in the operating manual.

- 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 wheel rim. On the inner face of the wheel rim has 20 or 22 nuts and the torque of these must be checked in a specialist workshop;  *Recognising two-piece aluminium rims*, p. 7 - 73.

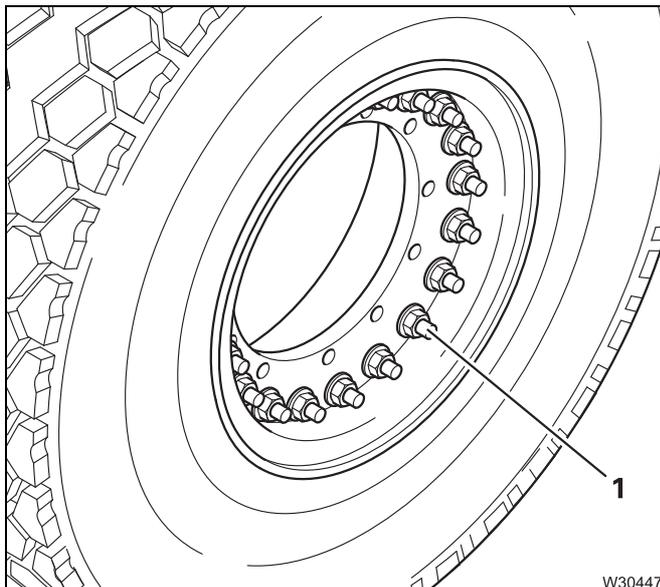
Recognising two-piece aluminium rims



The round-head bolts (1) are on the outer face of the wheel 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 that the specialist workshop must adhere to.



The nuts (1) are on the inner face of the wheel 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:

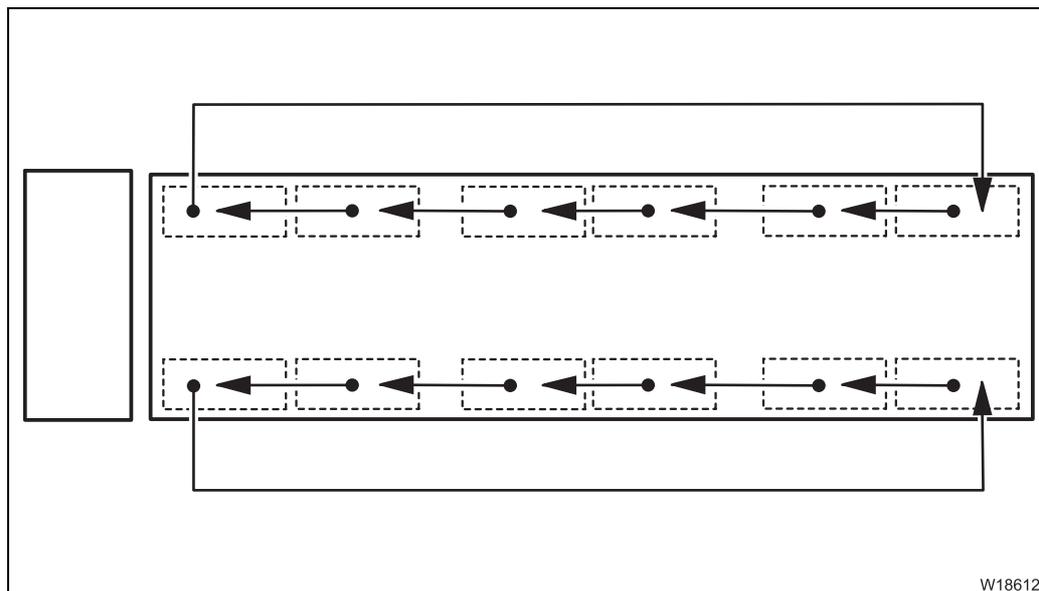
550 Nm (406 lbf ft)

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 - 71.



Extended Wheel change

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 tools.

This will prevent tyre damage caused by assembly errors.

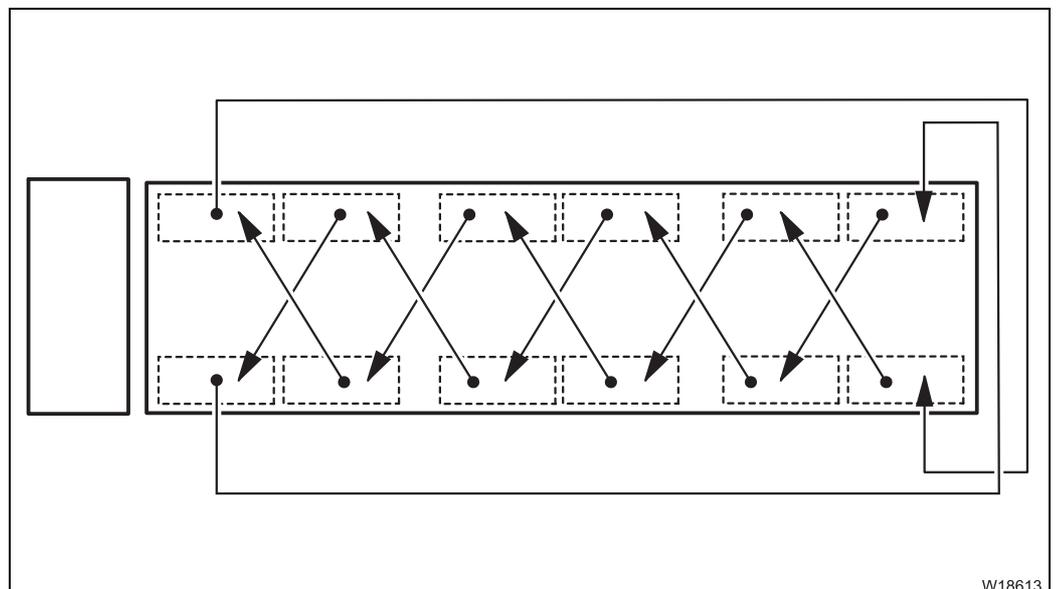


Risk of tyre damage caused by the tyres running in a different direction!

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 - 71.



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7.10 Vehicle brake

7.10.1 Checking the brake lining thickness

M 3

Spare parts and tools

Designation	Quantity per axle line	GROVE part no.
1st and 2nd Axle lines (duplex brake)		
Brake shoe with brake lining	4	03322112
Spring	4	03322110
Brake drum	2	01925703
3rd 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 not be running and must be 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 approval of the truck crane and no claims of liability for damage can then be accepted.

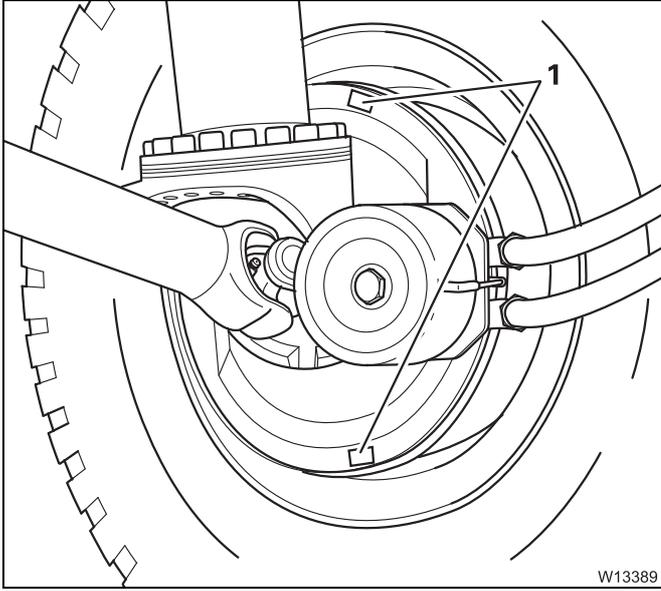
All repair work on the vehicle brakes may only be performed by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop with specially trained repair crew.

- Perform **only maintenance work**;  *Checking*, p. 7 - 78.



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 mark (stepped edges or grooves) **or** the brake lining thickness has worn down to only 6 mm (0.25 in):

- Have the brake lining replaced;
 ▣▣▣▣▣ *Having repairs performed*, p. 7 - 78.
- Close the openings using the covers.

Having repairs performed

- **Do not perform repair work** on the vehicle brakes; ▣▣▣▣▣ *Safety instructions*, p. 7 - 77.
- 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 - 77.



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.

For this, braking must first be performed at low speed and then later at medium speed.

- Make sure that the new brake pads are sufficiently run in through test drives 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 suspen- sion strut: 1.5 (0.4)	Rivolta S.K.D. gear oil 170	02310863

- Press with connected hose (from the toolbox).

Prerequisites

- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.
- Immediately before the inspection, the truck crane must be completely lowered and returned to *on-road level*;  *Operating manual*.



Risk of damage due to faulty suspension struts!

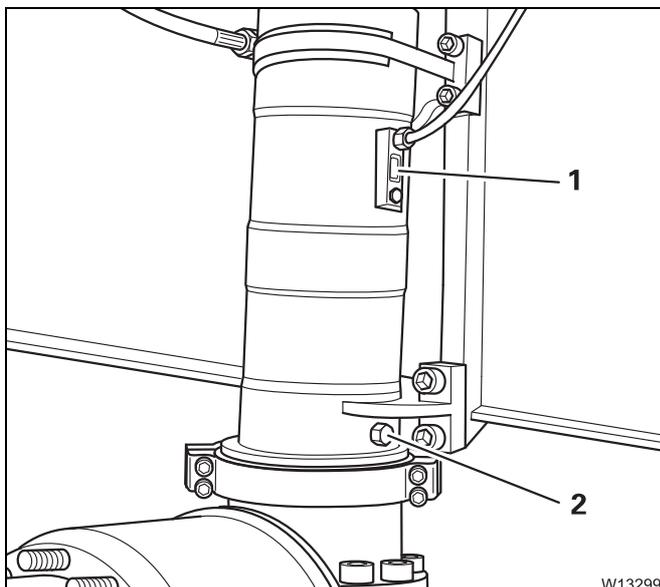
If the oil level is above the upper marking on the sight glass, the suspension strut is faulty and must be replaced.

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 that oil is visible in the middle of the sight 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

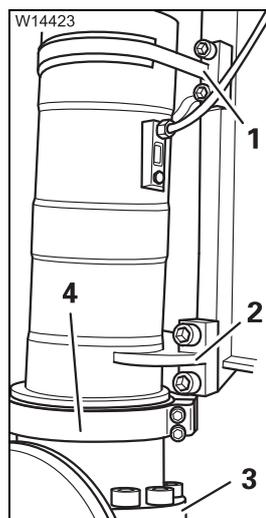
M 1

Spare parts and tools

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

Prerequisites

- The truck crane must be raised on outriggers;  *Operating manual*.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.
- The wheels must have been removed.



- Check that the bolts on all suspension struts are fitted tightly;
 *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

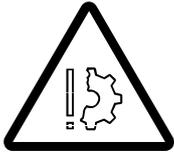
M 3

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!

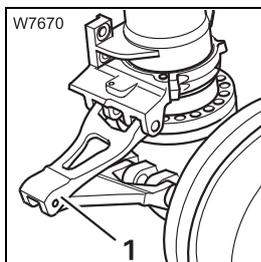
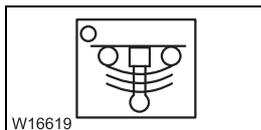
When the suspension is switched on, the wheels drop down suddenly. Ensure that nobody is in close proximity to the wheels when you switch on the suspension.



Risk of damage to the tyres!

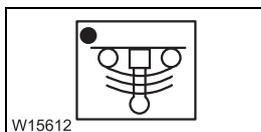
Remove sharp-edged or pointed objects from below the wheels before switching on the suspension. In this way you prevent the tyres from bursting or being damaged when the wheels come down.

- Start the engine.
- Lower the truck crane to the lowest level with the level adjustment system; *Operating manual*.
- Switch off the suspension; *Operating manual*.



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

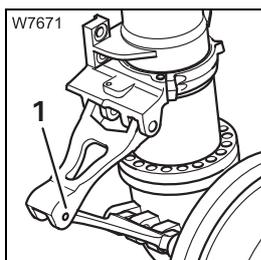
- Raise the truck crane with the outriggers; *Operating manual*.
- Switch on the suspension; *Operating manual*.



- 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.

- Have faulty forced levers 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

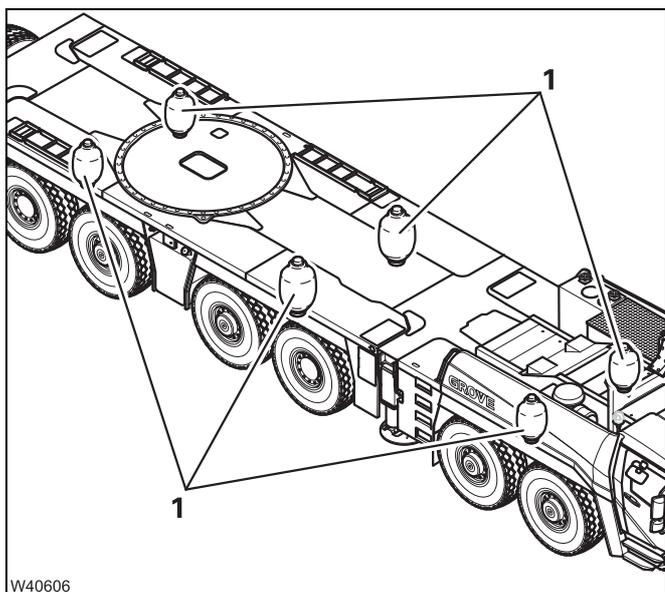
M 12

The gas pressure must be checked every 3,000 operating hours, but always at least every 12 months.



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 suspension has integrated, nitrogen-filled pressure accumulators (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 - 89.

After changing pipes and hose lines

- Bleed the hydraulic system;  *Bleeding the hydraulic system*, p. 7 - 102.

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

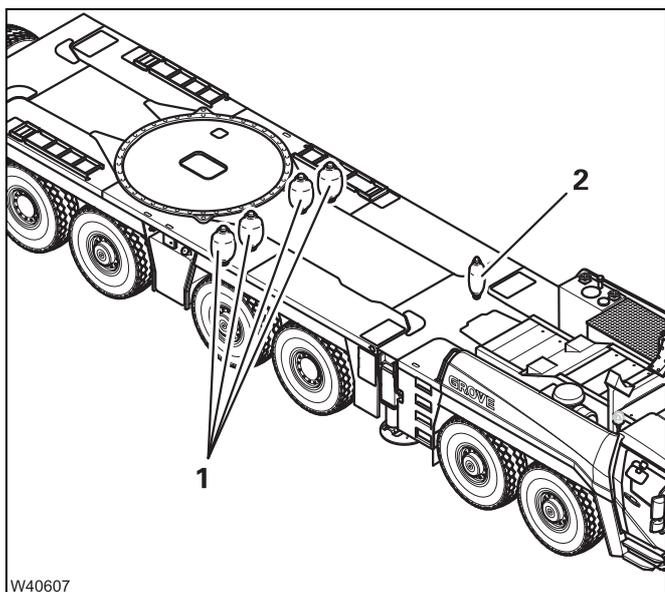
M 12

The gas pressure must be checked every 3,000 operating hours, but always at least every 12 months.



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.



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 (1,290 psi) |
| 2 | 100 bar (1,450 psi) |

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

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7.13 Compressed air system

7.13.1 Draining water from the compressed air system

W

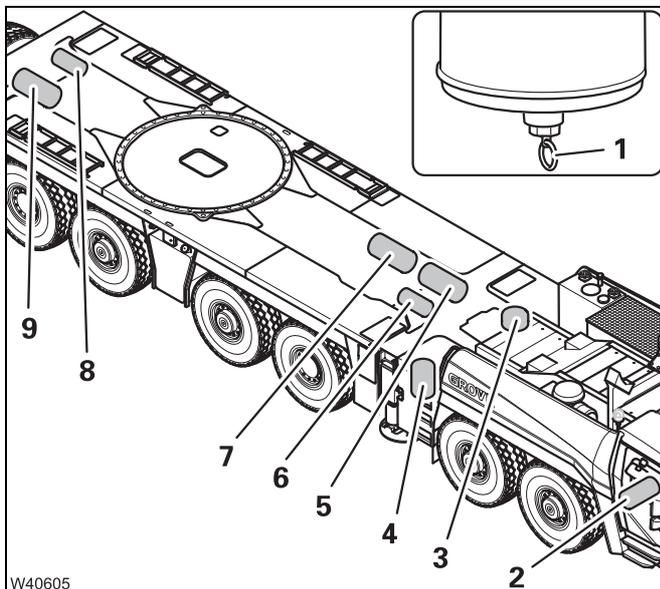
Spare parts and tools

Designation	Quantity	GROVE part no.
Valve	8	01570750
Gasket 22 x 27 Cu DIN 7603	8	00117142

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The compressed-air supply must be completely full;  *Operating manual*.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Draining water from the compressed air system



- Actuate the valves (1) on the air reservoirs (2) to (9).

The air reservoir (4) is present only with the *AdBlue system* additional equipment;  p. 7 - 1.

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.

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 compressed air dryer filter cartridge

M 12

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter cartridge with gasket	1	04156032

- Strap wrench.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.
- The covers have been removed;  p. 7 - 2.
- The engine, transmission and transfer case have cooled down.

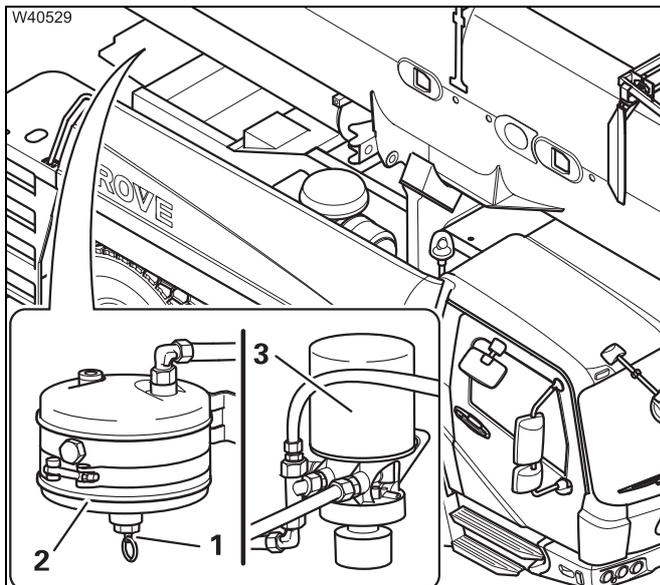
Changing the filter cartridge



Risk of injury from escaping compressed air!

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

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



- Bleed all the air from the reservoir (2) via the valve (1).
- 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

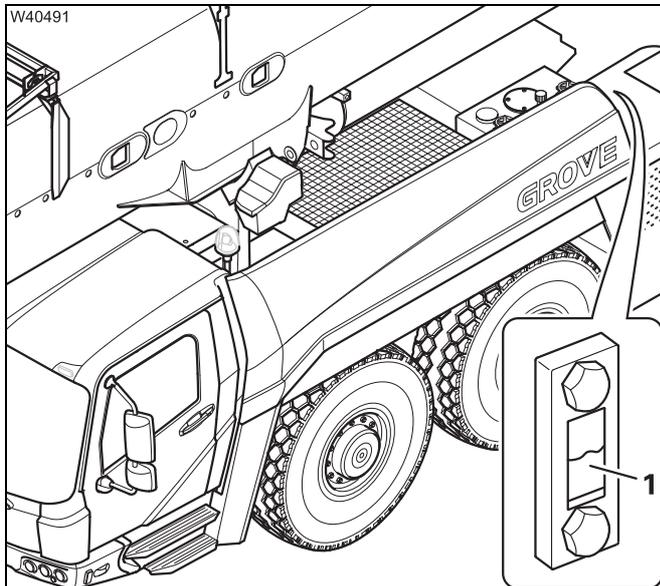
- The truck crane is aligned horizontally at on-road level; *Operating manual*.
- The outriggers are retracted; *Operating manual*.
- The engine must not be running and must be secured against unauthorised use; p. 2 - 3.



Risk of damage to the hydraulic system!

Cleanliness is imperative when handling hydraulic oil!

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 - 101.

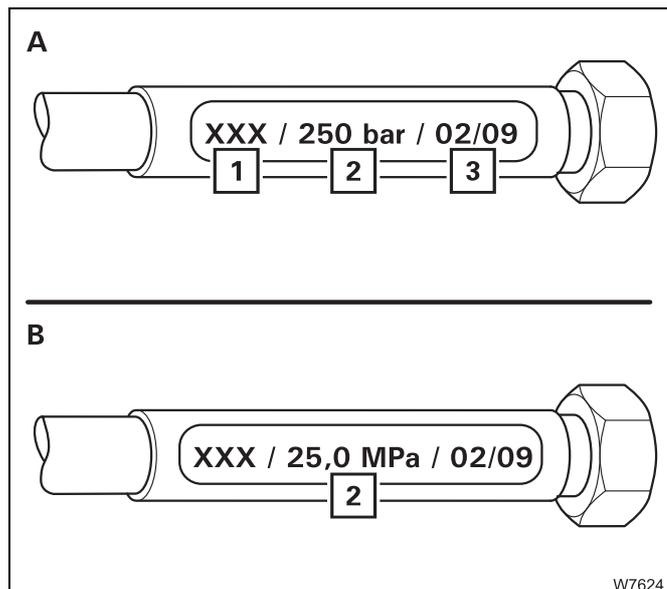
7.14.2

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 (cracks, 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 the date of manufacture. The date of manufacture and the permitted operating pressure are marked on the hose fitting:

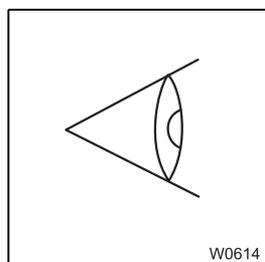
- 1 Manufacturer designation
- 2 Maximum operating pressure with units of measurement (**A**) (e.g. 250 bar (3,626 psi)).
Maximum operating pressure with units of measurement (**B**) (e.g. 25.0 MPa (3,626 psi)).
- 3 Month and year of manufacture.

- Always ensure that the corresponding parts of the hydraulic system are depressurised.
- Immediately replace damaged or old hydraulic hoses.

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 oil level if there are leaks;  *Checking the oil level*, p. 7 - 89.



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

After parts have been changed

- Bleed the carrier hydraulic system; *Bleeding the hydraulic system*, p. 7 - 102.

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

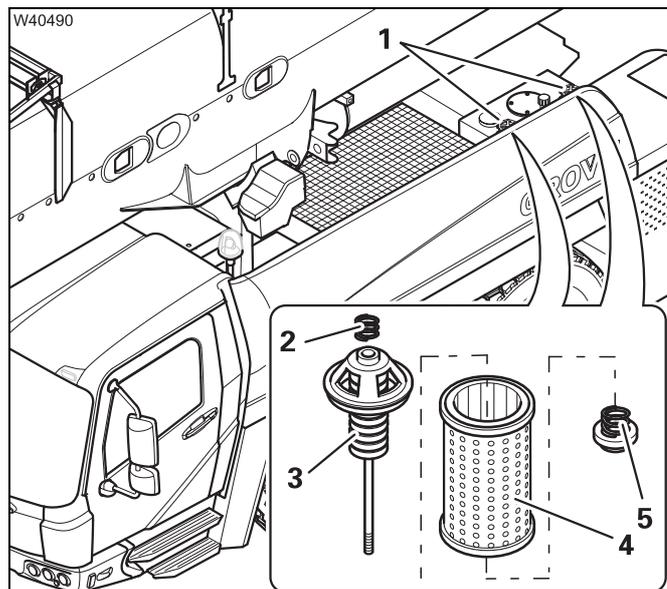
- Receptacle, about 5 l (1.5 gal); p. 2 - 4.

Prerequisites

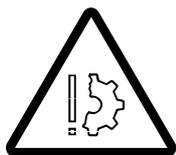
- The truck crane must be standing on a level surface.
- The engine must not be running and must be secured against unauthorised use; p. 2 - 3.
- During the first 100 operating hours: Clean the magnetic rods weekly.



Cleaning the magnetic rods

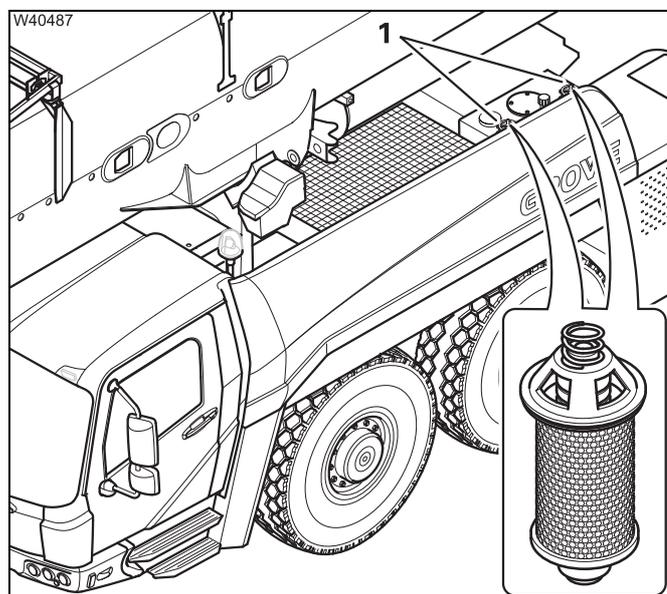


- Release the cap (1) and pull out the filters.
- Place the filters in a receptacle.
- Remove the spring (2).
- Remove the nuts (5).
- Take the magnetic rod (3) out of the filter cage (4) and clean it.
- Replace any damaged parts, where necessary.



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.
- If necessary, also replace the seals and fasten the caps (1).
- Start the engine and check for leaks.

7.14.5

Changing the ventilation filters

M 12

Reducing the interval

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

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	01576026

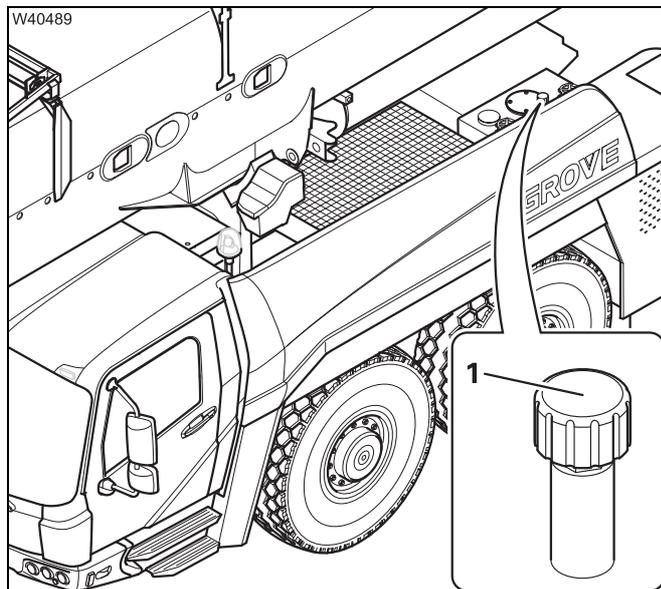
Prerequisites

- The engine must not be running and must be 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.



- Change the filter (1).

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.
One set of sample containers with a protective mailing bag and delivery note to the contracted laboratory	03141012

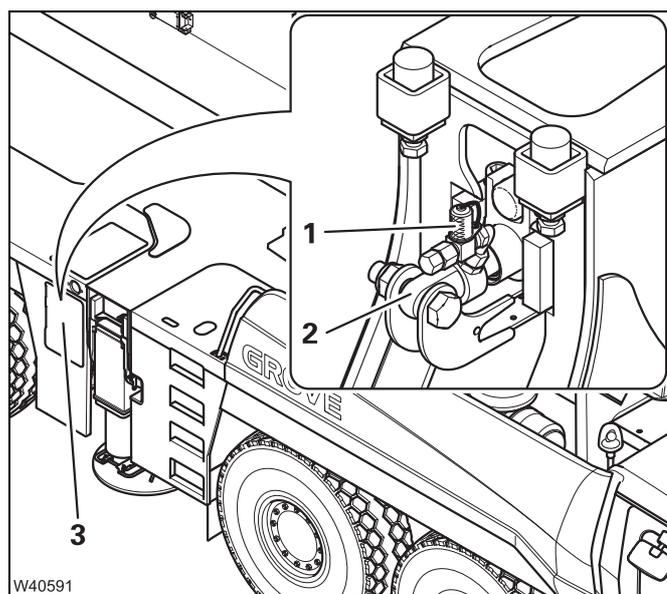
- Receptacle, about 5 l (1.5 gal);  p. 2 - 4.

Prerequisites

- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

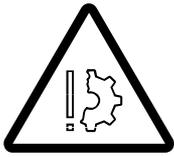
Selecting the sampling location

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.



- Remove the cover (3). The gauge port (1) is located on the cylinder (2) of the outrigger.
- Clean the gauge port before connecting the hose.

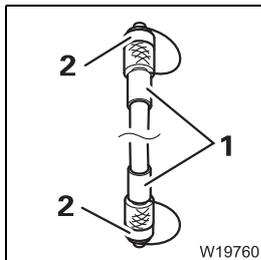
Protecting the hose from dirt



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



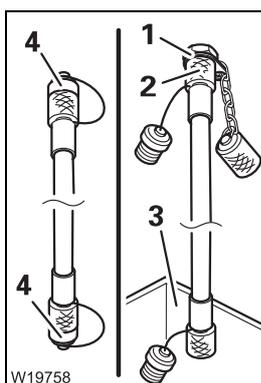
Danger due to escaping hydraulic oil!

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.

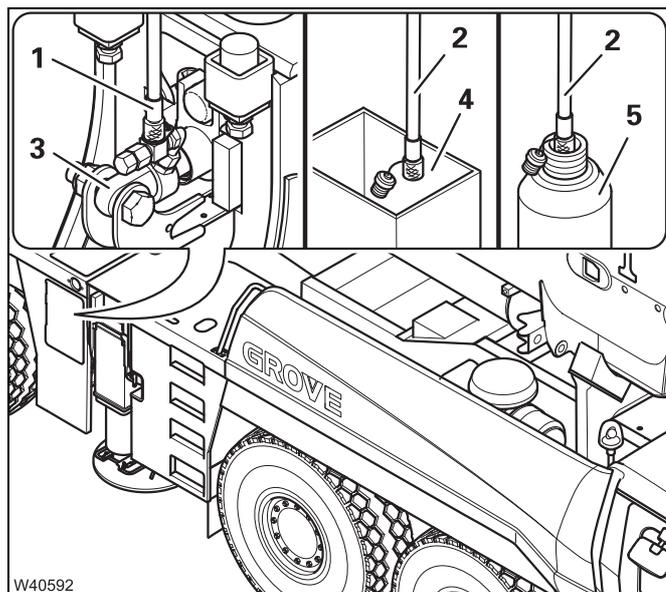
Ask about the applicable regulations.



- 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) onto the gauge port – the gauge port opens.



Taking oil samples

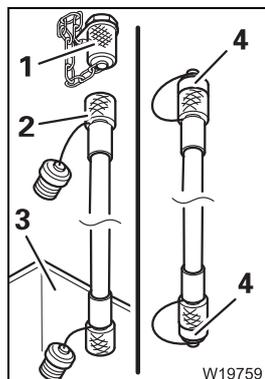


The hose end (1) is connected to the cylinder (3).

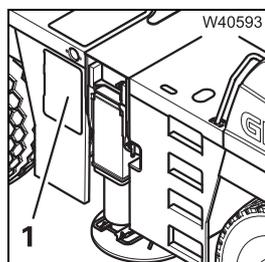
The hose end (2) is in the receptacle (4).

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

Connecting Removing



- 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.



- Attach the cover (1).

Dispatching 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,
 - date of sample,
 - 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:
 - Viscosity
 - Viscosity index
 - Contamination
 - 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:

- Perform an oil change;  p. 7 - 99.

Contamination limit value

- Contamination as per NAS 1638 Class 7 or ISO 4406:1999 Code 18/16/13 (purity class).

If this limit value has been reached/exceeded:

- Replace the filters of the hydraulic system;  p. 7 - 103.
- 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 this; *Determining the quality of the oil*, p. 7 - 97.

Oil, spare parts, tools

Hydraulic oil in litres (gal)	Designation to DIN 51502	Specifications 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, about 230 l (61 gal); p. 2 - 4.

Prerequisites

- The outriggers are retracted; *Operating manual*.
- The engine must not be running and must be secured against unauthorised use; p. 2 - 3.

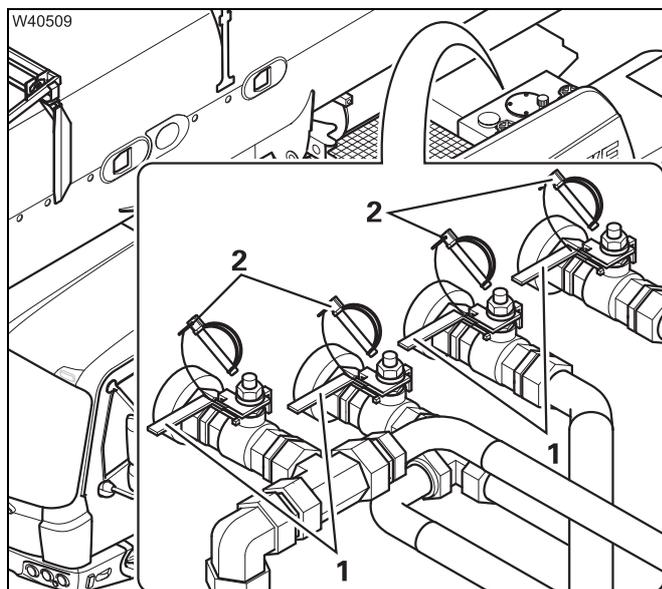
Closing the valves



Risk of damage to the hydraulic pumps!

Be sure to secure the engine against unauthorised use.

The hydraulic pumps will be damaged if the engine is started while the valves in the suction line are closed!



- Remove the linchpins (2) from the levers (1).
- 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!

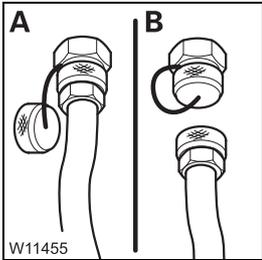
Use the supplied connecting piece and hose and a receptacle with sufficient capacity to drain the hydraulic oil.



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 onto 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.

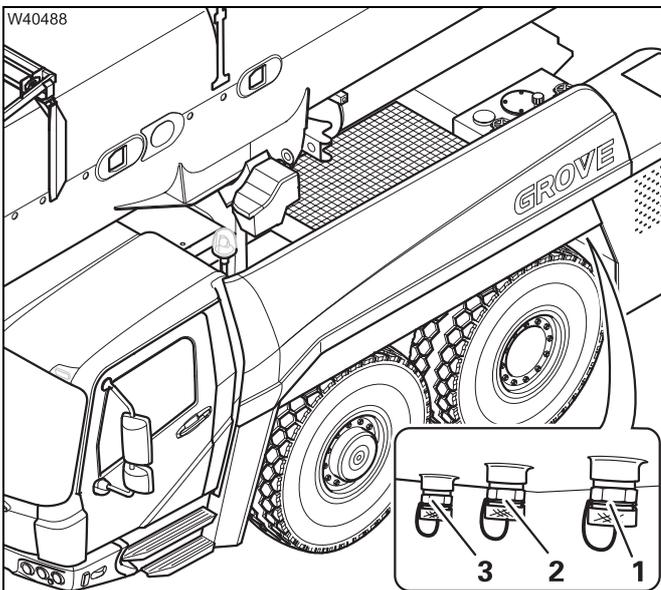


Draining oil



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.



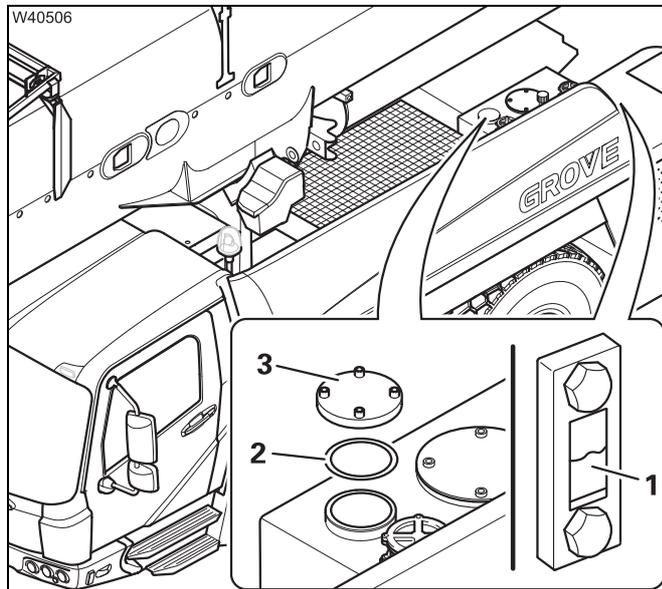
- Place a receptacle underneath the valves.
- Screw the connecting piece and hose onto the valves (1), (2) and (3) one after the other;  Handling the valves, p. 7 - 100.
- Change the filters;  p. 7 - 103.

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 cap (3).
- Add new oil through a filter until the level reaches the centre of the sight glass (1).
- If required, replace the gasket (2) and fasten the cap.

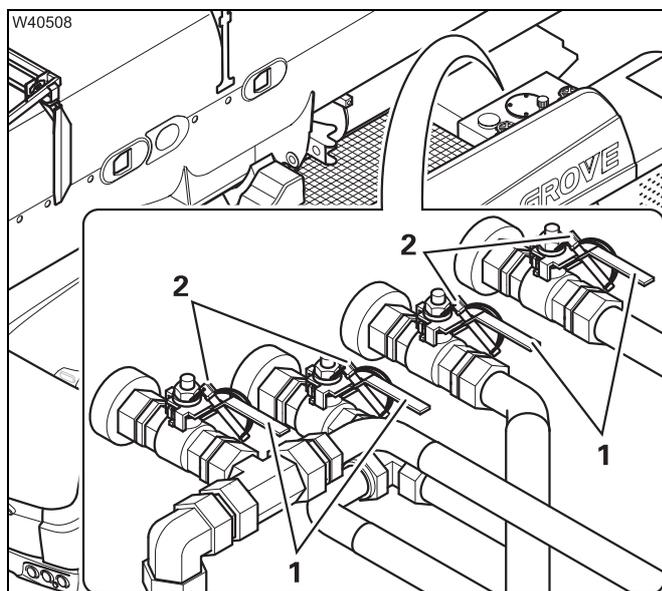
Establishing an operational status

After changing the oil filters and topping up the oil, you must re-establish the operating condition.



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.
- Secure the levers (1) using the linchpins (2).



- 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 - 89.

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;  *Operating manual*.
- The parking brake must be engaged.



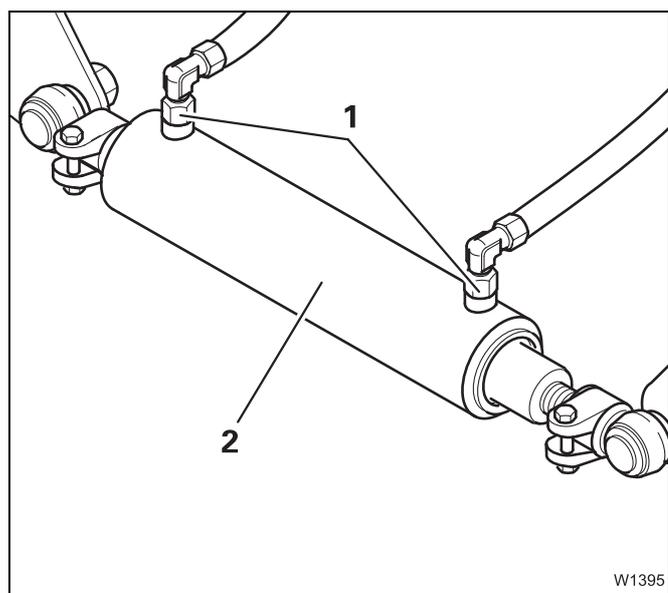
Risk of crushing from turning wheels!

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.



Bleeding 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

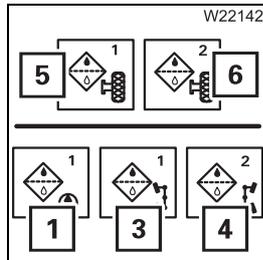
- Notify **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

7.14.8

Changing the hydraulic oil filter

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 filters 1 and 2
- 3 Red – Changing filter 3
- 4 Red – Changing filter 4
- 5 Red – Changing filter 5
- 6 Red – Changing filter 6

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
Filter (for filters 5 and 6)	2	03142530
Spring	2	03142531
O-ring	2	03142532

- Receptacle, about 5 l (1.5 gal); p. 2 - 4.
- Torque wrench for a torque of 45 Nm (33 lbf ft).

Prerequisites

- The engine must not be running and must be secured against unauthorised use; p. 2 - 3.

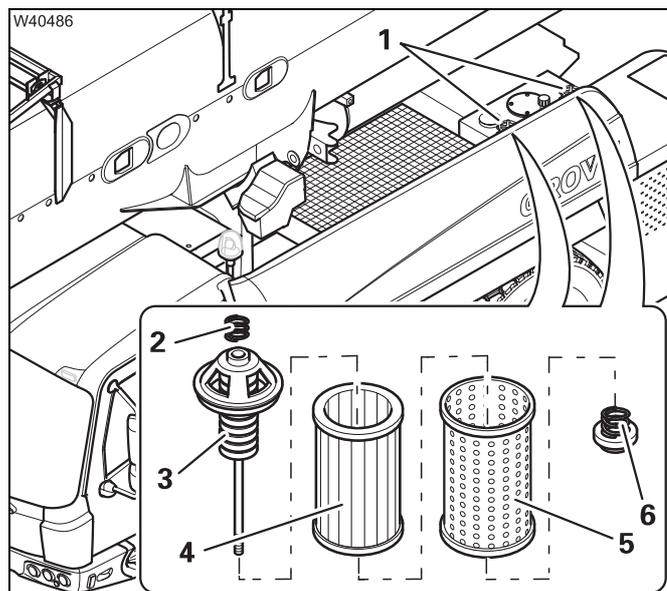


Risk of damage to the environment from filter residues!

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



Changing filters 1 and 2



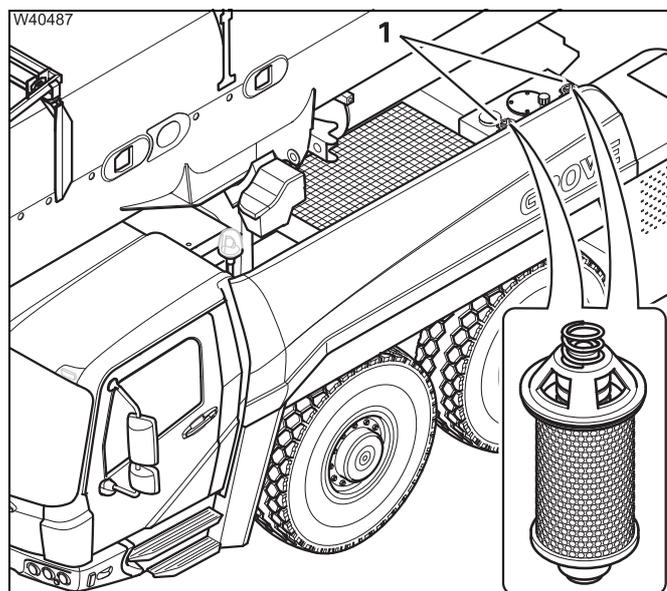
- Release the cap (1) and pull out the filters.
- Place the filters in a receptacle.
- Remove the spring (2).
- Remove the nuts (6).
- Remove the magnetic rod (3) and filter (4) from the filter cage (5).
- Clean the magnetic rod (3) and filter cage (5).
- Insert a new filter (4) into the filter cage (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.

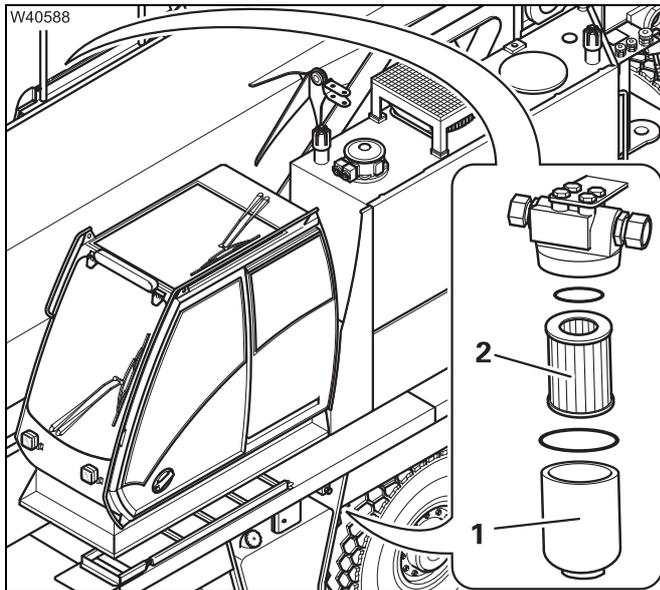
Have the hydraulic system checked by **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.



- 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

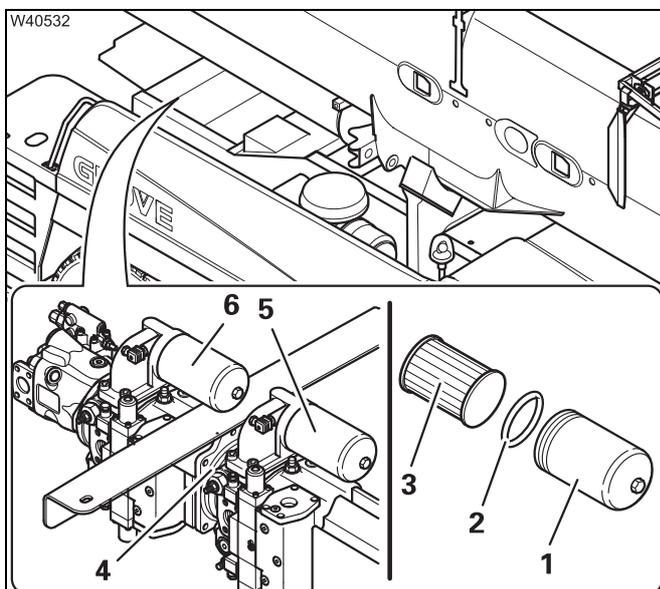
Filter 3 is installed on the left side and filter 4 is on the right side.



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

Changing filters 5 and 6

The filters (5) and (6) are located on the pump combination (4).



- Place a receptacle under the filter (1).
- Remove the housing (1).
- Change the filters (3).
- Replace the O-rings (2).
- Fit the housing on and tighten it – torque 45 Nm (33 ft lbf).

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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 filling level

W

Grease, spare parts, tools

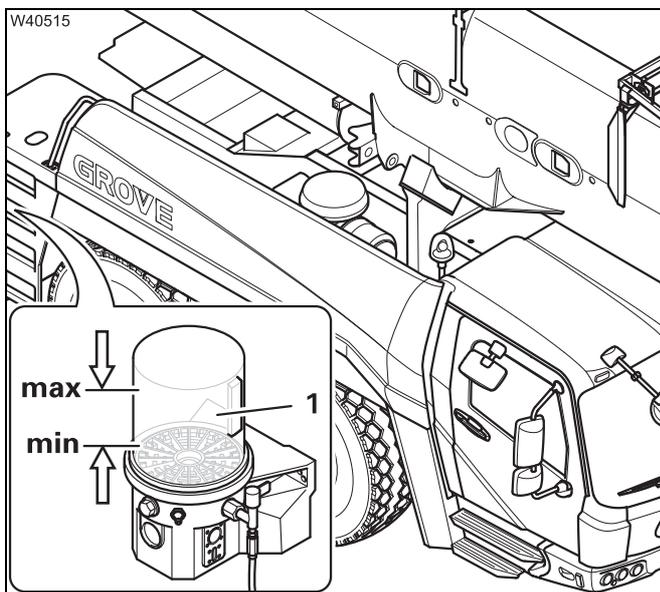
Lubricating grease	Designation to DIN 51502	Specifications Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

– Filling pump from the tool set.

Prerequisites

– The parking brake must be engaged.

Checking the filling level



- Check the filling level in the grease container (1). The filling 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

- Top up the grease; → p. 7 - 108.



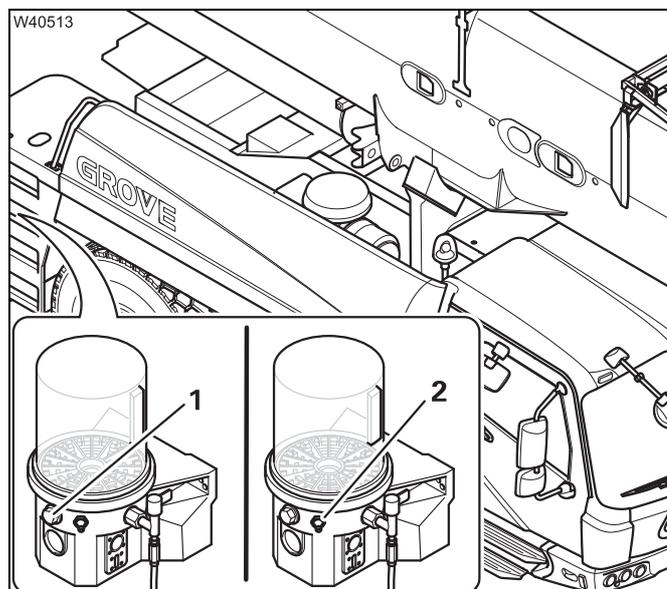
Topping up



Risk of damage to the central lubrication system!

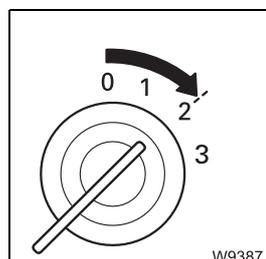
Cleanliness is of the utmost importance when handling grease and filling pumps.

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.

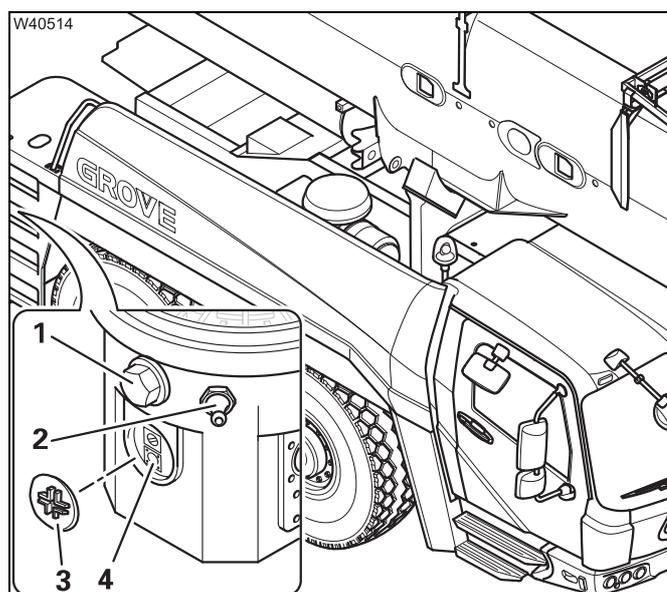


Fill the grease container as follows:

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



- Switch on the ignition.

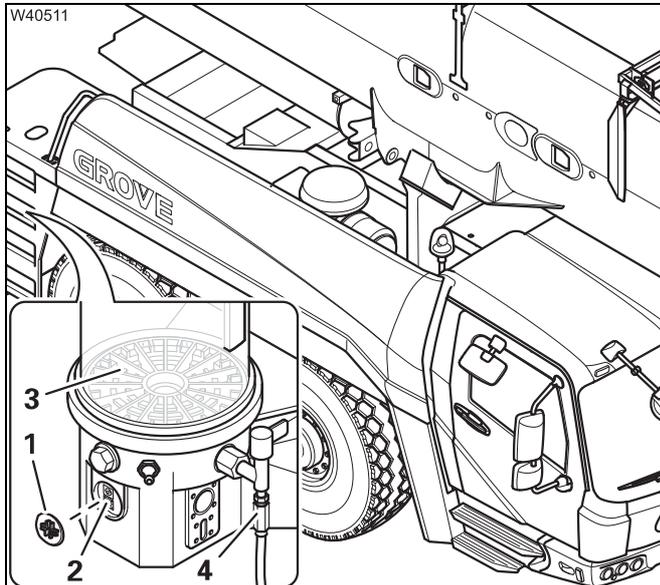


- Remove the cap (3).
- Connect the filling pump to the connection (1) or (2).
- Press button (4) once for about 2 seconds. Intermediate lubrication will be triggered.
- Fill the grease container up to the **Max.** marking.
- Remove the filling pump, wipe away any excess grease and close the holes.

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.

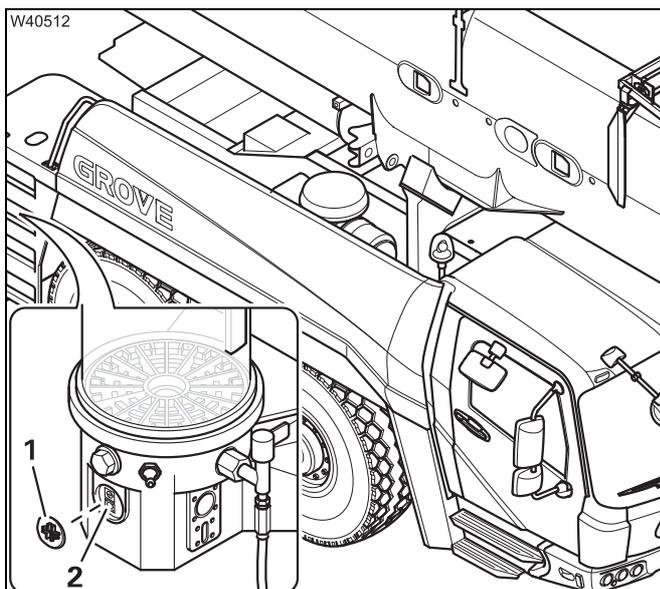
- Undo the connection (4).
- Switch on the ignition.
- Remove the cap (1) and press button (2) once for about 2 seconds. Repeat the procedure until the grease flowing from the connection no longer contains any bubbles.
- Attach the connection and the cap.
- Remove any grease that emerges.

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 about 2 seconds.

An intermediate lubrication cycle will be triggered which lasts about 3 minutes. Check that grease is applied to all the lubricating points (Steering arm at 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

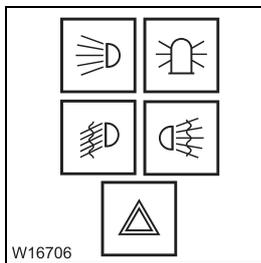
D



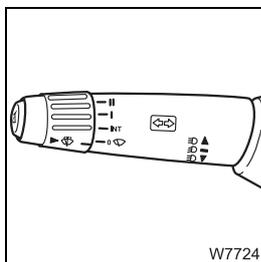
Risk of accidents in the event of faulty safety devices!

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

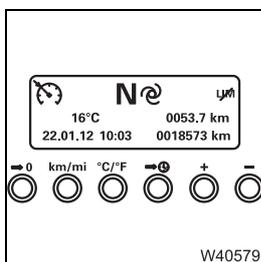
- Check the following functions every day before starting work or driving and have any faulty parts repaired:



- Parking light/headlight, marker lights, rotating beacons Fog tail light, fog light, outrigger lights
- Hazard warning system
- Brake lights
- Reversing lights
- Warning buzzer



- Full-beam headlight
- Turn signal indicator
- Horn
- Windscreen wipers
- Windscreen washing system



- Date/Time on the driving mode display

7.16.2

Checking the batteries

M 1



Risk of poisoning from storage 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 storage battery and keep naked flames away from the battery.



Risk of explosion from static charge!

Only use antistatic cloth 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.

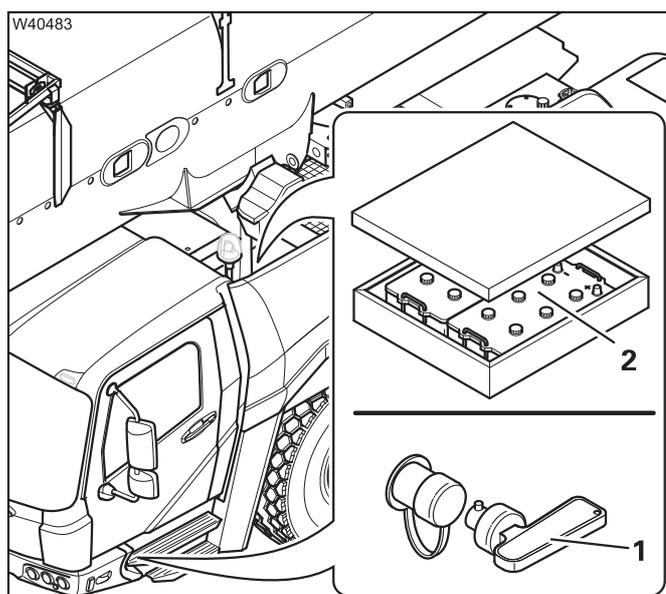
Do not tilt the battery. Rinse off or wash out any acid spray on the skin or clothing using soap suds.



Risk of damage to the crane's electrical system!

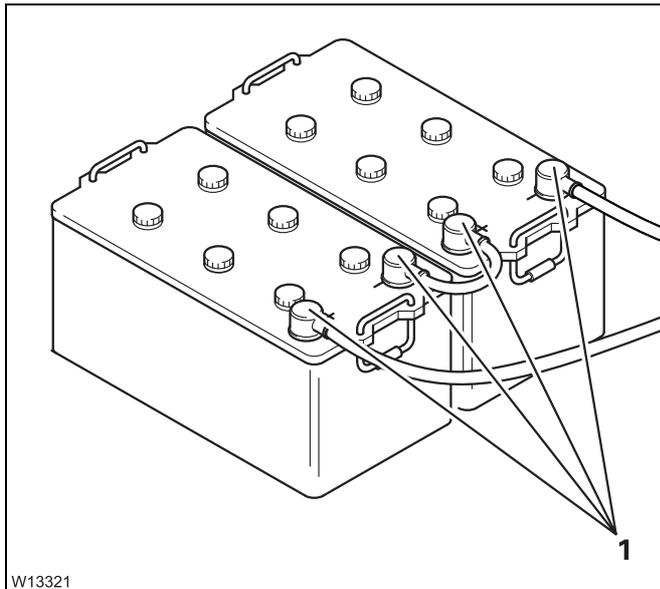
Always switch off the battery master switches before commencing work on the truck crane's electrical system.

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



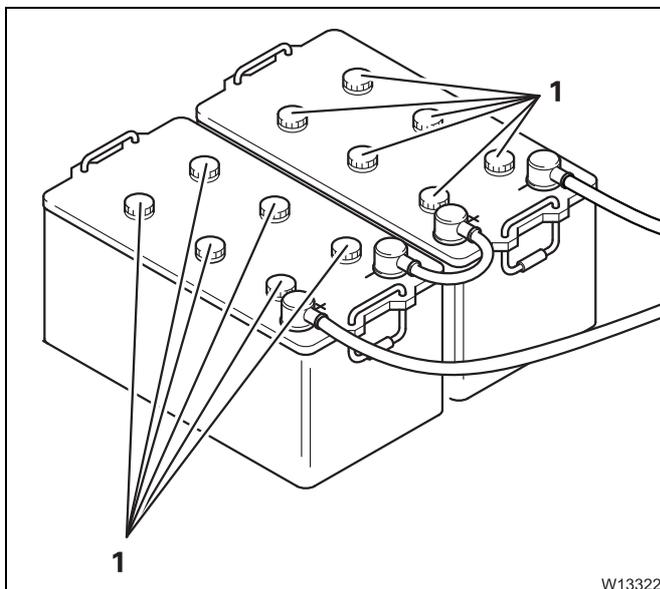
Before checking

- 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.
- Release 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

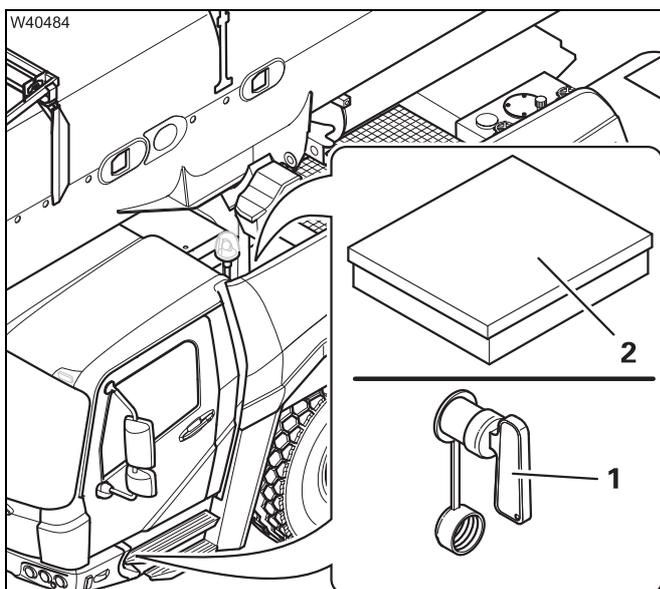
Batteries without covers (1) are maintenance-free.

- Remove all covers (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.
- Screw on all caps (1) tightly.



After checking

- Close the cover (2) on the battery box.
- Attach the selector handle and switch on the battery master switch (1).
- Check the clocks on the tachographs and auxiliary heater; *Operating manual*.
- Enter the code for the radio; *Separate operating manual*.

7.16.3

Checking the charge level of the batteries

M 3

Spare parts and tools

- Battery testing device;  *Separate operating manual*, o
- 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)	Table
1.28	good
1.20	half-charged; recharge
1.12	flat; recharge immediately



Risk of poisoning from storage 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 storage battery and keep naked flames away from the battery.



Risk of explosion from static charge!

Only use antistatic cloth to clean the batteries.

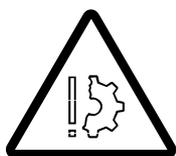
This prevents the build-up of static charges which could cause hydrogen mixtures to explode.



Risk of burns from battery acids!

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

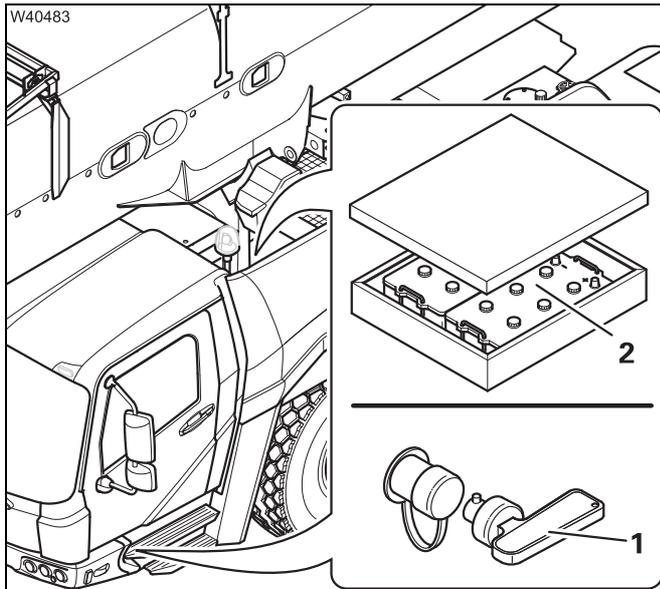
Do not tilt the battery. Rinse off or wash out any acid spray on the skin or clothing using soap suds.



Risk of damage to the crane's electrical system!

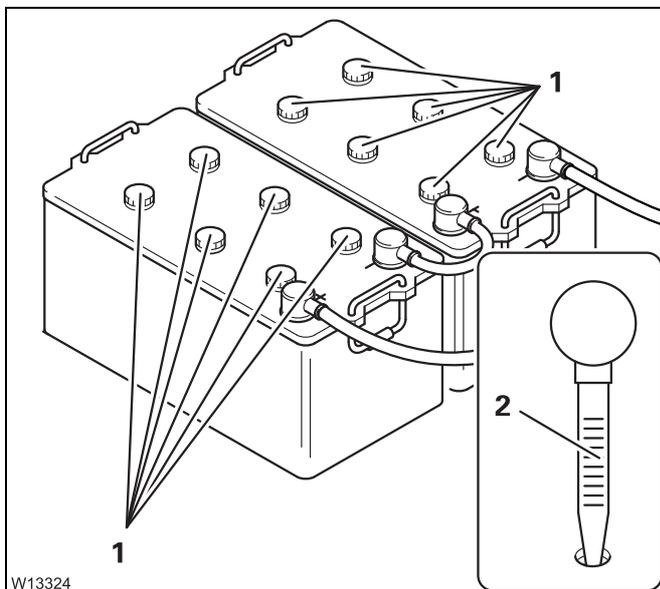
Always switch off the battery master switches before commencing work on the truck crane's electrical system.

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



Before checking

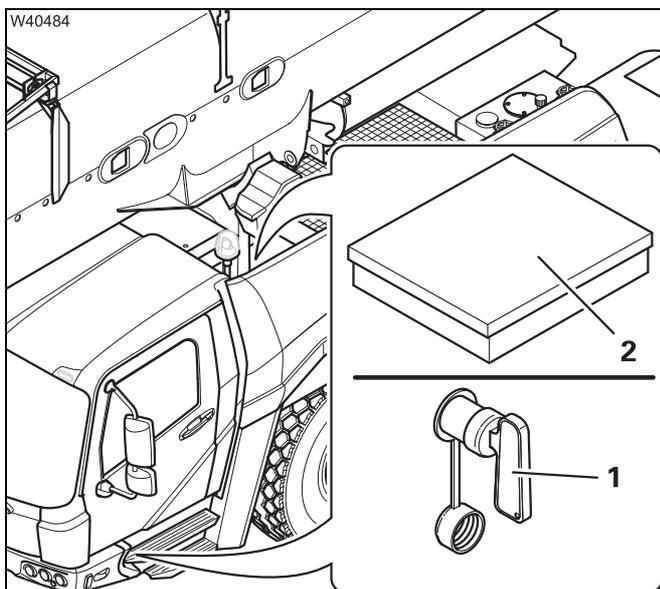
- Switch the battery master switch (1) off and remove the selector handle.
- Open the cover (2) on the battery box.



Checking the acid concentration

Batteries without covers (1) are maintenance-free.

- Remove all covers (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 - 114.*
- Check all cells in the same way.
- Screw on all caps (1) tightly.



After checking

- Close the cover (2) on the battery box.
- Attach the selector handle and switch on the battery master switch (1).
- Check the clocks on the tachographs and auxiliary heater;  *Operating manual.*
- Enter the code for the radio;  *Separate operating manual.*

7.16.4

Charging the batteries using the battery charger

M 3

Prerequisites

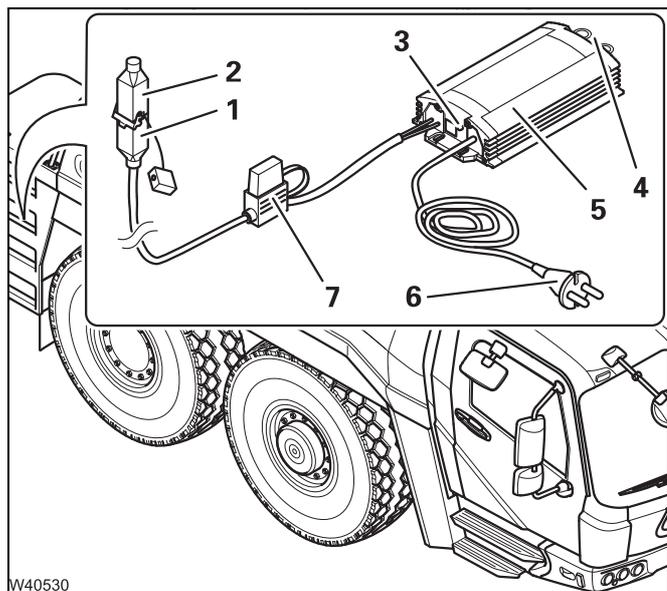
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.
- An external 230 V mains power supply must be available at the location.
- The battery charger (GROVE part no. 03320239; additional equipment) must be available.
- The location must be well ventilated and protected 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 operating manual.*

Connecting

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



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

Charging

- Check the charging process at the indicator lamp (3).

Indicator lamp flashing: The batteries are being charged.

Indicator lamp lit continuously: The batteries are fully charged.

After completion of charging

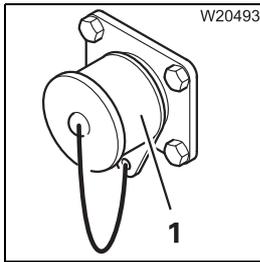
- Remove the plug (6) from the 230 V mains supply.
- Take out the plug (1) from the socket (2).

Return the battery charger to the storage compartment in the driver's cab.

7.16.5

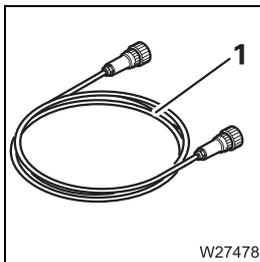
Checking the external starting socket

M 3



The GMK6400 truck crane can be equipped with an external starting socket (1) as additional equipment.

Accessories



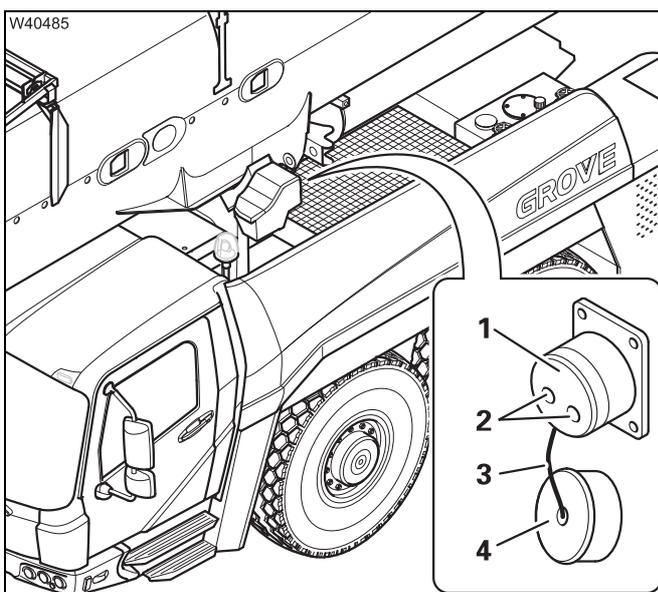
A connection cable (1) for the external starting socket can be ordered as an accessory.

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 use if needed; *Operating manual*.

Checks



- Remove the cap (4) from the socket (1).
- Check that the cap is undamaged (3) and secured with the chain.
- If necessary, clean the poles (2).
- Fit the cap – the cap must be fitted tightly and properly sealed on the socket.

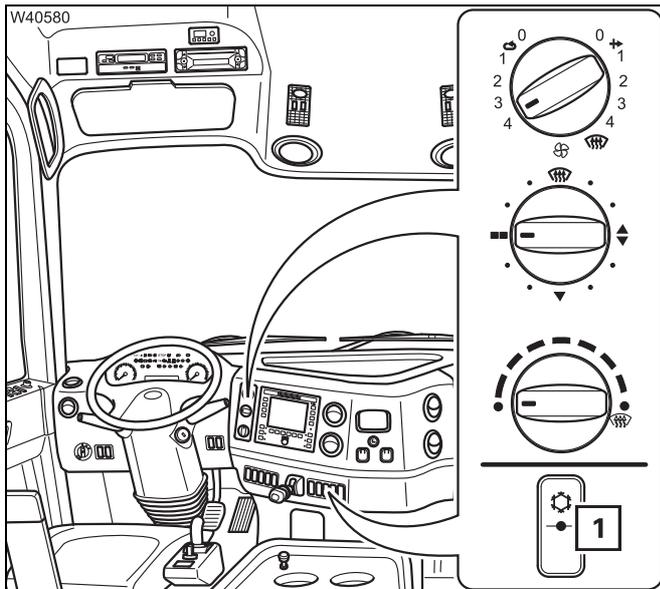
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7.17 Air-conditioning system

7.17.1 Checking the air conditioning system

M 1

The air-conditioning control panel is located on the front instrument panel in the driver's cab.



- Switch on the air conditioning system (1);
 ▶ *Operating manual.*
- Check that cooling takes place. If it does not, the air-conditioning system is defective.
- Switch the air conditioning system 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.

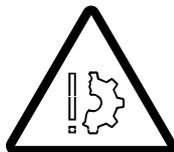
- Check all refrigerant hoses for damage and areas of wear.

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

7.17.3

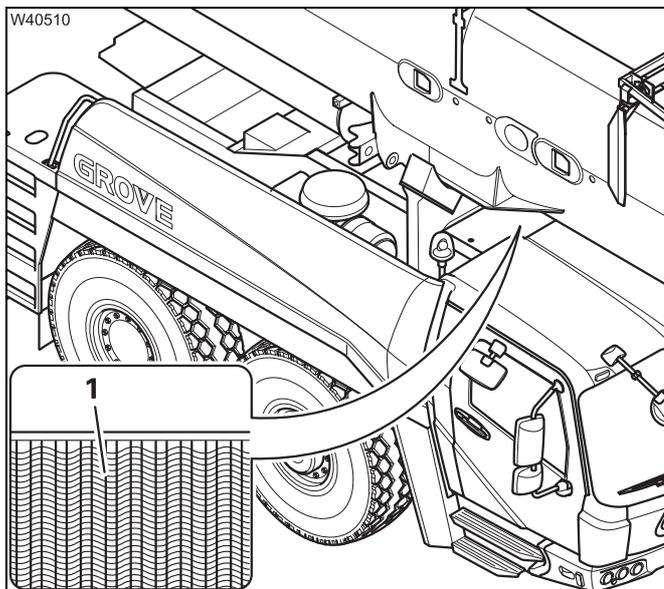
Cleaning the condenser fins

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 - 20.

7.17.4

Checking the entire air-conditioning system

M 12



The GMK6400 truck crane is equipped with a combined air-conditioning system for the driver's cab in the carrier and the crane cab.

This inspection may only be carried out 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.

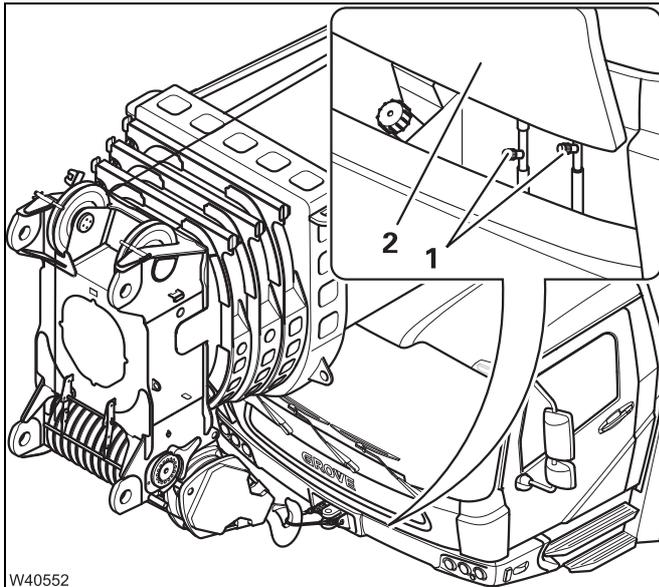
This will prevent injury from suddenly escaping refrigerant. Seek medical attention if the skin or eyes come into contact with the refrigerant.

- 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

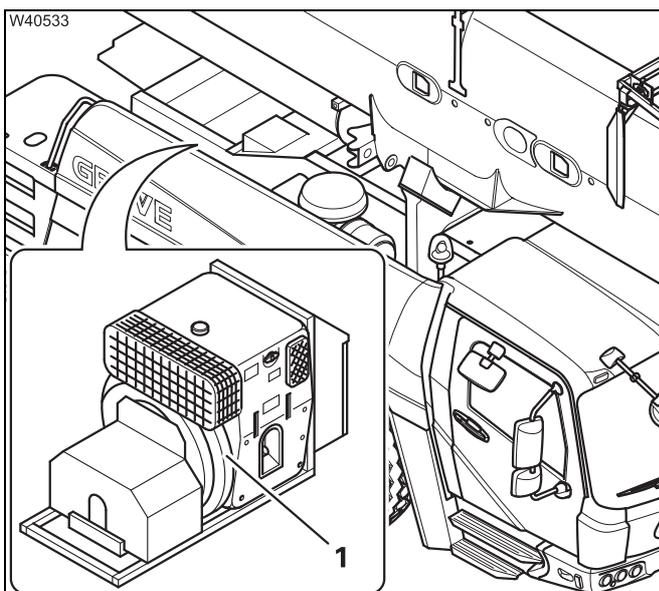
Fill quantity in kg (lbs)	Designation	CAS no. EC no.
2.60 (5.73)	Tetrafluoroethane (R134a)	811-97-2 212-377-0
2.85 (6.28) (with <i>Fuel Saver</i>)		

Filler connections



The filler connections (1) for refrigerants are located behind the front flap (2) on the driver's cab.

Fuel Saver additional equipment



If the GMK6400 truck crane is equipped with the *Fuel Saver* power unit (1) then the diesel engine can be switched off during waiting periods and the crane controls system and air conditioning system is then powered by the *Fuel Saver* power unit (1); *Separate operating manual*.

- Note the increased filling quantity for the combined cooling circuit including the *Fuel Saver*; p. 7 - 121.
- Also have the *Fuel Saver* power unit checked.

7.17.5

Changing the pollen filter

M 12

Reducing the interval

- Under difficult operating conditions – at extremely sandy or dusty locations – you must change the pollen filter earlier.

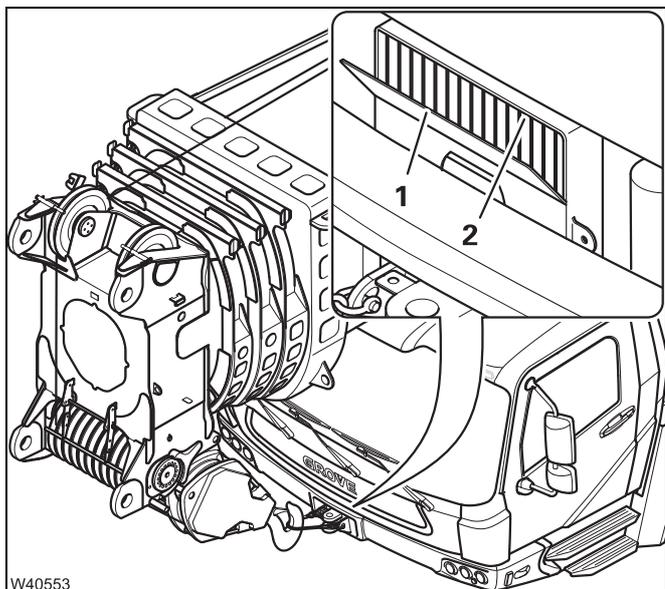
Spare parts and tools

Designation	Quantity	GROVE part no.
Pollen filter	1	03134974

Prerequisites

- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Changing



- Open the cap (1).
- Remove the filter (2) from the housing and clean the housing with a cloth.
- Insert a new filter.
- Close the cap.

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 operating manual.*

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

– Grease gun from the tool set.



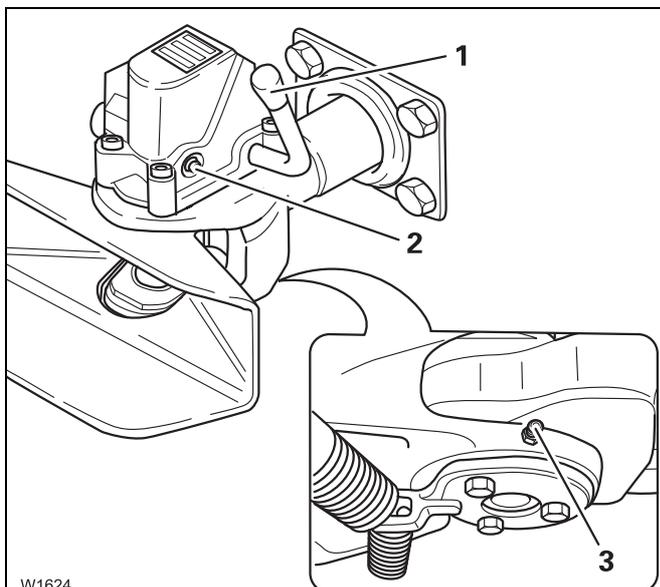
Risk of injury when the automatic closing device is triggered!

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.



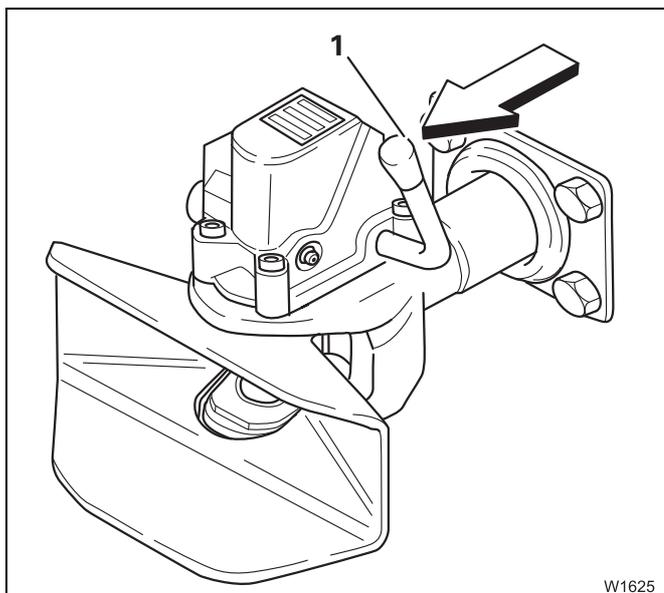
Closing the towbar coupling



Risk of injury when closing the towbar coupling by hand!

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.

- Hammer the lever (1) briefly in the direction of the coupling jaw (observe the arrow).
- Remove any grease that has escaped.

7.18.2

Checking the bearing

M 3

Prerequisites

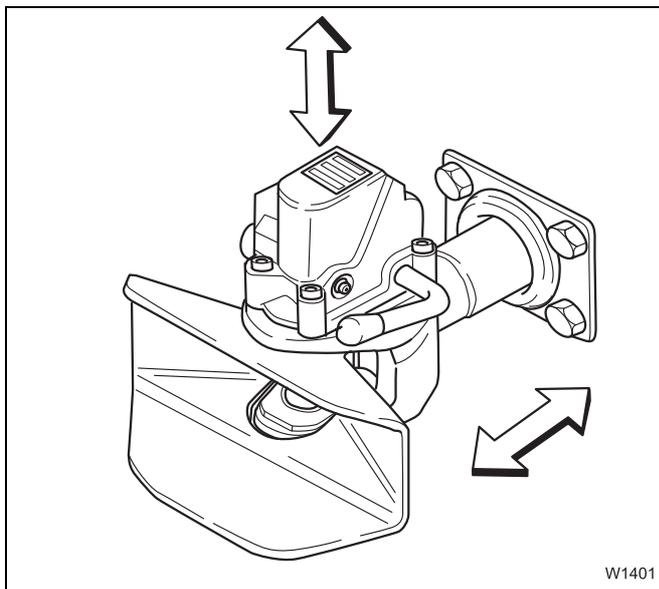
– The coupling is closed;  p. 7 - 124.

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). Do not hold the towbar coupling by the coupling jaw, but rather at the top and bottom of the coupling head.

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

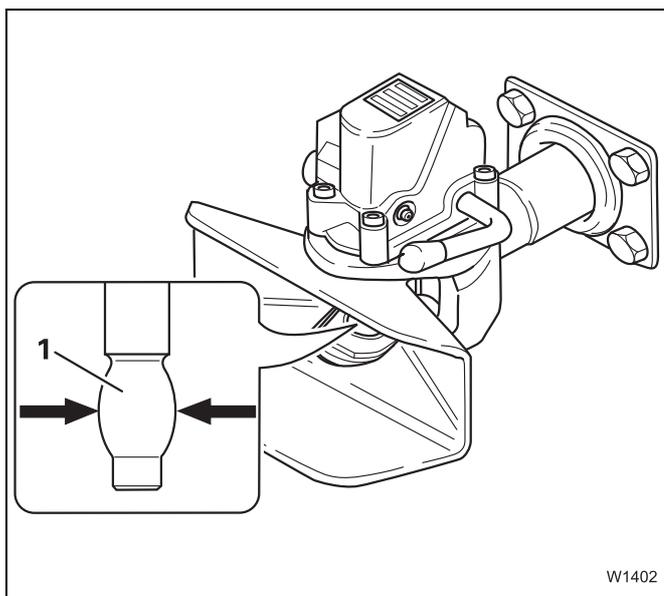
7.18.3

Checking the cotter pin

M 3

Prerequisites – The coupling is closed;  p. 7 - 124.

Checking the cotter pin

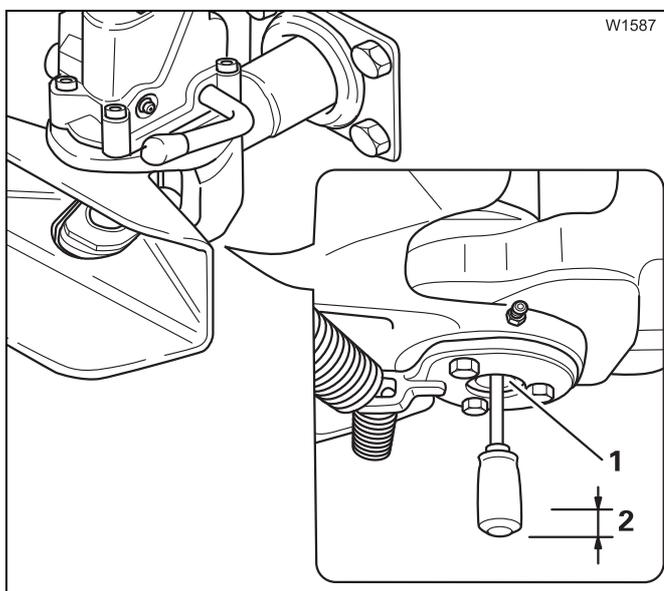


- Check the wear on the cotter pin (1). The diameter of the crowned section (arrows) must not be less than the following values:

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

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

If the dimension is smaller than the above mentioned dimension then have the coupling pin replaced by **Manitowoc Crane Care** or an authorised GROVE dealer or your qualified repair crew.



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

7.18.4

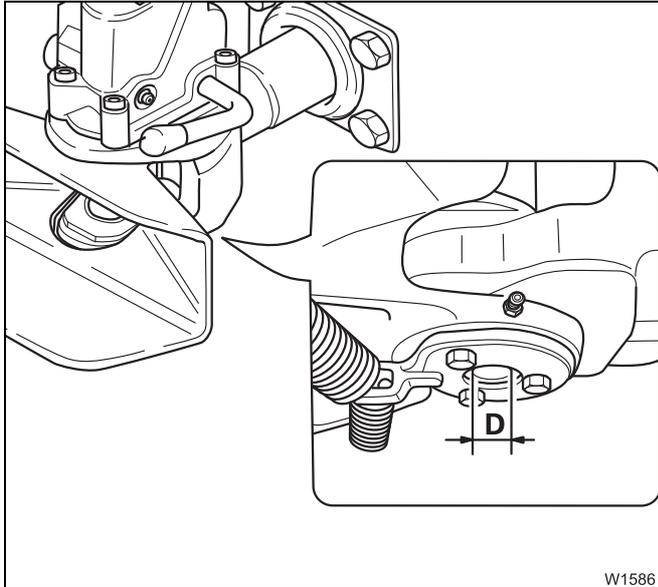
Checking the lower bushing

M 3

Prerequisites

– The coupling is closed;  p. 7 - 124.

Checking the bushing



- Check the internal diameter of the lower bushing. The dimension **D** must not be greater than 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 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.

- Check the initial tension of the rubber springs by twisting the coupling head clockwise and anticlockwise.

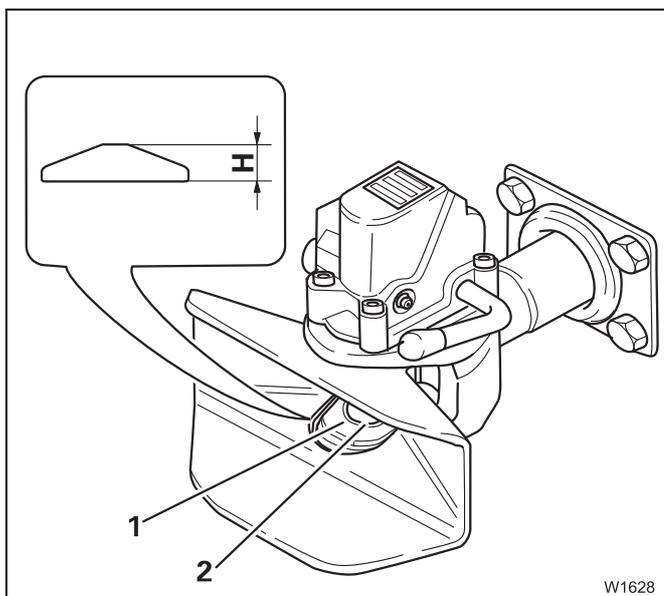
7.18.6

Checking the support ring

M 3

Prerequisites – The coupling is closed;  p. 7 - 124.

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 $H = 14 \text{ mm (0,55 in)}$.

7.18.7

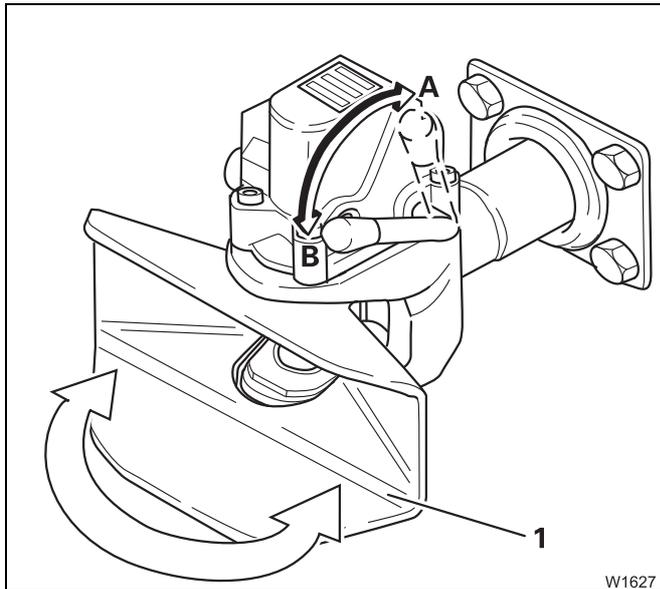
Checking the function of the coupling jaw / Resetting central position

M 3

Spare parts and tool – Torque wrench for a torque of 58 Nm (42.7 lbf ft).

Prerequisites – The coupling is closed;  p. 7 - 124.

Checking the functionality



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

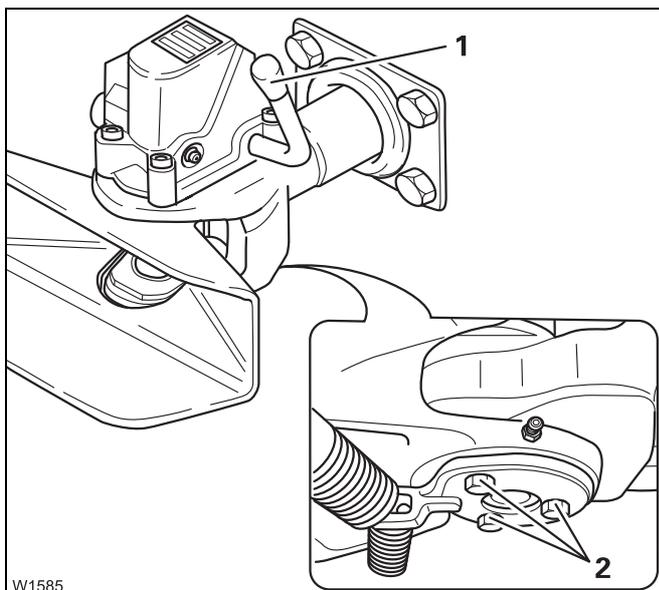
- Hold the coupling jaw (1) pressed slightly to the left or right.
- Open the coupling (position A) and let the coupling jaw go.

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 reset; p. 7 - 129.

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.
- Screw the bolts tight – Torque 58 Nm (42.7 lbf ft).
- Check the function of the coupling jaw; p. 7 - 128.

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7.19 Other maintenance work

7.19.1 Checking the windscreen washing system

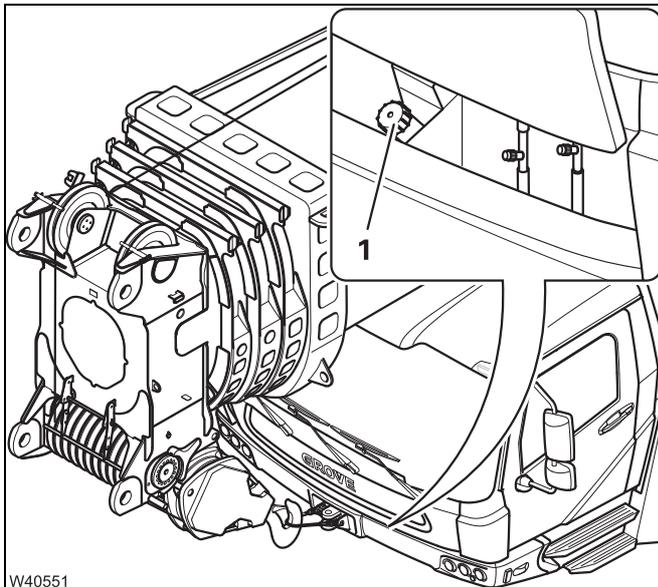
W

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.

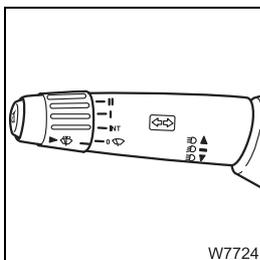
Topping up



W40551

- 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



W7724

- Press the multi-purpose switch of the windscreen wiper/washing system;  *Operating manual*.

- 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

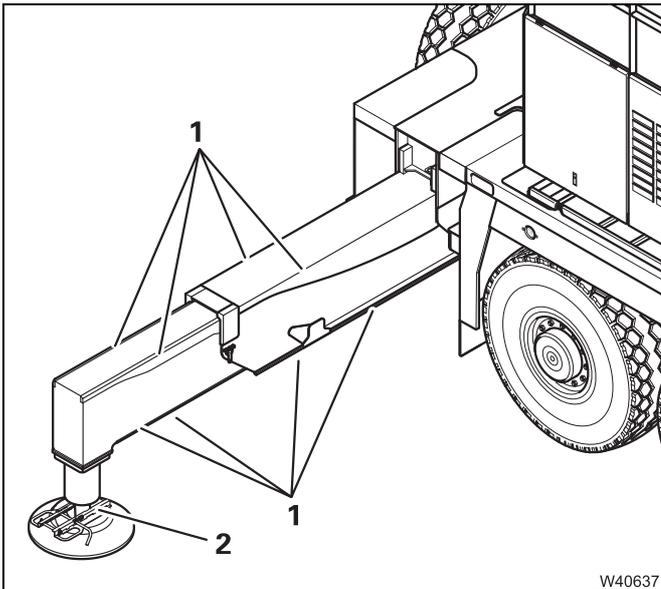
Lubricating grease	Designation to DIN 51502	Specifications Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369
Spray	Spray on Berulub; 0.5 litres (spray-on)		01929824

– Brush or roller.



Danger of crushing by 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;  *Operating manual*.
- 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.

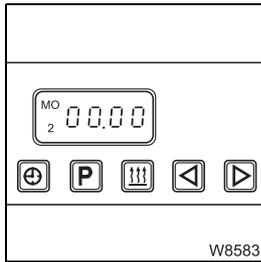
After every high-pressure cleaning of the truck crane

- 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.

During the warm summer months, run the auxiliary heating system for 20 to 30 minutes; *Operating manual*.

- Check that the system is working properly. Also check the functionality 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

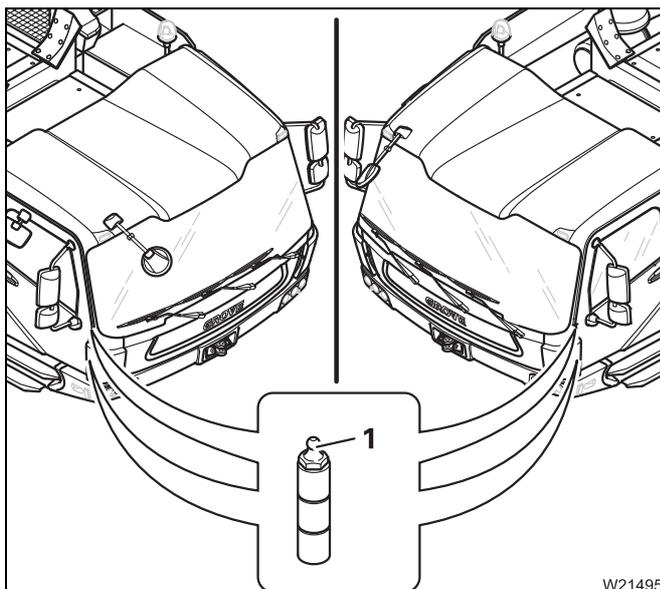
M 12

Grease, tools

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

– Grease gun from the tool set.

Lubrication



- 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 has escaped.

- If 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 pins and socket pins

M 12

Grease, tools

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

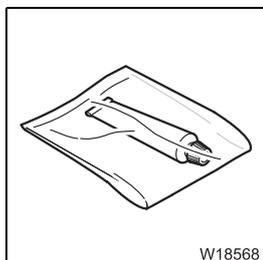
- Brush.

Checks

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.

Lubrication



- 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 has been thoroughly cleaned.
- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Checks

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:
 - Working temperature: above 10 °C (50 °F).
 - Removability before drying: with water.
 - Removability before drying: with test petrol.
 - Drying time: 1 hour.

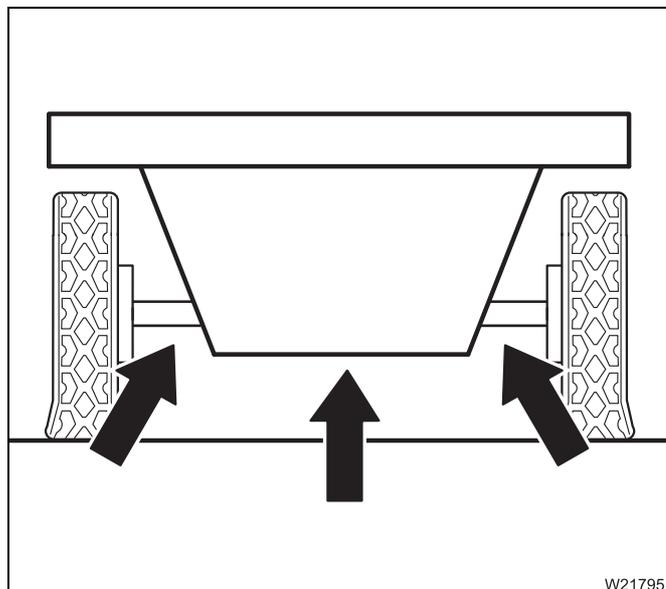


Spraying



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.



- Use a spray extension to spray the corrosion protection agent on the underside of the carrier.
- Clean accidentally sprayed surfaces 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

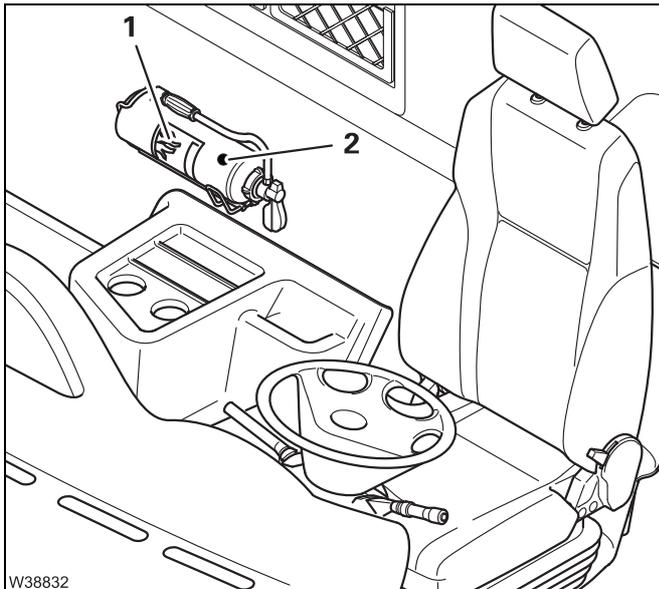
Having the fire extinguisher checked

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 operation of the fire extinguisher.
- Have the fire extinguisher serviced by trained personnel in good time before the maintenance interval specified on the label (2) expires.

W38832



Danger due to the fire extinguisher not working!

There is no guarantee that the fire extinguisher is still working properly after 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

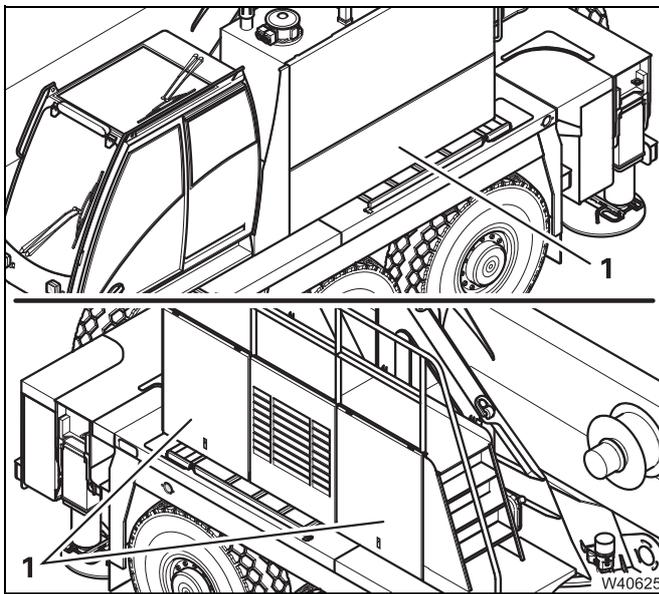
8.1

General instructions

8.1.1

Covers

For certain maintenance work, you must remove/fold out the covers.



Before maintenance work

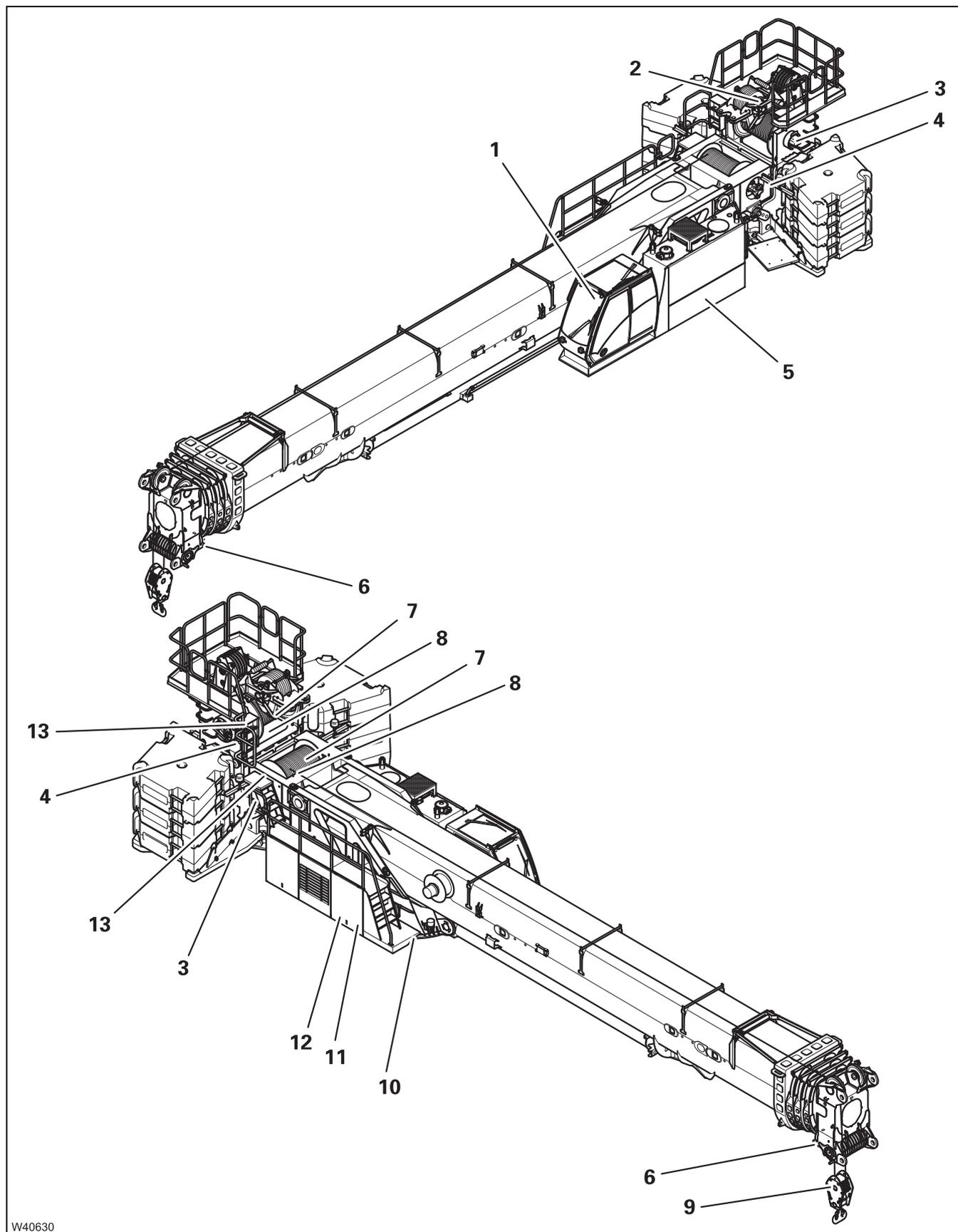
- Remove the covers (1).

After maintenance work

- Fasten the covers (1) with the locks.

8.1.2

Overview of maintenance work on the superstructure



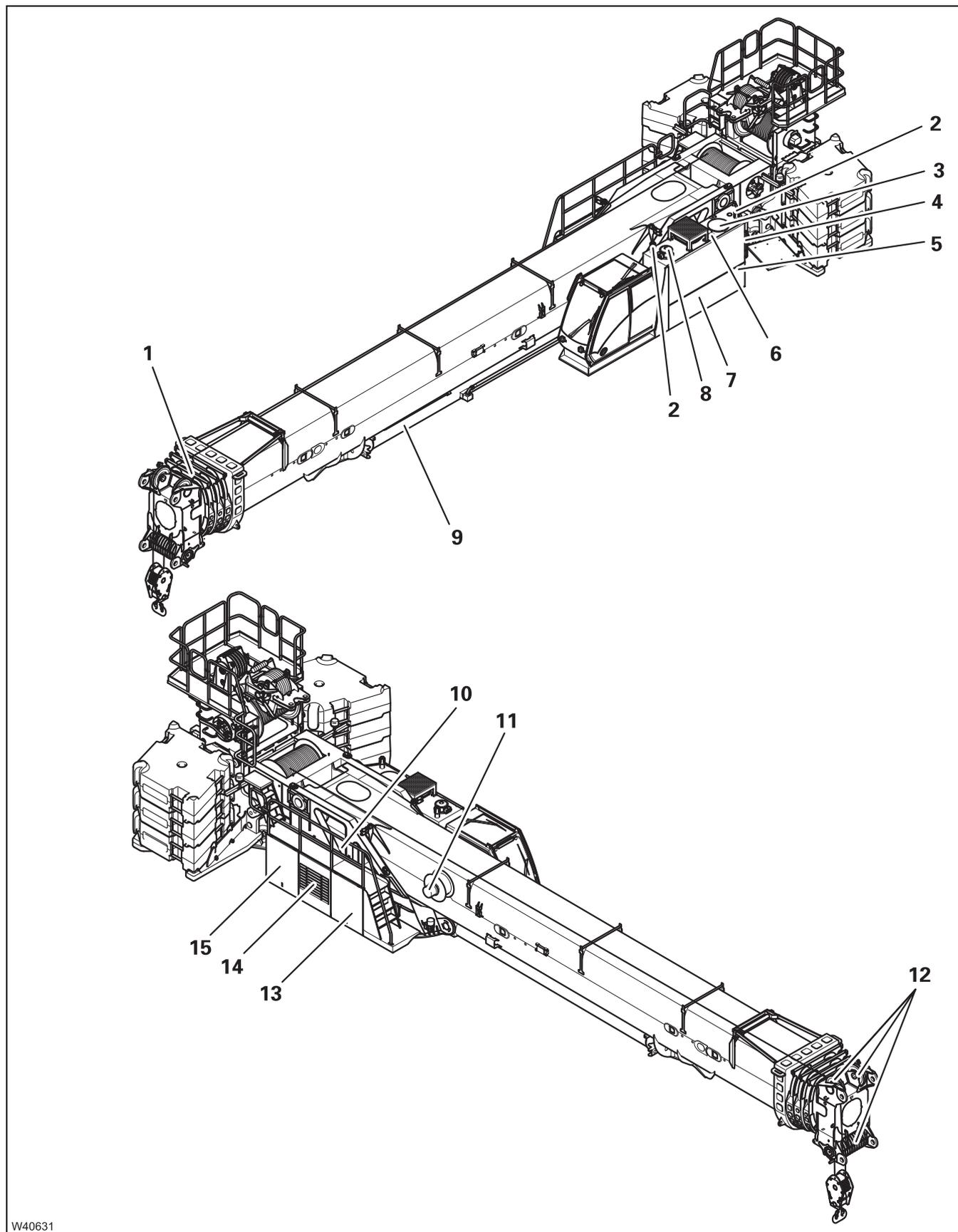
W40630

16.11.2018

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¹⁾ Additional equipment





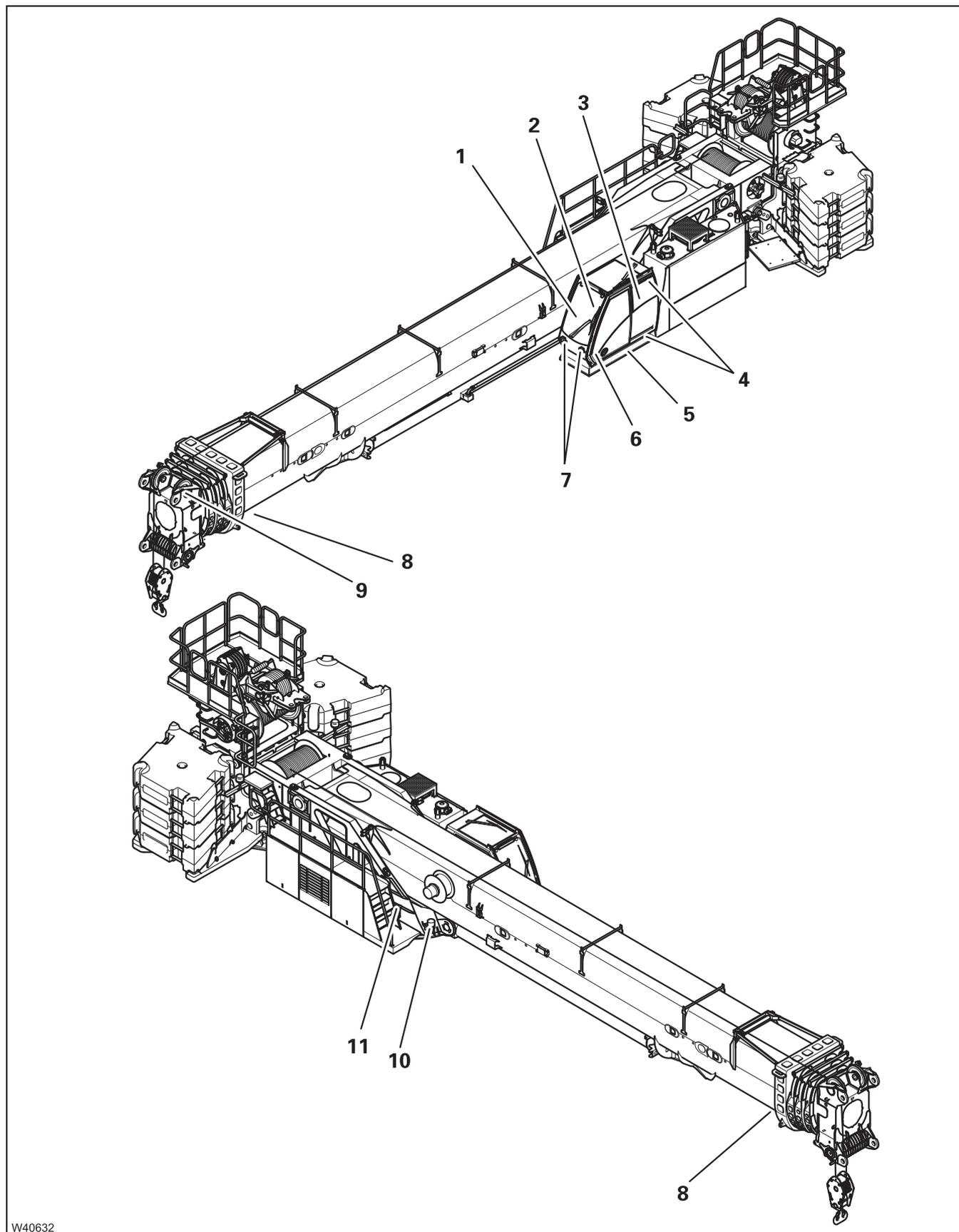
W40631

16.11.2018

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1) Additional equipment





W40632

16.11.2018

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Electrical system	▣▣▣▣ p. 8 - 95
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8 Spotlights on the telescopic boom	▣▣▣▣ p. 8 - 95
9 Anemometer, air traffic control light	▣▣▣▣ p. 8 - 95
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6 Windscreen washing system reservoir	▣▣▣▣ p. 8 - 99
2 Crane cab auxiliary heater ¹⁾	▣▣▣▣ p. 8 - 101
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– Corrosion protection	▣▣▣▣ p. 8 - 105
3 Fire extinguisher ¹⁾	▣▣▣▣ p. 8 - 107

¹⁾ Additional equipment

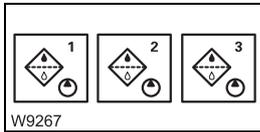
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8.2

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**;
 ▮▮▮▮ *Operating manual*.

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

- 1 Oil filter 1 in the superstructure; ▮▮▮▮ p. 8 - 53.
- 2 Oil filter 2 in the superstructure; ▮▮▮▮ p. 8 - 53.
- 3 Oil filter 3 in the superstructure; ▮▮▮▮ p. 8 - 53.



Warning messages e.g. regarding the engine can be monitored in the driver's cab and in the crane cab; ▮▮▮▮ *On the ECOS display*, p. 7 - 12.

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8.3

Hoists

8.3.1

Checking the oil level

W

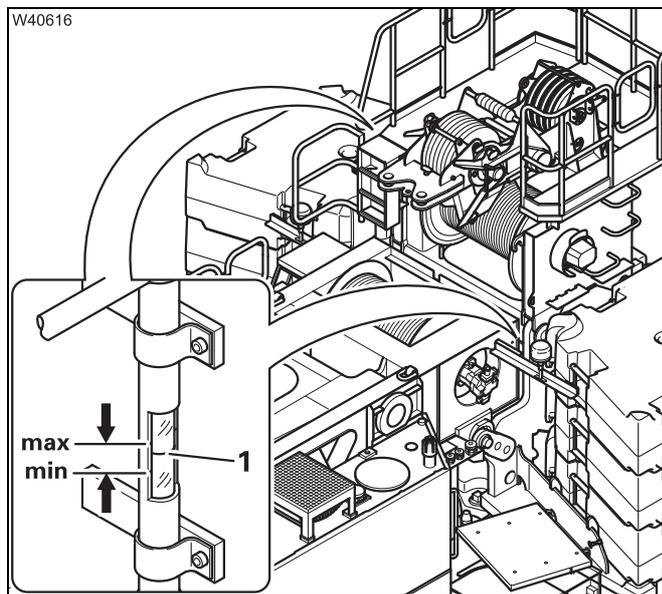
Spare parts and tools

Designation	Quantity	GROVE part no.
Gasket 14 x 18 St DIN 7603	2	03043733
Gasket 18 x 22 St DIN 7603	4	01927403

Prerequisites

- The truck crane must be level.
- The auxiliary hoist (additional equipment) is rigged;  *Operating manual*.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Checking the oil level



- Check that the oil level is visible between the **Min.** and **Max.** marks (1).

If the oil level is too low

- Top up the oil;  p. 8 - 14.

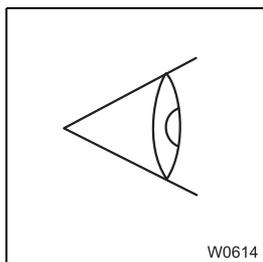


The oil level in the hoist gear must be 20 mm below the centre of rotation of the hoist. If the sight glass is loose in the clamps, or a new sight glass has been fitted, you must adjust this difference in height before you adjust the clamps.

8.3.2

General inspection

W



- Pay attention to any unusual running noises from the hoists.
- Check the hoists and the connections for leaks. In the event of leaking consumables; ■■■▶ *Checking the oil level*, p. 8 - 11.
- 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.

8.3.3

Checking the hoist brake

W

Check that the hoist brake is working correctly on the main hoist and the auxiliary hoist.

Main hoist

- Attach the hook block to the hoist rope, reeved once.
- Lift a load of about 12.7 t (28,000 lbs) to about 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 about 2 minutes, the brake is currently in working order.

If the load lowers, notify **Manitowoc Crane Care** or an authorised GROVE dealer.

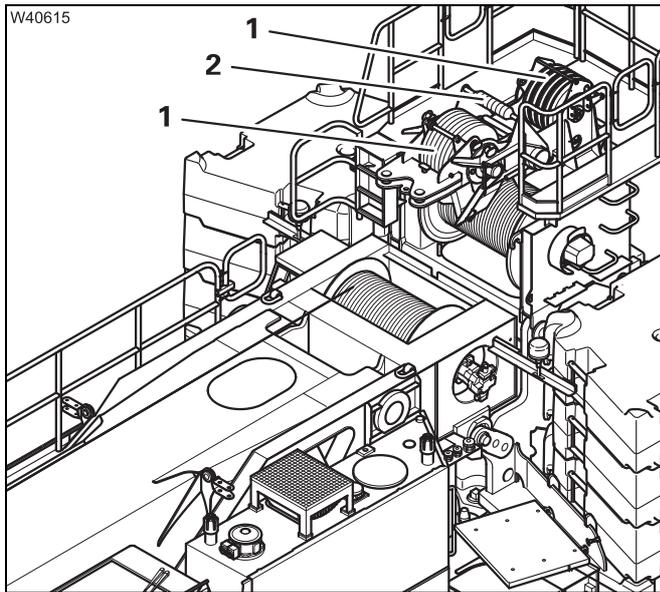
Auxiliary hoist

- Carry out the check on the auxiliary hoist in exactly the same way as with the main hoist, but use a load of about 10.6 t (23,370 lbs).

8.3.4

Support for block – Checking the sheaves

M 3



- Check all sheaves (1) on the support for block (2) for damage, wear, mobility and extreme soiling.

Have damaged, worn, sluggish or extremely soiled sheaves replaced by **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

8.3.5

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 to DIN 51502	Specifications Classification	GROVE part no.
7 (1.9) Main 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!
11.5 (3.0) Auxiliary hoist			

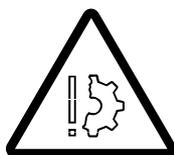
Designation	Quantity	GROVE part no.
Gasket 14 x 18 St DIN 7603	2	03043733
Gasket 18 x 22 St DIN 7603	4	01927403
Gasket 26 x 31 St DIN 7603	4	03142181

- Receptacle, about 15 l (4 gal); p. 2 - 4.

Prerequisites

- The truck crane must be level.
- The auxiliary hoist (additional equipment) is rigged; *Operating manual*.
- The engine must not be running and must be 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 inspection is used to detect any damage at an early stage; p. 8 - 15.



Risk of environmental damage due to leaking consumables!

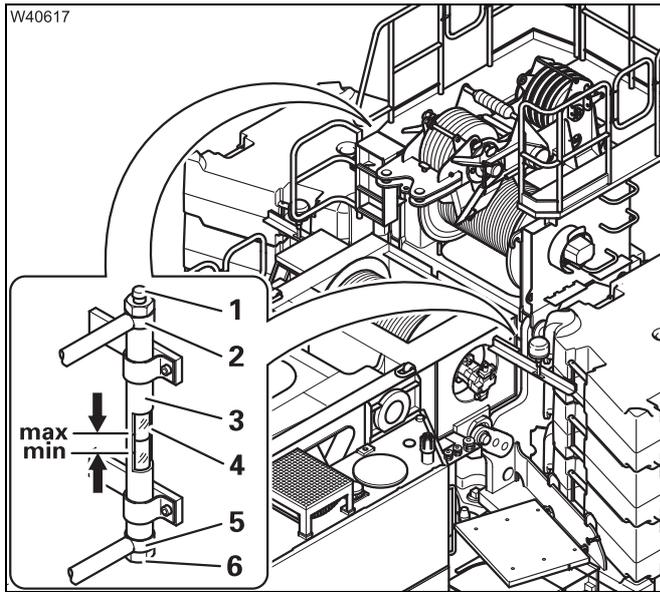
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

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 (3).
- Unscrew bolts (1) and (6) and allow the oil to drain.
- Replace the gaskets and secure the hose (5) with the screw (6).

Topping up the oil

- Fill the oil through the pipe (3) up to the **Max.** mark (4).
- Replace the gaskets and secure the hose (2) with the screw (1).

Checking the oil



Risk of accidents due to falling loads!

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 or 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 initiating any further measures.

8.3.6

Having a partial inspection carried out

Y 3

Only suitably trained specialists should carry out a partial inspection of:

- The multiple-disk 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.

8.3.7

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 monitoring the winches*, 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, a first oil change must be carried out after 200 and 1,000 operating hours;  *There are regulations regarding running in individual parts that must be followed, after:*, p. 4 - 1.

8.4

Slewing gear

8.4.1

Checking the oil level

W

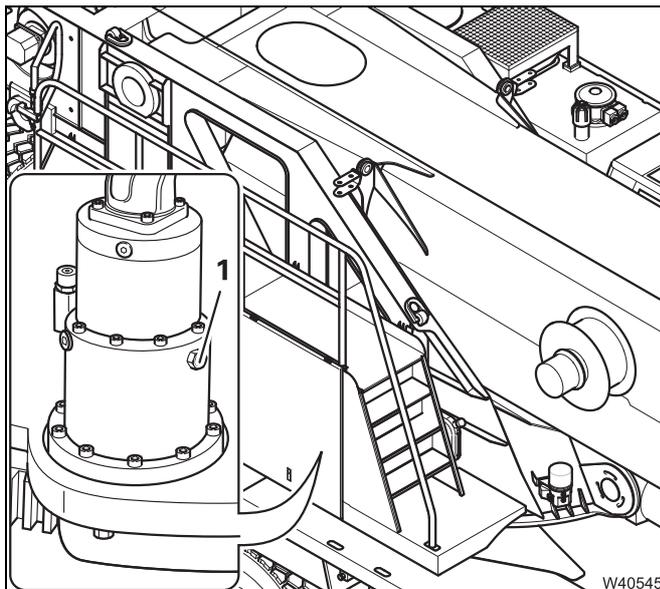
Spare parts and tools

Designation	Quantity	GROVE part no.
Gasket 10 x 13.5 Cu DIN 7603	3	00117125

Prerequisites

- The truck crane must be level and in on-road mode;  *Operating manual*.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Check 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.

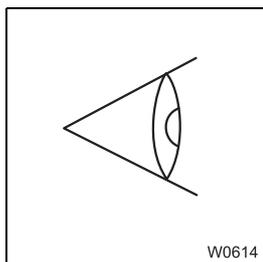
If the oil level is too low

- Top up the oil;  p. 8 - 20.

8.4.2

Checking for leaks

W



- Pay attention to any unusual running noises from the slewing gears.
 - Check the slewing gears and the connections for leaks.
In the event of leaking consumables;  *Checking the oil level*, p. 8 - 17.
 - Check that pipe lines 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.

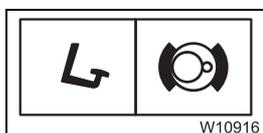
8.4.3

Checking the slewing gear brake

M 6

Prerequisites

- The truck crane is supported and levelled with the maximum outrigger span of **8.70 x 8.50 m (28.5 x 27.9 ft)**;  *Operating manual*.
- **No** counterweight is rigged;  *Operating manual*.
- The RCL code for the current rigging mode must be entered;
 *Operating manual*.
- 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;  *Operating manual*.
- 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).

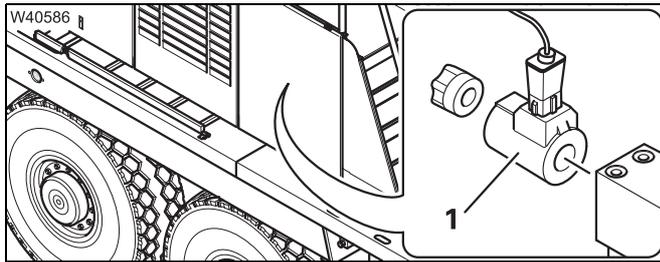


Risk of injury due to swinging hook block!

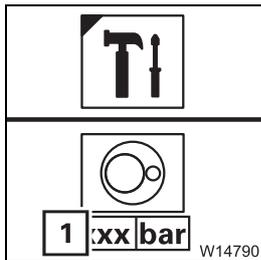
If a faulty slewing gear brake slips, the superstructure can accidentally, suddenly turn and the hook block can suddenly swing. People standing within the slewing range could be injured.
Secure the slewing range 360°, before you check the slewing gear brake.

Checks

When checking the slewing gear brake you must perform the slewing movement against the slewing gear brake.

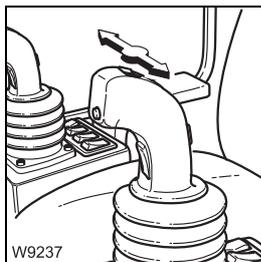


- Switch the engine off.
- Remove the coil (1) from the valve Y 2304. The slewing gear brake will now not be released when the slewing gear is switched on.



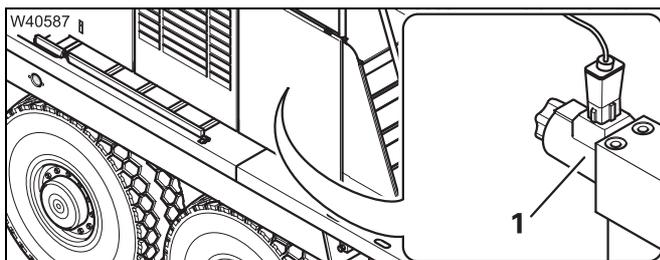
- Start the engine and switch on the slewing gear.
- Open the *Settings* submenu.

The display (1) shows the pressure in the slewing gear's hydraulic circuit.



- Move the control lever slowly to the end stop and wait until the pressure in the hydraulic circuit has risen to about 200 bar (about 2,900 psi).
 - If the superstructure still **does not** slew, the braking force of the slewing gear brake is adequate.
 - If the superstructure slews, the slewing gear brake is faulty and must be repaired immediately by **Manitowoc Crane Care** or an authorised GROVE dealer.

- Switch the slewing gear off and switch the engine off.



- Attach the coil (1) to the valve Y 2304 using the nut.
- Start the engine and check the slewing gear for correct operation.

8.4.4

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 to DIN 51502	Specifications 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 13.5 Cu DIN 7603	3	00117125
Gasket 14 x 20 Cu DIN 7603	3	00117132

- Receptacle, about 5 l (1.5 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be level and in on-road mode;  *Operating manual*.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Changing the oil



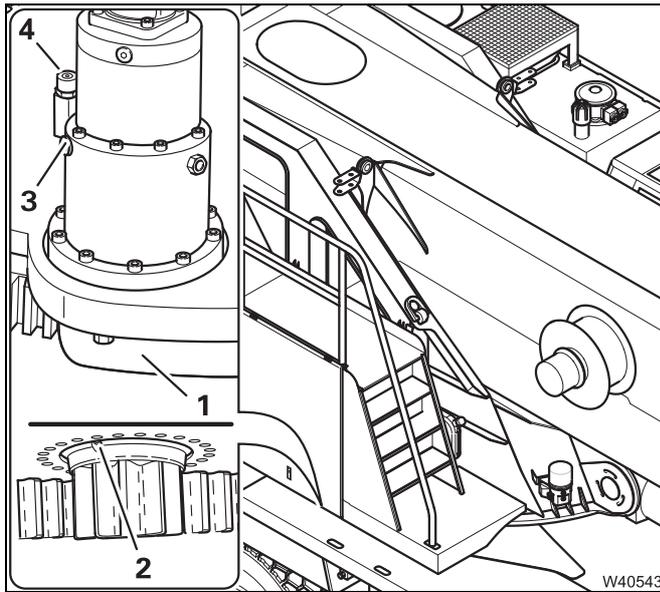
Risk of environmental damage due to leaking consumables!

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

Store/dispose of consumables and any soaked equipment properly.

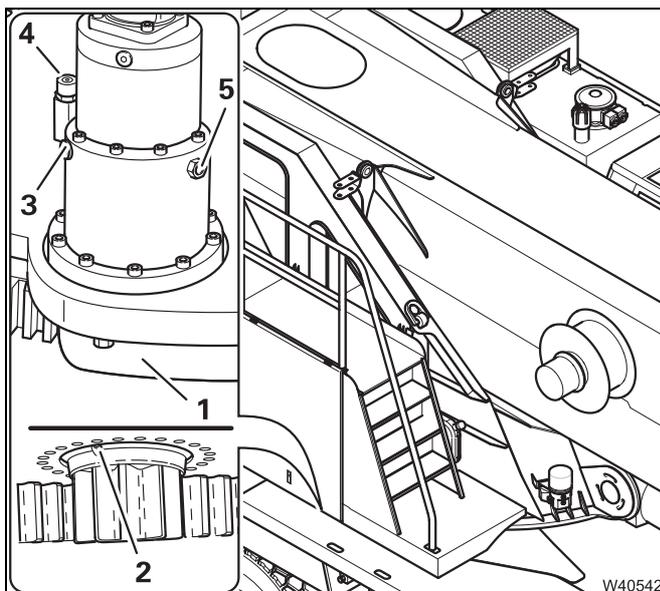
Ask about the applicable regulations.

- Always change the oil in all slewing gears.



Draining oil

- Remove the plate (1).
- Place a container under the screws (2).
- Unscrew the filter (4) and bolts (3) and (2).
- Drain the oil.



- Replace the gasket and tighten the screws (2).

Topping up the oil

- Top up the oil through the filler neck (4) until oil is visible in the sight glass (5).
- Replace the gaskets and tighten the screw (3) and the filter (4).
- Attach 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 or 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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8.5

Slewing bearing

8.5.1

Checking the bolts

M 3

- Comply also with the running-in regulations;  p. 4 - 1.

Tools

- Torque wrench for maximum of 1,450 Nm (1,070 lbf ft).
- Auxiliary tools for the torque wrench;  p. 8 - 25.

Prerequisites

- **No** counterweight is rigged;  *Operating manual*.
- The truck crane is supported and levelled with the maximum outrigger span of **8.70 x 8.50 m (28.5 x 27.9 ft)**;  *Operating manual*.
- In addition, the wheels on the 4th and 5th axle lines should be removed to improve the freedom of movement under the slewing bearing.
- The main boom is fully retracted and raised to 75°;  *Operating manual*.
- 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 not be running and must be secured against unauthorised use;  p. 2 - 3.

Safety instructions



Risk of damage to the bolts on the slewing bearing!

All bolts have been tightened at the factory to a certain torque, and this should be checked during maintenance. Only slight tightening of the bolts is permissible, if required.

You may **not** slacken the bolts 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 bolts** may be used to reinstall the superstructure. **Only original screws** should be used manufactured according to the factory specifications.



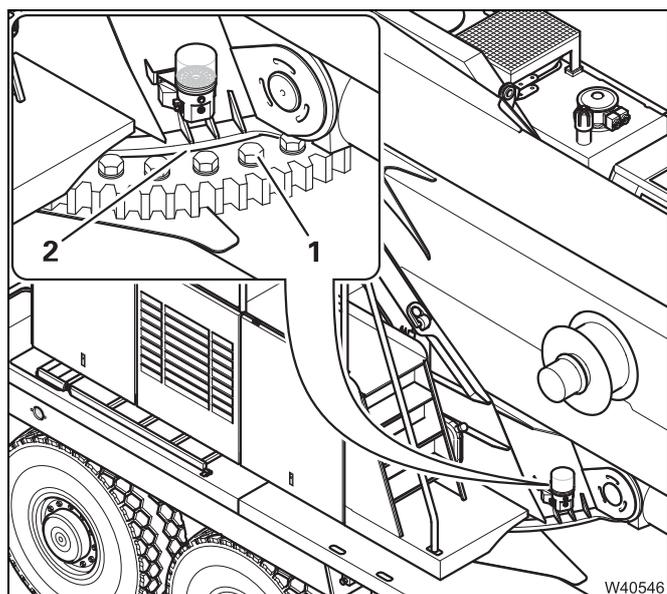


Danger of the slewing bearing being ripped off!

If while checking you notice very loose, broken or missing bolts, 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**.

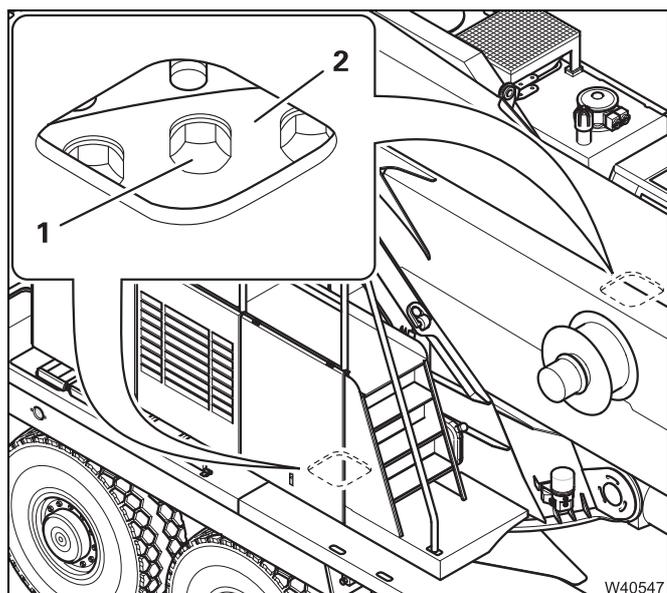
Access



The **outer ring** is attached to the carrier by the bolts (1).

- Check all 80 bolts (1) from **above**.

To do this, you must move the clear area (2) on the turntable around step by step to allow all the bolts (1) to be checked.

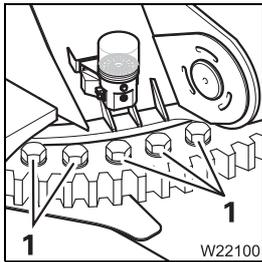


The **inner ring** is attached to the turntable by the bolts (1).

- Check all 80 bolts (1) from **below**.

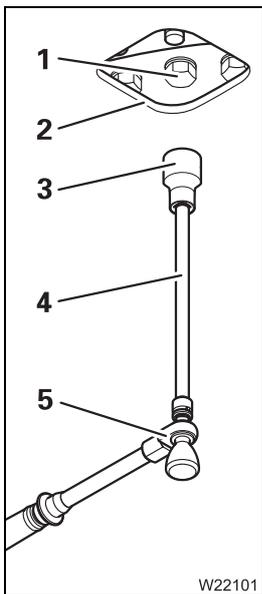
To do this, you must rotate the turntable gradually to gain access to a pair of bolts (1) opposite one another, through the openings (2) in the carrier.

Selecting the tools



Outer ring

The bolt heads (1) are easily accessible for fitting a socket wrench. Therefore, you can use **manual or mechanical torque tools** (electric or hydraulic screw drivers).



Inner ring

The screw head (1) is accessible only via a rectangular, long, narrow opening (2). An extension (4) is required for fitting a socket wrench (3).

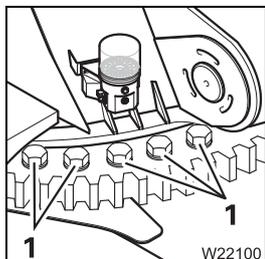
A **manual torque wrench** (5) is recommended so that it can be tightened gently, and slipping from the bolt head (1) is avoided.

Torques

Bolt type	GROVE part number	Torque Nm (lbf ft)
Roller slewing bearing Bearing type: RDV, three rows	03211775 Model plate: Inside the inner ring.	
M 30 x 150: 80 pieces on the outer ring	03202271	1,450 (1,070)
M 30 x 180: 80 pieces on the inner ring	03202272	1,450 (1,070)

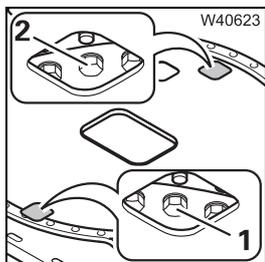


Checking the outer ring



- Divide the checking of the 80 screws into 16 working steps of 5 screws each.
Between each of the 16 operation steps you need to rotate the turntable to the next group of 5 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 5 adjoining screws (**1**);
■■■▶ *Torques*, p. 8 - 25.
- Mark the screws after checking, to avoid subsequent confusion.
- Remove the tool.
- Start the engine and turn the turntable by 180° – the second group of screws on the opposite side is now accessible.
- Switch the engine off.
- Check all other groups in the same way.

Checking the inner ring



- Divide the inspection of the 80 screws in 40 operation steps each with a pair of screws on the opposite side.
Between each of the 40 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 opposing pair of screws (**1**) and (**2**);
■■■▶ *Torques*, p. 8 - 25.
- Mark the screws after checking, to avoid subsequent confusion.
- Remove the tool.
- Start the engine and turn the turntable by 90° – the second pair of screws on the opposite side is now accessible.
- Switch the engine off.
- Check all the other pairs in the same way.

8.5.2

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; *Operating manual*.
- The main boom must be fully raised; *Operating manual*.
- The engine must not be running and must be secured against unauthorised use; p. 2 - 3.

Lubrication

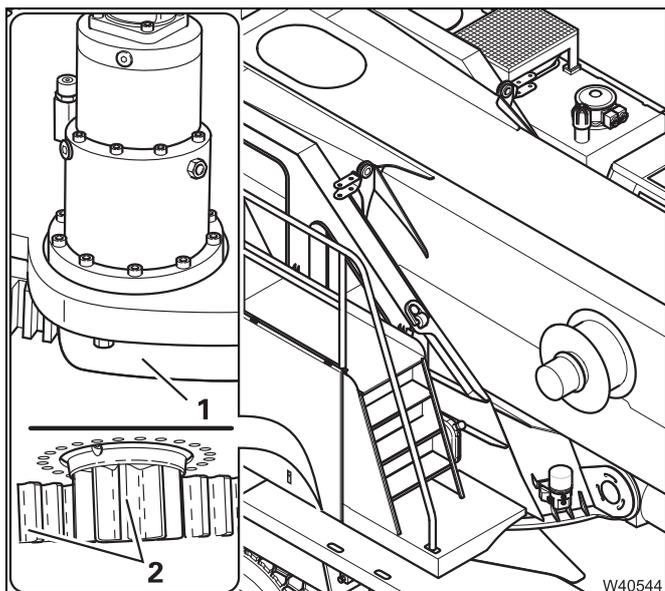


Risk of crushing from the gear teeth!

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.

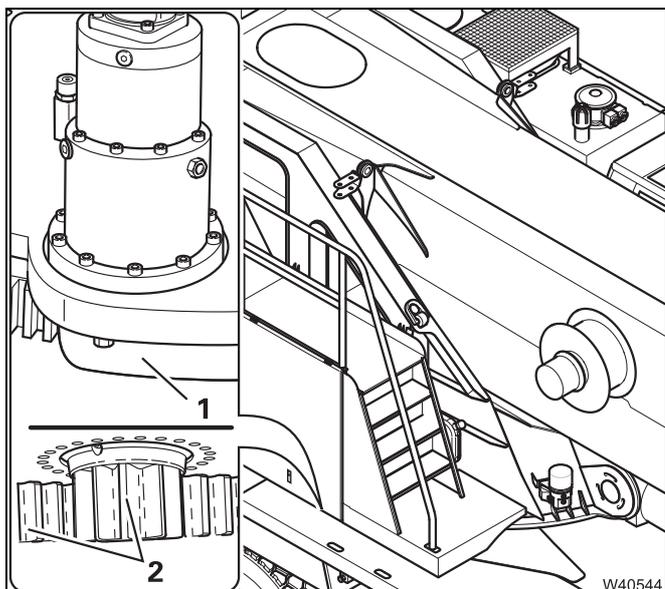
A distinction is made between initial lubrication and subsequent lubrications:





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.



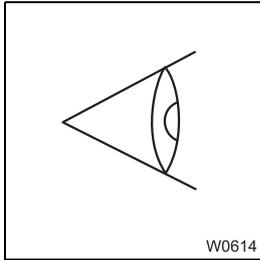
Subsequent lubrication

- Remove the plate (1).
- Apply new grease to all the gear teeth (2).
- Allow it to penetrate for about 30 minutes.
- Attach the plate.

8.5.3

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 ball 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).

8.5.4

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 first be checked for tightness;  *Checking the bolts*, p. 8 - 23.
- The truck crane is supported and levelled with an outrigger span of at least **8.70 x 6.30 m (28.5 x 20.6 ft)**;  *Operating manual*.
- The counterweight combination **35.0 t (77,150 lbs)** must be rigged according to the *lifting capacity table* and equipment on the truck crane.
- The lattice extension must have been removed.
- The auxiliary hoist has been removed.
- The main boom is telescoped to 0-88-0-0.
- The current load must not exceed **1 t (2 200 lbs)** – if necessary unreeve the hook block.

Type

The GMK6400 truck crane is equipped with a slewing bearing of the bearing type: RDV, three rows.

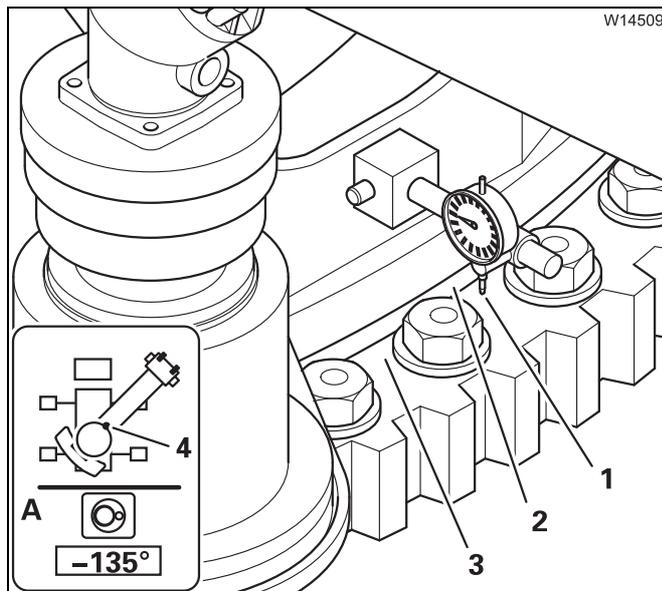
Type of slewing bearing	GROVE part number
Roller slewing bearing Bearing type: RDV, three rows	03211775 Model plate: Inside the inner ring.

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 slewing bearing is put into operation or replaced.

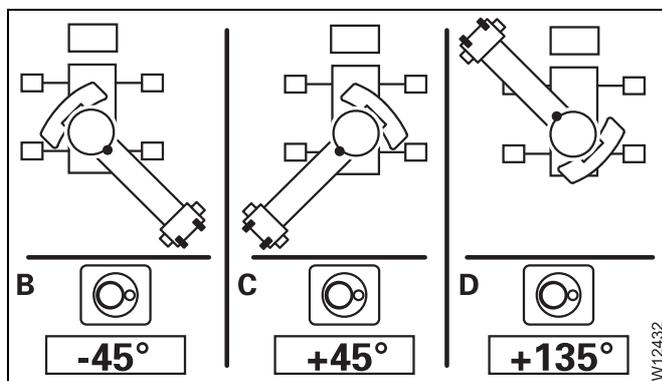
The maximum permissible wear is 0.7 mm (0.028 in).
This results in the maximum permissible tilting play.

Example: **Base value + max. permissible wear =** **max. permissible tilting play**
0.35 mm (0.014 in) + 0.7 mm (0.028 in) 1.05 mm (0.042 in)



Measuring current tilting play

- Derrick the main boom to 76° and slew to -135° – display (A).
- Attach a dial gauge to the front on the turntable (4) and position the probe (1) on to 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 the turntable inclination on the dial gauge 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 - 30.

8.5.5

Lubricating the turntable lock

M 12

Grease, tools

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

- Brush.

Prerequisites

- The turntable is in 180° position and not locked.
- The main boom must be set down on the support;  *Operating manual*.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Lubrication

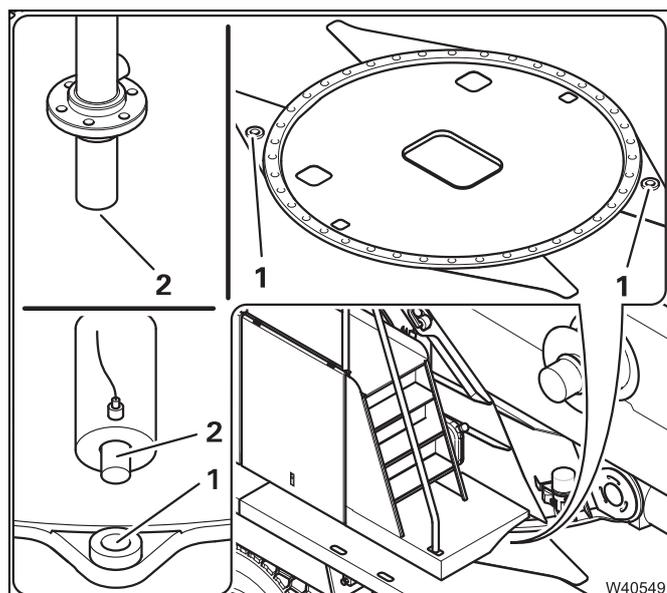
The turntable can be locked in 0° and 180° position. For this purpose, there are two openings in the carrier.



Risk of crushing at the openings!

When lubricating, your fingers may be crushed at the openings, if the turntable has been locked by a second person accidentally. The locking cylinder then extends into the opening.

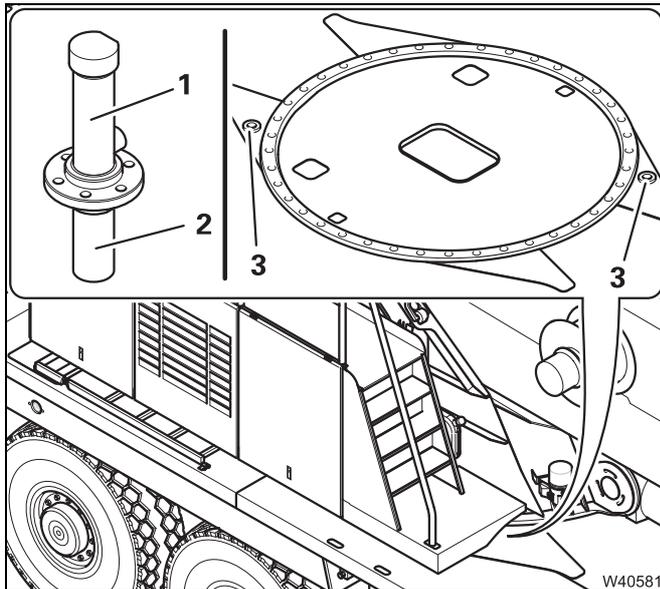
Secure the truck crane against unauthorised use, before lubricating;
 p. 2 - 3.



- Clean the openings (1).
- Clean the pin (2).
- Apply new grease to the openings (1) and pin (2) using a brush.

W40549

Checking the lock The lock is operated via the ECOS display in the crane cab;
➡ *Operating manual.*



- Monitor the locking cylinder (1) from a safe distance.
- Let a second person lock the turntable in the crane cab.
- Check whether the locking cylinder (1) extends into the opening (3) straight and without jerks.
- Let a second person unlock the turntable in the crane cab.
- Check whether the locking cylinder (1) retracts into the housing (2) straight and without jerks.

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

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8.6

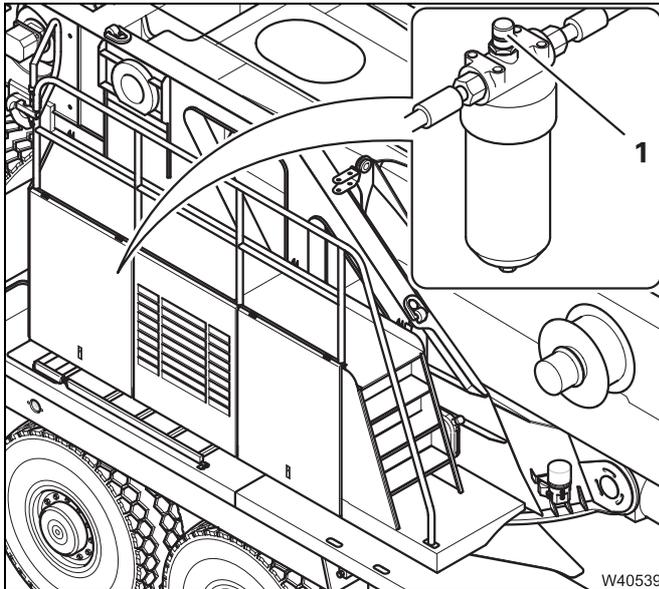
Pump transfer case

- Comply also with the running-in regulations;  p. 4 - 1.

8.6.1

Checking the oil filter

D



- Check the display (1) on the filter.

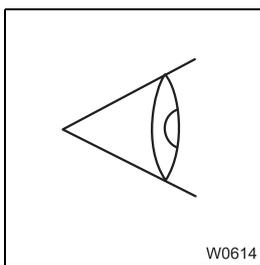
If the visual display is no longer green

- Change the filter;  *Changing the oil filter*, p. 8 - 41.

8.6.2

General inspection

W



- Pay attention to any unusual noises made by the pump transfer case.
- Check the pump transfer case, the oil cooler, the oil filter and the connections for leaks. In the event of leaking consumables;  *Checking the oil level*, p. 8 - 36.
- Check that pipe lines 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.

8.6.3

Checking the oil level

M 1

Spare parts and tools

Designation	Quantity	GROVE part no.
Gasket 21 x 26 Cu DIN 7603	1	00117141

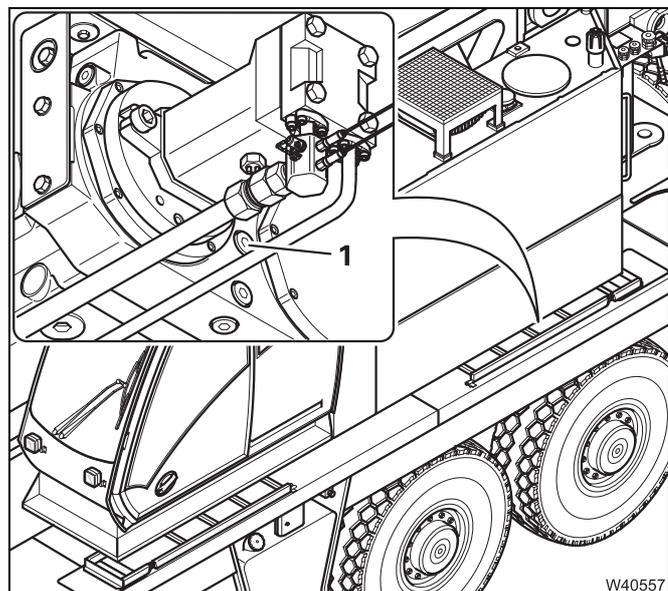
Prerequisites

- The truck crane is supported and levelled with an outrigger span of at least **8.70 x 2.71 m (28.5 x 8.9 ft)**.

Checking the oil level

Preparation

- Start the engine from the crane cab.
- Raise and lower the telescopic boom several times for about 3 minutes in the permissible working area.
This brings the gear oil into circulation in the gear oil circuit directly before the oil level check.
- Switch the engine off.



Checks

- Screw the plug out of the opening (1).
- Check whether the oil reaches the lower edge of the opening (1).
- If the oil level is too low, fill it with oil via this opening (1).
- Fit a new gasket and tighten the screw.

8.6.4

Changing the oil

M 12

Oil, spare parts,
tools

Gear oil in litres (gal)	Designation to DIN 51502	Specifications Classification	GROVE part no.
4.6 (1.2)		Omala S4 GX 150	03143502

Designation	Quantity	GROVE part no.
Gasket 21 x 26 Cu DIN 7603	2	00117141

- Receptacle, about 5 l (1.3 gal).

Prerequisites

- The truck crane must be level.
- The engine must not be running and must be 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.

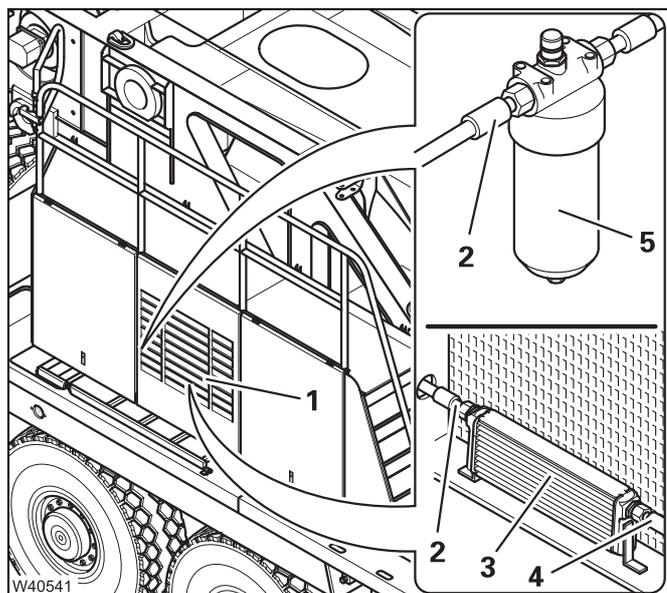


Risk of environmental damage due to leaking consumables!

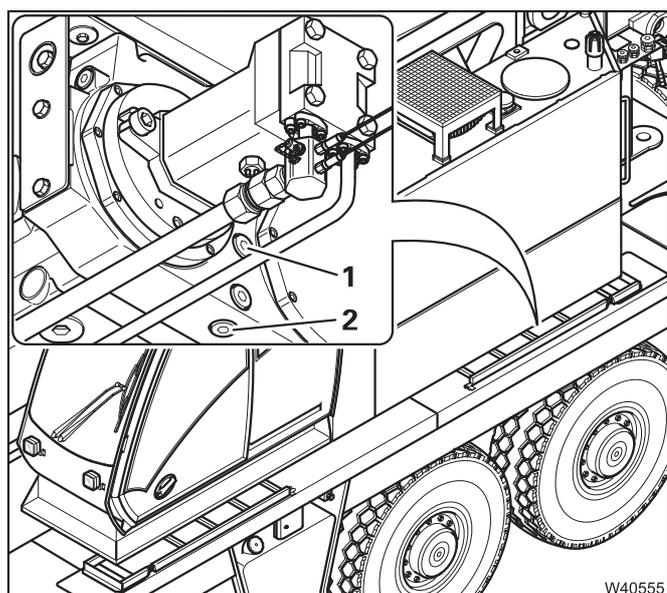
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape. Store/dispose of consumables and any soaked equipment properly. Ask about the applicable regulations.



Draining

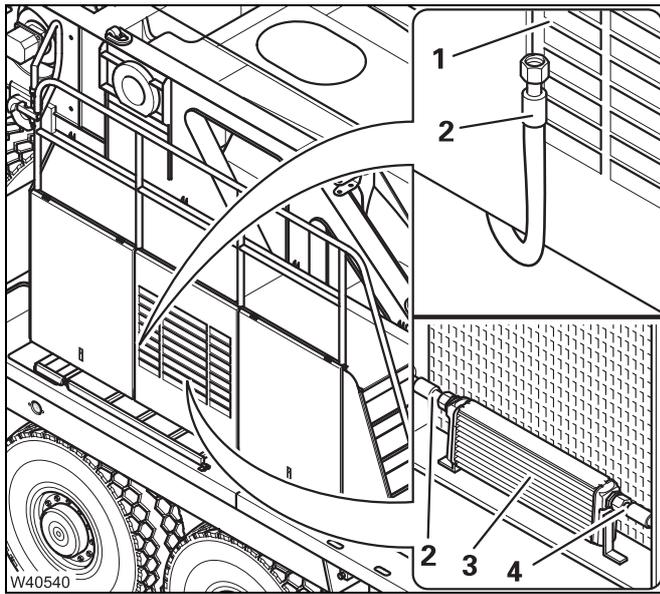


- Place a receptacle under the filter (5) and replace the filter; ■■■► *Changing the oil filter*, p. 8 - 41.
- Remove the end of the hose (2) on the filter (5).
- Remove the grille (1) and place a receptacle underneath the oil cooler (3).
- Remove the hoses (2) and (4).
- Disassemble the oil cooler (3) and tip the oil into the receptacle.
- Clean the outer fins (3) of the oil cooler; ■■■► p. 8 - 60.
- Install the oil cooler (3) and attach the hoses (2) and (4).
- Attach the grille (1).



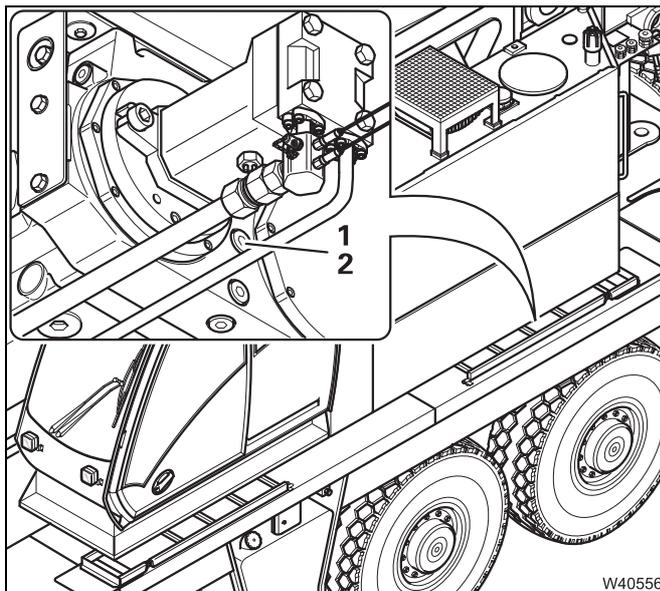
- Place a receptacle under the screw (2) on the pump transfer case.
- Unscrew bolts (1) and (2) and allow the oil to drain.
- Fit a new seal and tighten the screw (2).

Topping up



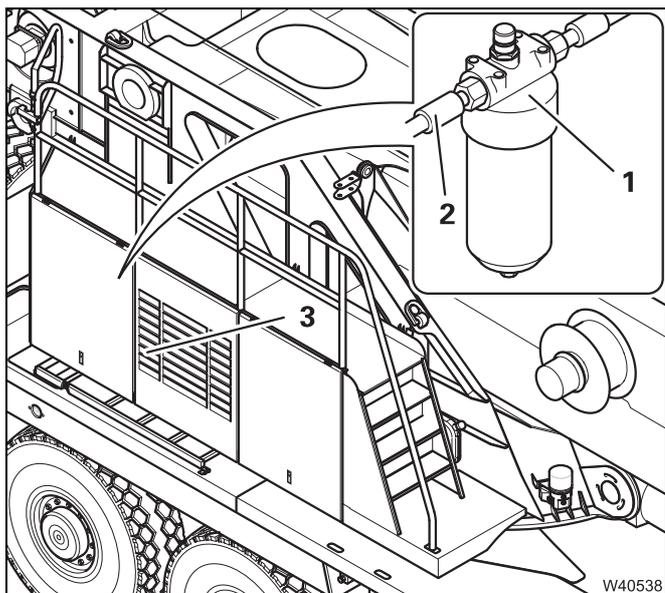
- Connect the end of the hose (2) to the grille (1).
- Position a funnel at the end of the hose (2).
- Empty all of the oil slowly through the funnel.

The oil flows through hose (2) into the oil cooler (3) and through hose (4) into the pump transfer case.



- Top up the oil until it reaches the lower edge of the opening (2) in the pump transfer case.
- Fit a new seal and tighten the screw (1).





- Remove the funnel.
- Disconnect the end of the hose (2) from the grille (3) and attach it to the filter (1).

**After changing
the oil**

- Check the oil level;  p. 8 - 36.
- Check the pump transfer case, the oil cooler and the oil filter for leaks.

8.6.5

Changing the oil filter

M 12

If the visual display is no longer green, then you must replace the oil filter;
 ■■■► *Checking the oil filter*, p. 8 - 35.

When changing the oil the oil filter must be replaced.

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	03135866
Packing set	1	04161645

- Torque wrench for 25 Nm (18.5 lbf ft).
- Receptacle, about 10 l (3 gal).

Prerequisites

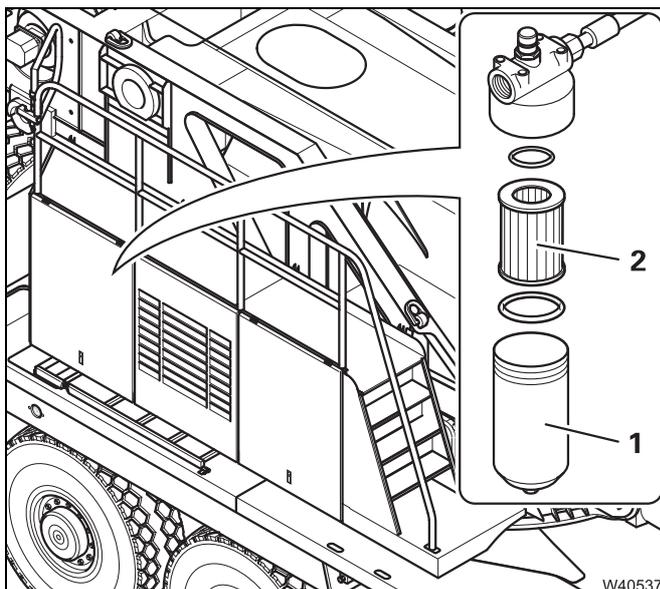
- The truck crane must be level.
- The engine must not be running and must be secured against unauthorised use; ■■■► p. 2 - 3.



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 the oil filter



- Release the receptacle (1) at the hexagon head.
- Change the filter (2).
- Replace the gaskets.
- Fill the receptacle with clean oil and tighten it – torque 25 Nm (18.5 ft lbf).

**After Changing
filters**

- Check the oil level;  p. 8 - 36.
- Check the oil filter for leaks.

8.7

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.

8.7.1

Checking the oil level

D

Prerequisites

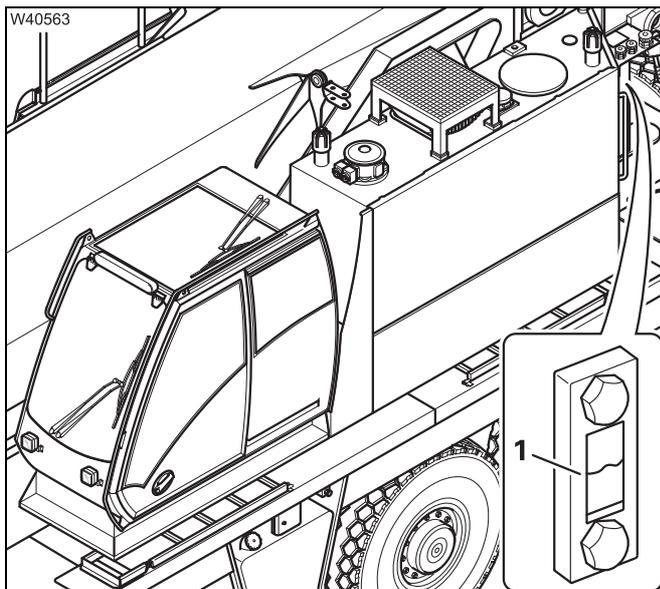
- The truck crane must be level and in on-road mode; *Operating manual*.
- The telescoping cylinder must be locked in telescopic section I; *Operating manual*.
- The truck crane must be standing on a level surface.
- The engine must not be running and must be secured against unauthorised use; p. 2 - 3.

Checking the oil level



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.



- 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 - 58.

8.7.2

Checking the hydraulic hoses

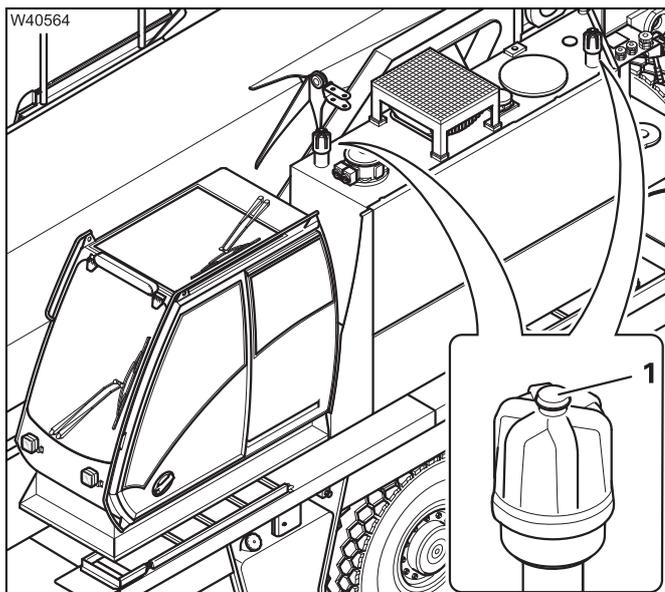
W

The inspection work is described in section *Checking the hydraulic hoses*, p. 7 - 90.

8.7.3

Checking the ventilation filters

W



- Check the displays (1) on the ventilation filters.

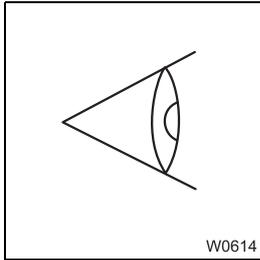
If the indicator is coloured

- Replace the filters; ► p. 8 - 49.

8.7.4

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 - 43.



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

After hydraulic components have been changed

- Bleed the hydraulic system; ▣▣▣▣▶ *Establishing the operating condition*, p. 8 - 59.

If damage cannot be rectified immediately or further damage is likely

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

8.7.5

Cleaning the magnetic rods

M 3

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	03317083
Cover gasket	1	01372280

– Receptacle, about 5 l (1.5 gal); ■■■▶ p. 2 - 4.

Prerequisites

- The truck crane must be standing on a level surface.
- The engine must not be running and must be secured against unauthorised use; ■■■▶ p. 2 - 3.
- During the first 100 operating hours: Clean the magnetic rods weekly.



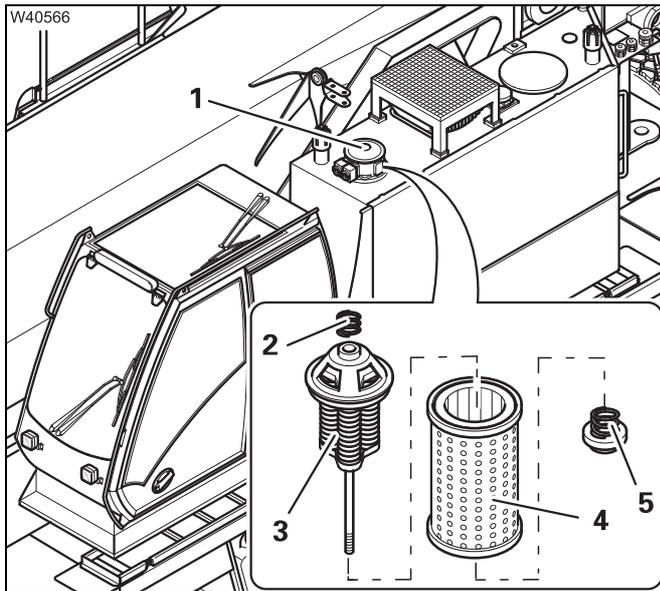
Risk of environmental damage due to leaking consumables!

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

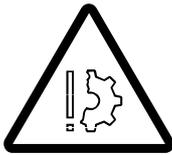
Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.

Cleaning oil filter 1

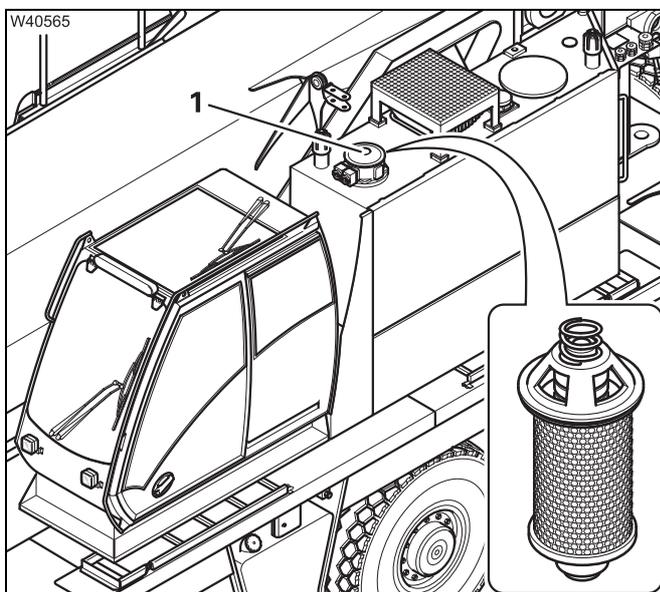


- Remove the cap (1) and pull out the filter.
- Place the filter in a receptacle.
- Remove the spring (2).
- Remove the nuts (5).
- Take the magnetic rod (3) out of the filter (4) and clean the magnetic rod.
- Replace any damaged parts, where necessary.



Risk of damage to the hydraulic system!

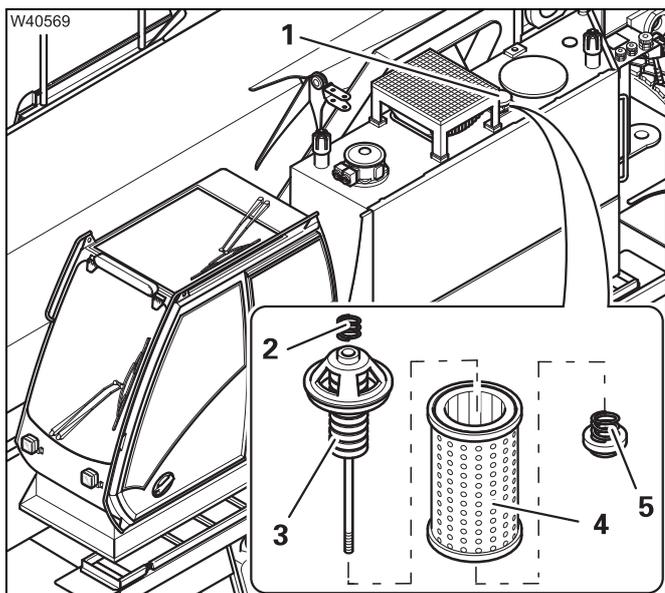
Large amounts of metal particles are a sign of damage in the hydraulic system. Have the hydraulic system inspected by **Manitowoc Crane Care** or by your qualified repair personnel.



- Replace the gaskets (packing set) if necessary.
- Assemble the filter and insert it.
- Attach the lid (1).



Cleaning oil filter 2

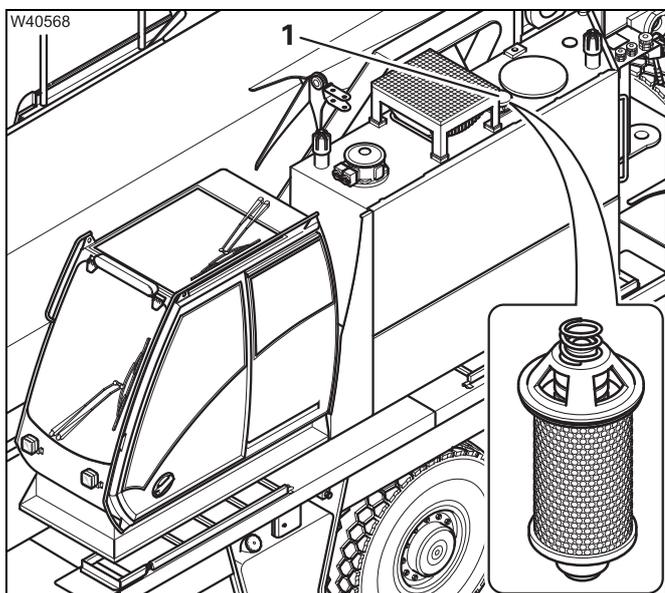


- Loosen the cap (1) and pull out the filter.
- Place the filter in a receptacle.
- Remove the spring (2).
- Remove the nuts (5).
- Take the magnetic rod (3) out of the filter (4) and clean the magnetic rod.
- Replace any damaged parts, where necessary.



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 personnel.



- Replace the cap gasket.
- Assemble the filter and insert it.
- Attach the lid (1).

8.7.6

Changing the ventilation filters

M 12

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	2	03134932

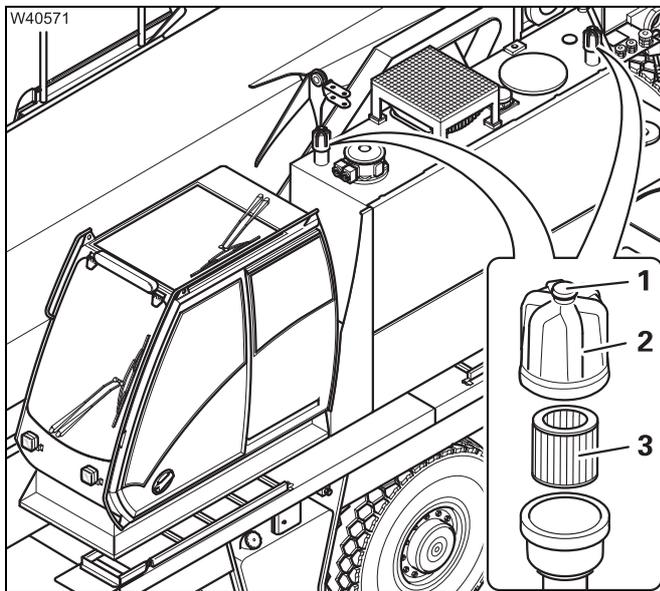
Prerequisites

- The engine must not be running and must be 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 screw on the cap tightly.
- Reset the display by depressing the pin (1) on the housing.

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8.7.7

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.

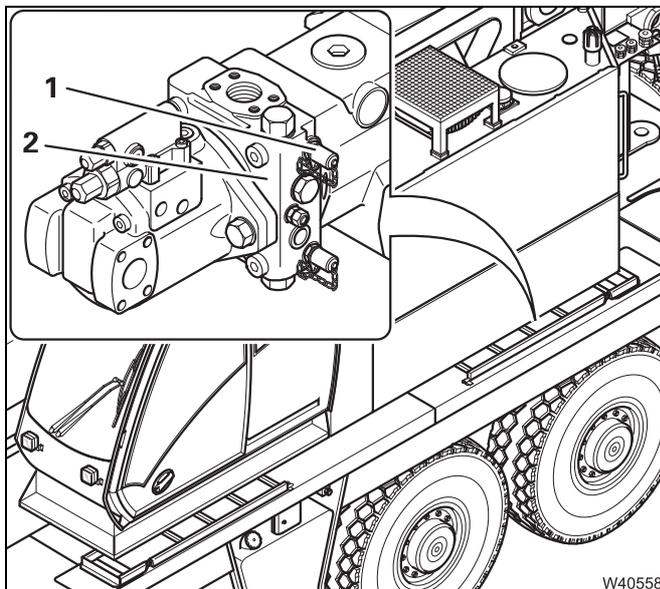
Information on taking samples with the hose and for the laboratory analysis;  *Taking oil samples*, p. 7 - 94.

Prerequisites

- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Selecting the sampling location

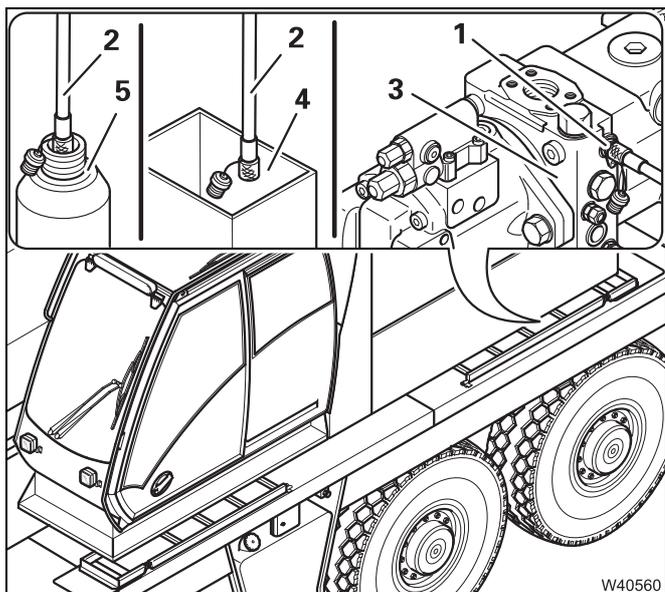
To determine the usability of the oil, you must take a sample from the hydraulic system. To do that you must connect the hose with the connecting piece to a gauge port.



There is a gauge port (1) on the pump (2). If the pump is running, then oil can be removed at the gauge port.



Taking oil samples



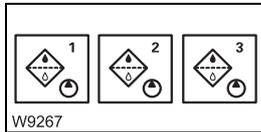
- Clean the gauge port and connect the hose (1) to the pump (3); **▣▣▣▣** *Connecting the hose, p. 7 - 95.*
 - Put the hose end (2) into the receptacle (4).
 - Start the engine.
 - Allow 2 litres (0.5 gal) of oil to flow into the receptacle.
 - Switch the engine off and insert the hose end (2) into the sample container (5).
 - Start the engine.
 - Allow 0.3 litres (0.08 gal) of oil to flow into the sample container.
-
- Switch the engine off.
 - Remove the hose; **▣▣▣▣** *Connecting Removing, p. 7 - 96.*
 - Seal the sample container and dispatch it; **▣▣▣▣** *Dispatching the oil sample to the laboratory, p. 7 - 97.*
 - Determine the condition of the oil; **▣▣▣▣** *Determining the quality of the oil, p. 7 - 97.*

8.7.8

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* sub-menu indicate which oil filters you have to change.



- 1 Red – Change oil filter 1
- 2 Red – Change oil filter 2
- 3 Red – Change oil filter 3

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	03317083
Cover gasket	1	01372280
For oil filter 3:		
Filter	1	03046526
Housing packing set	1	03137065

- Torque wrench for 25 Nm (18.5 lbf ft).
- Receptacle, about 10 l (3 gal); p. 2 - 4.

Prerequisites

- The truck crane must be level and in on-road mode; *Operating manual*.
- The engine must not be running and must be 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.



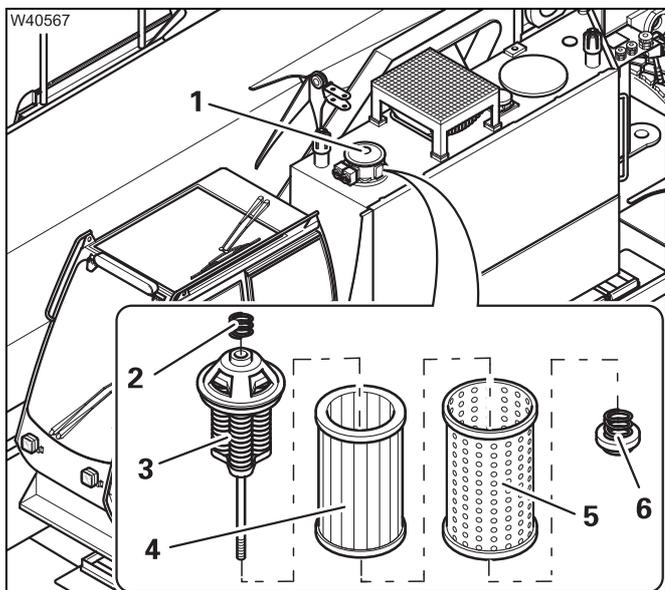
Changing oil filter 1



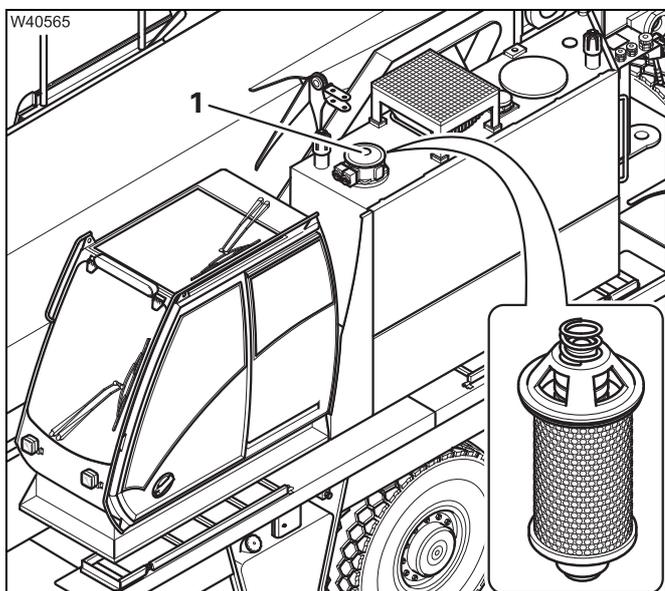
Risk of environmental damage due to leaking consumables!

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.



- Remove the cap (1) and pull out the filter.
- Place the filter in a receptacle.
- Remove the spring (2).
- Remove the nuts (6).
- Remove the magnetic rod (3) and filter (4) from 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.
- Attach the lid (1).

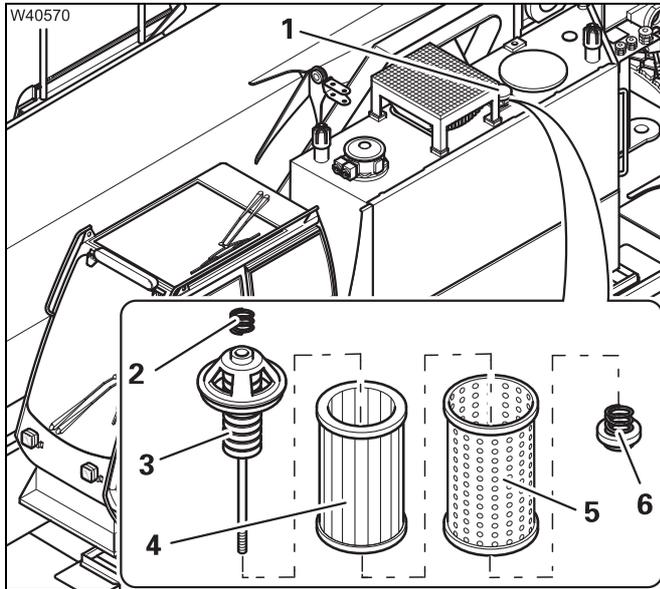
Changing oil filter 2



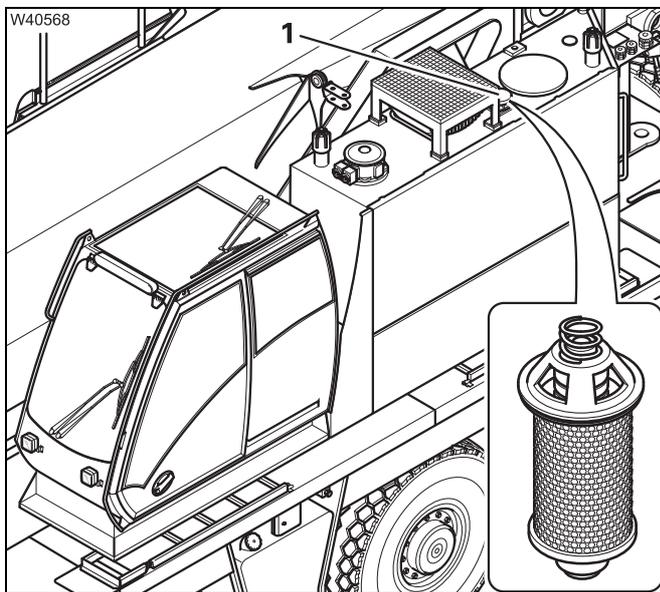
Risk of environmental damage due to leaking consumables!

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.



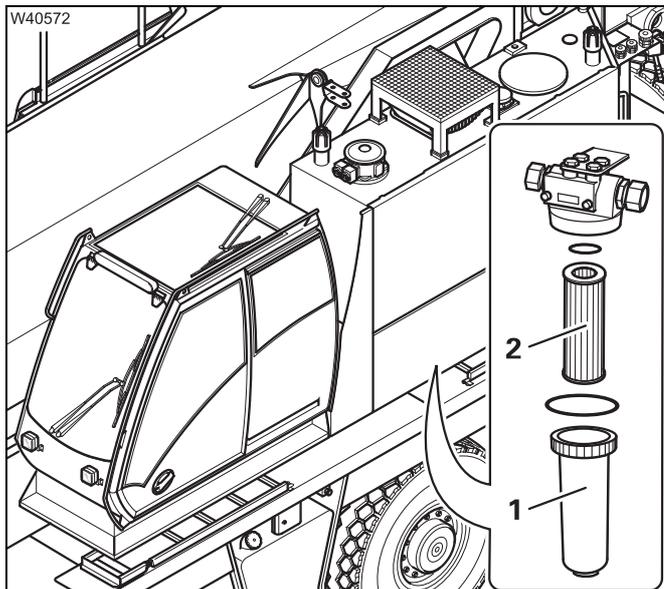
- Remove the cap (1) and pull out the filter.
- Place the filter in a receptacle.
- Remove the spring (2).
- Remove the nuts (6).
- Remove the magnetic rod (3) and filter (4) from the filter cage (5).
- Clean the magnetic rod (3) and filter cage (5).
- Insert a new filter (4) into the filter cage (5).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



- Replace the gaskets (packing set) if necessary.
- Assemble the filter and insert it.
- Attach the lid (1).



Changing oil filter 3



- Release the container (1).
- Change the filter (2).
- Replace the gaskets.
- Fill the receptacle with clean oil and tighten it – torque 25 Nm (18.5 ft lbf).

After changing filters



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 - 59.
- Check the oil level. Top up the oil if necessary;  p. 8 - 58.
- To bleed the system, start the engine and let it idle for 3 minutes to bleed the system.
- Check that none of the oil filters is leaking.

8.7.9

Changing the hydraulic oil

The oil only needs to be changed if the laboratory analysis results indicate this; *Taking oil samples*, p. 8 - 51.

Oil, spare parts, tools

Hydraulic oil in litres (gal)	Designation to DIN 51502	Specifications Classification	GROVE part no.
1320 (349)	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 (toolbox); p. 7 - 100.
- One or more receptacles, about 1320 l (349 gal); p. 2 - 4.

Prerequisites

- The truck crane must be level and in on-road mode; *Operating manual*.
- The engine must not be running and must be secured against unauthorised use; p. 2 - 3.
- The oil filters must have been removed; *Changing the hydraulic oil filter*, p. 8 - 53.

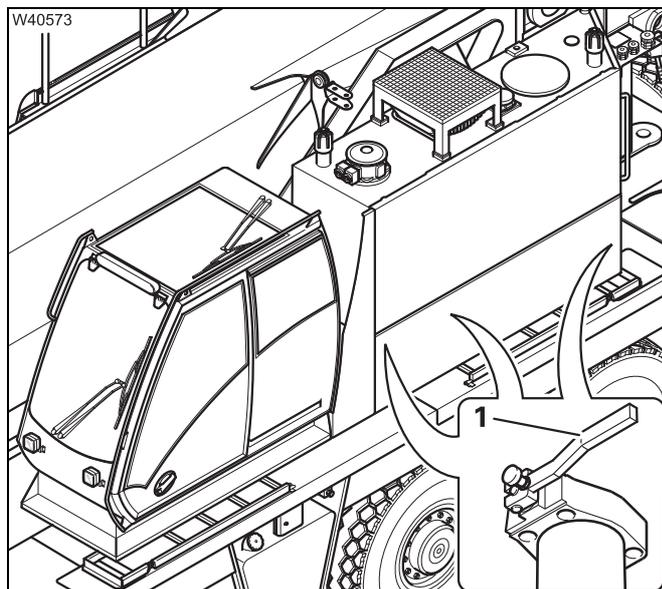
Closing the valves



Risk of damage to the hydraulic pumps!

Be sure to secure the engine against unauthorised use.

The hydraulic pumps will be damaged if the engine is started while the valves in the suction line are closed!



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

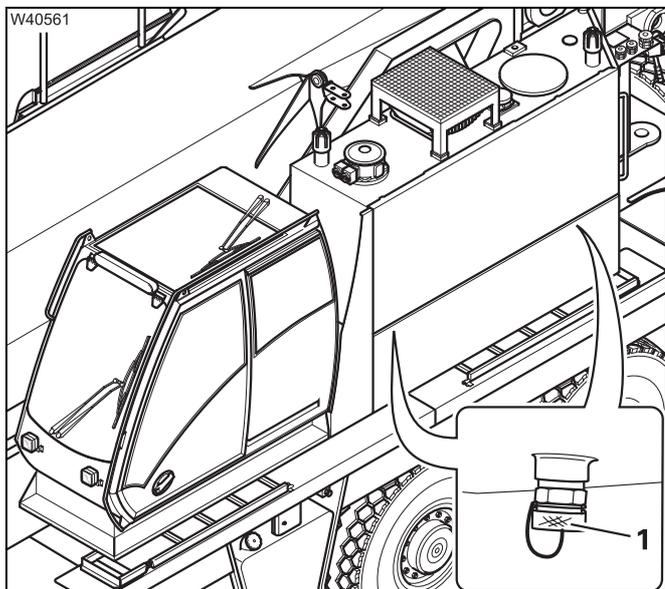


Draining oil



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.



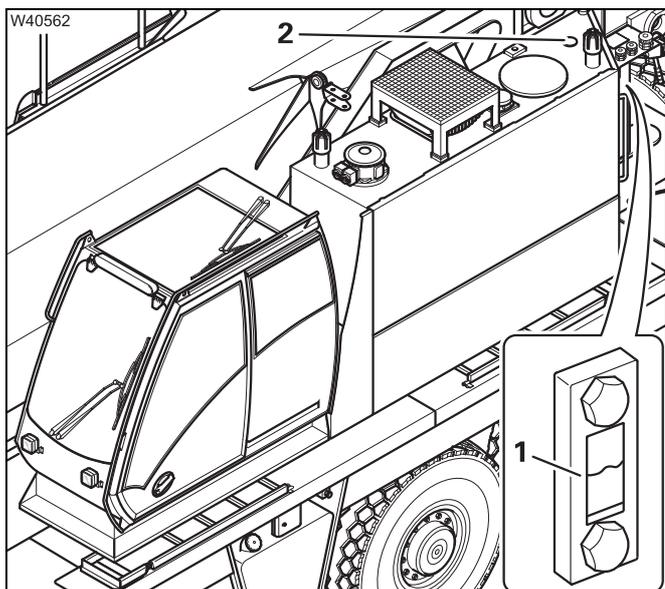
- Place a receptacle underneath the valve.
- Screw the connecting piece and hose onto the valve (1) and drain the oil;  *Handling the valves*, p. 7 - 100.
- Change the filters;  p. 8 - 53.

Topping up the oil



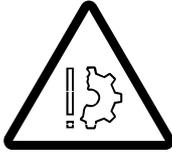
Risk of damage to the hydraulic system!

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 cap (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 cap (2).

Establishing the operating condition

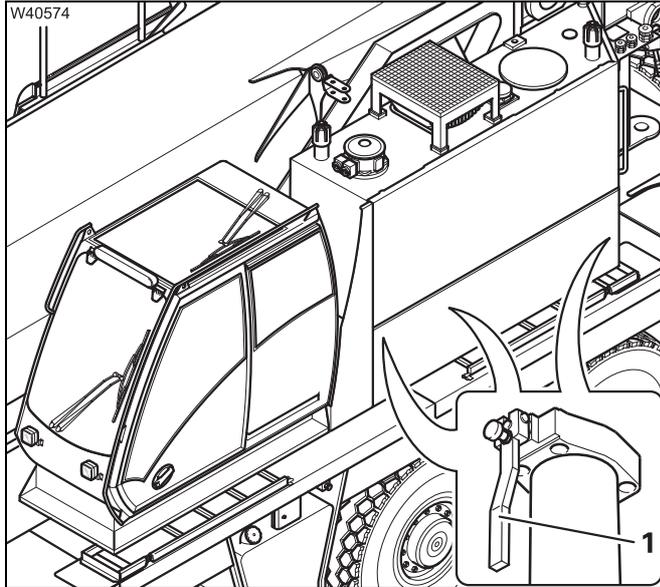


After changing the oil filters and topping up the oil, you must re-establish the operating condition.

Risk of damage to the hydraulic pumps!

Open the valve 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.
- 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 - 58.

8.7.10

Have the radiator checked/cleaned

M 12

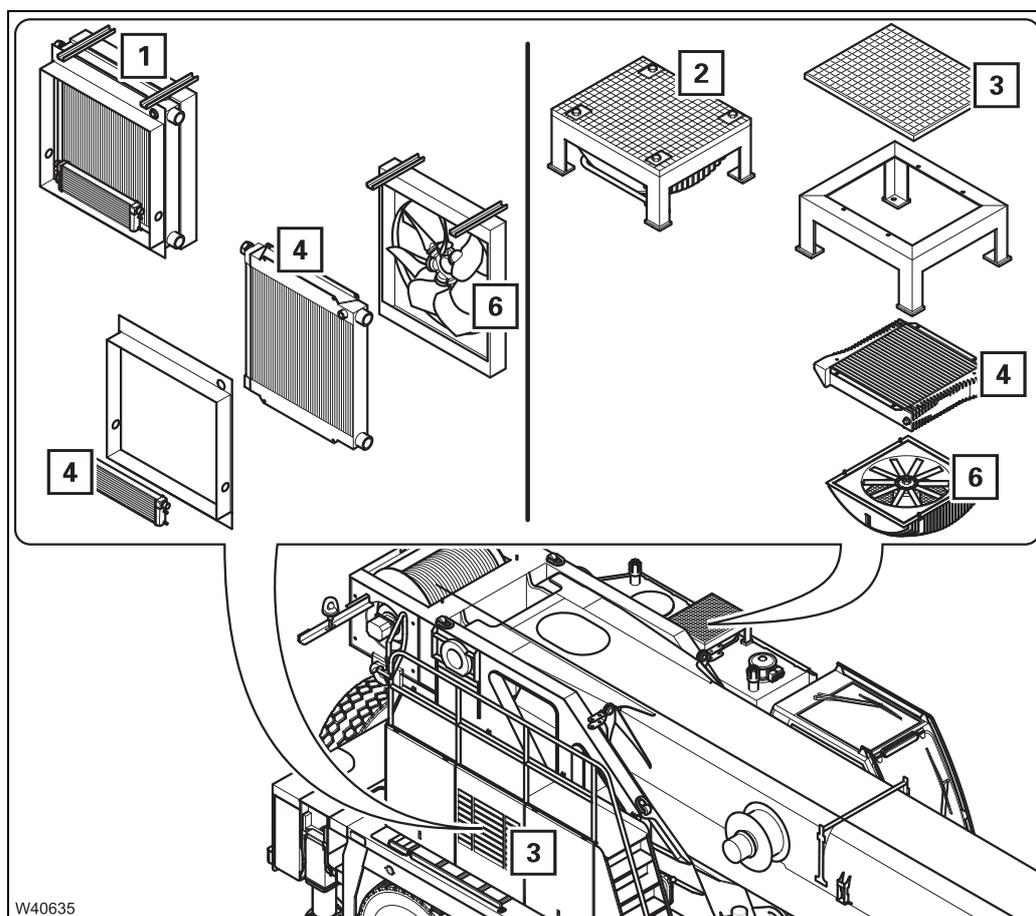
Reducing the interval

- 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 engine must not be running and must be 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) consist of different radiators (4). They are located below or behind the grilles (3). The fan impellers (6) are located under the radiators (4). The fan impellers rotate when the engine is running!



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) – series equipment

Radiator for hydraulic oil, radiator for pump transfer case gear oil.

Radiator unit (2) – additional equipment

Radiator for the hydraulic oil (mounted above the oil tank).

Checks

- If necessary remove leaves, twigs and other debris from the grilles (3).
- Check the condition of the fan impellers (6). 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 - 62.



Have them cleaned



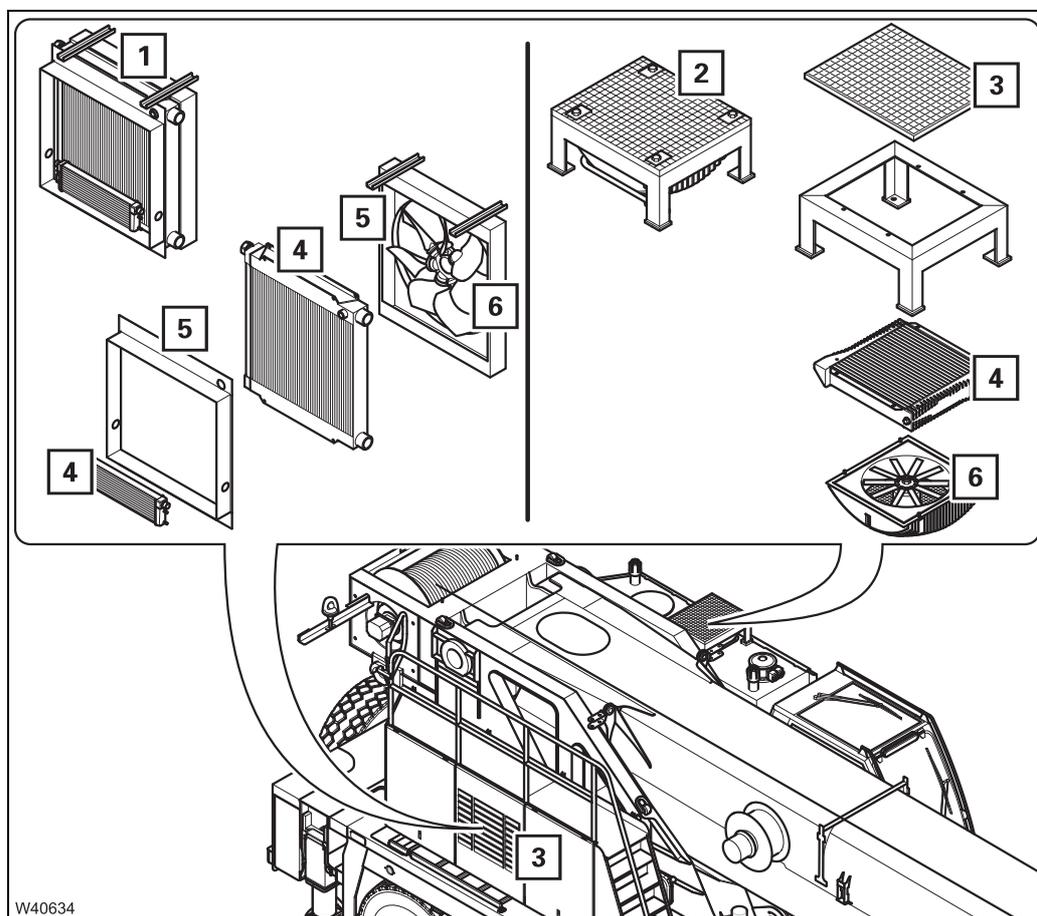
Risk of injury at the fan impeller!

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 (4) are accessible.
- Have the radiator fins (4) cleaned on both sides, using suitable cleaning agents.
- Have the fan impellers (6) cleaned.
- Have the grille (3) and the plates (5) 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 (5) are securely fastened.
- Start the engine and from a safe distance monitor the free running of the fan impellers (6).
- Check the respective temperature displays in the driver's cab;
 ▣▣▣▶ *Operating manual*.
- Switch the engine off.
- Check the radiator and connections for leaks.

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8.8

Main boom

8.8.1

Greasing the piston rod of the derricking cylinder

M 1

Grease, spare parts and tools

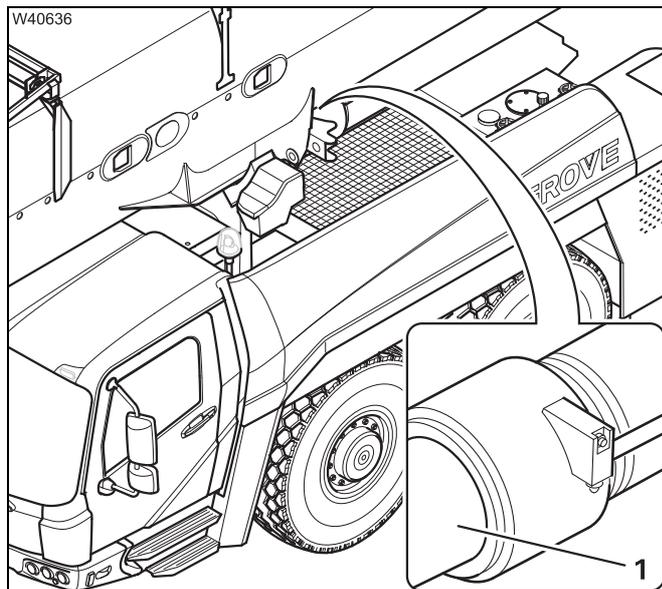
Designation	GROVE part no.
Lubricant RHUS SW 2; 1 kg (Apply the grease with a brush)	03325215
or	
Spray on Berulub; 0.5 litres (spray-on)	01929824

– 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. This prevents the formation of rust, which damages the seal in the derricking cylinder head when lowering fully.



- 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 of 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.

8.8.2

Lubricating the telescopic sections

M 3

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 grease gun for the grease nipples on the upper telescopic slide faces.
- A brush or roller for the outer, upper and lower telescopic slide faces.



Manitowoc Crane Group Germany GmbH recommends using pneumatic grease spray guns for more effective lubrication of the telescopic slide faces:

Designation	GROVE part no.
Grease spray gun, complete: Mobile, external compressed air connection required	03325445
Spray extension, length 2 m, splittable	04159862
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 Mega-Wing-Lift (MWL) must be removed; *Lattice extension operating manual*.
- 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 at the start you set up a rigging mode under which the telescope positions 44/100/0/0 are released in the context of the corresponding lifting capacity table, this rigging mode allows you to perform the complete maintenance work on the main boom.

Notes



Risk of overturning when telescoping if the RCL is overridden!

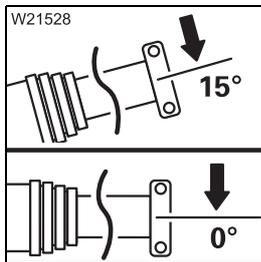
Do not override the rated capacity limiter (RCL) when telescoping is switched off. Select a suitable lifting capacity table which contains the required telescope status. Set the associated rigging mode and enter the RCL code.



Risk of accidents from slipping!

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!

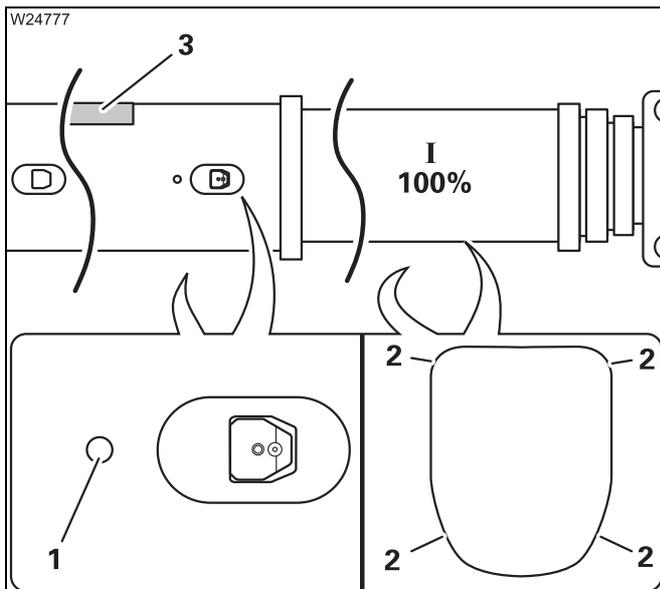


If the main boom has been telescoped **several times**, the telescoping mechanism and derricking gear can be so heavily loaded that the main boom can be neither telescoped nor derricked. Therefore note the following instructions:

- Before retracting the boom, raise it to approximately 15°.
- Do not lower the main boom below 0°.

Telescopic section I

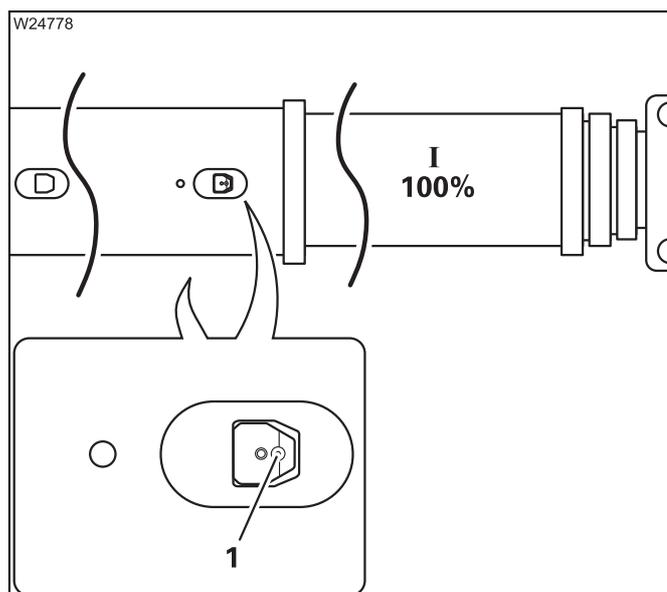
- Observe the following instructions regarding maintenance work.
- Extend the telescopic section I to 100%.



Lubricate the slide faces

- Use a brush or a roller (PAL1) to lubricate the outer, upper and outer, lower slide faces (2).
- Use the grease gun (PAL1) to lubricate the upper inner slide faces (3) at the lubricating nipples (1) on both sides.





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.

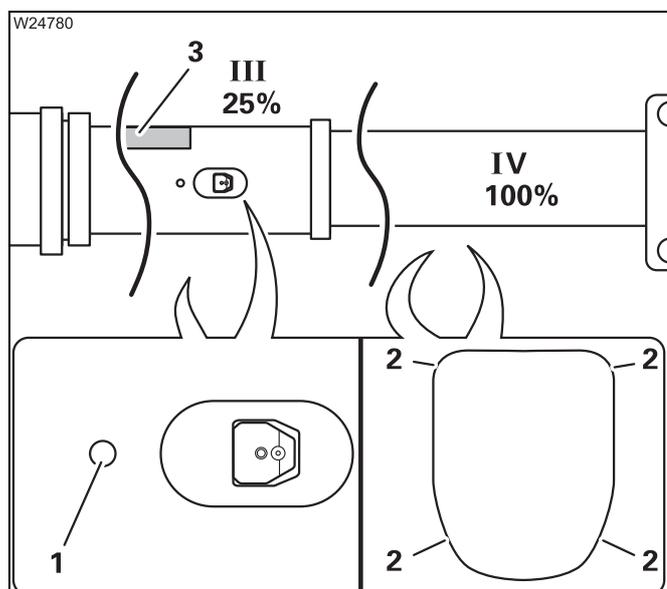
- Fully retract telescopic section I.
- Fully extend and retract telescopic section I again so that the grease is distributed over the slide faces.

Telescopic sections IV - II

- Observe the following instructions regarding maintenance work.

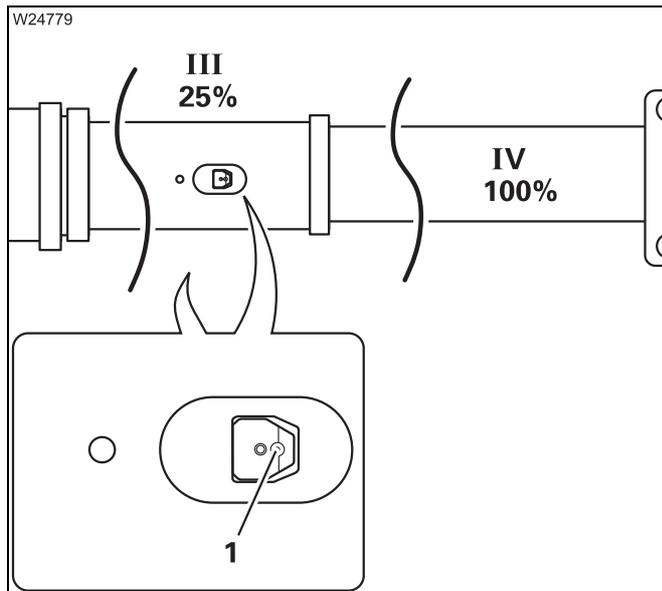
The following diagrams show the lubrication of the telescopic section IV. The telescopic sections III and II are lubricated in the same way.

- Extend telescopic section IV to 100% and telescopic section III to about 25%.



Lubricate the slide faces

- Use a brush or a roller (PAL1) to lubricate the outer, upper and outer, lower slide faces (2).
- Use the grease gun (PAL1) to lubricate the upper inner slide faces (3) at the lubricating nipples (1) on both sides.

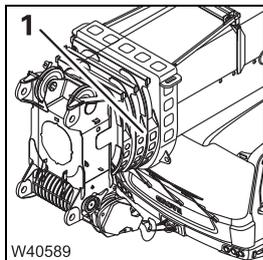


Lubricating the locking pins

- Use the grease gun (RHUS 2 AF) to lubricate the locking pins at the grease nipples (1) on both sides.
- Raise the main boom to 15°.
- Fully retract the telescopic section **III**.
- Fully retract the telescopic section **IV**.
- Lock and unlock the telescopic section **IV** several times, so that the grease is distributed over the locking pins.

- Fully extend and retract the telescopic section **IV** again so that the grease is distributed over the slide faces.
- Lower the main boom to 0°.
- Lubricate the telescopic sections **III** and **II** in the same way.

Before driving the truck crane



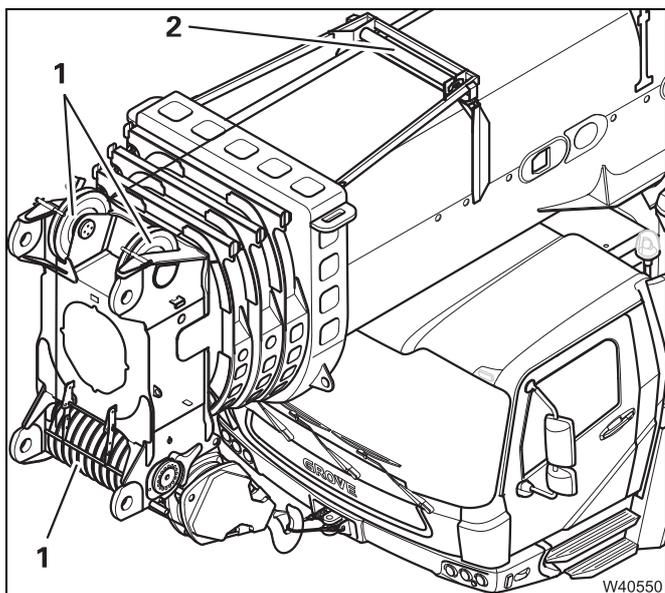
Fully retracting all telescopic sections of the main boom after greasing may result in excess lubricant paste emerging at the collar (1).

- Remove any excess lubricant paste from the collar (1).

8.8.3

Checking the sheaves

M 3



- Check all sheaves (1) and (2) for damage, wear, mobility and heavy soiling.

Have damaged, worn, stiff or extremely soiled sheaves replaced by **Manitowoc Crane Care** or an authorised GROVE dealer or your repair crew.

8.8.4

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.

8.9

Hoist ropes

8.9.1

Checking the winding

D



Risk of accidents due to rotating rope drum!

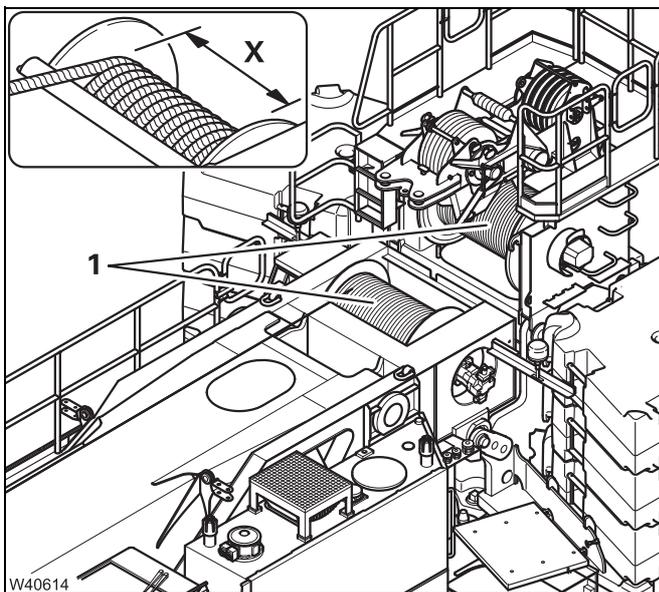
Keep away from the rope drum while it is turning.

This will prevent your limbs from being drawn in and getting crushed.

Prerequisites

- Video monitoring of the hoists from the crane cab is switched on; *Operating manual*.
- A hook block must be reeved; *Operating manual*.
- The main boom is lowered to about 30°; *Operating manual*.
- The engine has been started.

Checks



Always check the entire length of the winding of the ropes (1).

- Slowly perform the *Lower* 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, 0 to 2 mm (0 to 0.08 in) apart.
 - The cross-over points must be offset by about 180°.



The ropes of the top layer lie over the ropes of the bottom layer at the cross-over points.

8.9.2

Checking the hoist ropes

W

Spare parts and tools

- Torque wrench for 80 Nm (59 lbf ft).

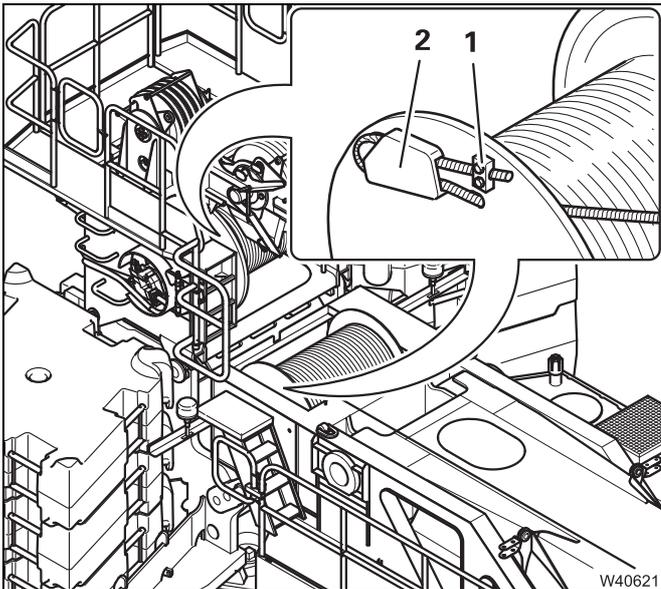
Prerequisites

- Establish a rigging mode in accordance with the *lifting capacity table* and enter the RCL code;  *Operating manual*.
- A hook block must be reeved 4-fold;  *Operating manual*.
- The main boom must be raised and fully extended;  *Operating manual*.

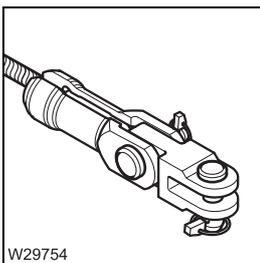
Checking the ropes

- Start the engine.
- Unreel the rope and check the rope and the rope spooling;
 *Assessing the condition of the hoist rope*, p. 8 - 74. 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 - 83.



- Check the clamp (1) for damage and firm seating – torque to 80 Nm (59 ft lbf).
- The free end of the rope must not project above the flanged wheel.
- The rope wedge must be in the pouch (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;
 *Operating manual*.

8.9.3

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.



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.

8.9.4

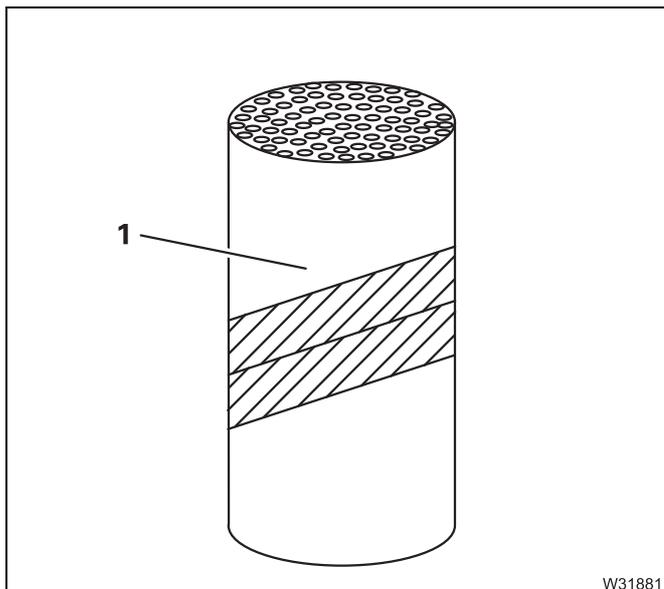
Assessing the condition of the hoist rope



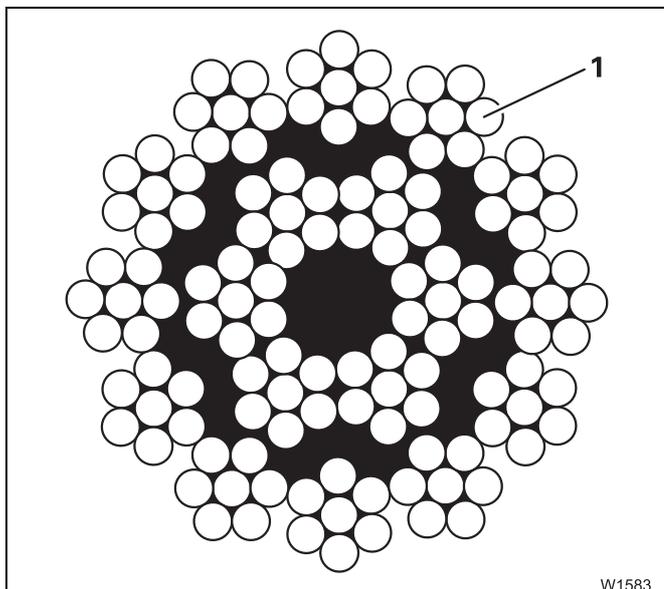
If in doubt about damage assessment, always consult an approved inspector.

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 (▮▮▮▮▶ *Operating manual*).



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!

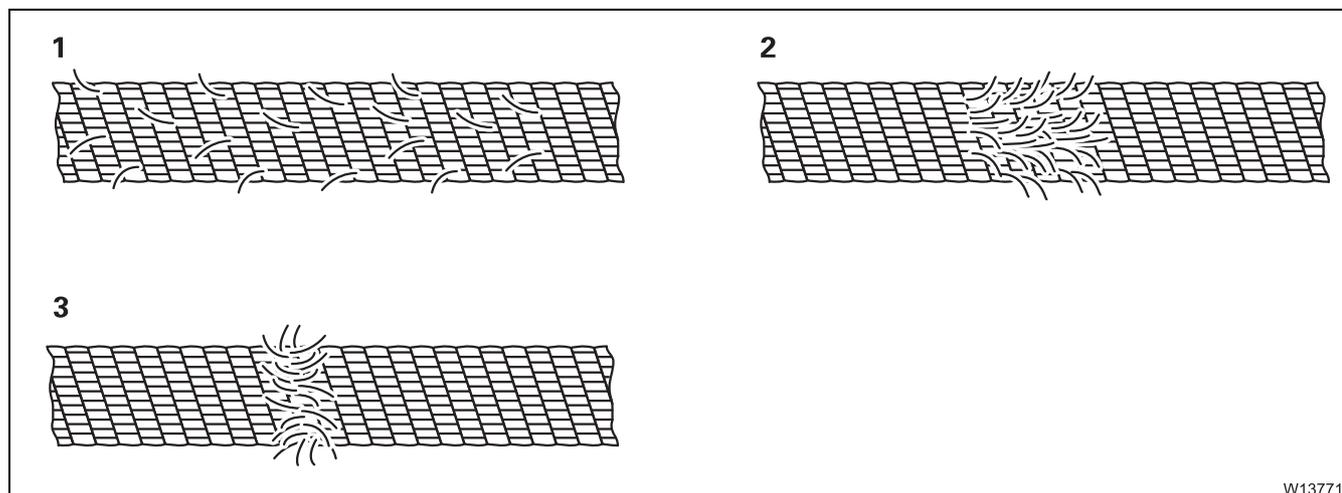
Number of visible wire breaks on a rotation-resistant hoist rope						
The rope section runs over a rope disc or on a drum wound as a single layer						
Number of load-bearing outer wires	Ø 13 mm		Ø 16 mm		Ø 17 mm	
	to 78 mm	to 390 mm	to 96 mm	to 480 mm	to 102 mm	to 510 mm
101-120	3	5	3	5	3	5
121-140	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





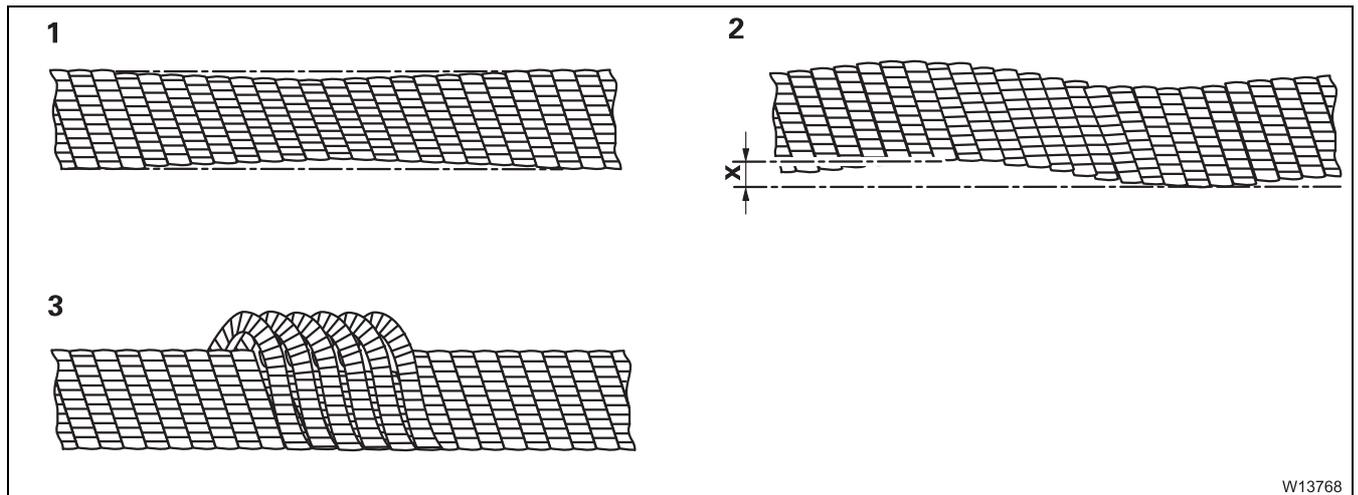
Risk of accidents due to reduced load bearing capacity!

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

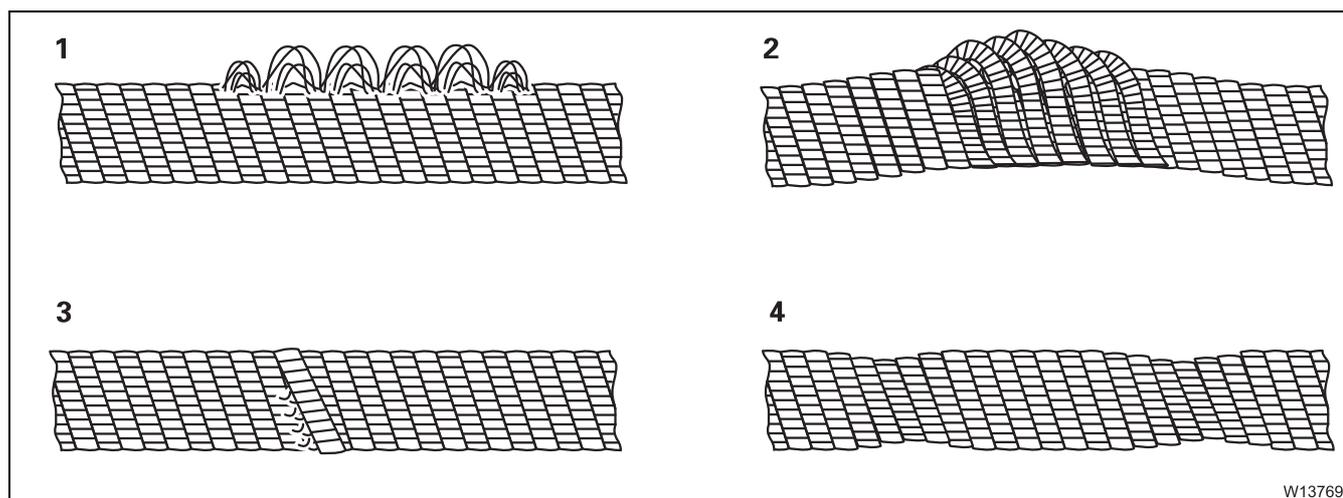
Damage	Description	Cause	Replacement
Wire break (1)	Individual wires are broken; the broken ends of the wires are protruding from the rope.	General wear caused by ageing of the rope or Subsequent damage resulting from damage to the rope.	Replace the rope at the latest when the maximum permissible number 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 as the rope ages. 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	Tarnished colour is visible externally on the rope.	Rope has been subjected to excessive heat.	Replace the rope immediately .



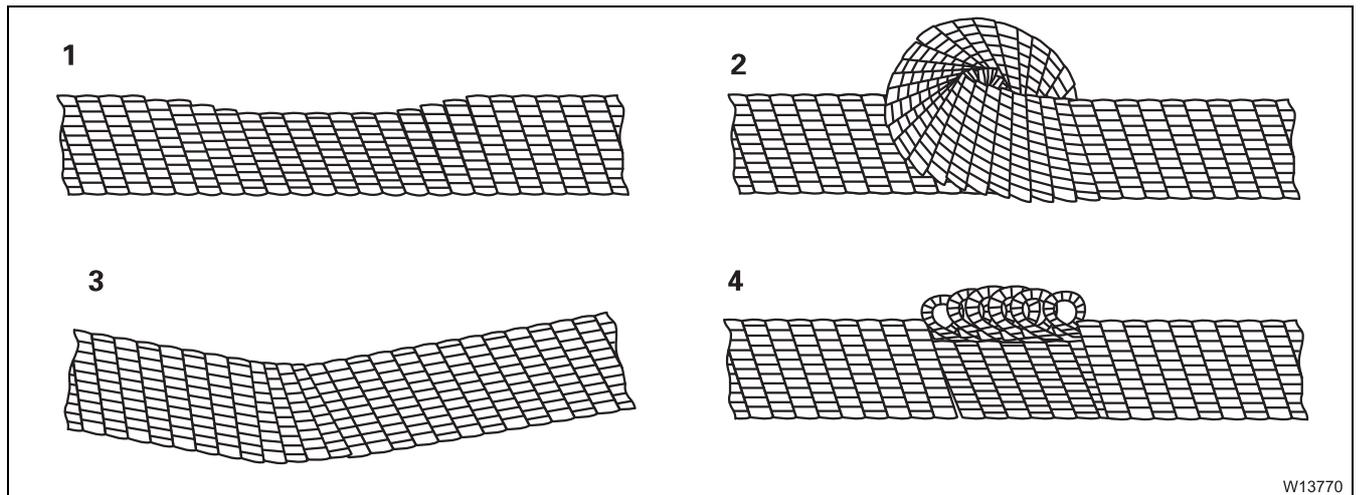
W13768

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 .
Basket-like 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 the 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 .

8.9.5

Replacing the hoist rope

Spare parts and tools

- An original replacement part; ■■■► *Rope certificate*.
- A reel stand with braking block.
- Torque wrench for 80 Nm (59 lbf ft).



Risk of accidents due to falling loads!

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; ■■■► *Operating manual*.

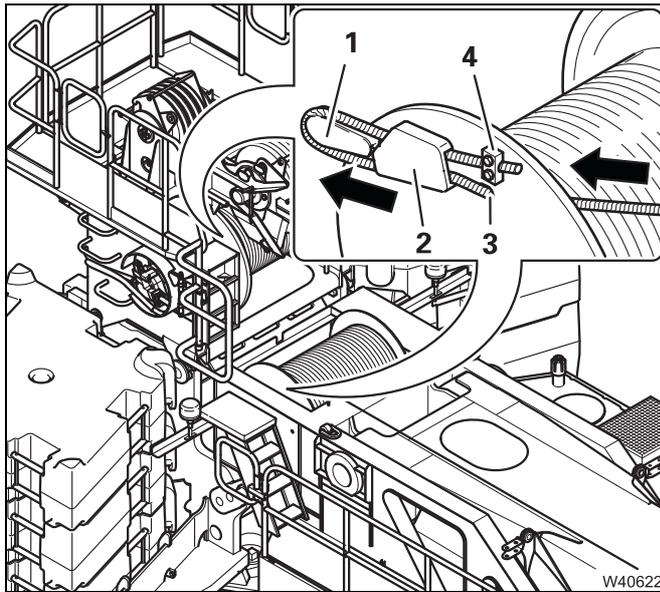
Setting down the old rope

- 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 - 83.
- Unreel the remaining layers from the hoist drum.
- Lock the truck crane to prevent unauthorised use; ■■■► p. 2 - 3.



Risk of accidents due to rotating rope drum!

Switch the engine off and remove the ignition key so that no unauthorised operation of the hoist can occur.

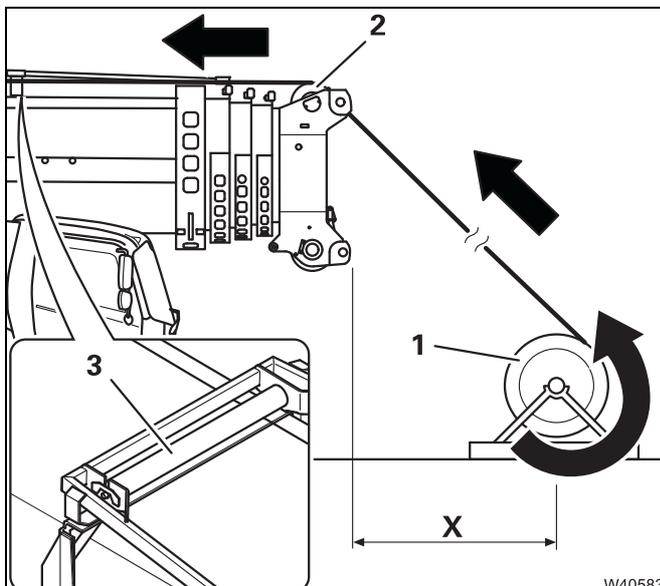


- Remove the clamp (4).
- Push the rope through the hole (3) until the rope wedge (1) slides out of the pouch (2).
- Remove the rope wedge and place the old rope away from the truck crane.

Fitting 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.

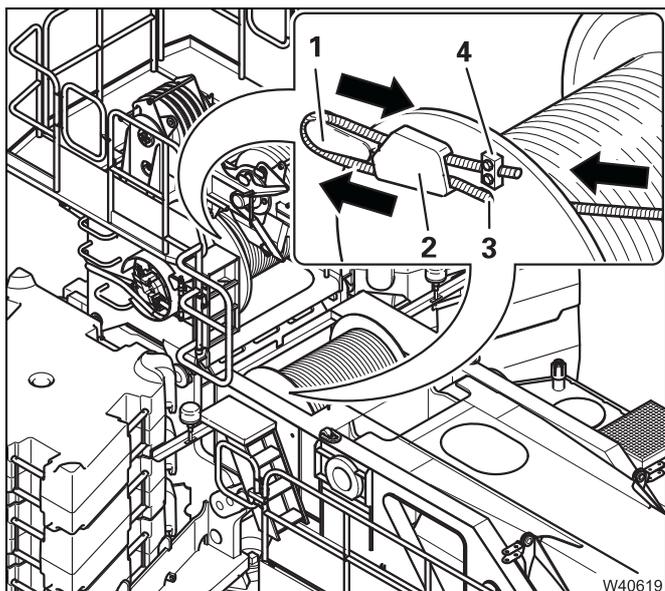


- Place the reel stand (1) with the new rope in front of the main boom head. The distance (X) between the reel stand (1) and the head sheave (2) must be at least 30 m (100 ft), so that the rope runs over the head sheave as straight as possible.

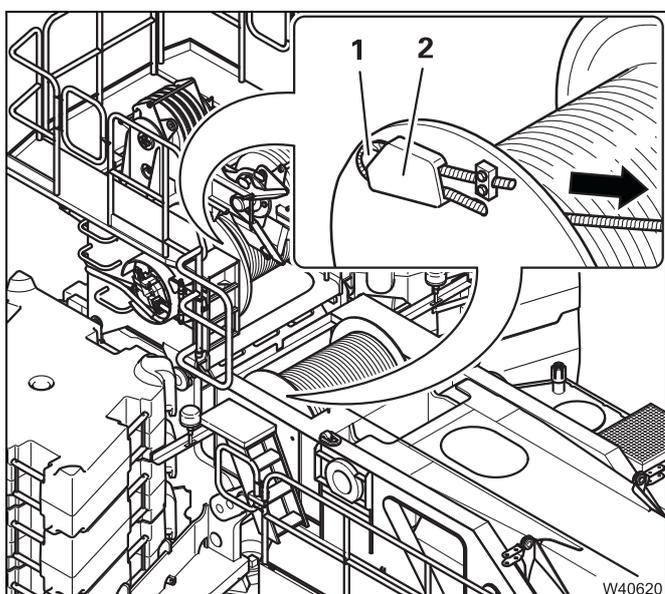
Ensure that the rope is being rolled on to the drum with the right slewing direction.

- 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 pouch (2).
- Feed the free end of the rope back through the pouch.
- Secure the clamp (4) and tighten it – torque to 80 Nm (59 ft lbf).
- Place the rope wedge (1) in the loop.



- Push the rope back until the rope wedge (1) is fully in the pouch (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;  *Operating manual*.
- 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 from incorrectly set lowering limit switch!

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 - 83.
- Run in the new rope with small loads so that the rope can settle on the hoist drum.

8.9.6

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	03137794

Prerequisites

- A hook block must be reeved 4-fold; *Operating manual*.
- The main boom must be fully raised and extended; *Operating manual*.
- The hook block is lowered until only five turns of the rope remain on the hoist drum.

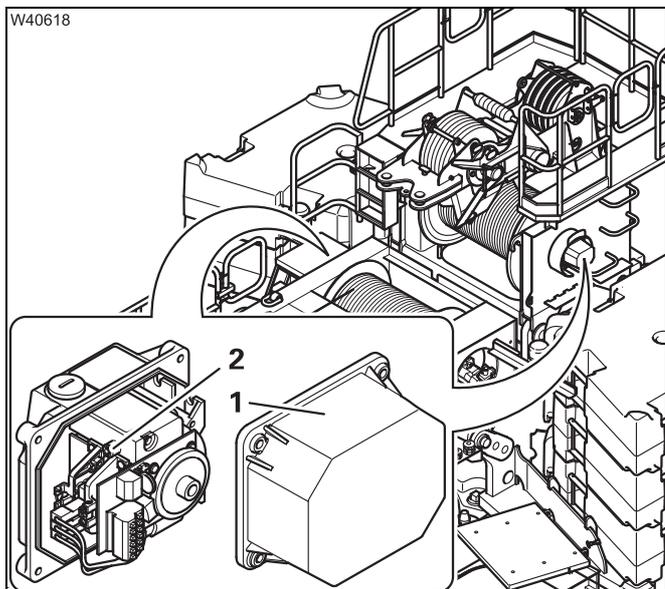


Setting the lowering limit switch



Risk of accidents due to overloaded rope end fitting!

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 cap (1).
- Turn the screw (2) until you hear the switch activate.
- Screw the cap on again. Replace the gasket if necessary.
- Check that the lowering limit switch switches off the hoist correctly.

Checking for shutdown

- Raise the hook block until there are about 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.

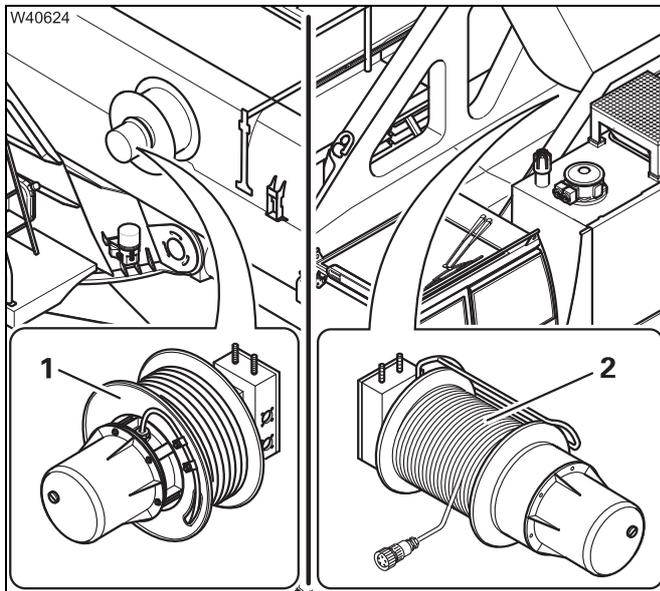
8.10

Cable drums and slewing angle sensor

8.10.1

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	03138891
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; *Operating manual*.

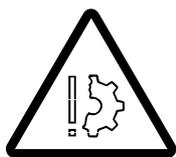
For cable drum 2

- The main boom must be fully raised; *Operating manual*.
- The cover plate in front of the cable drum 2 is removed.

For cable drums 1 and 2

- The engine must not be running and must be secured against unauthorised use; p. 2 - 3.
- The selector handle must be removed from the battery master switch; p. 7 - 112.





Risk of damage to the RCL!

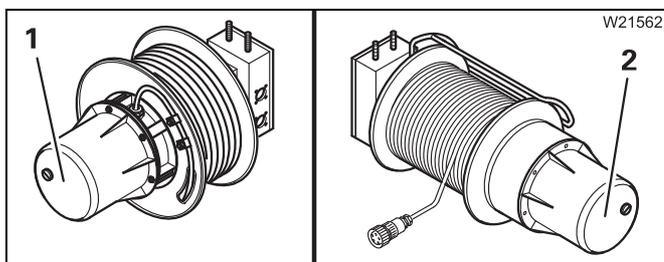
Before maintenance work on the slip ring assemblies, always switch off the battery master switch so that the cable drum is without power. This prevents short circuits which may lead to damage to the rated capacity limiter (RCL).



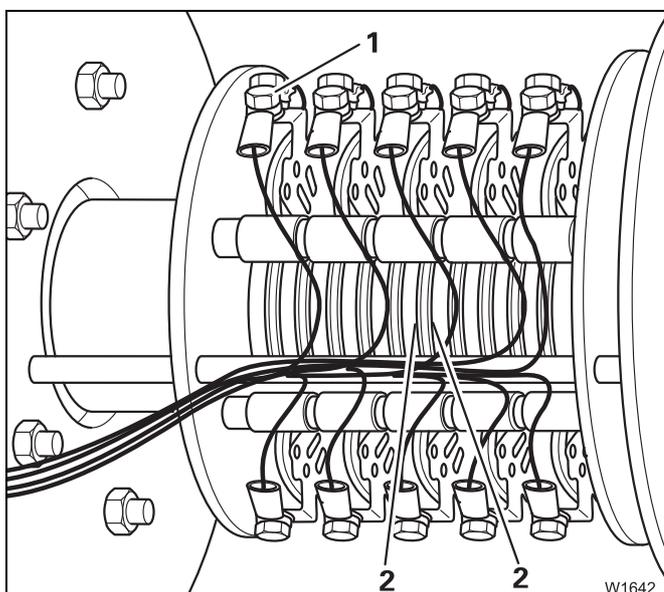
Risk of crushing from movement of the main boom!

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 cap (1) or (2).
- Clean and dry the cap.
- 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 cap to the cable drum.

8.10.2

Lubricating the slewing angle sensor

Y 5

Grease, spare parts, tools

Lubricating grease	Designation to DIN 51502	Specifications 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 not be running and must be secured against unauthorised use;  p. 2 - 3.

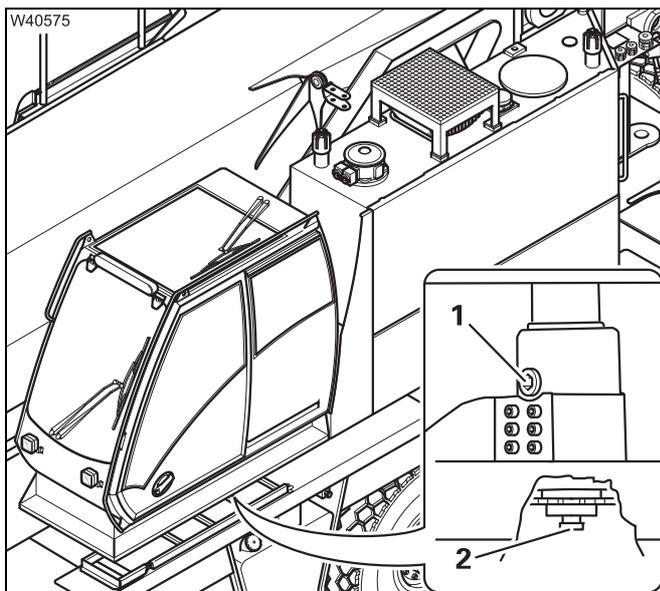


Risk of damage to the slewing angle sensor!

Before lubricating, always remove the screw from the slewing angle sensor.

This prevents the slewing angle sensor from damage.

Lubrication



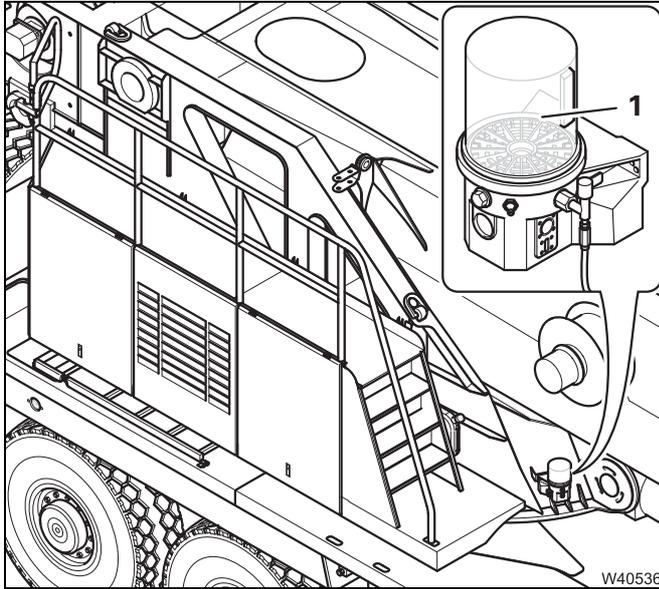
- Unscrew the bolt (1).
- Clean the grease nipple (2) and inject about 5 cm³ (0.3 in³) of grease.
- Remove any excess grease, and close the grease nipple.
- Tighten the bolt with a new gasket and sealing agent – torque 25Nm (18.5 lbf ft).

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8.11 Central lubrication system

8.11.1 Checking the filling level

W



The maintenance of the pump (1) is the same as the maintenance on the carrier;
▣▣▣▣► *Central lubrication system*, p. 7 - 107.

Connected lubricating points:

- Main hoist drum
- Auxiliary hoist drum
(if rigged and connected)
- Slewing bearing
- Telescopic boom – pivot pins,
- Derricking cylinder – pivot pin.

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8.12 Hook blocks

8.12.1 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.

8.12.2 Lubricating

M 12

- Comply also with the running-in regulations;  p. 4 - 1.

Grease, spare parts, 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.

Prerequisites

- The hook block has been reeved at least twice;  *Operating manual*.

Lubrication

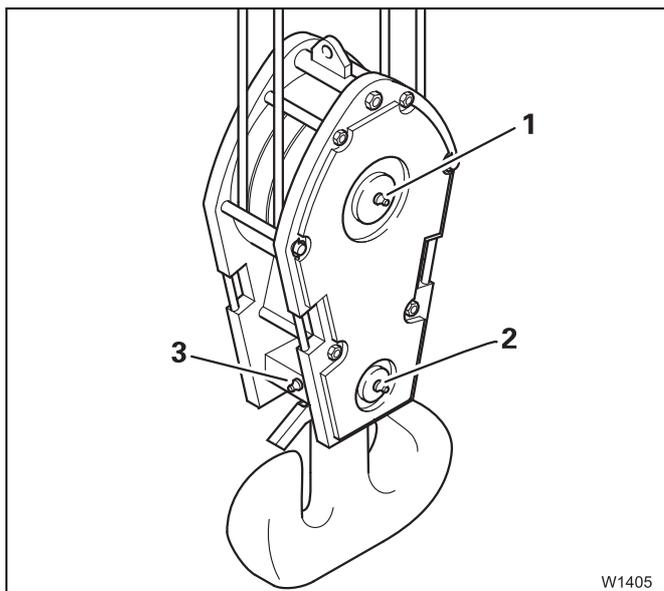
On the hook blocks supplied, the sheaves, crossheads and load hooks of the axial bearings are greased.



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.

Checking the fastenings



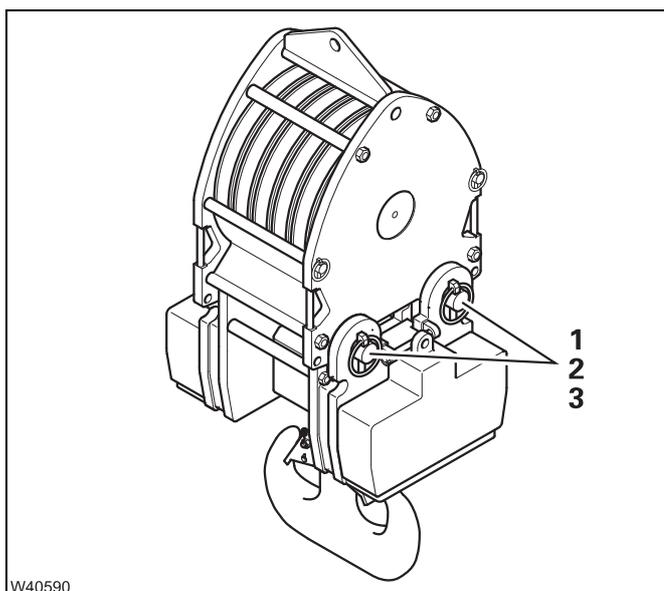
The GMK6400 truck crane can be equipped with **separable hook blocks**.

Risk of accidents due to non-secured hook block components!

If the removable components of the bottom hook block are not properly secured, then they can fall from a great height and fatally injure people during crane operation.

Always check that the removable components are properly secured during loading and before crane operation.

The figure shows an example of the removable components on a hook block.

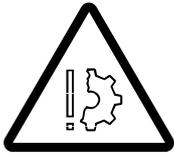


Separable hook block

- Check the separable joints (1) for damage.
- Check the bolts (2) and the retaining pins (3) for damage.

Information on crane operation

Exercise particular care when operating the crane. Check that the hook blocks have room to move freely, especially for two-hook operation.



Risk of damage to the hook blocks!

Check the hook block regularly for corrosion and condition. This applies in particular if

- work is frequently carried out in a corrosive environment,
- the hook blocks collide during crane operation.

This prevents damage than can lead to falling of the hook block components.

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 with your crane.
- Have the hook blocks dismantled by **Manitowoc Crane Care** or an authorised GROVE dealer or your qualified repair crew.

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8.13

Electrical system

8.13.1

Checking the lighting and indicators

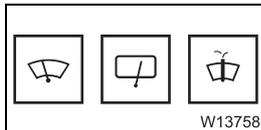
D



Risk of accidents in the event of faulty safety devices!

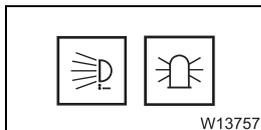
Have faulty lights and indicators repaired by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop.

- Check the lamps and displays on the *ECOS* and *RCL* control units;
 ▶ *Operating manual*.



- Check the following functions:

- Windscreen wipers, windscreen washing system



- Spotlight on the crane cab, air traffic control light,

- Spotlight on the main boom (xenon light),

- Horn, anemometer

- Camera systems (hoists, telescoping boom head).



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.

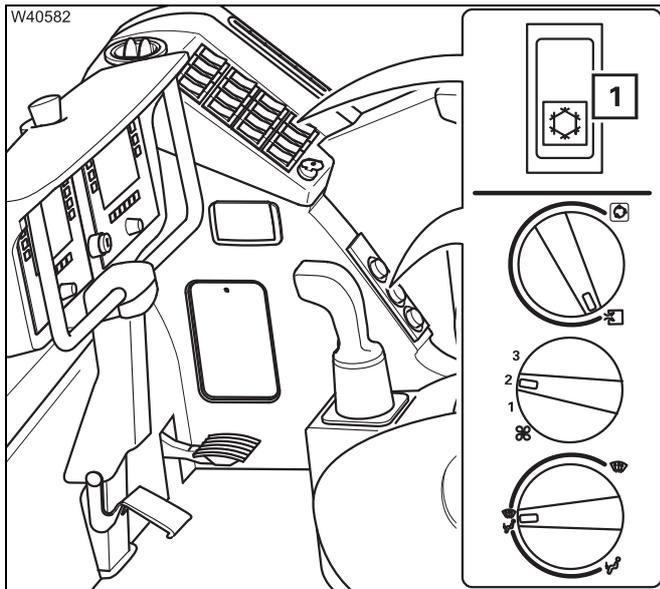
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8.14 Air-conditioning system

8.14.1 Checking the air conditioning system

M 1

The air-conditioning control panel is located on the side panel in the crane cab.



- Switch on the air conditioning system (1);
 ▣▣▣▣▶ *Operating manual.*
- Check that cooling takes place. If it does not, the air-conditioning system is defective.
- Switch off the air conditioning system (1).

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.

8.14.2 Checking hoses

M 6

- Check the hoses in the same way as when checking them on the carrier;
 ▣▣▣▣▶ *Checking the entire air-conditioning system, p. 7 - 120.*

8.14.3 Checking the entire air-conditioning system

M 12

The GMK6400 truck crane is equipped with a combined air conditioning system for the driver's cab in the carrier and the crane cab in the superstructure; ▣▣▣▣▶ *Checking the entire air-conditioning system, p. 7 - 120.*

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8.15 Other maintenance work

8.15.1 Checking the windscreen washing system

W

Water Spare parts Tool

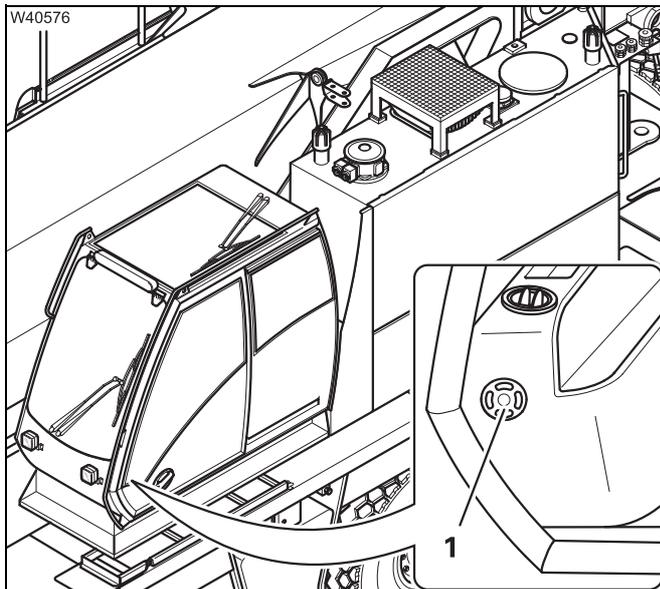
Designation	Quantity	GROVE part no.
Windscreen wiper blade	1	03326121
Roof wiper blade	1	03326121

- 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



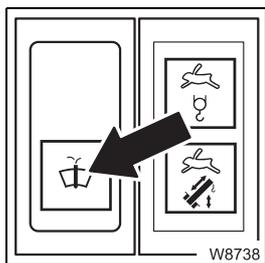
If the tank is empty

- 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.

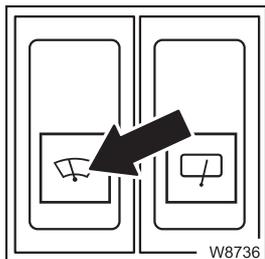


Wipe up

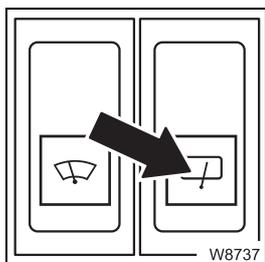
The wiping/washing system operation is described in the accompanying operating instructions;  *Operating manual*.



- Spray water on the **windscreen** – press the **bottom** part of the switch.
- Spray water on the **skylight** – press the **top** part of the switch.



- Switch the **windscreen wiper** on – press in the **bottom** part of the switch for continuous operation.
- Also check intermittent operation – push the switch in the middle position.
- Switch the **windscreen wiper** off – press in the **top** part of the switch.



- Switch the **roof window wiper** on – press in the **bottom** part of the switch for continuous operation.
- Also check intermittent operation – push the switch in the middle position.
- Switch the **roof window wiper** off – press in the **top** part of the switch.

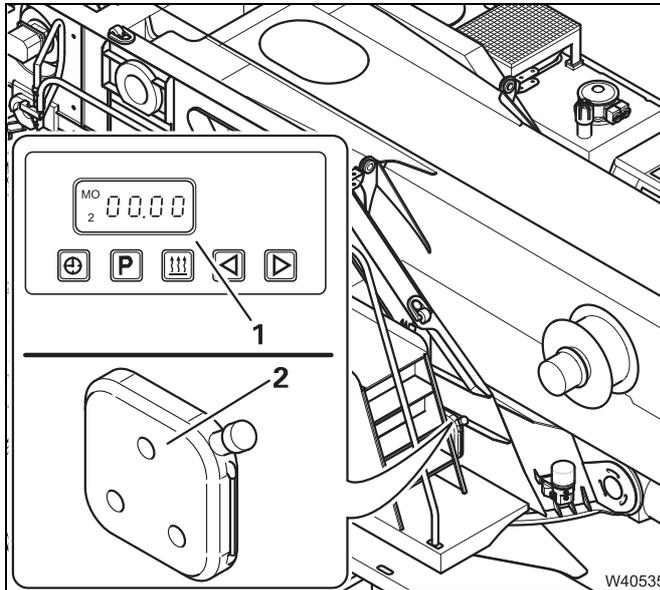
In case the windscreen/skylight is not wiped clean

- Change the wiper blade.

8.15.2

Checking the functioning of the auxiliary heater

M 1



- Check the auxiliary heater (1) in the crane cab in the same way as in the driver's cab;
▣▣▣▣▶ *Checking the functioning of the auxiliary heater, p. 7 - 133.*
- Check the filling level in the fuel tank (2);
▣▣▣▣▶ *Operating manual.*

8.15.3

Lubricating the crane cab door

M 12

Grease, spare parts, tools

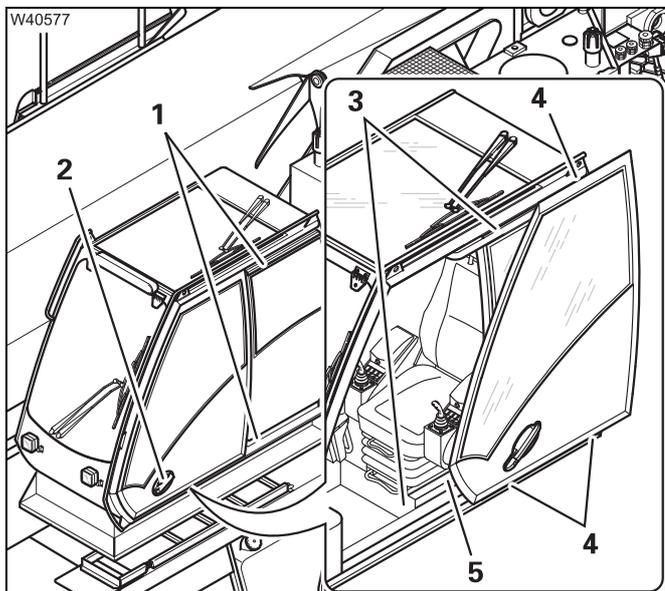
Designation	GROVE part no.
Grease: RHUS 2 AF, 1 kg can	03325215

- Brush.

Prerequisites

- The turntable is locked.
- The engine must not be running and must be secured against unauthorised use; ►► p. 2 - 3.

Lubrication



- With the door closed, clean the rails (1) outside.
- Lubricate the rails (1) lightly with a brush.
- Open the door completely using the handle (2) – the door locks in place.
- Clean the rails (3).
- Lubricate the rails (3) and the rollers (4) lightly with a brush.
- Pull the unlocking device (5).
- 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 adjusted by **Manitowoc Crane Care** or an authorised GROVE-dealer.

8.15.4

Lubricating the step

M 12

Grease, tools

Designation	GROVE part no.
Lubricant RHUS SW 2; 1 kg (Apply the grease with a brush)	03325215

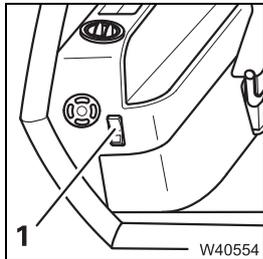
- Brush.

Prerequisites

- The turntable is locked.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Retracting/ extending

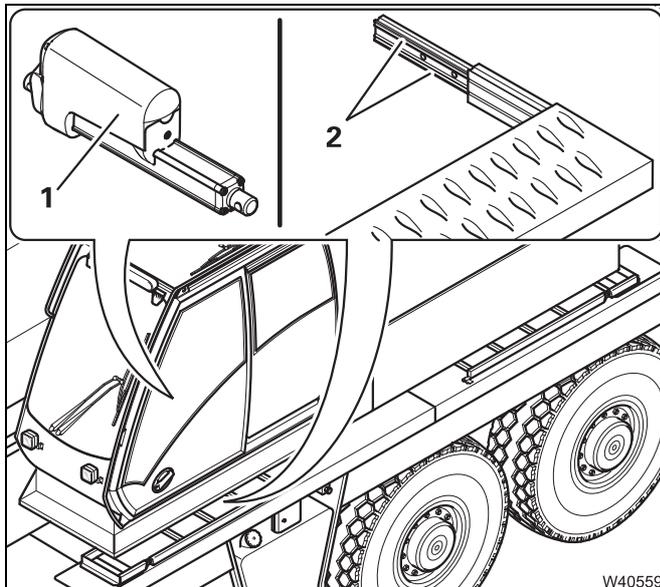
- Find out about retracting/extending the step in the operating manual and note the warning;  *Operating manual*.



The step is operated using the button (1) in the crane cab.

Lubrication

- Fully extend the step.
- Tilt the crane cab backwards.



- Clean the rails (2).
- Lubricate the rails (2) lightly with a brush.
- Fully 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 (1) is running smoothly and without jerking.
- 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.

8.15.5

Lubricating the connecting pins and socket pins

M 12

Grease, tools

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

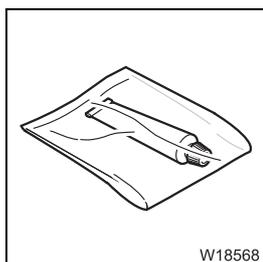
- Brush.

Checks

Depending on the equipment, the **superstructure** can have various connecting pins and socket pins such as:

- Hinged or fold out railings
 - Locks and supports on the covers
 - 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.

Lubrication



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

8.15.6

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 has been thoroughly cleaned.
- The engine must not be running and must be secured against unauthorised use;  p. 2 - 3.

Checks

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 - 106.

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 - 135.

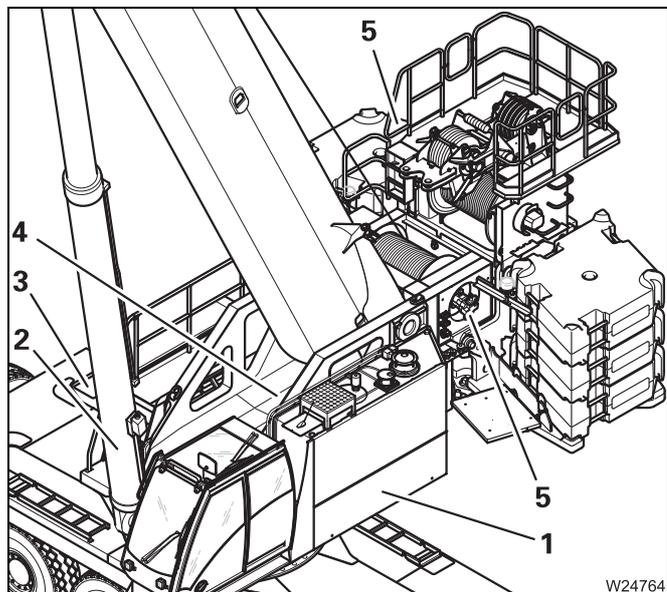


Spraying



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:
 - Under the oil tank (1)
 - On the derricking cylinder (2)
 - On the slewing gears (3)
 - On the slewing duct (4)
 - On the hoists (5)
- 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.

8.15.7

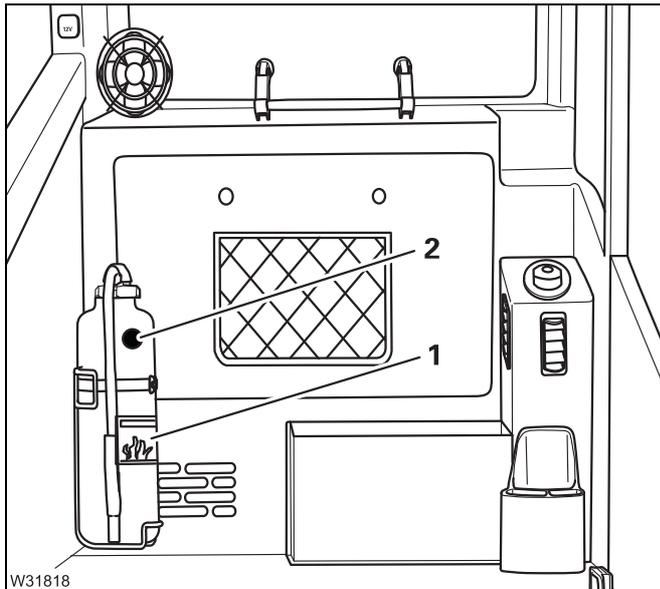
Having the fire extinguisher checked

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.



- Follow the instructions (1) regarding operation 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 is still working properly after the maintenance interval on the label has expired.

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9 Longer out of service periods

9

Longer out of service periods

Carry out the following work if the truck crane is to be out of service for a long period (months).

Shut down

- 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 the air filter.
- 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 if necessary.
- Perform a full functional test on the truck crane every two weeks. (Open the air filter beforehand!)
- Run the hydraulic systems up to a fluid temperature of about 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 the air filter again.

If the truck crane is put 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 the air filter.
- 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 retaining bolts.....	10 - 1
10.2	Special torques	10 - 2

10 Torques

10.1 Torques for retaining bolts

Metric standard screw thread Metric fine screw-thread		Approximate values			
Thread size (mm)	Size across flats (mm)		Torques (greatest permissible preloading for bolts) for oiled bolts (Nm)		
	Hexagon head screw	Cylinder 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 18 x 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	1,080 1,170
M 30	46	22	1,300	1,800	2,160
M 33	50	24		2,700	
M 36	55	27		3,300	

10.2 Special torques

Description	Thread size (mm)	Size across flats (mm)		Torque (Nm)
		Hexagon head screw	Cylinder 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 30	46	—	1,450
– Hoist drum rope clamp		—	—	80

11 Spare parts required for maintenance

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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.

Only the spare parts required for the maintenance work described are listed here.

A more detailed spare parts document can be found in the accompanying *Spare parts list*.

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	24V / 21W
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:			
– Side marker light	03140042	LED	
White rear marker lights: (at the rear of the chassis)			
– Left marker light	04164499	LED	
– Right marker light	04164500	LED	
Reversing lamp: (at the rear of the chassis)			
– Reversing lamp	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	03143783	M 70 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)			
– Cab light	01207144	R10W	10
– Reading light	00439055	P25-1	21
Dashboard light: (in the driver's cab; socket 12 V)			
– 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, left and right	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 marker lights: (6x ladder lights on the turntable)			
– Marker light	03143474		
Working area spotlight: (next to the hoists on the turntable)			
– Spotlight; complete	04160317	LED	
Inside light: (in the crane cab)			
– Cab light	01207144	R10W	10
– Reading light	00439055	P25-1	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						
Valve M 20 x 1.5	03041579	Once when the oil is changed the first time; recommended modification from oil drain plug to valve				
Gasket 20 x 24 Cu DIN 7603	00117139					
Valve M 26 x 1.5	03046878					
Gasket 26 x 31 Cu DIN 7603	00117147					
Air filter	03328262	1 item when the symbol lights up				
Fuel system						
Filter (filter 1)	03322877			1		
Gasket	03322879			1		
Filter element (if damaged)	03328656			1		
Filter with gasket (Filter 2)	03319653					1
Transmission						
O-ring 21 x 2	04155708	On the transmission				1
Gasket 26 x 31 Cu DIN 7603	00117147	On the power take-off				1
Transfer case						
Gasket 30 x 36 Cu DIN 7603	00117151		1		1	
Gasket 16 x 20 Cu DIN 7603	00117134				1	
Axle lines Axle centre drives						
Gasket 30 x 36 Cu DIN 7603	00117151		2			2
Gasket 24 x 29 Cu DIN 7603	00117145					2
Gasket 36 x 42 Cu DIN 7603	01371208					2
Axle lines Final drives						
Gasket 24 x 29 Cu DIN 7603	00117145		8			8
Gasket 30 x 36 Cu DIN 7603	00117151					4
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)							
1st and 2nd axle line (duplex brake):		Only if wear is present on the drum brakes					
Brake shoe with brake lining	03322112						4
Spring	03322110						4
Brake drum	01925703						2
3rd to 6th 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	(8)					
Gasket 22 x 27 Cu DIN 7603	00117142	(8)					
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
Filters 5 and 6	03142530						2
Spring	03142531						2
O-ring	03142532						2
Oil tank cover gasket 140 / 90 x 3	02313899	1 item for every oil change (if damaged)					
Ventilation filter	01576026					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	03328365	1				
Gasket for oil drain plug for diesel engine with AdBlue system	03329824	1				
Gasket for oil drain plug for diesel engine without AdBlue system	03329825	1				
Transmission (without Intarder)						
O-ring 21 x 2	04155708		2	On the transmission		
Gasket 26 x 31 Cu DIN 7603	00117147		1	On the power take-off		
Gasket 18 x 24 Cu DIN 7603	01377793		1			
Oil filter	04155134		1			
O-ring 78 x 3	03143694		1			
Transmission (with Intarder)						
O-ring 21 x 2	04155708		2	On the transmission		
Oil filter	04155134		1	On the Intarder		
O-ring 70 x 3	04155135		1			
Magnet	04159255		1			
Gasket 26 x 31 Cu DIN 7603	00117147		1	On the power take-off		
Gasket 18 x 24 Cu DIN 7603	01377793		1			
Oil filter	04155134		1			
O-ring 78 x 3	03143694		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
Hoists						
Gasket 14 x 18 St DIN 7603	03043733	(2)	(if damaged)			
Gasket 18 x 22 St DIN 7603	01927403	(4)				
Gasket 14 x 18 St DIN 7603	03043733					2
Gasket 18 x 22 St DIN 7603	01927403					4
Gasket 26 x 31 St DIN 7603	03142181					4
Slewing gear						
Gasket 10 x 13.5 Cu DIN 7603	00117125	(3)	(if damaged)			
Gasket 10 x 13.5 Cu DIN 7603	00117125					3
Gasket 14 x 20 Cu DIN 7603	00117132					3
Pump transfer case						
Gasket 21 x 26 Cu DIN 7603	00117141		1			2
Oil filter	03135866	At every oil change when indicated at the oil filter.				1
Packing set	04161645					1
Hydraulic system						
Filter 1 (only clean it)	03325700			(1)		
Packing set	03135853			1		
Filter 2 (only clean it)	03317083			(1)		
Cover gasket	01372280			1		
Filter 1	03325700	At every oil change and when a warning message is displayed, change the oil filter.				1
Packing set	03135853					1
Filter 2	03317083					1
Cover gasket	01372280					1
Filter 3	03046526					1
Packing set	03137065					1
Oil tank cover gasket 140 / 90 x 3	03328286	1 item for every oil change (if damaged)				
Ventilation filter	03134932					2

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	03137794	1 piece (if damaged)				For every rope change on the hoist
Cable drums						
Cover gasket for cable drum 1	03138891	(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
Slewing angle sensor						
Gasket 16 x 20 Cu DIN 7603	00117134			1		

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Appendix

Appendix

Table for determining the remaining theoretical service life on winch no.

Type of crane:

Serial number:

Commissioned on:

Serial number of the winch in accordance with the model plate:

Last general overhaul performed on:

Winch design data (see operating manual):

Power unit group:

Load spectrum:

Load spectrum factor:

Theoretical service life:

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	Operating hours of the winch	Operating hours of the winch since the last inspection	Used proportion of theoretical service life D:	Remaining theoretical service life	Name of the expert	Signature	Comment	Name of the approved inspector	Signature
"i"			Km _i	[h]	[h]	[h]	[h]	[h]	$S_i = \frac{K m_i}{K m} \times T_i$	$D_i = D_{i-1} - S_i$					
(*)															

IMPORTANT:

A general overhaul is to be performed every 10 years!
 For alternative provision, refer to section 5.4.2, p. 5 - 25.

- 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 operating hours in the inspection interval "i" according to section 2.2

General overhaul performed on.....

(*) Copy the last line of the previous page to the following page.

Table for determining the remaining theoretical service life on winch no.

Type of crane:

Serial number:

Commissioned on:

Serial number of the winch in accordance with the model plate:

Last general overhaul performed on:

Winch design data (see operating manual):

Power unit group:

Load spectrum:

Load spectrum factor:

Theoretical service life:

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	Operating hours of the winch	Operating hours of the winch since the last inspection	Used proportion of theoretical service life D:	Remaining theoretical service life	Name of the expert	Signature	Comment	Name of the approved inspector	Signature
"i"			Km _i	[h]	[h]	[h]	[h]	[h]	$S_i = \frac{K_{m_i} \times T_i}{K_{m_i}}$ [h]	$D_i = D_{i-1} - S_i$ [h]					

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
- K_m = Factor of the load spectrum used to calculate the winch.
This factor is given in the operating manual.
- K_{m_i} = Factor of the load spectrum in the inspection interval "i" according to section 2.1
- T_i = Effective operating hours in the inspection interval "i" according to section 2.2

(*) Copy the last line of the previous page to the following page.

