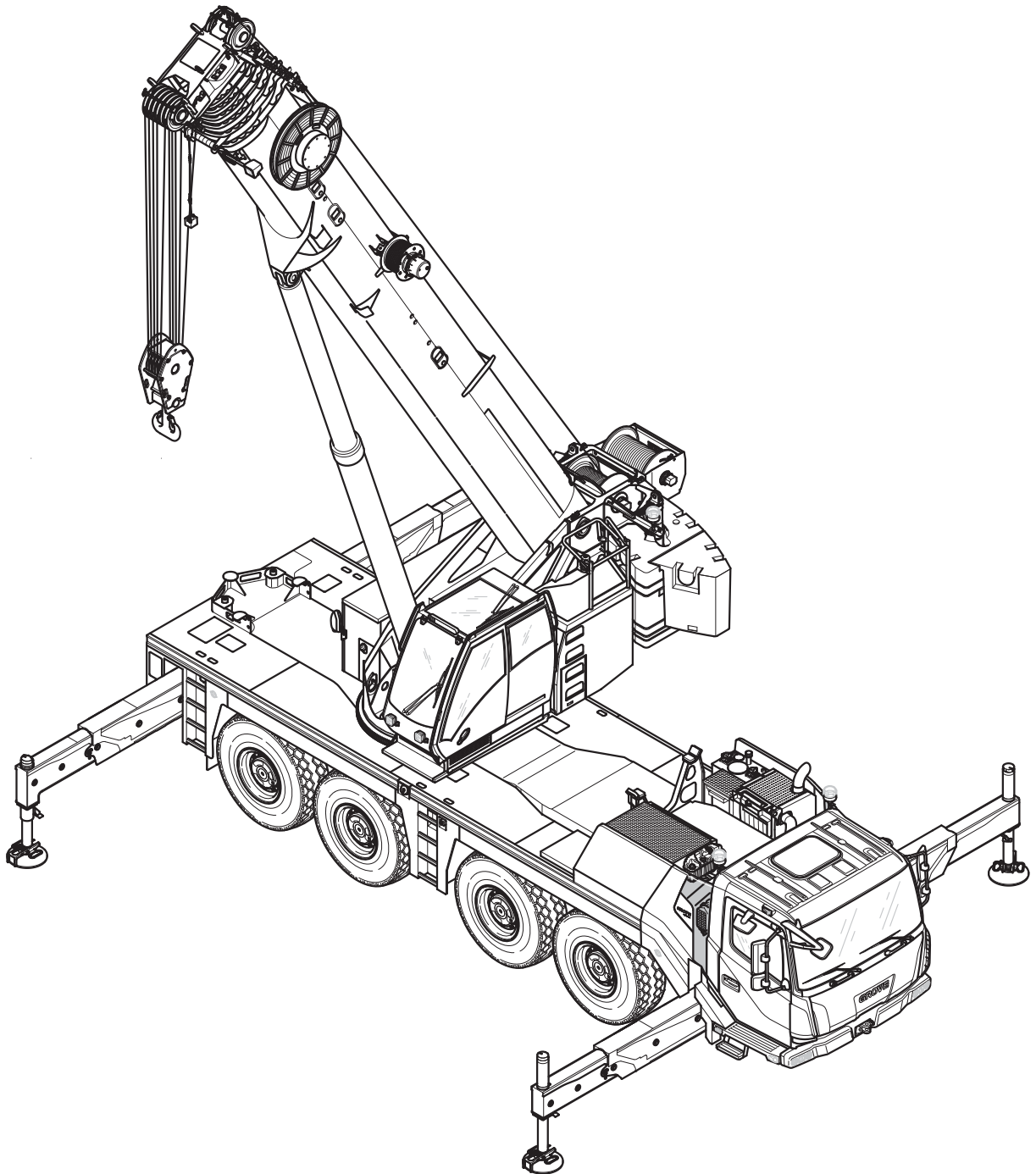


Grove GMK 4100L-1

Maintenance manual



3 302 364 en

25.11.2016

Grove

Manitowoc

National Crane

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Manitowoc

Important note

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25.11.2016


1

Additional maintenance work on the main boom

Maintenance personnel

The maintenance work on the telescoping cylinder described here (clean, check, lubricate) can be performed by the local maintenance personnel.

Customer service engineers

If the local maintenance personnel discover any damage then trained customer service engineers from **Manitowoc Crane Care** or an authorised GROVE dealer must be requested to perform repairs on the telescoping cylinder and check the entire locking system;  *Note – Having the telescoping cylinder repaired, p. 1 - 9.*


1.1

Maintenance plan

1.1.1

Maintenance plan M 12

M 12

Maintenance work on the SUPERSTRUCTURE: Every twelve months / after 1 000 oper. hrs.	
Main boom – Check/lubricate the telescoping cylinder	 p. 1 - 3

Blank page


1.2

Main boom

1.2.1

Check/lubricate the telescoping cylinder

M 12



- Consult the *Maintenance manual* supplied for information on prerequisites, and observe the safety instructions outlined in Chapter *Main boom*.
- Familiarise yourself with the slinging points for personal safety equipment on the GMK 4100L-1 truck crane;  *Operating manual*.

Grease, Tools

Designation	GROVE part no.
PAL1 lubricant paste, 25 kg bucket	02314698

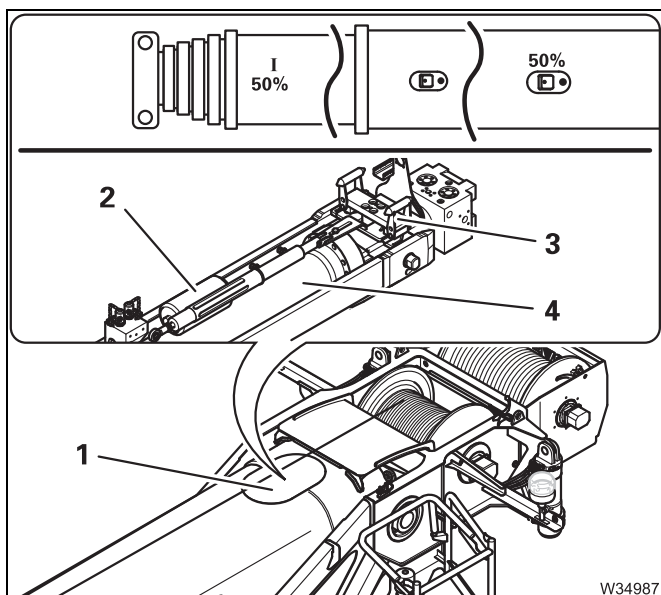
- Brush.
- Feeler gauge.

Prerequisites

- The truck crane must be level.
- The hook block must be unreeved.
- The main boom must be completely retracted and lowered into horizontal position.
- A rigging mode must be created with a telescope status that satisfies the lifting capacity table necessary for maintenance;  *Lifting capacity table*; Section *Telescoping sequences* for lubricating the main boom.
- The RCL code for the current rigging mode must be entered.
- Personal safety equipment to secure you from falling is used;  *Operating manual*.



Extending



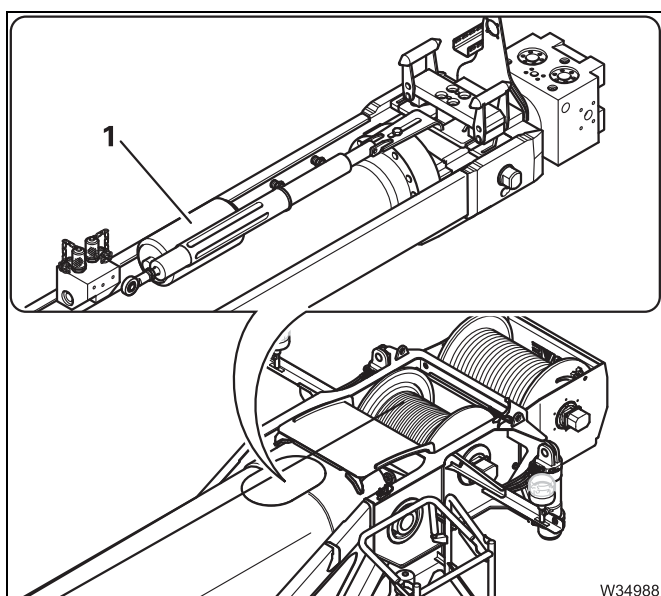
- Telescope the telescopic section I to 50% and mechanically lock the telescopic section I in the basic section; *Operating manual*.
- Pull out the telescoping cylinder (4) towards the rear; *Operating manual*.
- Switch the engine off and secure against unauthorised use of the truck crane.
- Secure yourself to prevent yourself from falling.
- Remove the lid (1) – the pressure accumulator (2) and head (3) of the telescoping cylinder (4) are now accessible.

Checking the pressure accumulator



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 pressure accumulator (1) is located on the telescoping cylinder.

Filling pressure at 20 °C (68 °F) – 10 bar (145 psi).

Tolerances:

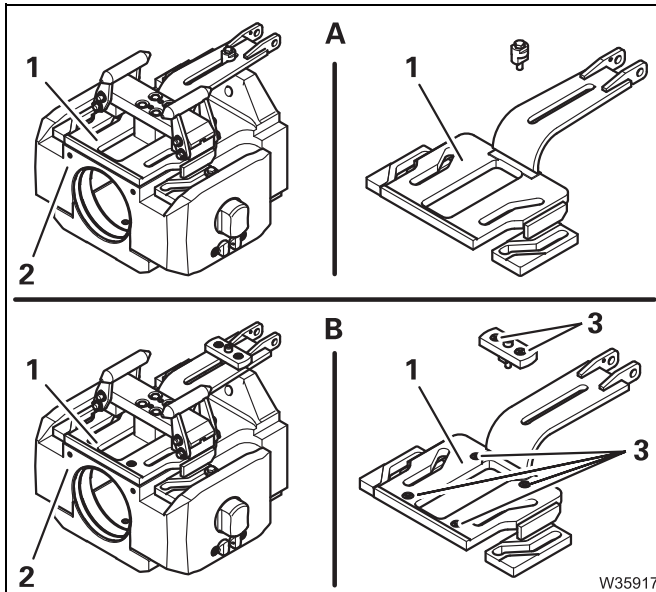
Maximum value: 10 bar (145 psi)

Minimum value: 9 bar (131 psi)

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

Head – variants

Two different variants of the head can be fitted depending on the truck crane equipment.

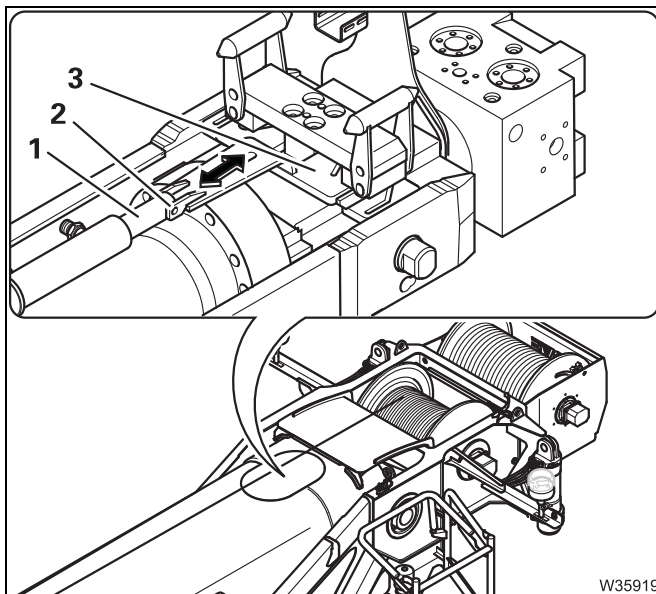


Type (A) – The connecting link (1) slides on the head (2) on metal surfaces.

Type (B) – The connecting link (1) slides on the head (2) over six plastic wear pads (3).

- Check whether type (A) or type (B) is installed on your truck crane.

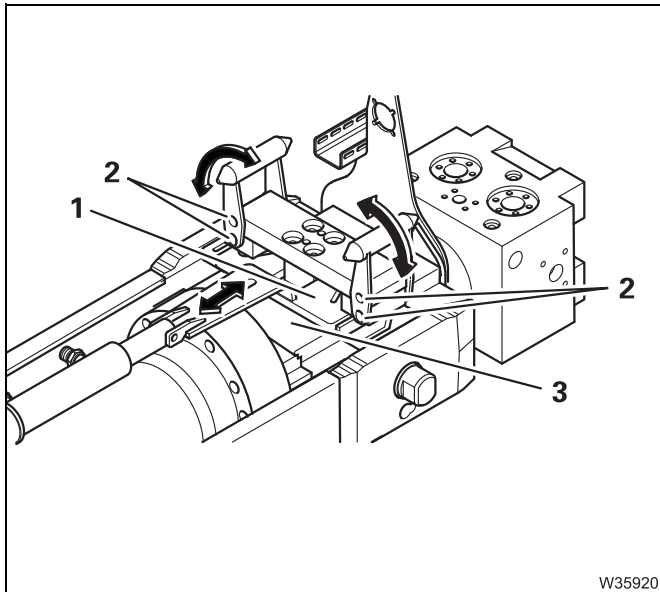
Check/lubricate the head



Disconnect the locking cylinder

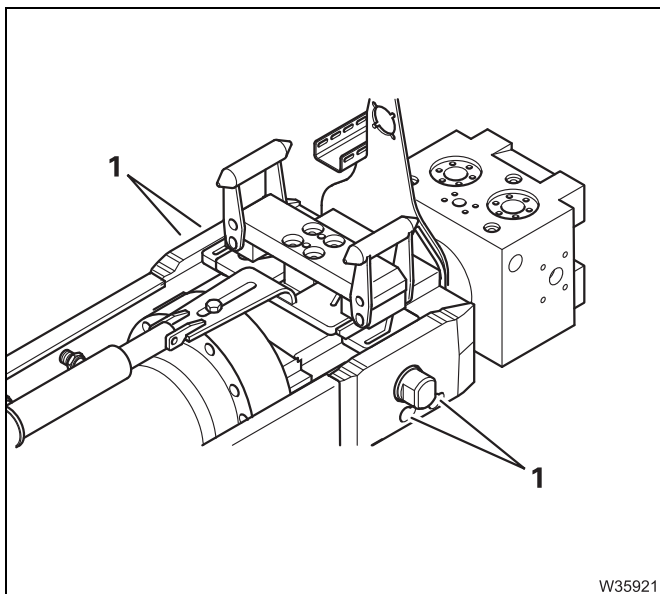
- Pull out the pin (2) and disconnect the locking cylinder (1) from the connecting link (3). This allows the connecting link (3) to be manually moved to both end positions.





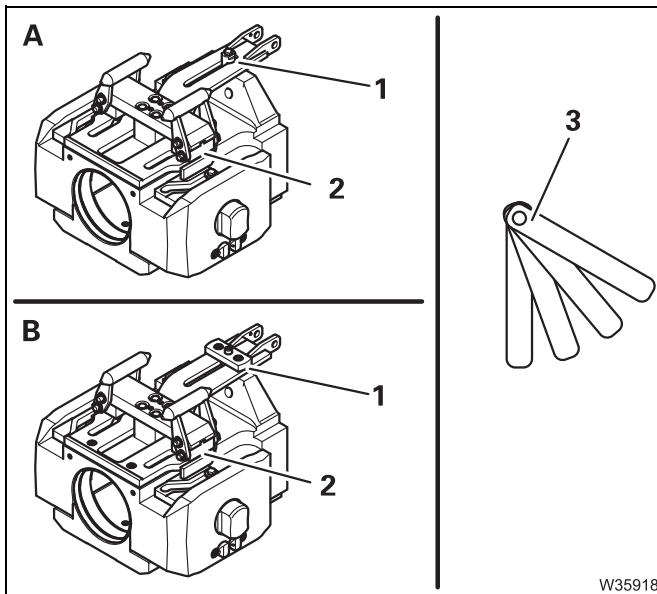
Cleaning

- Clean the head (3) with a clean cloth.
- Clean the running surfaces of the connecting link (1) and the guides and joints of the lever (2).
- Check all moving parts and running paths for damage.
- Check the sensor electrical connectors for damage.
- Manually push the connecting link (1) multiple times to both end positions. The movement must be soft and free. The stroke of the connecting link must be 44 mm (1.7 in) .



Check the tappet

- Check the tappet (1) for wear.
- Manually press the tappet (1) down against the spring force.
- Release the tappet (1) – the spring force must return the tappet to the end position. The stroke of the tappet must be 8 mm (0.3 in) .



Checking the gap dimensions

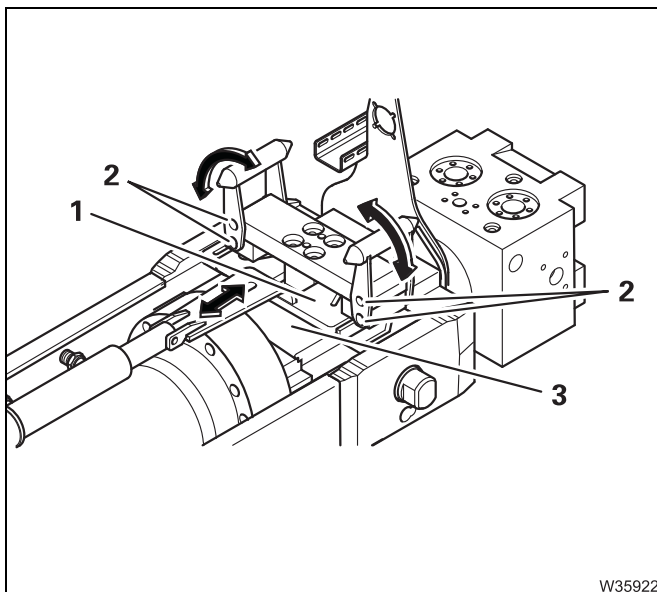
Head	Measuring point	
	(1)	(2)
Type (A)	1.3 mm up to 2.2 mm (0.05 in to 0.08 in)	0.3 mm up to 1.2 mm (0.01 in to 0.05 in)
Type (B)	0.15 mm up to 0.25 mm (0.006 in to 0.010 in)	0.15 mm up to 0.25 mm (0.006 in to 0.010 in)

- Check the gap dimensions at measuring points (1) and (2) using a feeler gauge (3).

If the gap dimensions are too large or too small

- Have the head repaired by **Manitowoc Crane Care** or an authorised GROVE dealer; **Note** – Having the telescoping cylinder repaired, p. 1 - 9.

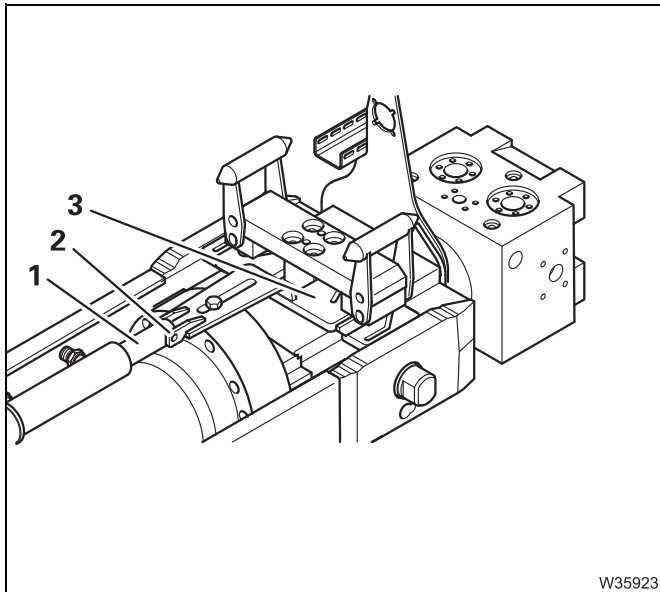
If the gap dimensions are correct



Lubricate the head

- Lubricate the running surfaces of the head (3), the connecting link (1) and the guides and joints of the lever (2) using a brush (PAL 1 lubricant paste).
- Manually push the connecting link (1) multiple times to both end positions to distribute the lubricant paste. The movement must be soft and free.

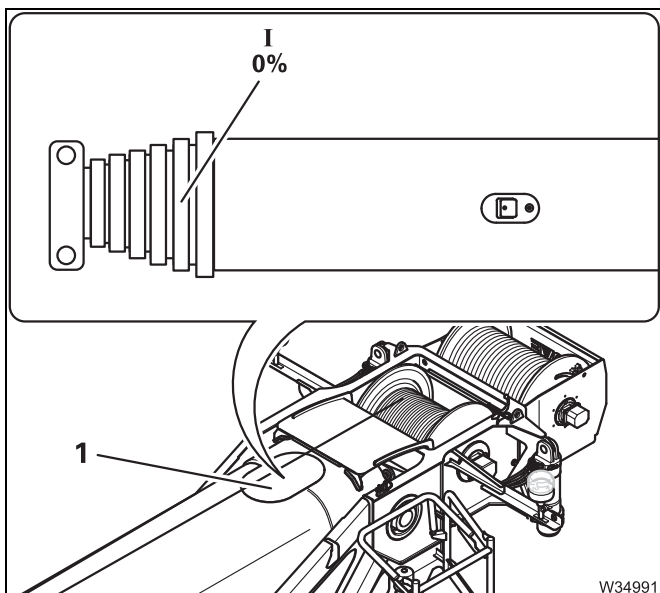




Connecting the locking cylinder

- Reconnect the locking cylinder (1) to the connecting link (3) and fasten it with the pin (2).

Retracting



- Secure yourself to prevent yourself from falling.
- Fasten the lid (1).
- Start the engine.
- Retract the telescopic section I to 0% and mechanically lock the telescopic section I in the basic section; *Operating manual*.


Testing the telescoping cylinder

- Telescope all telescopic sections into different positions one after another to check for correct operation of the telescoping cylinder; *Operating manual*.
- You will need to put the truck crane out of service if malfunctions occur in the telescoping system.
- Have any damage repaired immediately by **Manitowoc Crane Care** or an authorised GROVE dealer.

1.2.2**Note – Having the telescoping cylinder repaired**

The supplied maintenance manual GMK 4100L-1 already specifies that you must have the locking system on the main boom inspected annually (**M12**) by **Manitowoc Crane Care** or an authorised GROVE dealer.

Especially the head of the telescoping cylinder is checked and adjusted during this annual maintenance work. Components can be replaced if necessary. The gap dimensions are corrected with shims if necessary.

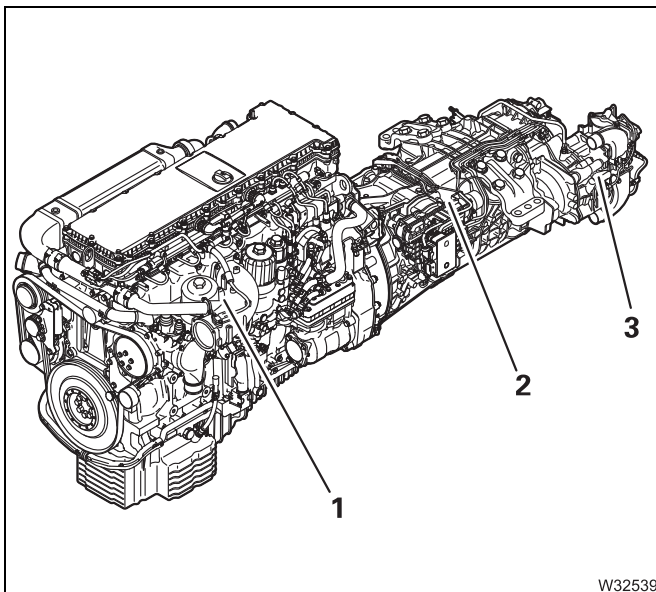
Conversion from head type (**A**) to type (**B**) is possible after consultation with **Manitowoc Crane Care**;  *Head – variants*, p. 1 - 5.

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1 Transmission – shorter maintenance intervals

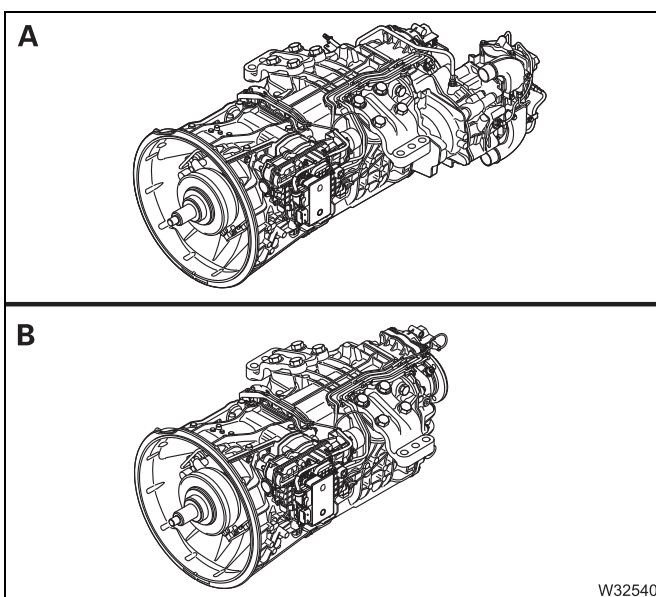
1.1 Engine-transmission unit – overview

GMK4100L-1,
GMK5150,
GMK5150L



Engine-transmission unit

- Diesel engine type OM 470 (1),
- Transmission (2),
- Water retarder SWR (3);
are the rear of the transmission (additional equipment);
SWR = Secondary Water Retarder.



Transmission

The automatic transmission has 16 speeds and the type designation G 280-16.

(A) transmission **with** Water Retarder **SWR**

(B) transmission **without** Water Retarder **SWR**



1.2 Shorter maintenance intervals

Maintenance information

- Perform the maintenance work as described in the maintenance manual supplied.
- Also observe the **shorter maintenance intervals**;
 - ▣▣▣▣► *Transmission oil change,*
 - ▣▣▣▣► *Replace coolant.*

1.2.1 Transmission oil change

Y 3

- Change the oil every **three** years (**Y 3**).

1.2.2 Replace coolant

Y 2/3

In the engine manufacturer's documentation supplied, it is recommended to replace the coolant in the radiator circuit of the diesel engine every three years (**Y3**); ▣▣▣▣► *Engine manufacturer's documentation.*

If a transmission with Water Retarder SWR is present, you must replace the coolant after two years (**Y 2**).

Transmission with SWR

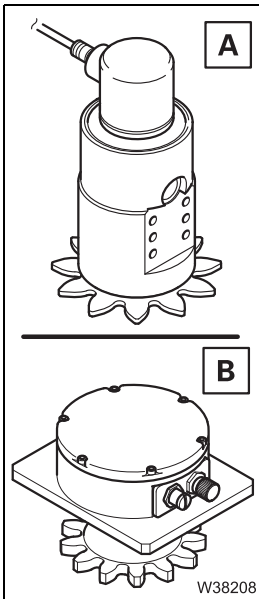
- Replace the coolant every **two** years (**Y 2**).

Transmission without SWR

- Replace the coolant every **three** years (**Y 3**).

Slewing angle sensor Version (A) and (B)

Depending on the type of truck crane, a slewing angle sensor of type (A) or (B) can be installed on the slewing bearing.



Version (A)

For this version, the specifications in the supplied *maintenance manual* apply.

Version (B)

Deviating from the specifications in the *maintenance manual* supplied, this version of the slewing angle sensor is maintenance-free.

Only use the telephone number **04160234** if in need of spare parts.

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1

Additional maintenance work on the rope attachment point

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

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

1.1

Main boom

1.1.1

Lubricating the rope attachment point

M 3

Grease, tools

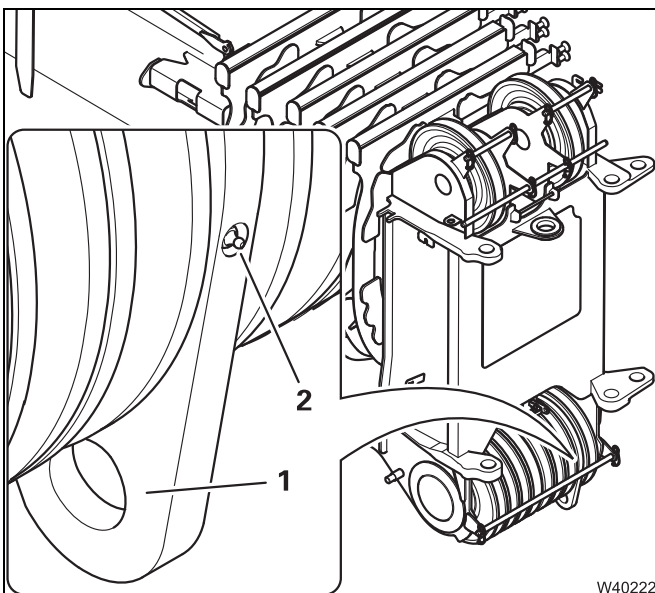
Lubricating grease	Designation to DIN 51502	Specifications Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set; supplied ladder.

Prerequisites

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

Lubrication



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

If you discover any damage

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

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Contents:

- 1 General instructions**
 - 2 Safety and environmental protection**
 - 3 Cleaning**
 - 4 Run-in regulations**
 - 5 Maintenance overview**
 - 6 Lubricants and consumables**
 - 7 Maintenance work on the carrier**
 - 8 Maintenance work on the superstructure**
 - 9 Longer out of service periods**
 - 10 Torques**
 - 11 Spare parts required for maintenance**
- Appendix**

**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	Instructions for using the maintenance manual	1 - 1
1.2	Warnings and symbols	1 - 1
1.3	Maintenance instructions	1 - 2
1.4	Instructions regarding the electronic controls	1 - 4
1.5	Safety instructions for welding work	1 - 4
1.6	Definition of direction references	1 - 5
1.7	Conversion table for US measuring units	1 - 6

1

General instructions

1.1

Instructions for using the maintenance manual

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

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

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



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

1.2

Warnings and symbols

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



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



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



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

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





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



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

1.3

Maintenance instructions

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

Repair work also requires:

- appropriate workshop equipment
- special tools and
- spare parts approved by **Manitowoc Crane Group Germany GmbH**.

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

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

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

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

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

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

A few **general maintenance instructions**:

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



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

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

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

Please contact **Manitowoc Crane Care**.

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

1.4

Instructions regarding the electronic controls

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

- The service life of the EEPROM allows 10^6 accesses. Data is retained for 10 years.
- Some conventional capacitors in the control system have a service life of 10 years.

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

1.5

Safety instructions for welding work

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

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

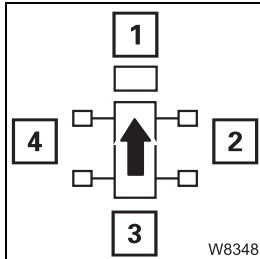
1.6

Definition of direction references

Basic rule

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

On the carrier

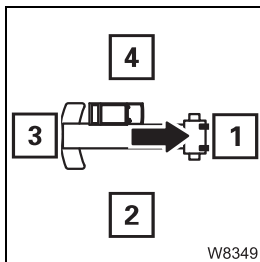


The driver's cab is always at the front, which means that:

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

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

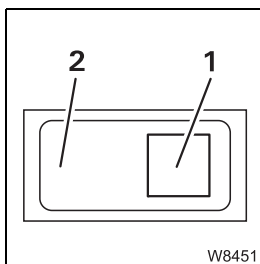
On the superstructure



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

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

Switches and buttons



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

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

- Down:** If (1) press – next to the symbol
Up: If (2) press – opposite the symbol

1.7**Conversion table for US measuring units**

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

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

2 Safety and environmental protection

2.1	Safety rules	2 - 1
2.1.1	Securing against unauthorised use	2 - 3
2.2	Handling substances which are harmful to the environment.	2 - 4
2.3	Disposal of the truck crane.	2 - 6

2

Safety and environmental protection

2.1

Safety rules

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

Observe the following safety rules:

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



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

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

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

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

2.1.1

Securing against unauthorised use

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



Danger due to unauthorised use.

Always stow away the hand-held control in 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 about
 - when
 - why
 - and by whom

the truck crane was secured to prevent unauthorised use.

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

2.2

Handling substances which are harmful to the environment

Which substances are harmful to the environment?

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

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

Using suitable equipment

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

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

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

Filling and draining

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

Separate collection and storage

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

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

Disposal

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

2.3

Disposal of the truck crane

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

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

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

Proper disposal

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

After disposal

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

3 Cleaning

3.1	Overview of assemblies easily damaged when cleaning	3 - 2
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3

Cleaning

During the first 3 months

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

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

After the first 3 months

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



Risk of accidents from a misdirected high pressure water jet.

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

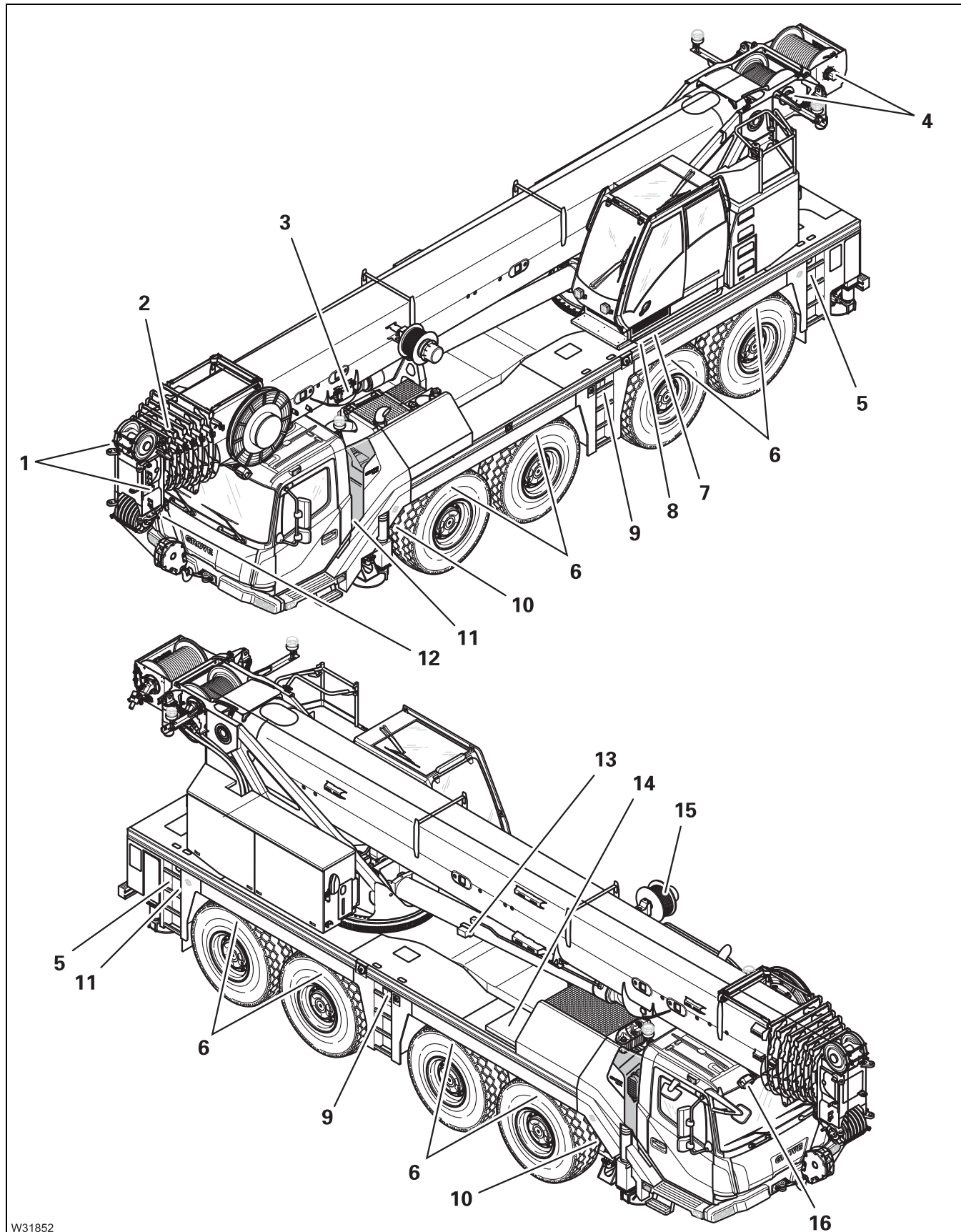
Always wear a face guard when cleaning the truck crane with high-pressure and steam-jet cleaning equipment.

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

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

- After cleaning with high-pressure or a steam jet equipment, activate intermediate lubrication on the central lubrication system (▣▣▣▣▶ *Triggering intermediate lubrication*, p. 7 - 118). Lubricate all remaining lubricating points using a grease gun.

3.1 Overview of assemblies easily damaged when cleaning




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- 1 Electrical connections on the boom head
- 2 Telescopic slide faces
- 3 Angle data transmitter
- 4 Lowering limit switch
- 5 Steering computer
- 6 Suspension struts
- 7 Slewing angle sensor
- 8 Heating/air conditioning system under the crane cab
- 9 Control units for outriggers
- 10 Steering angle sensor
- 11 Carrier electronic control equipment
- 12 Lifting limit switch
- 13 Pressure sensors on the derricking cylinder
- 14 Battery box
- 15 RCL length data transmitter
- 16 Spotlights, pivoting



Assemblies at risk of damage on the lattice extension;  *Operating Instructions Lattice Ex-tension.*

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4 Run-in regulations

4

Run-in regulations

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

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

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

Operating hours (oper. hrs.)	Driven km (mi)	Additional maintenance work on the CARRIER
after 4 and 24		Check the V-belt on the second alternator (additional equipment); ■■■► <i>Checking the V-belt tension, p. 7 - 23.</i>
	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 - 140.</i>
during the first 100		Check the hydraulic oil filters on a weekly basis; ■■■► <i>Cleaning the magnetic rods, p. 7 - 99,</i> ■■■► <i>Changing the hydraulic oil filter, p. 7 - 111.</i>
after 100	after 1,000 (650)	Change the drive oil; ■■■► p. 7 - 46 for the transfer case, ■■■► p. 7 - 57 for the axle centre drives, ■■■► p. 7 - 62 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
after 50	Tighten the clips on the coolant hoses; ■■■▶ <i>Special torques</i> , p. 10 - 2.
during the first 100	Check the hydraulic oil filter every week, and change it if necessary; ■■■▶ <i>Cleaning the magnetic rods</i> , p. 8 - 34, ■■■▶ <i>Changing the hydraulic oil filter</i> , p. 8 - 39.
after 100	Tighten the bolts on the slewing bearing; ■■■▶ <i>Checking the screws</i> , p. 8 - 21, ■■■▶ <i>Special torques</i> , p. 10 - 2.
after 100	Hook blocks; ■■■▶ <i>Lubricating</i> , p. 8 - 71.
after 200	First oil change on the hoists; ■■■▶ <i>Changing the oil/checking the oil</i> , p. 8 - 11.
after 1,000 or after 12 months at the latest	Second oil change on the hoists; ■■■▶ <i>Changing the oil/checking the oil</i> , p. 8 - 11.
after 200	Change the slewing gear oil; ■■■▶ <i>Changing the oil/checking the oil</i> , p. 8 - 19.
after 200	Change the oil on the angle gear (with the power transmission from the carrier to the superstructure at the centre of rotation); ■■■▶ p. 7 - 49.

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 given in table form, divided into

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

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

Check hydraulic oil level;  p. 7 - 97.



Checking the hydraulic oil level is described in Chapter 7, the section starts on page 7 - 97.

5.1

Maintenance intervals

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

The next maintenance must be carried out after

- a specified **time (maintenance interval)** or
- a specified number of **km driven (mi)** or
- a specified number of **operating hours (oper. hrs.)** or
- an **indication** on the *CCS* display in the driver's cab;  p. 7 - 11 or
- an **indication** on the *CCS* display in the crane cab;  p. 8 - 7.



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

- The **driven km (or mi)** can be taken from the speedometer.
- You can individually call up the **Operating hours (oper. hrs.) of the engine and power units** on the *CCS* display.

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

Maintenance plans	Maintenance interval	Driven km (mi) (carrier)	Engine operating hours (oper. hrs.)
D	daily/before putting into operation	—	—
W	Weekly	—	—
M 1	monthly	approx. 2,000 (approx. 1,240)	approx. 100
M 3	every three months	5,000 – 6,000 (3,100 – 3,730)	250
M 6	every six months	10,000 – 12,500 (6,210 – 7,770)	500
M 12	every 12 months	20,000 – 25,000 (12,430 – 15,530)	1,000
Y 2	every 24 months	40,000 – 50,000 (25,000 – 31,000)	2,000
Y 3	every 36 months	—	3,000
Y 5	every 60 months	100,000 (62,000)	5,000
Y 6	every 72 months	—	6,000
Y 10	every 120 months	200,000 (124,000)	12,000

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

5.2

Maintenance plans

The descriptions of specific maintenance work in the maintenance plans **D**, **W**, **M 1** to **M 12** and **Y 2** to **Y 10** have been 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 abbreviations (**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 (ltr) (and US gallons (gal)) (the exact oil amounts can always be determined by the oil level inspection holes, the oil dipsticks or the oil level indicators) *Lubricant applications list*, p. 6 - 3.



Items that are only available with additional equipment are designated accordingly in 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 *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 - 16</p> <p>▮▮▮▮ p. 7 - 17</p>
Fuel system – Draining off water from fuel filter 1	▮▮▮▮ p. 7 - 28
Exhaust system with exhaust emission control – Checking the AdBlue tank level	▮▮▮▮ p. 7 - 34
Wheels – Checking the tyres for damage	▮▮▮▮ p. 7 - 67
Vehicle brake – Checking the wear display	▮▮▮▮ p. 7 - 75
Steering – Checking the steering monitoring – Checking for leaks	<p>▮▮▮▮ p. 7 - 89</p> <p>▮▮▮▮ p. 7 - 91</p>
Hydraulic system – Checking the oil level	▮▮▮▮ p. 7 - 97
Electrical system – Checking the lighting and indicators	▮▮▮▮ p. 7 - 119

Maintenance work on the SUPERSTRUCTURE: Daily/before putting into operation	
Hydraulic system – Checking the oil level	▣▣▣▣▶ p. 8 - 31
Hoist ropes – Checking the winding	▣▣▣▣▶ p. 8 - 51
Electrical system – Checking the lighting and indicators	▣▣▣▣▶ p. 8 - 73

5.2.2

Maintenance plan W

W

Maintenance work on the CARRIER: Weekly	
Engine – General inspection	▣▣▣▣▶ p. 7 - 18
Transmission – General inspection	▣▣▣▣▶ p. 7 - 40
Transfer case – General inspection	▣▣▣▣▶ p. 7 - 45
Angle gear – General inspection	▣▣▣▣▶ p. 7 - 50
Axle lines – General inspection	▣▣▣▣▶ p. 7 - 55
Wheels – Checking the tyre pressure	▣▣▣▣▶ p. 7 - 68
Compressed air system – Draining water from the compressed air system – Checking for leaks	▣▣▣▣▶ p. 7 - 93 ▣▣▣▣▶ p. 7 - 94
Hydraulic system – Checking the hydraulic hoses – Checking for leaks	▣▣▣▣▶ p. 7 - 98 ▣▣▣▣▶ p. 7 - 98
Central lubrication system – Checking the level	▣▣▣▣▶ p. 7 - 115
Other maintenance work – Checking the windscreen washing system	▣▣▣▣▶ p. 7 - 139

















W

Maintenance work on the SUPERSTRUCTURE: Weekly	
Hoists – Checking the oil level – General inspection – Checking the hoist brake	<p>▣▣▣▣▶ p. 8 - 9</p> <p>▣▣▣▣▶ p. 8 - 10</p> <p>▣▣▣▣▶ p. 8 - 10</p>
Slewing gear – Checking the oil level – Checking for leaks	<p>▣▣▣▣▶ p. 8 - 15</p> <p>▣▣▣▣▶ p. 8 - 16</p>
Hydraulic system – Checking the hydraulic hoses – Checking the ventilation filter – Checking for leaks	<p>▣▣▣▣▶ p. 8 - 32</p> <p>▣▣▣▣▶ p. 8 - 32</p> <p>▣▣▣▣▶ p. 8 - 33</p>
Hoist ropes – Checking the hoist ropes	▣▣▣▣▶ p. 8 - 52
Central lubrication system – Checking the level	▣▣▣▣▶ p. 8 - 69
Other maintenance work – Checking the windscreen washing system	▣▣▣▣▶ p. 8 - 79

5.2.3

Maintenance plan M 1

M 1

Maintenance work on the CARRIER: monthly/after approx. 2,000 km (approx. 1,240 mi)	
Engine – Notes;  <i>Engine manufacturer's documentation</i>	 p. 7 - 13
Exhaust system with exhaust emission control – Check the exhaust system for external damage	 p. 7 - 35
Transfer case – Checking the oil level	 p. 7 - 45
Angle gear – Checking the oil level	 p. 7 - 50
Axle lines – Axle centre drives – checking the oil level – Final drives – Checking the oil level – Lubricating the Cardan shafts in the axle lines	 p. 7 - 55  p. 7 - 61  p. 7 - 64
Wheels – Checking that the wheel nuts are tight	 p. 7 - 69
Suspension – Suspension struts – Checking the oil level – Suspension struts – checking the fastening	 p. 7 - 83  p. 7 - 85
Electrical system – Checking the batteries	 p. 7 - 120
Air-conditioning system – Checking the air-conditioning system	 p. 7 - 127
Towbar coupling – Lubricating the towbar coupling	 p. 7 - 131
Other maintenance work – Lubricating the outrigger beams – Checking the auxiliary heater	 p. 7 - 140  p. 7 - 141
















M 1

Maintenance work on the SUPERSTRUCTURE: Monthly/after approx. 100 operating hours	
Main boom – Greasing the piston rod of the derricking cylinder	▣▣▣▣▶ p. 8 - 45
Air conditioning system – Checking the air conditioning system – Cleaning the condenser fins	▣▣▣▣▶ p. 8 - 75 ▣▣▣▣▶ p. 8 - 75
Other maintenance work – Checking the auxiliary heater	▣▣▣▣▶ p. 8 - 80

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 – Replacing fuel filter 1	 p. 7 - 29
Vehicle brake – Checking disc brakes	 p. 7 - 76
Suspension – Forced lever – checking correct functioning	 p. 7 - 86
Hydraulic system – Cleaning the magnetic rods	 p. 7 - 99
Electrical system – Checking the charge level of the batteries – Charging the batteries using the battery charger – Check the external starting socket	 p. 7 - 122  p. 7 - 124  p. 7 - 125
Towbar coupling – Checking the bearing – Checking the cotter pin – Checking the lower bushing – Checking the initial tension of the springs – Checking the support ring – Checking the function of the coupling jaw/ resetting the middle position	 p. 7 - 133  p. 7 - 134  p. 7 - 135  p. 7 - 135  p. 7 - 136  p. 7 - 136

M 3

Maintenance work on the SUPERSTRUCTURE: every three months/after 250 oper. hrs.	
Slewing bearing – Checking the screws	▣▣▣▣▶ p. 8 - 21
Hydraulic system – Cleaning the magnetic rods	▣▣▣▣▶ p. 8 - 34
Main boom – Lubricating the telescopic sections – Lubricating the sheaves	▣▣▣▣▶ p. 8 - 46 ▣▣▣▣▶ p. 8 - 50
Hoist ropes – Lubricating the hoist rope	▣▣▣▣▶ p. 8 - 53
Hook blocks – Checking the sheaves	▣▣▣▣▶ p. 8 - 71

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 - 46
Angle gear – Changing the oil and the oil filter	■■■■▶ p. 7 - 52
Axle lines – Lubricating longitudinal Cardan shafts	■■■■▶ p. 7 - 65
Wheels – Changing the wheels	■■■■▶ p. 7 - 70
Air-conditioning system – Checking hoses	■■■■▶ p. 7 - 127

M 6

Maintenance work on the SUPERSTRUCTURE: every six months/after 500 oper. hrs.	
Slewing gear – Checking the slewing gear brake	▣▣▣▣▶ p. 8 - 16
Slewing bearing – Lubricating the gear teeth – General inspection – Measuring tilting play	▣▣▣▣▶ p. 8 - 25 ▣▣▣▣▶ p. 8 - 27 ▣▣▣▣▶ p. 8 - 28
Cable drums and slewing angle sensor – Maintenance of the slip ring assemblies	▣▣▣▣▶ p. 8 - 65
Air conditioning system – Checking hoses	▣▣▣▣▶ p. 8 - 76

5.2.6

Maintenance plan M 12

M 12

Maintenance work on the CARRIER: every 12 months/after 20,000 – 25,000 km (12,430 – 15,530 mi)	
Engine – Notes; ■■■► <i>Engine manufacturer's documentation</i> – Have the radiator checked/cleaned – Checking the V-belt tension	■■■► p. 7 - 13 ■■■► p. 7 - 18 ■■■► p. 7 - 23
Fuel system – Replacing fuel filter 2	■■■► p. 7 - 31
Exhaust system with exhaust emission control – Having the AdBlue system checked	■■■► p. 7 - 37
Transmission – Checking the oil level	■■■► p. 7 - 41
Axle lines – Axle centre drives – changing the oil – Final drives – Changing the oil	■■■► p. 7 - 57 ■■■► p. 7 - 62
Suspension – Pressure accumulator – checking the gas pressure	■■■► p. 7 - 87
Compressed air system – Replacing the filter cartridge of the compressed air drier	■■■► p. 7 - 95
Hydraulic system – Changing the ventilation filter – Taking oil samples: depending on the oil sample test results: – Changing the hydraulic oil – Changing the hydraulic oil filter	■■■► p. 7 - 101 ■■■► p. 7 - 102 ■■■► p. 7 - 107 ■■■► p. 7 - 111
Air-conditioning system – Cleaning the condenser fins – Checking the entire air-conditioning system – Changing the pollen filter	■■■► p. 7 - 128 ■■■► p. 7 - 128 ■■■► p. 7 - 130
Other maintenance work – Lubricating the cab door – Lubricating the connecting and socket pins – Renewing the corrosion protection	■■■► p. 7 - 141 ■■■► p. 7 - 142 ■■■► p. 7 - 143

M 12

Maintenance work on the SUPERSTRUCTURE: every 12 months/after 1,000 oper. hrs.	
Hoists – Changing the oil/checking the oil	▣▣▣▣▶ p. 8 - 11
Slewing gear – Changing the oil/checking the oil	▣▣▣▣▶ p. 8 - 19
Slewing bearing – Lubricating the locking of turntable	▣▣▣▣▶ p. 8 - 30
Hydraulic system – Changing the ventilation filter – Pressure accumulator – checking the gas pressure – Taking oil samples: depending on the oil sample test results: – Changing the hydraulic oil – Changing the hydraulic oil filter	▣▣▣▣▶ p. 8 - 36 ▣▣▣▣▶ p. 8 - 37 ▣▣▣▣▶ p. 8 - 37 ▣▣▣▣▶ p. 8 - 42 ▣▣▣▣▶ p. 8 - 39
Main boom – Checking the locking system	▣▣▣▣▶ p. 8 - 50
Hook blocks – Lubricating	▣▣▣▣▶ p. 8 - 71
Air conditioning system – Checking the entire air conditioning system – Changing the pollen filter	▣▣▣▣▶ p. 8 - 76 ▣▣▣▣▶ p. 8 - 78
Other maintenance work – Lubricating the crane cab door – Lubricating the step – Lubricating the connecting and socket pins – Renewing the corrosion protection	▣▣▣▣▶ p. 8 - 81 ▣▣▣▣▶ p. 8 - 82 ▣▣▣▣▶ p. 8 - 83 ▣▣▣▣▶ p. 8 - 84

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 - 25
Other maintenance work – Having the fire extinguisher checked	■■■■► p. 7 - 145

Maintenance work on the SUPERSTRUCTURE: every 24 months/after 2,000 oper. hrs.	
Other maintenance work – Having the fire extinguisher checked	■■■■► p. 8 - 86

5.2.8

Maintenance plan Y 3

Y 3

Maintenance work on the CARRIER: every 36 months	
No maintenance work in this period. The long-term intervals always include the short-term intervals.	

Maintenance work on the SUPERSTRUCTURE: every 36 months/after 3,000 oper. hrs.	
Hoists – Having a partial inspection carried out	■■■■► p. 8 - 13

5.2.9

Maintenance plan Y 5

Y 5

Maintenance work on the CARRIER: every 60 months/ 100,000 km (62,000 mi)	
– Have the Cardan shaft between the transmission on the engine and the transfer case replaced by Manitowoc Crane Care or an authorised GROVE dealer.	
Transmission – Changing the oil	➡ p. 7 - 42

Maintenance work on the SUPERSTRUCTURE: every 60 months/after 5,000 oper. hrs.	
– Have both the Cardan shafts on the angle gear replaced by Manitowoc Crane Care or an authorised GROVE dealer.	
Cable drums and slewing angle sensor – Lubricating the slewing angle sensor	➡ p. 8 - 67

5.2.10

Maintenance plan Y 6

Y 6

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

Maintenance work on the SUPERSTRUCTURE: every 72 months/after 6,000 oper. hrs.	
Hoists – Having a general inspection carried out	➡ p. 8 - 13

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 construction – Check the load-bearing steel construction. For further information, please contact Manitowoc Crane Care .	

Maintenance work on the SUPERSTRUCTURE: every 120 months/after 12,000 oper. hrs.	
Electrical system – Have the battery on the electronics board replaced	▣▣▣▣▶ p. 8 - 74
Steel construction – Check the load-bearing steel construction. For further information, please contact Manitowoc Crane Care .	
Rated capacity limiter (RCL) – Have the RCL checked by Manitowoc Crane Care .	

5.3

Periodic inspections

Your GMK 4100L-1 truck crane has been inspected before delivery.

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

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

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

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

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

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

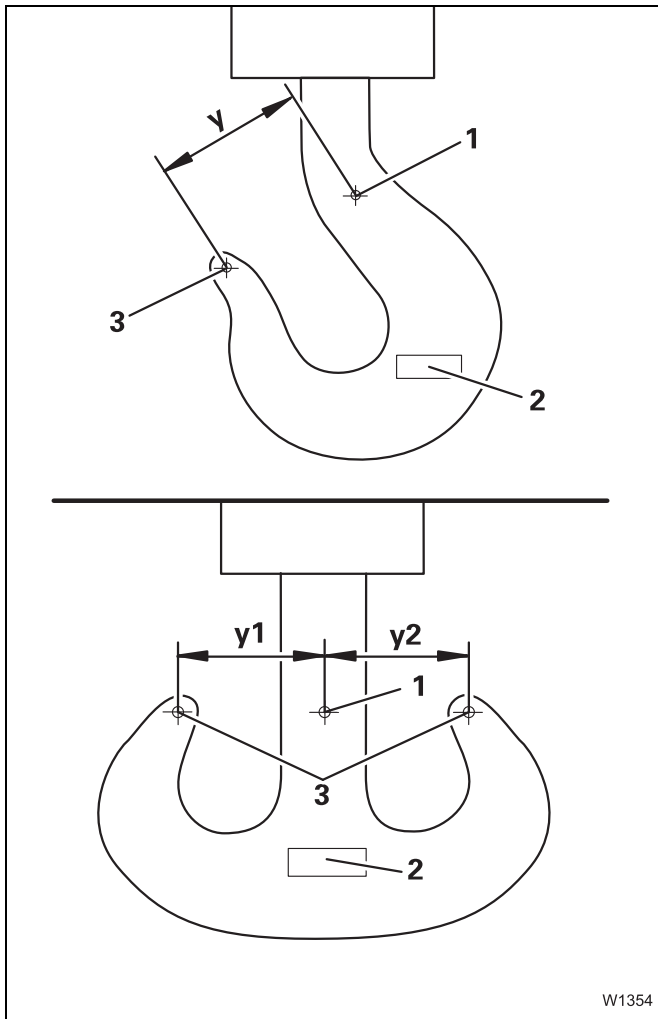
Prior to carrying out welding work on the truck crane, observe the ▣▣▣▣▶ *Safety instructions for welding work*, p. 1 - 4.

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

5.3.1 Load hook inspection

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

The hook opening must not have increased by more than 10% of the original dimension y , $y1$, $y2$.



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

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

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



Risk of accidents due to the load falling.

Hook blocks with deformed load hooks are no longer safe to use.
The load hooks could break and drop the load.
Deformed load hooks must always be replaced.

5.4

Measures required for winch monitoring



Also observe the information on the general inspection of the hoists;
▶▶▶ p. 8 - 13.

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

5.4.1

Theoretical service life

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

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



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



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

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

5.4.2

Proportion of theoretical service life used

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

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

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

Determining the operating conditions (load spectrum)

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



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

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

Determining the effective operating hours T_i

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

- The effective winch operating hours T_i displayed in the *Operating hours menu*;  *Operating Instructions*.

Determining the proportion of theoretical service life used

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

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


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

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

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

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

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

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

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

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

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

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

Alternative provision

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

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

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

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

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

5.4.3

Example

A GMK 4100L-1 is equipped with a separate operating hours counter for the hoist and is classified by **Manitowoc Crane Group Germany GmbH** as follows:

Power unit group:	M 3
Load spectrum:	light L1, $K_m = 0.125$
Theoretical service life:	$D = 3,200$ h

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

1. Inspection (1st year)

The truck crane was used for assembly work during the previous year:
Load spectrum 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 after the first inspection therefore is:

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

Remaining theoretical service life:

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

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

2. inspection (2nd year)

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

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

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

$$S_i = \frac{0,5}{0,125} \times 480 \text{ h} = 1,920 \text{ h}$$

Remaining theoretical service life:

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

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

3. inspection (3rd year)

The truck crane was used for assembly work and occasional unloading work on docks: Load spectrum: 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 after the third 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 hoist winch)

Crane type: **GMK 3045**
 Factory number: **3045 42 06**
 First commissioned on: **10. 06. 1990**
 Serial number of the winch in accordance with the model plate: **13 301**
 Last general overhaul performed on: **.....**
 Winch design data (see operating manual):

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

Inspection interval no. (max. 1 year)	Date of first commissioning/ date of inspection	Operating conditions since the last inspection	Factor of the load spectrum Km_1	Operating hours of the entire crane [h]	Operating hours of the superstructure [h]	Operating hours of the superstructure since the last inspection [h]	Winch operating hours [h]	Operating hours T_1 of the winch since the last inspection [h]	Used proportion S_1 of the theoretical service life D: [h]	Remaining theoretical service life $D_1 = D - S_1$ [h]	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
 Km = Factor of the load spectrum used to calculate the winch.
 This factor is given in the operating manual.
 Km_1 = Factor of the load spectrum in the inspection interval "i" according to section 2.1
 T_1 = Effective working hours in the inspection interval "i" according to section 2.2
 (*) Copy the last line of the previous page to the following page.

6 Lubricants and consumables

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6

Lubricants and consumables

6.1

Lubricants

All lubricants that you require for

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

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

▣▣▣▣▶ *Lubricants list*, p. 6 - 2.

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

6.1.1






















Lubricants list

Consec. no.	GROVE-Part number	Lubricant type	Designation according to DIN 51502	Specification classification	Viscosity
1	03329588	Engine oil	HD - CD	MIL-L 2104 C DB 228.5	SAE 5 W-30
2	04162042	Gear oil		Fuchs Titan Cytrac MB Synth API-GL-4	SAE 75 W-90
3	00552891	Gear oil	C - LPF	MIL-L 2105 B API-GL-5	Hyp SAE 90 ISO - VG 220
4	01373344	Gear oil		MIL-L 2105 C API-GL-5	SHC 75 W-90
5	02310863	Gear oil		Rivolta S.K.D. 170	
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	04177395	Hydraulic oil	HVLP	Shell Tellus S2 VX 15	
9	03233369	Lubricating grease	KP - 1K - 50	DIN 51825 Renolit JP 1619	- 50 °C to + 120 °C (- 58 °F to + 248 °F)
10	00554205	Spray		Ceplattyn 300	
11	02314698	Slide paste		PAL 1	
12	03325215	Lubricating grease		RHUS SW 2	
13	01929824	Spray		Berulub spray	
14	03133770	Lubricating grease		Elaskon 30	



6.1.2 Lubricant applications list

Consec. no.	Lubricant type	Usage	Fill quantity in litres (gal)	Maintenance interval
1	Engine oil	Diesel engine; ■■■▶ p. 7 - 25	34 (9.0)	Y 2
2	Gear oil	Transmission; ■■■▶ p. 7 - 42	15.5 (4.1)	Y 5
3	Gear oil	Transfer case; ■■■▶ p. 7 - 46	14 (3.7)	M 6
		1. Axle line axle centre drive; ■■■▶ p. 7 - 57	13.0 (3.5)	M 12
		4. Axle line axle centre drive; ■■■▶ p. 7 - 57	13.0 (3.5)	M 12
		2. Axle line axle centre drive; ■■■▶ p. 7 - 57	15.0 (4.0)	M 12
		3. Axle line axle centre drive; ■■■▶ p. 7 - 57	16.5 (4.4)	M 12
		6 or 8 x final drives; ■■■▶ p. 7 - 62	2.7 (0.7)	M 12
4	Gear oil	Angle drive type A; ■■■▶ p. 7 - 52	7.2 (1.9)	M 6
		Angle drive type B; ■■■▶ p. 7 - 52	8.6 (2.3)	M 6
5	Gear oil	8 x suspension struts; ■■■▶ p. 7 - 83	1.5 (0.4) each	M 1
6	Gear oil	2 x hoists; ■■■▶ p. 8 - 11	3.3 (0.9) each	M 12
		2 x slewing gears; ■■■▶ p. 8 - 19	0.9 (0.24) each	M 12
7	Hydraulic oil	Carrier hydraulic tank; ■■■▶ p. 7 - 107	165 (44)	M 12
		Superstructure hydraulic tank; ■■■▶ p. 8 - 42	650 (172)	M 12
8	Hydraulic oil	Driver's cab tilting system; ■■■▶ p. 7 - 2	1 (0,26)	M 12



Consec. no.	Lubricant type	Usage	Fill quantity in litres (gal)	Maintenance interval
9	Lubricating grease	Carrier central lubrication;  p. 7 - 115		W
		Superstructure central lubrication;  p. 8 - 69		W
		Cardan shafts – transverse;  p. 7 - 64		M 1
		Cardan shafts – longitudinal;  p. 7 - 65		M 6
		Towbar coupling;  p. 7 - 131		M 1
		Outrigger beams;  p. 7 - 140		M 1
		Turntable lock;  p. 8 - 30		M 12
		Slewing angle sensor;  p. 8 - 67		Y 5
		Hook blocks;  p. 8 - 71		M 12
		Cab door hinges;  p. 7 - 141		M 12
		Carrier pins;  p. 7 - 142		M 12
		Superstructure pins;  p. 8 - 83		M 12
10	Spray	Slewing bearing gear teeth;  p. 8 - 25		M 6
11	Slide paste	Telescopic slide faces;  p. 8 - 46		M 3
12	Lubricating grease	Telescopic locking pins;  p. 8 - 46		M 3
		Derricking cylinder piston rod;  p. 8 - 45		M 1
		Cab door rails;  p. 8 - 81		M 12
		Stair tread rails;  p. 8 - 82		M 12
13	Spray	Outrigger pad/support cylinder;  p. 7 - 140		M 1
		Derricking cylinder piston rod;  p. 8 - 45		M 1
14	Lubricating grease	Lubricating the hoist ropes;  p. 8 - 53		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 in the driver's cab;  p. 7 - 128 (Compressor oil: FUCHS SE 55)	1.0 (2.2)	M 12
	Air conditioning system in the crane cab;  p. 8 - 76 (Compressor oil: EMKARATE RL68H)	1 x 1.0 (2.2) or 2 x 0.95 (2.1)	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 Exhaust gas emission control

Designation	Usage	Fill quantity in litres (gal)
DEF (Diesel Exhaust Fluid) ¹⁾ <i>AdBlue</i> : GROVE part number: 03140555	AdBlue tank on the carrier;  p. 7 - 34	40 (10.5)

- ¹⁾ DEF (Diesel Exhaust Fluid),
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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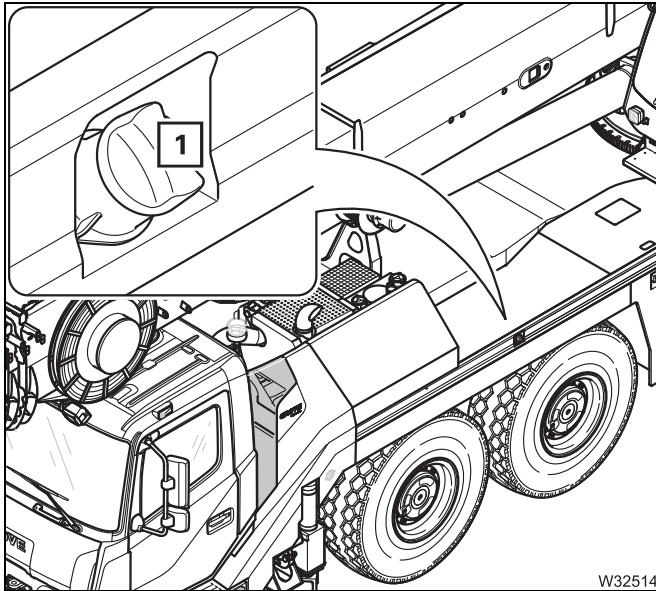
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7.20.2	Lubricating the outrigger beams	7 - 140
7.20.3	Checking the auxiliary heater	7 - 141
7.20.4	Lubricating the cab door	7 - 141
7.20.5	Lubricating the connecting and socket pins	7 - 142
7.20.6	Renewing the corrosion protection	7 - 143
7.20.7	Having the fire extinguisher checked	7 - 145

7

Maintenance work on the carrier

7.1

General instructions



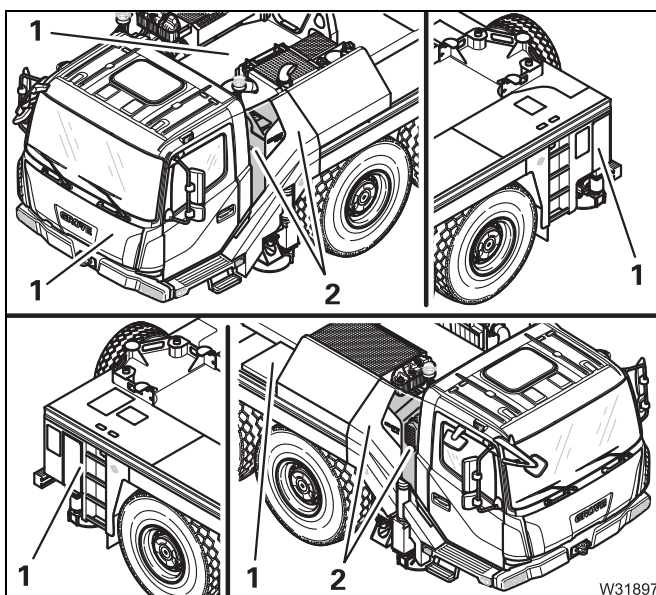
The truck crane GMK 4100L-1 is fitted as standard with an *AdBlue* system for exhaust gas emission control. In this case an AdBlue tank (1) fitted to the truck crane; ■■■► p. 7 - 33.

An engine that can be operated at the respective place of use without an *AdBlue* system is available, but only as special equipment. In that case there is no AdBlue tank (1) fitted to the truck crane. The relevant maintenance work does not arise; ■■■► *Exhaust system with exhaust emission control*, p. 7 - 33.

7.1.1

Covers

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



Before maintenance work

- Remove the covers (1)
- Remove the covers (2) only if you are performing general work on the engine and you need improved access to the engine.

After maintenance work

- Fasten the covers (1) and (2) with the catches.

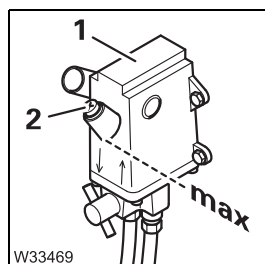
7.1.2

Tilting and lowering the driver's cab

- Check whether the truck crane GMK 4100L-1 is fitted with driver's cab that can be tilted (additional equipment).

A driver's cab that can be tilted makes it easier to access the front of the motor and maintenance work can be performed more conveniently.

Safety instructions



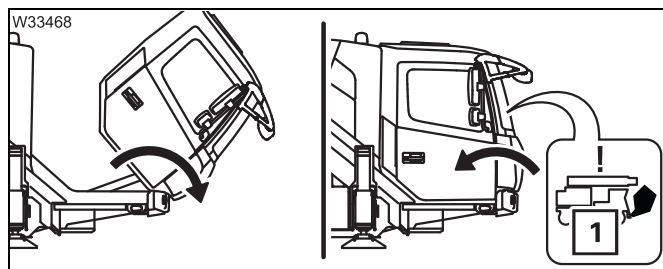
The driver's cab is tilted using a hydraulic hand pump (1).

- You can find information on how to operate the hand pump in the *operating manual*. Make sure you observe the safety instructions mentioned there; *Operating Instructions; Tilting and lowering the driver's cab*.

Oil, tools

Hydraulic oil in litres (gal)	Designation as per DIN 51502	GROVE part no.
1 (0.26)	HVLP	04177395 Shell Tellus S2 VX 15

- Oil level: Lower edge of opening (2). Check every 12 months.
- Refilling: When required via opening (2).
- Lever for hand pump (1) from the toolbox.



Before maintenance work

- Tilt the driver's cab; *Operating Instructions*.

After maintenance work

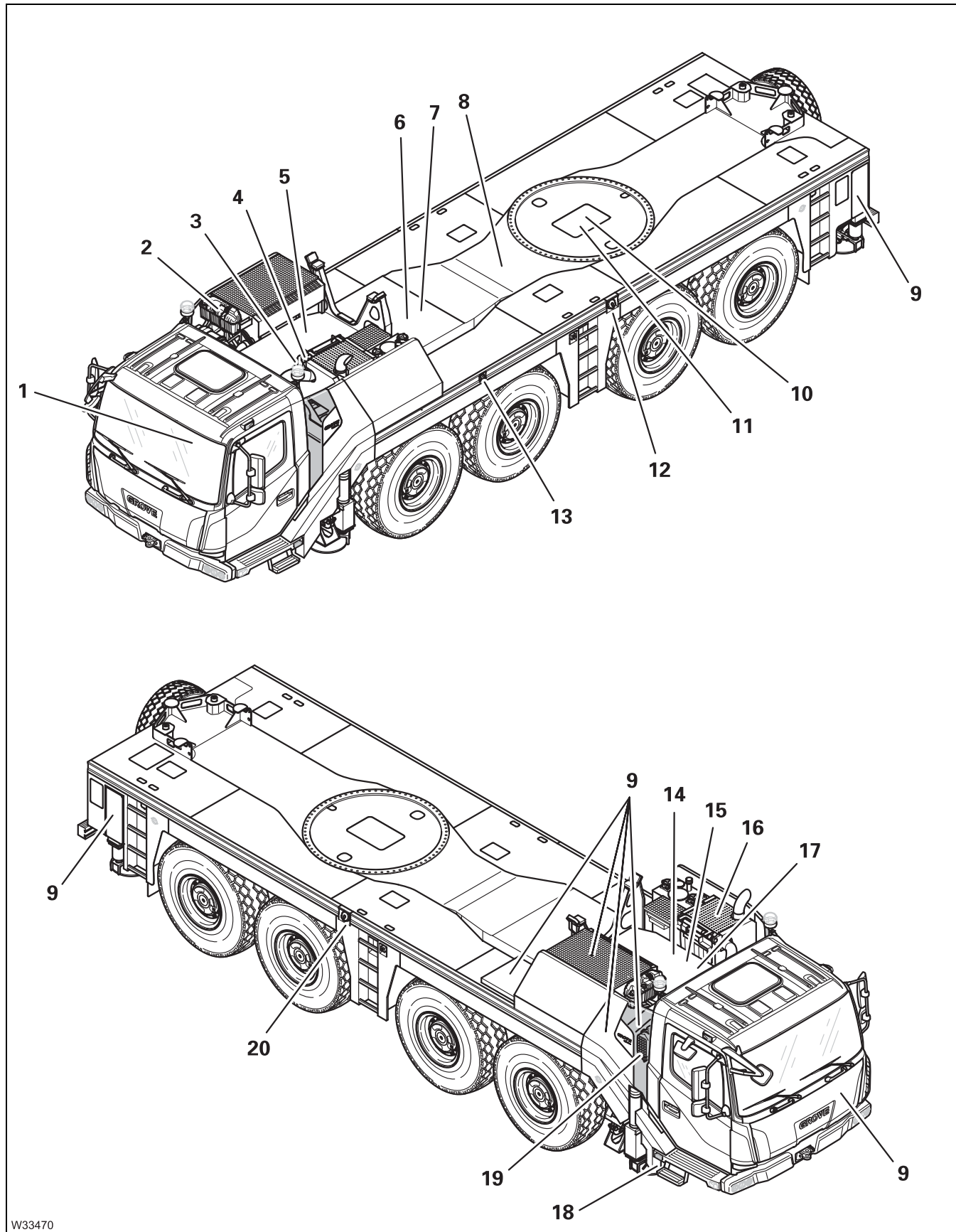
- Lower the driver's cab; *Operating Instructions*.

- Check that the lamp (1) on the CCS control unit has gone out – the driver's cab is then locked.

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7.1.3

Overview of maintenance work on the carrier



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Symbols for maintenance work

- 1 CCS (*Crane Control System*) control unit ▶▶▶▶ p. 7 - 11
▶▶▶▶ p. 7 - 11

Engine

- 5 Diesel engine ▶▶▶▶ p. 7 - 13
▶▶▶▶ p. 7 - 13
9 Covers ▶▶▶▶ p. 7 - 1
▶▶▶▶ p. 7 - 1
18 Hand pump tilting the driver's cab ▶▶▶▶ p. 7 - 2
▶▶▶▶ p. 7 - 2
3 Dipstick ▶▶▶▶ p. 7 - 13
▶▶▶▶ p. 7 - 13
4 Oil filler opening ▶▶▶▶ p. 7 - 15
▶▶▶▶ p. 7 - 15
19 Air filter ▶▶▶▶ p. 7 - 16
▶▶▶▶ p. 7 - 16
2 Coolant reservoir ▶▶▶▶ p. 7 - 17
▶▶▶▶ p. 7 - 17
17 Oil filter ▶▶▶▶ p. 7 - 25
▶▶▶▶ p. 7 - 25

Fuel system

- ▶▶▶▶ p. 7 - 27
12 Left fuel tank ▶▶▶▶ p. 7 - 27
▶▶▶▶ p. 7 - 27
20 Right fuel tank ▶▶▶▶ p. 7 - 27
▶▶▶▶ p. 7 - 27
14 Filter 1 ▶▶▶▶ p. 7 - 28
▶▶▶▶ p. 7 - 28
15 Filter 2 ▶▶▶▶ p. 7 - 31
▶▶▶▶ p. 7 - 31

Exhaust system with exhaust emission control

- ▶▶▶▶ p. 7 - 33
13 AdBlue tank ▶▶▶▶ p. 7 - 34
▶▶▶▶ p. 7 - 34
16 Exhaust silencer with SCR catalytic converter ▶▶▶▶ p. 7 - 35
▶▶▶▶ p. 7 - 35

Transmission

- ▶▶▶▶ p. 7 - 39
6 Oil level plug ▶▶▶▶ p. 7 - 41
▶▶▶▶ p. 7 - 41
7 Oil filter on the transmission ▶▶▶▶ p. 7 - 42
▶▶▶▶ p. 7 - 42

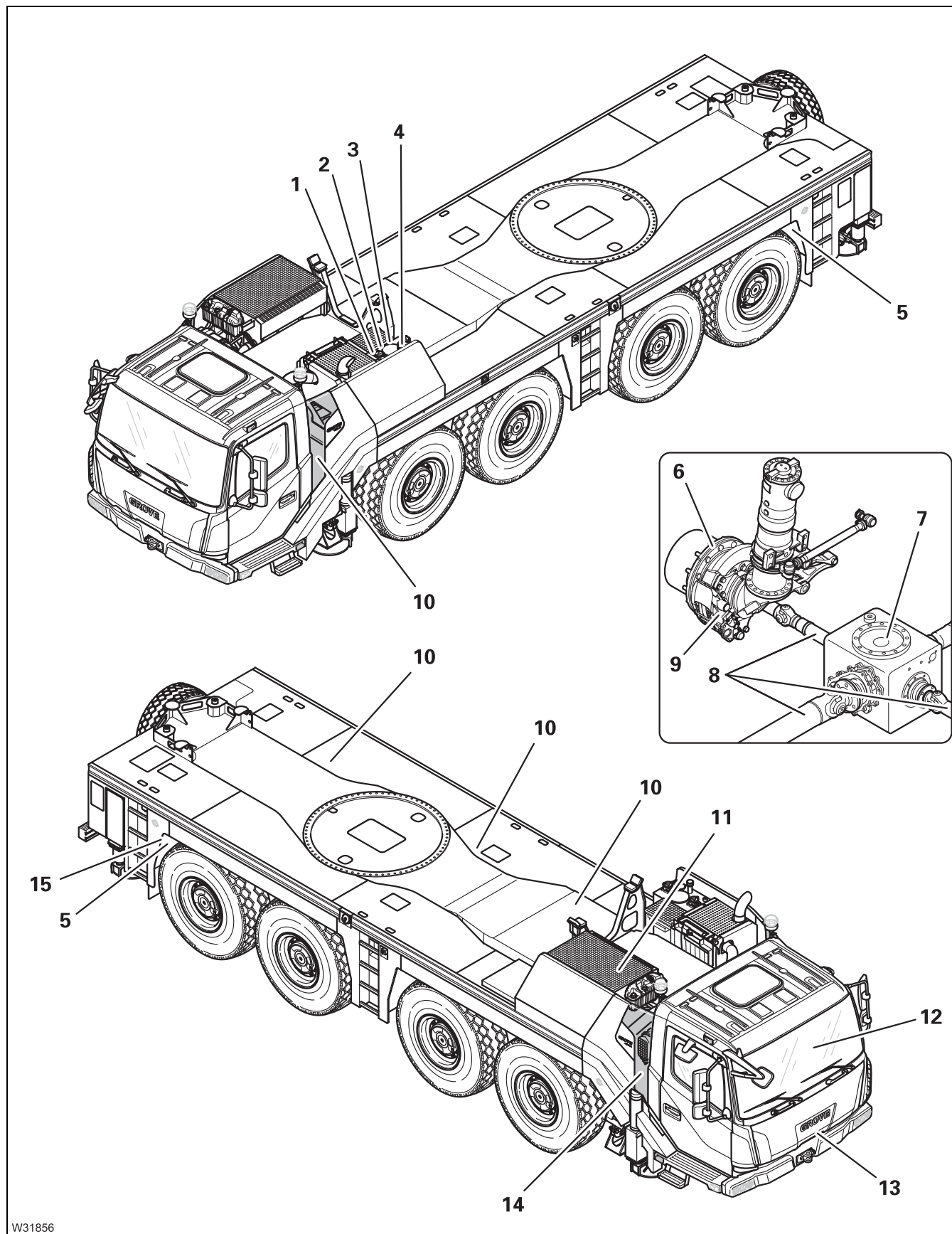
Transfer case

- ▶▶▶▶ p. 7 - 45
8 Oil level plug ▶▶▶▶ p. 7 - 45
▶▶▶▶ p. 7 - 45

Angle gear

- ▶▶▶▶ p. 7 - 49
10 Oil level plug ▶▶▶▶ p. 7 - 50
▶▶▶▶ p. 7 - 50
11 Filter and oil cooler ▶▶▶▶ p. 7 - 52
▶▶▶▶ p. 7 - 52



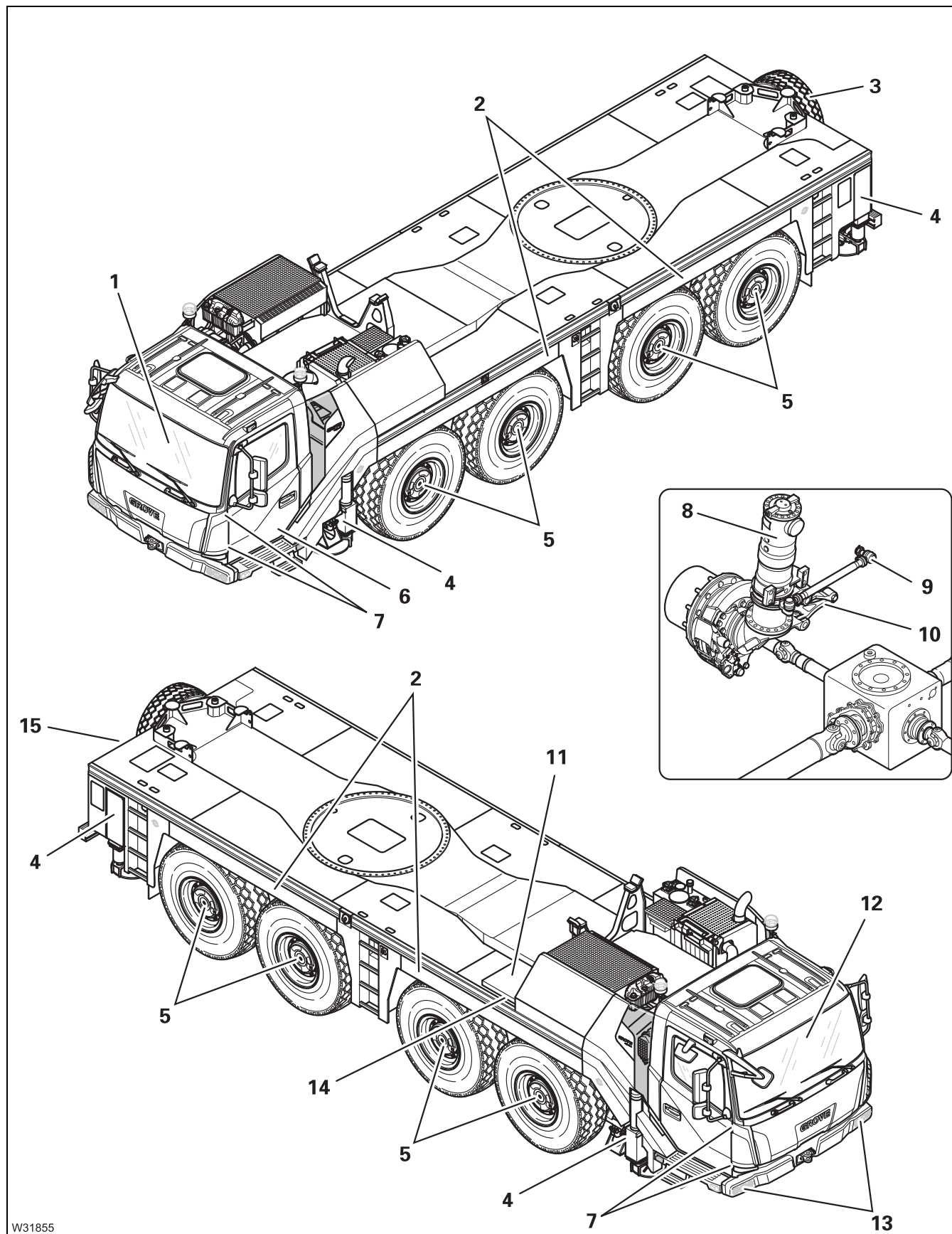


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Axle lines	▣▣▣▣▶ p. 7 - 55
7 Axle centre drives	▣▣▣▣▶ p. 7 - 55
6 Final drives	▣▣▣▣▶ p. 7 - 61
8 Cardan shafts	▣▣▣▣▶ p. 7 - 64
Vehicle brake	▣▣▣▣▶ p. 7 - 75
9 Disc brake	▣▣▣▣▶ p. 7 - 76
Compressed air system	▣▣▣▣▶ p. 7 - 93
10 Receptacle	▣▣▣▣▶ p. 7 - 93
14 Drier	▣▣▣▣▶ p. 7 - 95
Hydraulic system	▣▣▣▣▶ p. 7 - 97
1 Oil tank with sight glass	▣▣▣▣▶ p. 7 - 97
2 Oil filters 1 and 2	▣▣▣▣▶ p. 7 - 111
5 Oil filters 3 and 4	▣▣▣▣▶ p. 7 - 111
3 Ventilation filter	▣▣▣▣▶ p. 7 - 101
4 Oil filler opening	▣▣▣▣▶ p. 7 - 107
Central lubrication system	▣▣▣▣▶ p. 7 - 115
15 Centralized lubrication pump	▣▣▣▣▶ p. 7 - 115
Air-conditioning system	▣▣▣▣▶ p. 7 - 127
12 Air-conditioning system in the driver's cab	▣▣▣▣▶ p. 7 - 127
11 Condenser fins	▣▣▣▣▶ p. 7 - 128
13 Pollen filter	▣▣▣▣▶ p. 7 - 130





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Wheels	▣▣▣▣▶ p. 7 - 67
5 Wheels	▣▣▣▣▶ p. 7 - 67
3 Spare wheel (alternatively storage box)	
Suspension	▣▣▣▣▶ p. 7 - 83
8 Suspension struts	▣▣▣▣▶ p. 7 - 85
10 Forced lever	▣▣▣▣▶ p. 7 - 86
2 Pressure accumulator	▣▣▣▣▶ p. 7 - 87
Steering	▣▣▣▣▶ p. 7 - 89
9 Steering cylinder	▣▣▣▣▶ p. 7 - 91
Electrical system	▣▣▣▣▶ p. 7 - 119
13 Carrier lighting	▣▣▣▣▶ p. 7 - 119
11 Battery box	▣▣▣▣▶ p. 7 - 120
14 External starting socket	▣▣▣▣▶ p. 7 - 125
Towbar coupling	▣▣▣▣▶ p. 7 - 131
15 Towbar coupling ¹⁾	▣▣▣▣▶ p. 7 - 131
Other maintenance work	▣▣▣▣▶ p. 7 - 139
6 Windscreen washing system receptacle	▣▣▣▣▶ p. 7 - 139
4 Outrigger beams	▣▣▣▣▶ p. 7 - 140
7 Cab door hinges	▣▣▣▣▶ p. 7 - 141
12 Driver's cab auxiliary heater ¹⁾	▣▣▣▣▶ p. 7 - 141
– Various connecting pins and socket pins	▣▣▣▣▶ p. 7 - 142
– Corrosion protection	▣▣▣▣▶ p. 7 - 143
1 Fire extinguisher	▣▣▣▣▶ p. 7 - 145
¹⁾ Additional equipment	

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7.2

Symbols for maintenance work


CCS

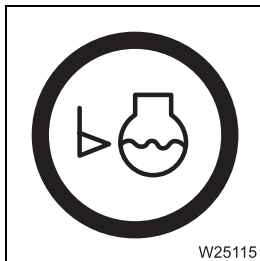
- Check the symbols on the *CCS* start menu (*Crane Control System*) in the driver's cab each day before starting work.
- The Start menu shows the most important measurements and the Maintenance submenu shows all the outstanding warning messages;  *Operating Instructions*.

Maintenance submenu

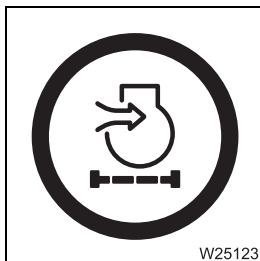
If one of the symbols is displayed, you must carry out the appropriate maintenance work:




- Oil pressure;  p. 7 - 13



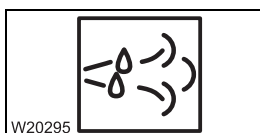
- Coolant level;  p. 7 - 17,




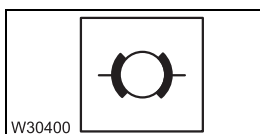
- Air filter;  p. 7 - 16




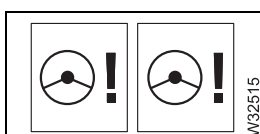
- Hydraulic oil filter;  p. 7 - 111,



- AdBlue system;  p. 7 - 34,



- Disc brakes wear display;  p. 7 - 75.



- Steering monitoring;  *Checking the steering monitoring*, p. 7 - 89.

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7.3

Engine

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

7.3.1


Checking the oil level

D

Prerequisites

- The truck crane must be level.

Checking the oil level

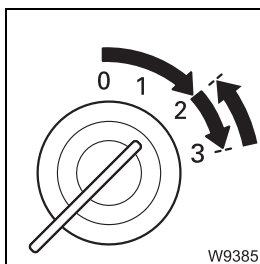
- Start the engine from the driver's cab;  *Operating Instructions*.



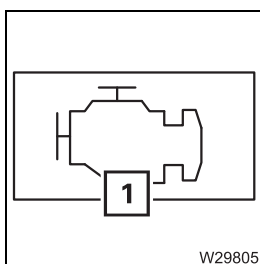
Risk of damage to the engine if the oil pressure is too low.

Switch the engine off immediately if the symbol (1) is displayed.

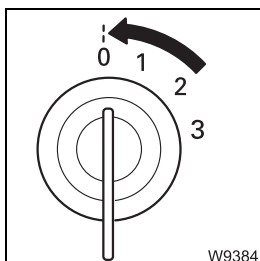
Running the engine when the oil pressure is too low can damage it.



- Start the engine and watch the symbol (1).
- **Stop the engine immediately** if the symbol does not disappear after 10 seconds.
If symbol (1) is displayed, the oil pressure is too low.

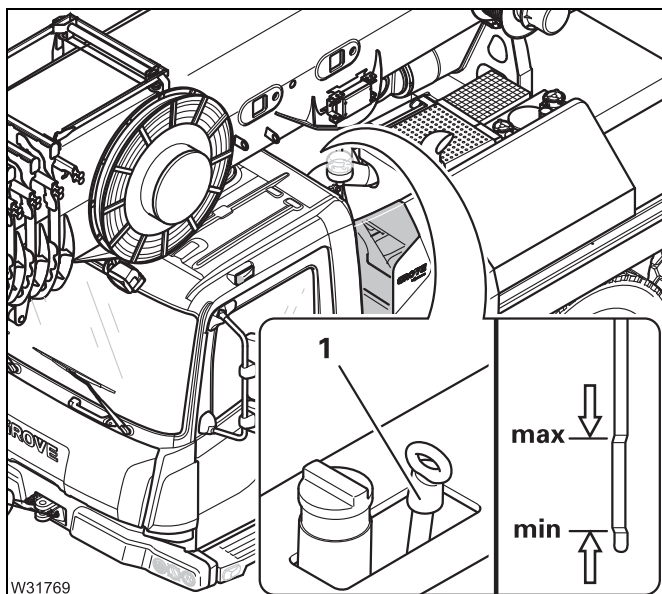


- Allow the engine to run at idling speed for 2 – 3 minutes.
- Switch the engine off.



- Check the oil level after about 2 minutes.






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

If the oil level is too low

- Top up the oil; ➡ p. 7 - 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	Specification classification	GROVE part no.
34 (9.0)	HD - CD	MIL-L 2104 C DB 228.5	SAE 5 W-30 03329588


Prerequisites

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

Topping up the oil



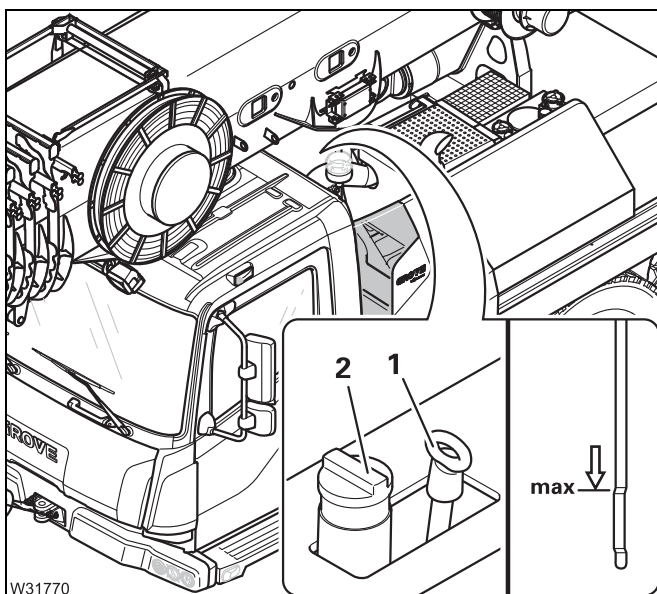
Risk of damage to the engine if the oil level is too high.

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



Risk of burns when the engine is hot.

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

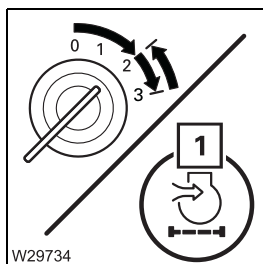


- Add oil through the filler neck (2) up to the **max.** mark.
- Close the filler neck with the cap.
- Put the dipstick (1) into the dipstick tube after checking the oil level.

7.3.3

Checking the air filter

D




- Start the engine and monitor the display.
- If the symbol (1) is displayed, you must change the air filter.
- Switch the engine off.

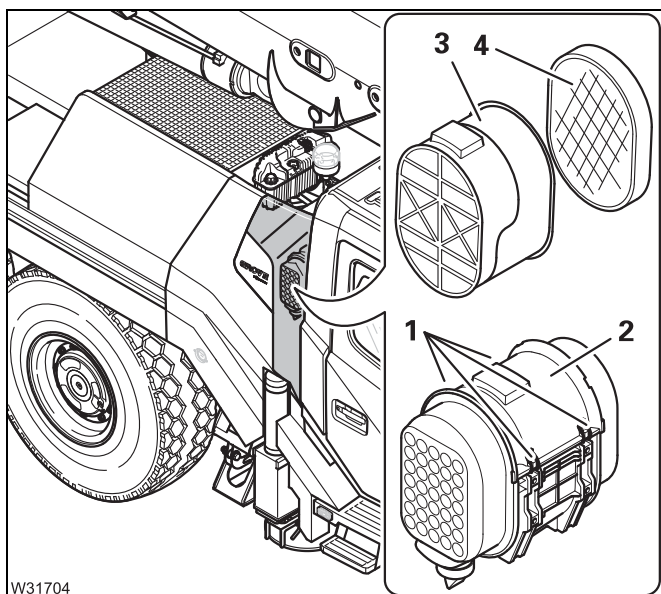
Spare parts and tools

Designation	Quantity	GROVE part no.
Main filter	1	04158601
Back-up filter	1	04158602

Prerequisites

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

Replacing the air filter

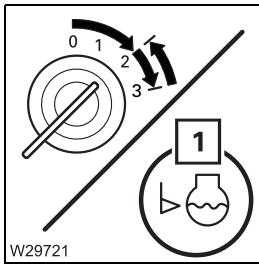


- Undo all the clamps (1) and remove the cover (2).
- Change the main filter (3) and the back-up filter (4).
- Replace the cover and secure it with all the clamps.

7.3.4

Checking the coolant level

D



W29721

- Start the engine and monitor the display.
- When the symbol (1) is displayed you must top up the coolant.
- Switch the engine off.

Topping up coolant

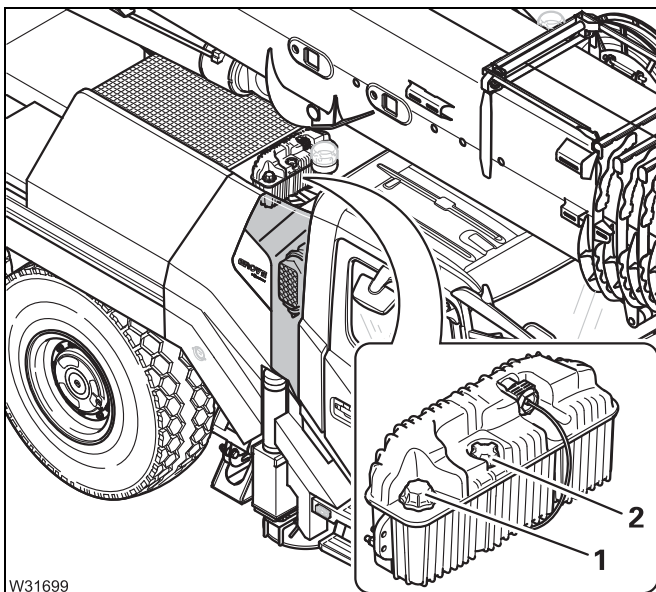


There is a risk of scalding when the cooling circuit is hot.

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

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

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



W31699

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

If the coolant level is too low

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



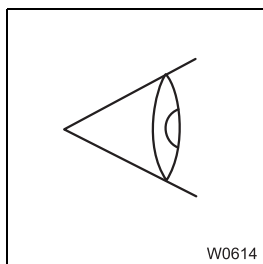
Risk of damage to engine due to lack of coolant.

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

7.3.5

General inspection

W



- Investigate any unusual running noises from the engine.
- Check the engine and the connections for leaks. If consumables are leaking;
 - ▣▣▣▣▶ *Checking the oil level*, p. 7 - 13,
 - ▣▣▣▣▶ *Checking the coolant level*, p. 7 - 17.

- Check that pipes and hoses are tightly connected and undamaged.

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

7.3.6

Have the radiator checked/cleaned

M 12

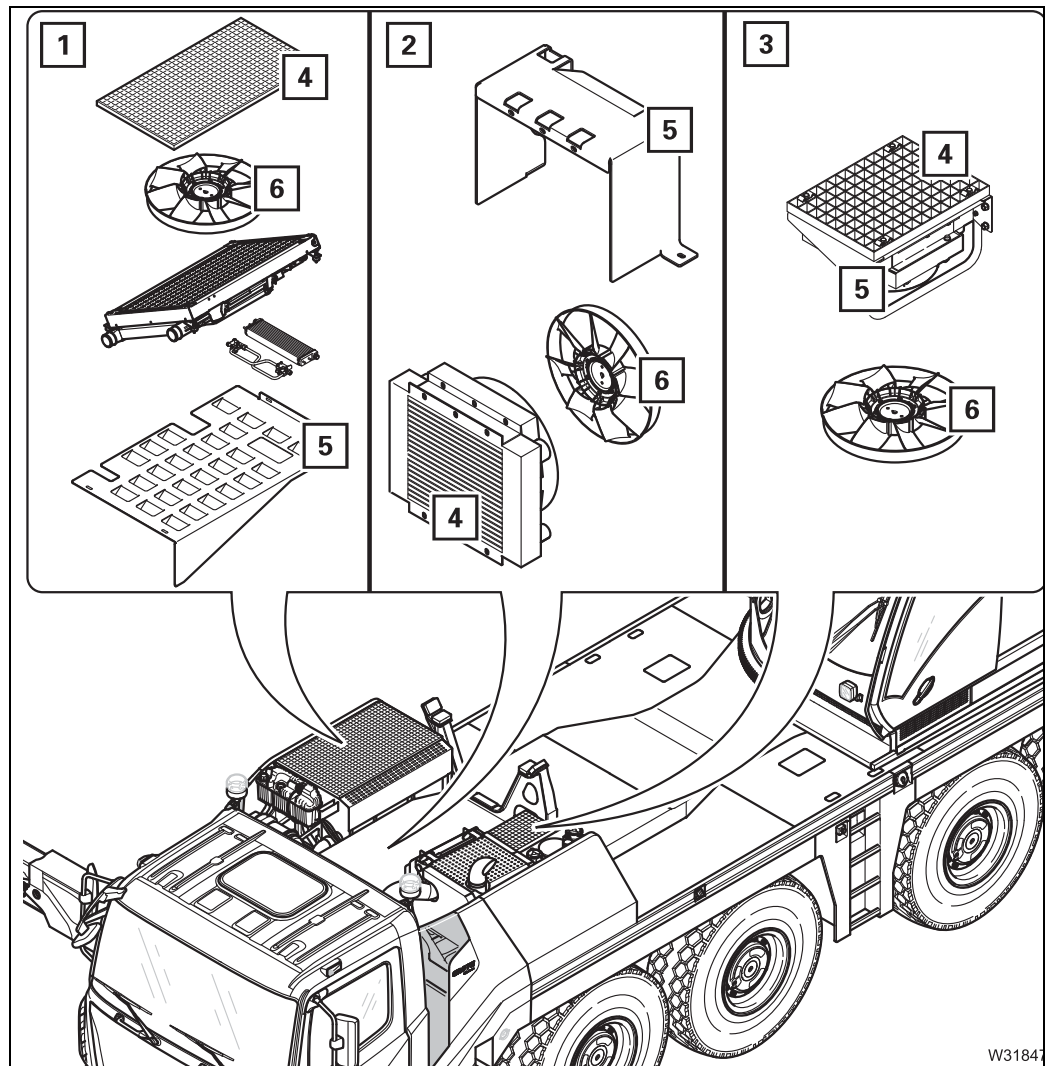
Reducing the interval

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

Prerequisites

- The truck crane must be supported on outriggers and must be level;
 - ▣▣▣▣▶ *Operating Instructions*.
- The main boom must be fully retracted and raised to 75°; ▣▣▣▣▶ *Operating Instructions*.
- The engine must be switched off and secured against unauthorised use;
 - ▣▣▣▣▶ p. 2 - 3.
- The working area around the carrier at the radiator unit must be freely accessible.
- Trained repair crew and repair tools must be available.

**Check the level
of dirt**



The radiator units (1), (2) and (3) are protected by grilles (4) and plates (5). The fan impellers (6) are located under the grilles. When the engine is running, the fan impeller rotates under the grille!



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 a fan impeller that is rotating. Do not push any tools through the grille to clean it.

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



Radiator unit 1

The radiator unit 1 consists of:

- Radiator for water/charge air engine,
- Cooler for the transmission gear oil.
- Cooler for the transfer case gear oil.
- Cooling coil for compressed air,
- Condenser for refrigerant for the driver's cab air-conditioning system.

Radiator unit 2

The radiator unit 2 consists of:

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

Radiator unit 3


The radiator unit 3 (additional equipment) consists of:

- Additional cooler for hydraulic oil (mounted on the hydraulic oil tank).

Checking

- If necessary remove leaves, twigs and other debris from the grilles (4).
- View the fan impellers (6) through the grilles from above to check their condition. The impeller blades must be clean and undamaged.



If the radiator fins are heavily soiled have them cleaned, since further soiling can lead to overheating;  *Have them cleaned*, p. 7 - 20.

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 a fan impeller that is rotating. Do not push any tools through the grille to clean it.

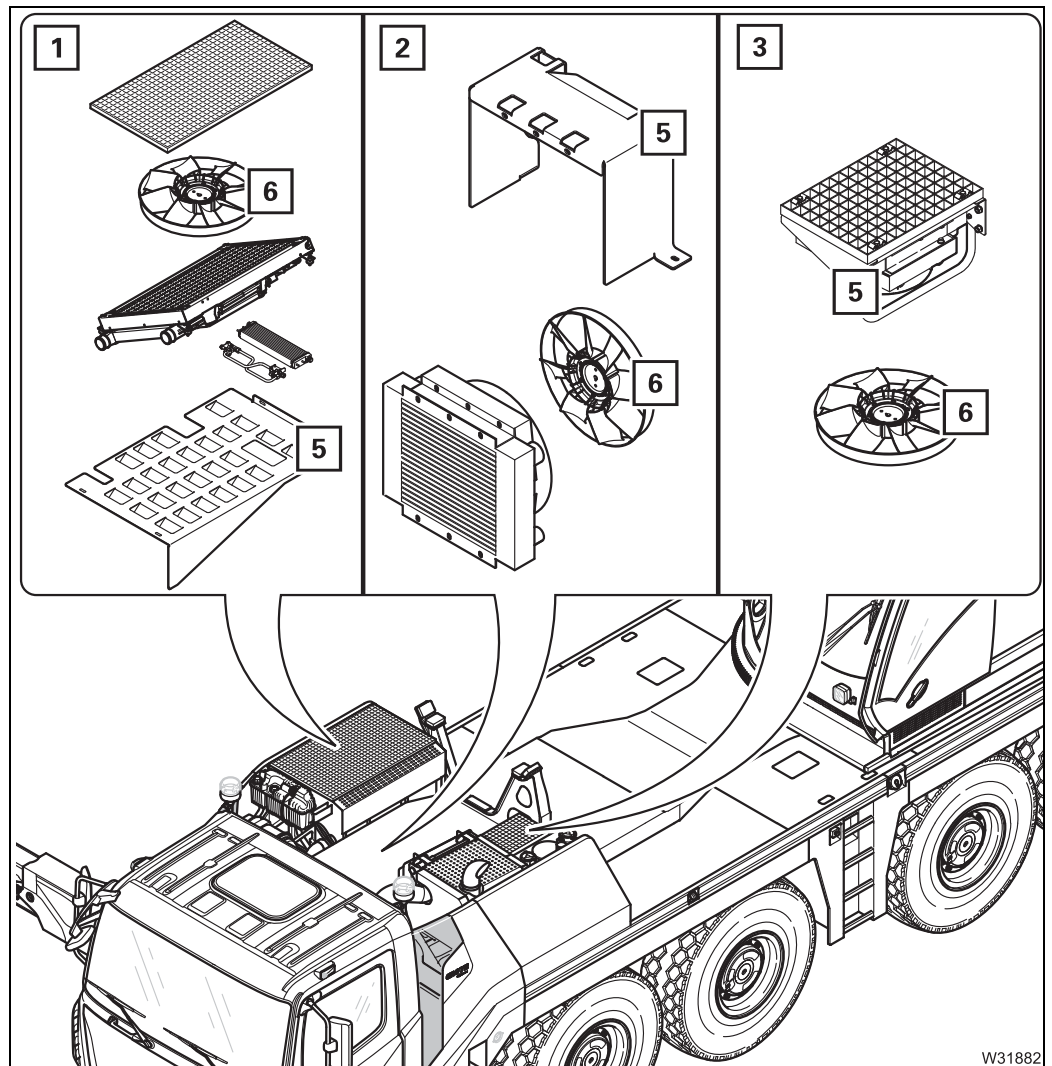
Always stop the engine before attempting to clean the fan impeller and radiator fins.



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), (2) and (3) opened up by the repair crew so that the radiator fins are accessible.
- Have the radiator fins cleaned on both sides, using suitable cleaning agents.
- Have the fan impellers (6) cleaned.
- Have the enclosure plates (5) cleaned.
- Have the hoses and connections checked for damage and leaks.
- Have any damaged parts replaced.



**After checking/
cleaning**

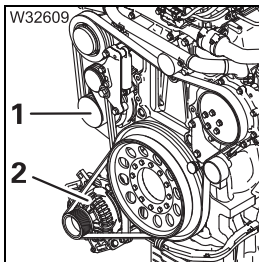
- Remove all tools and cleaning equipment.
- Check that the grille (4) and enclosure plates (5) are secure.
- Start the engine and wait until the fan impellers are rotating.
- Check that the fan impellers are running freely.
- Check the respective temperature displays in the driver's cab;
 ▮▮▮▮▶ *Operating Instructions*.
- Switch the engine off.
- Check the radiator and connections for leaks.

7.3.7


Checking the V-belt tension

M 12

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



- Check whether your truck crane is fitted with a second alternator (2) (additional equipment).

Maintenance of the V-belt of the first alternator (1) fitted as standard equipment is described in the documentation supplied;  *Engine manufacturer's documentation*.

Spare parts and tools

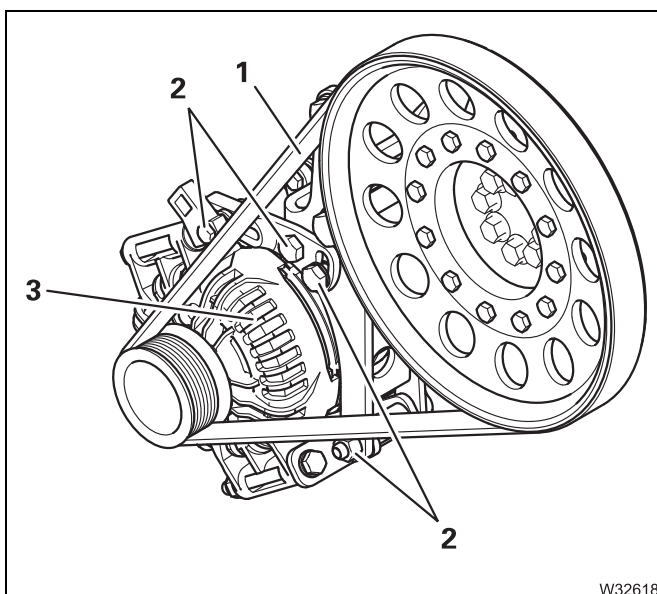
Designation	Quantity	GROVE part no.
Kit: Complete fitting of a second alternator	1	03301570
V-belt	1	03301576

- Frequency measuring instrument; GROVE part no. 04165439;
new V-belt: Frequency 78.2 Hz;
run-in V-belt: Frequency 68.6 Hz.

Prerequisites


- The engine must not be running and must be secured against unauthorised use.

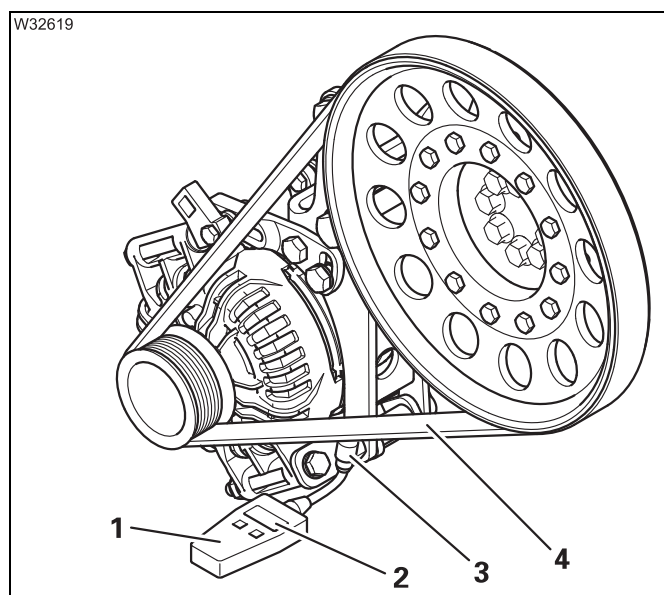
Checking



- Check the V-belt (1) for cracks and damage.
- If necessary, fit a new V-belt (1).
- Undo the nuts and bolts (2).
- Tilt the alternator (3) downwards until you have achieved the desired pre-tension.
- Tighten the nuts and bolts (2).



- Familiarise yourself with the correct operation of the frequency measuring instrument;  *Separate engine operating instructions, provided by the manufacturer.*



- Switch the frequency measuring instrument (1) on – it is now ready for acoustic measurement.
- Hold the measuring head (3) over the V-belt (4).
- Strike the V-belt (4) with an object (tool) so that it vibrates.
- On the display (2), read the measured value:
new V-belt: 78.2 Hz;
run-in V-belt: 68.6 Hz.

- If necessary, correct the pre-tension until the specified measured value is achieved.

7.3.8


Changing the oil and oil filter

Y 2




Oil, spare parts,
tools

Engine oil in litres (gal)	Designation to DIN 51502	Specification classification	GROVE part no.
34 (9.0)	HD - CD	MIL-L 2104 C DB 228.5	SAE 5 W-30 03329588

Designation	Quantity	GROVE part no.
Oil filter with cover gasket	1	04163013
Original oil drain plug	1	04161529

- Receptacle, approx. 40 ltr (11 gal);  p. 2 - 4.
- Torque wrench for a torque of 55 Nm (40.5 lbf ft).

Prerequisites

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

Changing



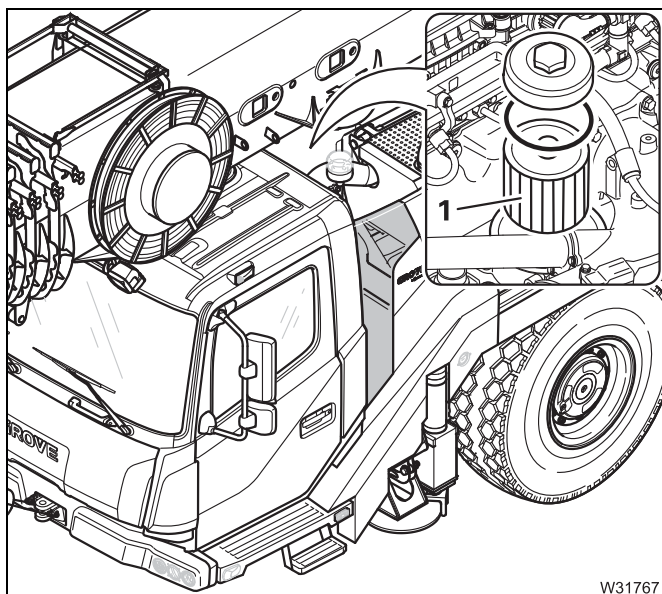
Risk of environmental damage due to leaking consumables.

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

Store/dispose of consumables and any soaked equipment properly.

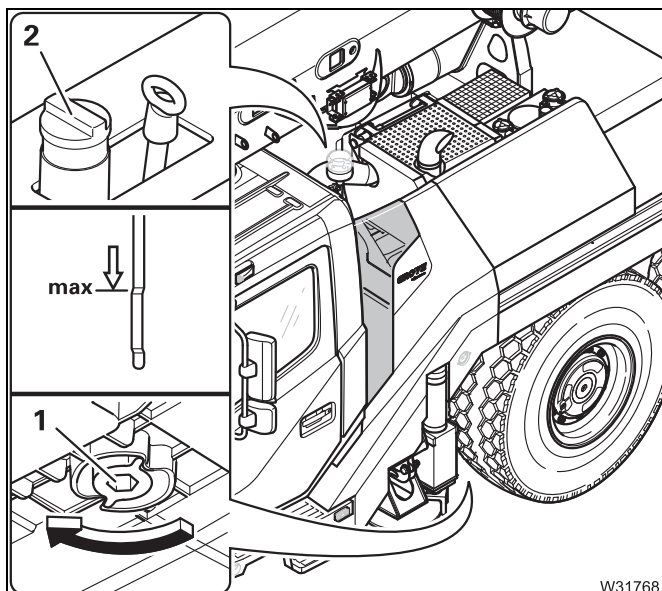
Ask about the applicable regulations.





Oil filter

- Place a receptacle underneath the engine.
- Change the oil filter (1) using a socket wrench – torque 55 Nm (40.5 lbf ft);
 ▮▮▮▮ *Engine manufacturer's documentation.*
- Leave the receptacle in place for the oil change.



Draining oil

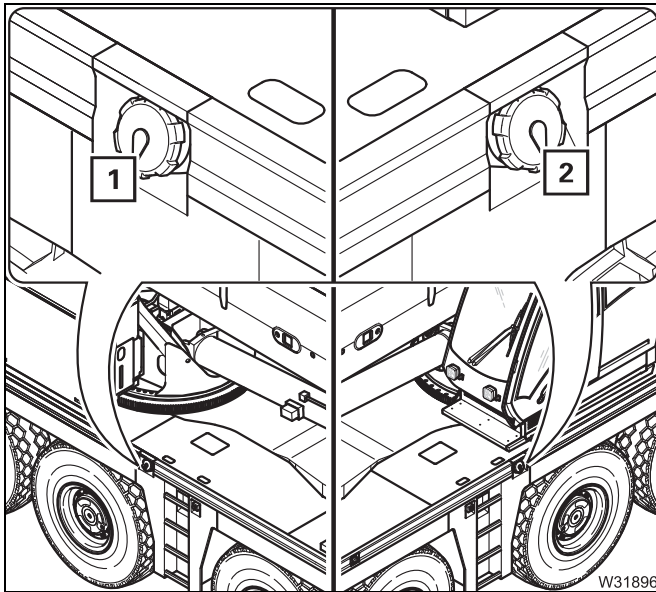
- Turn the drain plug (1) contrary to the sense of the arrow until it reaches the stop, then take it off. Let the oil drain into the receptacle.
- Insert the drain plug (1) and turn it in the sense of the arrow until it reaches the stop (spring-loaded engagement detent).
- Remove the receptacle.

Topping up oil


- Top up with fresh oil through the filler neck (2); ▮▮▮▮ p. 7 - 15.

7.4

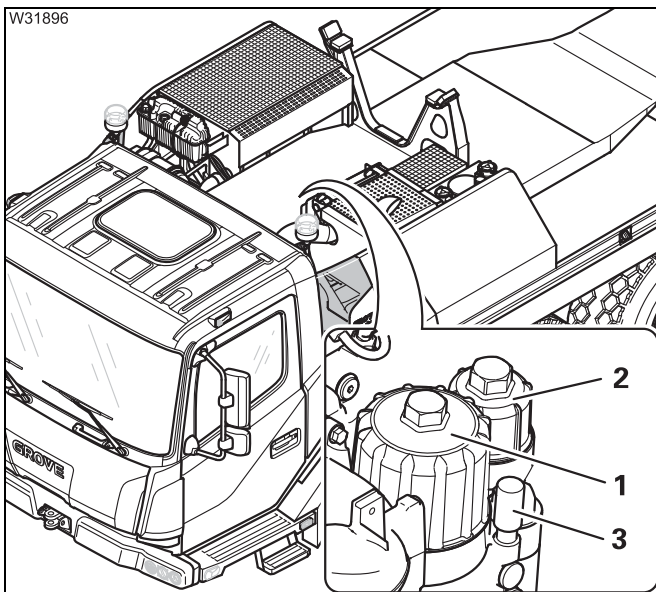
Fuel system



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 Instructions*.

- Obtain information from **Manitowoc Crane Care** on the additional fuel filter required for the dual tank system.



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


- 1 Fuel filter 1 (large)
- 2 Fuel filter 2 (small)
- 3 Fuel hand pump

7.4.1




Draining off water from fuel filter 1

D

Spare parts and tools

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

Prerequisites

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

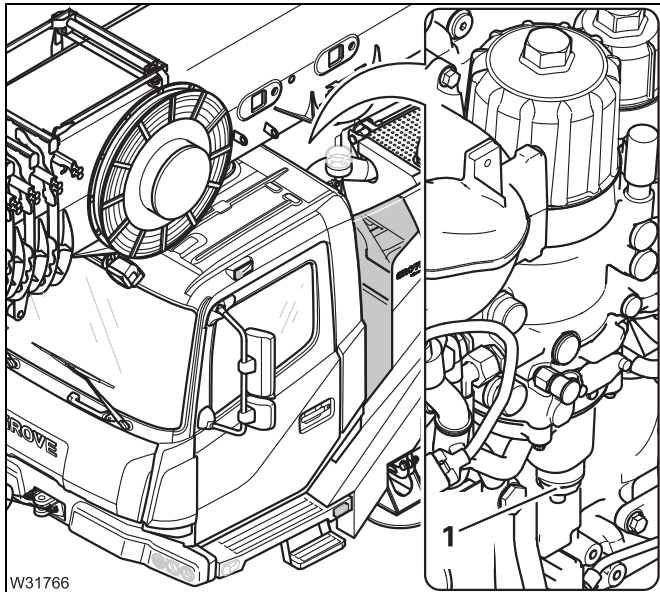
Draining off water



Risk of environmental damage due to leaking consumables.

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

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



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

W31766

7.4.2

Replacing fuel filter 1

M 3

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter (large)	1	04161991

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

Prerequisites

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

Changing

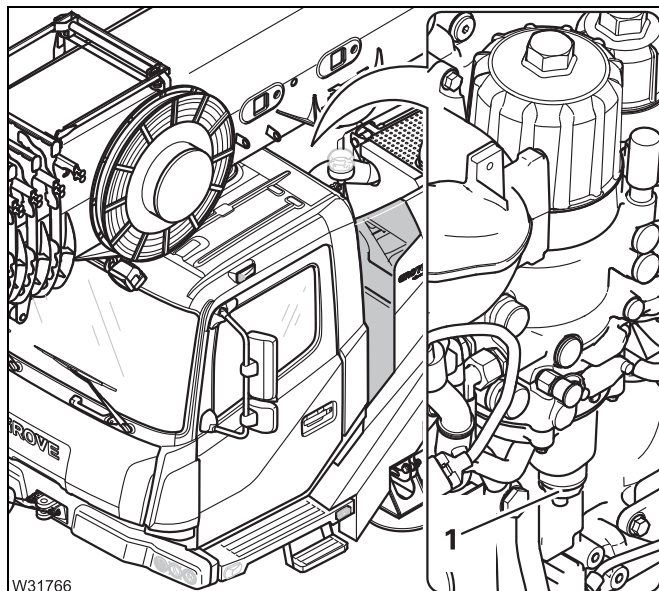


Risk of environmental damage due to leaking consumables.

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

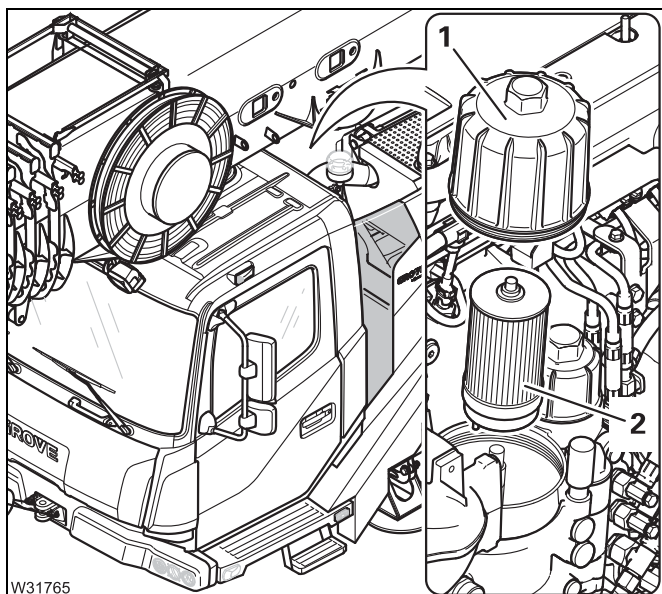
Store/dispose of consumables and any soaked equipment properly.


Ask about the applicable regulations.

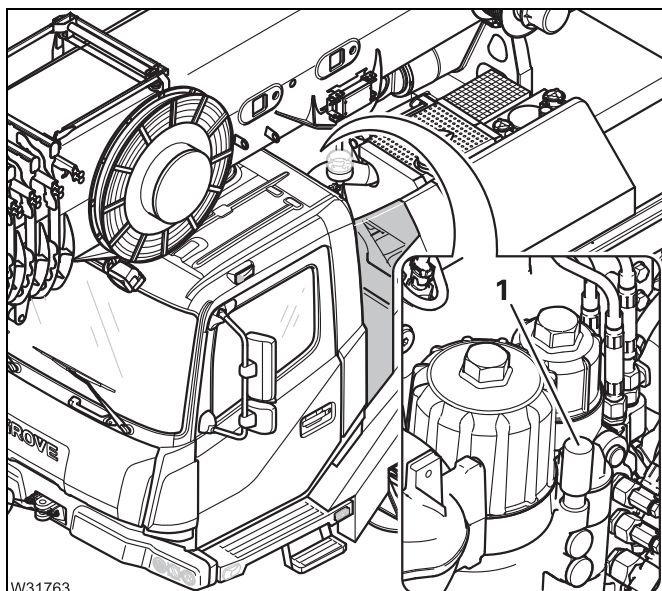



- Place a receptacle underneath the filter.
- Open the valve (1) and let the consumable drain out.





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



- Open the two tank covers on the fuel tank;  p. 7 - 27.
- Operate the hand pump (1) until you sense definite resistance.
- Close the two tank covers on the fuel tank.
- Start the engine and check for leaks.

7.4.3

Replacing fuel filter 2

M 12

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter (small)	1	04161566

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

Prerequisites

- The truck crane must be level and on outriggers; *Operating Instructions*.
- The main boom must be fully raised; *Operating Instructions*.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.
- The fuel must be drained from the fuel filter 1; p. 7 - 29.
- If the fuel is dirty: Reduce the maintenance interval.

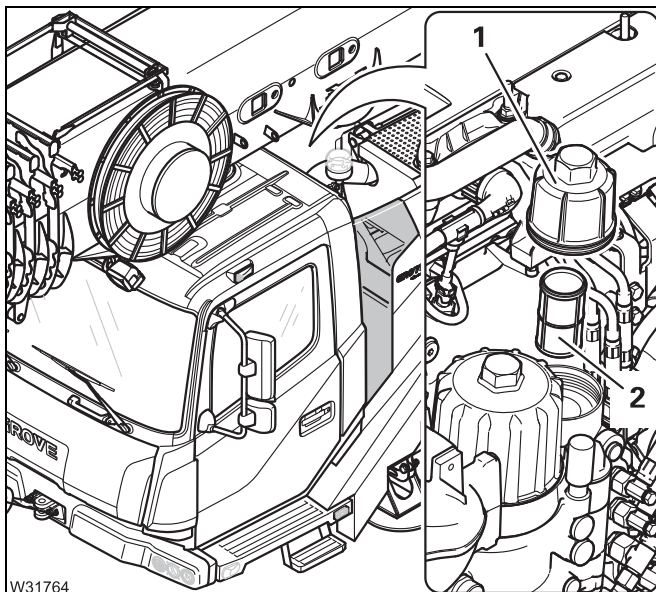
Changing



Risk of environmental damage due to leaking consumables.

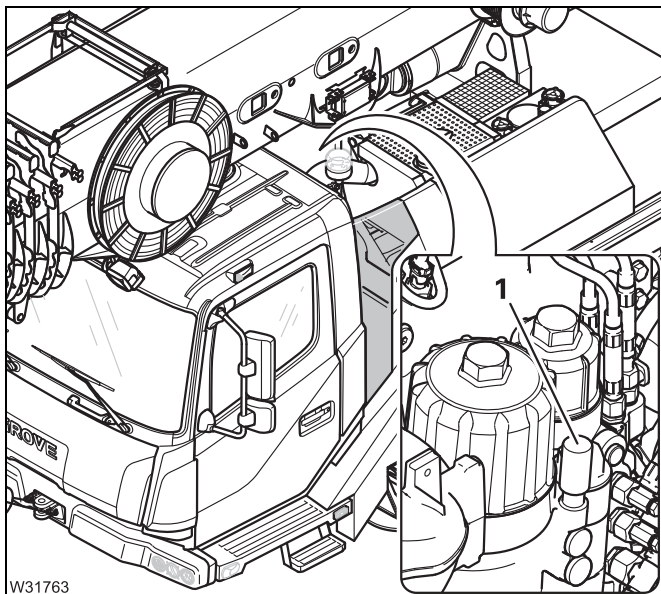
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

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



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





- Open the two tank covers on the fuel tank;
 ▣▶ p. 7 - 27.
- Operate the hand pump (1) until you sense definite resistance.
- Close the two tank covers on the fuel tank.
- Start the engine and check for leaks.



7.5

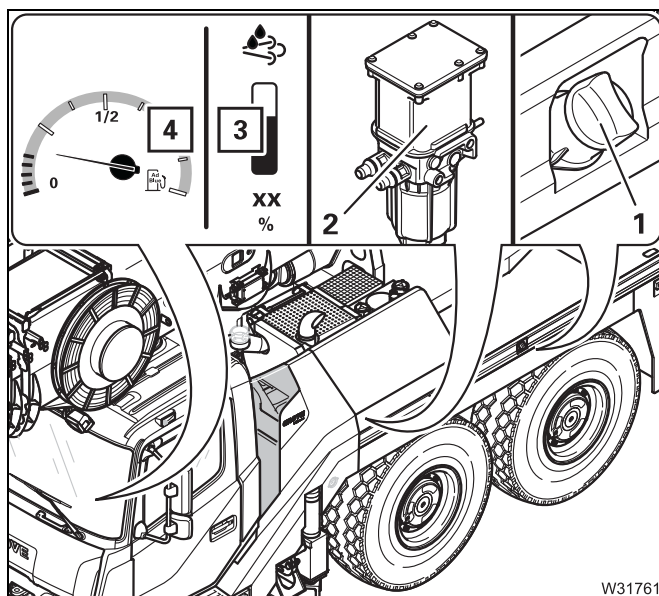
Exhaust system with exhaust emission control

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)**.

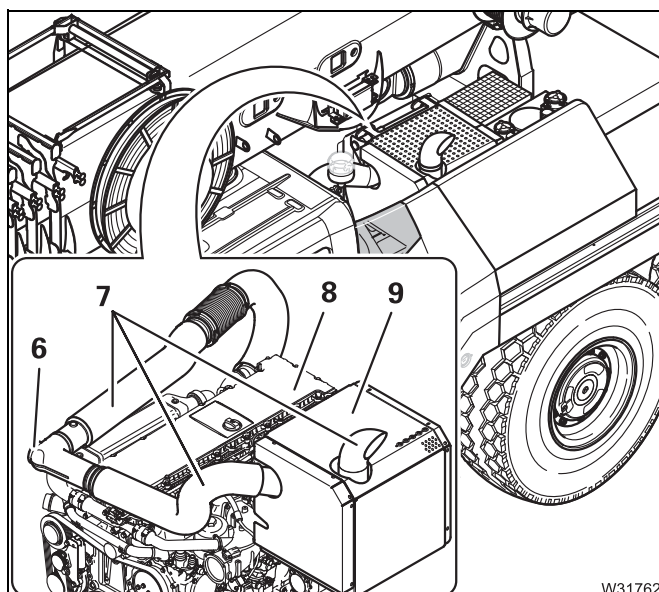
The exhaust gas is treated using a **DEF system**. To do this, **AdBlue (DEF) (Diesel Exhaust Fluid)** from the DEF tank is injected into the exhaust system.

The motor 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 Instructions*,  *Engine manufacturer's documentation*.



AdBlue system

- 1 AdBlue tank with insulation hood
- 2 Pump unit for pumping AdBlue to the dosing unit on the diesel engine and for pumping engine coolant for preheating the AdBlue tank.
- 4 Tank gauge, AdBlue tank
- 3 Tank gauge for AdBlue tank, with warning symbol



- 8 Diesel engine with dosing unit for AdBlue (compressed air supply) and a solenoid valve for preheating the AdBlue tank using engine coolant.
- 6 Injection nozzle for injecting the AdBlue/compressed air mixture.
- 7 Exhaust pipes
- 9 Exhaust silencer with SCR catalytic converter

7.5.1

Checking the AdBlue tank level

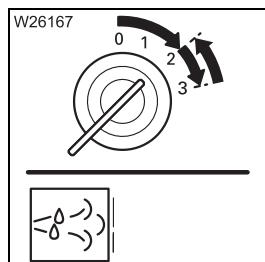
D

Checking

The display includes a gauge showing the level in the AdBlue tank.



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



- Start the engine and check the gauge after the engine starts; p. 7 - 35.
- Refill with AdBlue before the tank becomes empty.

7.5.2

Filling up with AdBlue

Consumable and tools

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

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

Prerequisites

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

Filling up

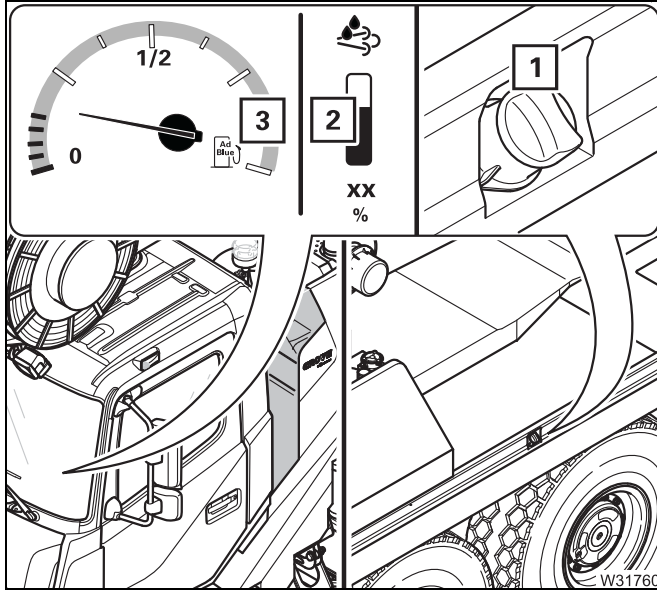
- Find out about filling up in the operating manual and note the warnings; *Operating Instructions*.



Danger of scalding due to ammonia vapours.

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

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



- Fill the AdBlue tank via the filler neck (1) and close it using the cap.
- Check the level on the gauges (2) and (3) in the driver's cab; p. 7 - 34.

7.5.3

Check the exhaust system for external damage

M 1

Spare parts and tools

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

Prerequisites

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

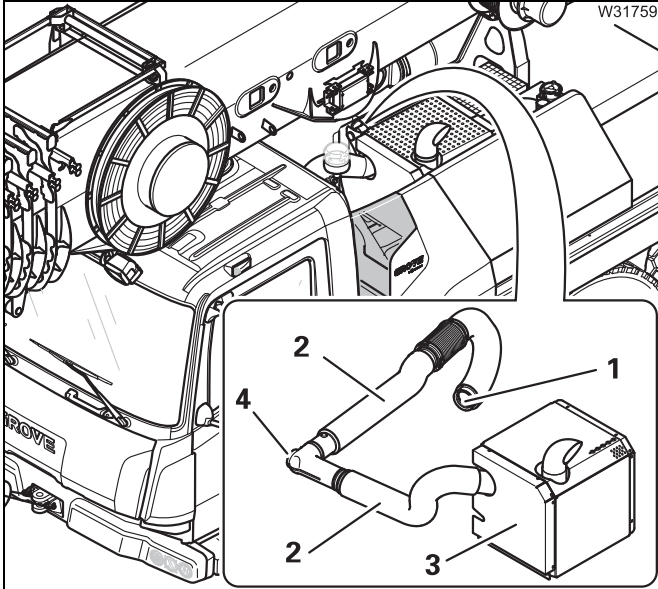


Checking



Risk of burns if the exhaust system is hot

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



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

After checking

- Start the engine.
- Check the AdBlue system gauge on the display in the driver's cab;
 ▶ p. 7 - 34.
- Check whether 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

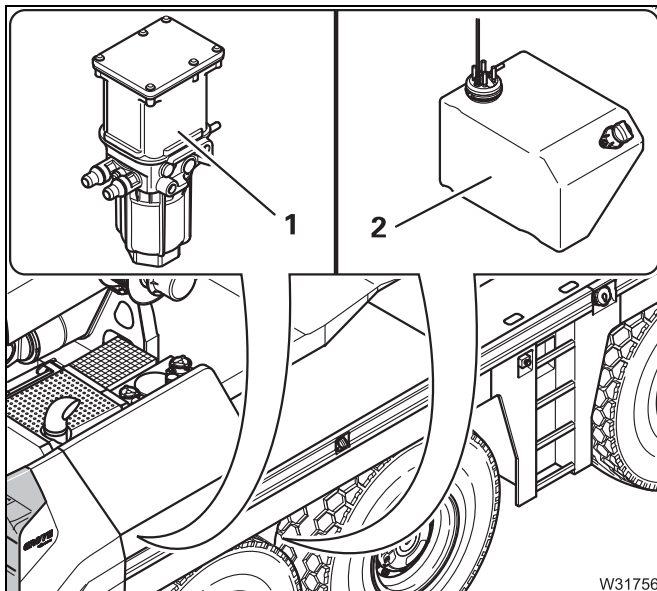
M 12

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

- Have the entire AdBlue system checked for leaks and correct operation; *Overview, p. 7 - 33.*
- Also observe the information on the components mounted on the engine; **▣▣▣▣** *Engine manufacturer's documentation:*
 - AdBlue dosing unit,
 - Solenoid valve for engine coolant for preheating the AdBlue tank.

Maintenance interval for the pump unit

The engine manufacturer specifies additional maintenance intervals for the pump unit (1); **▣▣▣▣** *Engine manufacturer's documentation.*



AdBlue filter

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

Pressure accumulator

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


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





Risk of damage to the pump unit.

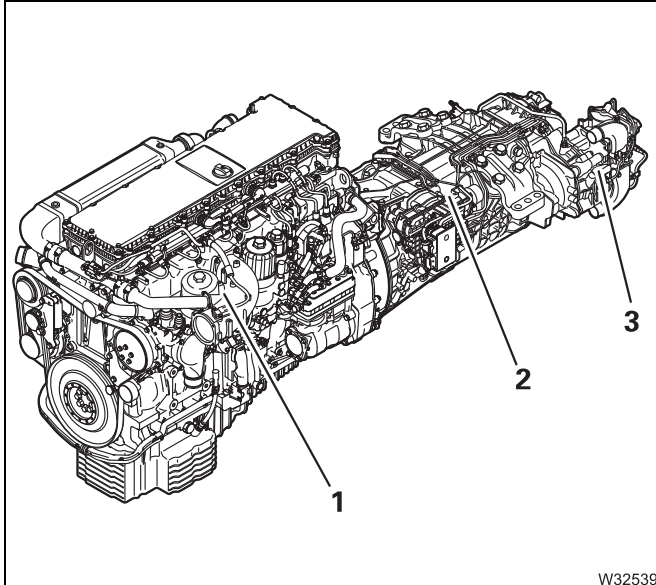
Oil from the compressed air system can damage the pump unit. Therefore, a filter cartridge must be installed in the compressed air drier that removes both water and oil. **Manitowoc Crane Care** recommends the suitable filter cartridge with the GROVE part number 04157844.

- Use only the suitable filter cartridge;  *Replacing the filter cartridge of the compressed air drier, p. 7 - 95.*

7.6

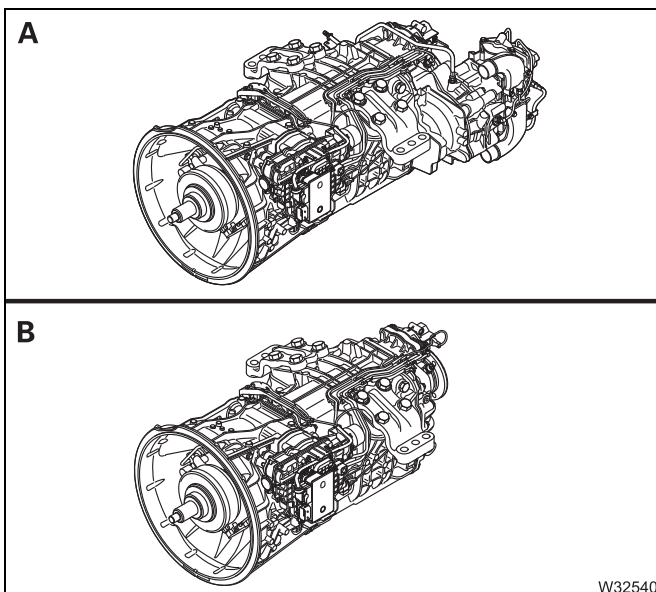
Transmission

Overview



Engine-transmission unit

- Diesel engine (1),
- Transmission (2),
- Water retarder SWR (3);
are the rear of the transmission (additional equipment);
SWR = Secondary Water Retarder.



Transmission

The automatic transmission has 16 speeds and the type designation G 280-16.

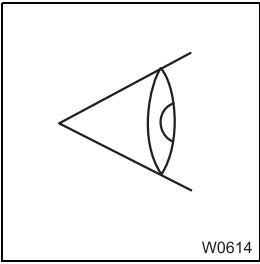
(A) transmission **with** Water Retarder **SWR**

(B) transmission **without** Water Retarder **SWR**

7.6.1

General inspection

W



- Pay attention to any unusual running noises from the transmission.
- Check the transmission and the connections for leaks.

The transmission can be checked at various **inspection openings** within the chassis:

Access	Inspection opening	viewing area
from above	behind the engine	front
from below	large, rectangular	Middle
from the right	small, diamond-shaped	rear
from the left	small, round	rear

In the event of leaking consumables: ■■■► *Checking the oil level*, p. 7 - 41.

- Check that pipes and hoses are tightly connected and undamaged.
From the rear transmission area, two hoses run to the transmission oil cooler. The transmission oil cooler is located within the radiator unit 1; ■■■► p. 7 - 20.

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 oil level



M 12

Spare parts and tools

Designation	Quantity	GROVE part no.
Gasket 24 x 29 Cu DIN 7603	1	00117145

- Receptacle, approx. 5 ltr (1.5 gal);  p. 2 - 4.
- Torque wrench for a torque of 25 Nm (18.4 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 not running and secured against unauthorised use;  p. 2 - 3.
- The inspection opening are now accessible;  p. 7 - 40.

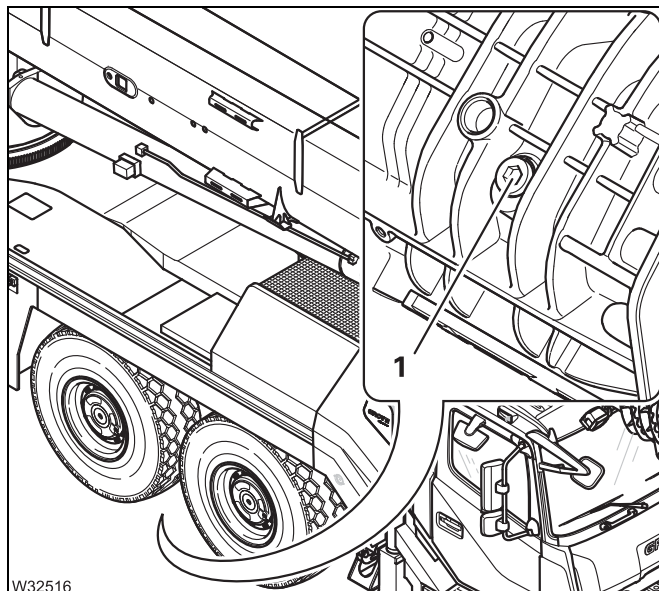
Check the oil level



Risk of damage to the transmission.


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

Check the oil level at the correct intervals.



- Remove the drain plug (1).
- Check the oil level; it must reach to the lower edge of the opening.
- Replace the gasket and tighten the drain plug – torque 25 Nm (18.4 lbf ft).

If the oil level is too low

- Top up the oil;  p. 7 - 44.

7.6.3


Changing the oil

Y 5



Oil, spare parts and tools

Gear oil in litres (gal)	Specification Classification	GROVE part no.
15.5 (4.1) with oil cooler	Fuchs Titan Cytrac MB Synth API-GL-4; SAE 75 W-90	04162042

Designation	Quantity	GROVE part no.
Filter	1	03328342
Spring	1	03328343
Gasket 42 x 49 Al DIN 7603	1	03328344
Gasket 24 x 29 Cu DIN 7603	2	00117145

- Receptacle, approx. 20 ltr (5 gal);  p. 2 - 4.
- Torque wrench for torque of 25 Nm (18.4 ft lbf) and 60 Nm (44.25 ft lbf).

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 engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The inspection opening are now accessible;  p. 7 - 40.

Draining oil



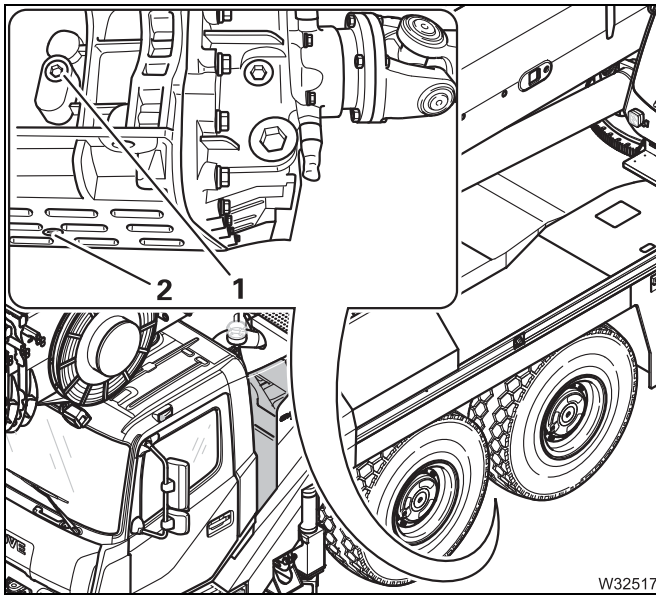
Risk of scalding from gear oil at operating temperature.

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.



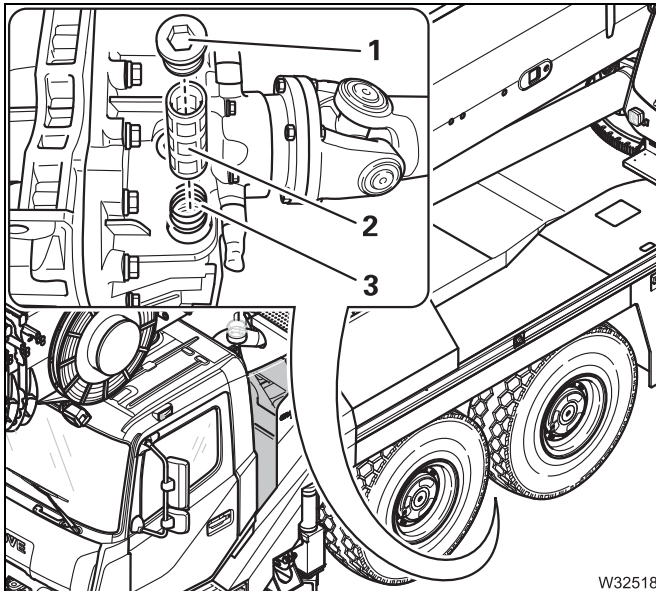
- Place a receptacle under the screw (2).
- Unscrew the screws (1) and (2) and allow the oil to drain off.
- Clean the drain plugs.
- Replace the gasket and tighten the drain plug (2) – torque 25 Nm (18.4 lbf ft).

Cleaning the filter



Risk of injury due to spring tension

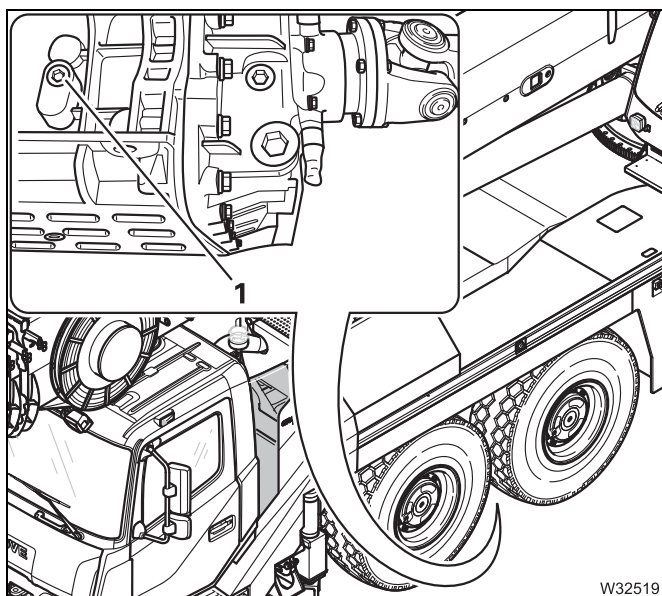
The oil filter bolt is spring-loaded. Release it carefully and be careful of the spring tension.



- Remove the drain plug (1).
- Take the filter (2) and the spring (3) out and clean them.
Replace any damaged parts.
- Insert the spring and filter into the opening.
- Replace the gasket and tighten the drain plug – torque 60 Nm (44.25 lbf ft).

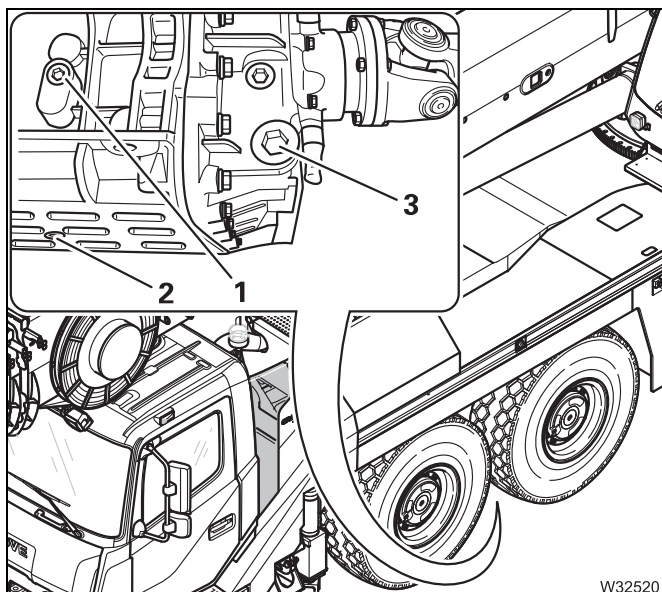


Topping up the oil



- Fill the oil up to the lower edge of the opening.
- Replace the gasket and tighten the drain plug (1) – torque 25 Nm (18.4 lbf ft).

Checks after the oil change



After changing oil, check for leakage:

- Start the engine and let it idle in neutral **N**
- Check the screw plugs (1) to (3) for leakage
- Check the hoses and connections on the oil cooler.

7.7

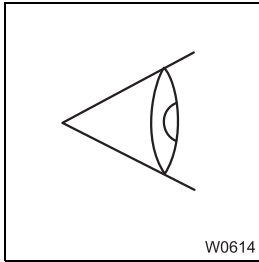
Transfer case


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

7.7.1

General inspection

W



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

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

7.7.2


Checking the oil level

M 1

Spare parts and tools

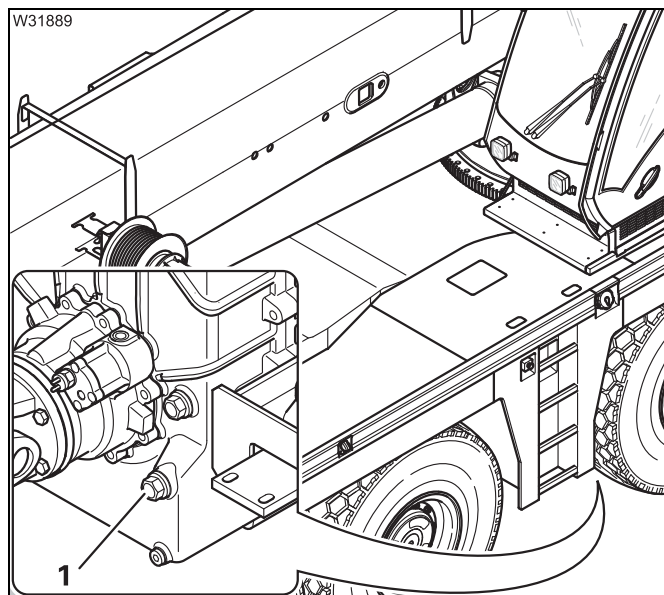
Designation	Quantity	GROVE part no.
Gasket 30 x 36 Cu DIN 7603	1	00117151

Prerequisites

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



Checking



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

If the oil level is too low

- Top up the oil; ►►► p. 7 - 47.

7.7.3

Changing the oil

M 6

Oil, spare parts, tools

Gear oil in litres (gal)	Designation to DIN 51502	Specification classification	GROVE part no.
14 (3.7) with oil cooler	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, approx. 15 ltr (4.0 gal); ►►► p. 2 - 4.

Prerequisites

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

Changing the oil



Risk of scalding from gear oil at operating temperature.

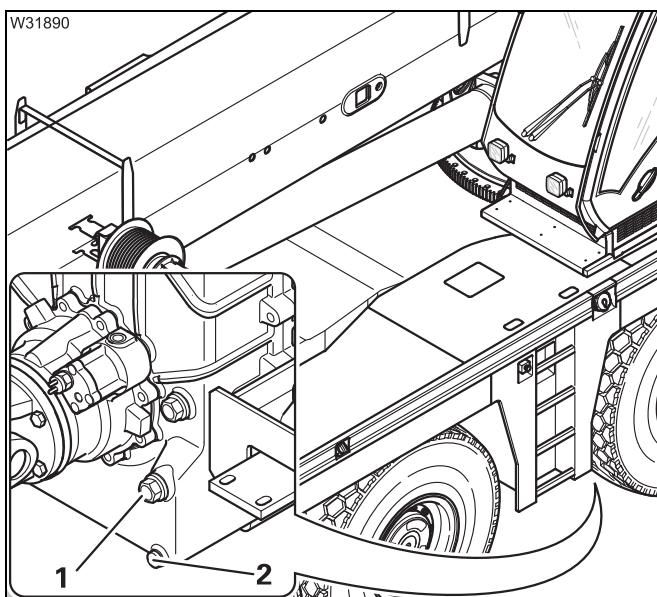
You could scald yourself by gear oil escaping in an uncontrolled manner at operating temperature. Wear appropriate protective gloves and take care not to come into contact with the gear oil.



Risk of environmental damage due to leaking consumables.

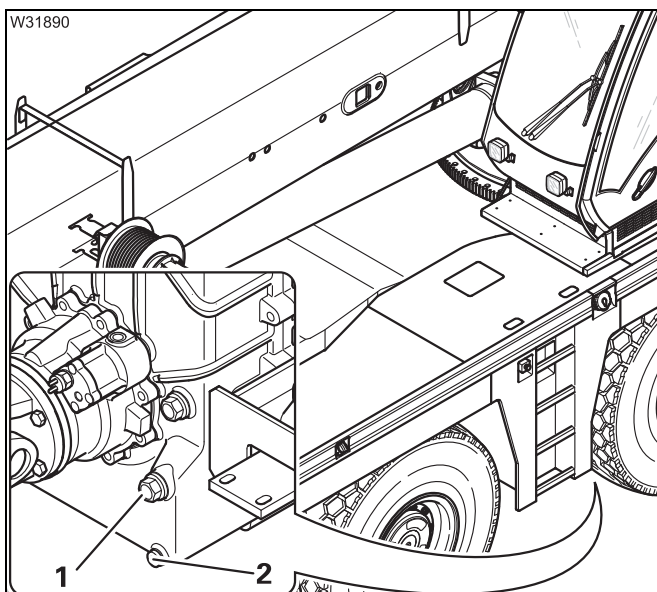
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.


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



- Place a receptacle under the screw (2).
- Unscrew the screws (1) and (2) and allow the oil to drain off.
- Fit a new gasket and tighten the drain plug (2).
- Fill the oil up to the lower edge of the opening.
- Fit a new gasket and tighten the screws (1).

Checks after the oil change



- Go for a test drive.
- Switch the engine off and wait for about 5 minutes.
- Check the oil level;  p. 7 - 45.
- Check drain plugs (1) and (2) for leaks.

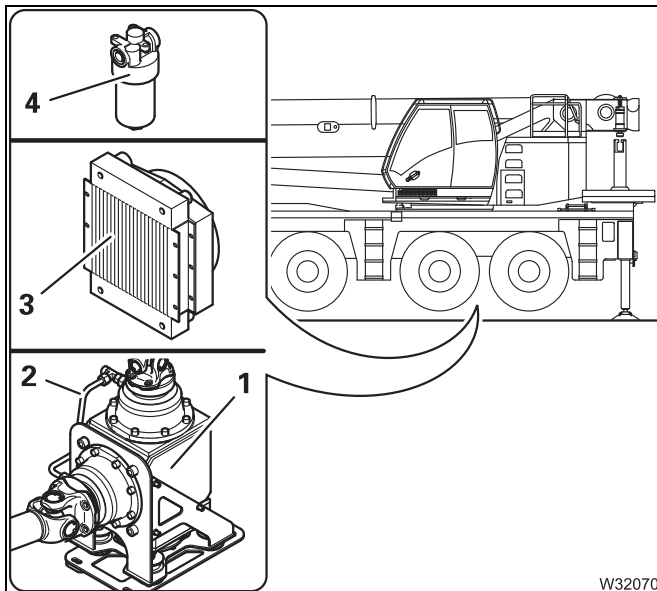
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7.8

Angle gear

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

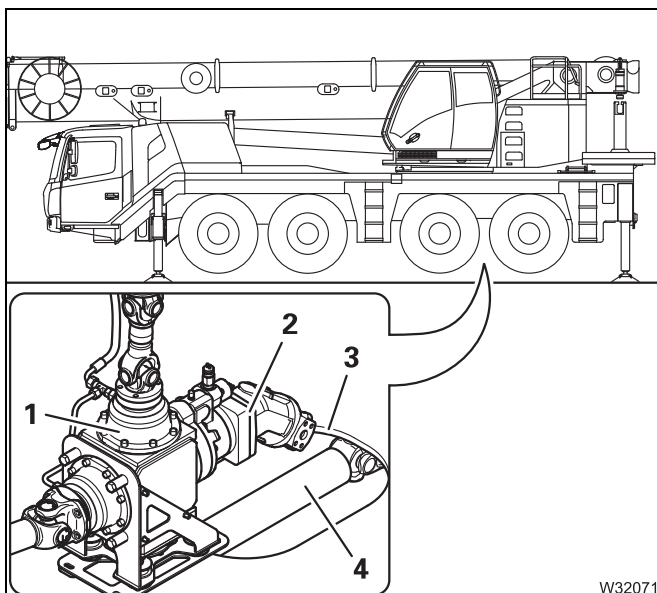
Access



The angle gear (1) is located in the travel gear frame at the centre of rotation of the turntable.

Within the oil circuit (2) the gear oil for the angle gear (1) is routed via a separate oil cooler (3) and through a separate filter (4).

The oil cooler (3) and the filter (4) are also located within the chassis in the area of the centre of rotation.



Access to the angle gear (1) is possible only from the underside of the chassis.

Access via the port (3) can be enlarged if necessary by removing the Cardan shaft (4) between the third and fourth axle lines.

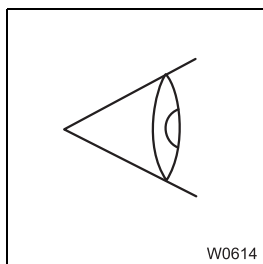
If the additional equipment *Driving from the crane cab* is fitted, the angle gear (1) is fitted with a flange for a hydraulic drive (2).

It may be necessary to remove the hydraulic drive (2) from the flange in order to enlarge the access via the port (3).

7.8.1

General inspection

W



- Investigate any unusual noises in the angle gear.
- Check the transmission and the oil circuit (oil cooler, filter, hoses, connections) for leaks. If consumables are leaking;
 - ▣▣▣▣▶ *Checking the oil level*, p. 7 - 50.
- 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

Checking the oil level

M 1

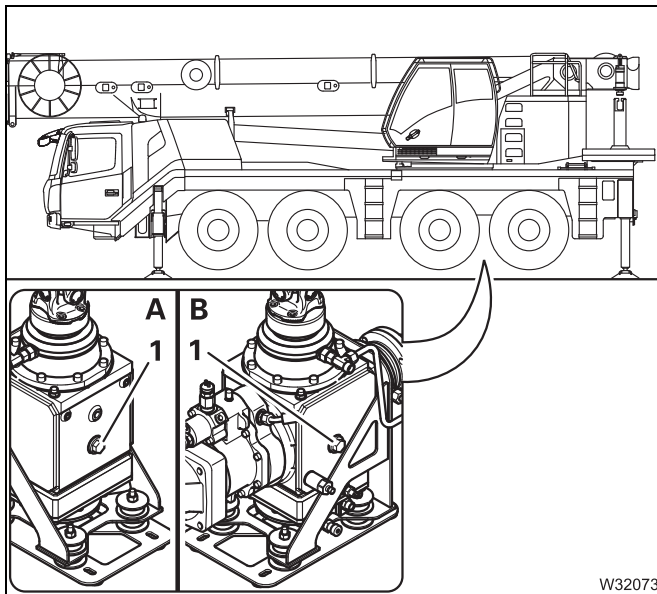
Spare parts and tools

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 be switched off and secured against unauthorised use;
 - ▣▣▣▣▶ p. 2 - 3.
- The angle gear must be adequately cooled.
- The inspection opening and the interior space must be clean and free of oil so that the fitter can work safely in the restricted space where the angle gear is installed.


Checking



(A) – angle gear without hydraulic drive (standard configuration).
(B) – angle gear with hydraulic drive (additional equipment *Driving from the crane cab*).

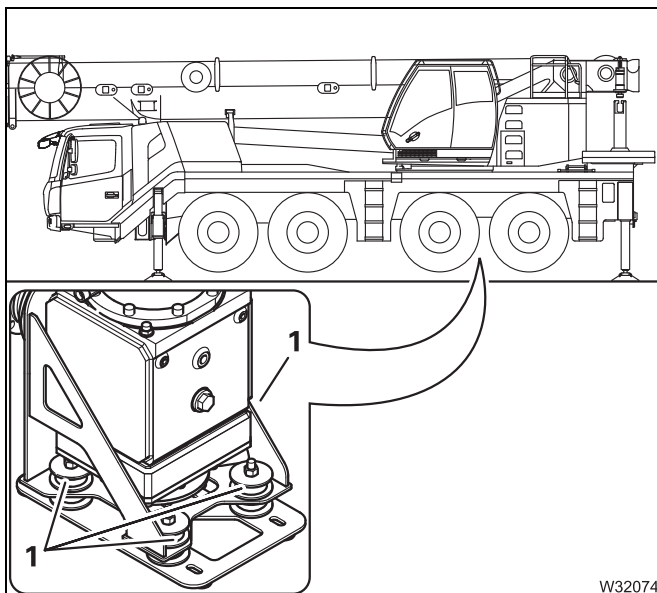
- Remove the drain plug (1).
- Check that the oil reaches the lower edge of the opening.
- Fit a new gasket and tighten the screw.

If the oil level is too low

- Top up the oil;  p. 7 - 52.

Checking the resilient dampers

The angle gear is mounted on four resilient dampers.



- Check the secure fastening and the condition of the resilient dampers (1):

If the resilient dampers are damaged, have them replaced by **Manitowoc Crane Care** or an authorised GROVE dealer.

7.8.3



Changing the oil and the oil filter

M 6


Oil, spare parts, tools

Gear oil in litres (gal)	Designation to DIN 51502	Specification classification	GROVE part no.
7.2 (1.9) for type A		MIL-L 2105 B API-GL-5 Viscosity: Hyp SHC 75-90	01373344
8.6 (2.3) for type B			

Designation	Quantity	GROVE part no.
Angle gear:		
Gasket 30 x 36 Cu DIN 7603	1	00117151
Filter:		
Filter	1	03135866
Packing set	1	04161645
Oil cooler:		
Drain plug with gasket	1	03326356

- Connecting piece and hose (tool box);  p. 7 - 108.
- Receptacle, approx. 10 ltr (2.5 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The angle gear must be adequately cooled.
- The inspection opening and the interior space must be clean and free of oil so that the fitter can work safely in the restricted space where the angle gear is installed.

Changing the oil



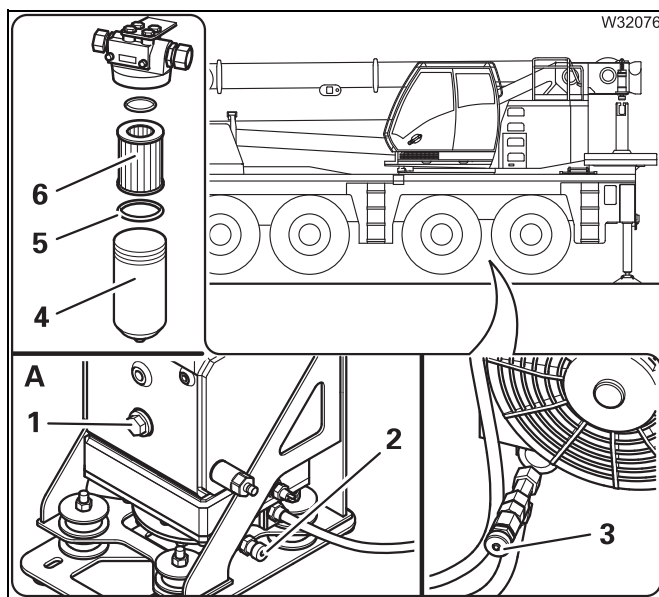
Risk of scalding from gear oil at operating temperature.

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.



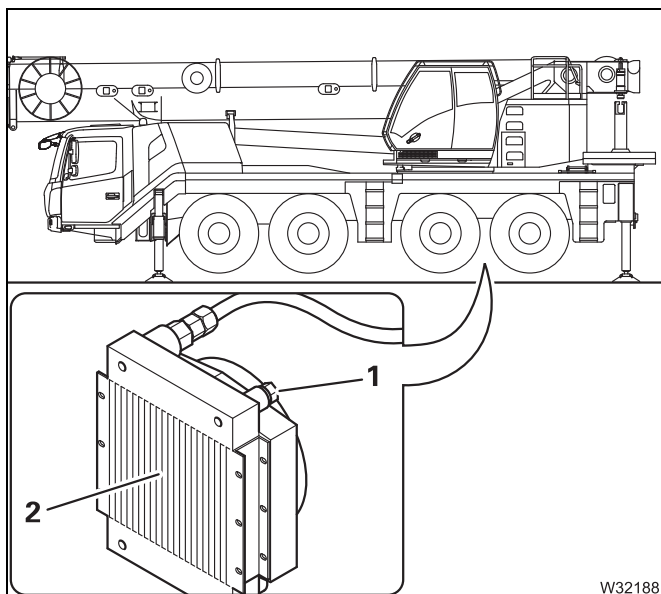
Risk of environmental damage due to leaking consumables.

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.

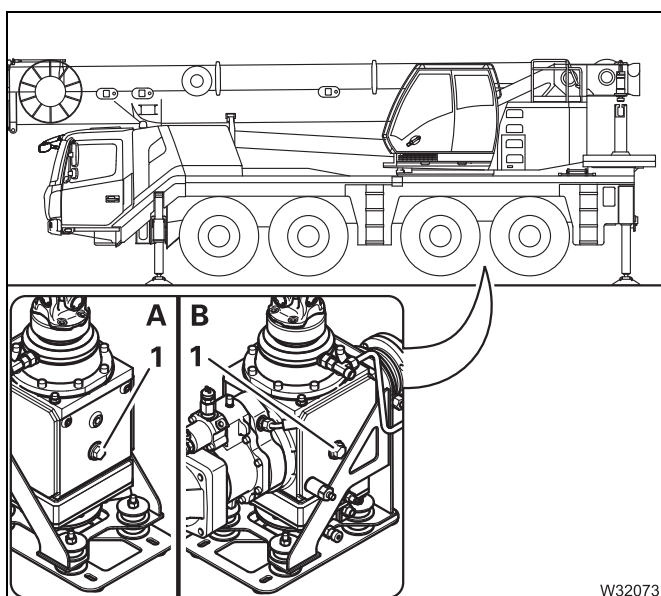


- Place a receptacle under the angle gear, the oil cooler and the filter.
- Check the type of the angle gear: **(A)** or **(B)**;
 ▣▣▣▣ *Checking*, p. 7 - 51.
- Remove the drain plug **(1)**. The illustration shows type **(A)**.
- Screw the discharge connection piece and hose on to the valve **(2)** on to the angle gear and drain the oil into the receptacle;
 ▣▣▣▣ *Handling the valves*, p. 7 - 108.
- Take the connecting piece and hose off the valve **(2)**.
- Screw the discharge connection piece and hose on to the valve **(3)** on to the oil cooler and drain the oil into the receptacle.
- Take the connecting piece and hose off the valve **(3)**.
- Remove the filter **(4)** and allow the oil to drain from it into the receptacle.
- Change the filter **(6)**.
- Replace the gasket **(5)**.
- Tighten the filter **(4)**.





- Remove the screw (1) from the oil cooler (2).
- Fill the oil up to the lower edge of the opening (1).
- If necessary fit a new gasket and tighten the screw (1).




(A) – angle gear without hydraulic drive (standard configuration).
(B) – angle gear with hydraulic drive (additional equipment *Driving from the crane cab*).

- Fill the oil up to the lower edge of the opening (1).
- Fit a new gasket and tighten the drain plug (1).

Checks after the oil change

In order to circulate the oil around the oil circuit you must try out operation of a hydraulic function on the superstructure (for instance tilting the crane cab).

- Switch the engine off and wait for about 5 minutes.
- Check the oil level;  p. 7 - 50.
- Check the angle gear, the filter and the oil cooler for leaks.

7.9

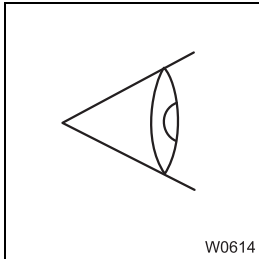
Axle lines



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

7.9.1

General inspection

W



- Investigate any unusual running noises from the axle centre drives and the final drives.
- Check the axle centre drives/final drives and the connections for leaks. If consumables are leaking;
 -  *Axle centre drives – checking the oil level*, p. 7 - 55,
 -  *Final drives – Checking the oil level*, p. 7 - 61.
- 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.

7.9.2

Axle centre drives – checking the oil level


M 1

Spare parts and tools

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

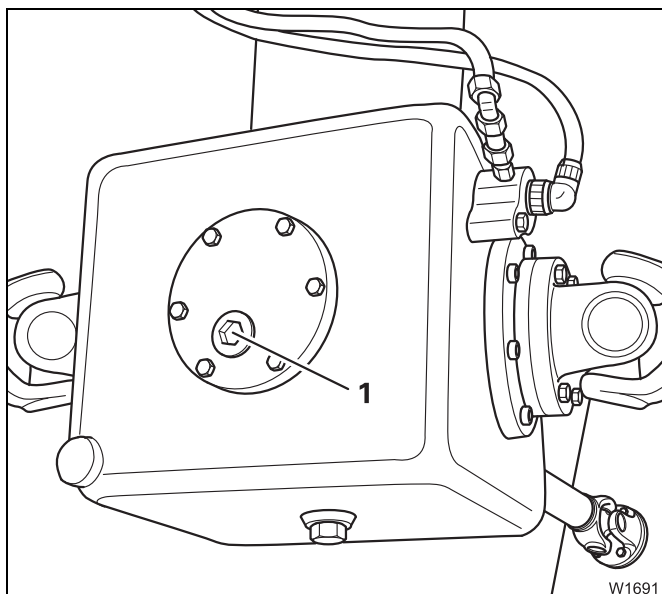
¹⁾ Additional equipment (2nd driven axle line)

Prerequisites

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



1. and 4th axle lines



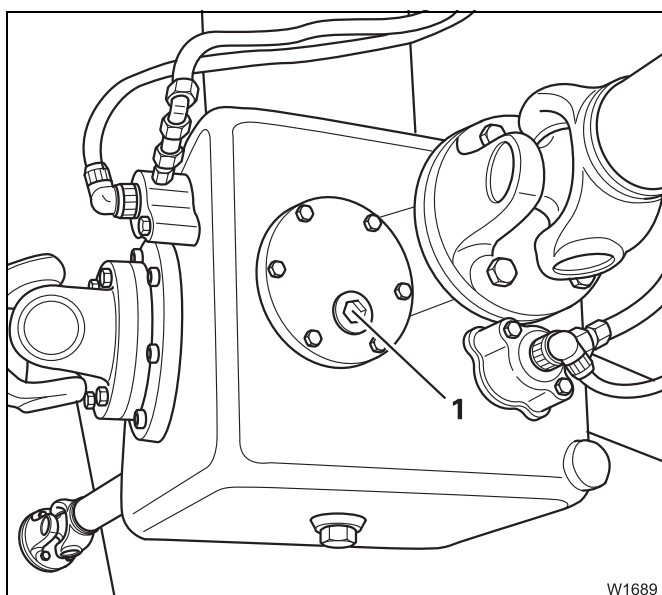
- Remove the drain plug (1).
- Check that the oil reaches the lower edge of the opening.
- Fit a new gasket and tighten the screw.

If the oil level is too low

- Top up the oil; ►►► p. 7 - 58.

2nd axle line

This axle centre drive is present only with the 8 x 8 x 8 drive.

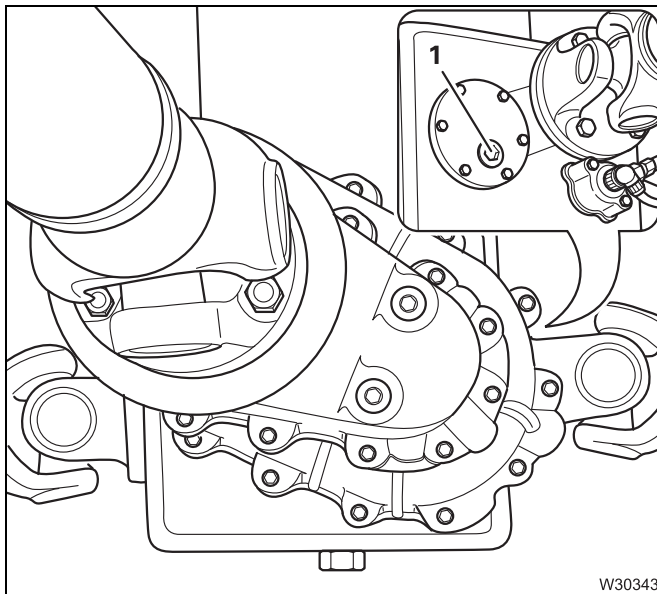


- Remove the drain plug (1).
- Check that the oil reaches the lower edge of the opening.
- Fit a new gasket and tighten the screw.

If the oil level is too low

- Top up the oil; ►►► p. 7 - 58.

3. axle line



The drive has two oil chambers.

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

If the oil level is too low

- Top up the oil; ■■■▶ p. 7 - 59.

7.9.3

Axle centre drives – changing the oil

M 12

Oil, spare parts,
tools

Gear oil in litres (gal)	Designation to DIN 51502	Specification classification	GROVE part no.
Axle line 1+4: each 13.0 (3.5) Axle line 2: 15 (4.0) Axle line 3: 16.5 (4.4)	C - LPF	MIL-L 2105 B API-GL-5 Viscosity: Hyp SAE 90 ISO - VG 220	00552891

for drive	Designation	Quantity	GROVE part no.
8 x 6 x 8	Gasket 30 x 36 Cu DIN 7603	3	00117151
	Gasket 24 x 29 Cu DIN 7603	2	00117145
	Gasket 36 x 42 Cu DIN 7603	3	01371208
8 x 8 x 8 ¹⁾	Gasket 30 x 36 Cu DIN 7603	4	00117151
	Gasket 24 x 29 Cu DIN 7603	2	00117145
	Gasket 36 x 42 Cu DIN 7603	4	01371208

- ¹⁾ Additional equipment (2nd driven axle line)
– Receptacle, approx. 20 ltr (5.0 gal); ■■■▶ p. 2 - 4.



Prerequisites

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



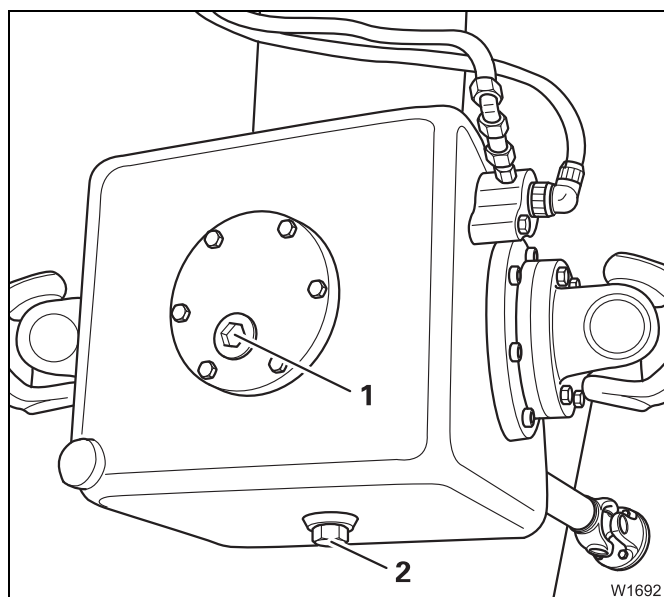
Risk of environmental damage due to leaking consumables.

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

Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.

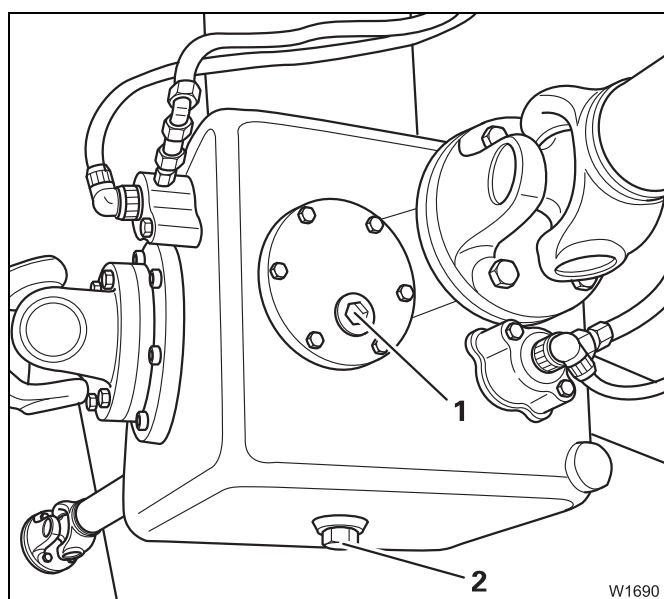
1st and 4th axle lines



- Place a receptacle under the screw (2).
- Unscrew the screws (1) and (2) and allow the oil to drain off.
- Fit a new gasket and tighten the drain plug (2).
- Fill the oil up to the lower edge of the opening.
- Fit a new gasket and tighten the drain plug (1).

2nd axle line

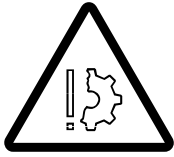
This axle centre drive is present only with the 8 x 8 x 8 drive.



- Place a receptacle under the screw (2).
- Unscrew the screws (1) and (2) and allow the oil to drain off.
- Fit a new gasket and tighten the drain plug (2).
- Fill the oil up to the lower edge of the opening.
- Fit a new gasket and tighten the drain plug (1).

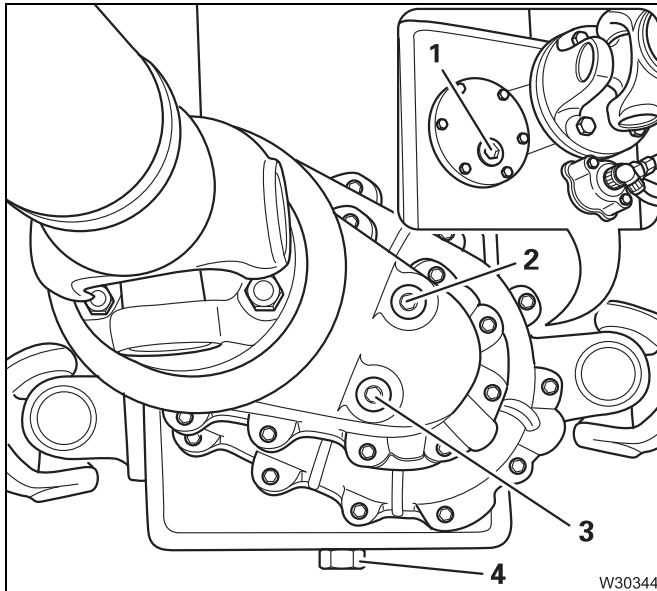
3rd axle line

The drive has two oil chambers.



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 oil tanks from being overfilled and thus the oil from overheating.



- Place a receptacle under screws (3) and (4).
- Remove the screws (1), (2), (3) and (4) and let the oil drain off.
- Fit new gaskets and tighten the screws (3) and (4).
- First add 1.5 ltr (0.4 gal) oil through the hole (2).
- Add more oil through the hole (1), up to the lower edge of the hole (1).
- Fit new gaskets and tighten the screws (1) and (2).

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7.9.4

Final drives – Checking the oil level


M 1

Spare parts and tools

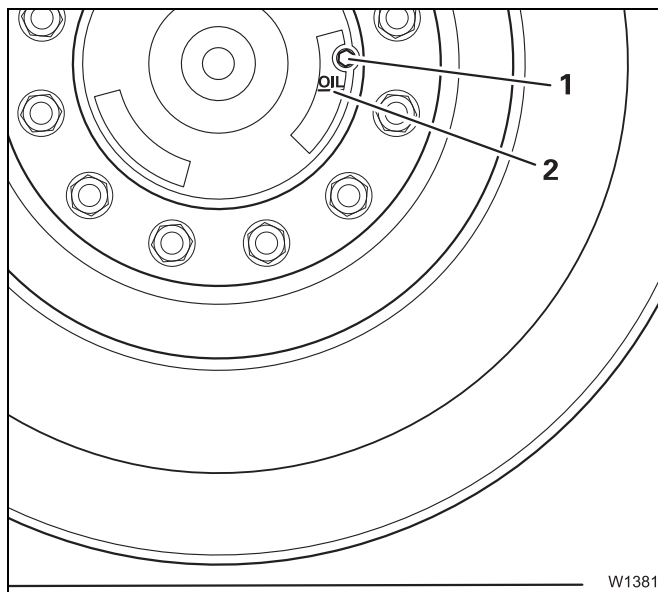
for drive	Designation	Quantity	GROVE part no.
8 x 6 x 8	Gasket 24 x 29 Cu DIN 7603	6	00117145
8 x 8 x 8 ¹⁾	Gasket 24 x 29 Cu DIN 7603	8	00117145


¹⁾ Additional equipment (2nd driven axle line)

Prerequisites

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

Checking the oil level



- Check the oil level at all other final drives in the same way.
 - Turn the wheel until the marking (2) is horizontal and is on the right, next to the centre of the axle.
 - Remove the drain plug (1).
 - Check that the oil level is at the mark (2).
 - Fit a new gasket and tighten the screw.
- If the oil level is too low**
- Top up the oil,  p. 7 - 63.

7.9.5

Final drives – Changing the oil


M 12

Oil, spare parts, tools


Gear oil in litres (gal)	Designation to DIN 51502	Specification classification	GROVE part no.
for each final drive: 2.7 (0.7)	C - LPF	MIL-L 2105 B API-GL-5 Viscosity: Hyp SAE 90 ISO - VG 220	00552891

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

¹⁾ Additional equipment (2nd driven axle line)

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

Prerequisites

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



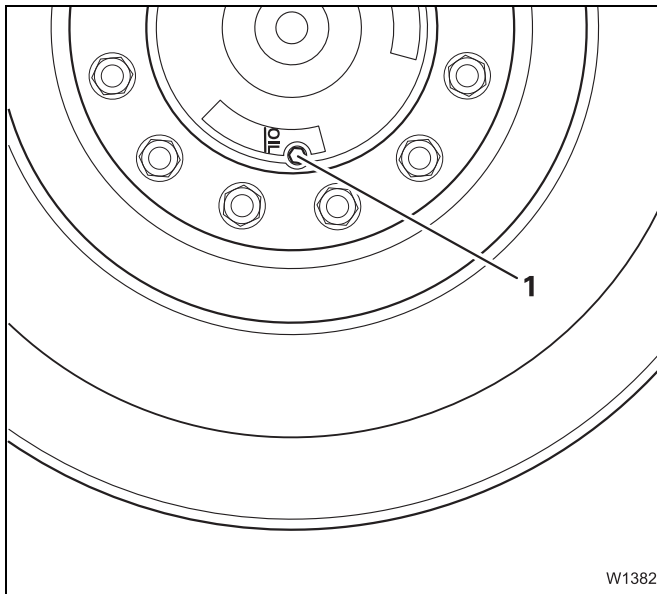
Risk of environmental damage due to leaking consumables.

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

Store/dispose of consumables and any soaked equipment properly.

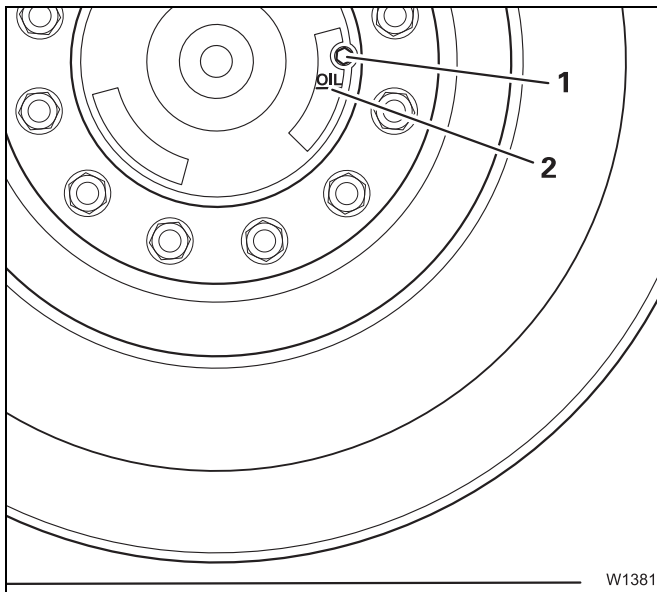
Ask about the applicable regulations.

Draining oil



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

Topping up the oil



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

7.9.6

Lubricating the Cardan shafts in the axle lines

M 1




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

Grease, spare parts, tools

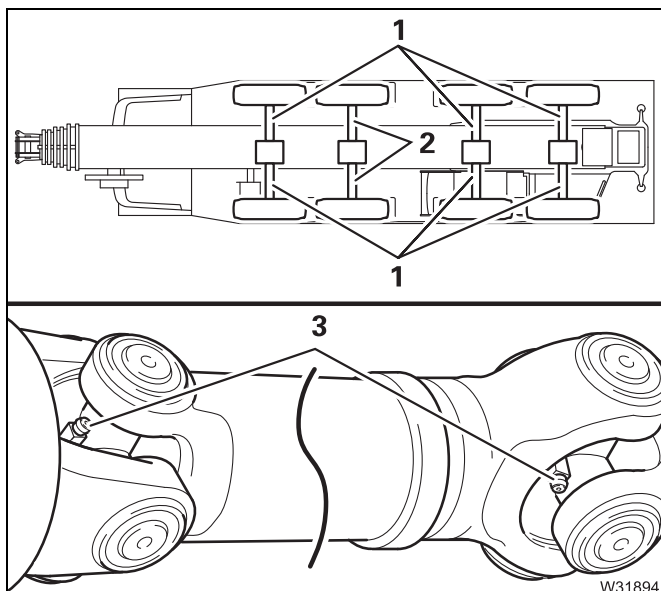
Lubricating grease	Designation to DIN 51502	Specification classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set.

Prerequisites

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

Lubricating



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

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

7.9.7

Lubricating longitudinal Cardan shafts

M 6



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

Grease, spare parts, tools

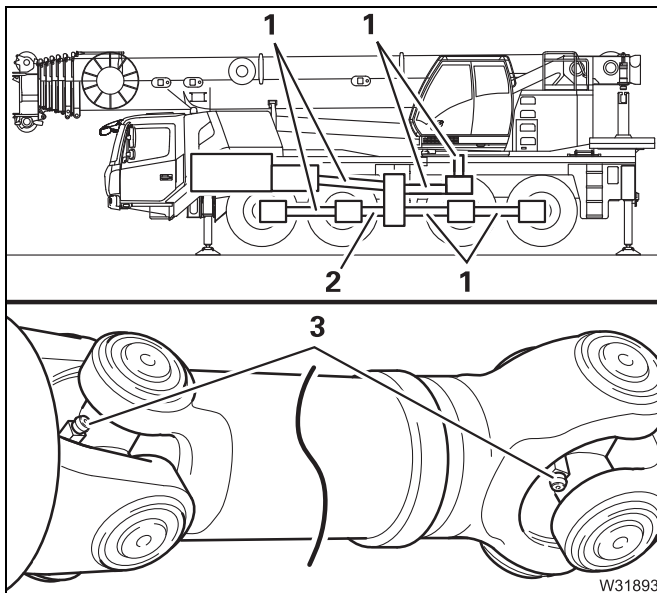
Lubricating grease	Designation to DIN 51502	Specification classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set.

Prerequisites

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

Lubricating



- The Cardan shaft (2) is fitted only to the 8 x 8 x 8 drive.
- Check which Cardan shafts (1) and (2) have lubricating nipples (3).
- Clean the grease nipples (3).
- Inject grease into the grease nipples until grease escapes from the bearing points. Do not inject grease with excessive force, otherwise the lip seals may be damaged.
- Remove the excess grease.

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7.10

Wheels

7.10.1

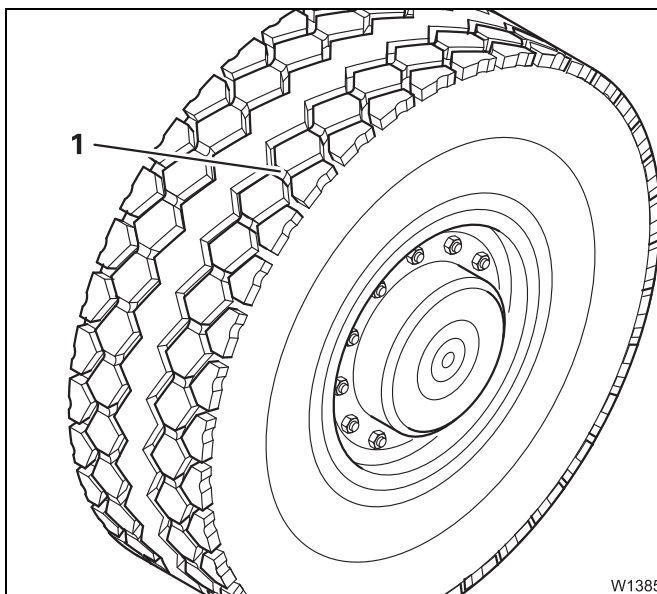
Checking the tyres for damage

D

Prerequisites

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

Checking



- Check all tyres for:
 - Broken off tread blocks
 - Dents
 - Areas of uneven wear
 - Whether the wear mark (1) has been reached
- Replace any damaged tyres.
- If the tyres show varying degrees of wear, change the wheels; ▣▣▣▣▶ *Changing the wheels*, p. 7 - 70.



Risk of accidents due to uneven braking.

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

Always replace all the tyres on an axle line.

7.10.2

Checking the tyre pressure

W



Risk of damage to the tyres.

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

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

- Check the tyre pressure using the following table.

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

7.10.3

Checking that the wheel nuts are tight

M 1

Spare parts and tools

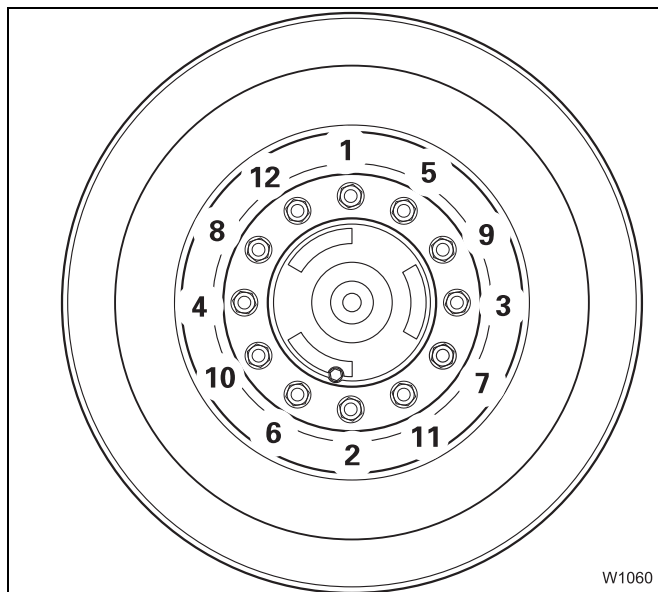
Designation	Quantity per wheel	GROVE part no.
Wheel nut with pressure plate for steel rims	12	01207756
Wheel nut with pressure plate for aluminium rims	12	7659100000

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

Prerequisites

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

Check the wheel nuts



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

7.10.4

Changing the wheels

M 6

The wear on tyres varies depending on whether the axle

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

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


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

Spare parts and tools

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

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

Prerequisites

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

Changing the wheels



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

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


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

- Remove the wheels from the axles.

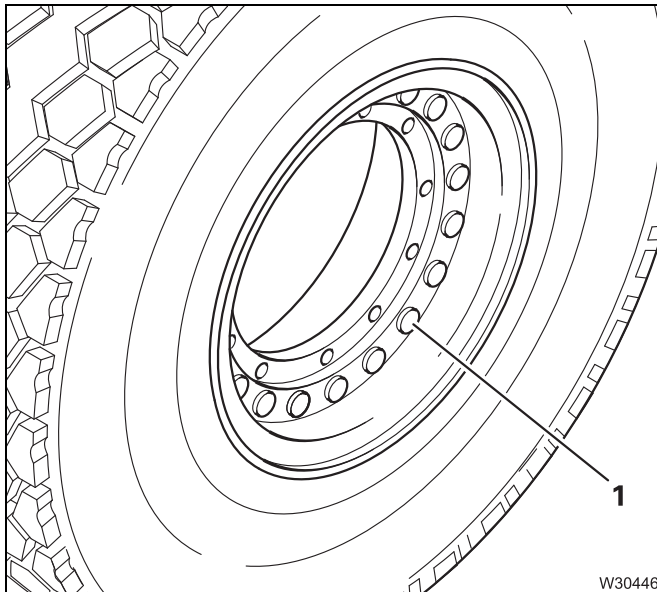
Only for two-piece aluminium rims

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

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

 *Recognising two-piece aluminium rims*, p. 7 - 71.

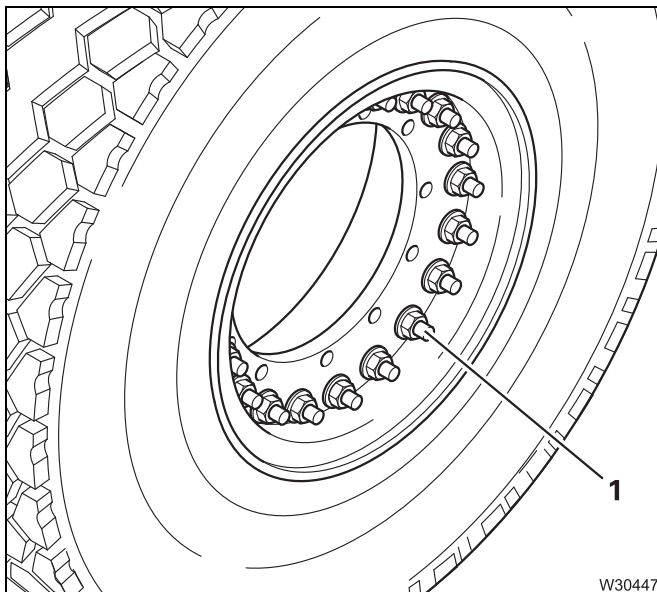
Recognising two-piece aluminium rims



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

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

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



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

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


Aluminium rims with 20 nuts:

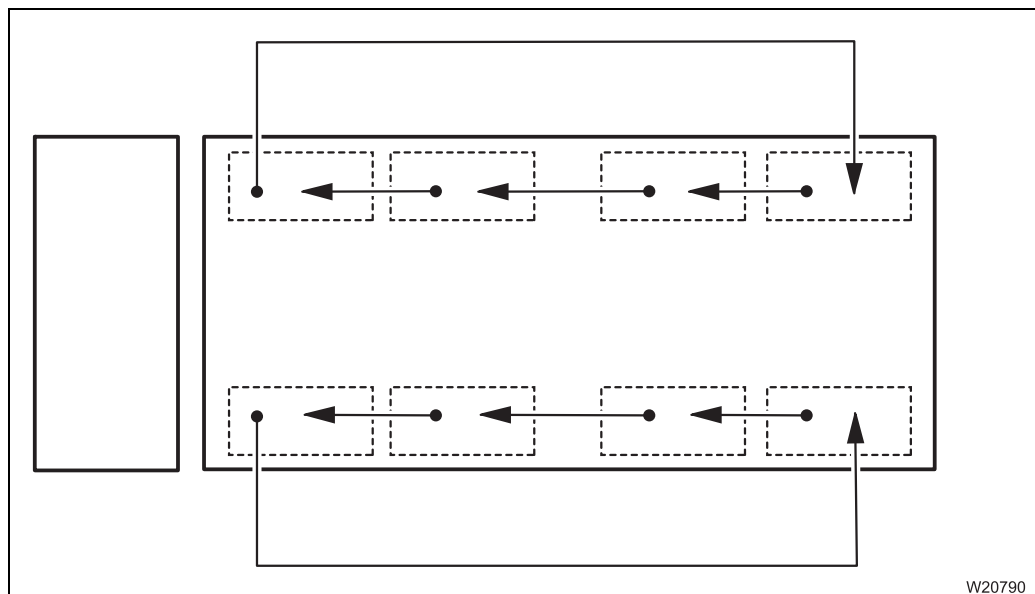
550 Nm (406 lbf ft)

Aluminium rims with 22 nuts:

385 Nm (284 lbf ft)



- Mount the wheels on another axle, as shown in the diagram. Replace any damaged parts. Tighten the wheel nuts;  p. 7 - 69.



Optimised wheel changes

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



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

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

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



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

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


This will prevent tyre damage caused by assembly errors.

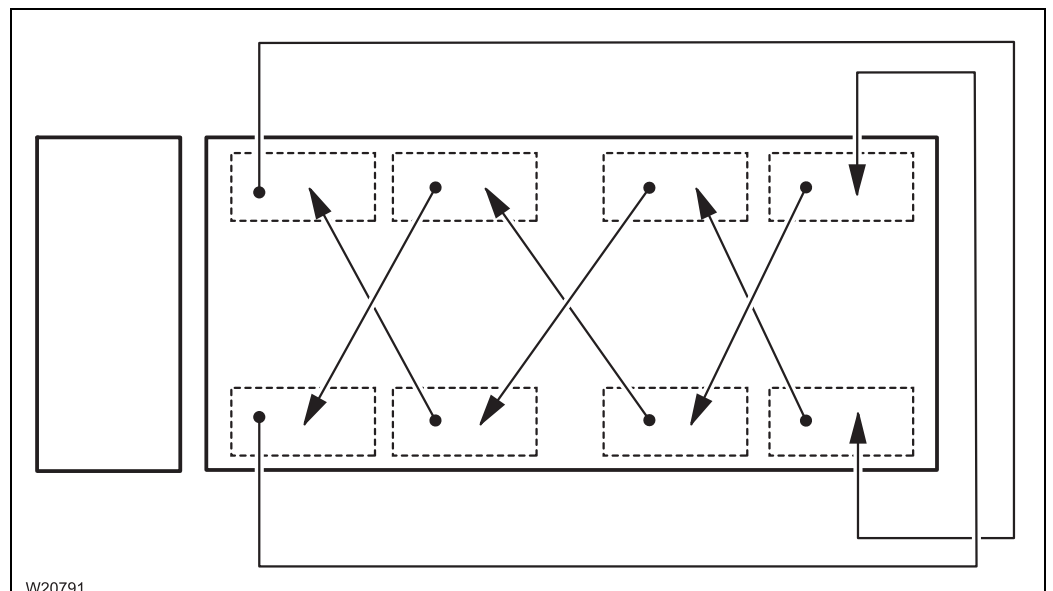


Risk of tyre damage caused by the tyres running in a different direction.

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

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

- Remove the wheels from the axles.
- Turn the tyre on the rim if the wheel is to be used on the other side of the crane.
- Mount the wheels on another axle, as shown in the diagram. Replace any damaged parts. Tighten the wheel nuts;  p. 7 - 69.

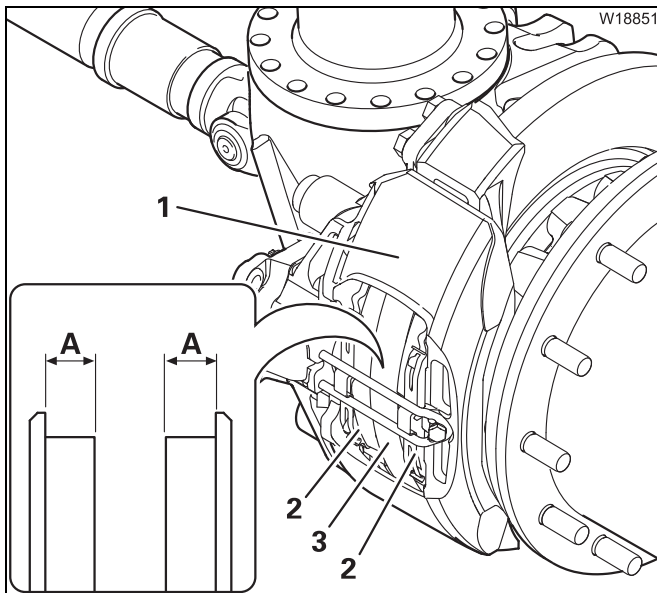


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7.11 Vehicle brake

7.11.1 Checking the wear display

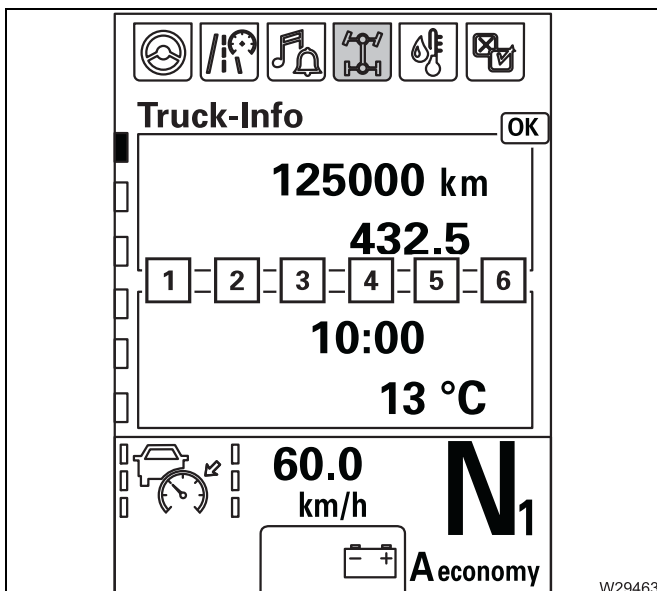
D



On the brake caliper

Each brake caliper (1) carries two brake pads (2), arranged one to the left and one to the right of the brake disc (3).

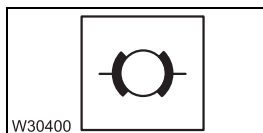
The lining thickness (A) is monitored by an electric wear indicator on the brake caliper (1). If the lining thickness (A) falls below the permissible minimum value, a warning message is displayed on the on-board computer in the driver's cab.



On the on-board computer

- Familiarise yourself with the correct operation of the on-board computer; *Operating Instructions*.
- The *Operation and Maintenance* menu also provides information on the condition of the disc brakes.
- Check the outstanding warning messages every day.





If the symbol (1) is displayed on the on-board computer, one of the disc brakes has exceeded the brake pad wear limit.

- Check **all** disc brakes on **all** axle lines; ■■■▶ *Checking disc brakes, p. 7 - 76.*
- Have the disc brakes repaired immediately; ■■■▶ *Having the brakes repaired, p. 7 - 81.*

7.11.2

Checking disc brakes

M 3

Spare parts and tools


Designation	Quantity	GROVE part no.
Wear contact set	12	03142924
Set of brake pads with a wear contact set	12	03142923
Guide set and packing set	24	03142922
Packing set	24	03142925
Brake disc	8	03142916

- Measuring tools for brake pad and brake disc thicknesses.
- Dial gauge for the brake disc runout.
- Ring spanner for adjustment.

Prerequisites

- The truck crane must be parked over an inspection pit.
- The truck crane must be raised on outriggers.
- The engine must be switched off and secured against unauthorised use; ■■■▶ p. 2 - 3.
- The wheels must be removed from all the axle lines.
- The parking brake must be released.

Safety instructions

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




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


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


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

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

- **Perform only maintenance work:**

 *Checking the brake discs*, p. 7 - 77,

 *Checking the brake pads*, p. 7 - 79,

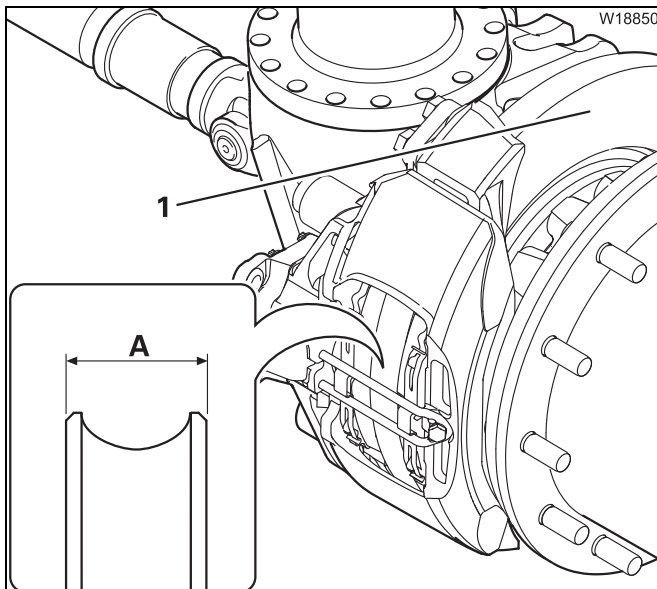
 *Checking the adjustment mechanism*, p. 7 - 79.

If damage is discovered then you must have the vehicle brakes repaired;

 *Having the brakes repaired*, p. 7 - 81.

Checking the brake discs

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



Measure the thickness

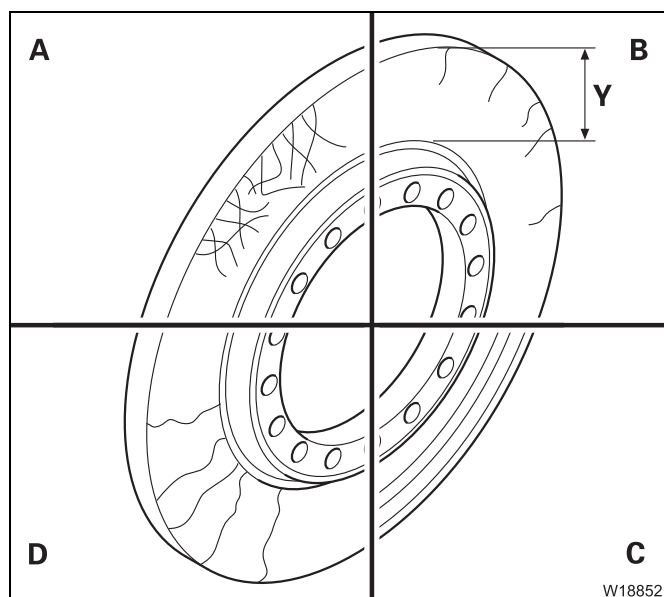
- Measure the thickness (**A**) of the brake discs (**1**).

New brake discs have a thickness of approx. 41 mm (1.61 in).

You must have the brake disc replaced if the thickness is less than 33 mm (1.30 in);


 *Having the brakes repaired*, p. 7 - 81.





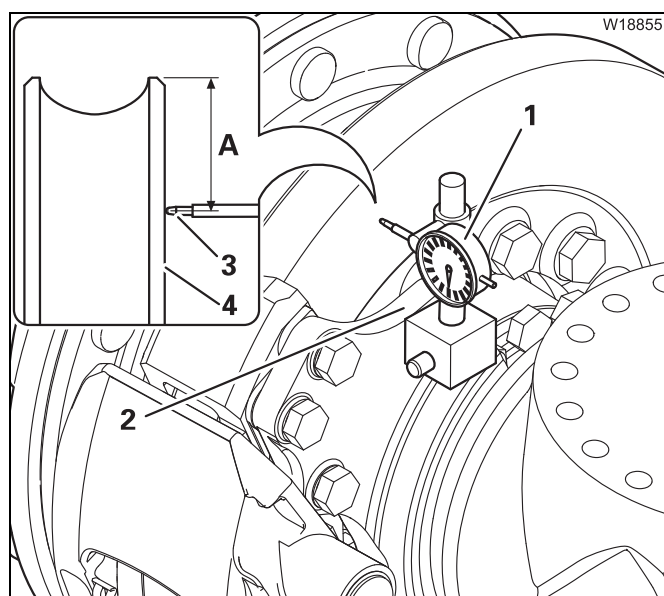
Checking the surface

- Check for signs of damage such as cracks and irregularities:
 - (A) – fine network of cracks,
 - (B) – radial cracks,
 - (C) – circular irregularities,
 - (D) – continuous cracks.
- Check that any damage found lies within the permissible **limit values**.

You must have the brake disc replaced if any limit values are exceeded;  *Having the brakes repaired*, p. 7 - 81.


Limit values for damage:

- (A) – permissible,
- (B) – only permissible for a crack length up to three-quarters of the length Y.
- (B) – only permissible for a crack width of up to 0.5 mm (0.02 in).
- (C) – only permissible for a crack depth of up to 1.5 mm (0.06 in).
- (D) – not permissible.



Measure the runout

- Attach the dial gauge (1) to the brake anchor plate (2).
- Position the measuring probe (3) perpendicular to the brake disc (4). The distance (A) to the edge of the brake disc must be 35 mm (1.38 in).
- Rotate the brake disc one full revolution and read the runout on the dial gauge pointer.

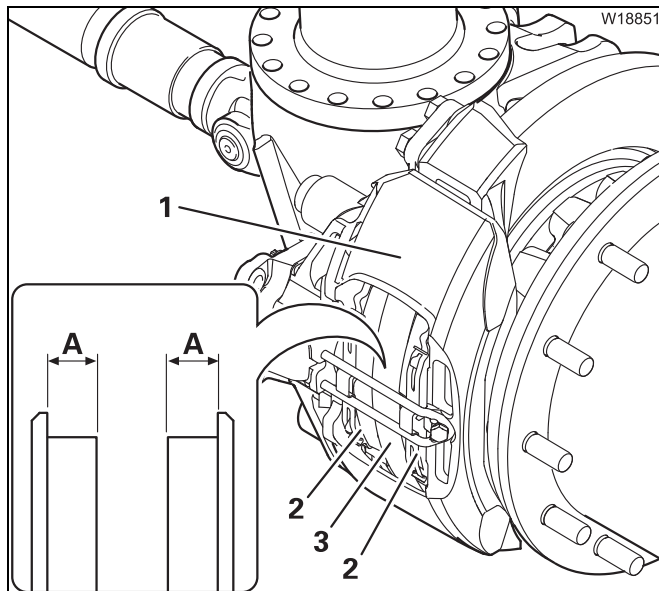
You must have the brake disc replaced if the runout is greater than 0.15 mm (0.006 in);  *Having the brakes repaired*, p. 7 - 81.

Checking the brake pads

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

Each brake caliper (1) carries two brake pads (2), arranged one to the left and one to the right of the brake disc (3).

The first and second axle lines have **two** brake calipers per brake disc.
The third and fourth axle lines have **one** brake caliper per brake disc.



On the brake caliper

- Measure the pad thickness (A).

New brake pads have a pad thickness of approx. 23 mm (0.90 in).

You must have the brake pads replaced if

- the brake pad thickness is less than 2 mm (0.08 in) or
- the brake pads are burnt, glazed, broken or oily; *Having the brakes repaired*, p. 7 - 81.
- Check that the electrical cable to the wear display is undamaged.



Brake pad wear (A) is taken up by the automatic adjustment mechanism. When the pad thickness is small, the travel adjustment is large and you must also check the adjustment mechanism; *Checking the adjustment mechanism*, p. 7 - 79.

Checking the adjustment mechanism

- Using a ring spanner, check all the brake calipers.



There is a risk of damage if an unsuitable tool is used

The use of an unsuitable tool can damage the hexagon head of the adjustment mechanism. An unsuitable tool can slip off the hexagon head or can become jammed.

Always use a ring spanner, never an open end wrench.

When you apply the brakes the ring spanner on the hexagon head will rotate with it. Therefore check in advance that there is sufficient clearance for this rotational movement.

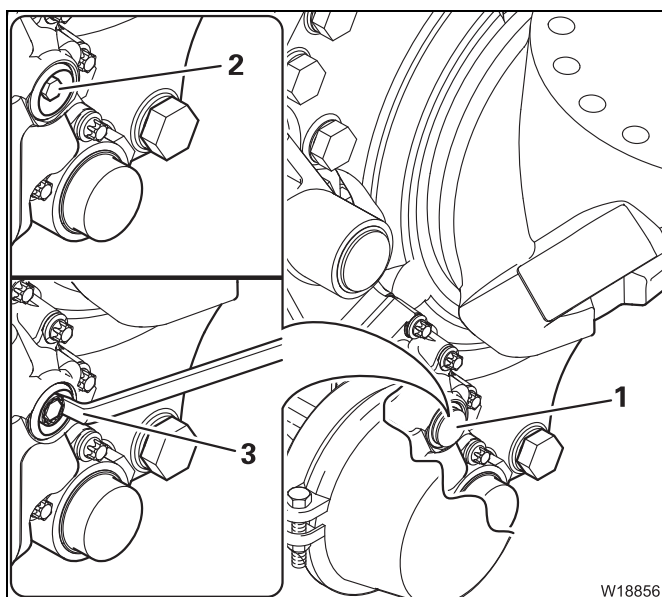




Risk of injury due to rotation of the ring spanner

If you are holding the ring spanner when another person in the driver's cab applies the brakes your hand could be crushed.

Do not hold the ring spanner when another person in the driver's cab applies the brakes. Just observe the rotation of the ring spanner from a safe distance.



On the brake caliper under the brake cylinder

- Remove the cap (1) – the hexagon head (2) is then exposed.
- Place the ring spanner (3) on the hexagon head.
- Turn the ring spanner half a turn clockwise. Leave the ring spanner attached.
- Ask a second person in the driver's cab to apply the brakes (approx. 5 times at approx. 1 bar) and observe the rotation of the ring spanner.
- Remove the ring spanner.
- Replace the cap.


The way the ring spanner rotates allows you to assess the condition of the adjustment mechanism.

The adjustment mechanism is OK if the ring spanner



- turns one step anticlockwise at each brake application,
- rotating a small angle at each step.

The adjustment mechanism is defective if the ring spanner

- fails to turn at any of the brake applications,
- or turns only at the first brake application,
- or at the brake application first turns anticlockwise but then turns back clockwise again.

If the adjustment mechanism is defective then you must have the vehicle brakes repaired;  *Having the brakes repaired*, p. 7 - 81.

Having the brakes repaired

- **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 - 76.



Risk of accidents due to uneven braking

If the brake pads and brake discs are replaced on only one side of the axle then the wheels will brake unevenly.

Always have the brake pads and brake discs replaced on both sides of the axle. Where axles lines have two brake calipers per brake disc, you must always have the brake pads changed on both brake calipers.

Running in the brake pads

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



Risk of damage to the brakes when running them in

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

The brakes must only be run in through periodic braking.

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

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

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7.12 Suspension

7.12.1 Suspension struts – Checking the oil level



M 1

Oil, spare parts,
tools

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

– Press with connected hose (from the toolbox).

Prerequisites

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



Risk of damage due to faulty suspension struts.

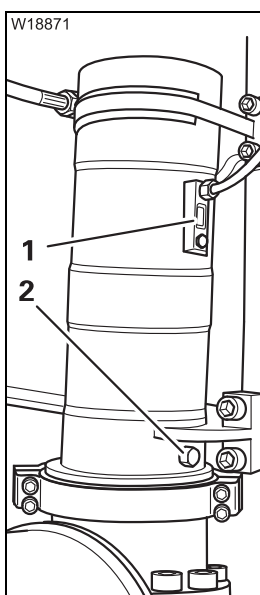
If the oil level is above the upper marking on the sight glass, the suspension strut is faulty and must be replaced.

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. Even so, do not fill oil through the sight glass connections. If you do this, the oil will not reach all the lubricating points.



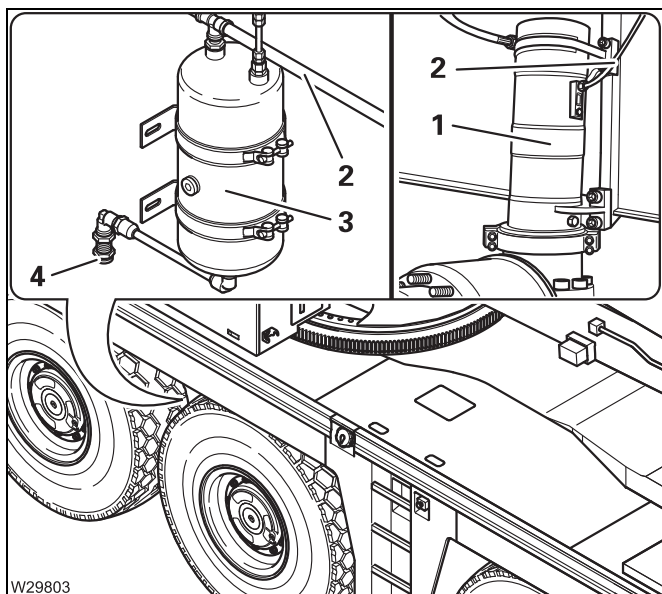
- Check whether oil is visible in the centre of the sight glass (1) on each suspension strut.

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).



Checking the bleed overflow oil collection tank



Each suspension strut (1) is connected to the oil collection tank (3) by means of a bleed hose (2).

- Place a receptacle underneath the oil collection tank (3).
- Open the drain plug (4) and allow the oil to drain; normally this is a very small quantity.
- If there is has been a large quantity of oil collected, then one or more suspension struts are defective.
- Close the drain plug (4).

- Defective suspension struts should be replaced as soon as possible by **Manitowoc Crane Care** or an authorised GROVE dealer.

7.12.2



Suspension struts – checking the fastening

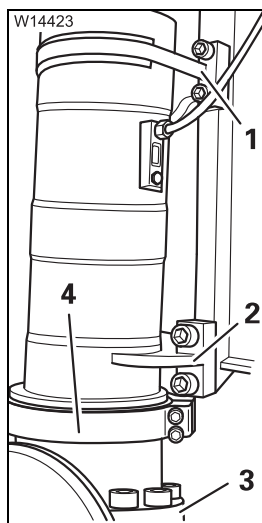
M 1


Spare parts and tools

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

Prerequisites

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



- Check whether the screws on all suspension struts are securely seated;  *Special torques*, p. 10 - 2:

- 1 on the upper bracket,
- 2 on the lower bracket,
- 3 on the lower flange,
- 4 on the half shells for the steering lever.

7.12.3

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.

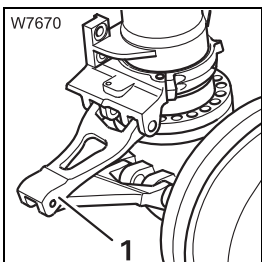
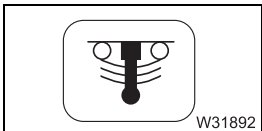


Risk of damage to the tyres.



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

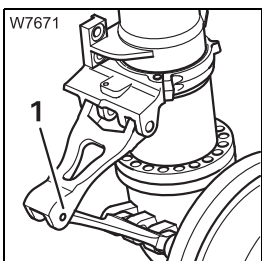
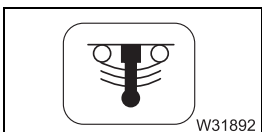
In this way you prevent the tyres from bursting or being damaged when the wheels come down.

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



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

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



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

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

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

7.12.4

Pressure accumulator – checking the gas pressure

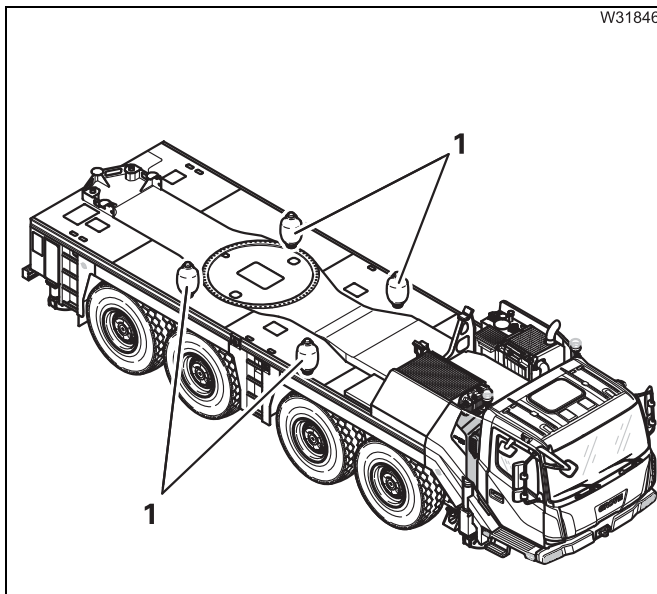
M 12

The gas pressure must be checked every 3,000 operating hours, but in any case no less frequently than 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 features integrated pressure accumulators that contain nitrogen (1).

The filling pressure at 20 °C (68 °F) is 50 bar (725 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

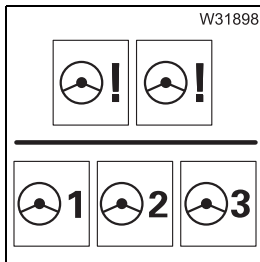
Steering

7.13.1

Checking the steering monitoring

D

Checks in the driver's cab



- Consult the operating instructions regarding lights and symbols for steering monitoring in the driver's cab; *Operating Instructions*.
- Start the engine and monitor the display.
- If after the engine is started the symbols go out, the steering system is free of defects.
If the symbols light up yellow or red, or flash, they are indicating the respective defect in the steering system; *Operating Instructions*.
- Switch the engine off.



Risk of accidents because the truck crane cannot be steered.

Stop as quickly as possible if the red lamp lights up.

The 3rd and 4th axles can steer in an uncontrolled manner, which may lead to serious accidents, even when driving at reduced speed.

Checking at the travel gear

There are a total of 5 **electrical angle sensors** at the 1st, 3rd and 4th axle line, for measuring the steering angle at the respective axle line.

The measured values are sent to two **steering computers**. If the steering is out of position, the steering computers send a malfunction message to the display in the driver's cab; *Checks in the driver's cab*, p. 7 - 89.

During the course of an inspection not less than every two years you must have all the event messages in the steering computer read.

Intensive off-road driving can cause damage to the angle sensors.

Depending on the operating conditions of the truck crane it is therefore advisable to perform a daily **visual check** of the angle sensors; *Checking the angle sensors*, p. 7 - 90.



Risk of crushing due to turning wheels

When you start the engine, no persons may be within the steering range of the 3rd and 4th axle lines. These axle lines are steered each time the engine is started, sometimes with a 5-second delay, in order to test the steering system.

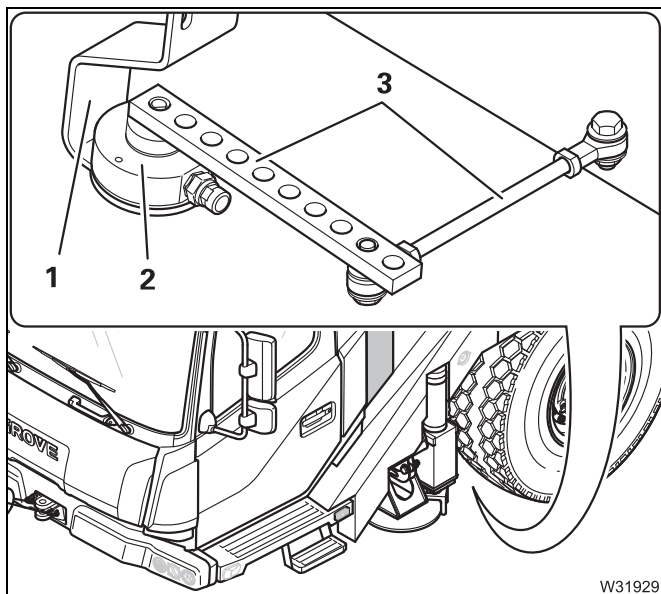


7.13.2 Checking the angle sensors

Prerequisites

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

Checking

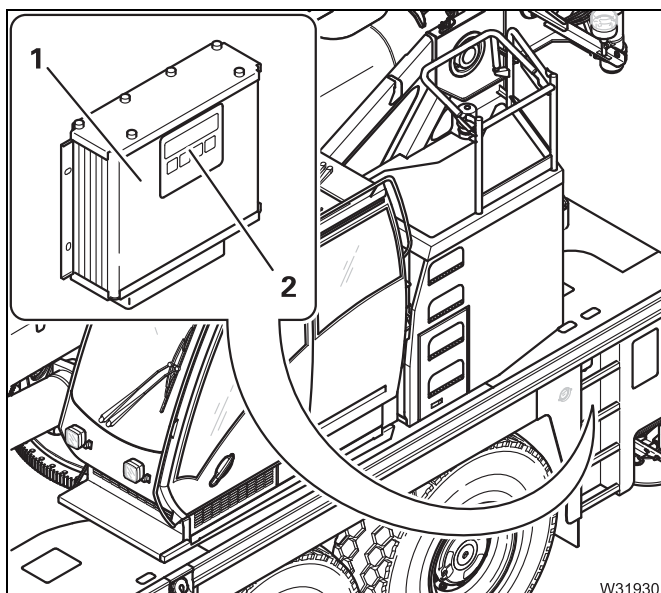


Angle sensor

There are five angle sensors mounted on various axle lines:

- 1. axle line right and left
- 3. axle line right
- 4. axle line right and left

- If necessary, clean the bracket (1), the angle sensors (2), and the linkage (3).
- Check that all bolts on the bracket are securely seated.
- Check the linkage for deformation and damage.



Steering computer

There are two steering computers fitted:

- 4. axle line right and left

- Do **not** press the button (2) – only the qualified repair crew are authorised to do this.
- Use only a cloth to clean the steering computer (1).
- Check the steering computer and the displays for external damage.

If you find damage to the angle sensors or steering computers

- Immediately notify **Manitowoc Crane Care** or an authorised GROVE dealer.

7.13.3

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 oil if necessary;  *Checking the oil level*, p. 7 - 97.

After changing pipes and hose lines

- Bleed the hydraulic system;  *Bleeding the hydraulic system*, p. 7 - 110.

If damage cannot be rectified immediately or further damage is likely

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

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7.14 Compressed air system



7.14.1 Draining water from the compressed air system

W

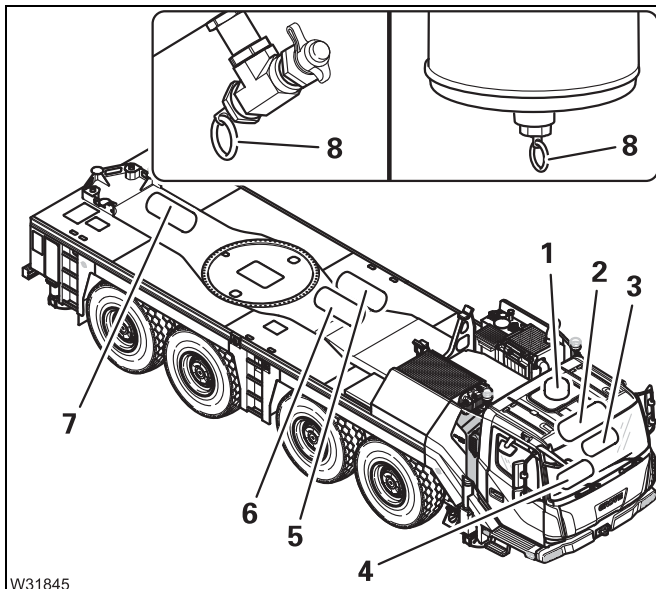
Spare parts and tools

Designation	Quantity	GROVE part no.
Valve	7	01570750
Gasket 22 x 27 Cu DIN 7603	7	00117142

Prerequisites

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

Draining water from the compressed air system



- Actuate the valves (8) on the air reservoirs (1) to (7).

If a great deal of water escapes

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

7.14.2

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.

7.14.3

Replacing the filter cartridge of the compressed air drier


M 12

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter cartridge	1	04157844

- Strap wrench.

Prerequisites

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

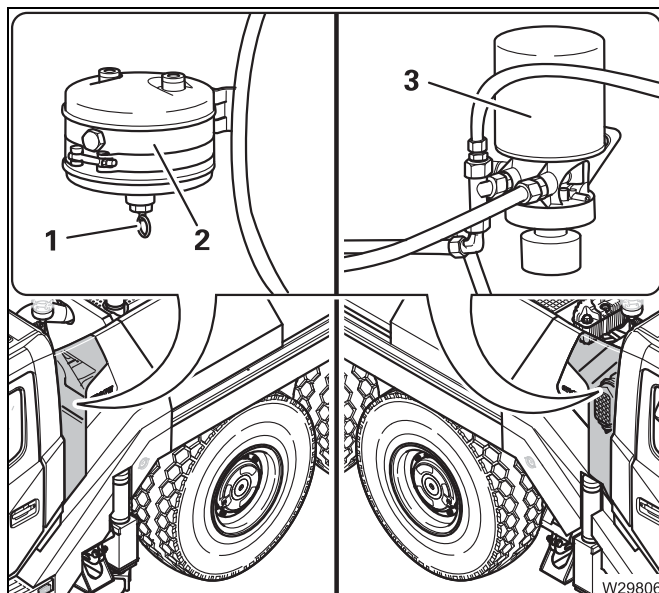
Changing the filter cartridge



Risk of injury from escaping compressed air.

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

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



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

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7.15

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.

7.15.1

Checking the oil level

D

Prerequisites

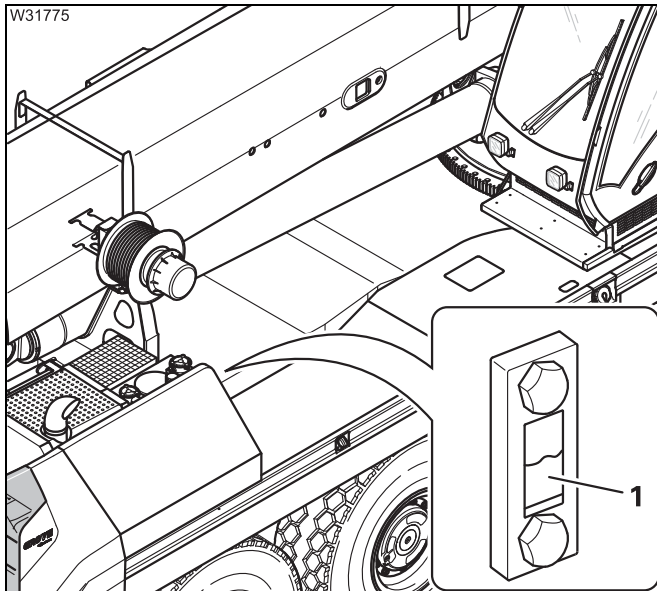
- The truck crane must be aligned horizontally at on-road level;
 ▣▣▣▣▶ *Operating Instructions*.
- The outriggers must be retracted; ▣▣▣▣▶ *Operating Instructions*.
- The engine must be switched off and secured against unauthorised use;
 ▣▣▣▣▶ p. 2 - 3.



Risk of damage to the hydraulic system

When working with hydraulic oil, cleanliness is imperative.

Even fresh hydraulic oil should be filtered.



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

If the oil level is too low

- Top up the oil; ▣▣▣▣▶ p. 7 - 109.

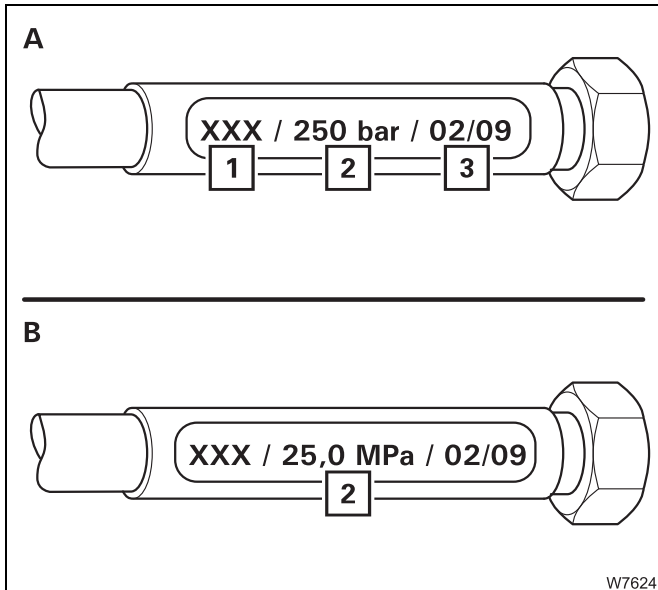
7.15.2

Checking the hydraulic hoses

W

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

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



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

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

Maximum operation pressure and unit of measurement (**B**) (e.g. 25.0 MPa (3,626 psi)).

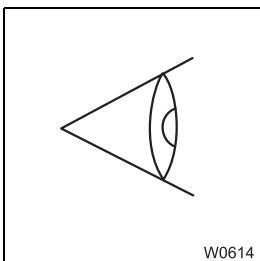
- 3 Month and year of manufacture.



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

7.15.3

Checking for leaks

W



- When the engine is running, carry out a visual inspection for leaks on the hydraulic system (pumps, drives, cylinders, control blocks, valves, pipe and hose lines and connections).
- Check the hydraulic oil cooler for dirt;  *Have the radiator checked/cleaned, p. 7 - 18.*
- Check the oil level if there are leaks;  *Checking the oil level, p. 7 - 97.*



Risk of accidents from hydraulic oil spraying out.

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



Risk of environmental damage due to leaking consumables.

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

After parts have been changed

- Bleed the carrier's hydraulic system; *Bleeding the hydraulic system*, p. 7 - 110.

If damage cannot be rectified immediately or further damage is likely

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

7.15.4

Cleaning the magnetic rods

M 3

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	2	03329152
Packing set	2	04163599

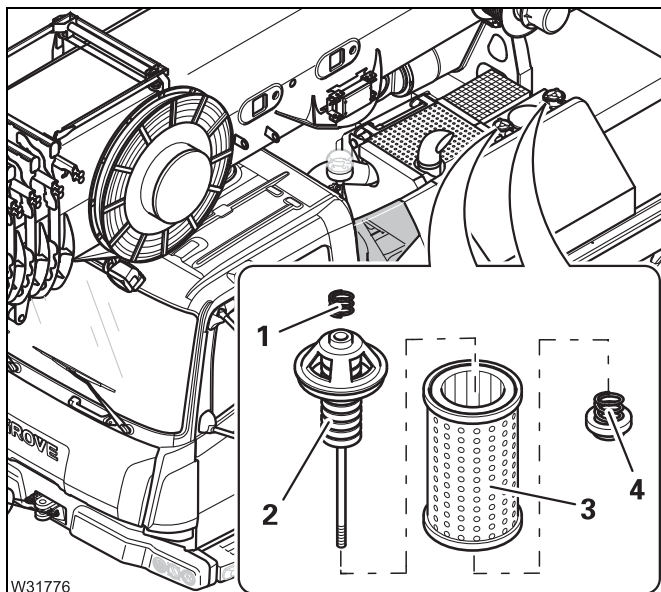
- Receptacle, approx. 5 ltr (1.5 gal); p. 2 - 4.

Prerequisites

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



Cleaning the magnetic rods

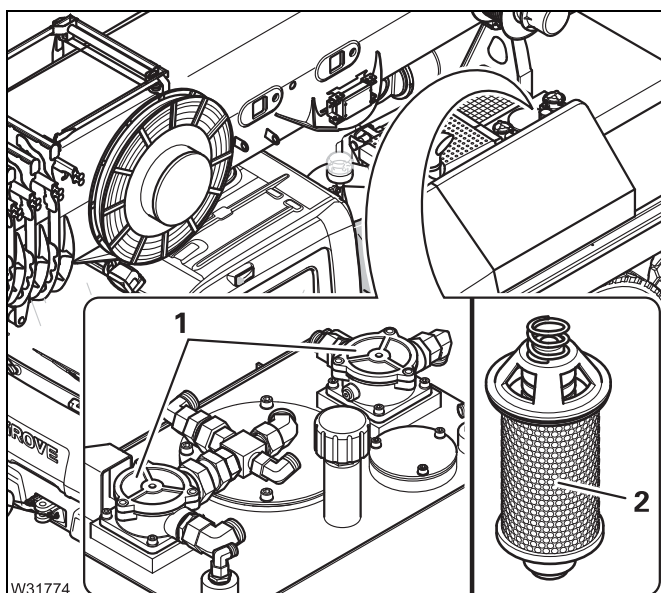


- Loosen the cover and pull out the filters.
- Place the filters in a receptacle.
- Remove the spring (1).
- Undo the nut (4).
- Take the magnetic rod (2) out of the filter cage (3) and clean it.
- Replace any damaged parts, where necessary.



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 qualified repair crew.



- Assemble the filters (2) and insert them.
- Replace the gaskets if necessary and fasten the cap (1).
- Start the engine and check for leaks.

7.15.5

Changing the ventilation filter

M 12


Reducing the interval

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

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	01576026

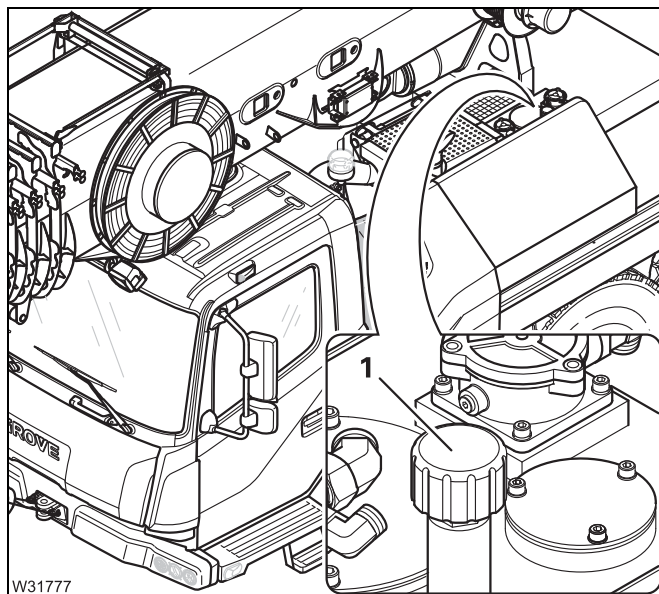
Prerequisites

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



Risk of damage to the environment from filter residues

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



- Change the filter (1).

7.15.6

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

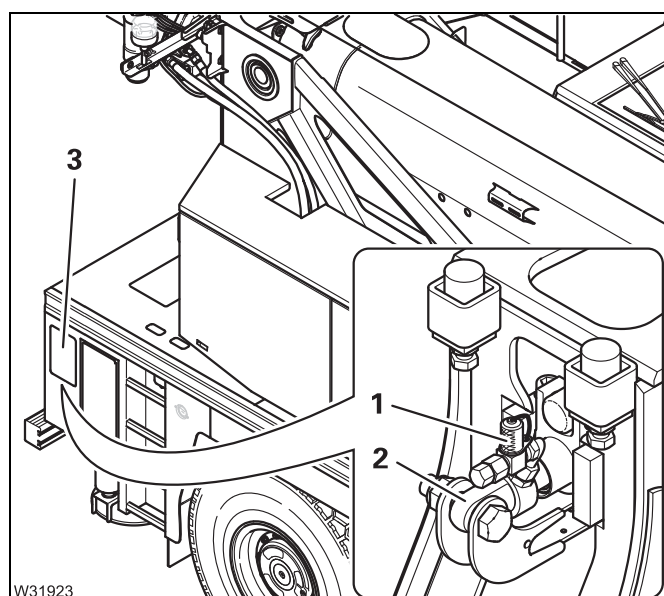
- Receptacle, approx. 5 litres (1.5 gal);  p. 2 - 4.

Prerequisites

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

Select the sampling location

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

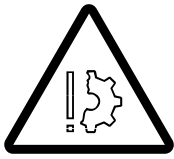


- Remove the cover (3). The gauge port (1) is located on the cylinder (2) of the outrigger.
- Clean the gauge port before connecting the hose.

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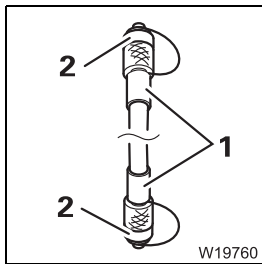
Protecting the hose from dirt



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 thus be incorrect.

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



When storing the hose

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

Connecting the hose

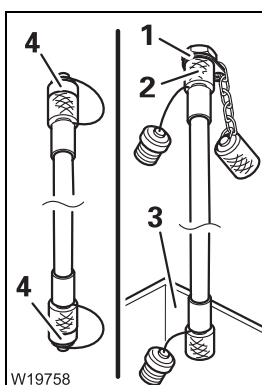


Danger due to escaping hydraulic oil

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

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

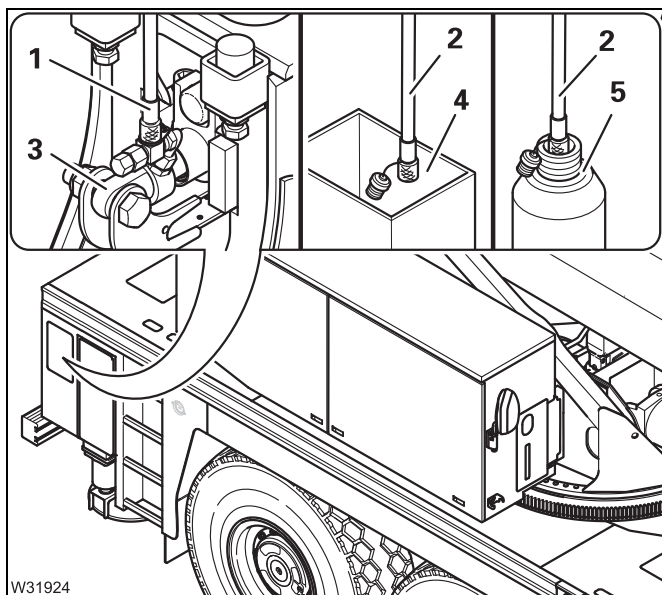
Store/dispose of consumables and any soaked equipment properly. Ask about the applicable regulations.



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



Taking oil samples

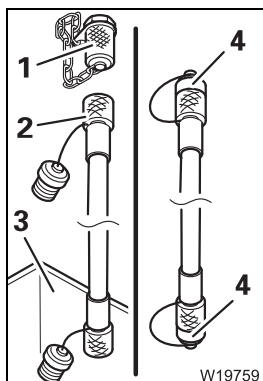


The hose end (1) is connected to the cylinder (3).

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

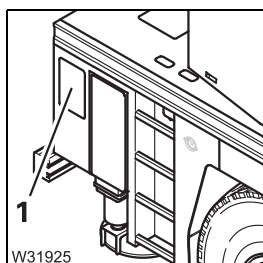
- Start the engine.
- Allow 2 litres (0.5 gal) of oil to flow into the receptacle.
- Switch the engine off and put the hose end (2) into the sample container (5).
- Start the engine.
- Allow 0.3 litres (0.08 gal) of oil to flow into the sample container.
- Switch the engine off.
- Put the hose end back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

Disconnecting the hose



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

Remove the receptacle and properly dispose of the oil.



- Fasten the cover (1).

Dispatch the oil sample to the laboratory

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

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


Determining the quality of the oil

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

Viscosity limit values

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


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

- Carry out an oil change;  p. 7 - 107.

Contamination limit value

- Contamination according to 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 - 111.
- 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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7.15.7 Changing the hydraulic oil

The oil only needs to be changed if the laboratory analysis indicates the need for it; *Determining the quality of the oil*, p. 7 - 105.

Oil, spare parts,
tools

Hydraulic oil in litres (gal)	Designation to DIN 51502	Specification classification	GROVE part no.
165 (44)	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).
- One or more receptacles, approx. 165 ltr (44 gal); p. 2 - 4.

Prerequisites

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

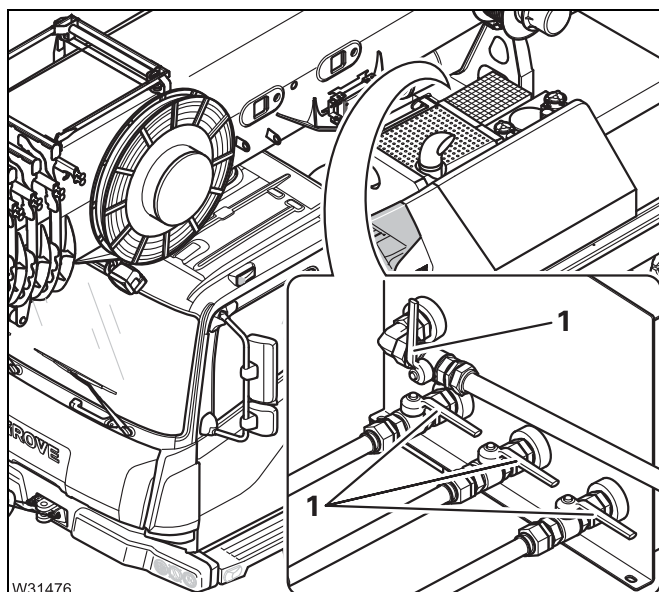
Close the valves



Risk of damage to the hydraulic pumps

Be sure to secure the engine against unauthorised use.

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



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



Handling the valves

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



Risk of environmental damage due to leaking consumables.

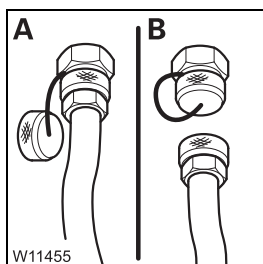
Use the supplied connecting piece and hose and a receptacle with sufficient capacity to drain the hydraulic oil.



Danger due to escaping hydraulic oil

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

- Fit the hose on to the connecting piece and put the other end of the hose into a receptacle.
- **A** – Remove the cap and screw the connecting piece and hose on to the valve – the valve will open.
- Drain the oil.
- **B** – Remove the connecting piece and hose – the valve will close.
- Screw the cap on to the valve.

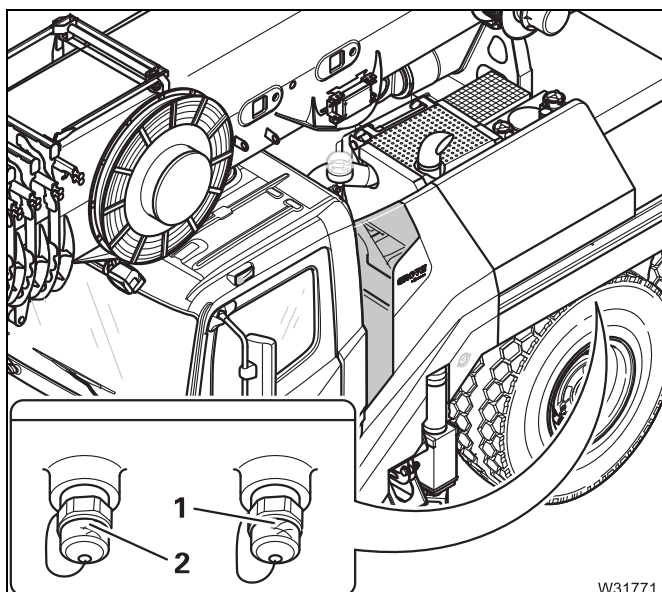




Draining oil



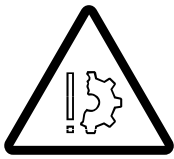
Risk of environmental damage due to leaking consumables.

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



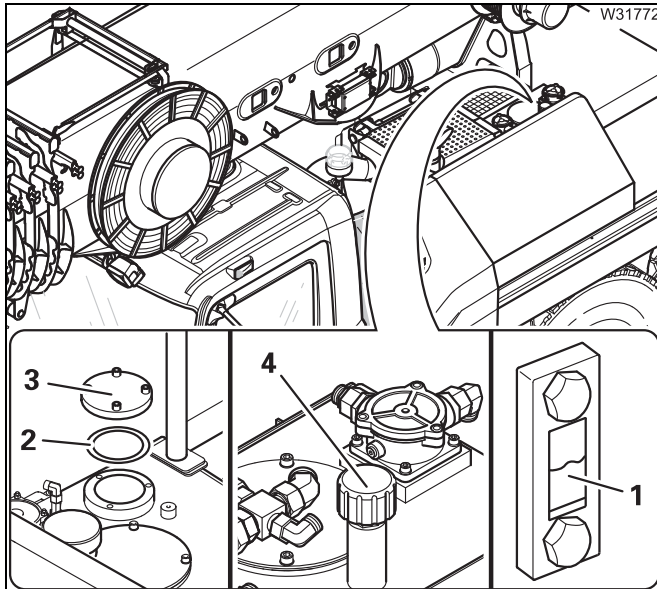
- Place a receptacle underneath the valves.
- One after the other, screw the connecting piece and hose onto the valves (1) and (2);  *Handling the valves*, p. 7 - 108.
- Change the filters;  p. 7 - 111.

Topping up the oil



Risk of damage to the hydraulic system

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



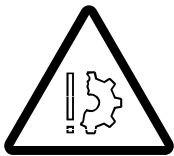
- Remove the cover (3).
- Add new oil through a filter until the level reaches the centre of the sight glass (1).
- If required, replace the gasket (2) and fasten the cap.

If no cap (3) is present

- Remove the cover and filter (4).
- Add new oil through a filter until the level reaches the centre of the sight glass (1).
- Fasten the cover with the filter (4).

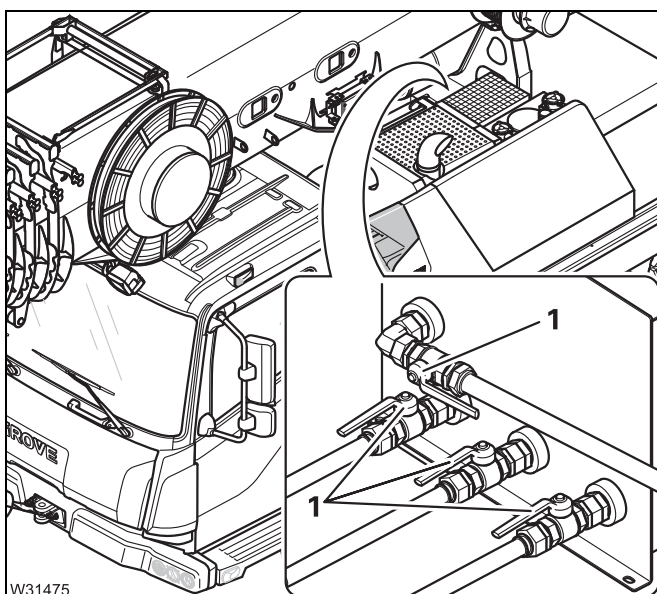
Establishing the operating conditions

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



Risk of damage to the hydraulic pumps



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



Opening the valves

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




- Start the engine.
- Carry out all hydraulic functions several times to remove any air in the system.
- Test drive the truck crane, turning the steering wheel several times to its fullest extent.
- Check the oil level through the sight glass on the hydraulic oil tank. Top up oil, if necessary;  *Checking the oil level*, p. 7 - 97.
- Also check the filling level on the hand pump of the driver's cab tilting device;  p. 7 - 2.

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 Instructions*.
- The parking brake must be applied.



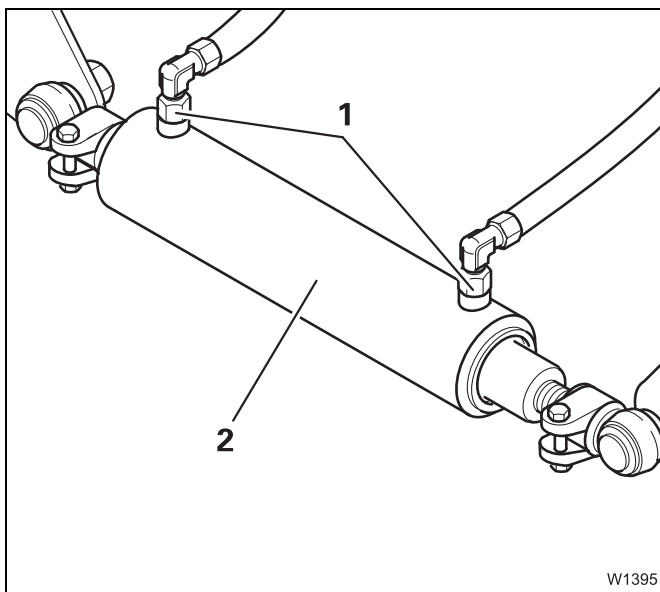
Risk of crushing from turning wheels.

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



Risk of accidents from high oil pressure

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



Bleed the steering cylinders individually, one after the other

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

If the steering system is still not operating properly

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

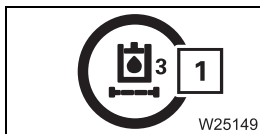
7.15.8

Changing the hydraulic oil filter

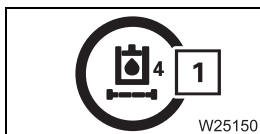
When changing the oil, all the oil filters must be replaced.



If a warning message appears, the symbol (1) in the *Warning* submenu indicates that you must change oil filters 1 and 2.



If a warning message appears, the symbol (1) in the *Warning* submenu indicates that you must change oil filter 3.



If a warning message appears, the symbol (1) in the *Warning* submenu indicates that you must change oil filter 4.

Filters 3 and 4 must be replaced together after the first 50 hours in driving mode and must then be replaced together annually (M 12) after this.

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter (for filters 1 and 2)	2	03329152
Packing set	2	04163599
Filter (for filters 3 and 4)	2	03140253
Packing set	2	03135867

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

Prerequisites

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

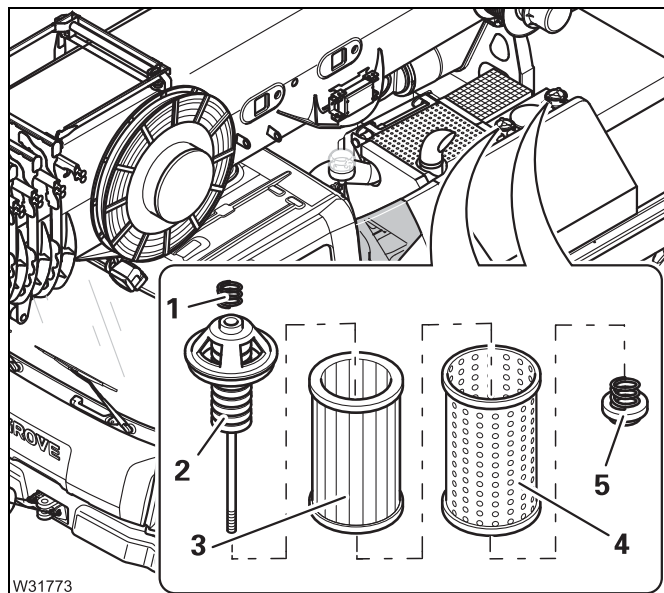


Changing filters 1 and 2



Risk of environmental damage due to leaking consumables.

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



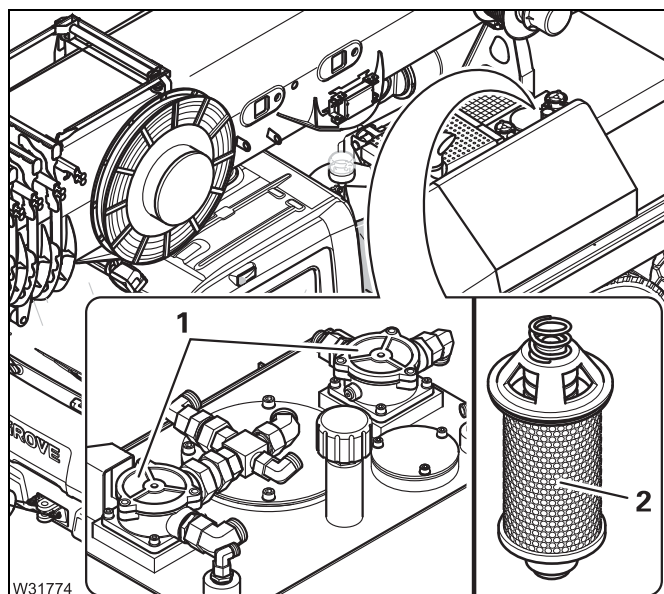
- Loosen the cover and pull out the filters.
- Place the filters in a receptacle.
- Remove the spring (1).
- Undo the nut (5).
- Take the magnetic rod (2) and filter (3) out of the filter cage (4).
- Clean the magnetic rod (2) and filter cage (4).
- Insert a new filter (3) into the filter cage (4).
-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



Risk of damage to the hydraulic system.

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

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



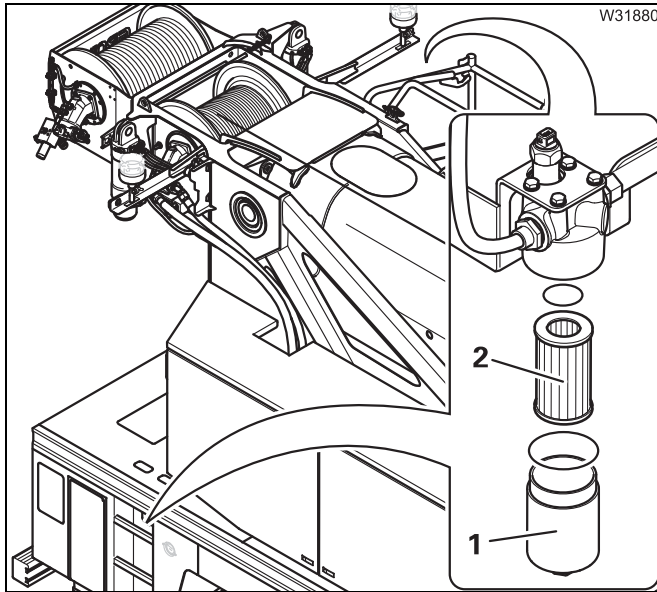
- Assemble the filters (2) and insert them.
- Replace the gaskets and fasten the caps (1).
- Start the engine and check for leaks.

Changing filters 3 and 4



Risk of damage to the environment from filter residues

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



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

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7.16 Central lubrication system

7.16.1 Checking the level

W

Grease, spare parts, tools

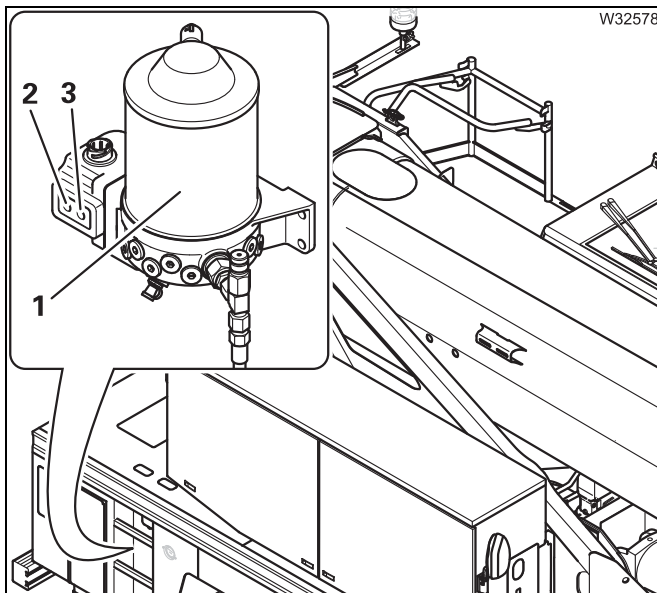
Lubricating grease	Designation to DIN 51502	Specification classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Filling pump from the tool set.

Prerequisites

- The parking brake must be applied.


Checking the level



- Check the level in the grease container (1). The grease level must be close to the **max.** mark and the green lamp (2) must light (ready for operation).

If it is below the **min.** mark the grease level is too low and the red lamp (3) will light.

If the level is too low

- Add more grease;  p. 7 - 116.



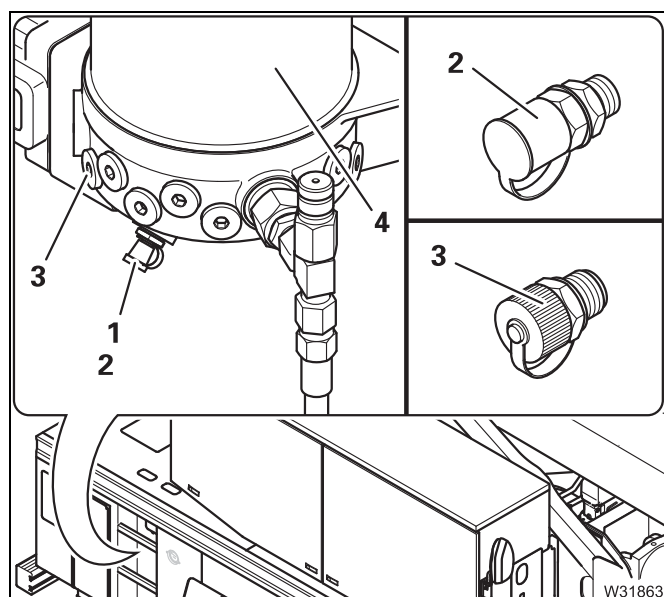
Topping up



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 connections and the filling pump until immediately before refilling the grease, as the grease could otherwise become contaminated. This prevents dirt particles from getting into the grease and damaging the central lubrication system. Do not overfill the container above the max. mark.



There are various options for filling the grease container (4):

1 Grease nipple (standard)

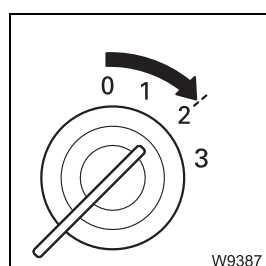
for connection of a manual grease gun.
GROVE part no. 04158709

2 Filling coupling plug (optional)

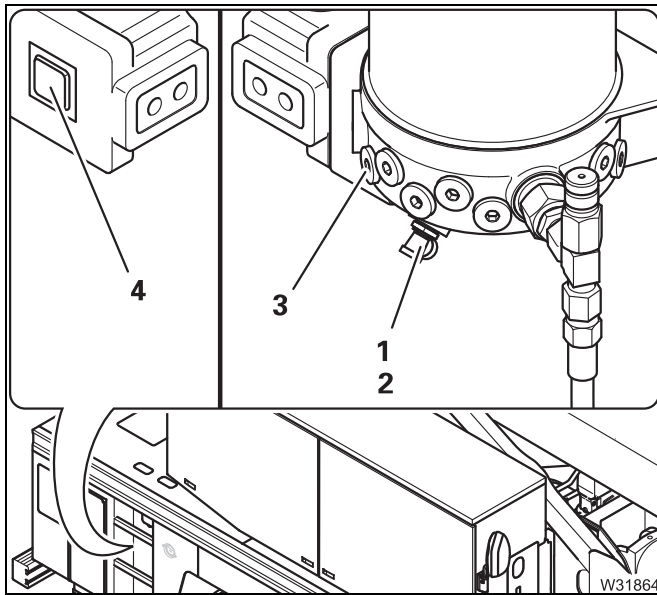
for connecting a the hose to a grease filling station with a drum.
GROVE part no. 04165389

3 Filler connection (optional)

for the filling pump from the tool set.
To use this, the plug (3) must be removed and the filler connection from the tool box inserted in its place.
GROVE part no. 04165390



- Switch on the ignition.



- Attach the filling pump to the respective connections (1), (2) or (3).
- Press the button (4) once.

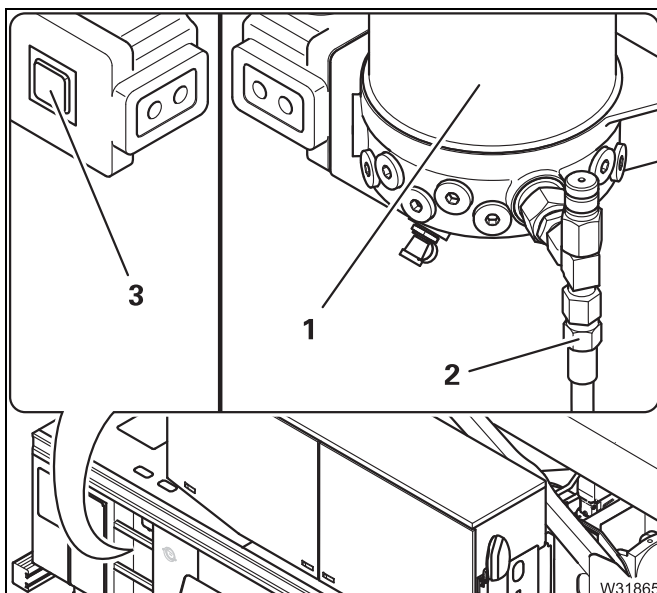
Intermediate lubrication will be triggered.

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

7.16.2

Bleeding the central lubrication system

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



The grease container (1) must be full.

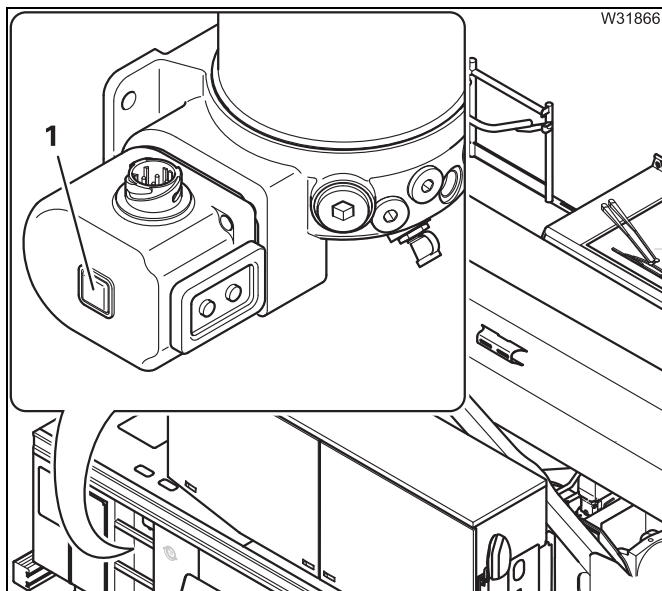
- Loosen the lubricating pipe at the connection (2).
- Switch on the ignition.
- Press the button (3).
Repeat the procedure until the grease flowing from the connection (2) no longer contains any bubbles.
- Tighten the lubricating pipe at connection (2).
- Remove any grease that has escaped.

7.16.3

Triggering intermediate lubrication

Intermediate lubrication should be activated:

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



- Switch on the ignition.
- Press the button (1) once.

An intermediate lubrication cycle will be triggered which lasts approximately 2 minutes. Check that grease is escaping at all lubricating points (steering arms on the 1st, 2nd, 3rd and 4th axle lines).

- Switch off the ignition and remove any excess grease.

7.17

Electrical system

7.17.1

Checking the lighting and indicators

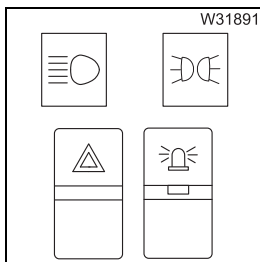
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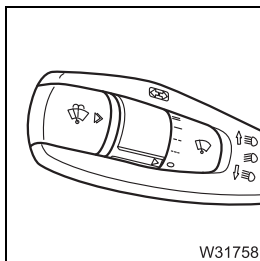
Risk of accidents if the safety devices are faulty!

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

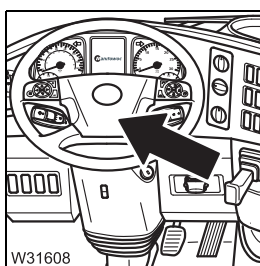
- Check the following functions every day before operating or driving the truck crane, and have faulty parts repaired:



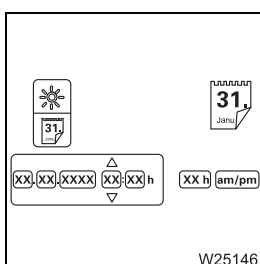
- Parking light/headlight, marker lights, rotating beacons, fog tail light, fog light, outrigger lights,
- Hazard warning system,
- Brake lights,
- Reversing lights,
- Warning buzzer,
- Reverse camera (additional equipment).




- High-beam headlight + headlight flasher
- Turn signal indicators,
- Windscreen wipers,
- Windscreen washing system,



- Horn.



- Date/Time on CCS display.
- You can correct the time/date via the *Settings* menu in the CCS display;
 *Operating Instructions*.

7.17.2

Checking the batteries

M 1



Risk of poisoning from batteries containing lead

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

Wash your hands after working on batteries.



Risk of explosion from escaping hydrogen.

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



Risk of explosion from static charge.

Only use antistatic cloth to clean the batteries.

This prevents static charging which could result in hydrogen mixtures exploding.



Risk of burns from battery acids

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

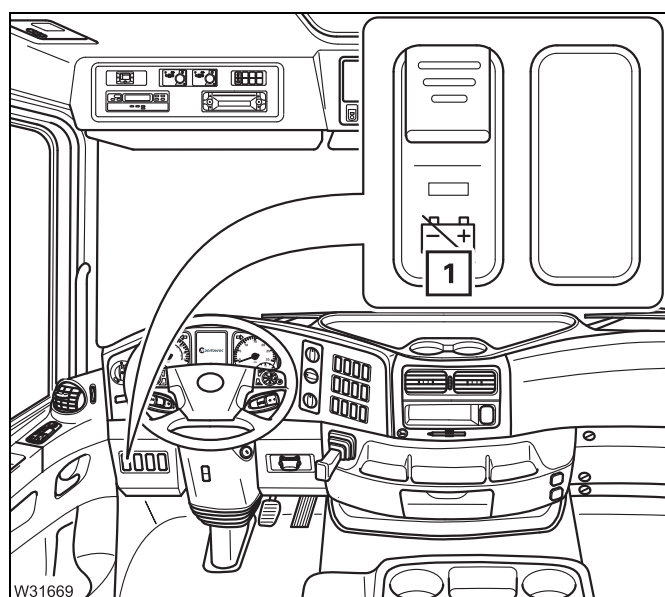
Do not tilt the battery. Rinse off or wash out any acid spray on the skin or clothing using soap suds.



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.

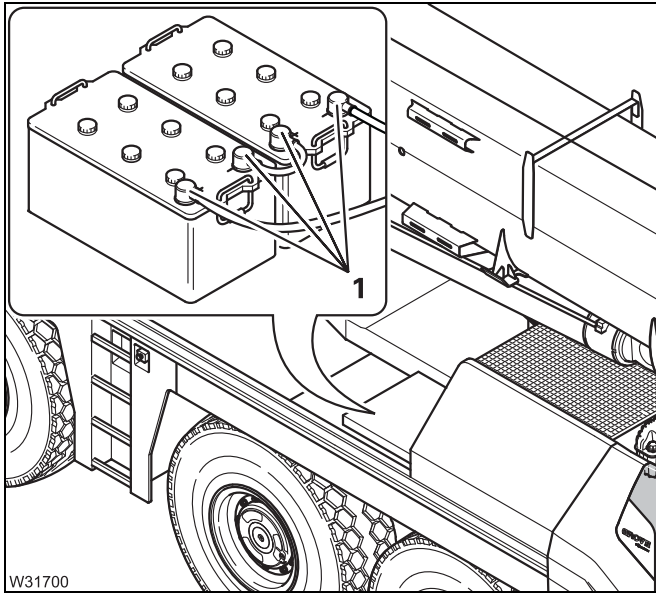


Before checking

- Switch off the battery master switch (1).
- Open the cover on the battery box.

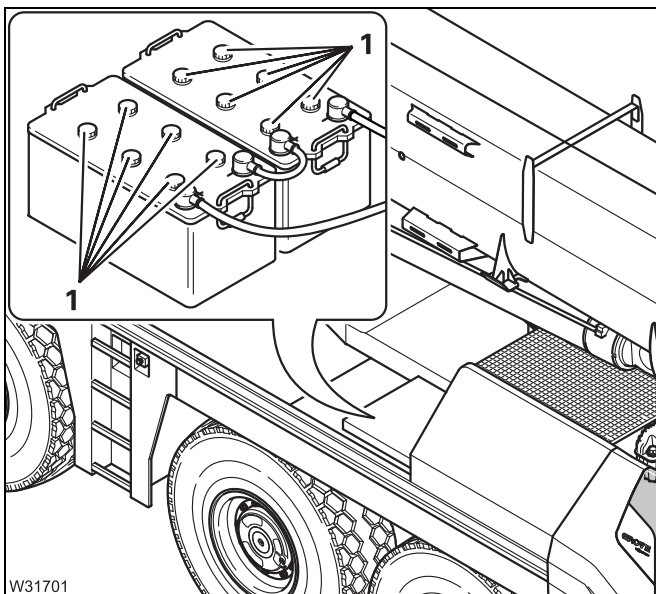
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Checking the connecting terminals

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



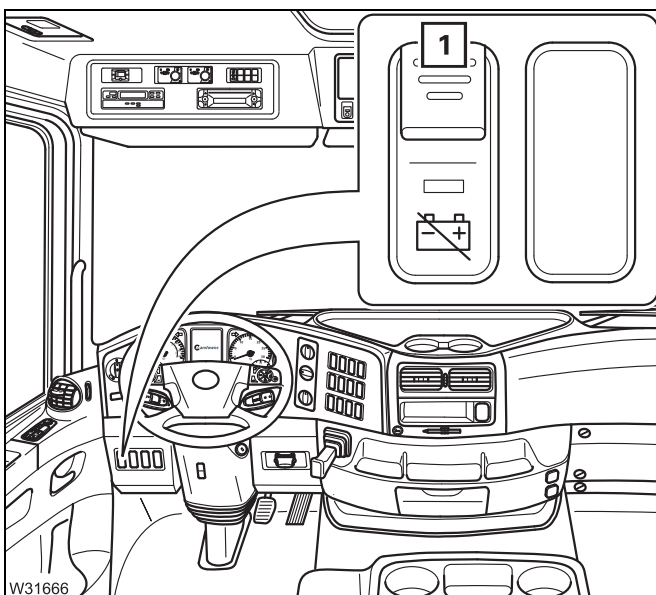
Checking the acid level

Batteries without covers (1) are maintenance-free.



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

If the acid level is too low

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



After checking


- Close the cover on the battery box.
- Switch the battery master switch (1) on.
- Check the timers on the tachograph and the auxiliary heater;  *Operating Instructions*.
- Enter the code for the radio;  *Separate engine operating instructions, provided by the manufacturer*.

7.17.3

Checking the charge level of the batteries

M 3

Spare parts and tools

- Battery charger (additional equipment);  p. 7 - 124; or
- Acid siphon.

Charge level table

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

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



Risk of poisoning from batteries containing lead

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

Wash your hands after working on batteries.



Risk of explosion from escaping hydrogen.

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



Risk of explosion from static charge.

Only use antistatic cloth to clean the batteries.

This prevents static charging which could result in hydrogen mixtures exploding.



Risk of burns from battery acids

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

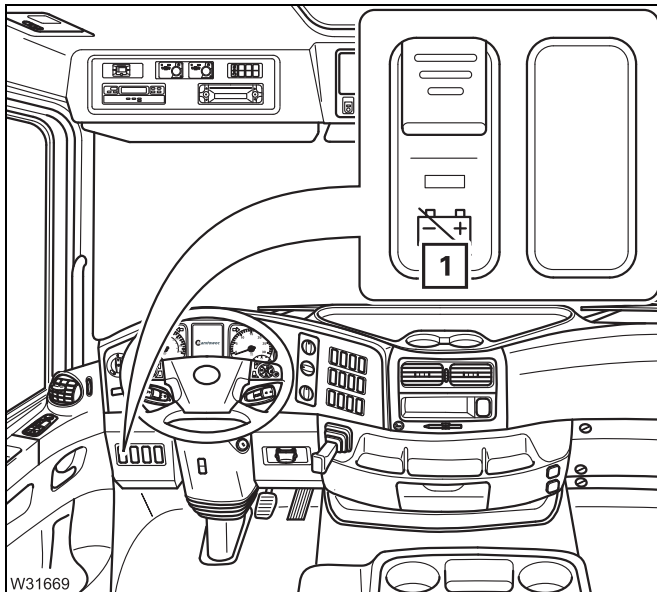
Do not tilt the battery. Rinse off or wash out any acid spray on the skin or clothing using soap suds.



Risk of damage to the crane's electrical system.

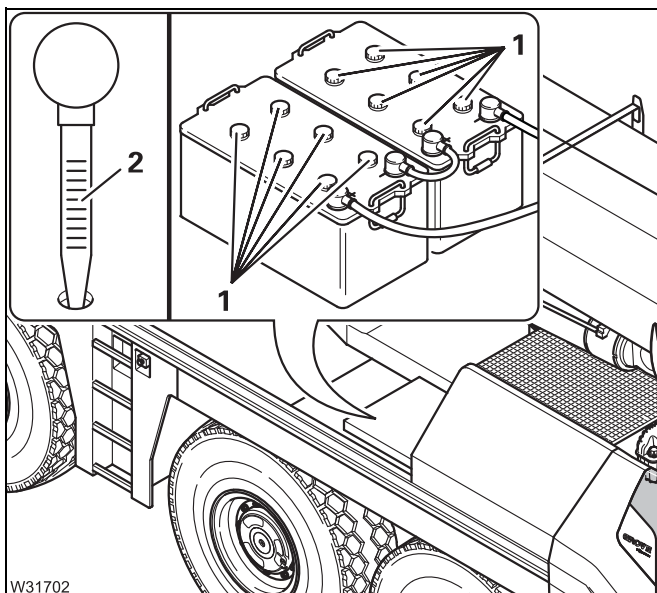
Always switch off the battery master switches before commencing work on the truck crane's electrical system.

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




Before checking

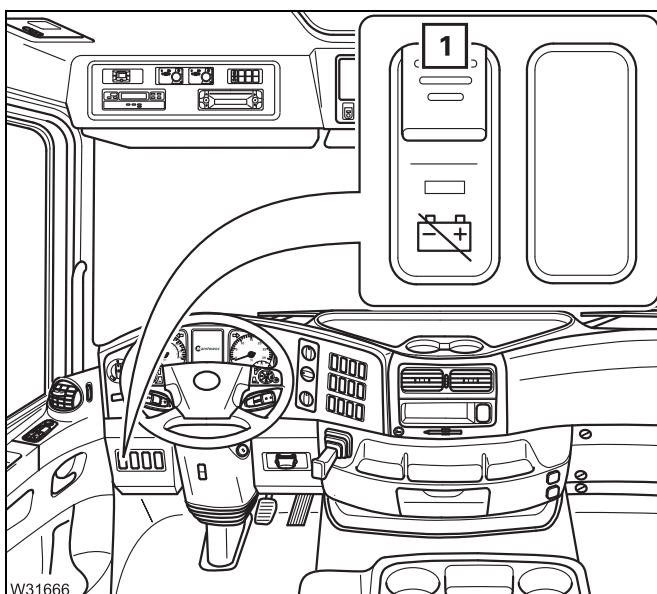
- Switch off the battery master switch (1).
- Open the cover on the battery box.





Checking the acid concentration

Batteries without covers (1) are maintenance-free.

- Remove all caps (1).
- Read off the cell value on the acid siphon (2) and compare the value with that in the table;  *Charge level table*, p. 7 - 122.
- Check all cells in the same way.
- Tightly bolt on all covers (1).



After checking


- Close the cover on the battery box.
- Switch the battery master switch (1) on.
- Check the timers on the tachograph and the auxiliary heater;  *Operating Instructions*.
- Enter the code for the radio;  *Separate engine operating instructions, provided by the manufacturer*.

7.17.4


Charging the batteries using the battery charger

M 3

Prerequisites

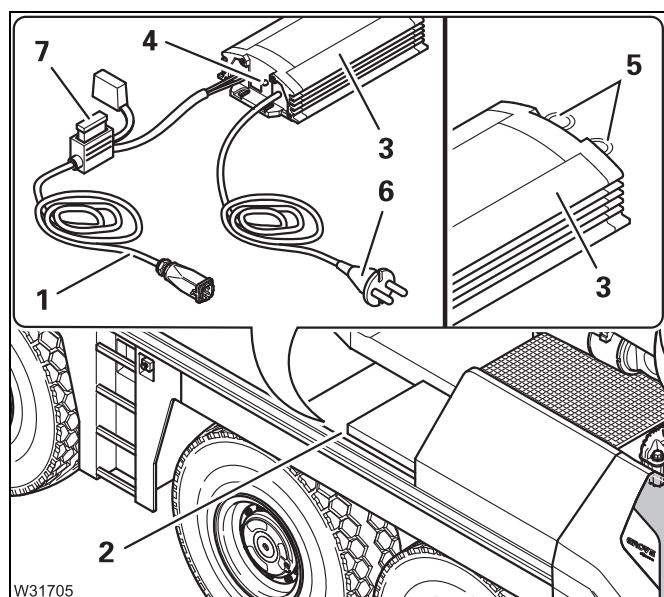
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- An external 230 V mains power supply must be available at the location.
- The battery charger (GROVE part no. 03320239; additional equipment) must be available.
- The location must be well ventilated and protected against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

Battery charger

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

Connecting

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



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

Charging

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

Indicator lamp flashing: The batteries are being charged.

Indicator lamp lit continuously: The batteries are fully charged.

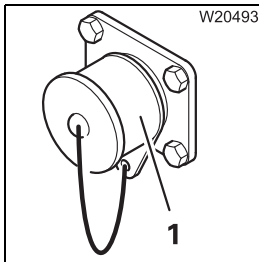
After completion of charging

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

7.17.5

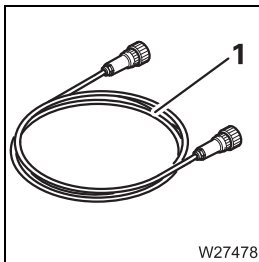
Check the external starting socket

M 3



The battery box is equipped with an external starting socket (1).


Accessories



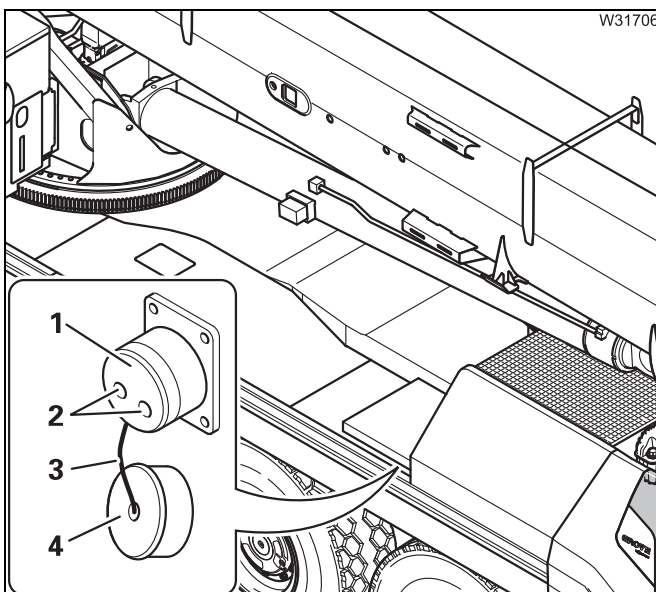
A connection cable (1) for the external starting socket is supplied with the truck crane (tool set).

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

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

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

Checking



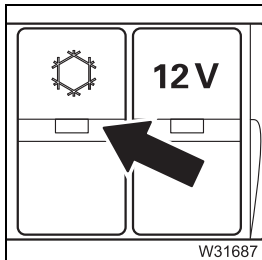
- Remove the cap (4) from the socket (1).
- Check that the cap is not damaged and is secured with the chain (3).
- If necessary, clean the poles (2).
- Attach the cap – the cap must be fitted tightly and compactly on the socket.


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7.18 Air-conditioning system

7.18.1 Checking the air-conditioning system

M 1



- Switch on the air-conditioning system;  *Operating Instructions*.
- 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.

7.18.2 Checking hoses

M 6



Risk of burns due to escaping refrigerant.

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

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

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

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

7.18.3

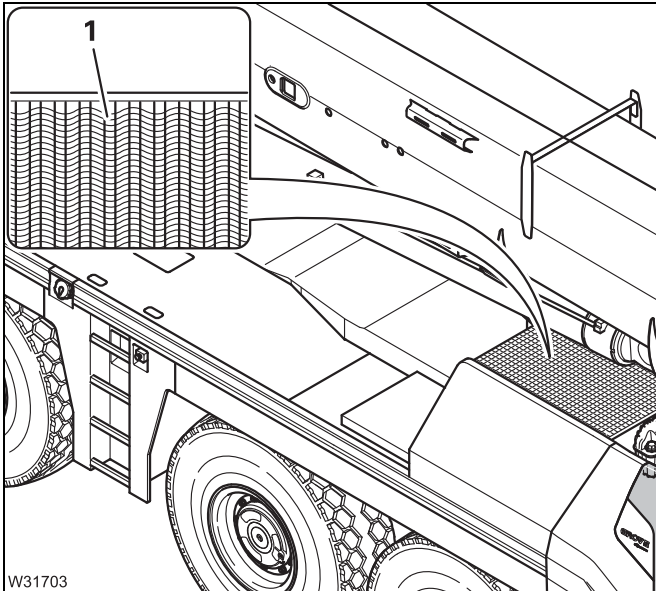
Cleaning the condenser fins


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 - 18.

W31703

7.18.4

Checking the entire air-conditioning system

M 12



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



Risk of burns due to escaping refrigerant.

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

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

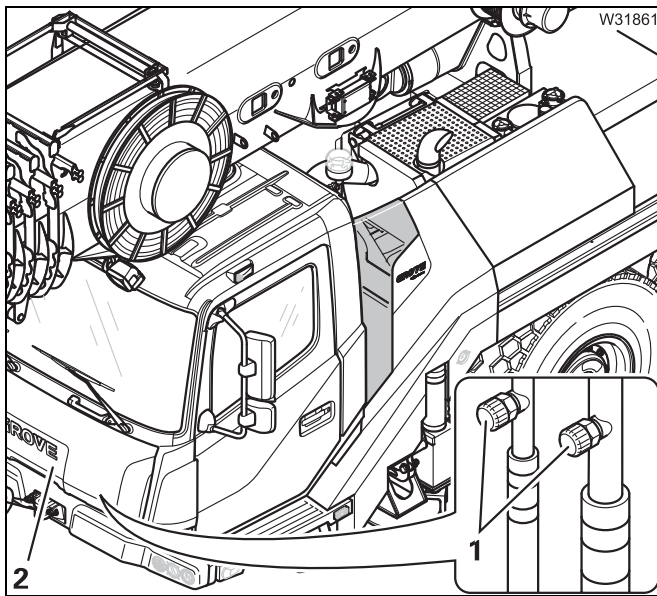
- Have the entire air-conditioning system checked for leaks and proper functioning.
The inspection of the air-conditioning system particularly includes the inspection of
 - the refrigerant collector, in accordance with the pressure container regulations (test group II) and
 - the refrigerant compressor.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

Refrigerant

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

Compressor oil FUCHS SE 65

Filler connections



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

7.18.5

Changing the pollen filter

M 12

Reducing the interval

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

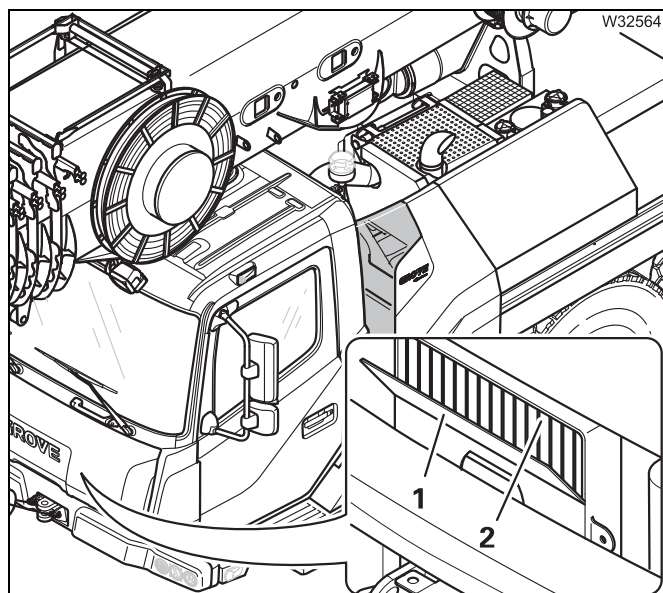
Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	03254375

Prerequisites

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

Changing



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

7.19 Towbar coupling

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

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

7.19.1 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	Specification classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

– Grease gun from the tool set.



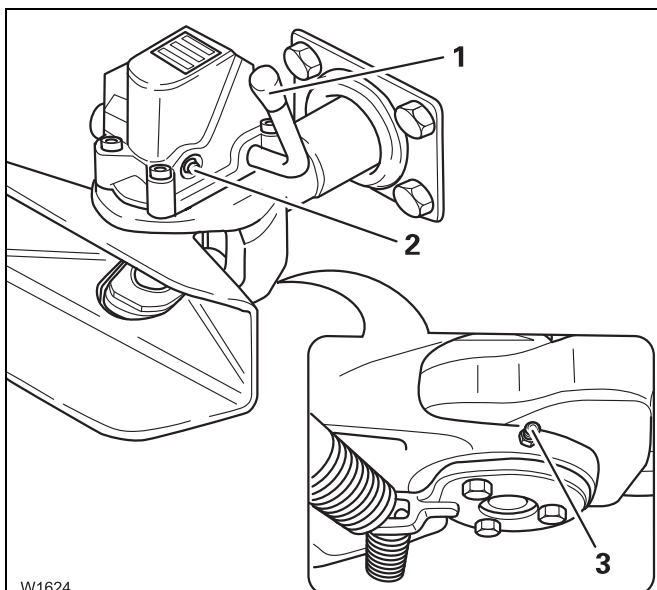
Risk of injury when the automatic closing device is triggered.

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

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



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



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



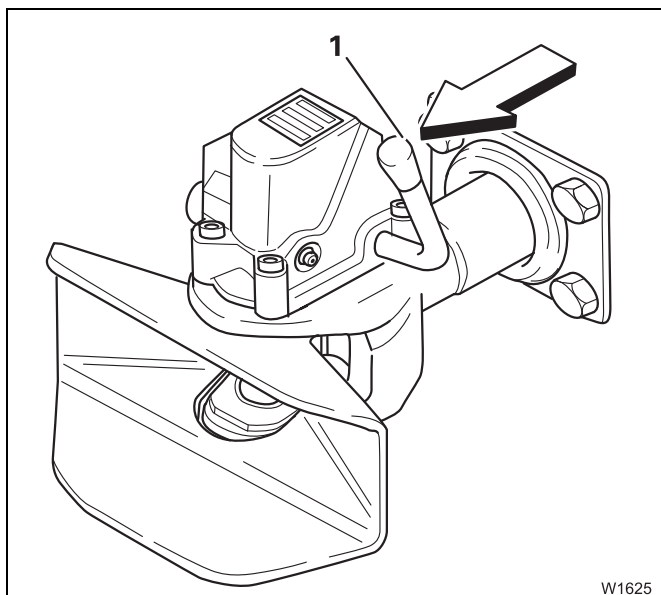
Closing the towbar coupling



Risk of injury when manually closing the towbar coupling

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

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



After lubrication you must close the towbar coupling.


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

7.19.2

Checking the bearing

M 3

Prerequisites

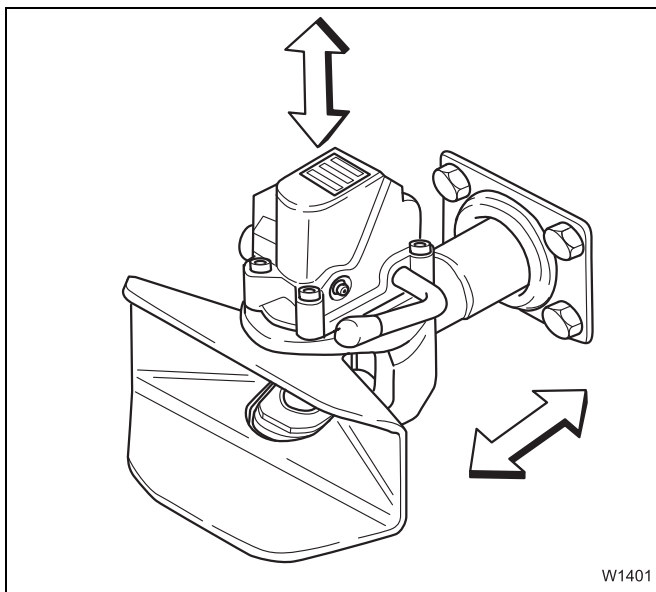
– The coupling must be closed;  p. 7 - 132.

Checking the bearing



Risk of injury!

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



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


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

7.19.3

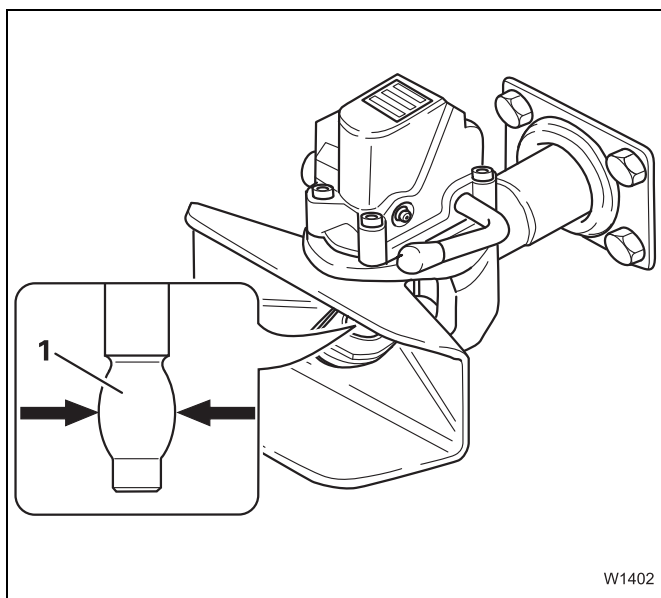
Checking the cotter pin

M 3

Prerequisites

– The coupling must be closed;  p. 7 - 132.

Checking the cotter pin

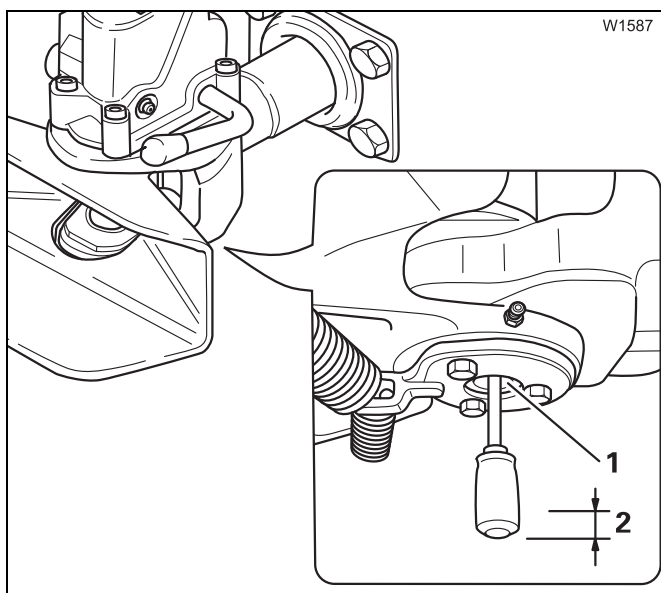


- Check the wear on the cotter pin (1). The diameter of the crowned section (arrows) must not be less than the following values:

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

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

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




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

7.19.4

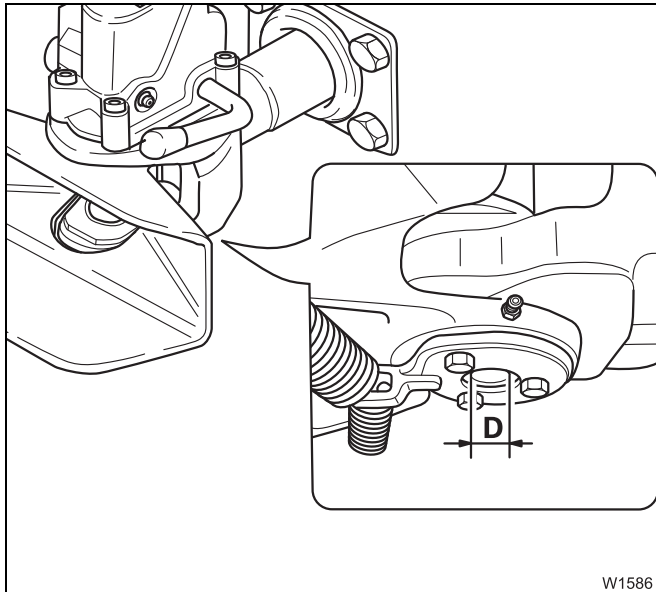
Checking the lower bushing

M 3

Prerequisites

– The coupling must be closed;  p. 7 - 132.

Checking the bushing



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

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

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

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

7.19.5

Checking the initial tension of the springs

M 3

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


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

7.19.6

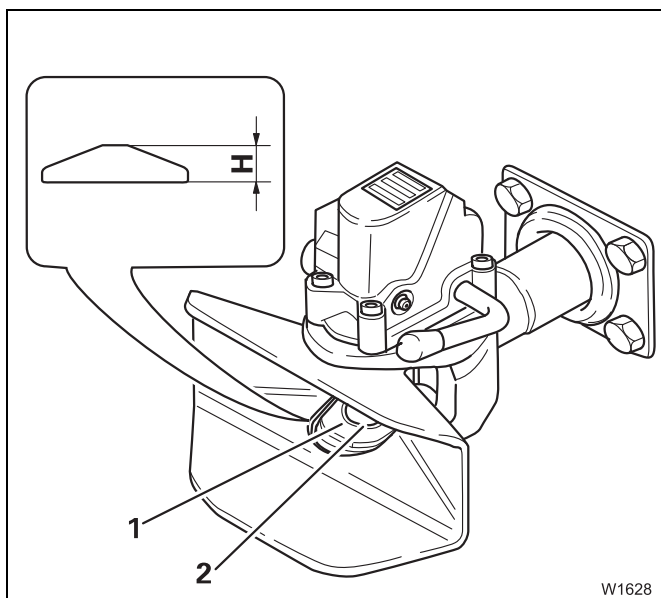
Checking the support ring

M 3

Prerequisites

- The coupling must be closed;  p. 7 - 132.

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 $H = 14 \text{ mm (0.55 in)}$

7.19.7


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

M 3

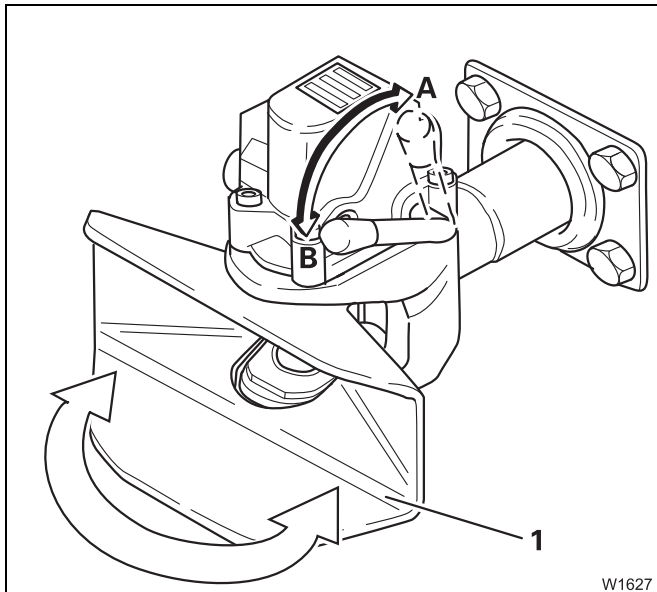
Spare parts and tool

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

Prerequisites

- The coupling must be closed;  p. 7 - 132.

Checking for correct functioning




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

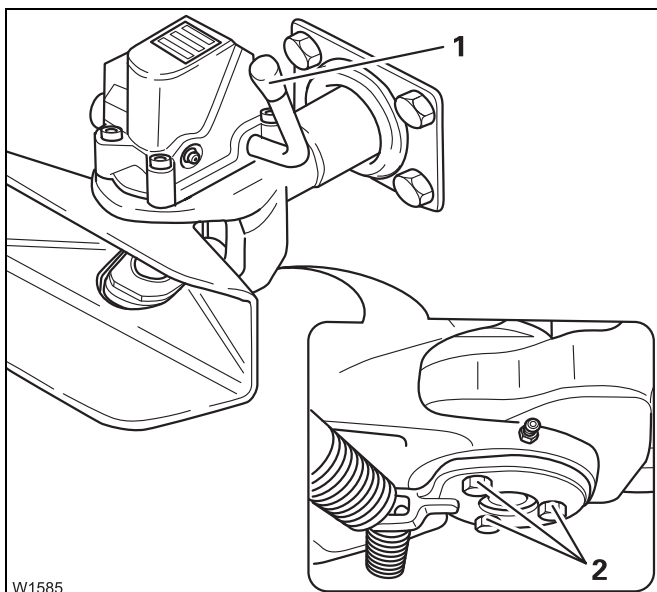
- Hold the coupling jaw (1) pressed slightly to the left or right.
- Open the coupling (position A) and let the coupling jaw go.


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



If the lever does not automatically engage with the coupling jaw, the middle position must be re-adjusted;  p. 7 - 137.

Resetting the middle position



- Open the coupling (lever (1) pointing upwards) and loosen the screws (2).
- Push the coupling jaw to the side until the lever engages.
- Tighten the screws – torque 58 Nm (42.7 lbf ft).
- Check the functioning of the coupling jaw;  p. 7 - 136.

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7.20 Other maintenance work

7.20.1 Checking the windscreen washing system

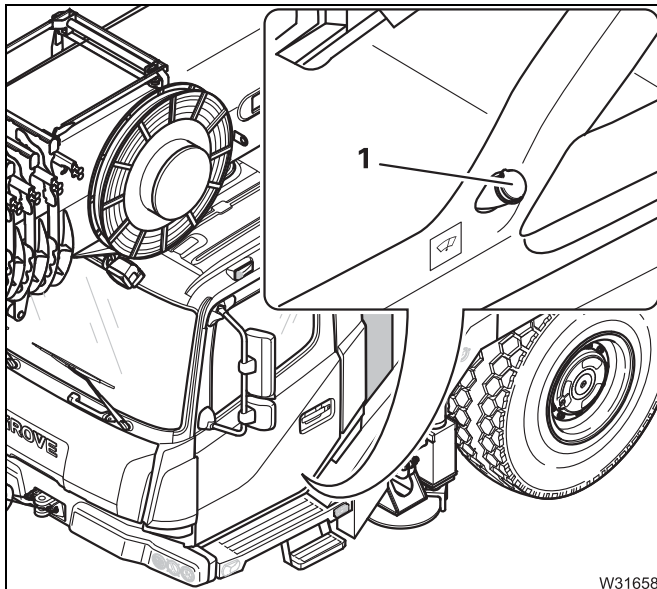
W

Water, spare parts, tool

Designation	Quantity	GROVE part no.
Wiper blades	2	04159795

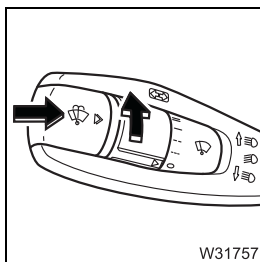
- Water; add commercially available detergent and antifreeze to it.
- A can for mixing and filling.


Topping up



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

Wiping



- Press the multipurpose switch of the windscreen wiper/washing system;  *Operating Instructions*.
- Check all the wiping stages (slow, fast, intermittent).

If the windscreen does not wipe clean

- Change the wiper blades.

7.20.2

Lubricating the outrigger beams

M 1

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

Grease, spare parts, tools

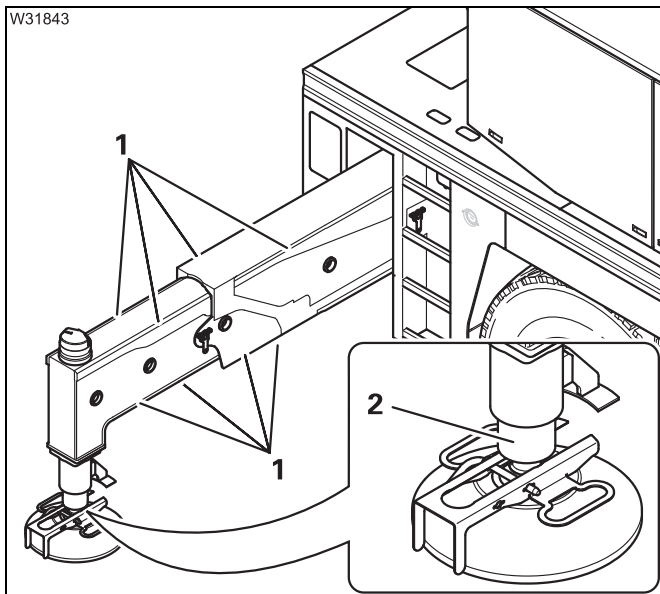
Lubricating grease	Designation to DIN 51502	Specification classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369
Spray	Spray on Berulub; 0.5 litres (spray-on)		01929824


– Brush or roller.



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

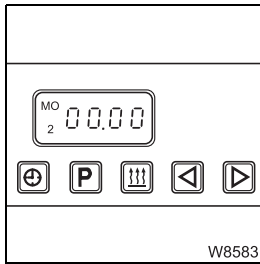
After every high-pressure cleaning operation on the truck crane

- Lubricate the outrigger beams.

7.20.3

Checking 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 heater for 20 to 30 minutes; *Operating Instructions*.

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

7.20.4

Lubricating the cab door

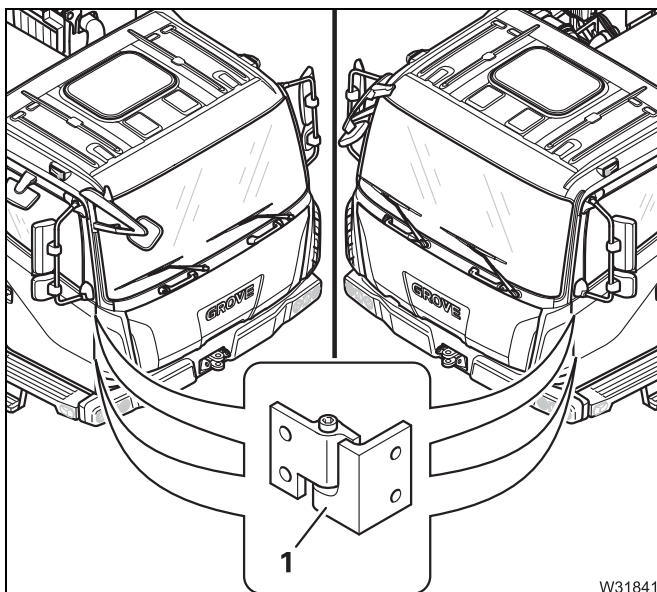
M 12

Grease, tools

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

– Brush.

Lubricating



- Open the doors on the driver and passenger side.
- Clean the door hinges (1).
- Lubricate the door hinges (1) lightly with a brush.
- Close and open the doors several times – the doors should move easily.
- Remove any grease that has escaped.

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

7.20.5

Lubricating the connecting and socket pins

M 12

Grease, tools

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

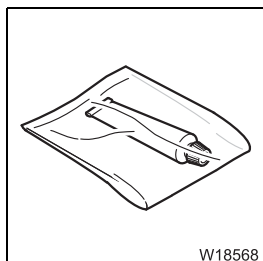
- Brush.

Checking

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

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

Lubricating



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

7.20.6

Renewing the corrosion protection

M 12

Protective agent, tools

Protective agent	GROVE part no.
Corrosion protection	03140192

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

Prerequisites

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

Checking

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

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

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

Processing instructions

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

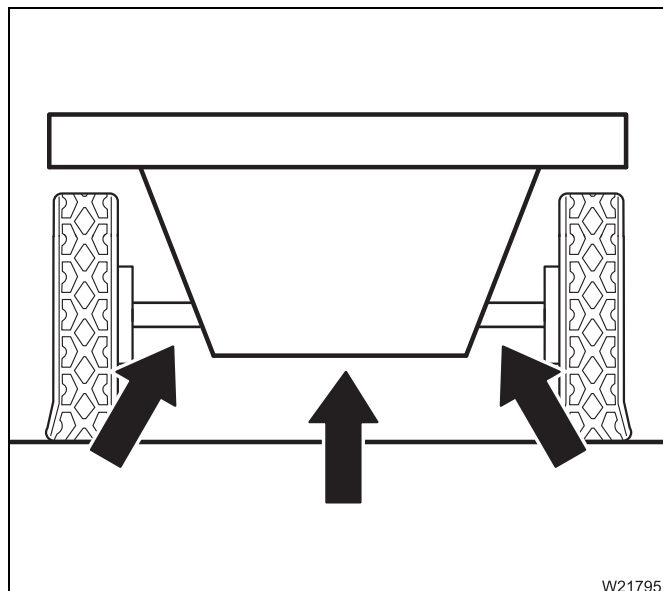


Spraying



Risk of injury to the eyes.

While working with the spray extension you could be hit by the spray jet or spray droplets. Wear protective goggles, protective clothing and gloves.



W21795

- Spray the corrosion protection agent on the underside of the carrier using a spray extension.
- Clean surfaces sprayed by accident immediately with water.
- Let the corrosion protection dry for one hour.
- Check that a transparent waxy protective film has covered the entire surface.

7.20.7

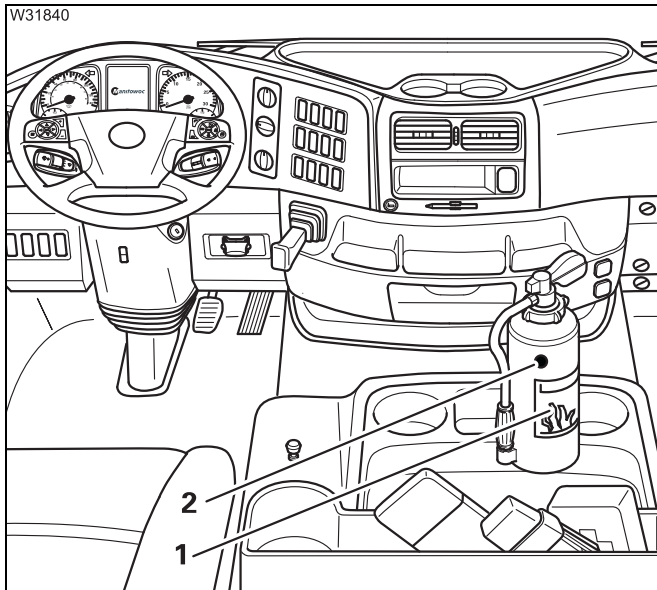
Having the fire extinguisher checked

Y 2

Depending on your truck crane's equipment, it can be fitted with fire extinguishers.



The maintenance interval may even be shorter, depending on the respective national regulations and the operating location. Ask the local fire safety officer about the national and local regulations.



- Observe the instructions (1) on the fire extinguisher.
- Have the fire extinguisher serviced by trained personnel in good time before the maintenance interval specified on the label (2) expires.



Danger due to the fire extinguisher not working.

There is no guarantee that the fire extinguisher will still work properly once the maintenance interval on the label has expired.

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8 Maintenance work on the superstructure

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8

Maintenance work on the superstructure

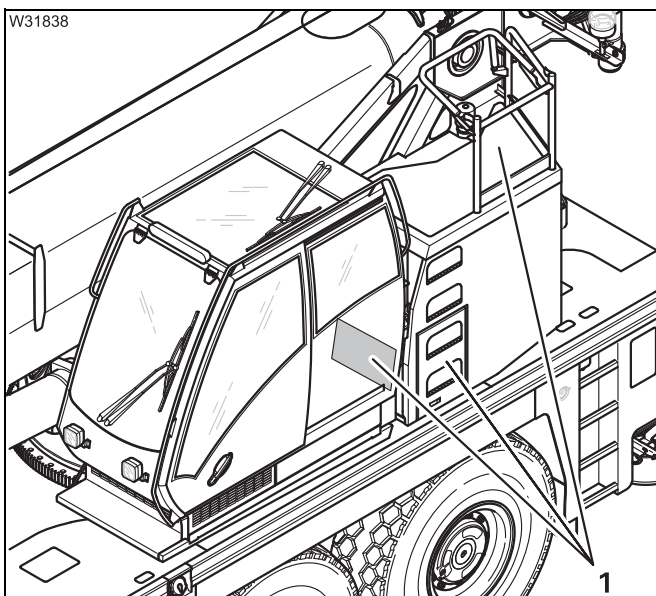
8.1

General instructions

8.1.1

Covers

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

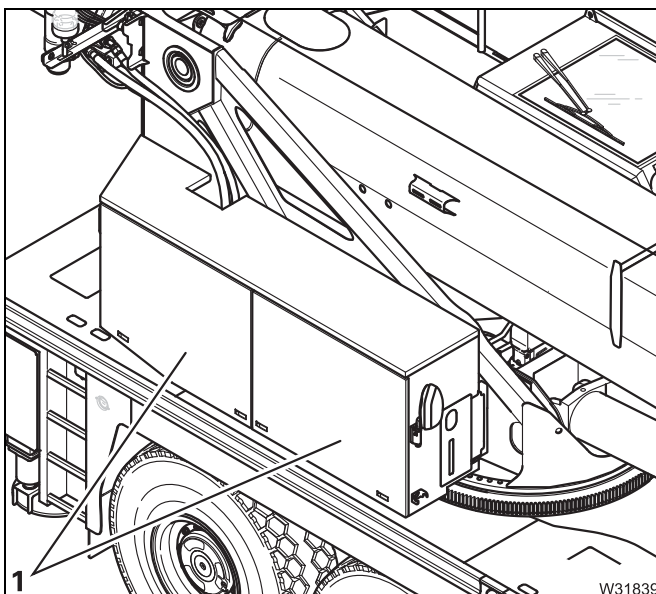


Before maintenance work

- Remove the covers (1)

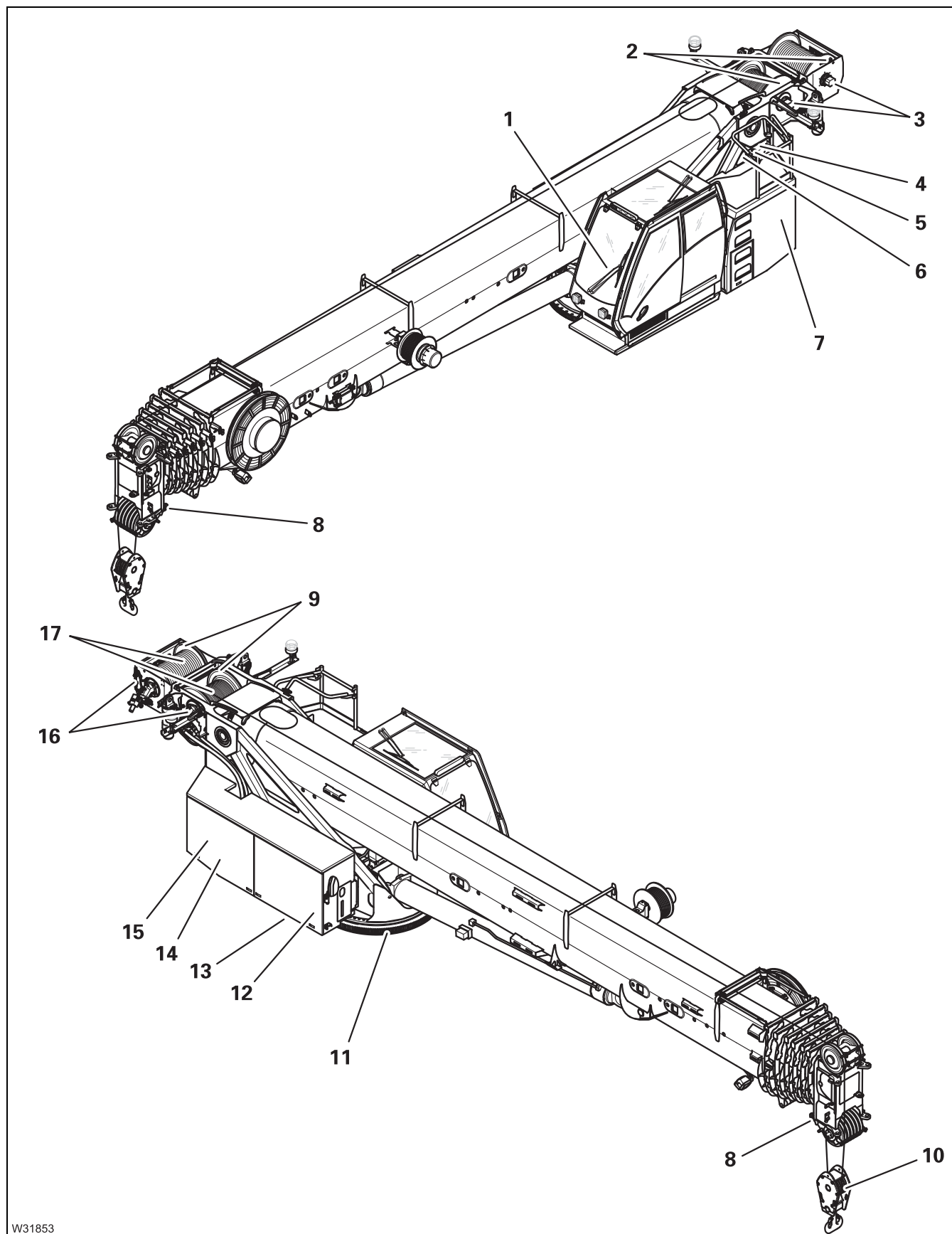
After maintenance work

- Fasten the covers (1) with the locks.



8.1.2

Overview of maintenance work on the superstructure



W31853

25.11.2016

Symbols for maintenance work

- 1 CCS (*Crane Control System*) control unit ▶▶▶▶▶ p. 8 - 7
- 1 ▶▶▶▶▶ p. 8 - 7

Hoists

- 17 Hoist ropes ▶▶▶▶▶ p. 8 - 9
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- 2 Rope wedges ▶▶▶▶▶ p. 8 - 52
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- 16 Oil inspection glasses ▶▶▶▶▶ p. 8 - 9
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Slewing gear

- 12 Oil inspection glasses ▶▶▶▶▶ p. 8 - 15
- 12 Oil inspection glasses ▶▶▶▶▶ p. 8 - 15

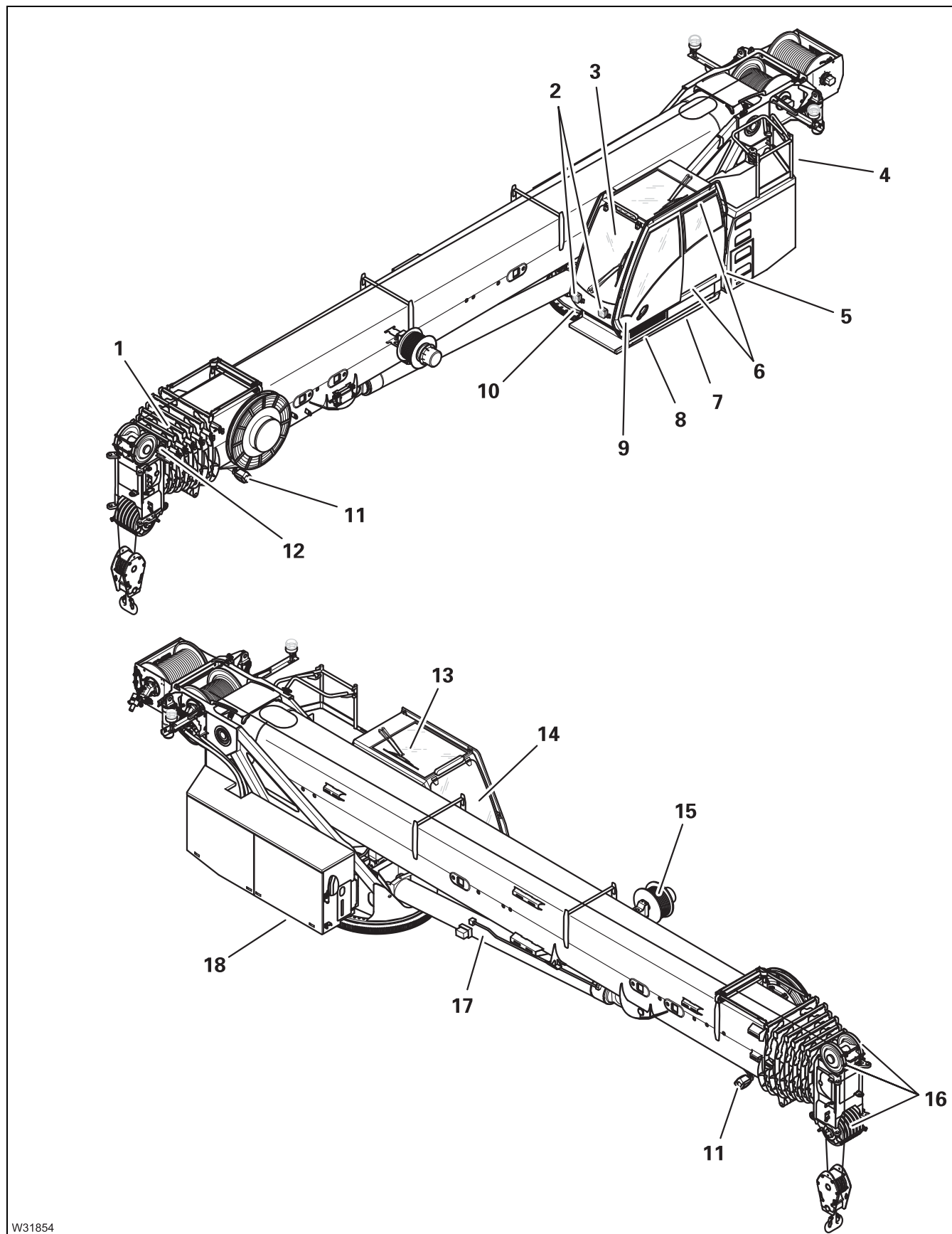
Slewing bearing

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Hydraulic system

- 7 Oil tank with sight glass ▶▶▶▶▶ p. 8 - 31
- 7 Oil tank with sight glass ▶▶▶▶▶ p. 8 - 31
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- 5 Ventilation filter ▶▶▶▶▶ p. 8 - 36
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Main boom	▣▣▣▣▶ p. 8 - 45
1 Telescopic sections 1 to 6 and basic section	▣▣▣▣▶ p. 8 - 46
17 Derricking cylinder	▣▣▣▣▶ p. 8 - 45
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Cable drums and slewing angle sensor	▣▣▣▣▶ p. 8 - 65
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4 Cable drum 2	▣▣▣▣▶ p. 8 - 65
18 Slewing angle sensor	▣▣▣▣▶ p. 8 - 67
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10 Centralized lubrication pump	▣▣▣▣▶ p. 8 - 69
Electrical system	▣▣▣▣▶ p. 8 - 73
2 Spotlights on the crane cab	▣▣▣▣▶ p. 8 - 73
11 Spotlights on the telescopic boom	▣▣▣▣▶ p. 8 - 73
12 Anemometer, air traffic control light	▣▣▣▣▶ p. 8 - 73
Air conditioning system	▣▣▣▣▶ p. 8 - 75
3 Crane cab air-conditioning system	▣▣▣▣▶ p. 8 - 75
7 Condenser fins	▣▣▣▣▶ p. 8 - 75
5 Pollen filter	▣▣▣▣▶ p. 8 - 78
Other maintenance work	▣▣▣▣▶ p. 8 - 79
9 Windscreen washing system receptacle	▣▣▣▣▶ p. 8 - 79
14 Crane cab auxiliary heater ¹⁾	▣▣▣▣▶ p. 8 - 80
6 Cab door rails	▣▣▣▣▶ p. 8 - 81
8 Pull-out step	▣▣▣▣▶ p. 8 - 82
– Various connecting pins and socket pins	▣▣▣▣▶ p. 8 - 83
– Corrosion protection	▣▣▣▣▶ p. 8 - 84
13 Fire extinguisher ¹⁾	▣▣▣▣▶ p. 8 - 86

¹⁾ Additional equipment


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8.2

Symbols for maintenance work

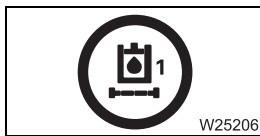
Check the following symbols every day before starting work.

CCS

- Check the symbols on the *CCS* start menu (*Crane Control System*) in the crane cab each day before starting work.
- The Start menu shows the most important measured values and the Warning submenu shows all pending warning messages;  *Operating Instructions*.

Warning submenu

If a symbol is displayed, you must carry out the maintenance work:



Hydraulic oil filter;  p. 8 - 39.

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8.3

Hoists

8.3.1



Checking the oil level

W

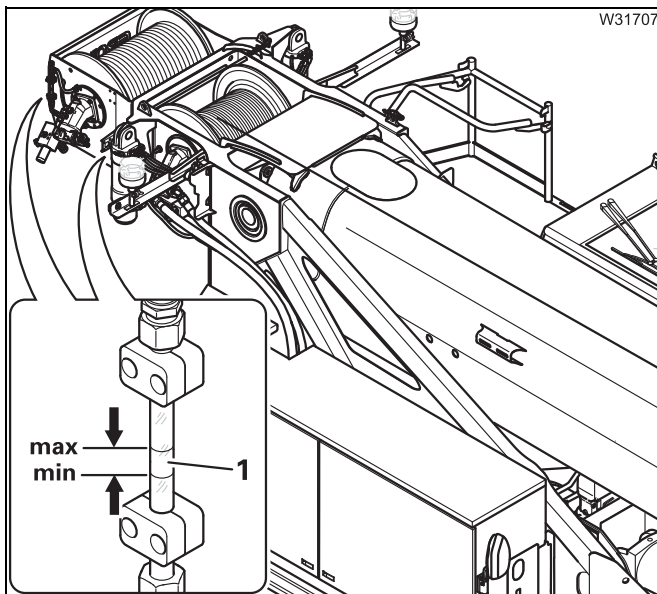
Spare parts and tools

Designation	Quantity	GROVE part no.
Oil inspection glass; complete	2	84012690

Prerequisites


- The truck crane must be level and in on-road mode;  *Operating Instructions*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Checking the oil level



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

If the oil level is too low

- Top up the oil;  p. 8 - 11.

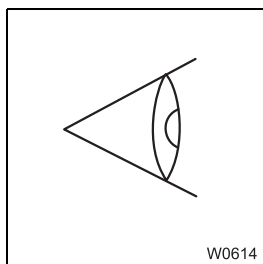



The oil level in the hoist gear must be 15 mm below the centre of rotation of the hoist. If the sight glass is loose in the clamps, or a new sight glass has been fitted, you must adjust this difference in height before you adjust the clamps.

8.3.2

General inspection

W



- Pay attention to any unusual running noises from the hoists.
- Check the hoists and the connections for leaks. If consumables are leaking;  *Checking the oil level*, p. 8 - 9.
- 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.

- Attach the hook block to the hoist rope, reeved once.
- Lift a load of approx. 7 t (15,500 lbs) to approx. 30 cm (1.0 ft) above the ground.
- Measure the distance to the ground when the load is hanging completely still.
- Switch the engine off.

If the load has not lowered after approx. 2 minutes, the brake is currently in working order.

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

8.3.4

Changing the oil/checking the oil


M 12

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



Oil, spare parts, tools

Gear oil in litres (gal)	Designation to DIN 51502	Specification classification	GROVE part no.
3.3 (0.9) for each hoist	C - LPF	MIL-L 2105 B API-GL-4/5 Viscosity: SAE 75 W-90 EP ISO - VG 220	02313611 Synthetic oil; do not mix this with mineral-based oils.

Designation	Quantity	GROVE part no.
Oil inspection glass; complete	2	84012690

- Receptacle, approx. 8 ltr (2 gal);  p. 2 - 4.


Prerequisites

- The truck crane must be level and in on-road mode;  *Operating Instructions*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Changing the oil at the hoist



Risk of damage to the hoist gears.

The waste oil must be checked for abrasion particles. This test is used to detect any damage at an early stage;  p. 8 - 12.



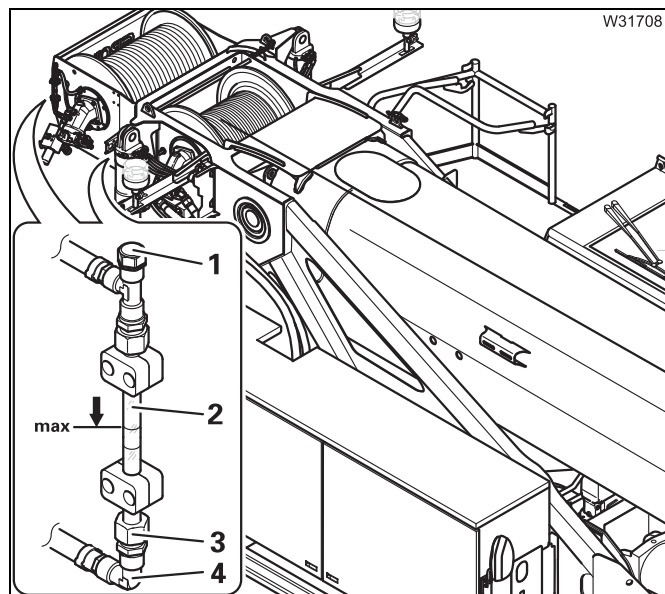
Risk of environmental damage due to leaking consumables.

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



During filling, the oil spreads only slowly in the hoist. The oil level therefore rises quickly in the standpipe at first, then drops slightly and then eventually rises again to its true level.





Draining oil

- Place a receptacle under the pipe (2).
- Remove the venting neck (1).
- Disconnect the screw fastening (3) and allow the oil to drain out of the hose (4) and the pipe (2).
- Replace the gasket if necessary.
- Reconnect the hose (4) to the screw fastening (3) at the pipe (2).

Topping up oil

- Add oil at the top through the pipe up to the **max.** mark.
- Secure the venting neck (1).

Checking the oil



Risk of accidents from falling load.

If this inspection is not performed, there is a risk of damage to the hoist gear which could lead to the load falling.



Check the waste oil for abrasion particles or have it tested in a laboratory:

- Pour the waste oil through a clean filter mat.
- Examine the oil, i.e. the residues on the filter mat using a magnifying glass.

If you find abrasion particles or solid materials on the mat, the hoist gear must be dismantled and inspected by the manufacturer.



Some abrasion particles may appear in the first oil filled. If you notice such particles during the first oil change (after 200 oper. hrs.), first consult **Manitowoc Crane Care** before introducing any specific measures.

8.3.5

Having a partial inspection carried out

Y 3

- Only suitably trained specialists should carry out a partial inspection of
- the multiple-disc brake,
 - the plug connections between the hydraulic motor and the multiple-disk brake,
 - the plug connections between the multiple-disk brake and transmission unit

and be permitted to exchange parts with signs of wear.

8.3.6

Having a general inspection carried out


Y 6



When carrying out the general inspection of the hoists, also observe the information contained in *Measures required for winch monitoring*, p. 5 - 21.

The general inspection involves removing the transmission and sending it to the manufacturer to be examined.



For transmissions that have undergone a general overhaul, an oil change must be carried out after 200 and 1000 operating hours;  *Run-in regulations*, p. 4 - 1.

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8.4

Slewing gear

8.4.1



Checking the oil level

W

Spare parts and tools

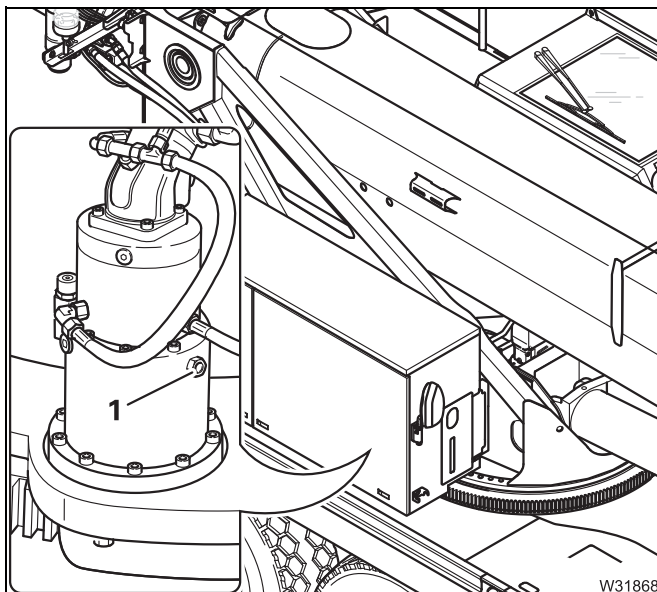
Designation	Quantity	GROVE part no.
Gasket 10 x 14 Cu DIN 7603	2	00117125

Prerequisites

- The truck crane must be level and in on-road mode;  *Operating Instructions*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.


Checking the oil level

Always check the oil level prior to using the crane.



- Check that oil is visible in the sight glass (1).
- Always check the oil level for all the slewing gears.

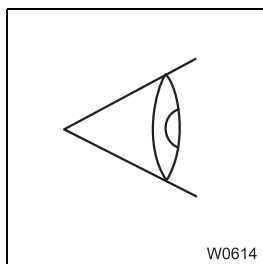
If the oil level is too low


- Top up the oil;  p. 8 - 19.

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. If consumables are leaking;  *Checking the oil level*, p. 8 - 15.
- Check that pipes and hoses are tightly connected and undamaged.



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

8.4.3

Checking the slewing gear brake

M 6

Prerequisites

- The crane must be rigged with an outrigger span of at least **8.66 x 7.20 m (28.4 x 23.6 ft)** and be level;  *Operating Instructions*.
- The truck crane must be rigged for a slewing range of 360° according to the *lifting capacity table*.
- The RCL code for the current rigging mode must be entered;  *Operating Instructions*.
- 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 main boom must be raised to 45° and fully retracted.



Risk of overturning while slewing.

Always set a rigging mode for the slewing range of 360° in accordance with the *lifting capacity table* and enter the corresponding RCL code. Do not override the rated capacity limiter (RCL).



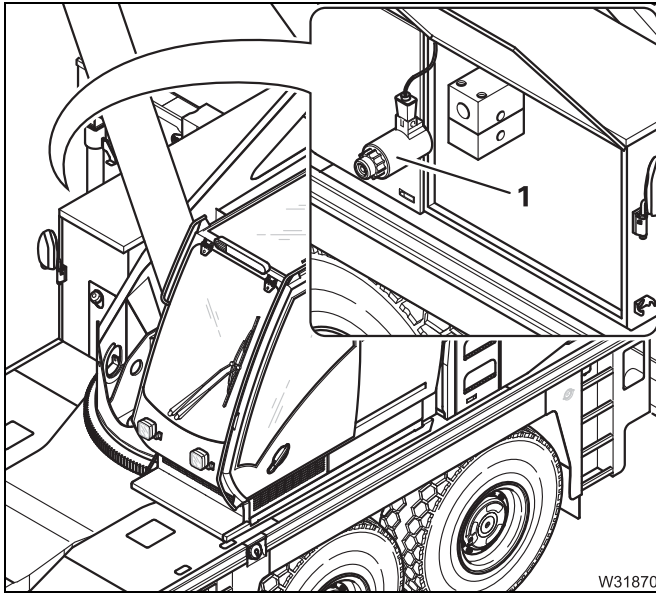
Risk of injury due to swinging hook block

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

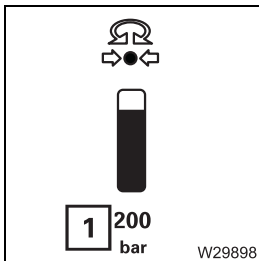
Secure the slewing range 360°, before you check the slewing gear brake.

Checking

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

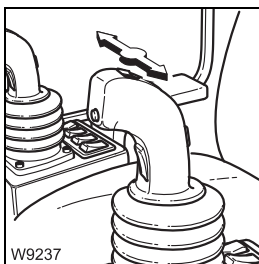


- Switch the engine off.
- Remove the coil (1) from the valve Y 2307 (release the slewing gear brake). The slewing gear brake will now not be released when the slewing gear is switched on.



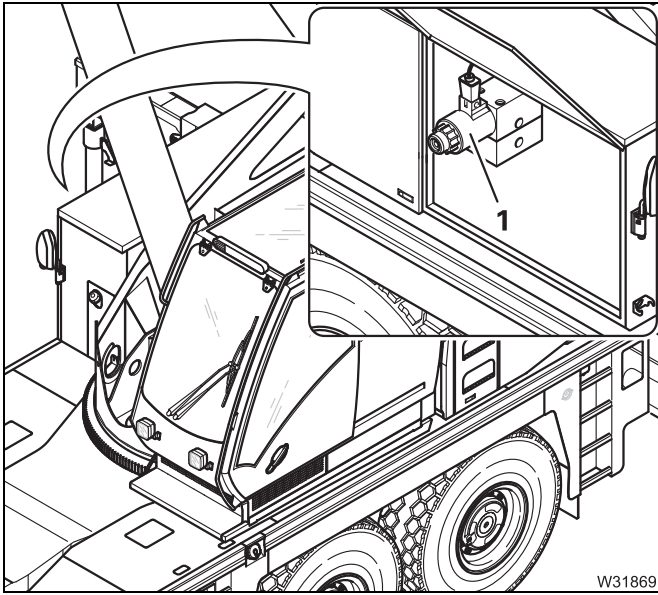
- Start the engine and switch on the slewing gear.
- Open the CCS menu *Hydraulic pressure*.

Display (1) will show the pressure in the slewing gear's hydraulic circuit.



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





- Switch the slewing gear off and switch the engine off.
- Fasten the coil (1) to the valve Y 2307 using the nut (release the slewing gear brake).
- 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  *Run-in regulations*, p. 4 - 1.



Oil, spare parts, tools

Gear oil in litres (gal)	Designation to DIN 51502	Specification classification	GROVE part no.
0.9 (0.24) for each slewing gear	C - LPF	MIL-L 2105 B API-GL-4/5 Viscosity: SAE 75 W-90 EP ISO - VG 220	02313611 Synthetic oil; do not mix this with mineral-based oils.

Designation	Quantity	GROVE part no.
Gasket 10 x 14 Cu DIN 7603	2	00117125
Gasket 14 x 20 Cu DIN 7603	2	00117132

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

Prerequisites

- The truck crane must be level and in on-road mode;  *Operating Instructions*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Changing the oil



Risk of environmental damage due to leaking consumables.

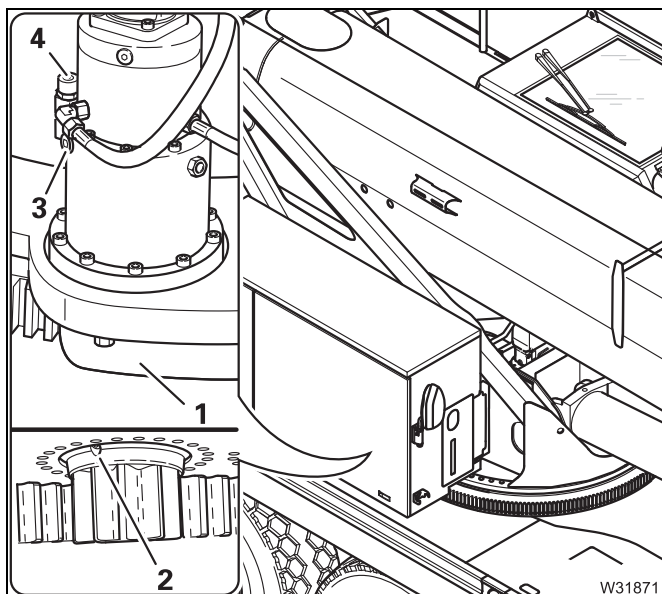
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.

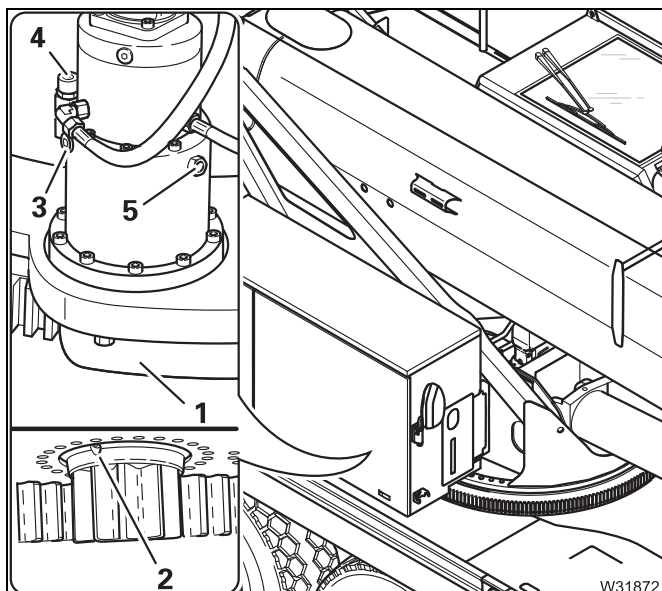
- Always change the oil in all slewing gears.





Draining oil

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



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

Topping up 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).
- Replace the plate (1).

Checking the oil

Check the waste oil that was drained from the slewing gears for abrasion particles, or have it tested at a laboratory.

- Pour the waste oil through a clean filter mat.
- Examine the oil, i.e. the residues on the filter mat using a magnifying glass.

If you find abrasion particles or solid materials on the mat, the slewing gear transmission must be removed and inspected by the manufacturer.

8.5

Slewing bearing


8.5.1

Checking the screws




M 3

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

Tools

- Torque wrench.
- Auxiliary tools for the torque wrench;  p. 8 - 23.

Prerequisites

- The truck crane must be rigged with an outrigger span of at least **8.66 x 5.31 m (28.4 x 17.4 ft)** and be level;  *Operating Instructions*.
- The auxiliary hoist, **or** alternatively the compensation weight **0.8 t (1,750 lbs)** must be rigged.
- No further counterweight must be been rigged; .
- In addition, the tyres on the 3rd axle line should be removed so that freedom of movement under the slewing bearing is improved.
- The main boom must be fully retracted and raised to 75°;  *Operating Instructions*.
- The current load must not exceed **1 t (2,200 lbs)** – if necessary unreeve the hook block.
- The slewing range 360° around the truck crane must be secured.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Safety instructions



Risk of damage to the screws on the slewing bearing.

All screws were tightened at the factory with a certain torque, and this should be checked during maintenance. Only slight tightening of the screws is permissible, if required.

You may **not** slacken the screws and re-tighten them, or completely unscrew and then reuse them.

If the superstructure has to be removed from the carrier, only a completely **new set of screws** may be used to reinstall the superstructure. **Only original screws** should be used, which were manufactured according to the factory specifications.



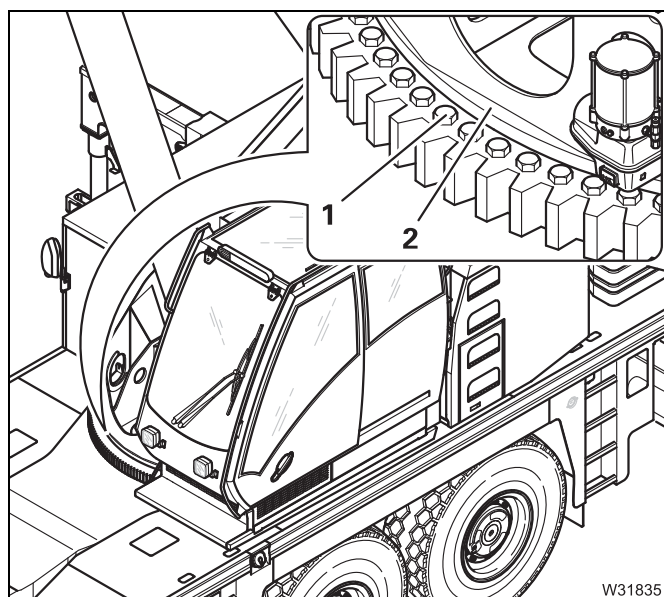


Danger of the slewing bearing being ripped off.

If while checking you notice very loose, broken or missing screws, then the slewing bearing has been overloaded and is no longer safe to use. During crane operation, the slewing bearing may rip off suddenly and thus cause fatal accidents.

Do not put the truck crane back into operation and have the slewing bearing repaired by **Manitowoc Crane Care**.

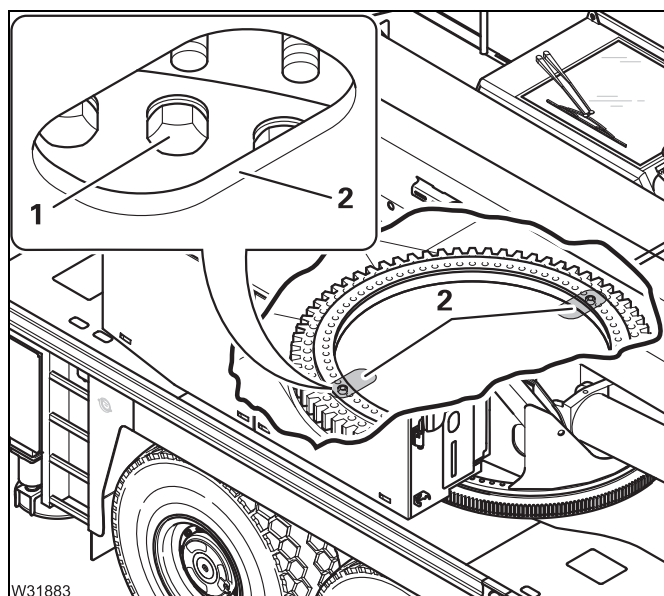
Access



The **outer ring** is connected to the carrier with the screws (1).

- Check all 72 screws (1) from **above**.

To do this, you must rotate the clear area (2) on the turntable gradually to check all the screws(1).

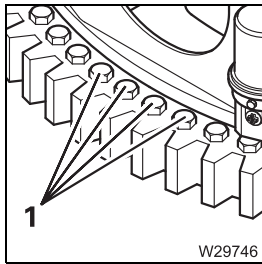


The **inner ring** is connected to the turntable with the screws (1).

- Check all 71 screws (1) from **below**.

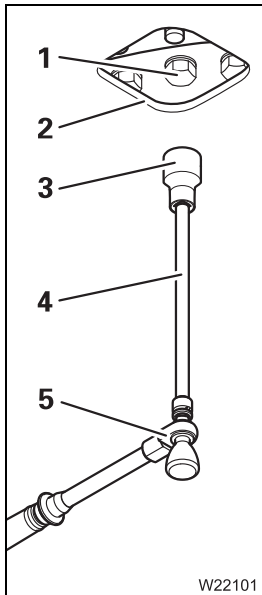
To do this, you must rotate the turntable gradually with a pair of screws (1) each on the opposite side through the openings (2) in the carrier.

Selecting the tools



Outer ring

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



Inner ring

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

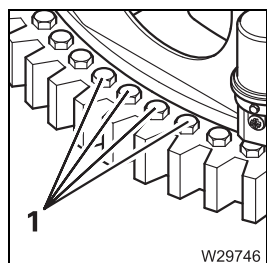
A **manual torque tool (5)** is recommended so that it can be tightened gently, and slipping from the screw head (1) is avoided.

Torques

Screw type	GROVE part number	Torque Nm (lbf ft)
Ball slewing bearing Bearing type: KDV, single-row	03272334 or 03272344 Model plate: Inside the inner ring.	
M 24 x 140: 72 pieces on the outer ring	03272342	790 (583)
M 24 x 140: 71 pieces on the inner ring	03272342	790 (583)

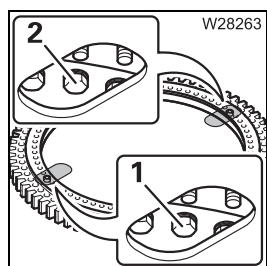


Checking the outer ring



- Divide the checking of the 72 screws into 18 working steps of 4 screws each (1).
Between each of the 18 operation steps you need to rotate the turntable to the next group of 4 screws on the opposite side.
- Switch the engine off after every rotation and secure the truck crane against unauthorised use; ■■■▶ p. 2 - 3.
- Check the tightness of the first group of 4 adjoining screws (1); ■■■▶ *Torques*, p. 8 - 23.
- Once they have been checked, mark the screws to avoid subsequent confusion.
- Remove the tool.
- Start the engine (from the crane cab) and turn the turntable by 180° – the second group on the opposite side is now accessible.
- Switch the engine off.
- Check all other groups in the same way.

Checking the inner ring



- Divide the inspection of the 71 screws into 35 work steps with 2 screws each and 1 work step with 1 screw.
Between each of the 35 operation steps you need to rotate the turntable to the next pair of screws on the opposite side.
- Switch the engine off after every rotation and secure the truck crane against unauthorised use; ■■■▶ p. 2 - 3.
- Check the tightness of the first pair of screws (1) and (2) on the opposite side; ■■■▶ *Torques*, p. 8 - 23.
- Mark the screws that have been checked, to avoid confusion later.
- Remove the tool.
- Start the engine (from the crane cab) and turn the turntable by 90° – the second pair of screws on the opposite side is now accessible.
- Switch the engine off.
- Check all other screws in the group 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 Instructions*.
- The main boom must be fully raised; *Operating Instructions*.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.

Lubricating

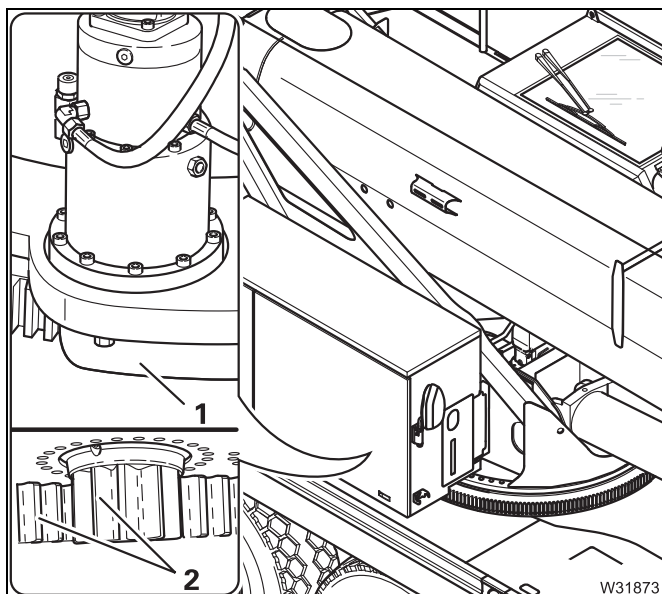


Risk of crushing from the gear teeth.

Fingers may be crushed or clothing can be drawn into the open, rotating pinion. For this reason, be sure to remount the plate after lubricating.

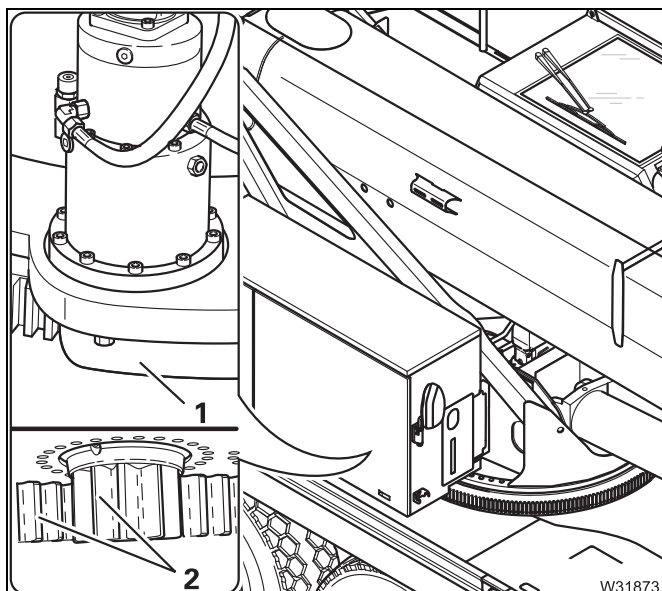
A distinction is made between initial lubrication and subsequent lubrications.





First lubrication

- Remove the plate (1).
- Remove the old grease from all the gear teeth (2).
- Apply a thin layer of new grease to all the gear teeth and allow it to penetrate for about 10 minutes.
- Apply a second, thicker layer of grease and allow it to penetrate for about 30 minutes.
- Attach the plate.



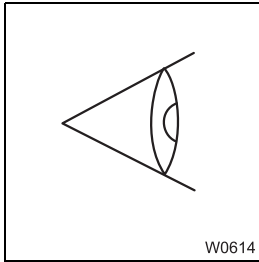
Subsequent lubrication

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

8.5.3

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 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 (**M3**).

Spare parts and tools

- Dial gauge (precision 0.01 mm (0.00039 in)) with tripod.
- Measurement report from when the truck crane was put into operation;  *Delivery receipt.*

Prerequisites

- The slewing bearing must have been previously checked for tightness;  *Checking the screws*, p. 8 - 21.
- The crane must be rigged with an outrigger span of at least **8.66 x 5.31 m (28.4 x 17.4 ft)** and be level;  *Operating Instructions.*
- The auxiliary hoist, **or** alternatively the compensation weight **0.8 t (1,750 lbs)** must be rigged.
- No further counterweight must be been rigged; .
- The lattice extension must be removed.
- The main boom must be fully retracted
- The load being lifted must not exceed **1 t (2,200 lbs)** – where necessary unreeve the hook block.

Type

The truck crane GMK 4100L-1 is equipped with a slewing bearing of the bearing type: KDV, single-row.

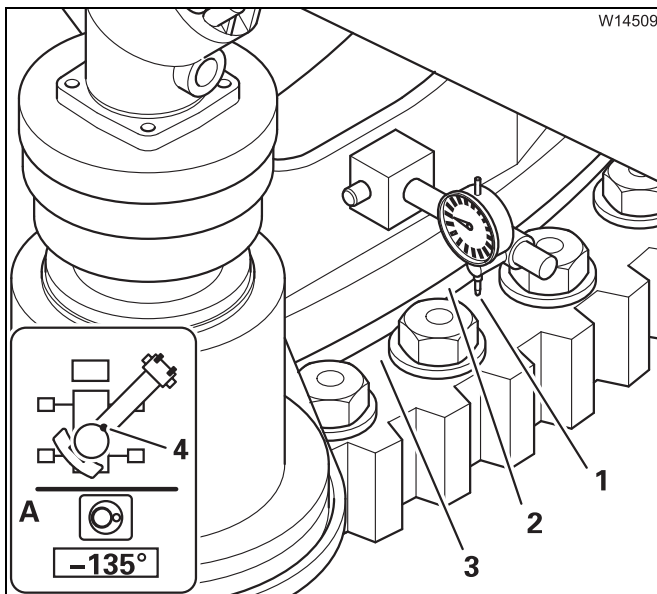
Type of slewing bearing	GROVE part number
Ball slewing bearing Bearing type: KDV, single-row	03272334 or 03272344 Model plate: Inside the inner ring.

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.

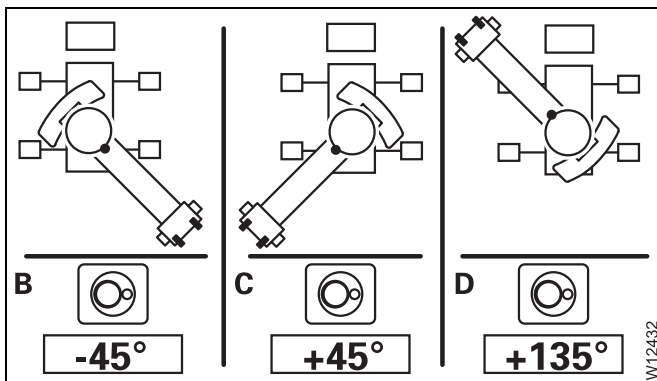
The maximum permissible wear is 3.2 mm (0.126 in).
This results in the maximum permissible tilting play.

Example: **Base value + max. permissible wear =** **max. permissible tilting play**
0.35 mm (0.014 in) + 3.2 mm (0.126 in) 3.55 mm (0.14 in)



Measuring current tilting play

- Raise the main boom to 82° and slew to -135° – display (A).
- Fasten a dial gauge on the front on the turntable (4) and place the button (1) on to the lower ring (3) as close as possible to the gasket (2).
- Slowly lower the main boom to 50°. The hook block may not touch the ground.
- Read off from the dial gauge how far the turntable is inclined and record this value as the current tilting play; ►► *Appendix – Tilting play measurement report.*
- Remove the dial gauge.



- Repeat the measurement with the slewing angles
 - B** - 45°
 - C** + 45°
 - D** + 135°

If the **current tilting play** is greater than the **max. permissible tilting play**, you must have the slewing bearing replaced by **Manitowoc Crane Care** or an authorised GROVE dealer.

If the **current tilting play** is half as great as the **max. permissible tilting play**, you must reduce the maintenance interval; ►► *Reducing the interval*, p. 8 - 28.

8.5.5

Lubricating the locking of turntable



M 12

Grease, spare parts, tools


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

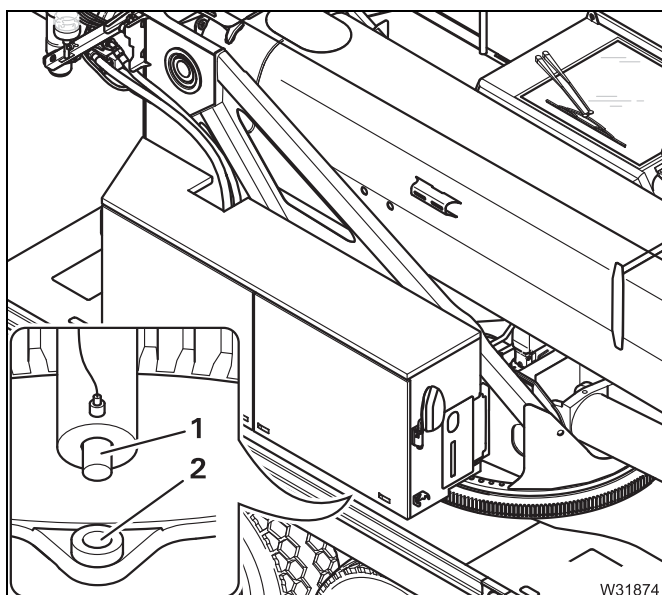
- Brush.

Prerequisites

- The truck crane must be level and in on-road mode;  *Operating Instructions*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Lubricating

- Familiarise yourself with the correct operation of the turntable lock;  *Operating Instructions*.



- Grease the lubricating points (1) and (2) with the brush.

8.6

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.

8.6.1

Checking the oil level

D

Prerequisites

- The truck crane must be level and in on-road mode; *Operating Instructions*.
- The telescoping cylinder must be locked in telescopic section I; *Operating Instructions*.
- The truck crane must be standing on a level surface.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.

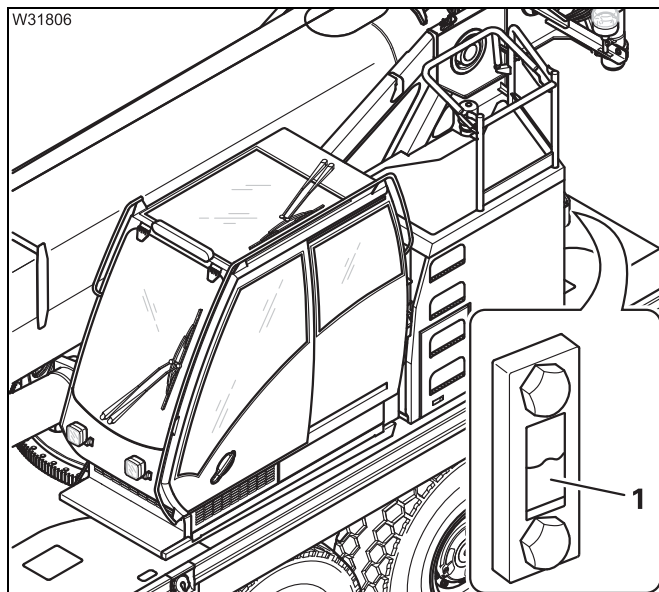
Checking the oil level



Risk of damage to the hydraulic system

Cleanliness is imperative when handling hydraulic oil.

Even fresh hydraulic oil must be filtered before it is added to the tank.



- Check whether oil is visible in the middle of the sight glass (1).

If the oil level is too low

- Top up the oil; p. 8 - 43.

8.6.2

Checking the hydraulic hoses

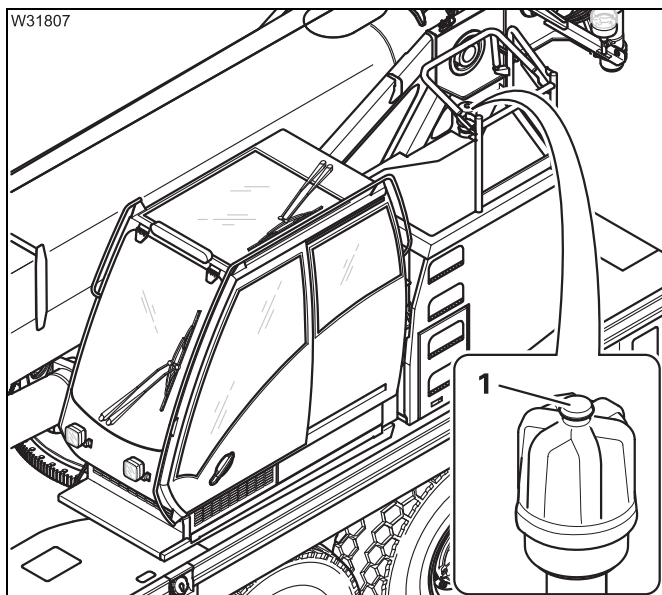
W

The inspection work is described in section *Checking the hydraulic hoses*, p. 7 - 98.

8.6.3

Checking the ventilation filter

W



- Check the display (1) on the ventilation filter.

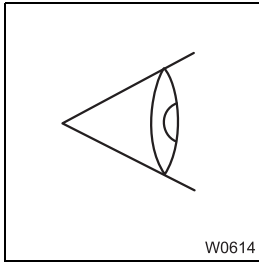
If the indicator is coloured

- Replace the filter; ► p. 8 - 36.

8.6.4

Checking for leaks

W



- Start the engine from the crane cab, so that the hydraulic pumps in the superstructure also start running; *Operating Instructions*.
- 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 - 31.



Risk of accidents from hydraulic oil spraying out.

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



Risk of environmental damage due to leaking consumables.

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

After hydraulic components have been changed

- Bleed the hydraulic system; *Establishing the operating conditions*, p. 8 - 44.

If damage cannot be rectified immediately or further damage is likely

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


8.6.5

Cleaning the magnetic rods


M 3

Spare parts and tools

Designation	Quantity	GROVE part no.
For oil filter 1:		
Filter	1	04156358
Packing set	1	04165792

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

Prerequisites

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



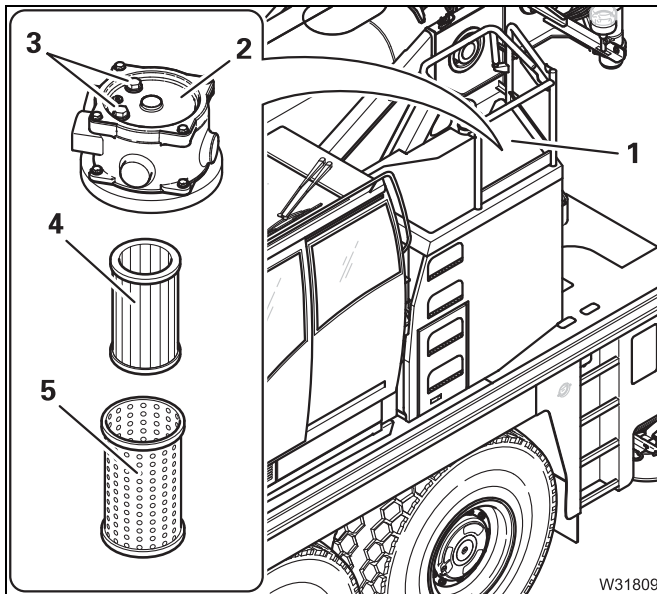
Risk of environmental damage due to leaking consumables.

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



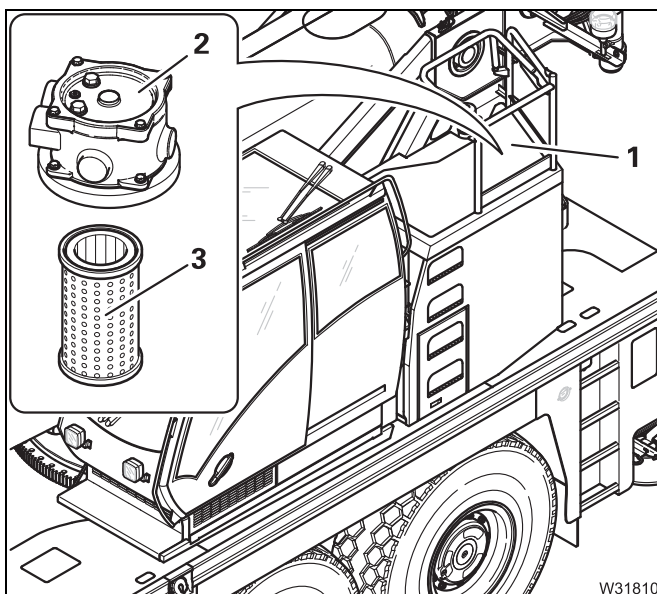
- Remove the cover (1).
- Remove the cover (2) and pull out the hydraulic oil filter.
- Place the filter in a receptacle.
- Remove the filter (4) from the filter cage (5).
- Clean the filter cage (5) and the magnetic rod (3).
- Replace the filter (4) if necessary.



Risk of damage to the hydraulic system.

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

Have the hydraulic system inspected by **Manitowoc Crane Care** or by your qualified repair crew.



- Assemble the filter (3) and insert it.
- Replace the cover gasket if necessary.
- Bolt the cover (2) on.
- Attach the cover (1).

8.6.6

Changing the ventilation filter

M 12

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	03134932

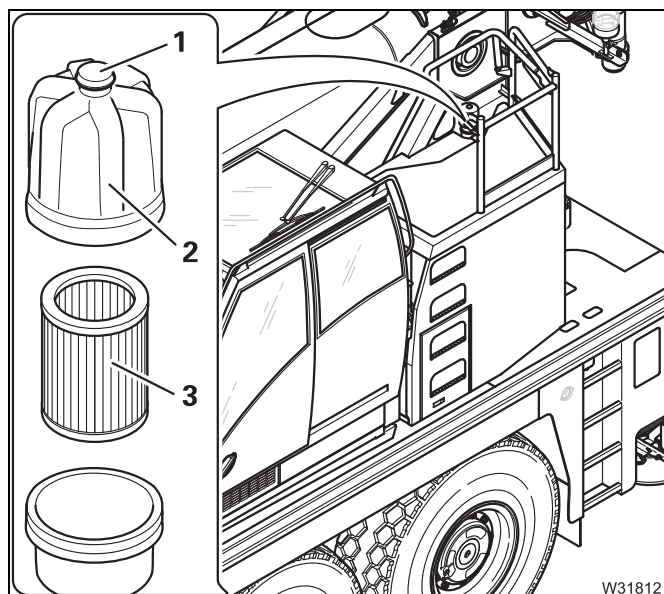
Prerequisites

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



Risk of damage to the environment from filter residues

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



- Remove the cap (2).
- Change the filter (3) and fasten the cap.
- Reset the display by depressing the pin (1) on the housing.

8.6.7

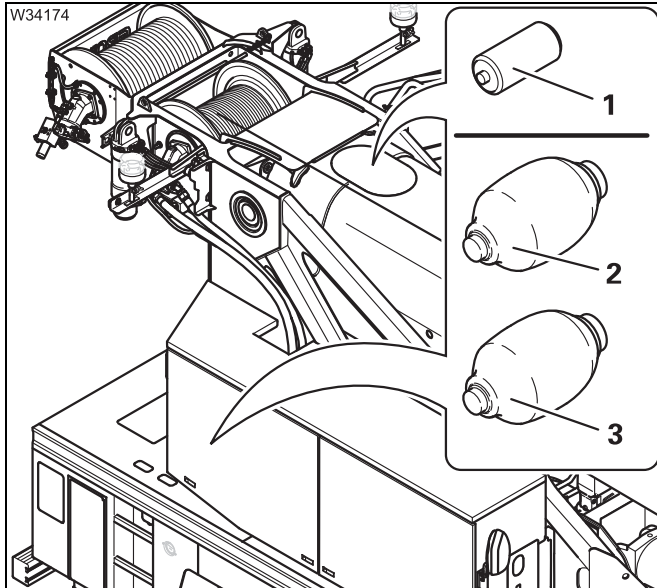
Pressure accumulator – checking the gas pressure

M 12



Risk of accidents due to incorrect inspection.

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



The superstructure is equipped with pressure accumulators.

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

1 Pressure accumulator	10 bar (145 psi)
2 Pressure accumulator	20 bar (290 psi)
3 Pressure accumulator	180 bar (2610 psi)

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

8.6.8

Taking oil samples

M 12

The oil sample from the superstructure hydraulic system is taken in a way similar to that for the carrier hydraulic system.

Information for taking samples with the hose and for the laboratory analysis; *Taking oil samples*, p. 7 - 102.

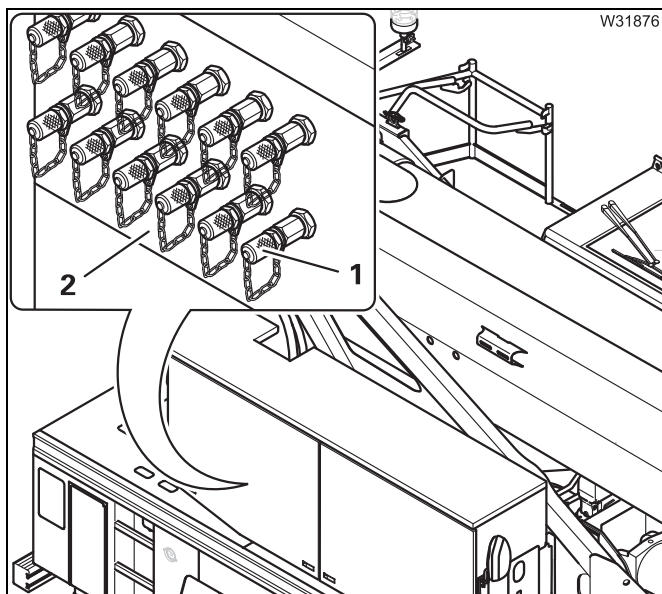
Prerequisites

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

Select the sampling location

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

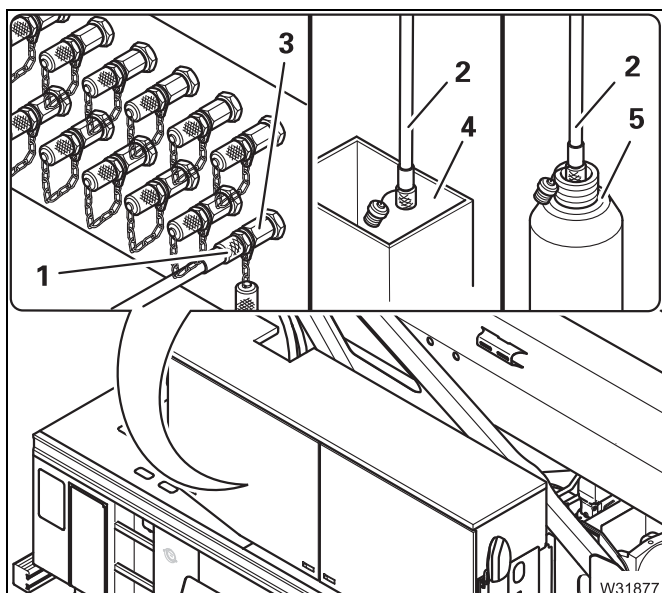








The *MLS* gauge port (1) is located on the bracket (2). When a hydraulic function is run (tilt the crane cab), oil can be taken at the gauge port.

- This maintenance work must be performed by a team of two persons:
 - **Person 1** stands at the console (2) and fills the sample container.
 - **Person 2** sits in the crane cab and controls the tilting of the crane cab.

Taking oil samples



- Clean the gauge port and connect the hose (1) at the port (3);  *Connecting the hose*, p. 7 - 103.
- Put the hose end (2) into the receptacle (4).
- Start the engine from the crane cab.
- Tilt the crane cab.
- Allow 2 litres (0.5 gal) of oil to flow into the receptacle.
- Switch the engine off and put the hose end (2) into the sample container (5).
- Start the engine from the crane cab.
- Tilt the crane cab.
- Allow 0.3 litres (0.08 gal) of oil to flow into the sample container.
- Switch the engine off.
- Remove the hose;  *Disconnecting the hose*, p. 7 - 104.
- Seal the sample container and dispatch it;  *Dispatch the oil sample to the laboratory*, p. 7 - 105.
- Determine the quality of the oil;  *Determining the quality of the oil*, p. 7 - 105.

8.6.9

Changing the hydraulic oil filter

All oil filters must be replaced when changing the oil.

If a warning message appears, the red symbols on the CCS control unit CCS indicate whether oil filter 1 or oil filter 2 is clogged.



- 1 red – Change oil filter 1
- 2 red – Change oil filter 2

Spare parts and tools

Designation	Quantity	GROVE part no.
For oil filter 1:		
Filter	1	04156358
Packing set	1	04165792
For oil filter 2:		
Filter	1	03142356
Housing packing set	1	03326049

- Torque wrench for 25 Nm (18.5 lbf ft).
- Receptacle, approx. 5 ltr (1.5 gal); p. 2 - 4.

Prerequisites

- The truck crane must be level and in on-road mode; *Operating Instructions*.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.



Risk of damage to the environment from filter residues

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



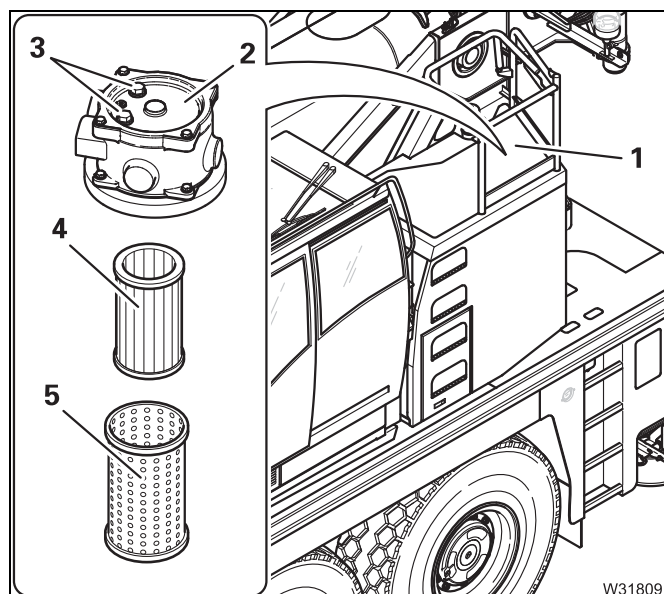
Changing oil filter 1



Risk of environmental damage due to leaking consumables.

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

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



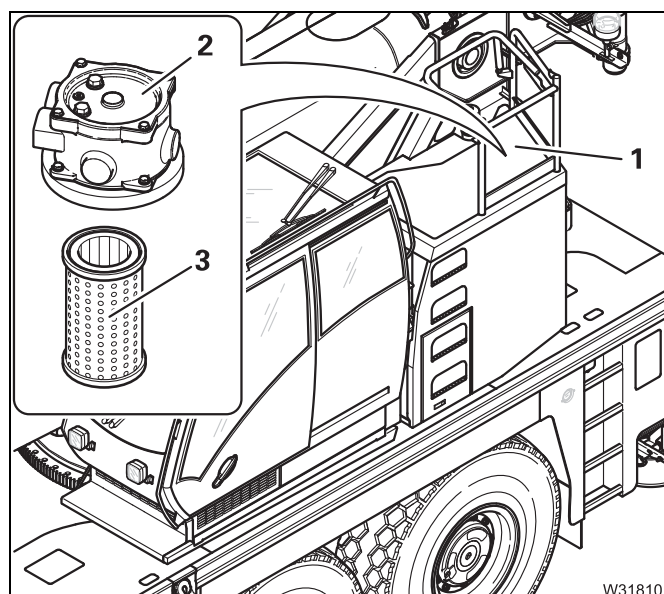
- Remove the cover (1).
- Remove the cover (2) and pull out the hydraulic oil filter.
- Place the filter in a receptacle.
- Remove the filter (4) from the filter cage (5).
- Clean the filter cage (5) and insert a new filter (4).
- Clean the magnetic rods (3).
- Replace any damaged parts, where necessary.



Risk of damage to the hydraulic system.

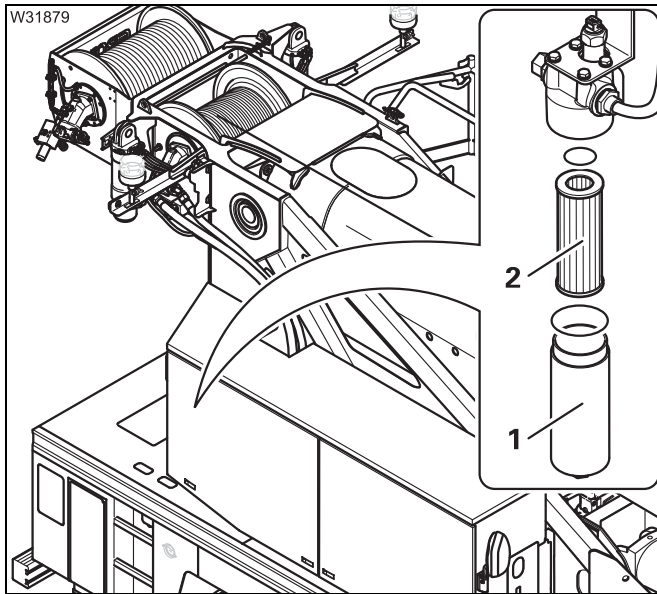
Large amounts of metal particles are a sign of damage in the hydraulic system.

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



- Assemble the filter (3) and insert it.
- Replace the cover gasket if necessary.
- Bolt the cover (2) on.
- Attach the cover (1).

Changing oil filter 2





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

After changing the filter




Risk of damage to the hydraulic pumps

The engine may only be started if the valve in the suction line of the hydraulic pumps is open and there is enough hydraulic oil in the hydraulic oil tank.



- Check the valve on the hydraulic oil tank. Open the valve, if necessary;  p. 8 - 44.
- Check the oil level. Top up the oil, if necessary;  p. 8 - 43.
- To bleed the system (from the crane cab), start the engine and let it idle for 3 minutes.
- Check that none of the oil filters is leaking.

8.6.10 Changing the hydraulic oil




The oil only needs to be changed if the laboratory analysis results indicate this;  *Taking oil samples*, p. 8 - 37.

Oil, spare parts, tools

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

- Connecting piece and hose (tool box);  p. 7 - 108.
- One or more receptacles, approx. 650 ltr (172 gal);  p. 2 - 4.

Prerequisites

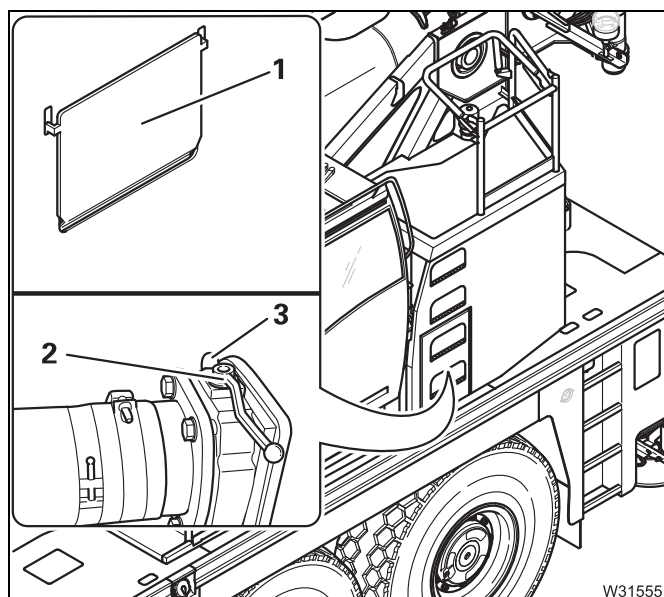
- The truck crane must be level and in on-road mode;  *Operating Instructions*.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.
- The oil filters must be removed;  *Changing the hydraulic oil filter*, p. 8 - 39.

Closing the valve



Risk of damage to the hydraulic pumps

Be sure to secure the engine against unauthorised use.
If the engine is started while the valve in the suction line is closed, the hydraulic pumps will be damaged.



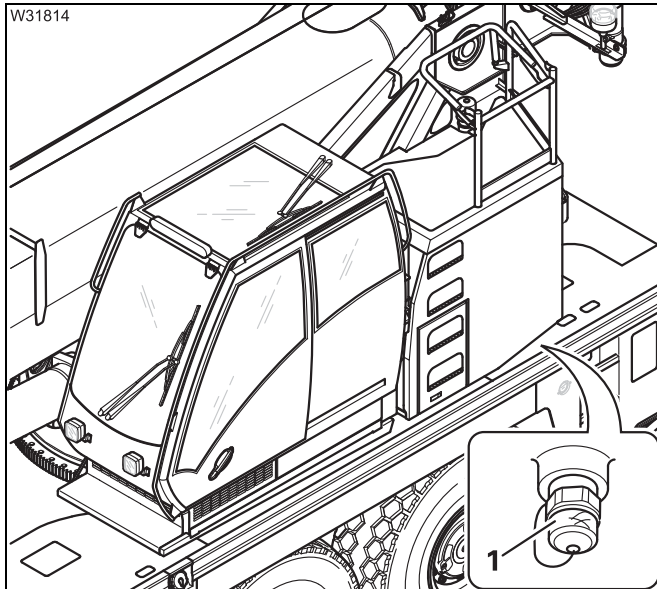
- Open the flap (1).
- Pull the locking bar (3).
- Close the valve – lever (2) at right angles to the line.
- Insert the locking bar (3).
- Leave the flap (1) open.

Draining oil



Risk of environmental damage due to leaking consumables.

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



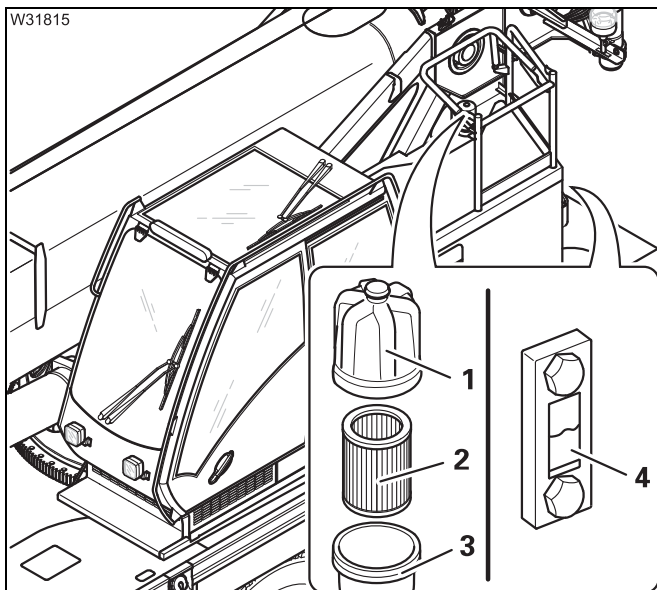
- Place a receptacle underneath the valve.
- Screw the connecting piece and hose on to the valve (1) and drain the oil; *Handling the valves*, p. 7 - 108.
- Change the filters; p. 8 - 39.

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 (1) and the filter (2).
- Add new oil via the filler neck (3) through a filter until the level reaches the centre of the sight glass (4).
- Tighten the cap and filter.



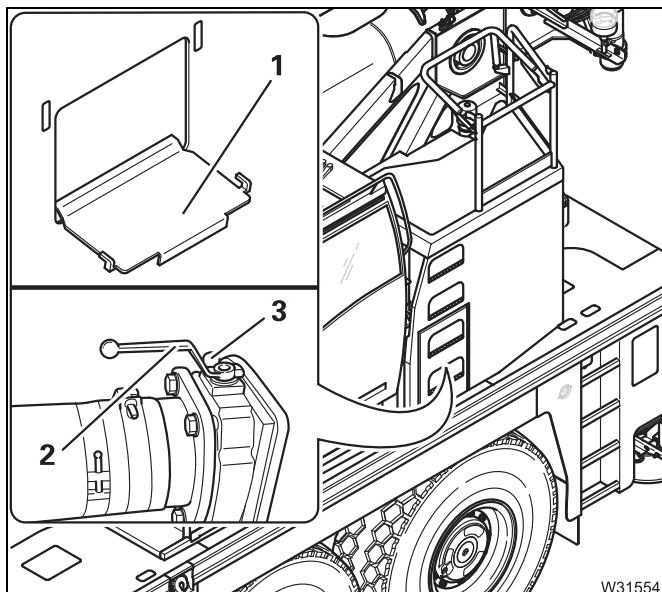
Establishing the operating conditions

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



Risk of damage to the hydraulic pumps

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



Opening the valve

The plug (1) must be open.

- Pull the locking bar (3).
- Open the valve – lever (2) parallel to the line.
- Insert the locking bar (3).
- Close the flap (1).

- Start the engine (from the crane cab).
- 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 - 43.

8.7

Main boom

8.7.1

Greasing the piston rod of the derricking cylinder

M 1

Grease, spare parts and tools

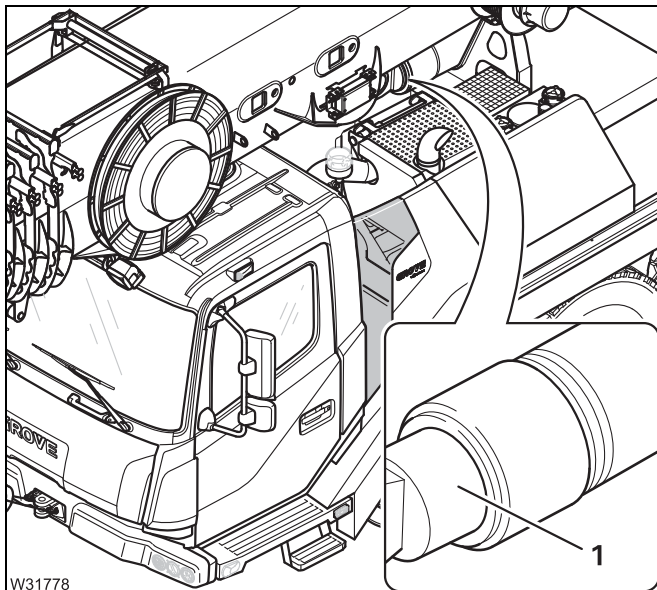
Designation	GROVE part no.
Lubricant RHUS SW 2; 1 kg (Apply the grease with a brush)	03325215
or	
Spray on Berulub; 0.5 litres (spray-on)	01929824

– 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. In this way you can avoid rust which damages the seal in the derricking cylinder head when fully lowered.



- Clean the uncovered end (1) of the piston rod by removing old grease, dirt particles and rust.
- Grease the uncovered end, making sure the grease coating is evenly distributed.

After every high-pressure cleaning operation on the truck crane

- Grease the piston rod.



You can hinder the formation of rust if you turn the main boom to the side between maintenance intervals and completely lower it.

8.7.2

Lubricating the telescopic sections

M 3

Grease, spare parts, tools

Designation	GROVE part no.
Lubricant for the locking pins: RHUS SW 2, 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.



The **Manitowoc Crane Group Germany GmbH** recommends 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 hook block must be unreeved.
- The main boom must be completely retracted and lowered into horizontal position.
- A rigging mode must be created with a telescoping status which satisfies the lifting capacity table necessary for maintenance; *Lifting capacity table*; Section *Telescoping sequences* for greasing the boom.
- The RCL code for the current rigging mode must be entered.



If initially you set up a rigging mode under which the telescope statuses 50/100/0/0/0/0 are available in the context of the associated lifting capacity table, this rigging mode allows you to perform the complete maintenance work on the main boom.



If the desired telescoping status is not a fixed length, you can first telescope to the next closest fixed length with the semi-automation and then telescope further to the desired length manually; *Operating Instructions*.

Information



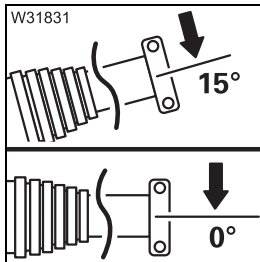
Risk of overturning when telescoping if the RCL is overridden.

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



Risk of accidents from slipping off the main boom.

There is grease residue on the telescopic sections. For this reason, you must not walk on the main boom. Use the extendable ladders provided with your crane.

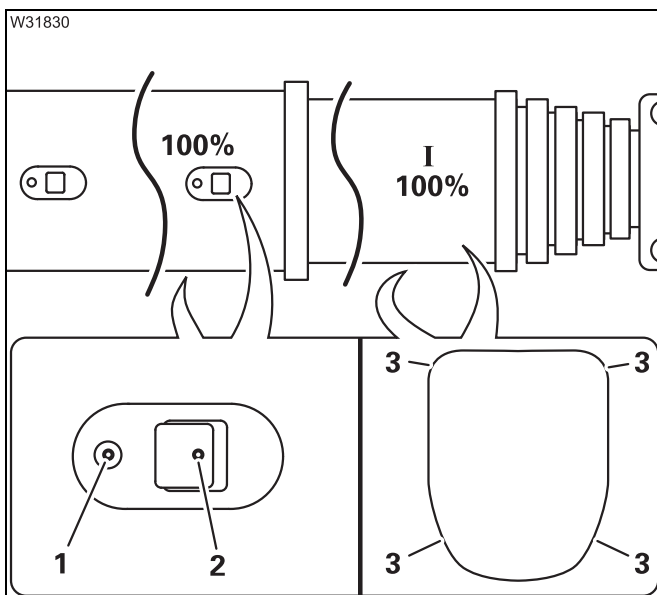


If the main boom has been telescoped several times, the telescoping mechanism and derricking gear can be so heavily loaded that the main boom can be neither telescoped nor derricked. Therefore note the following instructions:

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

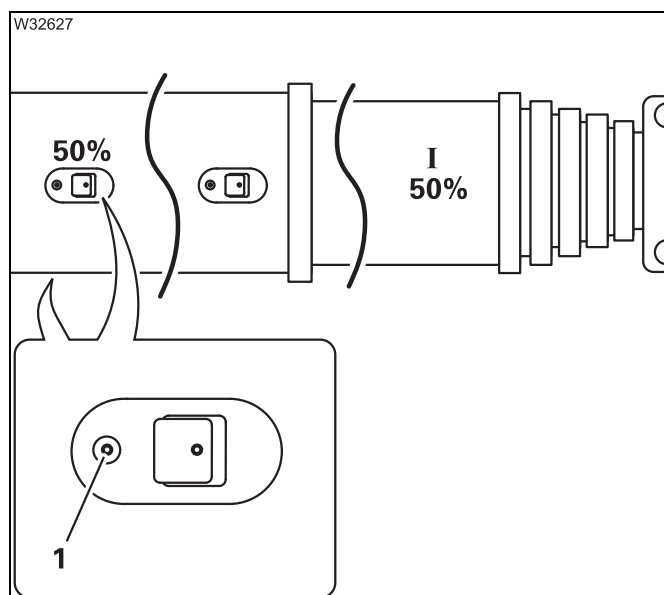
Telescopic section I

- Observe the following instructions regarding maintenance work.



- Extend the telescopic section I to 100%.
- Use a brush or a roller (PAL1) to lubricate the outer, upper and outer, lower slide faces (3).
- Use the grease gun (PAL1) to lubricate the upper inner slide faces at the lubricating nipples (1) on both sides.
- Use the grease gun (RHUS SW 2) to lubricate the locking pins at the grease nipples (2) on both sides.
- Lock and unlock the telescopic section I several times, so that the grease is distributed over the locking pins.



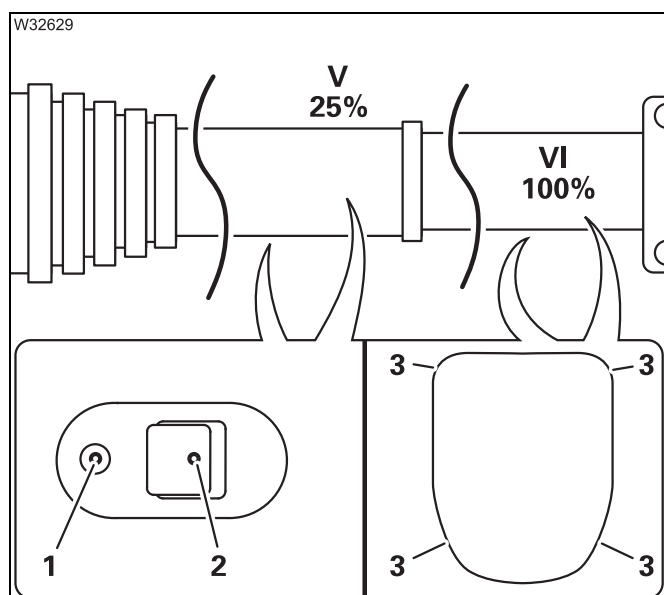


- Extend the telescopic section **I** to 50%.
- Use the grease gun (PAL1) to lubricate the upper inner slide faces at the lubricating nipples (1) on both sides.
- Fully retract telescopic section **I**.
- Fully extend and retract telescopic section **I** again so that the grease is distributed over the telescope slide faces.

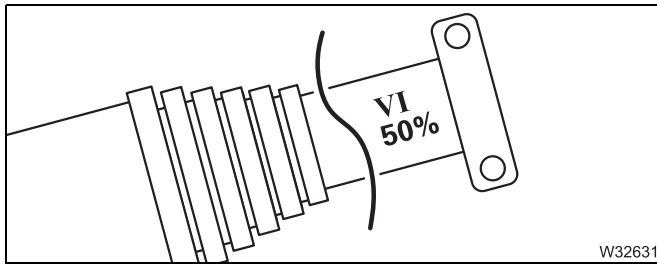
Telescopic section II - VI

- Observe the following instructions regarding maintenance work.

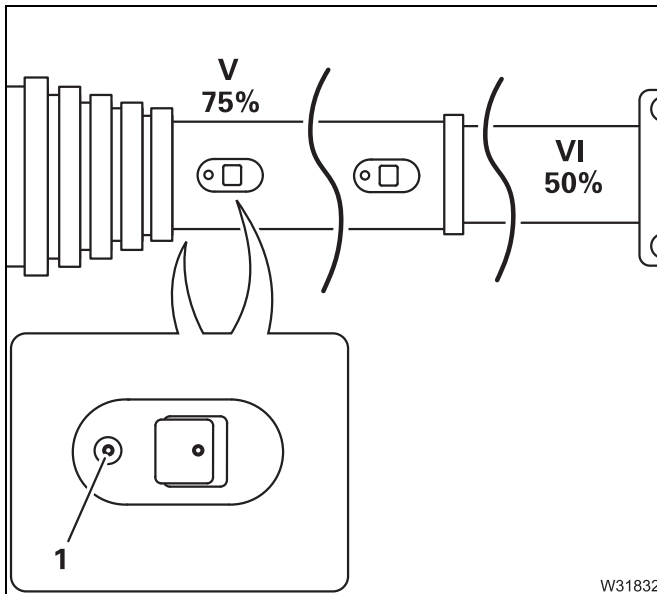
The following diagrams show the lubrication of the telescopic section **VI**. The telescopic sections **V**, **IV**, **III**, **II** are lubricated in the same way.



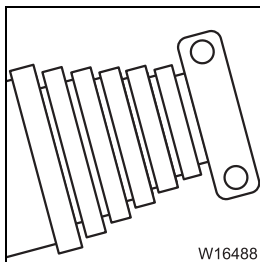
- Extend the telescopic section **VI** 100% and the telescopic section **V** approx. 25%.
- Use a brush or a roller (PAL1) to lubricate the outer, upper and outer, lower slide faces (3).
- Use the grease gun (PAL1) to lubricate the upper inner slide faces at the lubricating nipples (1) on both sides.
- Use the grease gun (RHUS SW 2) to lubricate the locking pins at the grease nipples (2) on both sides.
- Lock and unlock the telescopic section **VI** several times, so that the grease is distributed over the locking pins.



- Derrick the main boom to 15°.
- Retract the telescopic section **V** to 0% and extend the telescopic section **VI** to 50%.



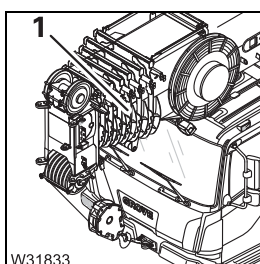
- Lower the main boom to 0° – do not lower to below 0°.
- Extend the telescopic section **V** to approx. 75%.
- Use the grease gun (PAL1) to lubricate the upper inner slide faces at the lubricating nipples (1) on both sides.



- Raise the main boom to 15°.
- Retract the telescopic sections **V** and **VI** to 0%.
- Fully extend and retract the telescopic section **VI** again so that the grease is distributed over the telescope slide faces.
- Lower the main boom to 0°.

- Lubricate the telescopic sections **V**, **IV**, **III** and **II** in the same way.

Before driving the truck crane



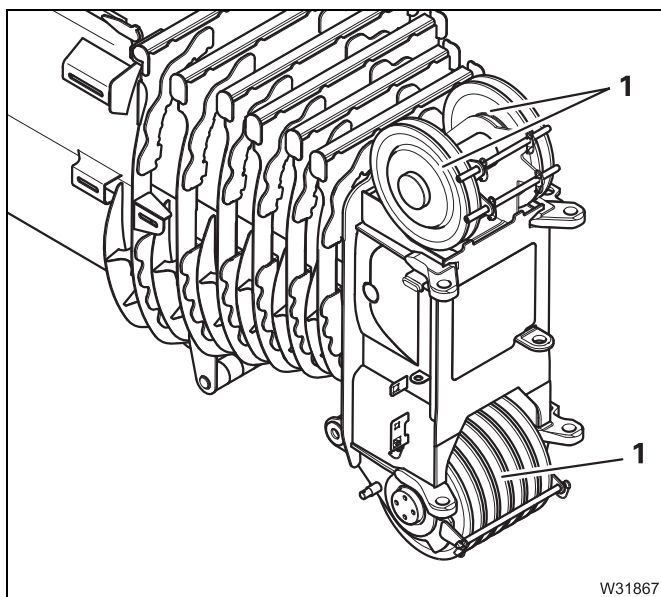
Fully retracting all telescopic sections of the main boom after greasing may result in excess lubricant paste emerging at the collar (1).

- Remove any excess lubricant paste from the collar (1). This is to prevent any lumps dropping off on to the windscreen and suddenly obstructing the view when driving.

8.7.3

Lubricating the sheaves

M 3



- Check all sheaves (1) on the main boom head 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.

8.7.4

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.

8.8

Hoist ropes

8.8.1

Checking the winding

D



Risk of accidents when the rope drum is turning.

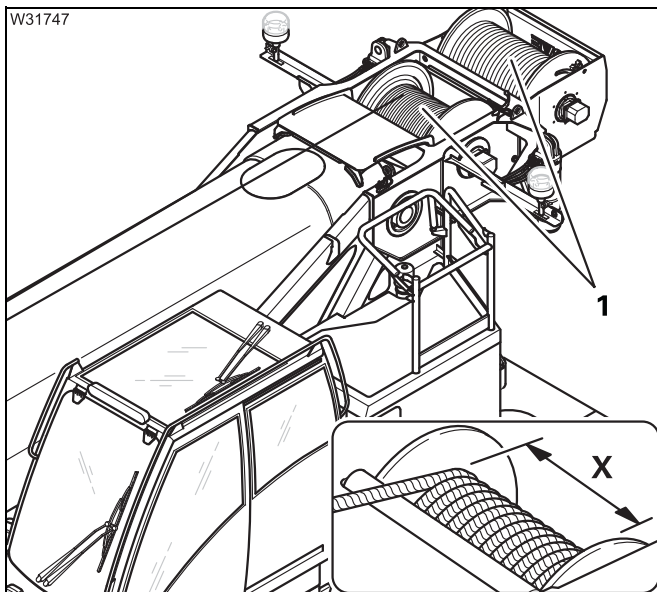
Keep away from the rope drum while it is turning.

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

Prerequisites

- Video monitoring of the hoists from the crane cab is switched on; *Operating Instructions*.
- One hook block must be reeved; *Operating Instructions*.
- The main boom must be raised to about 30°; *Operating Instructions*.
- The engine must be started.

Checking



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

- Slowly perform the *lowering* movement until the rope has moved over the complete width (X) of the rope drum.
 - The rope must be evenly wound.
 - The rope turns on the drum must be evenly spaced, 0 to 2 mm (0 to 0.08 in) apart.
 - The cross-over points must be offset by approximately 180°.



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

8.8.2




Checking the hoist ropes

W


Spare parts and tools


- Torque wrench for 78 Nm (57.5 lbf ft).

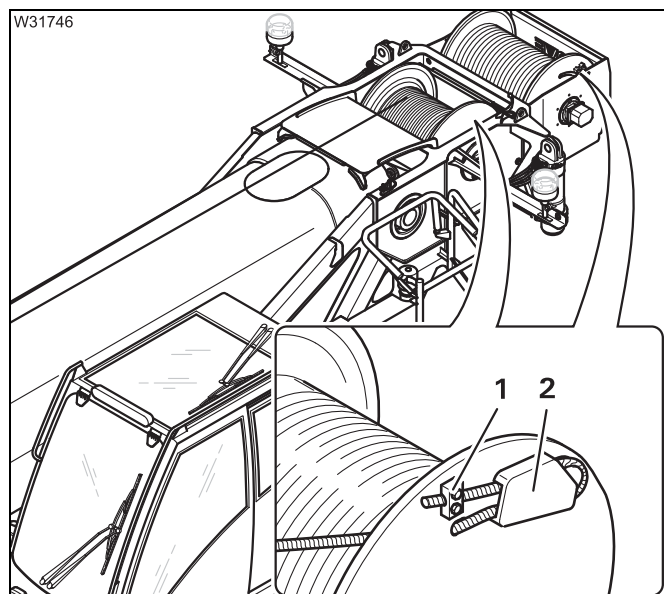
Prerequisites

- Establish a rigging mode in accordance with the *Lifting capacity table* and enter the RCL;  *Operating Instructions*.
- A hook block must be reeved 5-fold;  *Operating Instructions*.
- The main boom must be raised and fully extended;  *Operating Instructions*.

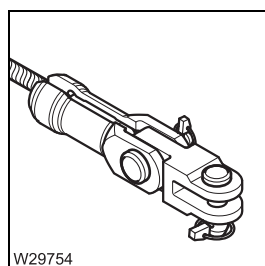
Checking the ropes


- Start the engine.
- Unreel the rope and check the rope and the rope spooling;  *Assessing the condition of the hoist rope*, p. 8 - 54. 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 - 63.



- Check the clamp (1) for damage and firm seating – torque to 78 Nm (57.5 lbf ft).
- The free end of the rope must not project above the flanged wheel.
- The rope wedge must be in the pocket (2).
- The rope end on the rope wedge must not show any signs of wear.
- Reel in the rope. At the same time, the rope may not show any signs of kinking or being flattened.



- Check the end of the rope and the rope end fitting for damage.
- Make sure the rope end is correctly fitted in the rope end fitting;  *Operating Instructions*.

8.8.3

Lubricating the hoist rope

M 3

Grease, spare parts and tools

Designation	Quantity	GROVE part no.
Grease	1	03133770

- Brush, roller, spray gun, tray or pressure pump.

Lubricating the rope

Lubricating the rope

- significantly prolongs its service life and
- keeps the friction between the rope, the sheaves and the hoist drum as low as possible.

The lubricant is applied to the rope by

- spraying, brushing, rolling or
- by running it through a tray filled with lubricant or
- by means of high-pressure lubrication with a pressure pump.



The **Manitowoc Crane Group Germany GmbH** recommends high-pressure lubrication with a pressure pump (GROVE part no. 90018525) for reasons of sustainability, efficiency and environmental protection.

When lubricating the hoist ropes, observe the instructions concerning the lubricant.

When using the pressure pump, observe the manufacturer's separate operating instructions.

For further information, contact **Manitowoc Crane Care** or an authorised GROVE dealer.

8.8.4

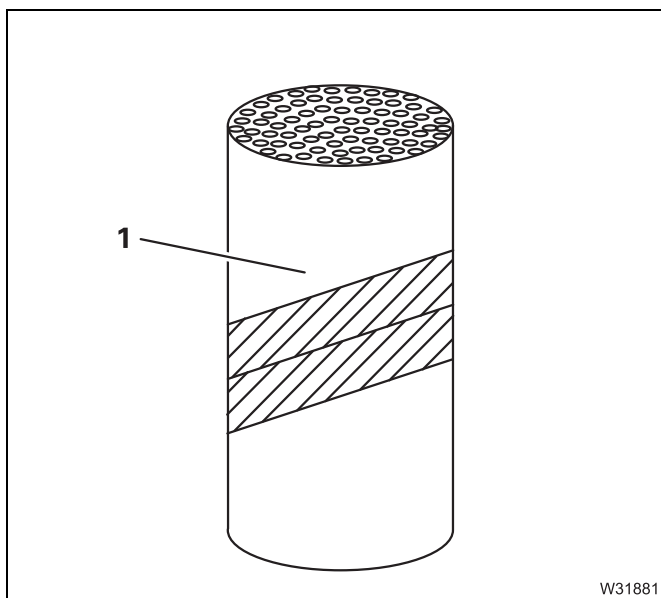
Assessing the condition of the hoist rope



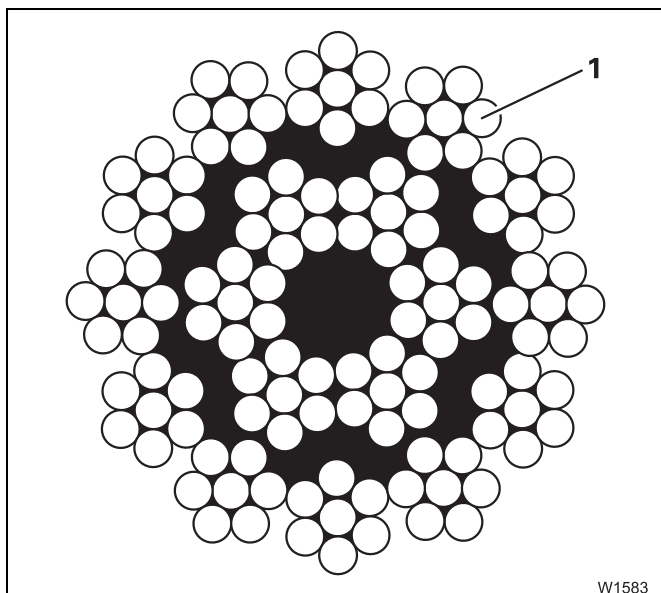
If in doubt about damage assessment, always consult an official inspector.

To assess the condition of the rope, you must be familiar with the following:

- the type of rope (lang lay rope)
- the number of load-bearing wires in the outer strands
- the rope diameter (▣▣▣▣▶ *Operating Instructions*).



In a lang lay rope (**1**) the wires run at an angle of approximately 45° to the longitudinal direction of the rope.



The number of load-bearing outer wires (**1**) is found by counting the number of outer strands of the rope and multiplying by 7.



If there are multiple layers of strands, only the outer layer is counted.

The **tables** show by rope diameter the number of wire breaks in a length 6 times and 30 times the rope diameter which if reached would require replacement of the rope.

- Familiarise yourself with DIN ISO 4309:2013-06 (rotation-resistant ropes).

This table applies only to the **hoist ropes** fitted as initial equipment and original replacement ropes.

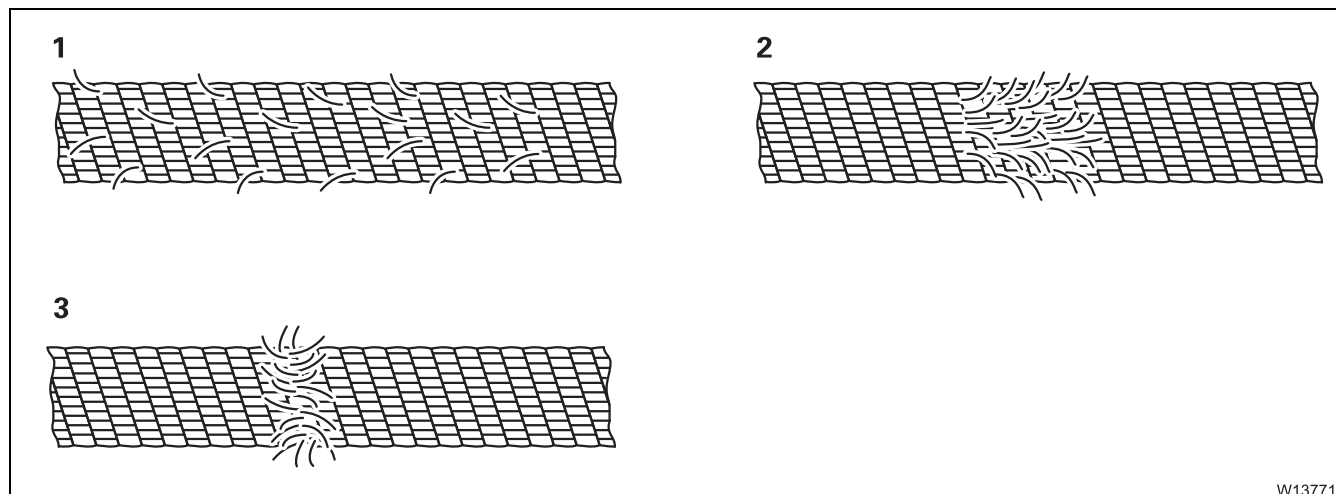
Number of visible wire breaks on a rotation-resistant hoist rope						
The rope section runs over a rope disc or on a drum wound as a single layer						
Number of load-bearing outer wires	Ø 13 mm		Ø 16 mm		Ø 17 mm	
	to 78 mm	to 390 mm	to 96 mm	to 480 mm	to 102 mm	to 510 mm
101–120	3	5	3	5	3	5
121–140	3	5	3	5	3	5
	Ø 19 mm		Ø 22 mm		Ø 24 mm	
	to 114 mm	to 570 mm	to 132 mm	to 660 mm	to 144 mm	to 720 mm
101–120	3	5	3	5	3	5
121–140	3	5	3	5	3	5
The rope section is running on a drum wound as multiple layers						
	Ø 13 mm		Ø 16 mm		Ø 17 mm	
	to 78 mm	to 390 mm	to 96 mm	to 480 mm	to 102 mm	to 510 mm
101–120	5	10	5	10	5	10
121–140	6	11	6	11	6	11
	Ø 19 mm		Ø 22 mm		Ø 24 mm	
	to 114 mm	to 570 mm	to 132 mm	to 660 mm	to 144 mm	to 720 mm
101–120	5	10	5	10	5	10
121–140	6	11	6	11	6	11





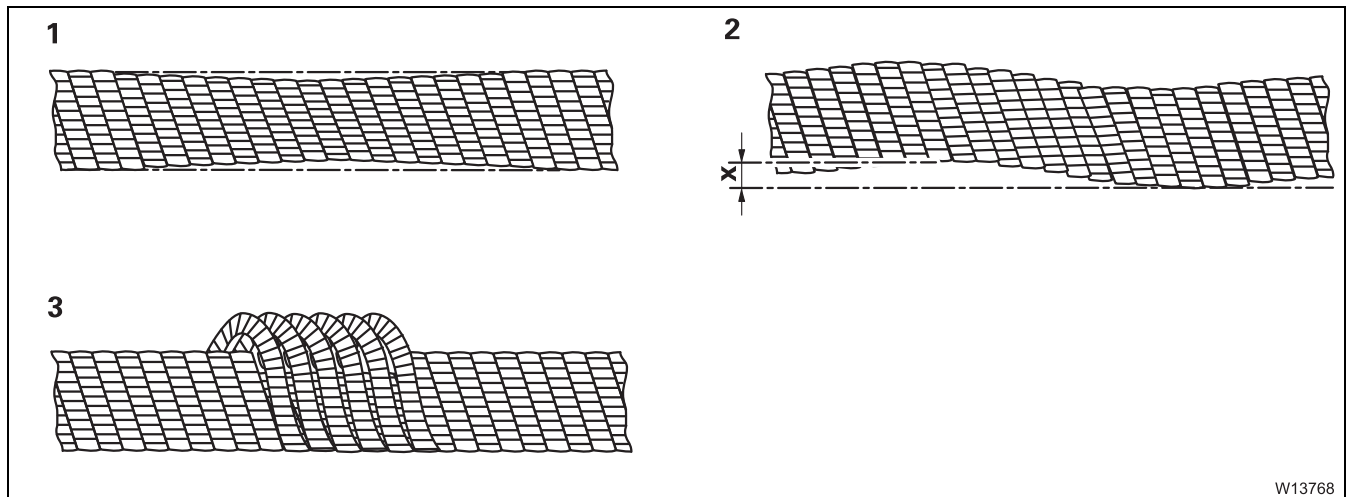
Risk of accidents due to reduced load bearing capacity.

Remember that other factors may also make it necessary to replace a rope before the number of wire breaks requiring rope replacement has been reached (age of rope, frequency of use or exceptional loading).



W13771

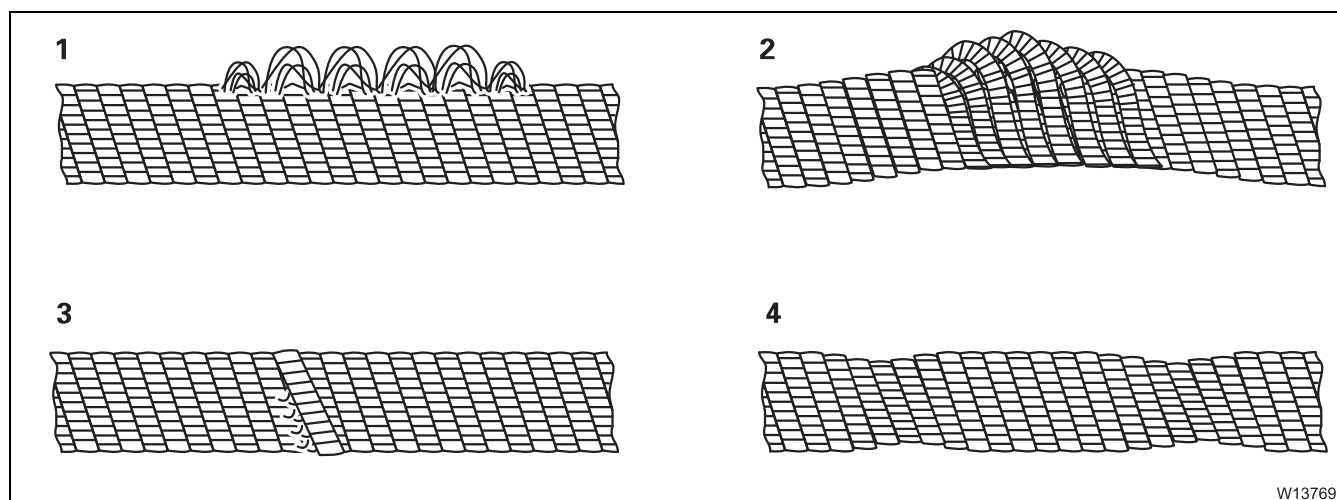
Damage	Description	Cause	Replacement
Wire break (1)	Individual wires are broken; the broken ends of the wires are protruding from the rope.	General wear caused by ageing of the rope or consequential damage as a result of damage to the rope.	Replace the rope at the latest when the maximum permissible number of wire breaks according to the table are visible externally. Replace the rope immediately if wire wire breakage clusters or strand breakages occur. The frequency of wire breaks increases with a rope's age. For reasons of safety, it is advisable to replace the rope while the number of wire breaks is still low.
Wire break-age cluster (2)			
Strand breakage (3)			
Effect of heat	Tarnishing colour is visible externally on the rope.	Rope has been subjected to excessive heat.	Replace the rope immediately .



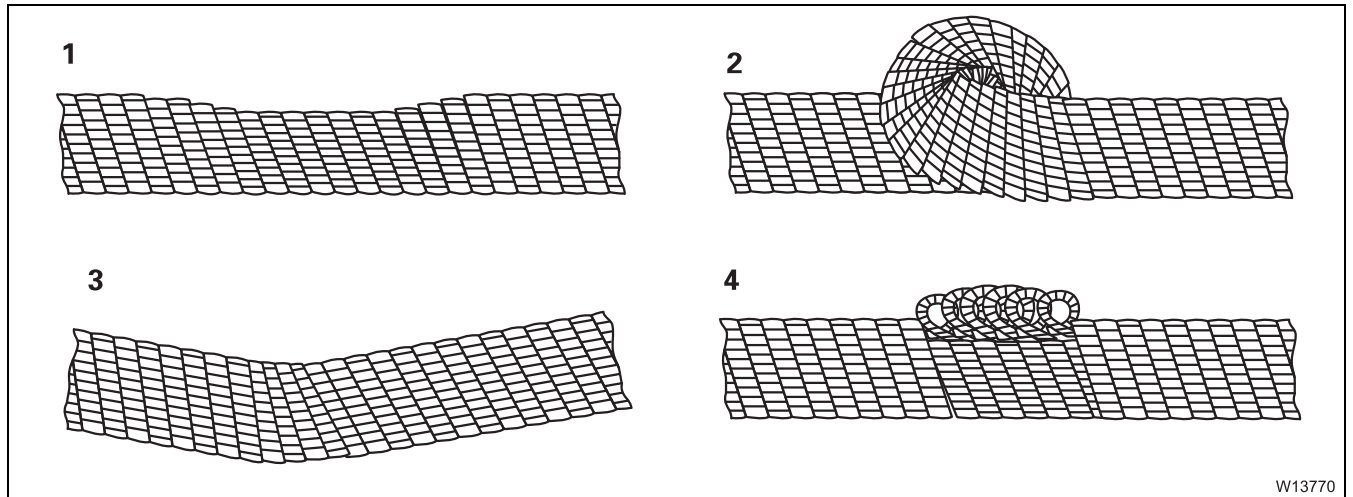
W13768

Damage	Description	Cause	Replacement
Reduced diameter (1)	The diameter of the rope has become smaller along large sections.	Structural changes	Replace the rope immediately if the diameter has decreased by 15% or more compared to the nominal diameter.
		Corrosion or abrasion.	Replace the rope immediately if the diameter has decreased by 10% or more compared to the nominal diameter.
Corkscrew-type rope deformation (2)	The rope winds its way along its longitudinal axis in a way that is similar to a corkscrew. Deformation is measured with suspended hook block.	Damage resulting from overloading.	Even a small amount of deformation leads to increased abrasion, wire breaks and rough operation of the rope drive. If deformation 'x' at a position on the rope is greater than a third of the rope diameter, the rope must be replaced immediately .
Basketlike deformation (3)	Wires of the outer layer protrude. In other areas of the rope, the insert has buckled or is protruding from the rope.	Outer and inner layers have been displaced in relation to each other.	Replace the rope immediately .





Damage	Description	Cause	Replacement
Loop formation (1)	Outer layer wires in the form of hair pins are protruding from the rope away from the sheave.	General wear due to ageing of the rope or consequential damage as a result of damage to the rope.	Immediately replace rope if the rope structure has been substantially altered by the loop formations.
Loosening of wires or strands (2)	Outer wires or strands have become loose. Only the inner strands continue to bear the load.	Corrosion or abrasion.	Replace the rope immediately .
		Other causes.	The number of wire breaks determines when the rope must be replaced.
Knot formation (3)	If there is repeatedly occurring knot-like thickening of the rope; the insert comes out frequently. Strands bear on each other at thin points; increased frequency of wire breaks.	General wear due to ageing of the rope or consequential damage as a result of damage to the rope.	Determine number of wire breaks; replace rope immediately if serious knot formation occurs.
Constriction (4)	Diameter reduction over short sections.	General wear caused by ageing of the rope.	Replace rope immediately if serious constrictions are detected.




Damage	Description	Cause	Replacement
Flattening (1)	Crushed areas, mostly with wire breaks.	Mechanical damage, e. g. due to driving over the rope.	Determine number of wire breaks; replace rope immediately if serious crushing has occurred.
Kinks (2)	Rope deformation with twists and wire breaks.	Rope in the eyelets was pulled straight while twisted.	Replace the rope immediately .
Buckling (3)	Buckled section in the rope.	Mechanical damage.	Replace the rope immediately .
Crinkling (4)	Crinkling rope deformation.	Loaded rope was pulled over an edge.	Replace the rope immediately .

8.8.5

Replacing the hoist rope

Spare parts and tools


- An authentic replacement rope;  *Rope certificate*.
- A reel stand with braking block.
- Torque wrench for 78 Nm (57.5 lbf ft).





Risk of accidents from falling load.

Use only a replacement rope that has the same technical specifications as the defective rope, or an authentic replacement rope.

Prerequisites

- The truck crane must be level.
- The main boom must be set down on the boom rest.
- The hook block must be unreeved;  *Operating Instructions*.

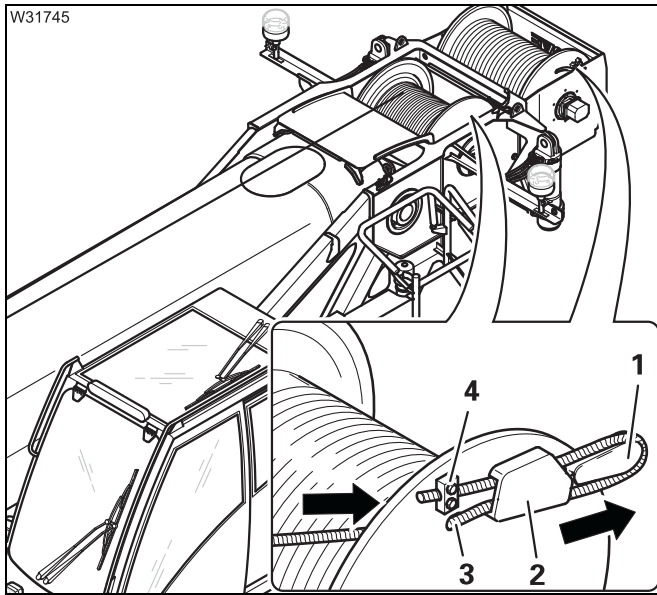
Replacing the old rope

- Unreel the hoist rope until it switches off.
- Adjust the lowering limit switch so that you can unreel the rope completely;  *Setting the lowering limit switch*, p. 8 - 63.
- Unreel the remaining layers from the hoist drum.
- Protect the truck crane from unauthorised use;  p. 2 - 3.



Risk of accidents due to the rotating rope drum

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

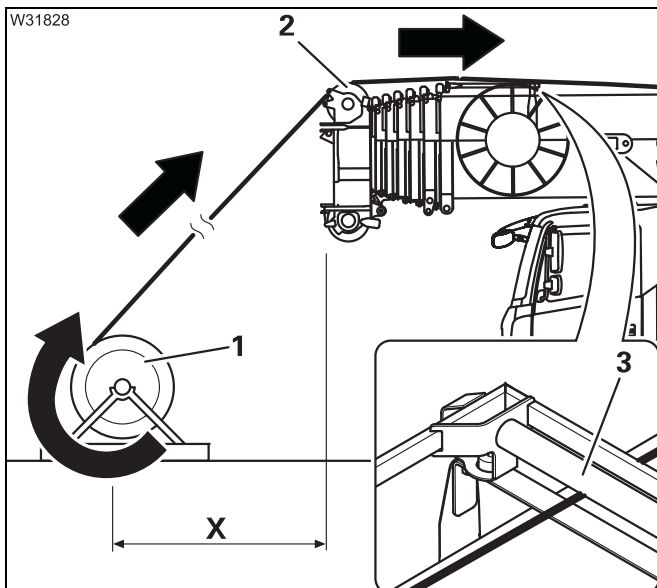


- Remove the clamp (4).
- Push the rope through the bore (3) until the rope wedge (1) slides out of the pocket (2).
- Remove the rope wedge and place the old rope away from the truck crane.

Inserting a new rope

The service life of a rope can be significantly affected by the insertion procedure. Errors can significantly reduce the service life, therefore:

- Make sure the rope is not twisted when it is inserted.
- Avoid soiling and damage when fitting.
- Wind the rope up in the same direction in which the rope is reeled on to the reel.
- Tense the rope slightly while winding it up.

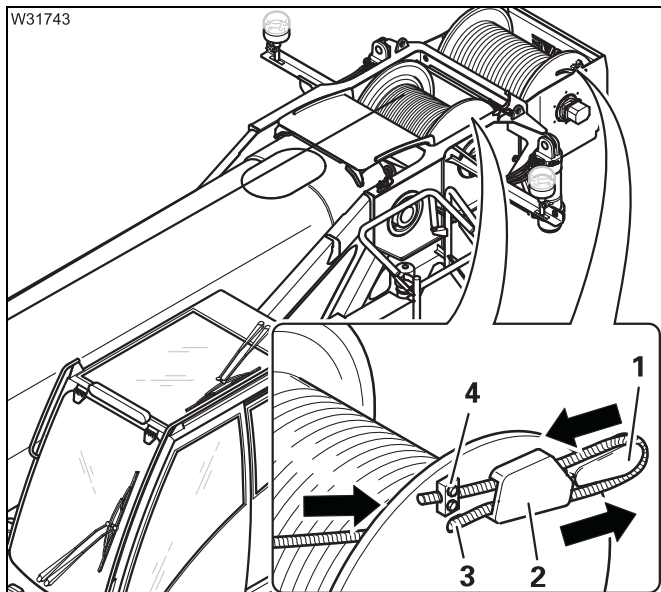


- Place the reel stand (1) with the new rope in front of the main boom head. The distance (X) between the reel stand (1) and the head sheave (2) must be at least 30 m so that the rope runs over the head sheave as straight as possible.

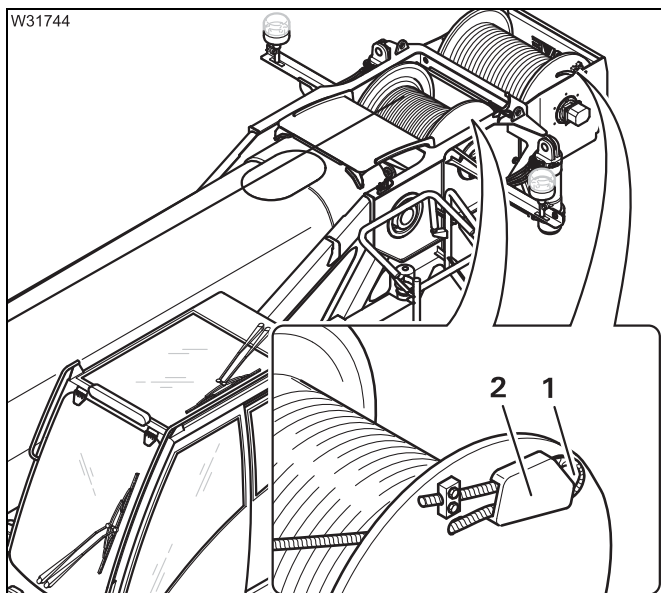
Ensure that the rope is being rolled on to the drum with the right slewing direction.

- Guide the rope over the head sheave (2) and under the bracket (3) up to the hoist drum.






- Guide the rope through the bore (3) until it protrudes about 1.5 m (5.0 ft) beyond the pocket (2).
- Feed the free end of the rope back through the pocket.
- Secure the clamp (4) and tighten it – torque to 78 Nm (57.5 lbf ft).
- Place the rope wedge (1) in the loop.



- Push the rope back until the rope wedge (1) is fully in the pocket (2).
- Ensure that the rope wedge, loop and rope end do not protrude beyond the flanged wheel. This will prevent damage.

- Start the engine (from the crane cab).
- Hold the rope taut and wind up the rope slowly.
- Reeve a hook block – reeve it at least 5 times;  *Operating Instructions*.
- Raise the main boom to a steep position and extend it fully.
- Unwind the rope until only five turns remain on the rope drum.



Observe the hook block when unreeling.
The hook block must not rotate.



Risk of accidents if the lowering limit switch is set incorrectly.

After inserting a new rope, the lowering limit switch must always be reset. In this way you avoid the lowering limit switch switching off too late or not at all, the rope being damaged and the load being dropped.

- Set the lowering limit switch; p. 8 - 63.
- Run in the new rope with small loads so that the rope can settle on the hoist drum.

8.8.6

Setting the lowering limit switch

A lowering limit switch is mounted both on the main hoist and on the auxiliary hoist.

Spare parts and tools

Designation	Quantity	GROVE part no.
Cover gasket	2	02315305

Prerequisites

- A hook block must be reeved 5-fold; *Operating Instructions*.
- The main boom is fully raised and extended; *Operating Instructions*.
- The hook block is lowered until only five turns of the rope remain on the hoist drum.

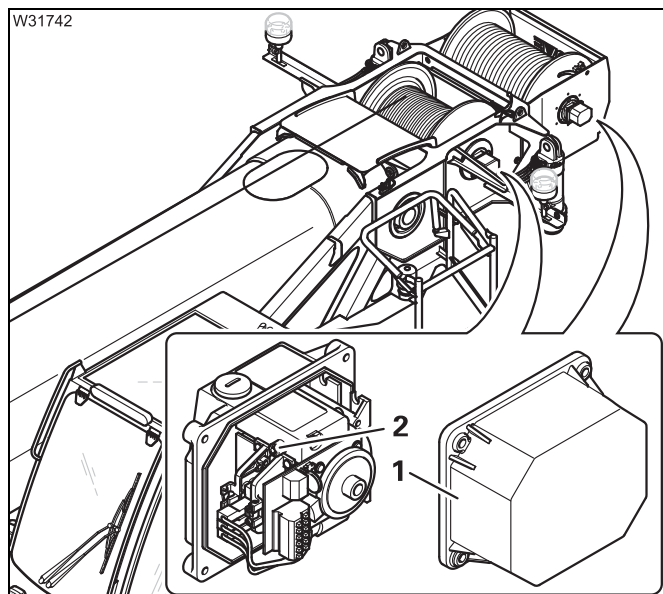


Setting the lowering limit switch



Risk of accidents if the rope end fitting is overloaded

The lowering limit switch must always be reset after repair work on the hoist and after rope replacement. A faulty lowering limit switch must always be replaced.



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

Checking switch-off

- Raise the hook block until there are approx. 10 turns on the hoist drum.
- Lower the hook block and check whether the lowering limit switch switches off properly.

The lowering limit switch must switch off the hoist while five rope turns are still on the hoist drum.

- Correct the setting of the lowering limit switch if necessary.

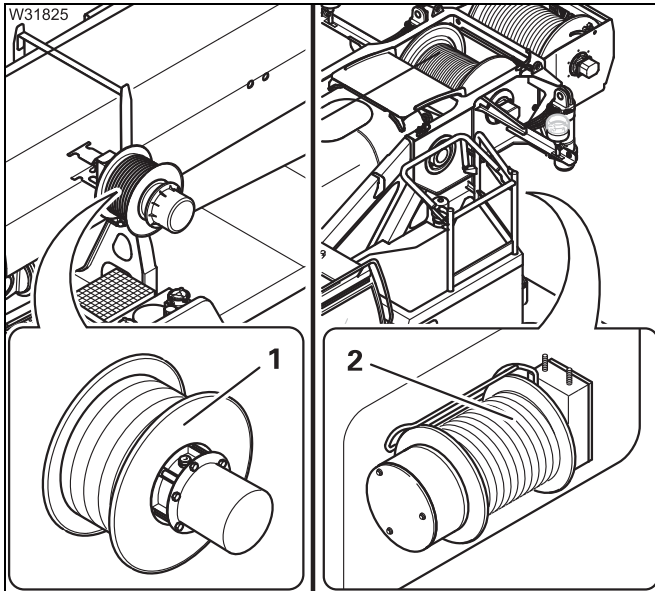
8.9

Cable drums and slewing angle sensor

8.9.1

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	03138894

- Clean, lint-free cloth.
- Dry, oil-free compressed air.

Prerequisites

- All counterweight sections must be removed – the opening for cable drum 2 at the rear of the turntable must be accessible; *Operating Instructions*.
- The main boom must be set down on the support; *Operating Instructions*.
- The engine must be switched off and secured against unauthorised use; p. 2 - 3.
- The battery master switch must be switched off in the driver's cab; *Operating Instructions*.





Risk of damage to the RCL.

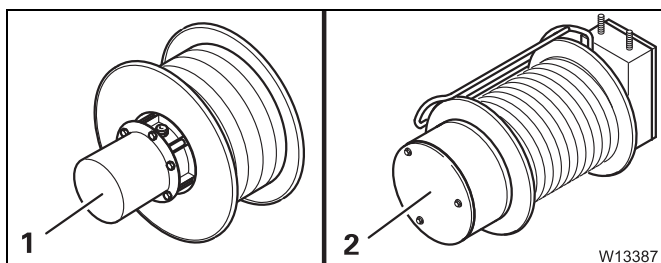
Before maintenance work on the slip ring assemblies, always switch off the battery master switch so that the cable drum is without power. This prevents short circuits which may lead to damage to the rated capacity limiter (RCL).



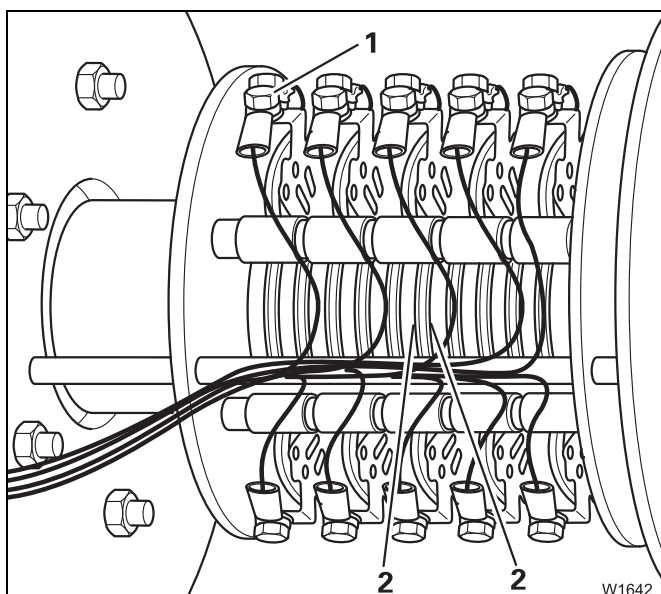
Risk of crushing from movement of the main boom.

Only perform maintenance work when the main boom is resting in the support and the truck crane is not running. Always ensure that the truck crane is protected from unauthorised use before beginning maintenance work. Remove the keys from the crane cab and put up warning signs.

Maintenance of the slip ring assemblies



- Remove the cover (1) or (2).
- Clean and dry the cover.
- Replace the gasket if necessary.



- Only use a cloth and compressed air to remove any dirt on the slip rings (2).
- Do **not** use spray oil.
- Check to make sure all screws (1) are tight.
- Attach the cover to the cable drum.

8.9.2

Lubricating the slewing angle sensor

Y 5


Grease, spare parts, tools

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

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

- Grease gun from the tool set.
- Sealing agent (e.g. Hylomar).
- Torque wrench for 25 Nm (18.5 lbf ft).

Prerequisites

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

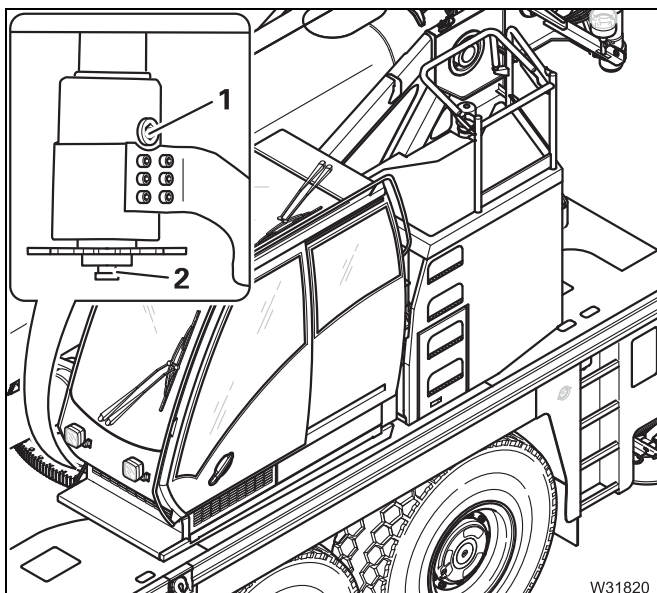


Risk of damage to the slewing angle sensor.

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

This prevents the slewing angle sensor from damage.

Lubricating



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

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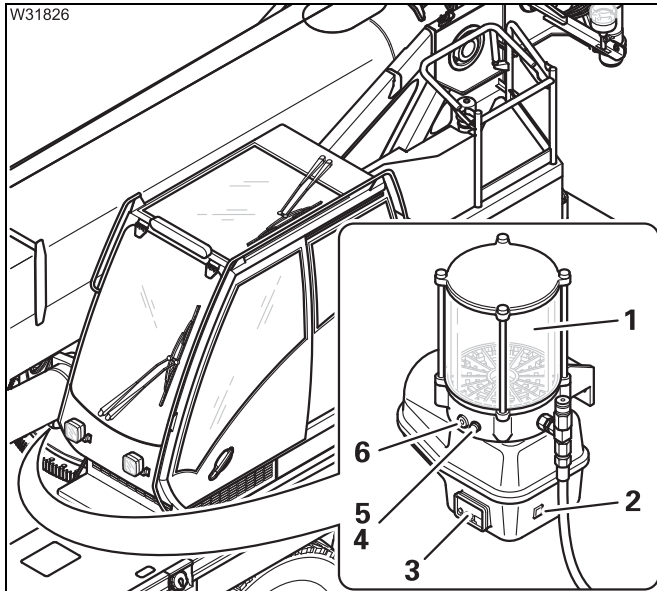
8.10

Central lubrication system

8.10.1

Checking the level

W



The maintenance of the pump (1) is similar to the maintenance on the carrier;
▣▣▣▣► *Central lubrication system*, p. 7 - 115.

Connected lubricating points

- Main hoist drum,
- Auxiliary hoist carrier,
- Slewing bearing,
- Telescopic unit – pivot pins,
- Derricking cylinder – pivot pins



If necessary, initiate intermediate lubrication by pressing button (2). The duration of the intermediate lubrication is about 6 minutes. The lights (green = ready for operation, red = empty) are located on the display (3).

Topping up

There are various options for filling the grease container (1):

4 Grease nipple (standard)

for connection of a manual grease gun.
GROVE part no. 04158709

5 Filling coupling plug (optional)

for connecting a the hose to a grease filling station with a drum.
GROVE part no. 04165387 straight; 04165388 angled

6 Filler connection (optional)

for the filling pump from the tool set.
To use this, the plug (6) must be removed and the filler connection from the tool box inserted in its place.
GROVE part no. 03137895

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8.11 Hook blocks

8.11.1 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.

8.11.2 Lubricating

M 12


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

Grease, spare parts, tools

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

- Grease gun from the tool set.

Prerequisites

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

Lubricating

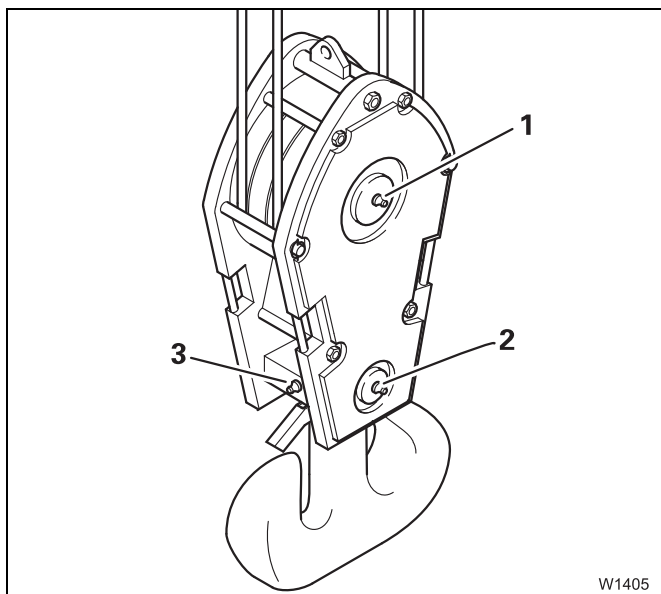
On the hook blocks supplied, the sheaves, crossheads and load hooks of the axial bearings are greased.



The sheaves on the hook block often have no grease nipple and are maintenance-free.

- Check all hook blocks for grease nipples. Hook blocks with grease nipples must be serviced, hook blocks without grease nipples are maintenance-free.





The diagram gives an example of the arrangement of the grease nipples (1), (2) and (3) on a hook block.

There are more grease nipples on the other side.

- Clean the grease nipples on all hook blocks and grease them using a grease gun.

Having them dismantled

Depending on the manufacturer, there are different maintenance intervals for the dismantling of the hook blocks. The maintenance-free sheaves are also greased at this time. Some manufacturers recommend dismantling every 4 years or after 500 operating hours.

- Ask **Manitowoc Crane Care** about the maintenance intervals for the hook blocks supplied to you.
- Have the hook blocks dismantled by **Manitowoc Crane Care** or an authorised GROVE dealer or your qualified repair crew.

8.12

Electrical system

8.12.1

Checking the lighting and indicators

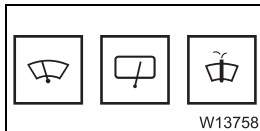
D



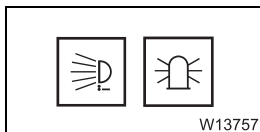
Risk of accidents if the safety devices are faulty!

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

- Check the symbols and indicator lamps on the *CCS (Crane Control System)* control unit; *Operating Instructions*.

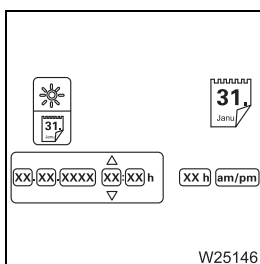


W13758



W13757

- 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 lights on the main and auxiliary hoists.



W25146

- Date/Time on CCS display.
- You can correct the time/date via the *Settings* menu in the CCS display; *Operating Instructions*.
- A long-life battery with a service life of 10 years for retaining the control system data is located next to the fuses in the crane cab; *Have the battery on the electronics board replaced, p. 8 - 74.*





Risk of accidents from exploding glass bodies and high voltage.

The glass bodies of gas discharge lamps (xenon lights) are pressurised. If the lamp breaks, the glass splinters explosively and shards scatter. Xenon lights operate at high voltage. While changing the lamp, there is still a danger of residual voltage discharging (electric shock) even when the battery master switch is switched off.

Have faulty lamps replaced only by properly qualified personnel who use the relevant protective equipment.

- Have faulty lamps in the spotlights replaced only by qualified personnel.

8.12.2

Have the battery on the electronics board replaced

Y 10

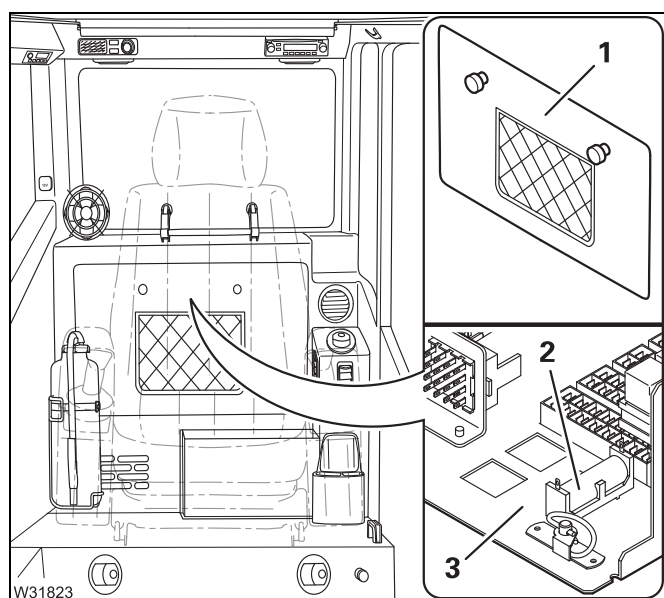
Spare parts and tools

Designation	Quantity	GROVE part no.
Lithium battery 3.6 V	1	03143172

Prerequisites

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

Changing




- Open the cover (1) behind the seat in the crane cab.
- Changing the battery (2) on the electronics board (3).
- Close the cover.
- Check the correct operation of all controls.

8.13 Air conditioning system

8.13.1 Checking the air conditioning system

M 1

- Check the air-conditioning system in the same way as when checking it on the carrier;  *Checking the air-conditioning system*, p. 7 - 127.

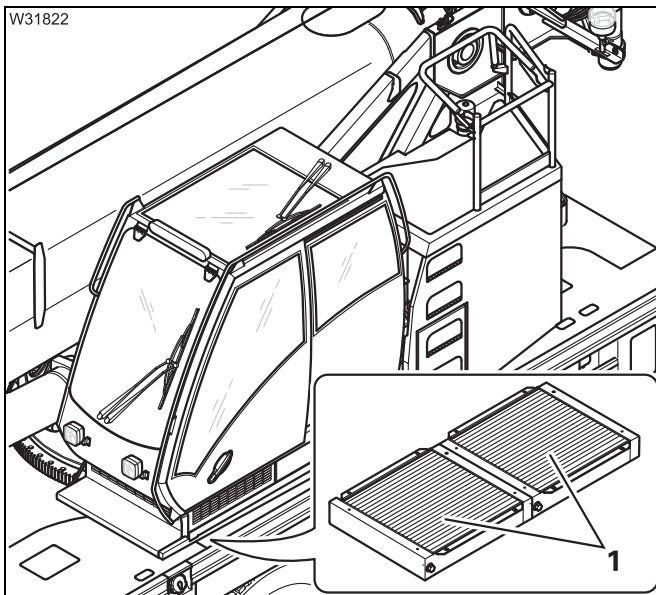
8.13.2 Cleaning the condenser fins

M 1



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.

8.13.3

Checking hoses

M 6



Risk of burns due to escaping refrigerant.

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

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

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

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

8.13.4

Checking the entire air conditioning system

M 12



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



Risk of burns due to escaping refrigerant.

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

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

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

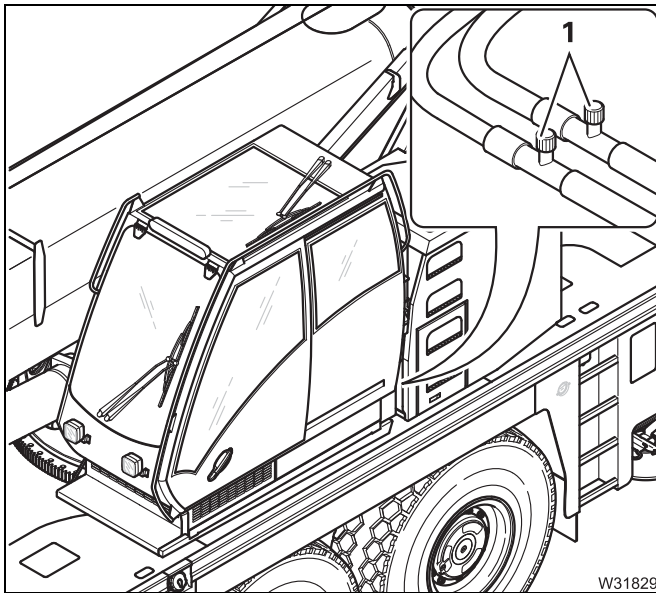
Only allow the system to be topped up with suitable refrigerant.

Refrigerant

Fill quantity in kg (lbs)	Designation	CAS no. EC no.
1.0 (2.2) 1-circuit (3 KW)	Tetrafluoroethane (R134a)	811-97-2 212-377-0
2 x 0.95 (2.1) 2-circuit (6 KW)		

Compressor oil POE-OIL; EMKARATE RL68H

Filler connections



The filler connections (1) for the refrigerant are on the compressor behind the cover (2).

Depending on the output (KW) of the air-conditioning system there may be two separate refrigerant circuits, which must be filled separately. There are then four filler connections (1) instead of two.

8.14 Other maintenance work

8.14.1 Checking the windscreen washing system

W

Water, spare parts, tool

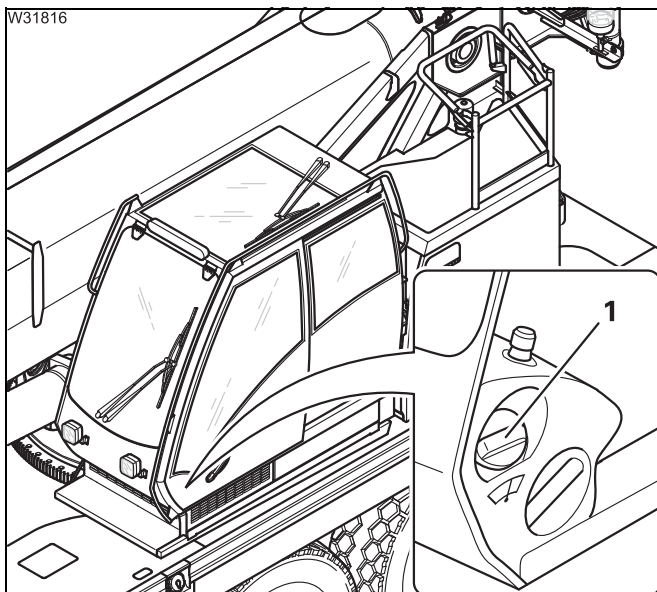
Designation	Quantity	GROVE part no.
Windscreen wiper blade	1	03268512
Roof wiper blade	1	03326121

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

Prerequisites

- The crane cab door is pushed back - the filler neck with the cap (1) is accessible.

Topping up




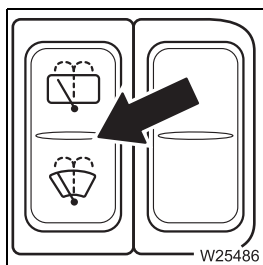
If the tank is empty

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

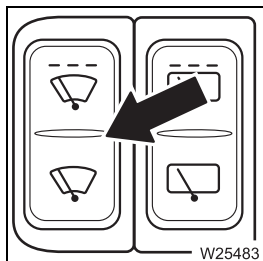


Wiping

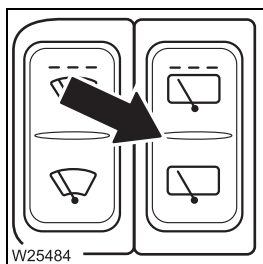
The wiping/washing system operation is described in the accompanying operating instructions;  *Operating Instructions*.



- Spray water on the **windscreen** – press **down** on the switch.
- Spray water on the **skylight** – press **up** on the switch.



- Switch on the **windscreen wiper** – press the switch **down** for continuous operation.
- Also check intermittent operation – push the switch in the middle position.
- Switch off the **windscreen wiper** – press the switch **up**.



- Switch on the **roof window wiper** – press the switch **down** for continuous operation.
- Also check intermittent operation – push the switch in the middle position.
- Switch off the **roof window wiper** – press the switch **up**.

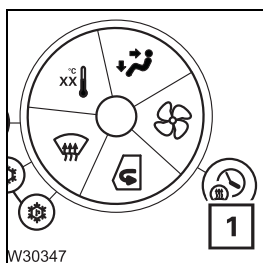
In case the windscreen/skylight is not wiped clean


- Change the wiper blade.

8.14.2

Checking the auxiliary heater

M 1



Check the auxiliary heater (1) in the same way you check it on the carrier;  *Checking the auxiliary heater*, p. 7 - 141.

- Familiarise yourself with the CCS Heating/Air-conditioning system menu in the crane cab;  *Operating Instructions*.

8.14.3

Lubricating the crane cab door


M 12

Grease, spare parts, tools

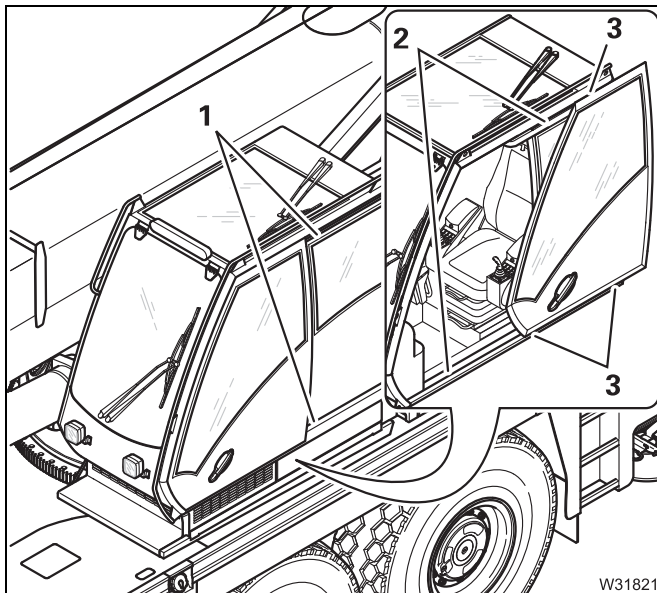
Designation	GROVE part no.
Grease: RHUS SW 2, 1 kg can	03325215

- Brush.

Prerequisites

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

Lubricating



- With the door closed, clean the rails (1) outside.
- Lubricate the rails (1) lightly with a brush.
- Open the door completely using the handle – the door locks in place.
- Clean the rails (2).
- Lubricate the rails (2) and the rollers (3) lightly with a brush.
- Check if the door moves smoothly on the rails and if it locks easily.

If the door is sluggish or does not close properly, have it reset by **Manitowoc Crane Care** or an authorised GROVE-dealer.

8.14.4

Lubricating the step


M 12

Grease, spare parts, tools


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

- Brush.

Prerequisites

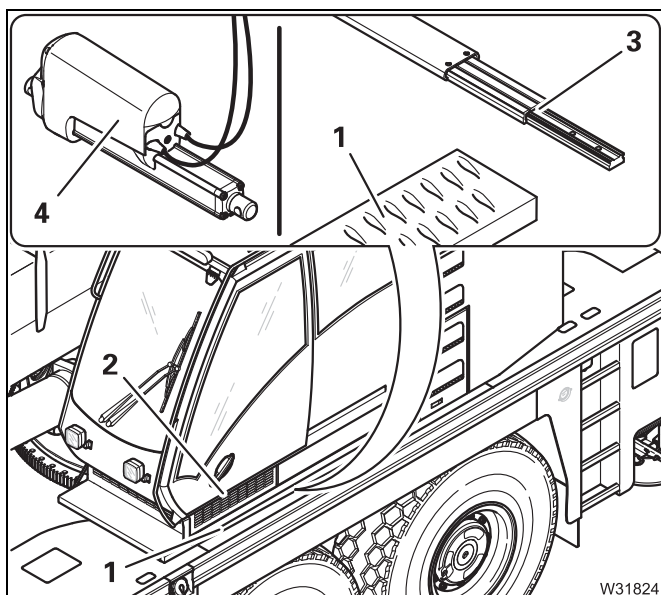
- The turntable must be locked.
- The engine must be switched off and secured against unauthorised use;  p. 2 - 3.

Retracting/ extending

- Familiarise yourself with the description in the operating instructions of retracting/extending the step (from the crane cab or at the outrigger control unit);  *Operating Instructions*.

Lubricating

- Fully extend the step.



- Remove the step (1) and the grille (2) – the rails (3) are now exposed.
- Clean the rails (3).
- Lubricate the rails (3) lightly with a brush.
- Retract and extend the step several times. Whilst doing so, check that the step is moving easily on the rails.
- Check that the electric spindle motor (4) is running smoothly and without jerking.
- Attach the step (1) and the grille (2).

- Fully retract the step.

If the step is stiff, bent or does not retract completely, have the step aligned and adjusted by **Manitowoc Crane Care** or an authorised GROVE dealer.

8.14.5

Lubricating the connecting and socket pins

M 12

Grease, tools

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

- Brush.

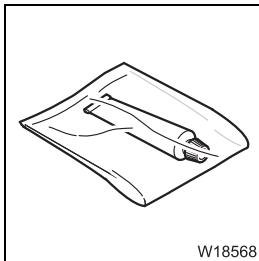
Checking

On the **superstructure**, depending on the equipment, there are various connecting pins and socket pins such as:

- 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.

Lubricating



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

8.14.6

Renewing the corrosion protection

M 12

Protective agent, tools

Protective agent	GROVE part no.
Corrosion protection	03140192

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

Prerequisites

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

Checking

Some particular parts of the superstructure were sprayed for corrosion protection for the first time in the factory itself.

These are pumps, valve blocks, controls and fittings, pipes, screw connections, hose fittings of the hydraulic system of the superstructure;
 ▶ p. 8 - 85.

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

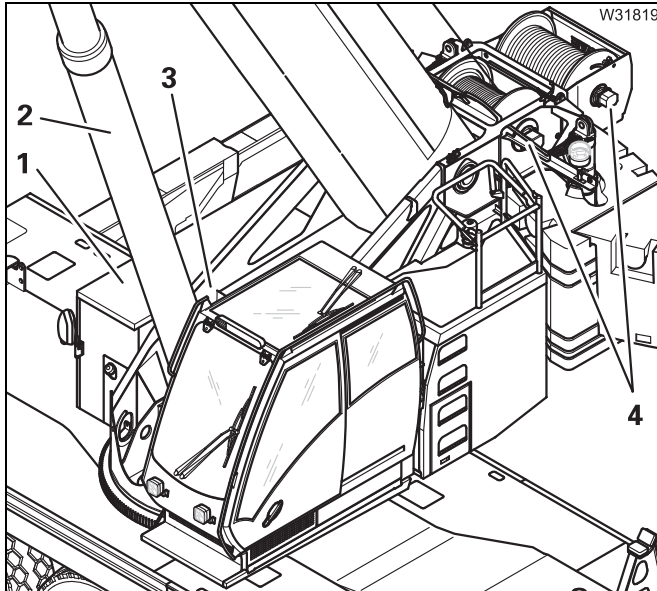
- Observe the processing instructions for corrosion protection;
 ▶ *Processing instructions*, p. 7 - 143.

Spraying



Risk of injury to the eyes.

While working with the spray extension you could be hit by the spray jet or spray droplets. Wear protective goggles, protective clothing and gloves.



- Make sure that you do not spray running surfaces. There is a risk of slipping.
- Spray the corrosion protection with a spray gun aimed only at the pumps, valve blocks, screw connections, pipes, hoses of the hydraulic system of the superstructure:
 - On the derricking cylinder (2)
 - On the slewing gears (1)
 - On the slewing duct (3)
 - On the hoists (4)
- Clean surfaces sprayed by accident immediately with water.

- Let the corrosion protection dry for one hour.
- Check that a transparent waxy protective film has covered the entire surface.

8.14.7

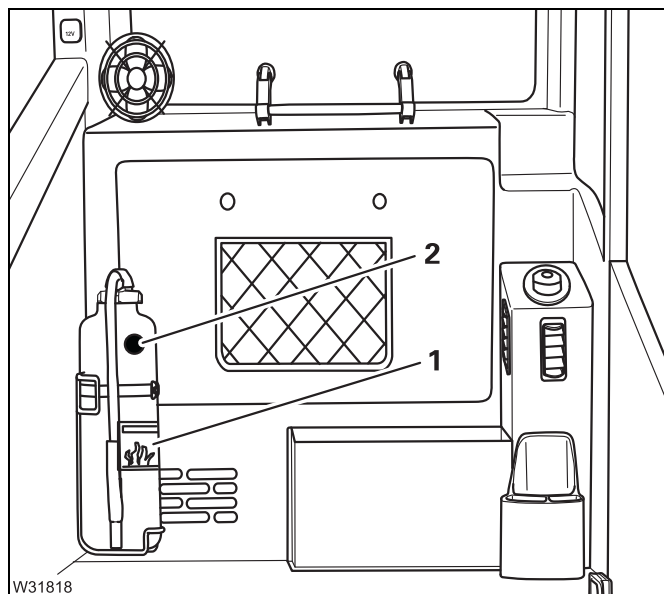
Having the fire extinguisher checked

Y 2

Depending on your truck crane's equipment, it can be fitted with fire extinguishers.



The maintenance interval may even be shorter, depending on the respective national regulations and the operating location. Ask the local fire safety officer about the national and local regulations.



- Observe the instructions (1) on the fire extinguisher.
- Have the fire extinguisher serviced by trained personnel in good time before the maintenance interval specified on the label (2) expires.



Danger due to the fire extinguisher not working.

There is no guarantee that the fire extinguisher will still work properly once the maintenance interval on the label has expired.

9 Longer out of service periods

9

Longer out of service periods

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

Putting the truck crane out of service

- Clean the truck crane thoroughly on the inside and outside.
- Remove any rust and touch up the paintwork.
- Parts that are not painted must be lubricated with an acid-free grease or oil.

If more than half of the oil change interval has passed:

- Change the oil according to the maintenance plans **M 3** to **M 12**.
- Seal 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 level in the fuel tanks. Always keep the tanks filled.
- Check the batteries every week and recharge them if necessary.
- Check the tyre pressure every week and correct it if necessary.
- Perform a full functional test on the truck crane every two weeks. (Open the air filter beforehand).
- Run the hydraulic systems up to a fluid temperature of approx. 50 °C (122 °F) and then check all functions of the carrier and superstructure hydraulic systems.



- Ensure that the tyre positioning is different each time the crane is parked (without outriggers).
- Seal the air filter again.

If the truck crane is going to be out of service for more than 12 months:

- Carry out all maintenance work in accordance with the maintenance plan **M 12**.
- Observe the specifications on preservation in the *Engine manufacturer's documentation*.

Putting the truck crane into operation

- Open 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 the retaining bolts	10 - 1
10.2	Special torques	10 - 2

10 Torques

10.1 Torques for the retaining bolts

Metric standard screw-thread Metric fine thread			Guide values		
Thread size (mm)	Size across flats (mm)		Torques (maximum permissible pre-tensioning for bolts) for oiled bolts (Nm)		
	Hexagon-head bolt	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

Designation	Thread size (mm)	Size across flats (mm)		Torque (Nm)
		Hexagon-head bolt	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
– Upper steering arm on suspension strut	M 20	30		610
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 24		—	790
– Hoist drum rope clamp	M 12	2 nuts		78

11 Spare parts required for maintenance

11.1	General information	11 -	1
11.2	Lighting	11 -	1
11.3	Spare parts for the carrier	11 -	5
11.4	Spare parts for the superstructure	11 -	8

11

Spare parts required for maintenance

11.1

General information

The spare parts required for maintenance are divided into

- lighting,
- spare parts for the carrier and
- spare parts for the superstructure.

The only spare parts listed here are those required for the maintenance work described.

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

An overview of the required lubricants can be found in:

- *Lubricants list*, p. 6 - 2,
- *Lubricant applications list*, p. 6 - 3.

11.2

Lighting

Lamps are listed according to the installation point. The list includes standard and additional lighting equipment for the truck crane.

Lighting specific to certain countries can be found in the accompanying *Spare parts list*, in the section on country-specific packages.



Risk of accidents from exploding glass bodies and high voltage.

The glass bodies of gas discharge lamps (xenon lights) are pressurised. If the lamp breaks, the glass splinters explosively and shards scatter. Xenon lights operate at high voltage. While changing the lamp, there is still a danger of residual voltage discharging (electric shock) even when the battery master switch is switched off.

Have faulty lamps replaced only by properly qualified personnel who use the relevant protective equipment.



Installation point	GROVE part number	Designation	Power (W)
CARRIER LIGHTING:			
Front spotlights: (integrated in the bumper)			
– Daytime driving light (left)	04163680	LED	
– Daytime driving light (right)	04136679	LED	
– Low-beam + full-beam headlights	03134828	H7 24V	70
– Low-beam + full-beam headlights (USA)	03143584	H9 12V	65
– Indicator light	03327578	PY21W 24V	21
– Parking light (in the direction indicator light)	03140908	LED	
– Yellow side marker light	03320937	LED	
Front, side indicator lights: (under the access ladder to the driver's cab)			
– Indicator light	03327578	PY21W 24V	21
Tail lights: (at the rear of the chassis)			
– Marker light	03137450	R5W 24V	5
– Number plate light	03137450	R5W 24V	5
– Rear light	03137450	R5W 24V	5
– Brake light	03328445	P21W 24V	21
– Indicator light	03327578	8GA 006841241	24 V / 21 W
– Fog tail light	03328445	P21W 24V	21
– Reverse light	03328445	P21W 24V	21
Licence plate lamp, external: (at the rear of the chassis)			
– LED licence plate light	04163112	LED	
Yellow side marker lights: (at the sides, along the chassis)			
– Side marker light	03140042	LED	
White rear marker lights: (at the rear of the chassis)			
– Left marker light	03327625	LED	
– Right marker light	03327626	LED	

Installation point	GROVE part number	Designation	Power (W)
White front marker lights: (at the top on the driver's cab)			
– Marker light	01207144	R10W 24V	
Outrigger beam spotlights: (above the front and rear outrigger beams)			
– LED spotlight; complete	03143786	M70 LED	
Yellow rotating beacon: (on the driver's cab)			
– Rotating beacon; complete	04156048		
Inside light: (in the driver's cab)			
– Cab light	03135111	24V	24V / 15W
– Reading light	03135111	24V	24V / 15W
Dashboard light: (in the cab; socket 12V)			
– Filament lamp	04159964	Xenon	12V / 6W



Installation point	GROVE part number	Designation	Power (W)
SUPERSTRUCTURE LIGHTING:			
Marker lights, yellow: (left and right on the main boom head)			
– Marker light; complete	03329569	LED	
Red rear marker lights: (on the turntable)			
– Marker light; complete	03329492	LED	
Yellow rotating beacon: (on the turntable)			
– Rotating beacon; complete	04156048		
Inside light: (in the crane cab)			
– Cab light	00550434	K 24V	10
– Reading light	00550434	K 24V	10
Spotlight, angular-shaped, permanently installed: (at the front of the crane cab)			
– Filament lamp	01573349	H3 24V	70
Spotlight, electrically adjustable: (at the front of the main boom)			
– Halogen bulb	03142726	8GS009028001	35

11.3 Spare parts for the carrier

Assemblies and spare parts Carrier	GROVE- part number	Quantity, in single parts For maintenance interval				
		W	M 1	M 3	M 6	M 12
Engine						
Air filter – main filter	04158601	1 item when the symbol lights up				
Air filter – back-up filter	04158602					
Fuel system						
Filter (filter 1; large)	04161991			1		
Filter (filter 2; small)	04161566					1
Transmission						
Gasket 24 x 29 Cu DIN 7603	00117145					1
Transfer case						
Gasket 30 x 36 Cu DIN 7603	00117151		1		1	
Gasket 16 x 20 Cu DIN 7603	00117134				1	
Angle gear						
Gasket 30 x 36 Cu DIN 7603	00117151		1		1	
Filter	03135866				1	
Packing set	04161645				1	
Screw with gasket (oil cooler)	03326356				1	
Axle lines Axle centre drive (for max. 8 x 8 x 8)						
Gasket 30 x 36 Cu DIN 7603	00117151		4			4
Gasket 24 x 29 Cu DIN 7603	00117145					2
Gasket 36 x 42 Cu DIN 7603	01371208					4
Axle lines Final drive (for max. 8 x 8 x 8)						
Gasket 24 x 29 Cu DIN 7603	00117145		8			8



Assemblies and spare parts Carrier	GROVE- part number	Quantity, in single parts For maintenance interval				
		W	M 1	M 3	M 6	M 12
Wheels						
Wheel nuts for steel rims	01207756	In case of damage; 12 each per wheel				
Wheel nuts for aluminium rims	7659100000					
Vehicle brake (for all 4 axle lines)						
Wear contact set	03142924	only if wear is present on the disc brakes				12
Set of brake pads with a wear contact set	03142923					12
Guide set and packing set	03142922					24
Packing set	03142925					24
Brake disc	03142916					8
Compressed air system						
Valve (if defective)	01570750	(7)				
Gasket 22 x 27 Cu DIN 7603	00117142	(7)				
Filter cartridge	04157844					1
Hydraulic system						
Filters 1 and 2 (only clean)	03329152			(2)		
Packing set	04163599			(2)		
Filters 1 and 2	03329152	at every oil change and when the symbol lights up				2
Packing set	04163599					2
Filters 3 and 4	03140253					2
Packing set	03135867					2
Oil tank cover gasket 140 / 90 x 3	03328286	1 item for every oil change (if damaged)				
Ventilation filter	01576026					1
Air-conditioning system						
Driver's cab pollen filter	03254375					1
Other maintenance work						
Driver's cab wiper blades	04159795	(2)	(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 cover gasket	04163013	1				
Original oil drain plug, complete	04161529	1				
Transmission						
Filter	03328342			1		
Spring	03328343			1		
Gasket 42 x 49 Al DIN 7603	03328344			1		
Gasket 24 x 29 Cu DIN 7603	00117145			2		

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						
Sight glass with hoses; complete	84012690	(2)	(if damaged)			(2)
Slewing gear						
Gasket 10 x 14 Cu DIN 7603	00117125	(2)	(if damaged)			
Gasket 10 x 14 Cu DIN 7603	00117125					2
Gasket 14 x 20 Cu DIN 7603	00117132					2
Hydraulic system						
Filter 1 (only clean it)	04156358			(1)		
Packing set	04165792			(1)		
Filter 1	04156358	at every oil change and when the symbol lights up				1
Packing set	04165792					1
Filter 2	03142356					1
Housing packing set	03326049					1
Ventilation filter	03134932					1
Hoist ropes						
Cover gasket	02315305	1 (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	03138894				(1)	
Air conditioning system						
Pollen filter for crane cab	04163620					1
Other maintenance work						
Windscreen wiper blade	03268512	(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		
Electrical system						
Lithium battery 3.6 V	03143172					1

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Appendix

Appendix

Table to determine the remaining theoretical service life on winch no.

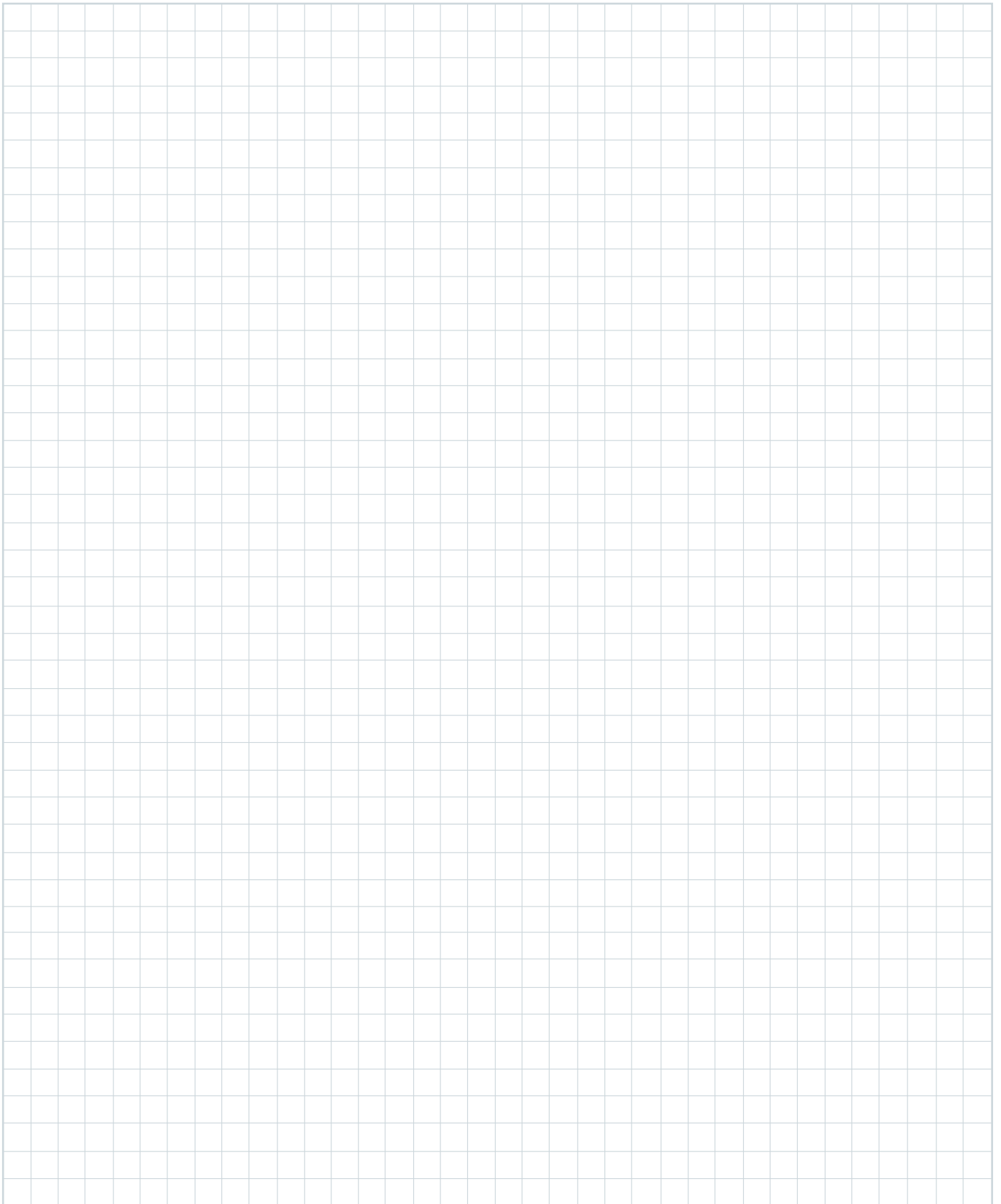
Crane type:
 Work no.:
 First put into operation on:
 Winch serial number in accordance with the model plate:
 Last general overhaul performed on:
 Winch design data (see operating manual):
 Engine group:
 Load spectrum:
 Load spectrum factor:
 Theoretical service life:

Inspection interval no. (max. 1 year)	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	Winch operating hours 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
"1"			Km ₁	[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 must 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
 (*) Copy the last line of the previous page to the following page.

General overhaul performed on.....



Grove

Manitowoc

National Crane

Potain



Grove

Manitowoc

National Crane

Potain

