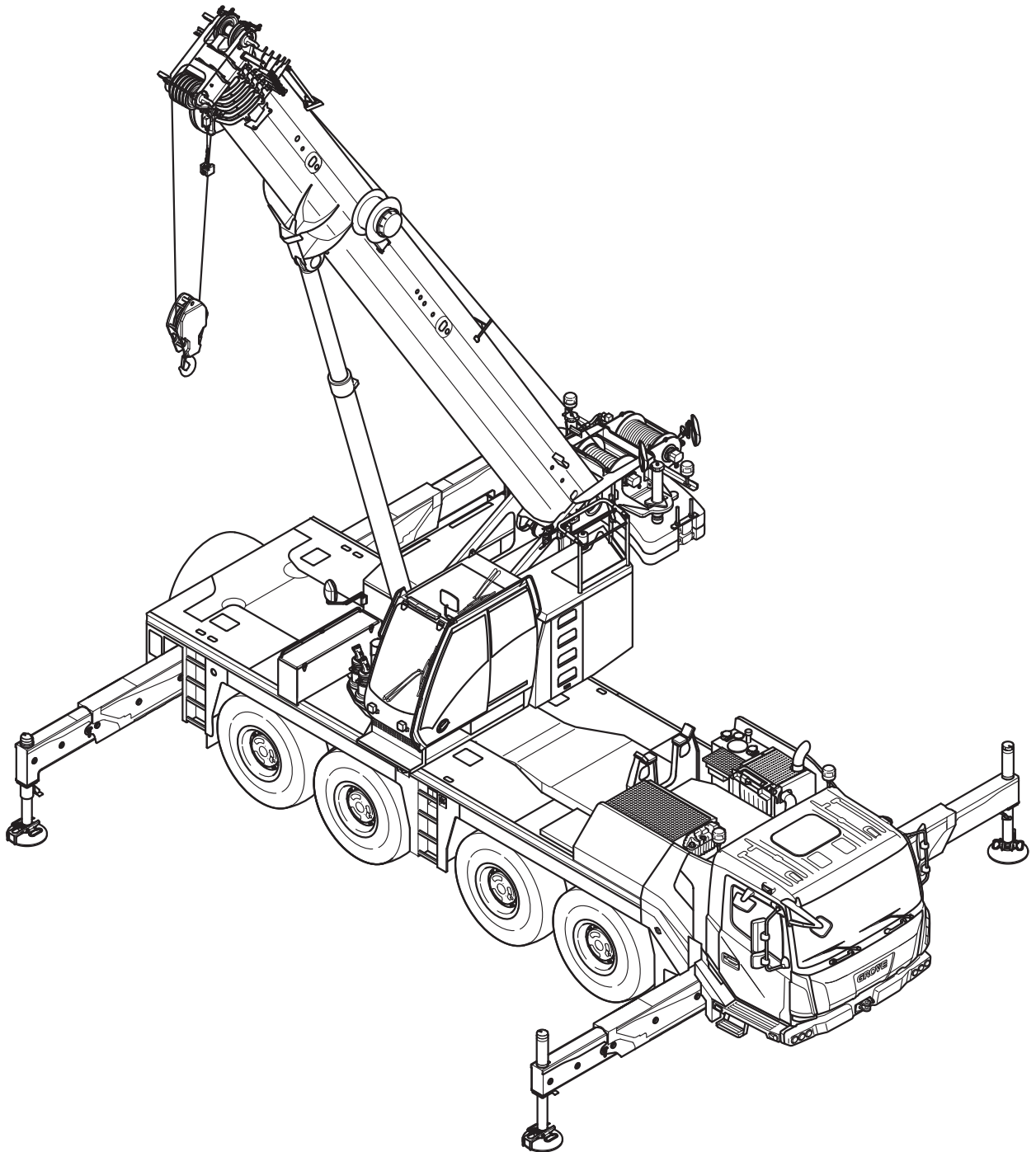


GROVE GMK4090

Maintenance manual



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07.12.2017

 **Manitowoc**[®]

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07.12.2017

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 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 information 1 - 5

1.7 Conversion table for US measuring units 1 - 6

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

3 Cleaning

3.1 Overview of assemblies easily damaged when cleaning 3 - 2

4 Run-in regulations

5 Maintenance overview

5.1	Maintenance intervals	5 - 1
5.2	Maintenance plans	5 - 3
5.2.1	Maintenance plan D	5 - 4
5.2.2	Maintenance plan W	5 - 6
5.2.3	Maintenance plan M 1	5 - 8
5.2.4	Maintenance plan M 3	5 - 10
5.2.5	Maintenance plan M 6	5 - 12
5.2.6	Maintenance plan M 12	5 - 14
5.2.7	Maintenance plan Y 2	5 - 16
5.2.8	Maintenance plan Y 3	5 - 16
5.2.9	Maintenance plan Y 5	5 - 17
5.2.10	Maintenance plan Y 6	5 - 17
5.2.11	Maintenance plan Y 10	5 - 18
5.3	Periodic inspections	5 - 19
5.3.1	Load hook inspection.	5 - 20
5.4	Measures required for winch monitoring	5 - 21
5.4.1	Theoretical service life.	5 - 21
5.4.2	Proportion of theoretical service life used.	5 - 22
5.4.3	Example	5 - 26

6 Lubricants and consumables

6.1	Lubricants	6 - 1
6.1.1	Lubricants list	6 - 2
6.1.2	Lubricant applications list	6 - 3
6.2	Refrigerant	6 - 5
6.3	Consumables	6 - 5
6.3.1	Fuel	6 - 5
6.3.2	Engine coolant admixtures	6 - 5
6.3.3	After-treatment of exhaust gases	6 - 6
6.3.4	Windscreen washing system admixtures	6 - 6
6.3.5	Fuel for crane cab heating system	6 - 6

7	Maintenance work on the carrier	
7.1	General instructions	7 - 1
7.1.1	Covers	7 - 1
7.1.2	Tilting/lowering the driver's cabin	7 - 2
7.1.3	Overview of maintenance work on the carrier	7 - 4
7.2	Symbols for maintenance work	7 - 11
7.3	Engine	7 - 13
7.3.1	Check the oil level	7 - 13
7.3.2	Topping up the oil	7 - 15
7.3.3	Checking the air filter	7 - 16
7.3.4	Checking the coolant level	7 - 17
7.3.5	General inspection	7 - 18
7.3.6	Have the radiator checked/cleaned	7 - 18
7.3.7	Checking the V-belt tension	7 - 23
7.3.8	Changing the oil and oil filter	7 - 25
7.4	Fuel system	7 - 27
7.4.1	Draining off water from fuel filter 1	7 - 28
7.4.2	Replacing fuel filter 1	7 - 29
7.4.3	Replacing fuel filter 2	7 - 31
7.5	Exhaust system with exhaust emission control	7 - 33
7.5.1	Checking the AdBlue tank level	7 - 34
7.5.2	Filling up with AdBlue	7 - 34
7.5.3	Check the exhaust system for external damage	7 - 35
7.5.4	Having the AdBlue system checked	7 - 37
7.6	Transmission	7 - 39
7.6.1	General inspection	7 - 40
7.6.2	Check the oil level	7 - 41
7.6.3	Changing the oil	7 - 42
7.7	Transfer case	7 - 45
7.7.1	General inspection	7 - 45
7.7.2	Check the oil level	7 - 45
7.7.3	Changing the oil	7 - 46
7.8	Angle gear	7 - 49
7.8.1	General inspection	7 - 50
7.8.2	Check the oil level	7 - 50
7.8.3	Changing the oil and the oil filter	7 - 52
7.9	Axle lines	7 - 55
7.9.1	General inspection	7 - 55
7.9.2	Axle centre drives – checking the oil level	7 - 55
7.9.3	Axle centre drives – changing the oil	7 - 57
7.9.4	Final drives – Checking the oil level	7 - 61
7.9.5	Final drives – changing the oil	7 - 62
7.9.6	Lubricating the Cardan shafts in the axle lines	7 - 64
7.9.7	Lubricating longitudinal Cardan shafts	7 - 65

7.10	Wheels	7 - 67
7.10.1	Checking the tyres for damage	7 - 67
7.10.2	Checking the tyre pressure	7 - 68
7.10.3	Checking that the wheel nuts are tight	7 - 69
7.10.4	Changing the wheels	7 - 70
7.11	Vehicle brake	7 - 75
7.11.1	Checking brake lining thickness	7 - 75
7.12	Suspension	7 - 77
7.12.1	Suspension struts – checking the oil level	7 - 77
7.12.2	Suspension struts – checking the fastening	7 - 79
7.12.3	Forced lever – checking correct functioning	7 - 80
7.12.4	Pressure accumulator – checking the gas pressure	7 - 81
7.13	Steering	7 - 83
7.13.1	Checking the steering monitoring	7 - 83
7.13.2	Checking the angle sensors	7 - 84
7.13.3	Checking for leaks	7 - 85
7.14	Compressed air system	7 - 87
7.14.1	Draining water from the compressed air system	7 - 87
7.14.2	Checking for leaks	7 - 88
7.14.3	Replacing the filter cartridge of the compressed air drier	7 - 89
7.15	Hydraulic system	7 - 91
7.15.1	Check the oil level	7 - 91
7.15.2	Checking the hydraulic hoses	7 - 92
7.15.3	Checking for leaks	7 - 92
7.15.4	Cleaning the magnetic rods	7 - 93
7.15.5	Changing the ventilation filter	7 - 95
7.15.6	Taking oil samples	7 - 96
7.15.7	Changing the hydraulic oil	7 - 101
7.15.8	Changing the hydraulic oil filter	7 - 106
7.16	Central lubrication system	7 - 109
7.16.1	Checking the filling level	7 - 109
7.16.2	Bleeding the central lubrication system	7 - 111
7.16.3	Triggering intermediate lubrication	7 - 112
7.17	Electrical system	7 - 113
7.17.1	Checking the lighting and indicators	7 - 113
7.17.2	Checking the batteries	7 - 114
7.17.3	Checking the charge level of the batteries	7 - 116
7.17.4	Charging the batteries using the battery charger	7 - 118
7.17.5	Check the external starting socket	7 - 119
7.18	Air conditioning system	7 - 121
7.18.1	Checking the air conditioning system	7 - 121
7.18.2	Checking hoses	7 - 121
7.18.3	Cleaning the condenser fins	7 - 122
7.18.4	Checking the entire air conditioning system	7 - 122
7.18.5	Changing the pollen filter	7 - 124

7.19	Towbar coupling	7 - 125
7.19.1	Lubricating the towbar coupling	7 - 125
7.19.2	Checking the bearing	7 - 127
7.19.3	Checking the cotter pin	7 - 128
7.19.4	Checking the lower bushing	7 - 129
7.19.5	Checking the initial tension of the springs	7 - 129
7.19.6	Checking the support ring	7 - 130
7.19.7	Checking the function of the coupling jaw / resetting the middle position ...	7 - 130
7.20	Other maintenance work	7 - 133
7.20.1	Checking windscreen washing system	7 - 133
7.20.2	Lubricating the outrigger beams	7 - 134
7.20.3	Checking the auxiliary heater	7 - 135
7.20.4	Lubricating the cab door	7 - 135
7.20.5	Lubricating the connecting and socket pins	7 - 136
7.20.6	Renewing the corrosion protection	7 - 137
7.20.7	Having the fire extinguisher checked	7 - 139

8 Maintenance work on the superstructure

8.1	General instructions	8 - 1
8.1.1	Covers	8 - 1
8.1.2	Overview of maintenance work on the superstructure	8 - 2
8.2	Symbols for maintenance work	8 - 7
8.3	Hoists	8 - 9
8.3.1	Checking the oil level	8 - 9
8.3.2	General inspection	8 - 10
8.3.3	Checking the hoist brake	8 - 10
8.3.4	Changing the oil/checking the oil	8 - 11
8.3.5	Having a partial inspection carried out	8 - 13
8.3.6	Having a general inspection carried out	8 - 13
8.4	Slewing gear	8 - 15
8.4.1	Checking the oil level	8 - 15
8.4.2	Checking for leaks	8 - 16
8.4.3	Checking the slewing gear brake	8 - 16
8.4.4	Changing the oil/checking the oil	8 - 19
8.5	Slewing bearing	8 - 21
8.5.1	Checking the screws	8 - 21
8.5.2	Lubricating the gear teeth	8 - 25
8.5.3	General inspection	8 - 27
8.5.4	Measuring tilting play	8 - 28
8.5.5	Lubricating the locking of turntable	8 - 30
8.6	Hydraulic system	8 - 31
8.6.1	Check the oil level	8 - 31
8.6.2	Checking the hydraulic hoses	8 - 32
8.6.3	Checking ventilation filters	8 - 32
8.6.4	Checking for leaks	8 - 33
8.6.5	Cleaning the magnetic rods	8 - 34
8.6.6	Changing the ventilation filter	8 - 36
8.6.7	Pressure accumulator – checking the gas pressure	8 - 37
8.6.8	Taking oil samples	8 - 37
8.6.9	Changing the hydraulic oil filter	8 - 39
8.6.10	Changing the hydraulic oil	8 - 42
8.7	Main boom	8 - 45
8.7.1	Grease the piston rod of the derricking cylinder	8 - 45
8.7.2	Lubricating the telescopic sections	8 - 46
8.7.3	Lubricating the sheaves	8 - 50
8.7.4	Checking the locking system	8 - 50
8.8	Hoist ropes	8 - 51
8.8.1	Checking the winding	8 - 51
8.8.2	Checking the hoist ropes	8 - 52
8.8.3	Lubricating the hoist rope	8 - 53
8.8.4	Assessing the condition of the hoist rope	8 - 54

8.8.5	Replacing the hoist rope	8 - 60
8.8.6	Setting the lowering limit switch	8 - 63
8.9	Cable drums	8 - 65
8.9.1	Maintenance of the slip ring assemblies	8 - 65
8.10	Central lubrication system	8 - 67
8.10.1	Checking the filling level	8 - 67
8.11	Hook blocks	8 - 69
8.11.1	Checking the sheaves	8 - 69
8.11.2	Lubricating hook blocks	8 - 69
8.12	Electrical system	8 - 73
8.12.1	Checking the lighting and indicators	8 - 73
8.12.2	Have the battery on the electronics board replaced	8 - 74
8.13	Air conditioning system	8 - 75
8.13.1	Checking the air conditioning system	8 - 75
8.13.2	Cleaning the condenser fins	8 - 75
8.13.3	Checking hoses	8 - 76
8.13.4	Checking the entire air conditioning system	8 - 76
8.13.5	Changing the pollen filter	8 - 78
8.14	Other maintenance work	8 - 79
8.14.1	Checking windscreen washing system	8 - 79
8.14.2	Checking the auxiliary heater	8 - 80
8.14.3	Lubricating the crane cab door	8 - 81
8.14.4	Lubricating the step	8 - 82
8.14.5	Lubricating the connecting and socket pins	8 - 83
8.14.6	Renewing the corrosion protection	8 - 84
8.14.7	Having the fire extinguisher checked	8 - 86

9 Longer out-of-service periods

10 Torques

10.1	Torques for retaining bolts.....	10 - 1
10.2	Special torques	10 - 2

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

Appendix

1

General instructions

1.1

Using the maintenance manual

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

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

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



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

1.2

Warnings and symbols

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



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



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



This symbol is to remind you that you are working with substances which pose a risk to the environment. Exercise special caution. The measures required for the corresponding maintenance work are indicated next to the symbol. 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. So turn the page!

1.3

Maintenance instructions

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

Repair work also requires:

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

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

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

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

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

- Insufficient oil, grease or antifreeze
- Dirt
- Rope damage
- Faulty compressed air and hydraulic systems
- Hose damage or loose screw connections
- Faulty brakes
- Faulty tyres or wheel rims
- Exceeded maintenance intervals

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

A few **general maintenance instructions**:

- Clean the parts of the truck crane that are to be serviced, particularly the area around the oil filler 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 fresh hydraulic oil must be filtered.



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

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

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

Please contact **Manitowoc Crane Care**.

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

1.4

Instructions regarding the electronic controls

The electronic 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 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.

The device must be serviced or replaced by **Manitowoc Crane Care** before one of these limits is reached

1.5

Safety instructions for welding work

To avoid damage, especially to electronic parts, there are certain measures you must take before doing any welding work. 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 expert personnel with the prior written permission from **Manitowoc Crane Group Germany GmbH**.

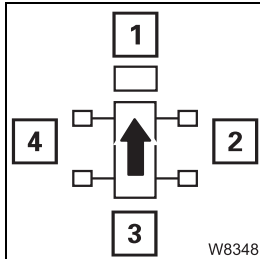
1.6

Definition of direction information

Basic rule

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

On the carrier



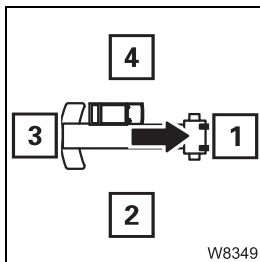
The driver's cab is always at the front, which means that:

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

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

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

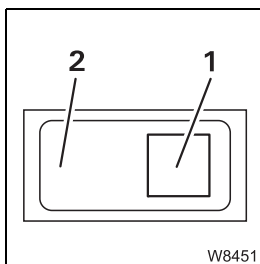
On the superstructure



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

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

Switches and buttons



For switches and buttons, the terms at the **bottom** and **top** are used.

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

Down: press (1) – next to the symbol

Up: press (2) – opposite the symbol

1.7**Conversion table for US measuring units**

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

Converting from	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	2,204,622
lbs	t	0,0004536
kN	lbf	224,809
daN/cm ²	lbf/in ²	14,50378
lbf/in ²	daN/cm ²	0,06895
bar	psi	14,50378
psi	bar	0,06895
m/s	ft/s	3,28084
km/h or km	mph or mi	0,62137
mph or mi	km/h or km	1,60935
Nm	lbf ft	0,7375
°C	°F	1.8 x °C + 32
°F	°C	(°F-32)/1.8
t/m ²	lbs/ft ²	204,8
m ² /t	ft ² /lbs	0,04882
MPa	bar	10
bar	MPa	0,1

2

Safety and environmental protection

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 **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 truck crane is not in operation. Only tighten loose screw connections when the systems are depressurised. Always depressurise the hydraulic and compressed air systems before opening them.

- Do not allow hot fluids to escape in an uncontrolled manner. Risk of scalding.
- Observe the applicable safety regulations when working with 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
 - 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 containers and in locations which meet the requirements of current national and regional regulations.

Disposal

- Ask your local environmental protection authority about the prescribed disposal options.
- Once collected, have environmentally harmful substances disposed of only by disposal companies 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 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

During the first 3 months

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

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

After the first 3 months

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



Risk of accidents from misdirected high pressure water jet

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

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

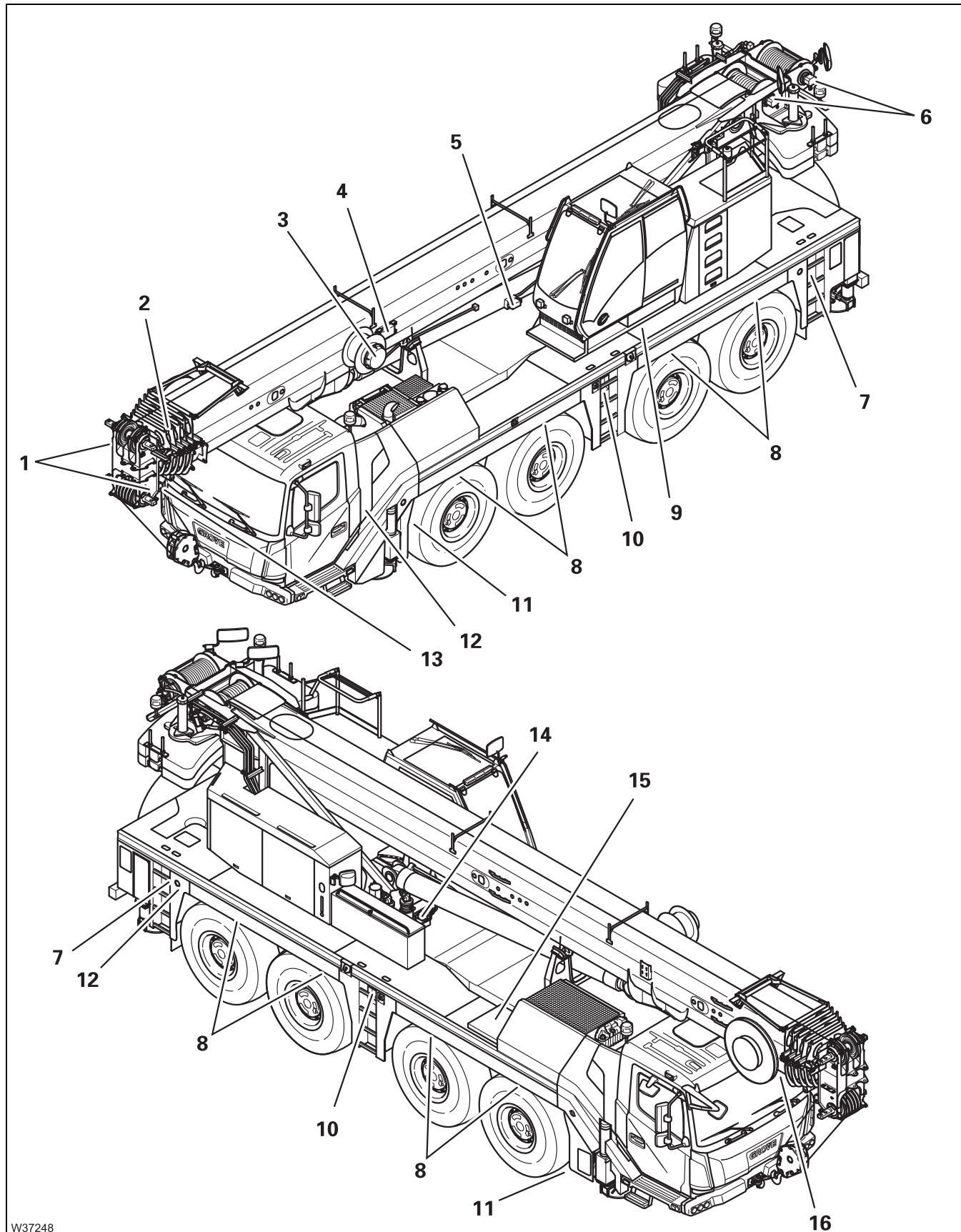
- To prevent damage to the gaskets, never point the spray nozzle directly at them.
- Never point the spray nozzle at electrical equipment, relay and switch boxes, suction and ventilation filters or control elements and lubricated surfaces.
- To prevent corrosion, relubricate all slide faces after cleaning.
- 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 - 112). 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 RCL length data transmitter
- 4 Angle data transmitter
- 5 Pressure sensors on the derricking cylinder
- 6 Lowering limit switch
- 7 Steering computer
- 8 Suspension struts
- 9 Heating/air conditioning system under the crane cab
- 10 Control units for outriggers
- 11 Steering angle sensor
- 12 Carrier electronic control equipment
- 13 Lifting limit switch
- 14 Slewing angle sensor
- 15 Battery box
- 16 Spotlights, slewable



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

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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** at specific intervals:

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 - 134.</i>
during the first 100		Check the hydraulic oil filter every week, and change it if necessary; ■■■▶ <i>Cleaning the magnetic rods, p. 7 - 93,</i> ■■■▶ <i>Changing the hydraulic oil filter, p. 7 - 106.</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; <ul style="list-style-type: none"> ▣▣▣▣► <i>Special torques</i>, p. 10 - 2.
during the first 100	Check the hydraulic oil filter every week, and change it if necessary; <ul style="list-style-type: none"> ▣▣▣▣► <i>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; <ul style="list-style-type: none"> ▣▣▣▣► <i>Checking the screws</i>, p. 8 - 21, ▣▣▣▣► <i>Special torques</i>, p. 10 - 2.
after 100	Hook blocks; <ul style="list-style-type: none"> ▣▣▣▣► <i>Lubricating hook blocks</i>, p. 8 - 69.
after 200	First oil change on the hoists; <ul style="list-style-type: none"> ▣▣▣▣► <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; <ul style="list-style-type: none"> ▣▣▣▣► <i>Changing the oil/checking the oil</i>, p. 8 - 11.
after 200	Change the slewing gear oil; <ul style="list-style-type: none"> ▣▣▣▣► <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); <ul style="list-style-type: none"> ▣▣▣▣► p. 7 - 49.

5


Maintenance overview

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

The maintenance plans are provided in tabular form, divided into

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

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

Check the hydraulic oil level;  p. 7 - 91.



Checking the hydraulic oil level is described in Chapter 7, the section starts on page 7 - 91.

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 that 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	about 2,000 (about 1,240)	about 100
M 3	every three months	5,000 – 6,000 (3,100 – 3,730)	250
M 6	every six months	10,000 – 12,500 (6,210 – 7,770)	500
M 12	every twelve months	20,000 – 25,000 (12,430 – 15,530)	1,000
Y 2	every 24 months	40,000 – 50,000 (25,000 – 31,000)	2,000
Y 3	every 36 months	—	3,000
Y 5	every 60 months	100,000 (62,000)	5,000
Y 6	every 72 months	—	6,000
Y 10	every 120 months	200,000 (124,000)	12,000

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

5.2

Maintenance plans

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

- the carrier in Chapter 7 and for
- the superstructure in Chapter 8

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

The section titles

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

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

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

- The **designations** of the oils/lubricants in accordance with *Lubricants list*, p. 6 - 2.
- The **amounts** as approximate values for oil amounts in litres (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 accompanying *Engine manufacturer's documentation*.

5.2.1

Maintenance plan D

D

Maintenance work on the CARRIER: Daily/before putting into operation	
Engine – Check 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
Steering – Checking the steering monitoring – Checking for leaks	<p>▣▣▣▣▶ p. 7 - 83</p> <p>▣▣▣▣▶ p. 7 - 85</p>
Hydraulic system – Check the oil level	▣▣▣▣▶ p. 7 - 91
Electrical system – Checking the lighting and indicators	▣▣▣▣▶ p. 7 - 113

Maintenance work on the SUPERSTRUCTURE: Daily/before putting into operation	
Hydraulic system – Check 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 - 87 ▣▣▣▣▶ p. 7 - 88
Hydraulic system – Checking the hydraulic hoses – Checking for leaks	▣▣▣▣▶ p. 7 - 92 ▣▣▣▣▶ p. 7 - 92
Central lubrication system – Checking the filling level	▣▣▣▣▶ p. 7 - 109
Other maintenance work – Checking windscreen washing system	▣▣▣▣▶ p. 7 - 133



















Maintenance work on the SUPERSTRUCTURE: weekly	
Hoists – Checking the oil level – General inspection – Checking the hoist brake	■■■▶ p. 8 - 9 ■■■▶ p. 8 - 10 ■■■▶ p. 8 - 10
Slewing gear – Checking the oil level – Checking for leaks	■■■▶ p. 8 - 15 ■■■▶ p. 8 - 16
Hydraulic system – Checking the hydraulic hoses – Checking ventilation filters – Checking for leaks	■■■▶ p. 8 - 32 ■■■▶ p. 8 - 32 ■■■▶ p. 8 - 33
Hoist ropes – Checking the hoist ropes	■■■▶ p. 8 - 52
Central lubrication system – Checking the filling level	■■■▶ p. 8 - 67
Other maintenance work – Checking windscreen washing system	■■■▶ p. 8 - 79

5.2.3

Maintenance plan M 1

M 1

Maintenance work on the CARRIER: monthly/after about 2,000 km (about 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 – Check the oil level	 p. 7 - 45
Angle gear – Check 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 - 77  p. 7 - 79
Electrical system – Checking the batteries	 p. 7 - 114
Air conditioning system – Checking the air conditioning system	 p. 7 - 121
Towbar coupling – Lubricating the towbar coupling	 p. 7 - 125
Other maintenance work – Lubricating the outrigger beams – Checking the auxiliary heater	 p. 7 - 134  p. 7 - 135
















M 1

Maintenance work on the SUPERSTRUCTURE: Monthly/after approx. 100 operating hours	
Main boom – Grease 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 brake lining thickness	 p. 7 - 75
Suspension – Forced lever – checking correct functioning	 p. 7 - 80
Hydraulic system – Cleaning the magnetic rods	 p. 7 - 93
Electrical system – Checking the charge level of the batteries – Charging the batteries using the battery charger – Check the external starting socket	 p. 7 - 116  p. 7 - 118  p. 7 - 119
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 - 127  p. 7 - 128  p. 7 - 129  p. 7 - 129  p. 7 - 130  p. 7 - 130

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 - 69

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 - 121

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 – 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 – Check 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 - 81
Compressed air system – Replacing the filter cartridge of the compressed air drier	■■■► p. 7 - 89
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 - 95 ■■■► p. 7 - 96 ■■■► p. 7 - 101 ■■■► p. 7 - 106
Air conditioning system – Cleaning the condenser fins – Checking the entire air conditioning system – Changing the pollen filter	■■■► p. 7 - 122 ■■■► p. 7 - 122 ■■■► p. 7 - 124
Other maintenance work – Lubricating the cab door – Lubricating the connecting and socket pins – Renewing the corrosion protection	■■■► p. 7 - 135 ■■■► p. 7 - 136 ■■■► p. 7 - 137

Maintenance work on the SUPERSTRUCTURE: Every twelve 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 hook blocks	▣▣▣▣▶ p. 8 - 69
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> – Replace coolant (with water retarder) – Changing the oil and oil filter	■■■► p. 7 - 13 ■■■► p. 7 - 18 ■■■► p. 7 - 25
Other maintenance work – Having the fire extinguisher checked	■■■► p. 7 - 139

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	
Engine – Notes; ■■■► <i>Engine manufacturer's documentation</i> – Replace coolant (with water retarder)	■■■► p. 7 - 13 ■■■► p. 7 - 18
Transmission – Changing the oil	■■■► p. 7 - 42

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.	

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.	

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

<p>Maintenance work on the CARRIER: every 120 months/after 200,000 km (124,000 mi)</p>	
<p>Steel constructions – Check the load-bearing steel fabrication. For more information, please contact Manitowoc Crane Care.</p>	
<p>Maintenance work on the SUPERSTRUCTURE: every 120 months/after 12,000 oper. hrs.</p>	
<p>Electrical system – Have the battery on the electronics board replaced</p>	<p>▣▣▣▣▶ p. 8 - 74</p>
<p>Steel constructions – Check the load-bearing steel fabrication. For more information, please contact Manitowoc Crane Care.</p>	
<p>Rated capacity limiter (RCL) – Have the RCL checked by Manitowoc Crane Care.</p>	

5.3

Periodic inspections

Your GMK4090 truck crane has been inspected before delivery.

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

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

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

Inspections are to be carried out on the following, where these are not already included in the list of periodic maintenance work:

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

If damage is found on the steel fabrication, 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.

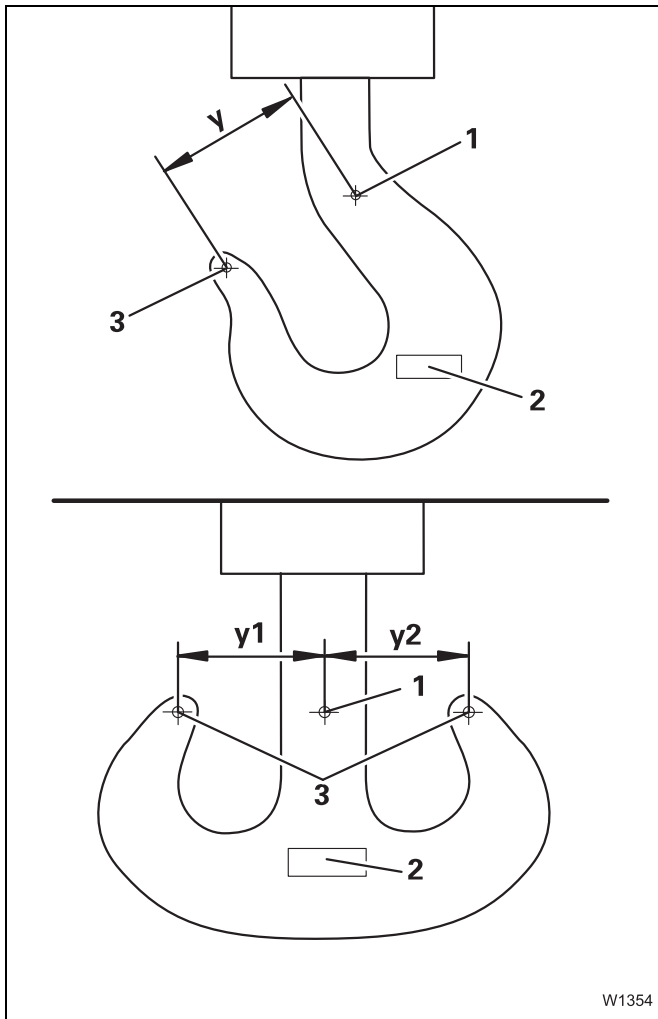
Prior to carrying out welding work on the truck crane, observe the ▮▮▮▶ *Safety instructions for welding work*, p. 1 - 4.

The inspector is to write a report containing the result of the annual inspection carried out and the measures taken to repair any damage.

5.3.1 Load hook inspection

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

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



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

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

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



Risk of accidents due to the load falling.

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

Deformed load hooks must always be replaced.

5.4

Measures required for 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 mobile cranes according to the German *Accident Prevention Regulations for Winches, Hoists and Tractor Machines, BGV D 6 (VGB 9) and BGV D 8 (VGB 8)*.

5.4.1

Theoretical service life

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

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



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



The 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. Concealed damage caused by accidents.
9. Extreme environmental conditions: Low or high temperatures
aggressive atmosphere,
Dust and dirt

5.4.2

Proportion of theoretical service life used

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

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

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

Determining the operating conditions (load spectrum)

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



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

Load spectrum Class	Definition	Proportions of the running time	Factor of the load-spectrum $K_m =$	Graphic representation
Light Q 1 L 1	Power units or parts thereof that are subject to high stress in exceptional situations, but which are generally subject to only low stress	10% of the running time with greatest load (dead load + 1/1 payload) 40% of the running time with dead load + 1/3 payload 50% of the running time with dead load	0,125	<p>W1355</p>
Medium Q 2 L 2	Power unit or parts thereof that are subject to high stress quite often, but which are generally subject to only minimal stress	1/6 of the running time with greatest load (dead load + 1/1 payload) 1/6 of the running time with dead load + 2/3 payload 1/6 of the running time with dead load + 1/3 payload 50% of the running time with dead load	0,25	<p>W1356</p>
Heavy Q 3 L 3	Power units or parts thereof that are subject to high stress frequently and medium stress continuously	50% of the running time with greatest load (dead load + 1/1 payload) 50% of the running time with dead load	0,5	<p>W1357</p>
Very heavy Q 4 L 4	Power unit or parts thereof that are regularly subjected to high stress from neighbouring stress sources	90% of the running time with greatest load (dead load + 1/1 payload) 10% of the running time with dead load	1	<p>W1358</p>

07.12.2017




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

Note for truck cranes:

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

Determining the effective operating hours T_i

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

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

Determining the proportion of the 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 = Factor of the load spectrum used as the basis for winch calculation. This factor is given in the operating manual.

K_{m_i} = Factor of the load spectrum 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 expert has confirmed that the used proportion of the service life is correct and useful by signing his/her name in the crane test book after every inspection.

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

- A visual examination of the exterior (for leaks, damage, deformation etc.),
- An oil inspection (especially for metallic residues),
- A load inspection with minimum and maximum rope pull and each at maximum possible speed. At least one position is to be wound. Pay attention to any unusual noises during the load inspection.

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

5.4.3

Example

A GMK4090 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:
L 3, i.e. $K_{m2} = 0.5$.

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

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

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

Remaining theoretical service life:

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

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, that is, 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 hoisting winch)

Crane type: **GMK 3045**
 Factory number: **3045 42 06**
 First commissioned on: **10 June 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: **Q 1 (L1)**
 Factor of the load spectrum: **Km = 0.125**
 Theoretical service life: **D = 3,200 hrs.**

Inspection interval no. (max. 1 year)	Date of first commissioning/date of inspection	Operating conditions since the last inspection	Factor of the load spectrum	Operating hours of the entire crane	Operating hours of the superstructure	Operating hours of the superstructure since the last inspection	Operating hours of the winch	Operating hours T_1 of the winch since the last inspection	Used proportion S_1 of theoretical service life D :	Remaining theoretical service life $D_1 = D \cdot (1 - S_1)$	Name of the expert	Signature	Comment	Name of the approved inspector	Signature
0(*)	10. 6. 90	-	-	-	-	-	-	-	0	3,200					
1	5. 6. 91	L 1	0,125	-	-	-	160	160	160	3,040	Müller				
2	20. 5. 92	L 3	0,5	-	-	-	640	480	1,920	1,120	Huber				
3	18. 5. 93	L 2	0,25	-	-	-	940	300	600	520	Schmitz				

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

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

General overhaul performed on.....

S_1 = Used proportion of theoretical service life since the last inspection
 D_1 = Remaining theoretical service life
 D_{1-1} = Remaining theoretical service life after the previous inspection
 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 "1" according to section 2.1
 T_1 = Effective operating hours in the inspection interval "1" according to section 2.2
 (*) Copy the last line of the previous page to the following page.

6

Lubricants and consumables

6.1

Lubricants

All lubricants that you require for

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

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

▣▣▣▣▶ *Lubricants list*, p. 6 - 2.

















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

6.1.1





















Lubricants list

Con-sec. no.	GROVE part number	Lubricant type	Designation according to DIN 51502	Specifications Classification	Viscosity
1	03329588	Engine oil	HD - CD	MIL-L 2104 C DB 228.5	SAE 5 W-30
2	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

Con-sec. 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 3
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 - 77	1.5 (0.4) each	M 1
6	Gear oil	2 x hoists;  p. 8 - 11	3.3 (0.9) each	M 12
		2 slewing gears;  p. 8 - 19	0.9 (0.24) each	M 12
7	Hydraulic oil	Carrier hydraulic tank;  p. 7 - 101	165 (44)	M 12
		Superstructure hydraulic tank;  p. 8 - 42	505 (134)	M 12
8	Hydraulic oil	Driver's cab tilting system;  p. 7 - 2	1 (0,26)	M 12



Con-sec. no.	Lubricant type	Usage	Fill quantity in litres (gal)	Maintenance interval
9	Lubricating grease	Carrier central lubrication;  p. 7 - 109		W
		Superstructure central lubrication;  p. 8 - 67		W
		Cardan shafts – transverse;  p. 7 - 64		M 1
		Cardan shafts – longitudinal;  p. 7 - 65		M 6
		Towbar coupling;  p. 7 - 125		M 1
		Outrigger beams;  p. 7 - 134		M 1
		Turntable lock;  p. 8 - 30		M 12
		Hook blocks;  p. 8 - 69		M 12
		Cab door hinges;  p. 7 - 135		M 12
		Carrier pins;  p. 7 - 136		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/supporting cylinder;  p. 7 - 134		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	Driver's cab air-conditioning system; ▶▶▶▶▶ p. 7 - 122 (Compressor oil: FUCHS SE 55)	1,0 (2,2)	M 12
	Crane cab air-conditioning system; ▶▶▶▶▶ 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*.

Coolant circulation for the **SWR** water retarder comes from the engine's cooling circuit. The coolant must be replaced early if the transmission is equipped with a water retarder; ▶▶▶▶▶ p. 7 - 18.

with SWR water retarder: replace coolant every two years

without SWR water retarder: replace coolant every three years

6.3.3 After-treatment of exhaust gases

Designation	Usage	Fill quantity in litres (gal)
DEF (D iesel E xhaust F luid) ¹⁾ <i>AdBlue</i> : GROVE part number: 03140555	AdBlue tank on the carrier;  p. 7 - 34	40 (10,5)

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

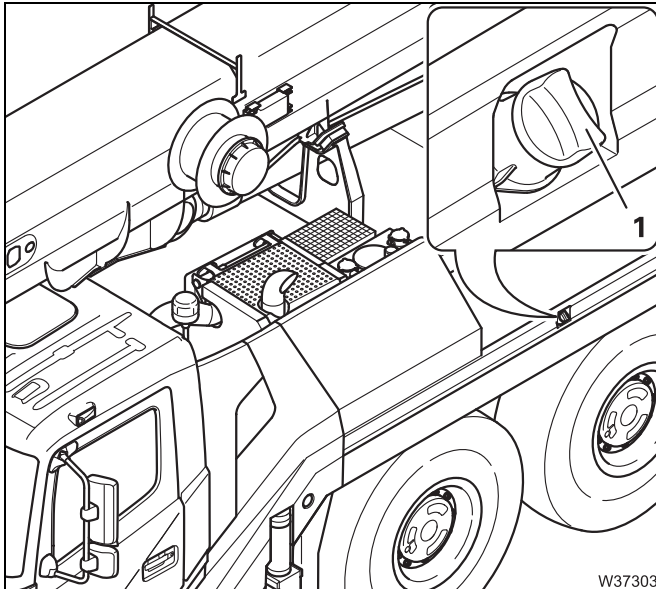
Only if the truck crane is fitted with a separate tank for the auxiliary heater do you have the option of selecting whether to use the same fuel as in section 6.3.1 or to use EL heating oil.


7


Maintenance work on the carrier

7.1

General instructions



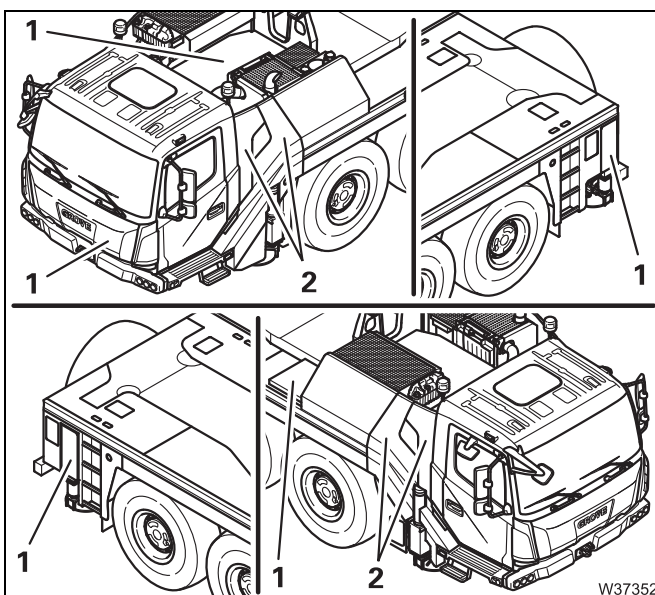
The truck crane GMK4090 is fitted as standard with an *AdBlue system* for exhaust gas emission control. In this case an AdBlue tank (1) fitted to the truck crane;  p. 7 - 33.

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.

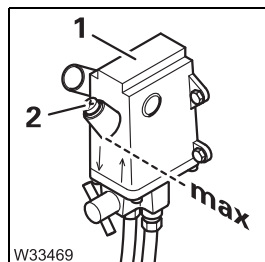
7.1.2

Tilting/lowering the driver's cabin

- Check whether the truck crane GMK4090 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



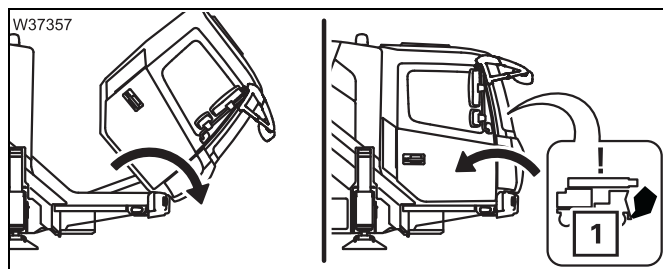
The driver's cab is tilted using a hydraulic hand pump (1).

- 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 manual; Tilting and lowering the driver's cab*.

Oil, tools

Hydraulic oil in litres (gal)	Designation acc. to 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 manual*.

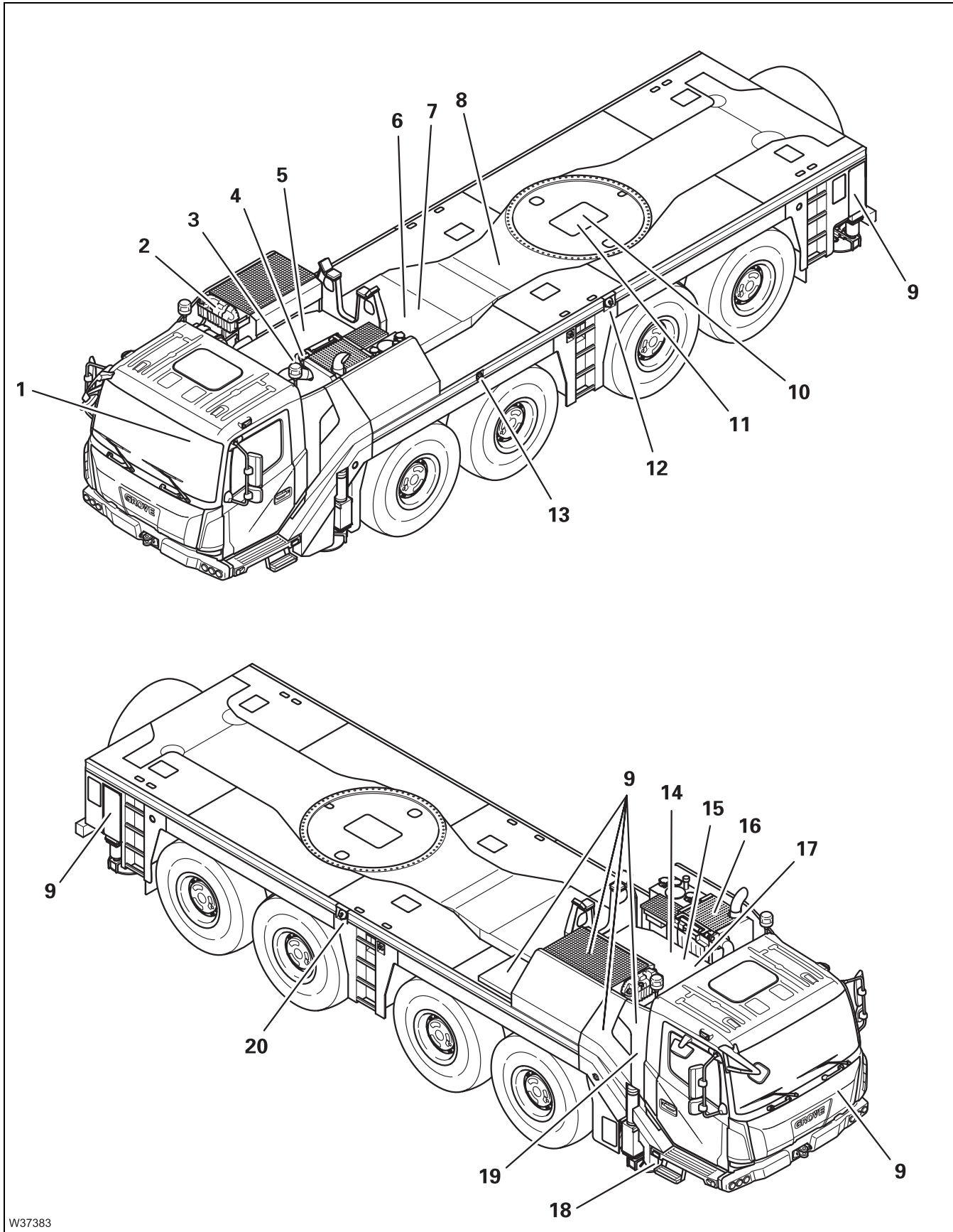
After maintenance work

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

- 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



W37383

07.12.2017

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

- 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

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

Transmission

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

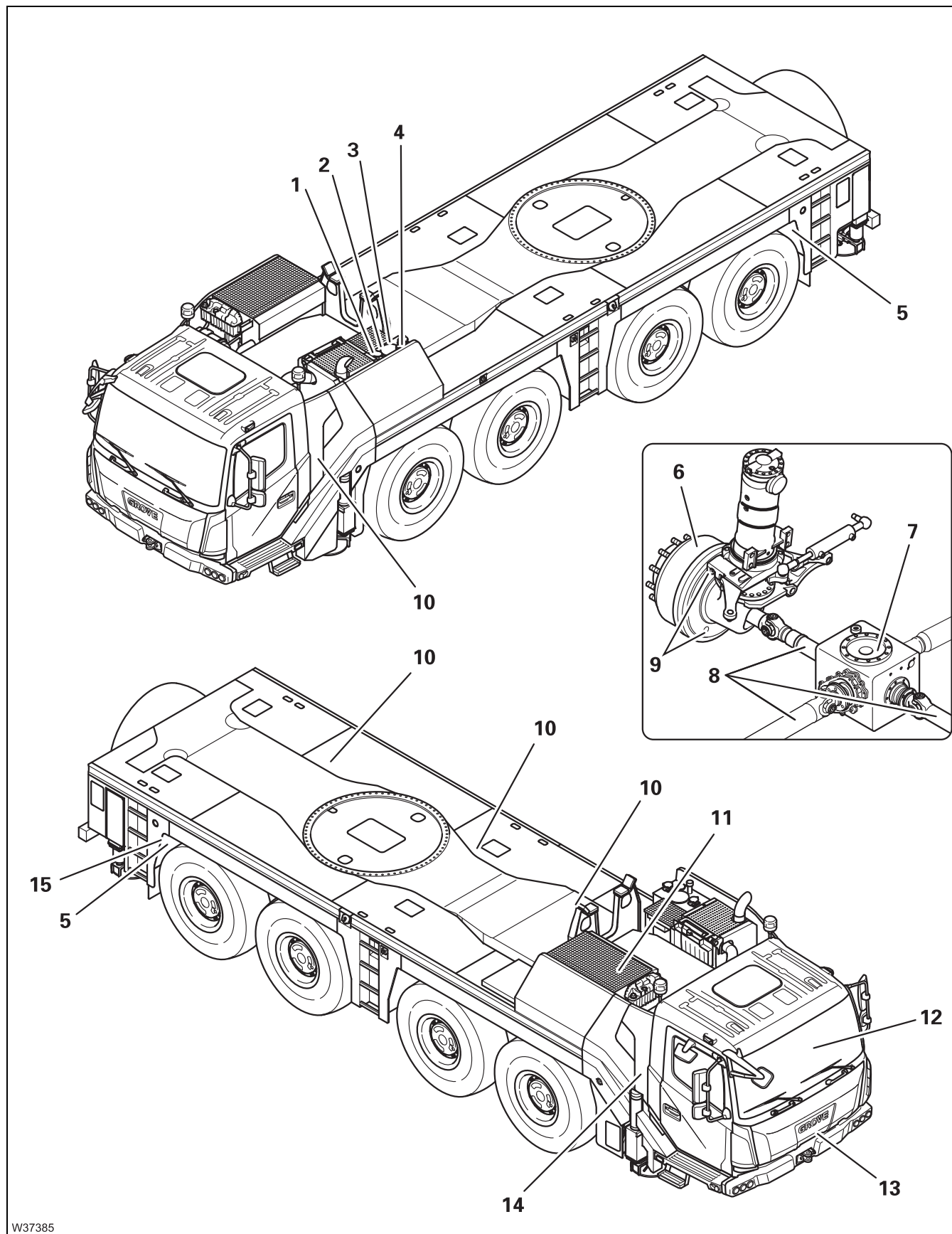
Transfer case

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

Angle gear

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



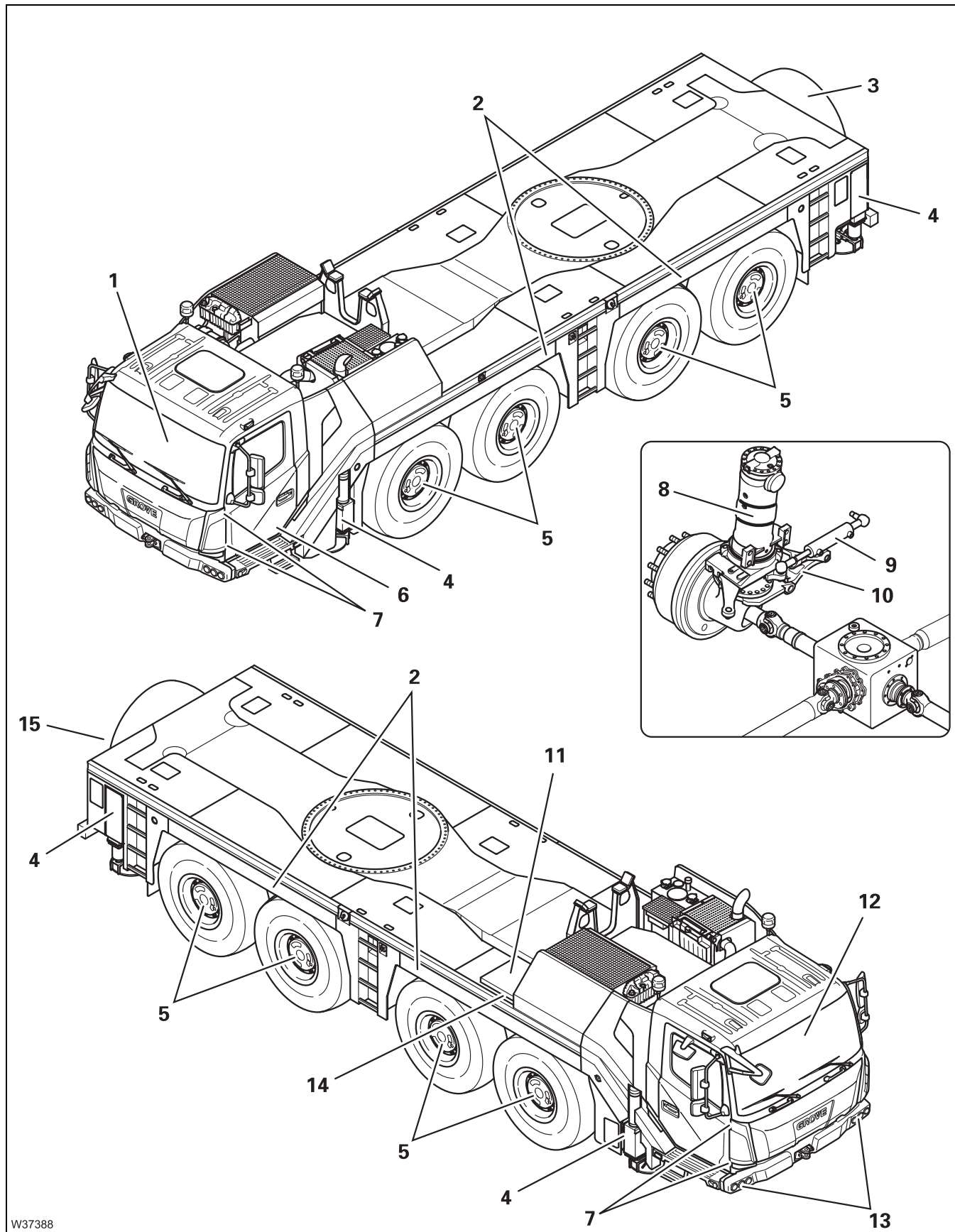


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Axle lines	▣▣▣▣▶ p. 7 - 55
7 Axle centre drives	▣▣▣▣▶ p. 7 - 55
6 Final drives	▣▣▣▣▶ p. 7 - 61
8 Cardan shafts	▣▣▣▣▶ p. 7 - 64
Vehicle brake	▣▣▣▣▶ p. 7 - 75
9 Brake linings	▣▣▣▣▶ p. 7 - 75
Compressed air system	▣▣▣▣▶ p. 7 - 87
10 Receptacle	▣▣▣▣▶ p. 7 - 87
14 Drier	▣▣▣▣▶ p. 7 - 89
Hydraulic system	▣▣▣▣▶ p. 7 - 91
1 Oil tank with sight glass	▣▣▣▣▶ p. 7 - 91
2 Oil filters 1 and 2	▣▣▣▣▶ p. 7 - 106
5 Oil filters 3 and 4	▣▣▣▣▶ p. 7 - 106
3 Ventilation filter	▣▣▣▣▶ p. 7 - 95
4 Oil filler opening	▣▣▣▣▶ p. 7 - 101
Central lubrication system	▣▣▣▣▶ p. 7 - 109
15 Centralised lubrication pump	▣▣▣▣▶ p. 7 - 109
Air conditioning system	▣▣▣▣▶ p. 7 - 121
12 Air-conditioning system in the driver's cab	▣▣▣▣▶ p. 7 - 121
11 Condenser fins	▣▣▣▣▶ p. 7 - 122
13 Pollen filter	▣▣▣▣▶ p. 7 - 124





W37388

07.12.2017


Wheels	▣▣▣▣▶ p. 7 - 67
5 Wheels	▣▣▣▣▶ p. 7 - 67
3 Spare wheel (alternatively storage box)	
Suspension	▣▣▣▣▶ p. 7 - 77
8 Suspension struts	▣▣▣▣▶ p. 7 - 79
10 Forced lever	▣▣▣▣▶ p. 7 - 80
2 Pressure accumulator	▣▣▣▣▶ p. 7 - 81
Steering	▣▣▣▣▶ p. 7 - 83
9 Steering cylinder	▣▣▣▣▶ p. 7 - 85
Electrical system	▣▣▣▣▶ p. 7 - 113
13 Carrier lighting	▣▣▣▣▶ p. 7 - 113
11 Battery box	▣▣▣▣▶ p. 7 - 114
14 External starting socket	▣▣▣▣▶ p. 7 - 119
Towbar coupling	▣▣▣▣▶ p. 7 - 125
15 Towbar coupling ¹⁾	▣▣▣▣▶ p. 7 - 125
Other maintenance work	▣▣▣▣▶ p. 7 - 133
6 Windscreen washing system reservoir	▣▣▣▣▶ p. 7 - 133
4 Outrigger beams	▣▣▣▣▶ p. 7 - 134
7 Cab door hinges	▣▣▣▣▶ p. 7 - 135
12 Driver's cab auxiliary heater ¹⁾	▣▣▣▣▶ p. 7 - 135
– Various connecting pins and socket pins	▣▣▣▣▶ p. 7 - 136
– Corrosion protection	▣▣▣▣▶ p. 7 - 137
1 Fire extinguisher	▣▣▣▣▶ p. 7 - 139
¹⁾ Additional equipment	

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7.2

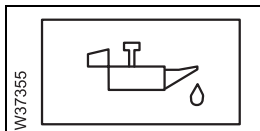
Symbols for maintenance work


CCS

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

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,




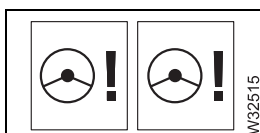
- Air filter;  p. 7 - 16




- Hydraulic oil filter;  p. 7 - 106,



- AdBlue system;  p. 7 - 34,



- Steering monitoring;  *Checking the steering monitoring*, p. 7 - 83.

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7.3

Engine

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

7.3.1

Check the oil level

D

Prerequisites

- The truck crane must be level.

Check the oil level

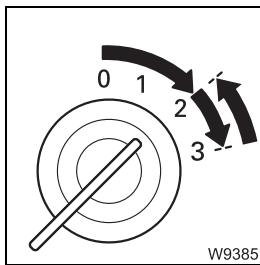
- Start the engine from the driver's cab;  *Operating manual*.



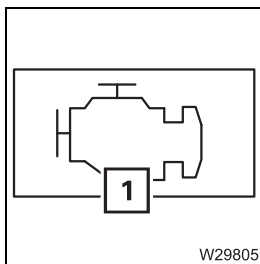
Risk of damage to the engine if the oil pressure is too low

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

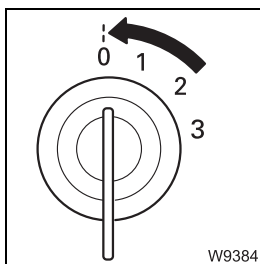
Running the engine when the oil pressure is too low can damage it.



- 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.

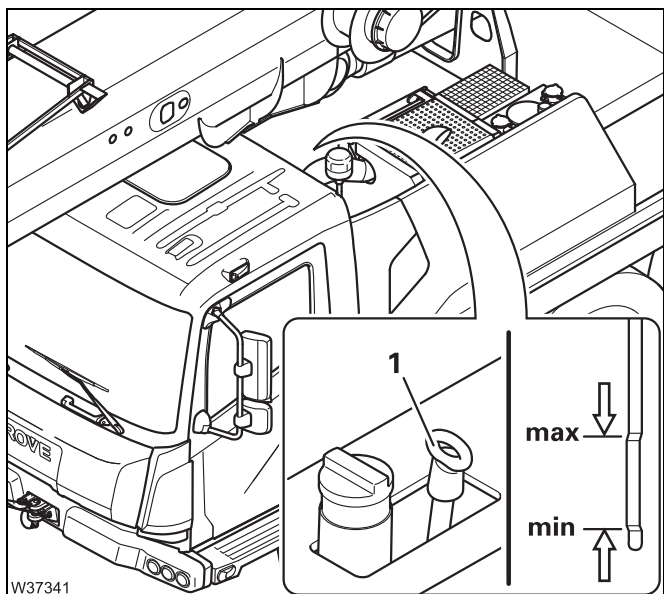


- Allow the engine to run at idling speed for 2 – 3 minutes.
- Switch off the engine.




- Check the oil level after about two minutes.





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

If the oil level is too low

- Top up with 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 acc. to DIN 51502	Specifications 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 is not running and is secured against unauthorised use; p. 2 - 3.

Topping up the oil



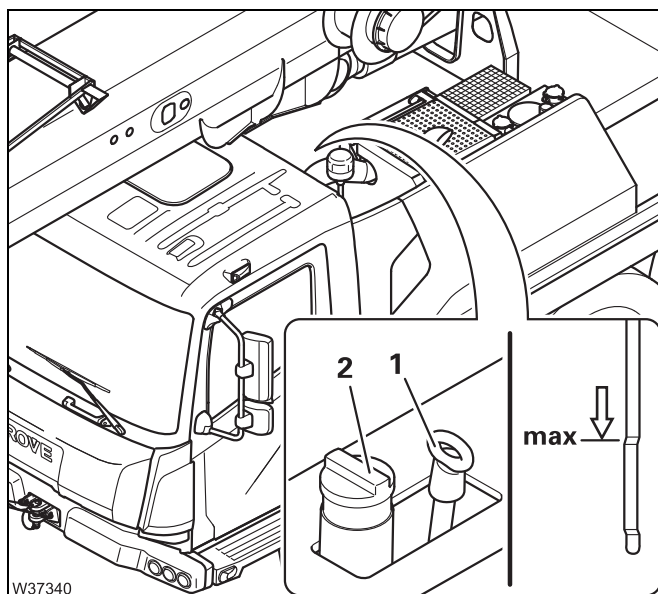
Risk of damage to the engine if the oil level is too high

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



Risk of burns when engine is hot

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

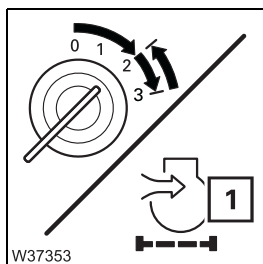


- Add oil through the filler neck (2) up to the **max.** mark.
- Close the filler neck with the cap.
- Insert the dipstick (1) into the dipstick tube after checking the oil level.

7.3.3

Checking the air filter

D



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

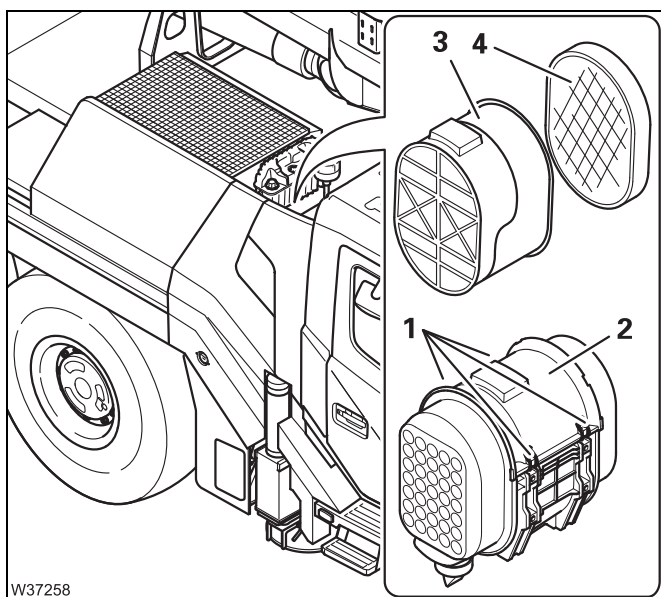
Spare parts and tools

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

Prerequisites

- The engine is not running and is secured against unauthorised use;
 ▶▶▶ p. 2 - 3.

Replace air filter

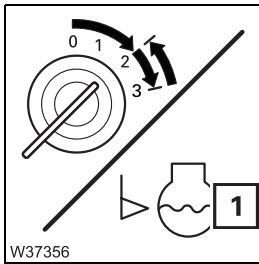


- Undo all the clamps (1) and remove the cap (2).
- Change the main filter (3) and the back-up filter (4).
- Replace the cap and secure it with all the clamps.

7.3.4

Checking the coolant level

D



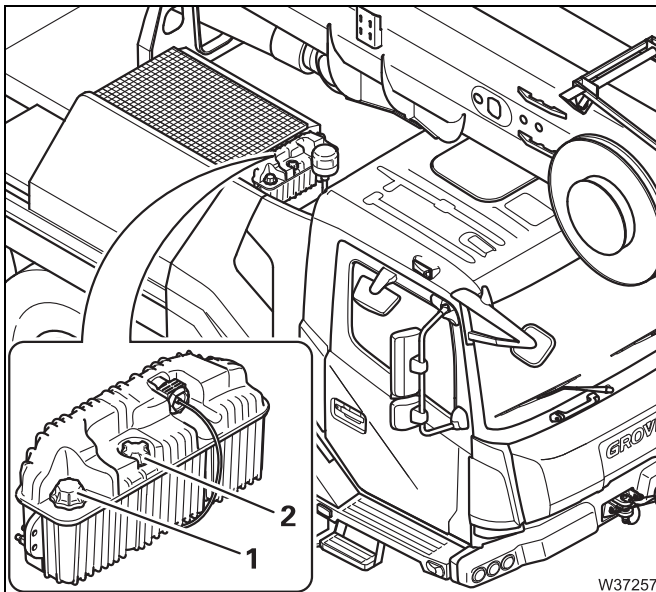
- Start the engine and observe the display.
- When the symbol (1) is displayed then you must top up the coolant.
- Switch the engine off.

Topping up coolant



Danger of being scalded due to hot cooling circuit

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



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

If the coolant level is too low

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



Risk of damage to engine due to lack of coolant

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



Replace coolant

Additional equipment, transmission with water retarder

Coolant circulation for the **SWR** water retarder comes from the engine's cooling circuit. The coolant must be replaced early if the transmission is equipped with a water retarder; ■■■► p. 7 - 39.

with SWR water retarder: all 2 years (**Y 2**)

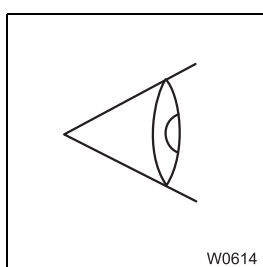
without SWR water retarder: all 3 years (**Y 3**)

■■■► *Engine manufacturer's documentation*

7.3.5

General inspection

W



- Pay attention to any unusual running noises from the engine.
- Check the engine and the connections for leaks. In the event of leaking consumables;
 - *Check 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

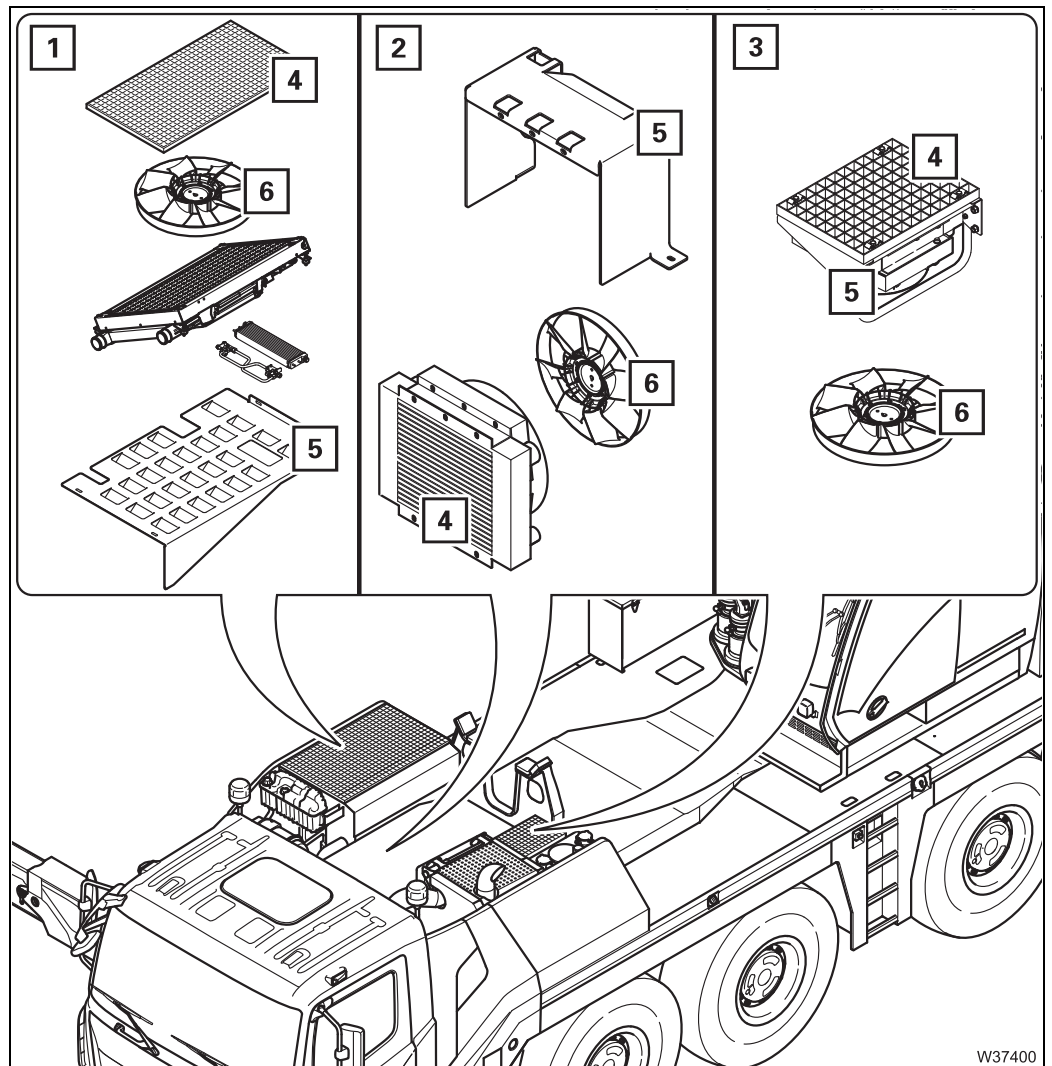
Reducing the interval

- 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 is on outriggers and level; ■■■► *Operating manual*.
- The main boom is fully retracted and raised to 75°; ■■■► *Operating manual*.
- The engine is not running and is 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 wheel rotates under the grille!



Risk of injury at the fan wheel

When the fan wheel is rotating, it can trap and cut off amputate your fingers. Never reach into a fan wheel that is rotating. Do not push any tools through the grille to clean it.

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



Radiator unit 1

The radiator unit 1 consists of:

- Radiator for water/charge air engine
- Radiator for the transmission gear oil
- Radiator 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:

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

Radiator unit 3


The radiator unit 3 (additional equipment) consists of:

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

Check

- If necessary remove leaves, twigs and other debris from the grilles (4).
- View the fan wheels (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 wheel

When the fan wheel is rotating, it can trap and cut off amputate your fingers. Never reach into a fan wheel that is rotating. Do not push any tools through the grille to clean it.

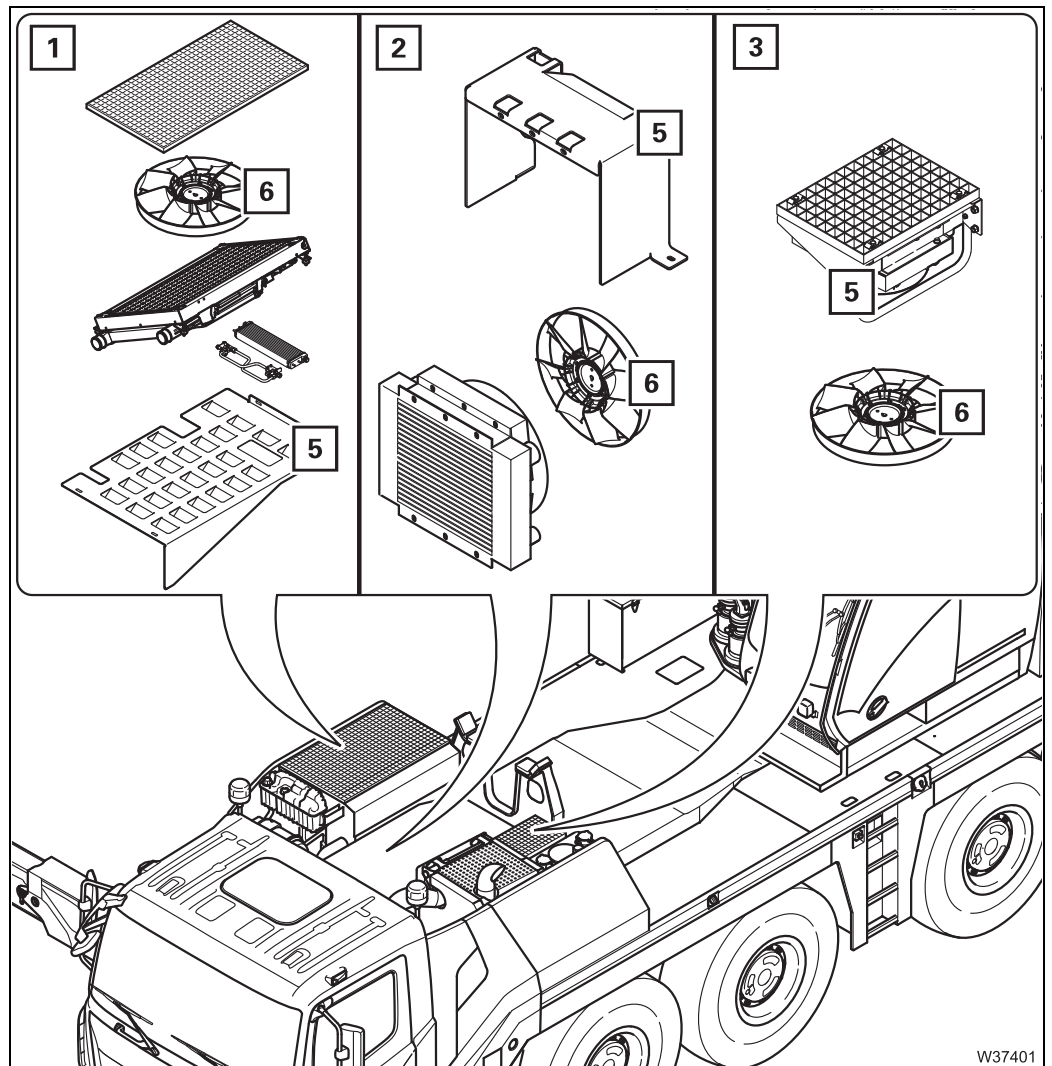
Always stop the engine before attempting to clean the fan wheel and radiator fins.



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 wheels (6) cleaned.
- Have the enclosure plates (5) cleaned.
- Have the hoses and connections checked for damage and leaks.
- Have any damaged parts replaced.



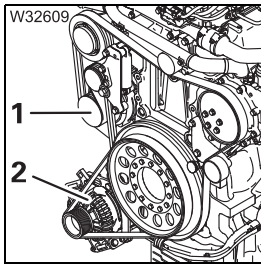
**After checking/
cleaning**

- Remove all tools and cleaning equipment.
- Check whether all grilles and metal sheets are attached.
- Start the engine and wait until the fan wheels are rotating.
- Check that the fan wheels are running freely.
- Check the respective temperature displays in the driver's cab;
 ▣▣▣▣▶ *Operating manual*.
- Switch the engine off.
- Check the radiator and connections for leaks.

7.3.7

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

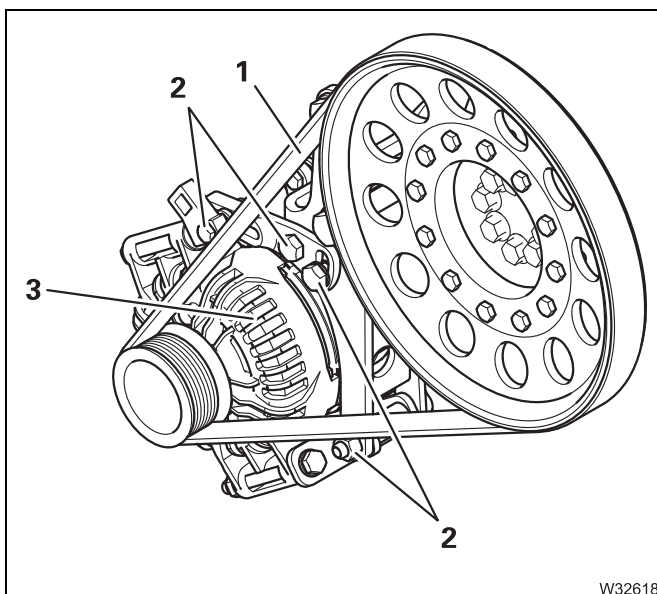
Designation	Quantity	GROVE part no.
Kit: Complete fitting of a second alternator	1	03301570
V-belt	1	03301576

- 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.

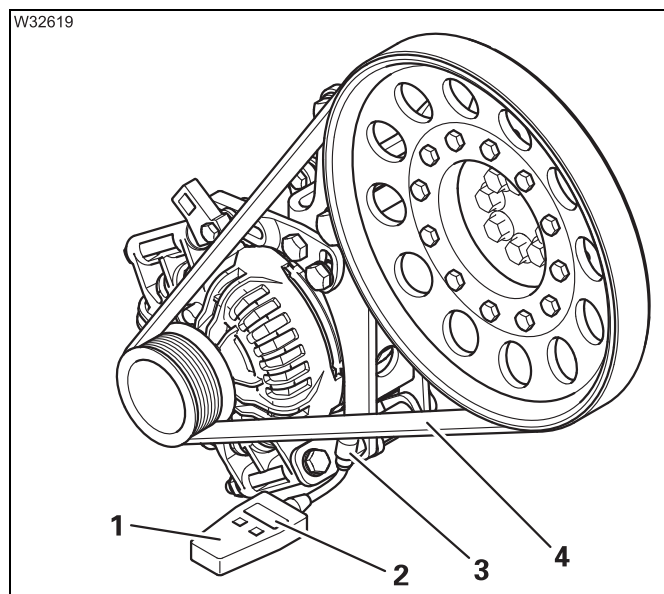
Check



- 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 operating manual*.



- 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 acc. to DIN 51502	Specifications 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, about 40 l (11 gal);  p. 2 - 4.
- Torque wrench for a torque of 55 Nm (40.5 lbf ft).

Prerequisites

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

Changing



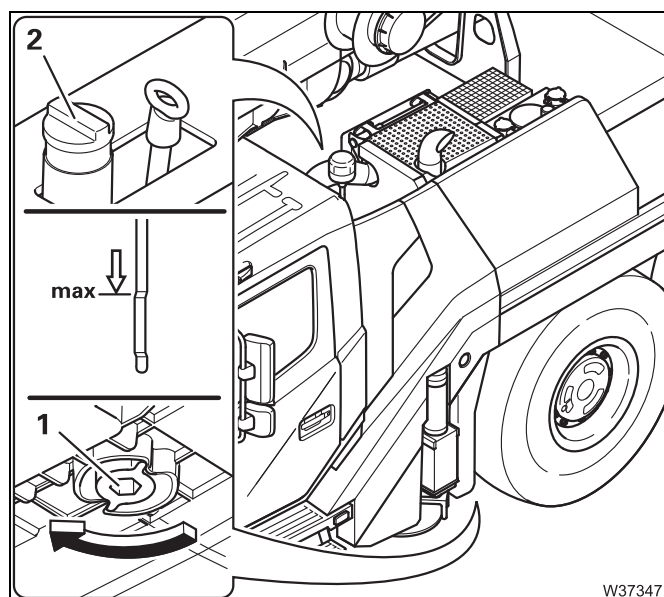
Risk of environmental damage due to leaking consumables

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.

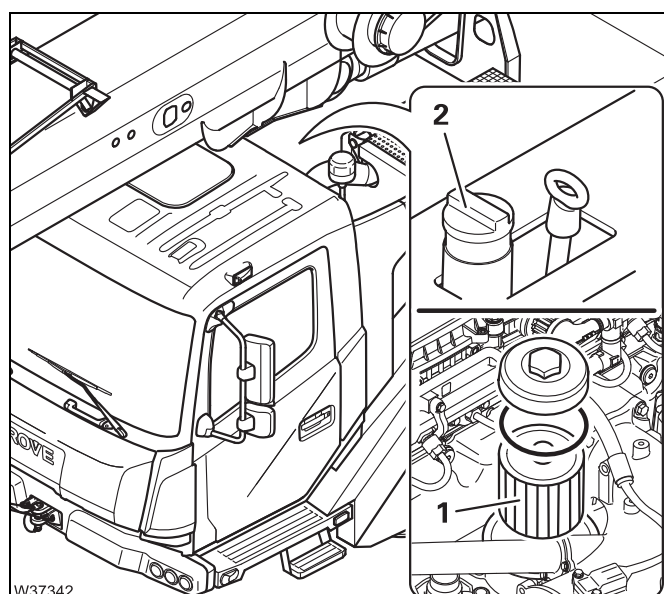




Draining oil

- Place a receptacle underneath the engine.
- Remove the cap (2) from the filler neck.
- 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).

- Leave the receptacle in place for the filter change.



Oil filter

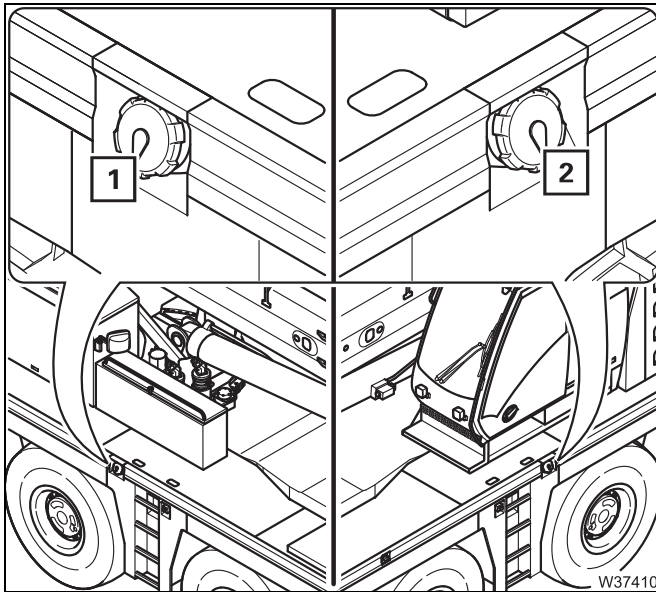
- Change the oil filter (1) using a socket wrench – torque 55 Nm (40.5 lbf ft);
 ▮▮▮▮ *Engine manufacturer's documentation.*

Topping up the oil


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

7.4

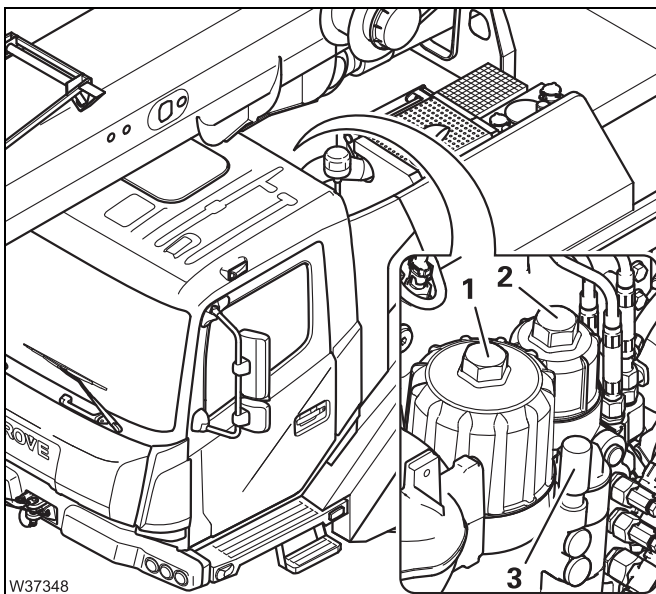
Fuel system



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

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

- 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

T

Spare parts and tools

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

Prerequisites

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

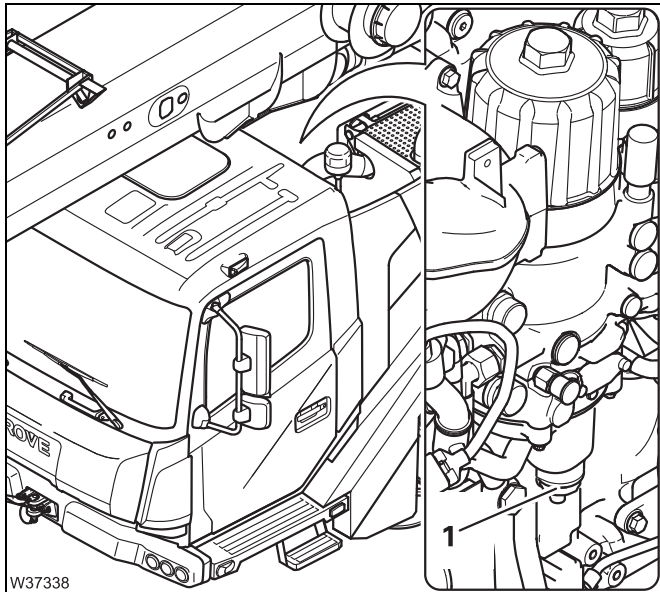
Draining off water



Risk of environmental damage due to leaking consumables

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

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



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


7.4.2

Replacing fuel filter 1




M 3

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter (large)	1	04161991
alternatively: Set for both filters 1 + 2 (large + small)	1	04183793

- Receptacle, about 5 l (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 manual*.
- The main boom must be fully raised;  *Operating manual*.
- The engine is not running and is secured against unauthorised use;  p. 2 - 3.
- If the fuel is dirty: Reduce the maintenance interval.

Changing

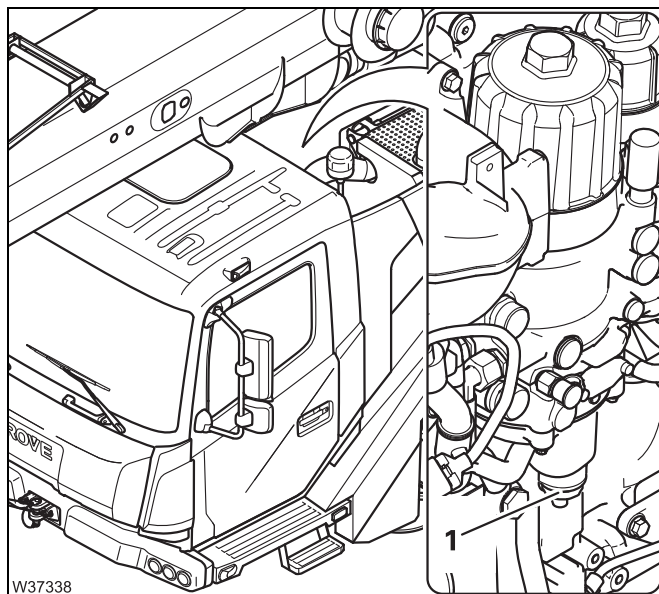


Risk of environmental damage due to leaking consumables

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

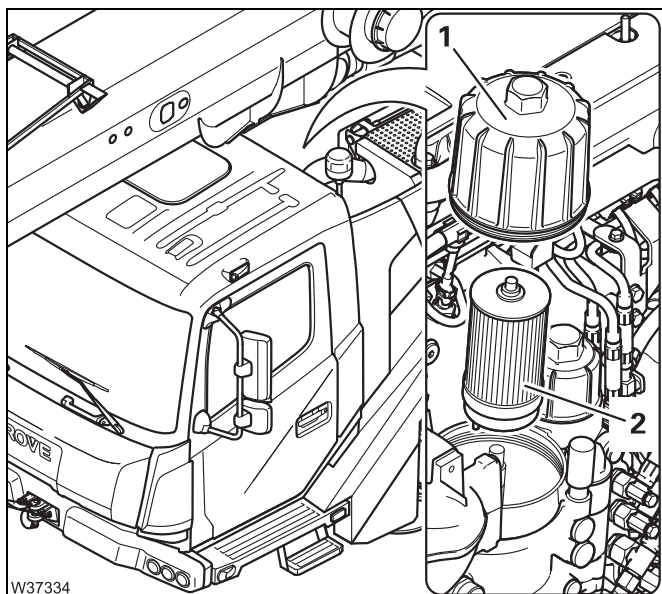
Store/dispose of consumables and any soaked equipment properly.


Ask about the applicable regulations.

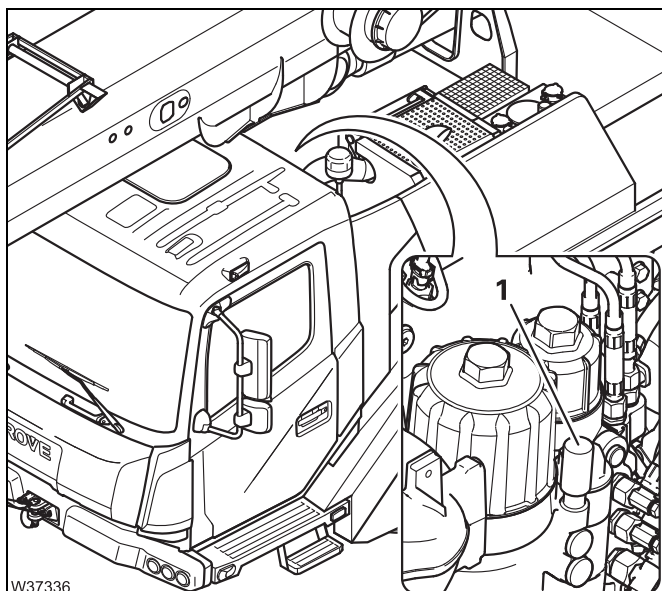



- Place a receptacle underneath the filter.
- Open the valve (1) and let the consumable drain out.





- Remove the cap (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.
- Fasten 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
alternatively: Set for both filters 1 + 2 (large + small)	1	04183793

- Receptacle, about 5 l (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 manual*.
- The main boom must be fully raised; *Operating manual*.
- The engine is not running and is 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

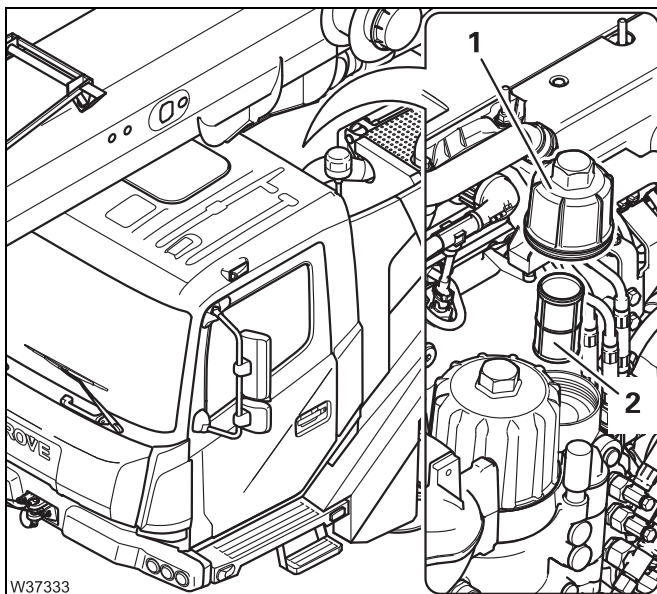


Risk of environmental damage due to leaking consumables

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

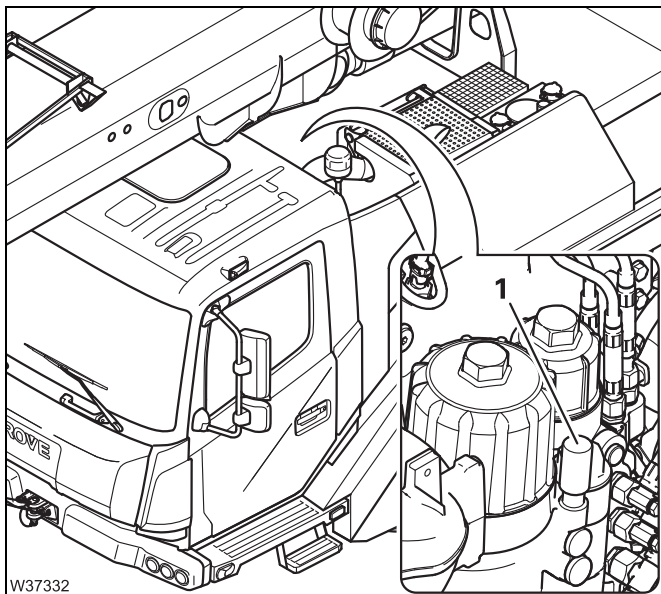
Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.



- Place a receptacle underneath the filter.
- Remove the cap (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.
- Fasten 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

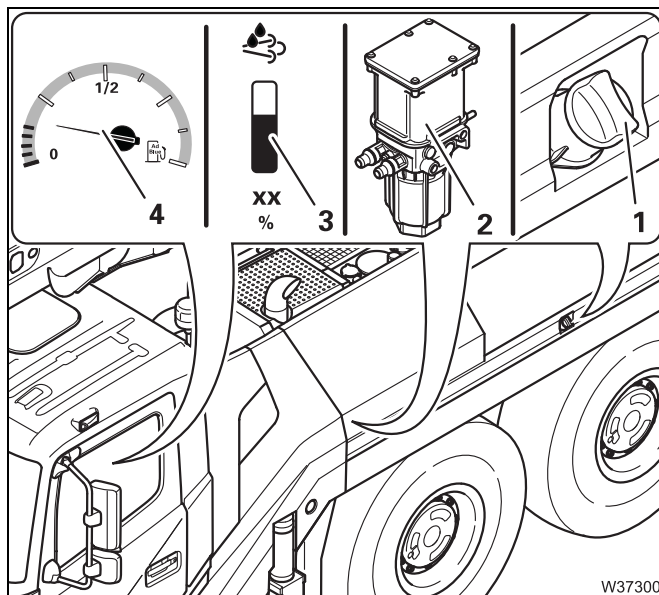
Exhaust system with exhaust emission control

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)**.

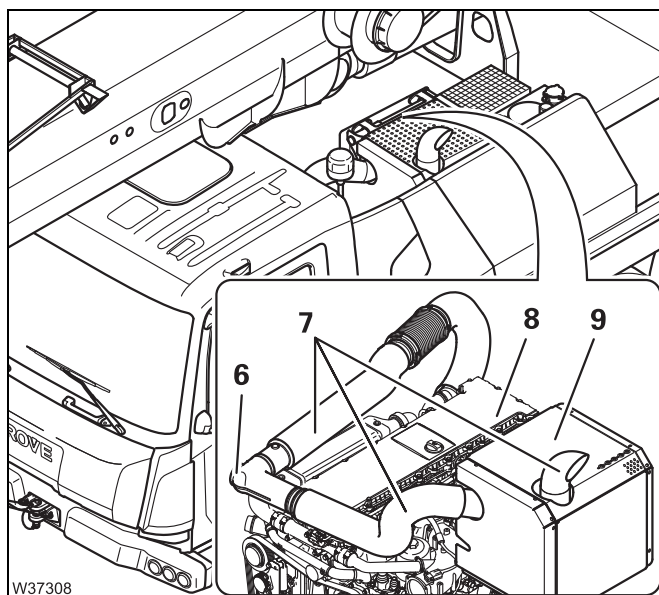
The exhaust gas is treated using an **AdBlue system**. **AdBlue** For this, **(DEF) (Diesel Exhaust Fluid)** from the AdBlue tank is injected into the exhaust system.

The engine output is automatically sharply reduced when there is not enough AdBlue solution available. Driving with an empty AdBlue tank will invalidate the truck crane's licence for use on public roads; *Operating manual*, *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, 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 mixture of AdBlue and compressed air.
- 7 Tail pipes
- 9 Exhaust silencer with SCR catalytic converter

7.5.1

Checking the AdBlue tank level

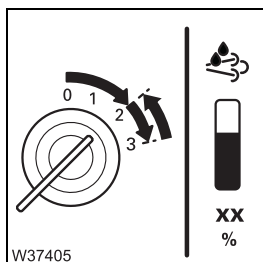
D

Check

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



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



- Start the engine and check the 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)	Specifications 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 is not running and is secured against unauthorised use; p. 2 - 3.

Refuelling

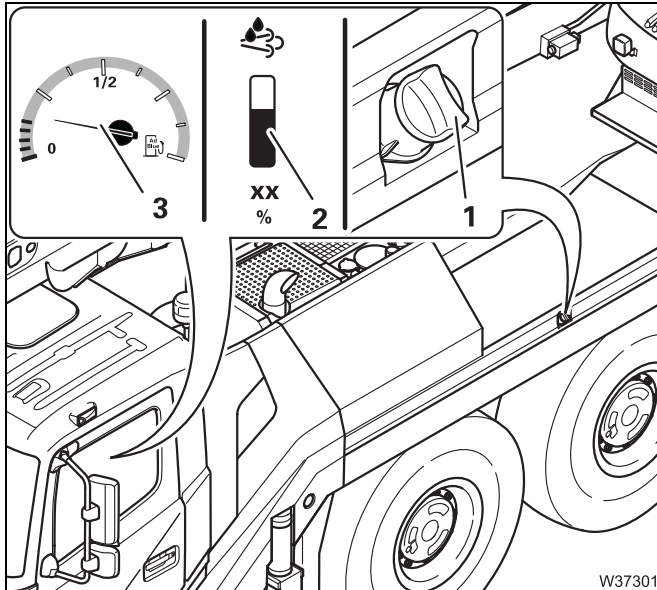
- Find out about refuelling in the operating manual and note the warnings;
 ▣▣▣▣► *Operating manual.*



Danger of scalding due to ammonia vapours

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

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



- 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 is not running and is secured against unauthorised use;
 ▣▣▣▣► p. 2 - 3.
- The engine and the exhaust system are cool.

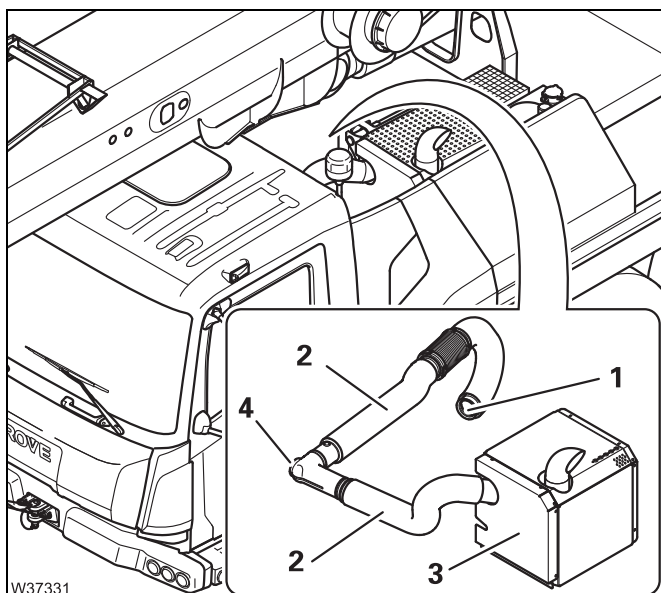


Check




Risk of burns when the exhaust system is hot

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



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

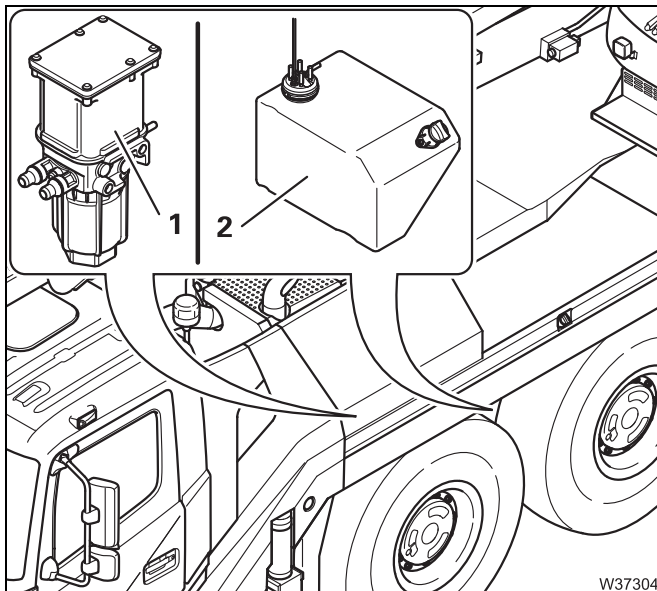
M 12

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

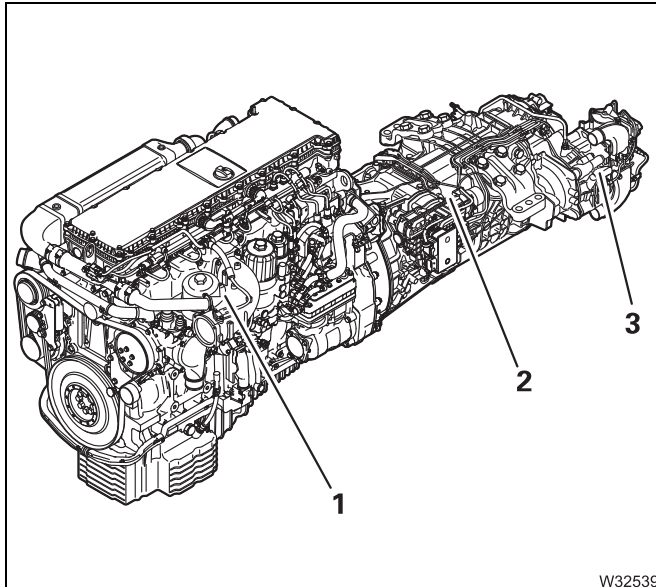
Oil from the compressed air system can damage the pump unit. Therefore, a filter cartridge must be installed in the compressed air drier that removes both water and oil. **Manitowoc Crane Care** recommends the suitable filter cartridge with the GROVE part number 04157844.

- Use only the suitable filter cartridge;  *Replacing the filter cartridge of the compressed air drier, p. 7 - 89.*

7.6

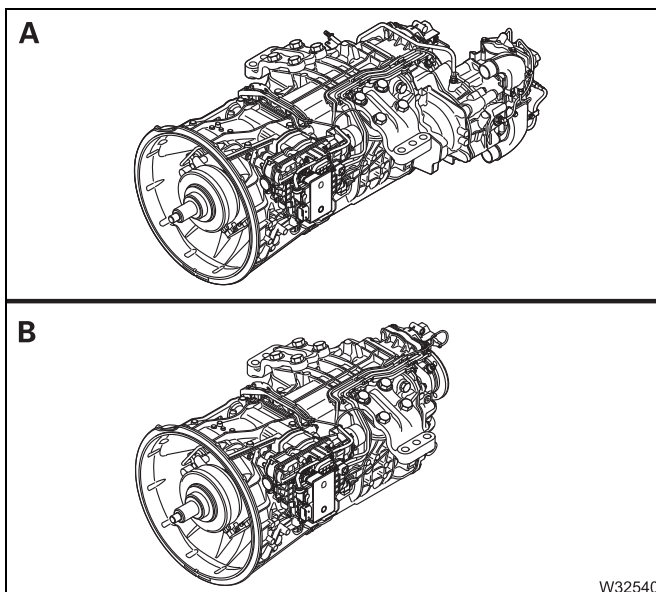
Transmission

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**

Coolant circulation for the **SWR** water retarder comes from the engine's cooling circuit. The coolant must be replaced early if the transmission is equipped with a water retarder;  p. 7 - 18.

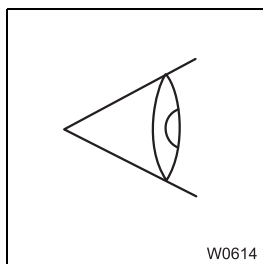
with SWR water retarder: replace coolant every two years

without SWR water retarder: replace coolant every three years

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: ■■■► *Check 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

Check the oil level

M 12

Spare parts and tools

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

- Receptacle, about 5 l (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 is not running and is secured against unauthorised use; ■■■▶ p. 2 - 3.
- The inspection opening are now accessible; ■■■▶ p. 7 - 40.

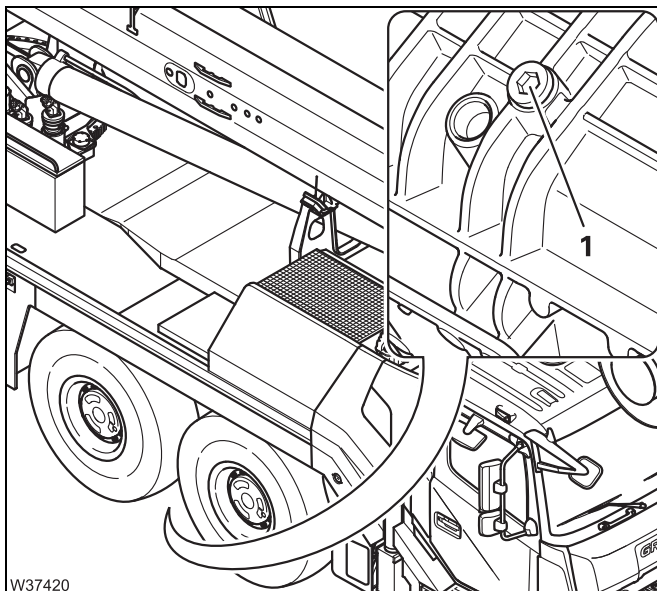
Check the oil level



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 with oil; ■■■▶ p. 7 - 44.

7.6.3


Changing the oil

Y 3



Oil, spare parts and tools

Gear oil in litres (gal)	Specifications 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, about 20 l (5 gal);  p. 2 - 4.
- Torque wrenches for torques 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 is not running and is secured against unauthorised use;  p. 2 - 3.
- The inspection opening are now accessible;  p. 7 - 40.

Draining oil



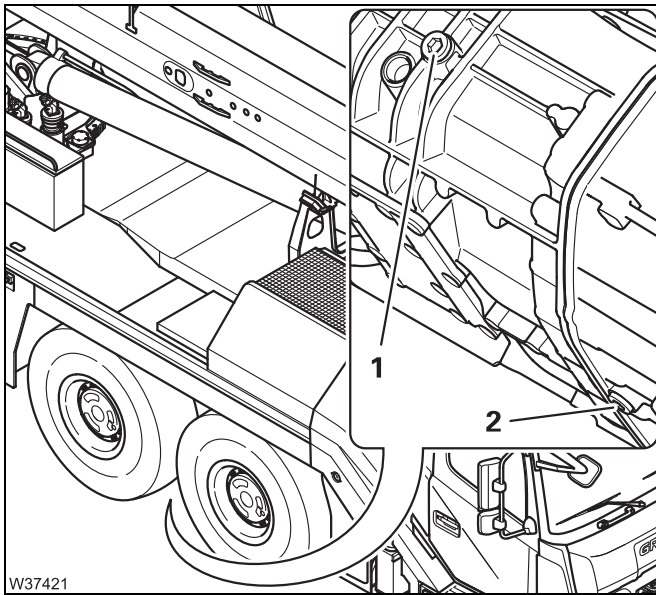
Risk of scalding from gear oil at operating temperature

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.



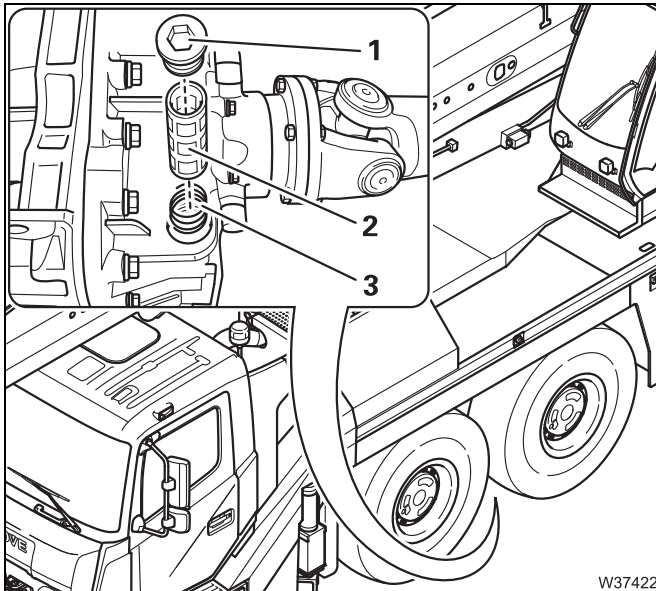
- Place a receptacle under the screw (2).
- Unscrew bolts (1) and (2) and allow the oil to drain.
- Clean the drain plugs.
- Replace the gasket and tighten the drain plug (2) – torque 25 Nm (18.4 lbf ft).

Cleaning the filter



Risk of injury due to spring tension

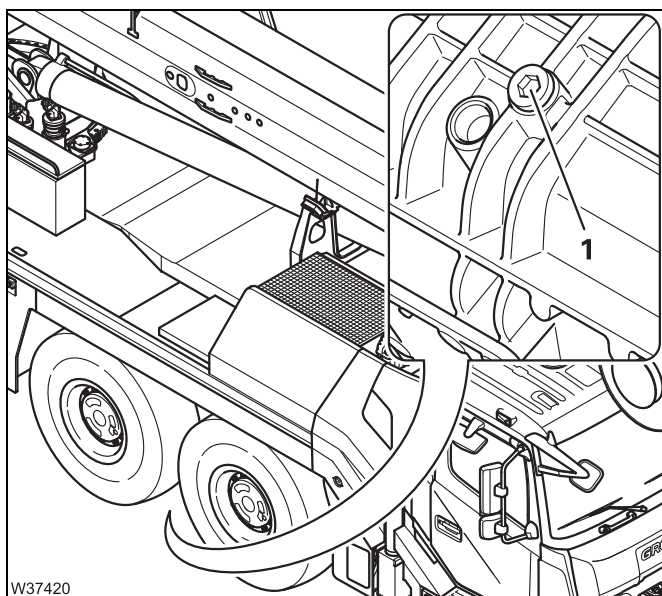
The oil filter bolt is spring-loaded. Release it carefully and be careful of the spring tension.



- 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).

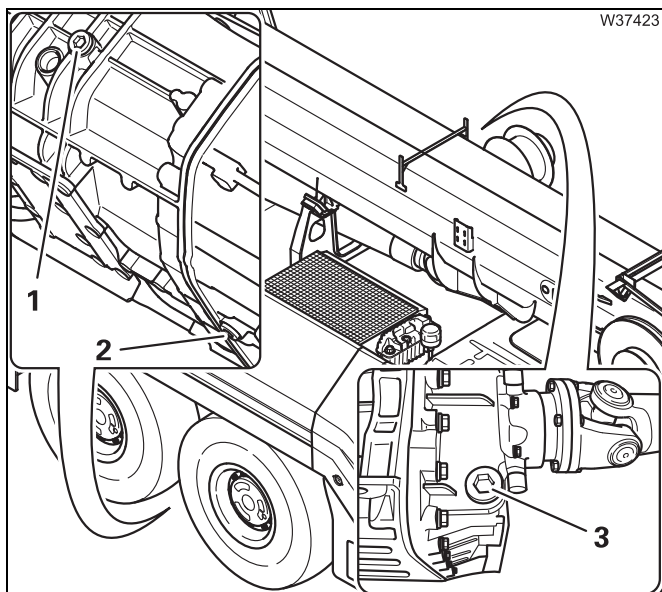


Topping up the oil



- 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

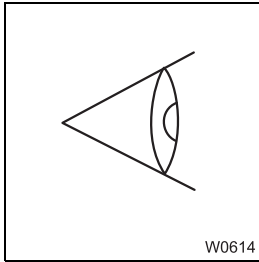
Transfer case


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

7.7.1

General inspection

W



- Pay attention to any unusual noises made by the transfer case.
- Check the transfer case and the connections for leaks. In the event of leaking consumables;  *Check 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


Check the oil level

M 1

Spare parts and tools

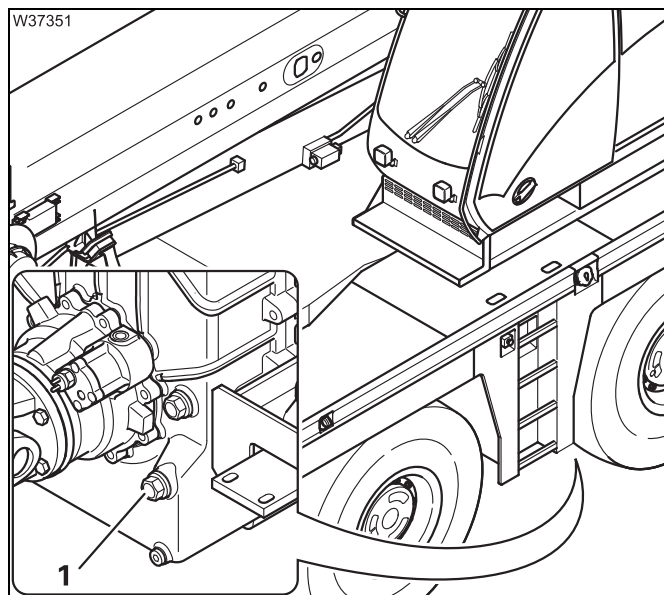
Designation	Quantity	GROVE part no.
Gasket 30 x 36 Cu DIN 7603	1	00117151

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine is not running and is 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 with oil; ►►► p. 7 - 47.

7.7.3

Changing the oil

M 6

Oil, spare parts,
tools

Gear oil in litres (gal)	Designation acc. to DIN 51502	Specifications 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, about 15 l (4.0 gal); ►►► p. 2 - 4.

Prerequisites

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

Changing the oil



Risk of scalding from gear oil at operating temperature

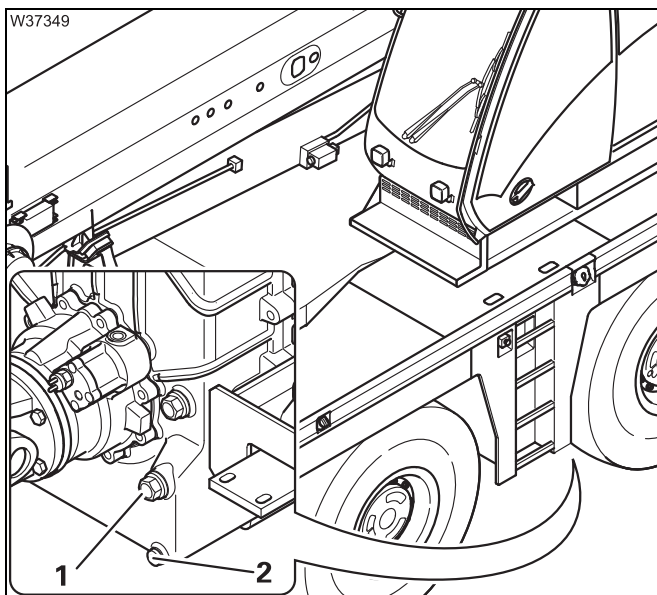
You could scald yourself by gear oil escaping in an uncontrolled manner at operating temperature. Wear appropriate protective gloves and take care not to come into contact with the gear oil.



Risk of environmental damage due to leaking consumables

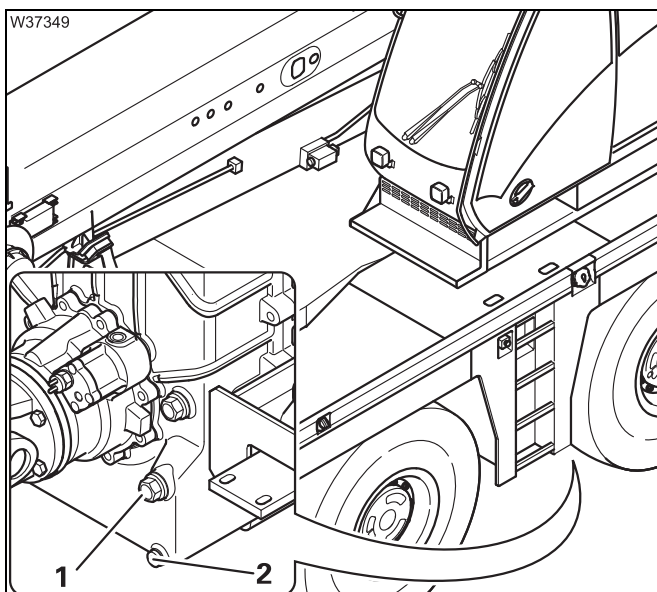
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.


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



- Place a receptacle under the screw (2).
- Unscrew bolts (1) and (2) and allow the oil to drain.
- Fit a new gasket and tighten the screw (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.

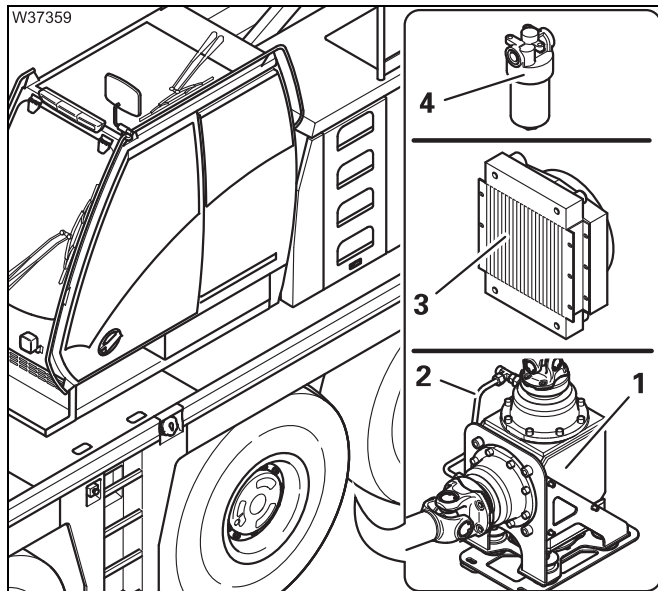
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7.8

Angle gear

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

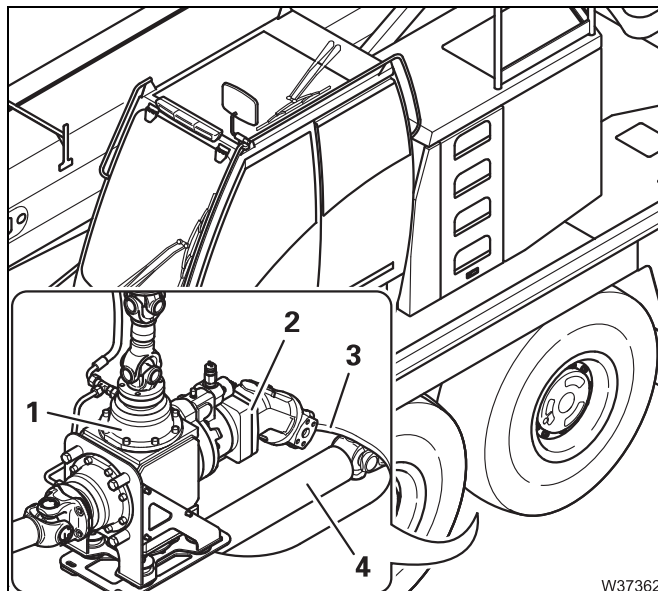
Access



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.

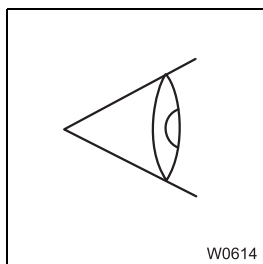
If the additional equipment *Driving from the crane cab* is fitted, the angle gear (1) is fitted with a flange for a hydraulic drive (2).

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. In the event of leaking consumables;
 - ▣▣▣▣▶ *Check 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

Check the oil level

M 1

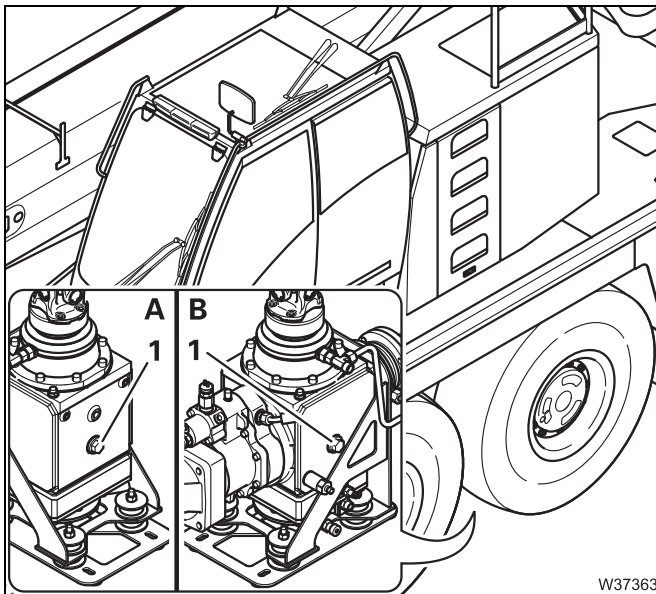
Spare parts and tools

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 is not running and is 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*).

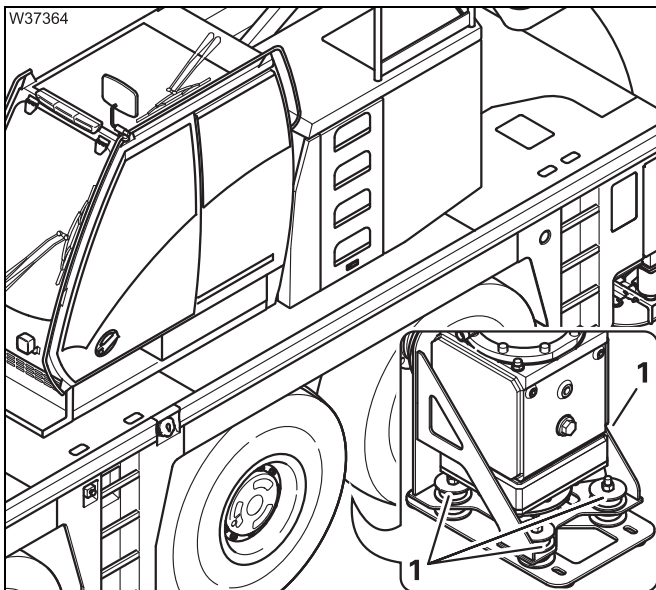
- Remove the drain plug (1).
- Check that the oil reaches the lower edge of the opening.
- Fit a new gasket and tighten the screw.

If the oil level is too low

- Top up with 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 acc. to DIN 51502	Specifications 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 - 102.
- Receptacle, about 10 l (2.5 gal);  p. 2 - 4.

Prerequisites

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

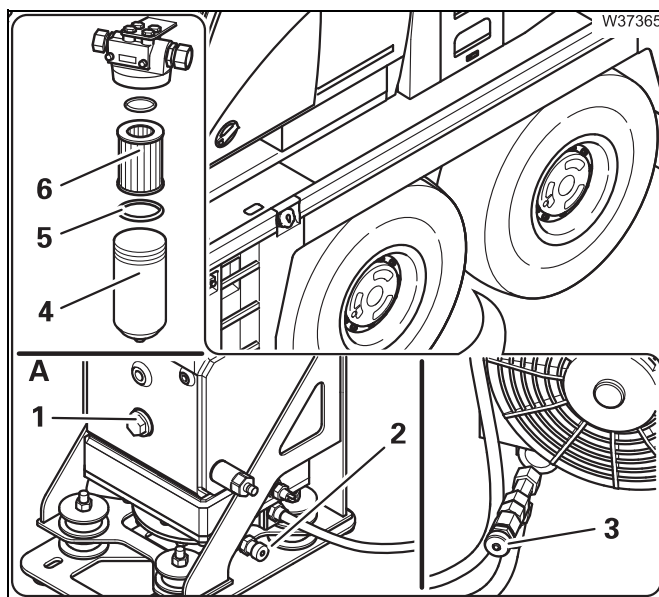
You could scald yourself by gear oil escaping in an uncontrolled manner at operating temperature. Wear appropriate protective gloves and take care not to come into contact with the gear oil.



Risk of environmental damage due to leaking consumables

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

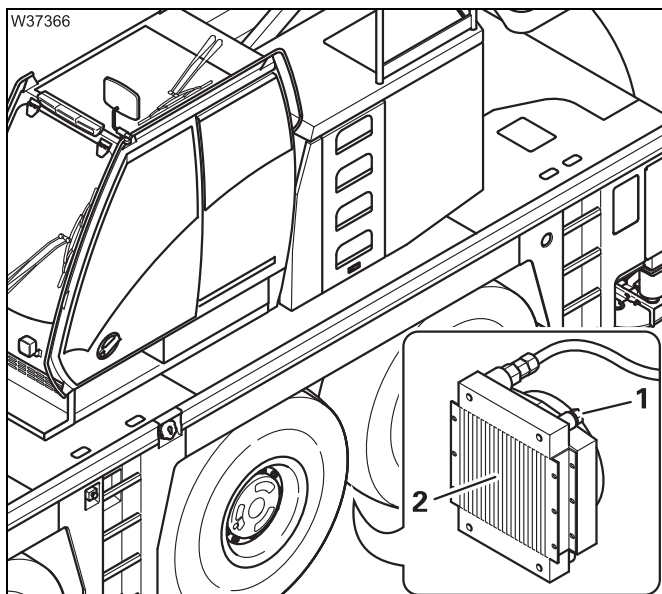
Store/dispose of consumables and any soaked equipment properly. Ask about the applicable regulations.



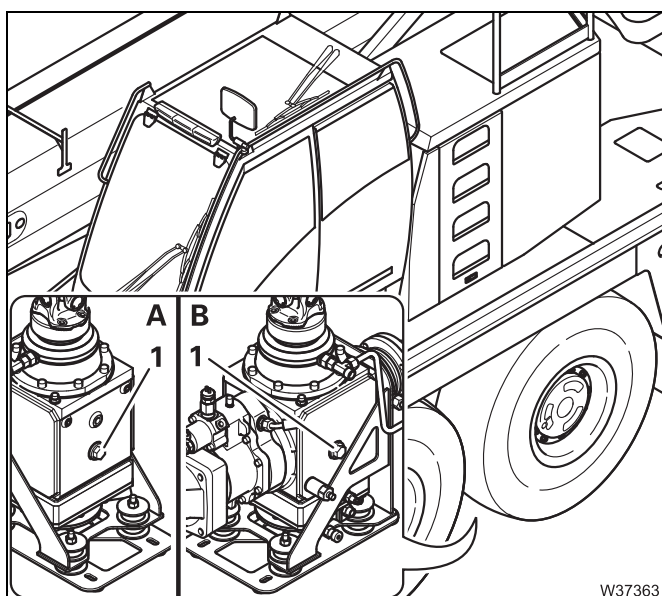
- Place a receptacle under the angle gear, the oil cooler and the filter.
- Check the type of the angle gear: **(A)** or **(B)**;
 ▣▣▣▣ *Checking*, p. 7 - 51.
- Remove the drain plug **(1)**. The illustration shows type **(A)**.
- Screw the discharge connection piece and hose on to the valve **(2)** on to the angle gear and drain the oil into the receptacle;
 ▣▣▣▣ *Handling the valves*, p. 7 - 102.
- 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 screw (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

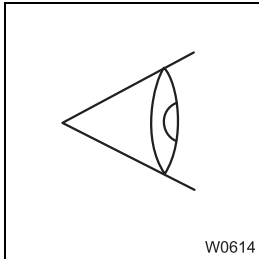
Axle lines



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

7.9.1

General inspection

W



- Pay attention to 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. In the event of leaking consumables;
 -  *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

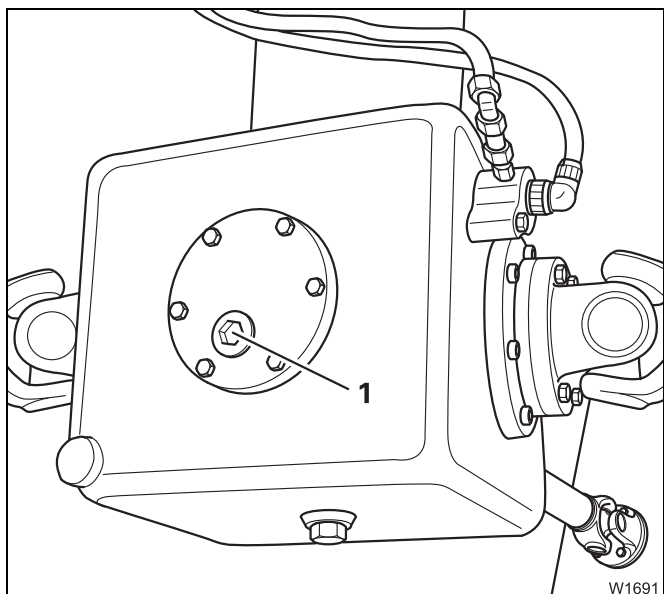
¹⁾ Additional equipment (2nd driven axle line)

Prerequisites

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



1. and 4th axle lines



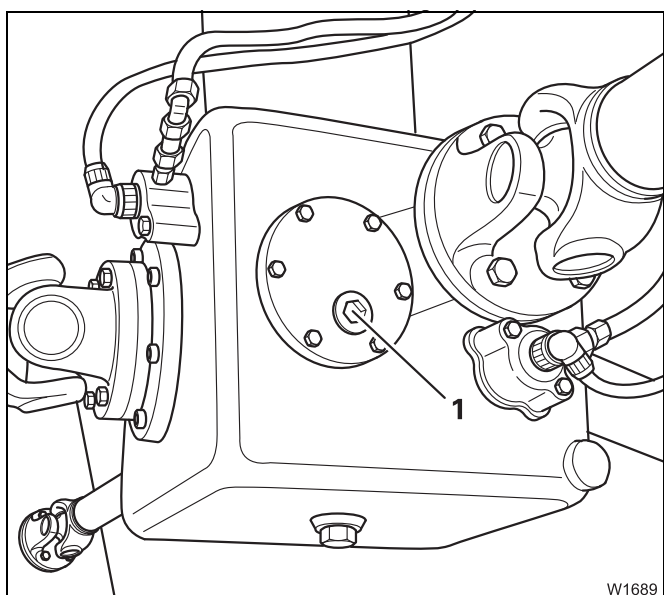
- Remove the drain plug (1).
- Check that the oil reaches the lower edge of the opening.
- Fit a new gasket and tighten the screw.

If the oil level is too low

- Top up with oil; ►► p. 7 - 58.

2nd axle line

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

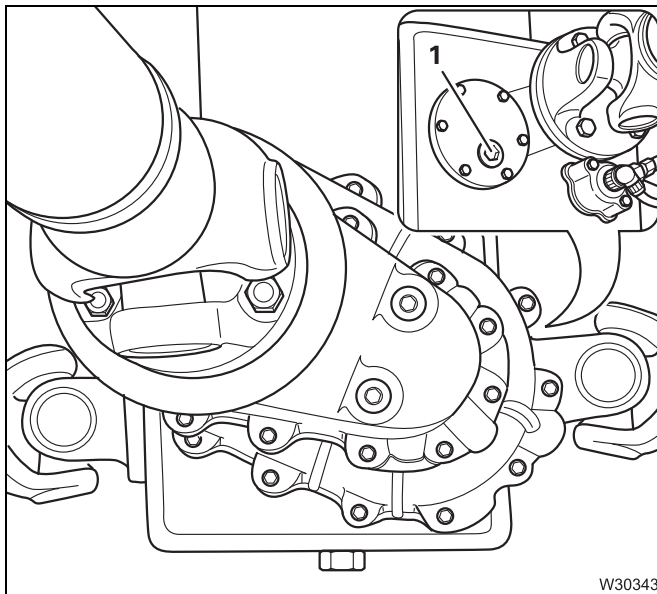


- Remove the drain plug (1).
- Check that the oil reaches the lower edge of the opening.
- Fit a new gasket and tighten the screw.

If the oil level is too low

- Top up with 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 with 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 acc. to DIN 51502	Specifications Classification	GROVE part no.
Axle line 1+4: each 13.0 (3.5) Axle lines 2: 15 (4,0) Axle lines 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, about 20 l (5.0 gal); ►►► p. 2 - 4.



Prerequisites

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



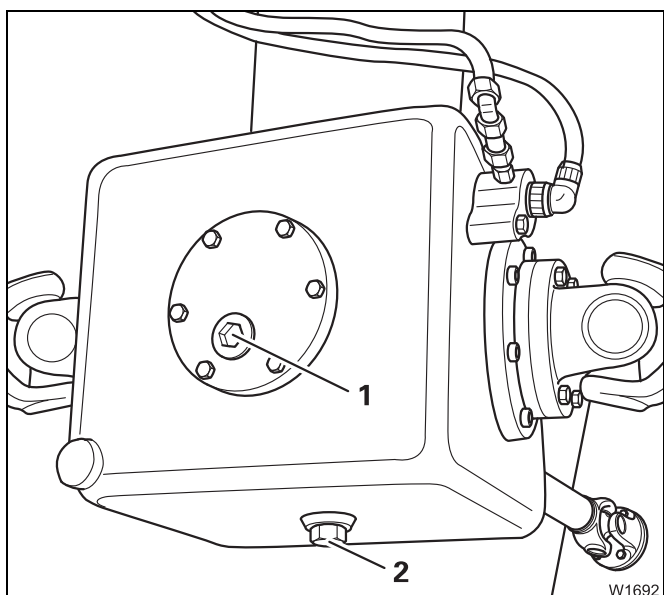
Risk of environmental damage due to leaking consumables

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.

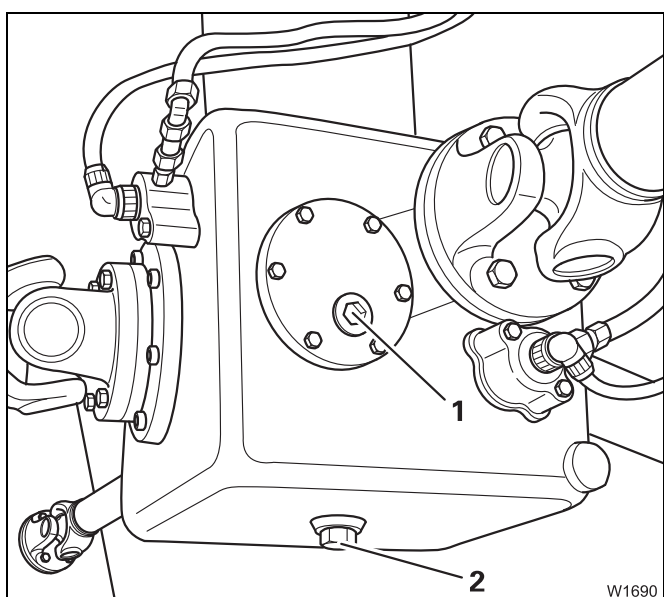
1st and 4th axle lines



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

2nd axle line

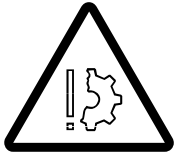
This axle centre drive is present only with the 8 x 8 x 8 drive.



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

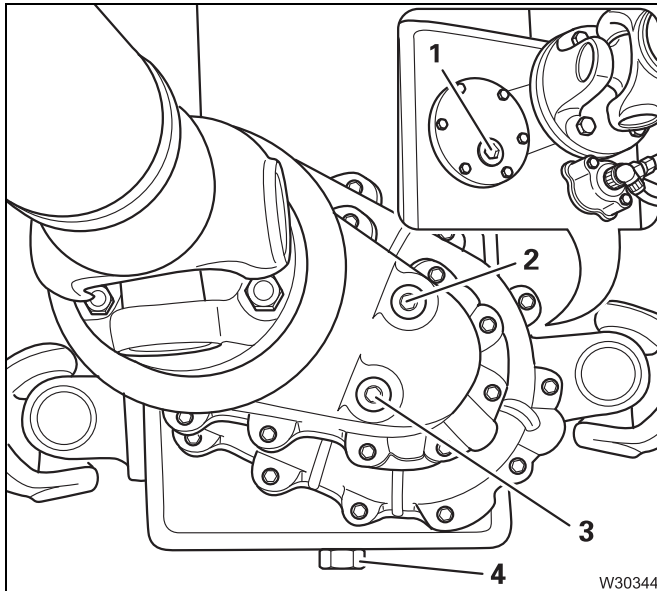
3rd axle line

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 drain plugs **(1)**, **(2)**, **(3)** and **(4)** and let the oil drain off.
- Fit new gaskets and tighten bolts **(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 bolts **(1)** and **(2)**.

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7.9.4

Final drives – Checking the oil level

M 1

Spare parts and tools

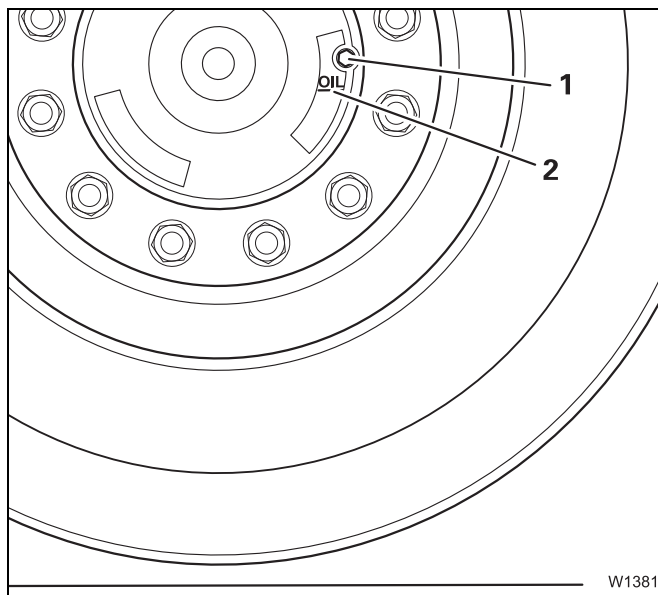
for drive	Designation	Quantity	GROVE part no.
8 x 6 x 8	Gasket 24 x 29 Cu DIN 7603	6	00117145
8 x 8 x 8 ¹⁾	Gasket 24 x 29 Cu DIN 7603	8	00117145

¹⁾ Additional equipment (2nd driven axle line)

Prerequisites

- The truck crane must be raised on outriggers and must be level.
- The engine is not running and is secured against unauthorised use;
 ▮▮▮▮▶ p. 2 - 3.
- The parking brake is 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 acc. to DIN 51502	Specifications 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, about 5 l (1.5 gal);  p. 2 - 4.

Prerequisites

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



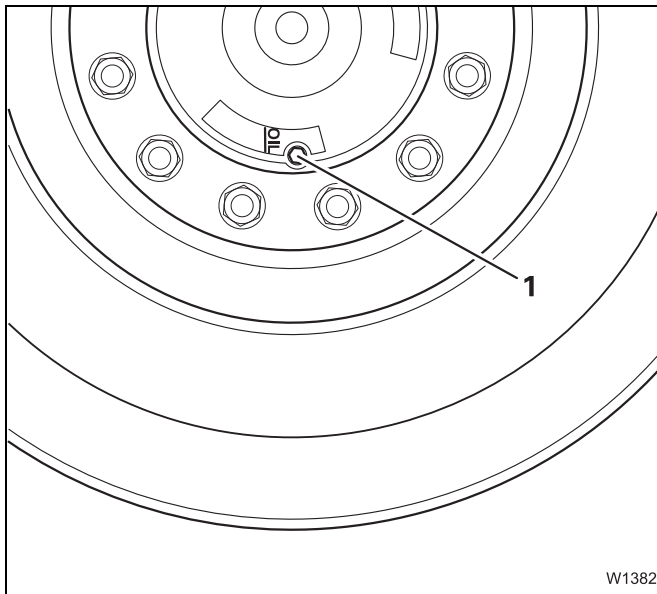
Risk of environmental damage due to leaking consumables

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

Store/dispose of consumables and any soaked equipment properly.

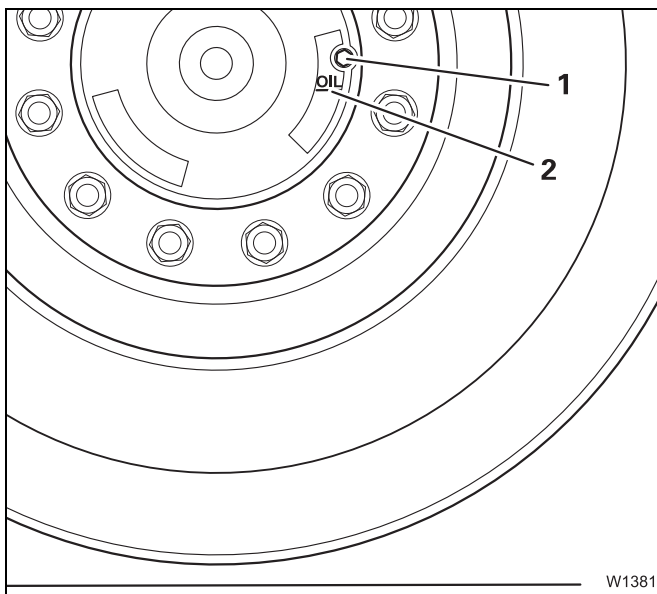
Ask about the applicable regulations.

Draining oil



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

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 screw (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

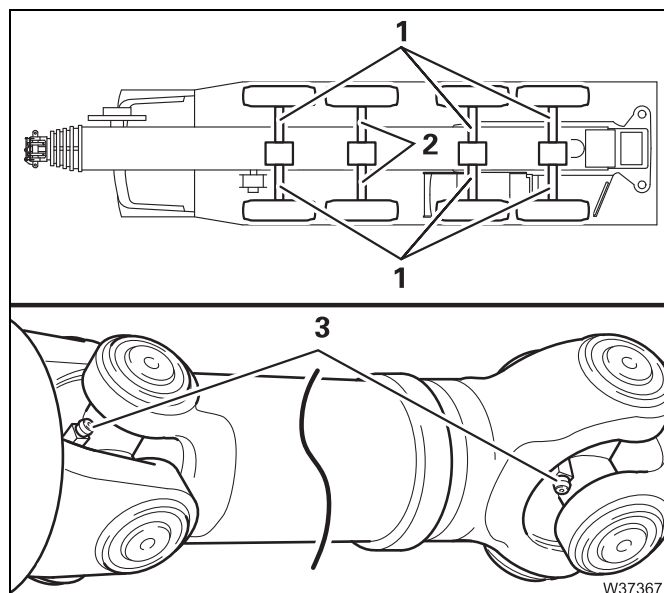
Lubricating grease	Designation acc. to DIN 51502	Specifications Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set.

Prerequisites

- The truck crane must be raised on outriggers or parked over an inspection pit.
- The engine is not running and is secured against unauthorised use; p. 2 - 3.
- The wheels must be turned as far as they will go, so that the lubricating nipples on the sides of the final drives are more easily accessible.

Lubrication



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.

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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

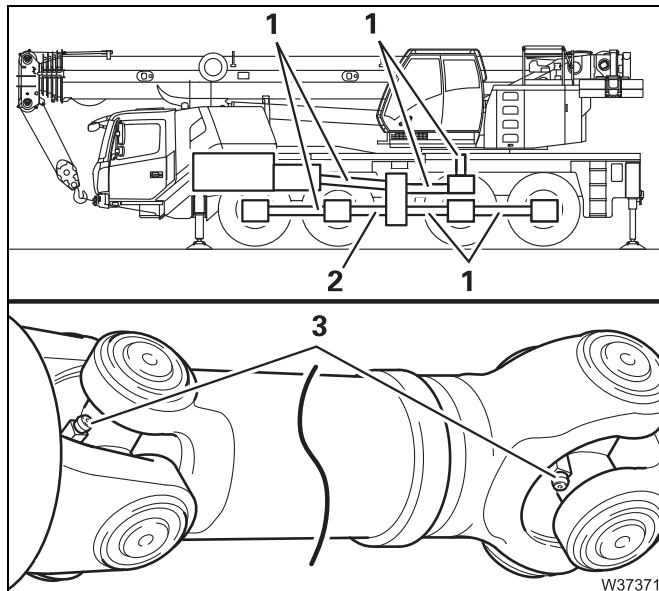
Lubricating grease	Designation acc. to DIN 51502	Specifications Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Grease gun from the tool set.

Prerequisites

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

Lubrication



- 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

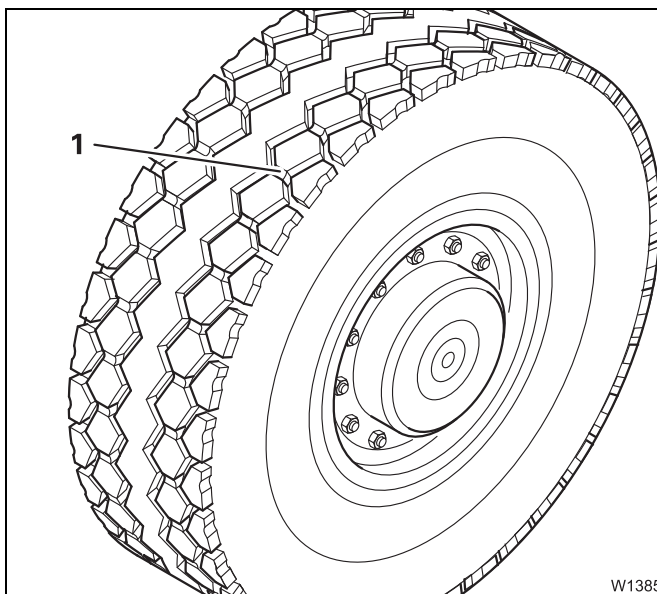
Checking the tyres for damage

D

Prerequisites

- The truck crane must be raised on outriggers.
- The engine is not running and is secured against unauthorised use;
 ▣▣▣▣ p. 2 - 3.
- The parking brake is 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 tyres of original equipment quality (dimensions, load bearing capacity, air pressure) so that the driving characteristics are maintained.

Always replace all the tyres on an axle line.

7.10.2

Checking the tyre pressure

W



Risk of damage to the tyres

The air pressure increases when the tyres become hot during driving. 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 25 385/95 R25	9,0 (131)
16.00 R 25 445/95 R25	9,0 (131)
20.50 R 25 525/80 R 25	7,0 (102)

7.10.3

Checking that the wheel nuts are tight

M 1

Spare parts and tools

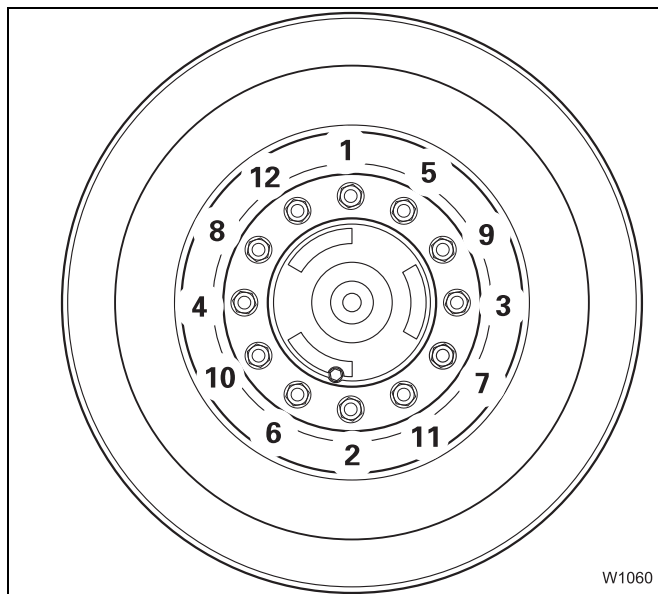
Designation	Quantity per wheel	GROVE part no.
Wheel nut with pressure plate for steel rims	12	01207756
Wheel nut with pressure plate for aluminium rims	12	7659100000

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

Prerequisites

– The engine is not running and is 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 is not running and is secured against unauthorised use;  p. 2 - 3.

Changing the wheels



Risk of accidents if procedure is incorrect

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


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

- Remove the wheels from the axles.

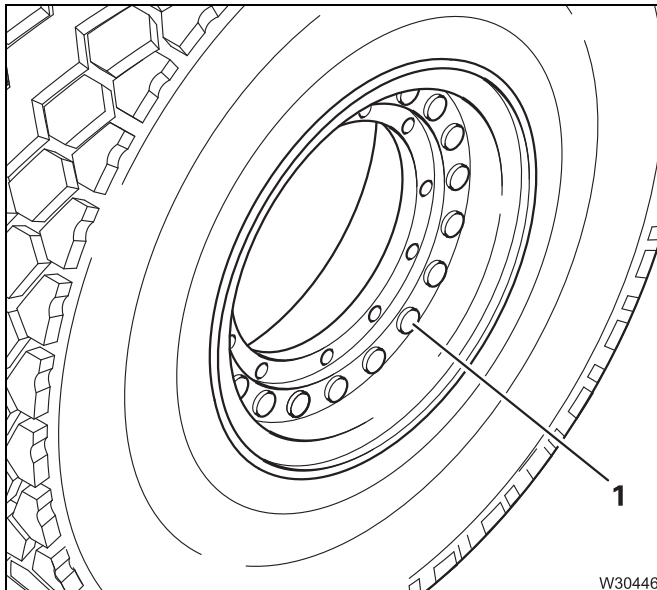
Only for two-piece aluminium rims

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

Depending on the manufacturer, there are 20 or 22 bolts visible on the outer face of the wheel rim. On the inner face of the wheel rim there are 20 or 22 nuts and the torque of these must be checked in a specialist workshop;

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

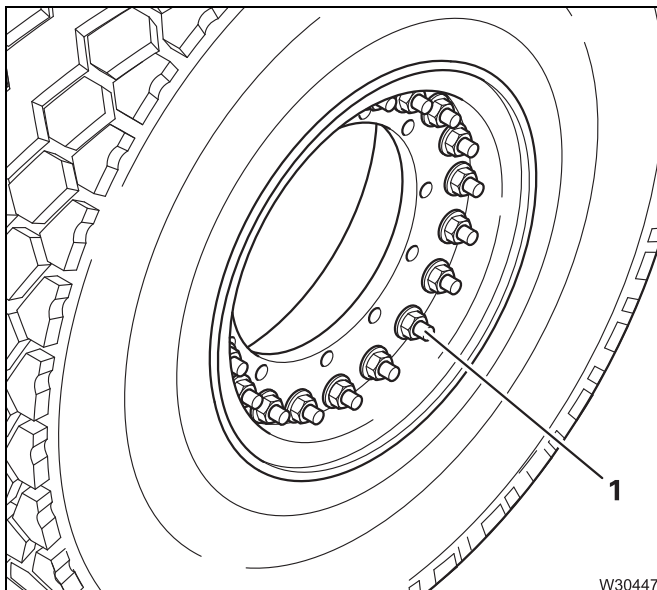
Recognising two-piece aluminium rims



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

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

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



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

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


Aluminium rims with 20 nuts:

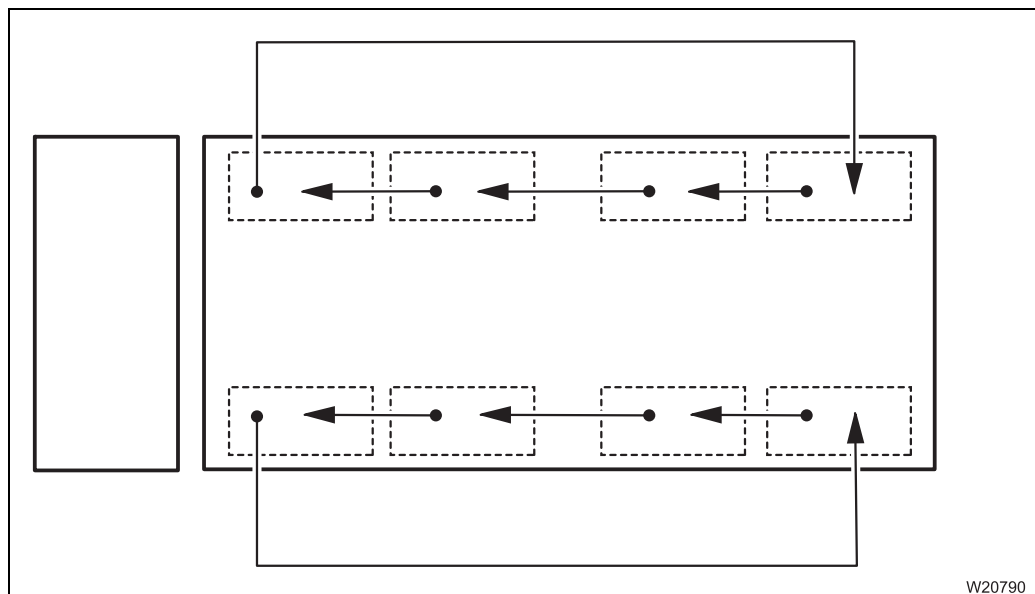
550 Nm (406 lbf ft)

Aluminium rims with 22 nuts:

385 Nm (284 lbf ft)



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



Optimised wheel change

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



Risk of accidents if procedure is incorrect

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.

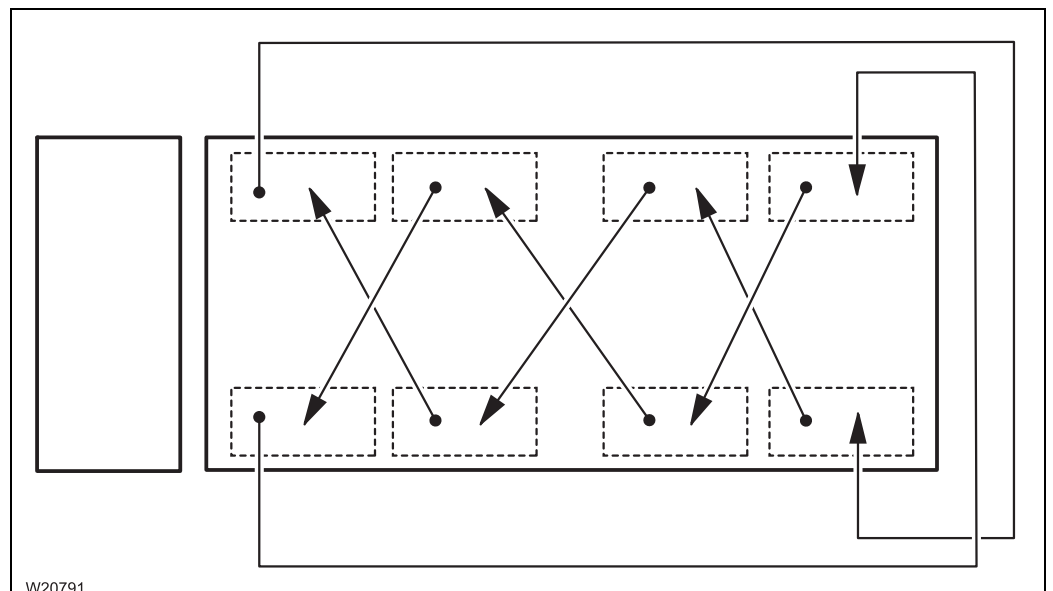


Risk of tyre damage caused by the tyres running in a different direction

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 brake lining thickness


M 3

Spare parts and tools

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

- Measuring tool for brake linings.

Prerequisites

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

Safety instructions



Risk of accidents due to incorrect work on the vehicle brakes

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

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

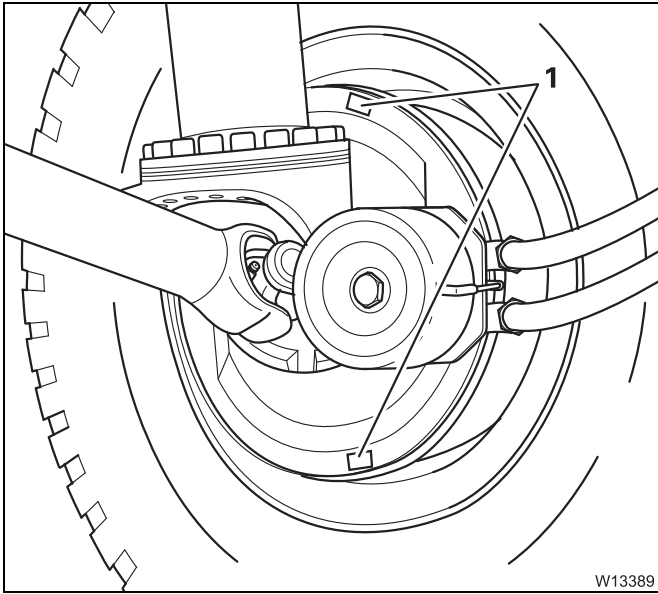
All repair work on the vehicle brakes may only be performed by **Manitowoc Crane Care** or an authorised GROVE dealer or an authorised specialist workshop with specially trained repair crew.

- Perform **only maintenance work**;  *Checking*, p. 7 - 76.



Checking

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



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

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

- Have the brake lining replaced; ▣▣▣▣▣ *Having it repaired*, p. 7 - 76.
- Close the openings using the covers.

Having it repaired

- **Do not perform repair work** on the vehicle brakes; ▣▣▣▣▣ *Safety instructions*, p. 7 - 75.
- 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 - 75.



Risk of accidents due to uneven braking

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

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

Allow the brakes to run in

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



Risk of damage to the brakes when running them in

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

The brakes must only be run in through periodic braking.

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

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

7.12 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).

Designation	Quantity	GROVE part no.
Filter	1	03324588

Prerequisites

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

Checking the oil level



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.

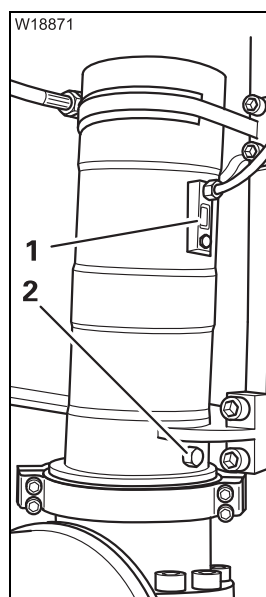
Notify **Manitowoc Crane Care** or an authorised GROVE dealer.



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.



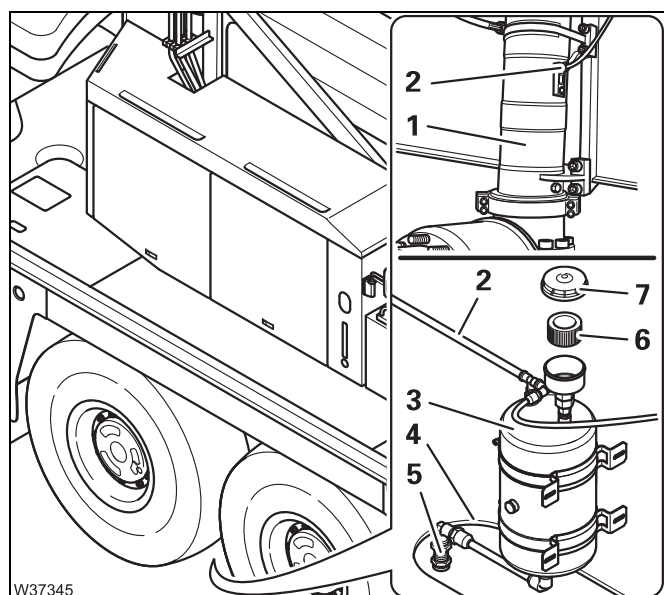


- Check whether oil is visible in the centre of the sight glass (1) on each suspension strut.

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



All suspension struts (1) are connected to the oil collection tank (3) by its bleed hose (2). The oil collection tank (3) is accessible from below through the opening (4).

- Place an oil collection container under the oil drain plug (5).
 - Open the drain plug (5) and allow the oil to drain; normally this is a very small quantity.
 - If there has been a large quantity of oil collected, then one or more suspension struts are defective.
 - Close the drain plug (5).
- Remove the cap (7).
 - Change the filter (6) if necessary and fasten the cover.
- 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

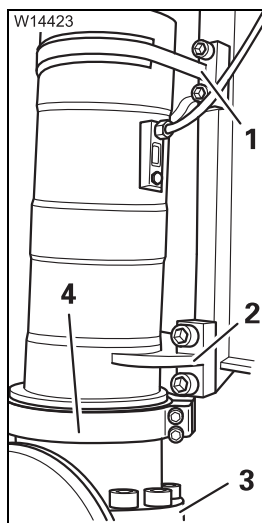
M 1


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 manual*.
- The engine is not running and is 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

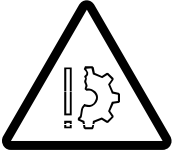
M 3

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

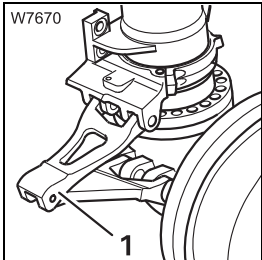
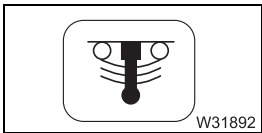
When the suspension is switched on, the wheels drop down suddenly. Ensure that nobody is in close proximity to the wheels when you switch on the suspension.



Risk of damage to the tyres

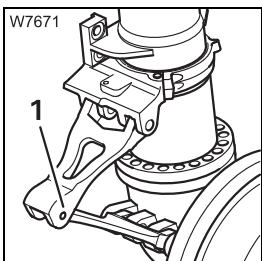
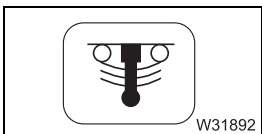
Remove sharp-edged or pointed objects from below the wheels before switching on the suspension. In this way you prevent the tyres from bursting or being damaged when the wheels come down.

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



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

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



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

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

- 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

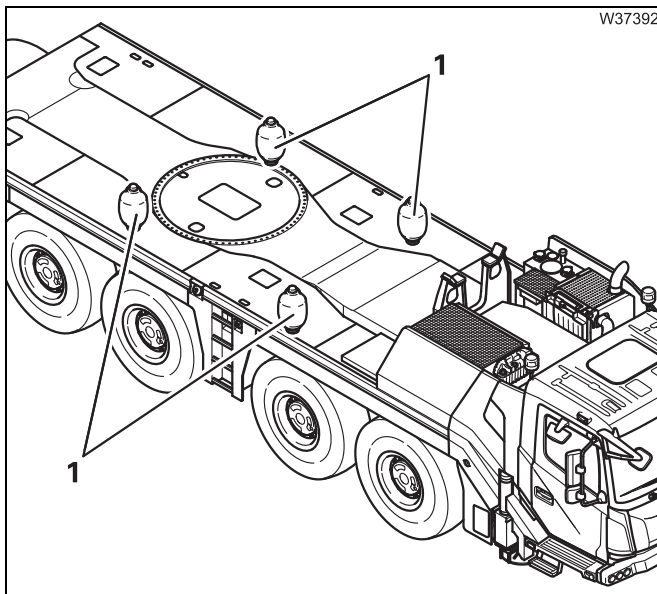
M 12

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



Risk of accidents due to incorrect inspection

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



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

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

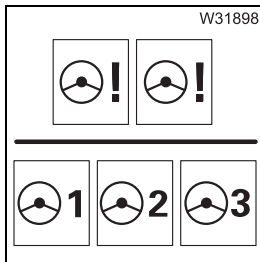
Steering

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 manual*.
- Start the engine and observe 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 malfunction in the steering system; *Operating manual*.
- 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 - 83.

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 - 84.



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.

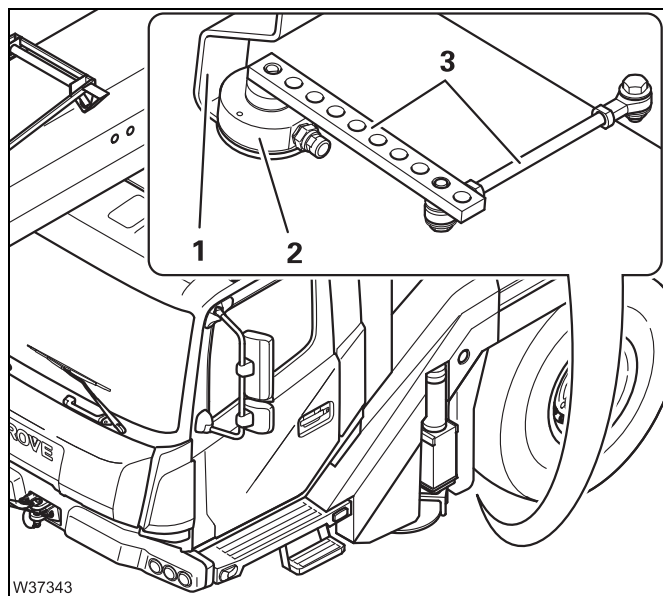


7.13.2 Checking the angle sensors

Prerequisites

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

Checking

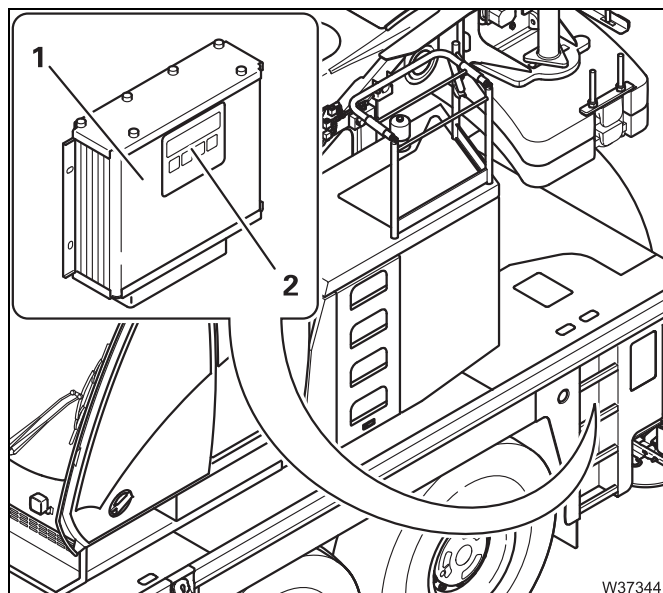


Angle sensor

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;  *Check the oil level*, p. 7 - 91.

After changing pipes and hose lines

- Bleed the hydraulic system;  *Bleeding the hydraulic system*, p. 7 - 105.

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

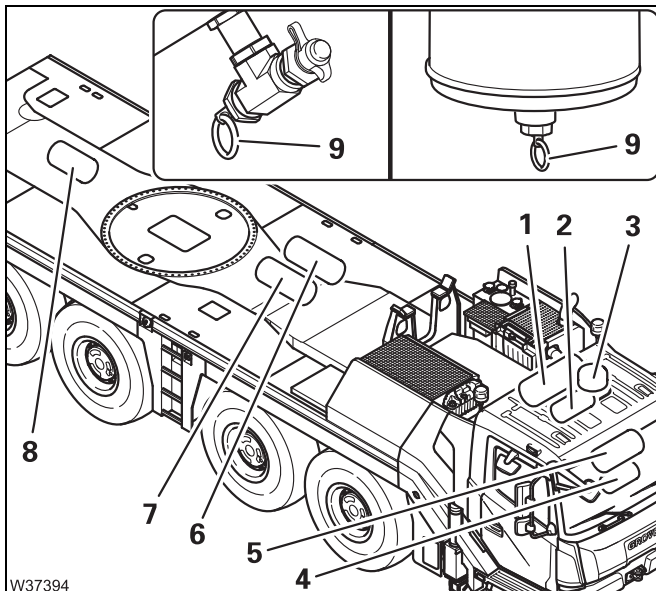
Spare parts and tools

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

Prerequisites

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

Draining water from the compressed air system



- Actuate the valves (9) on the air reservoirs (1) to (8).

If a great deal of water escapes

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

7.14.2

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 is not running and is secured against unauthorised use;
 ▶▶▶ p. 2 - 3.

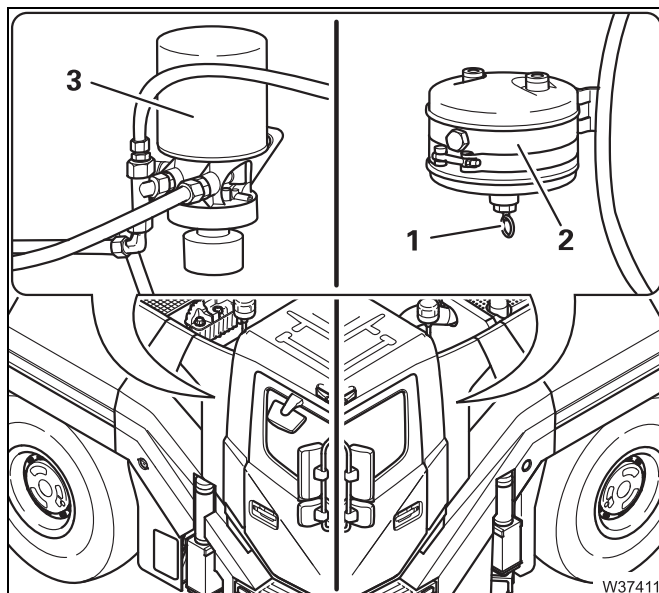
Changing the filter cartridge



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.



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

Check the oil level

D

Prerequisites

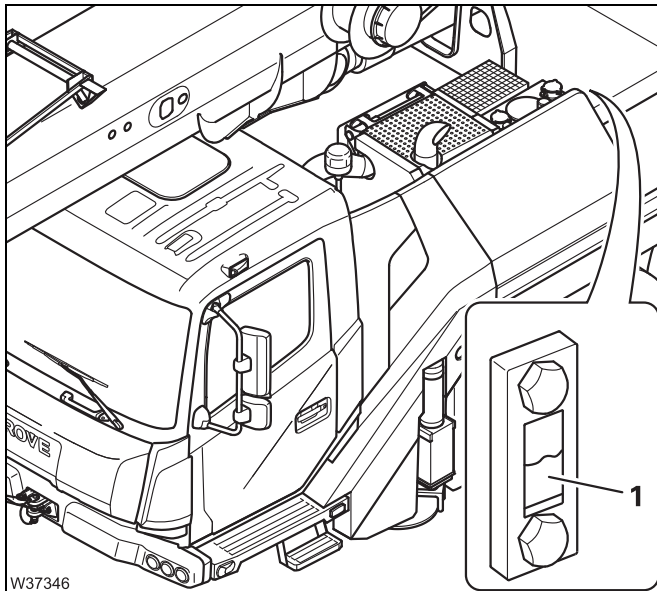
- The truck crane is aligned horizontally at on-road level; *Operating manual*.
- The outriggers must be retracted; *Operating manual*.
- The engine is not running and is secured against unauthorised use; p. 2 - 3.



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 with oil; p. 7 - 103.

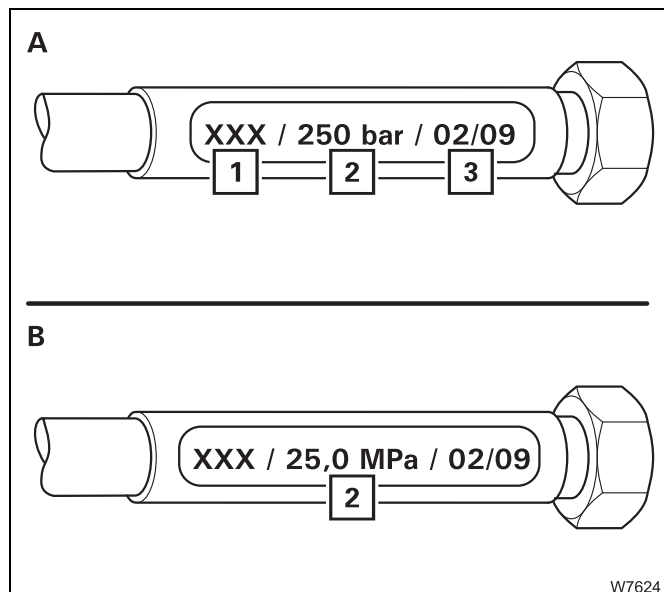
7.15.2

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:

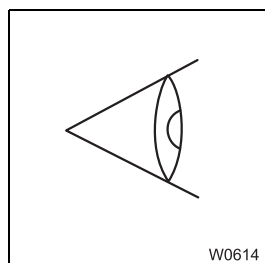
- 1 Manufacturer designation
- 2 Maximum operation pressure and unit of measurement (**A**) (e.g. 250 bar (3,626 psi)).
Maximum operating pressure and unit of measurement (**B**) (e.g. 25.0 MPa (3,626 psi)).
- 3 Month and year of manufacture.



- 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;  *Check the oil level, p. 7 - 91.*



Risk of accidents from hydraulic oil spraying out

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



Risk of environmental damage due to leaking consumables

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

After parts have been changed

- Bleed the carrier's hydraulic system; *Bleeding the hydraulic system*, p. 7 - 105.

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

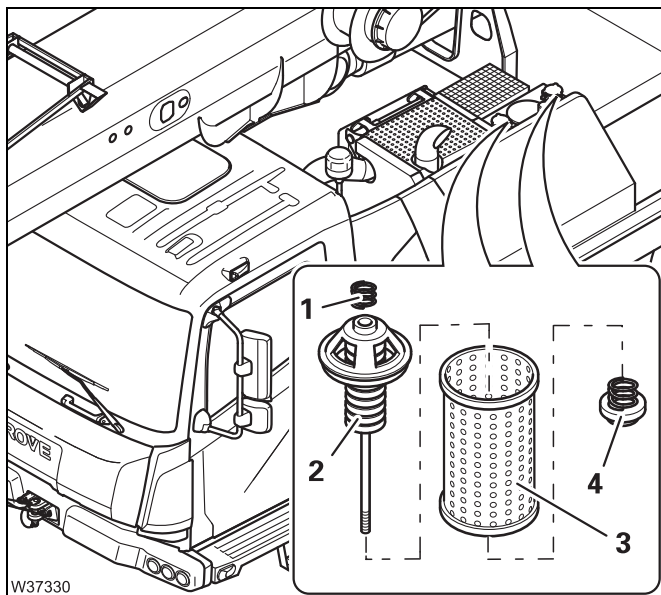
- Receptacle, about 5 l (1.5 gal); p. 2 - 4.

Prerequisites

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



Cleaning the magnetic rods

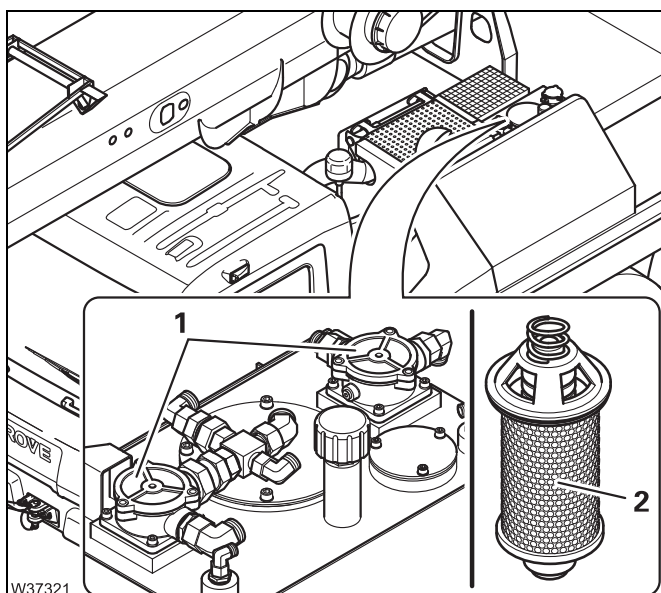


- Loosen the cover and pull out the filters.
- Place the filters in a receptacle.
- Remove the spring (1).
- Remove the nuts (4).
- Take the magnetic rod (2) out of the filter cage (3) and clean it.
- Replace any damaged parts, where necessary.



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 filter earlier than normal.

Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	01576026

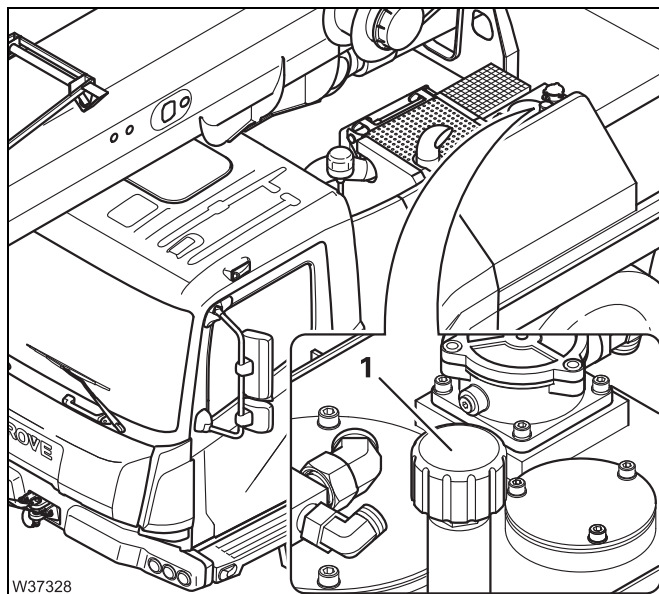
Prerequisites

- The engine is not running and is 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

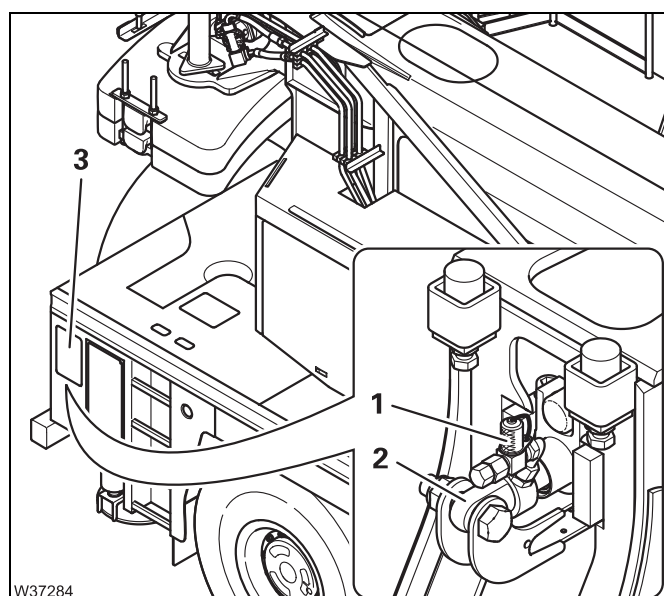
- Receptacle, about 5 l (1.5 gal);  p. 2 - 4.

Prerequisites

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

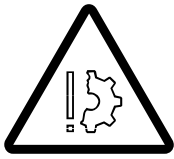
Select the sampling location

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.

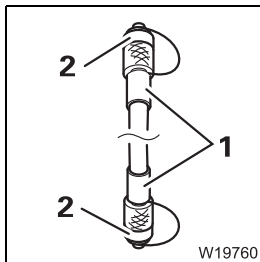
Protecting the hose from dirt



Danger of contamination of the oil sample

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

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



When storing the hose

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

Connecting the hose

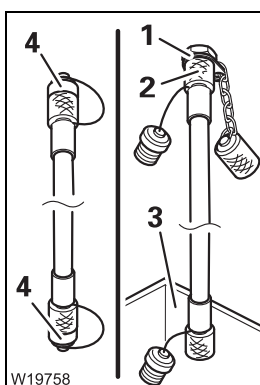


Danger due to escaping hydraulic oil

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

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

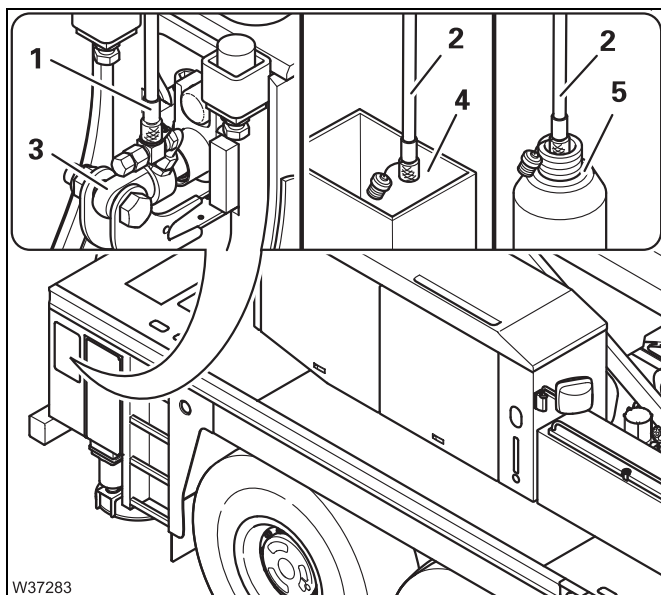
Store/dispose of consumables and any soaked equipment properly. Ask about the applicable regulations.



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



Taking oil samples

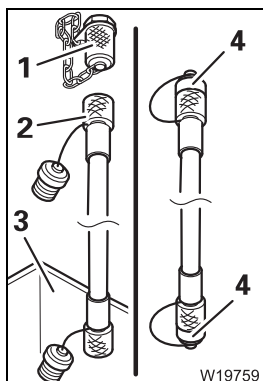


The hose end (1) is connected to the cylinder (3).

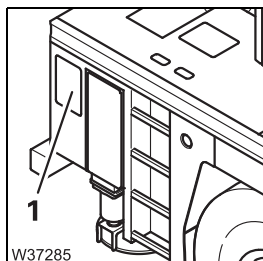
The hose end (2) is in receptacle (4).

- 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,
 - date of sample,
 - the number of operating hours since the last oil change and
 - the sampling location (e.g. gauge port on a control block).
- Have the following properties of the oil sample determined by the laboratory:
 - Viscosity
 - Viscosity index
 - Contamination
 - Water content


Determining the quality of the oil

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

Viscosity limit values

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


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

- Carry out an oil change;  p. 7 - 101.

Contamination limit value

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

If this limit value has been reached/exceeded:

- Replace the filters of the hydraulic system;  p. 7 - 106.
- 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 - 99.

Oil, spare parts, tools

Hydraulic oil in litres (gal)	Designation acc. to DIN 51502	Specifications Classification	GROVE part no.
165 (44)	HVLP	DIN 51524-3 Viscosity: ISO-VG 32	04162158 Castrol Hyspin AWH-M 32

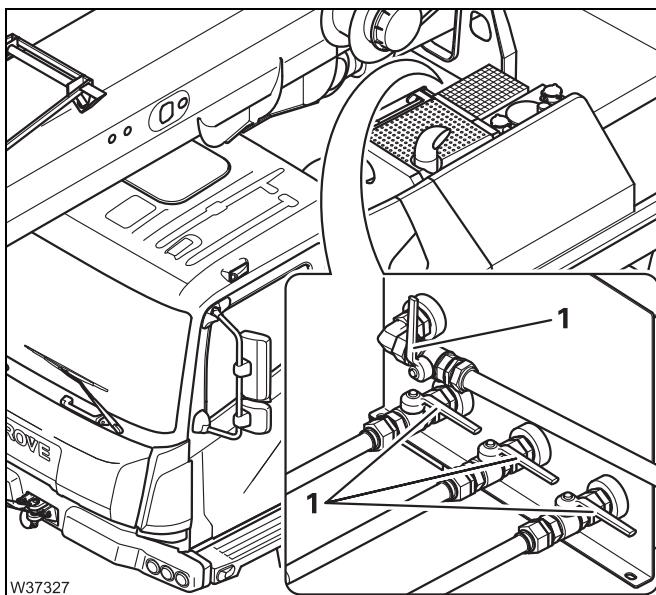
Designation	Quantity	GROVE part no.
Cover gasket 140 / 90 x 3	1	03328286

- Connecting piece and hose (toolbox).
- One or more receptacles, about 165 l (44 gal); p. 2 - 4.

Prerequisites

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

Closing the valves



- Close the valves – lever (1) at right angles to the line.
- Be sure to secure the engine against unauthorised use.





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.

Handling the valves

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



Risk of environmental damage due to leaking consumables

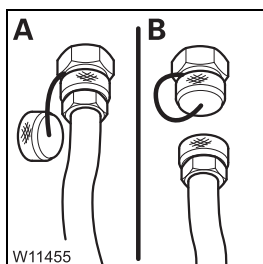
Use the supplied connecting piece and hose and a receptacle with sufficient capacity to drain the hydraulic oil.



Danger due to escaping hydraulic oil

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

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

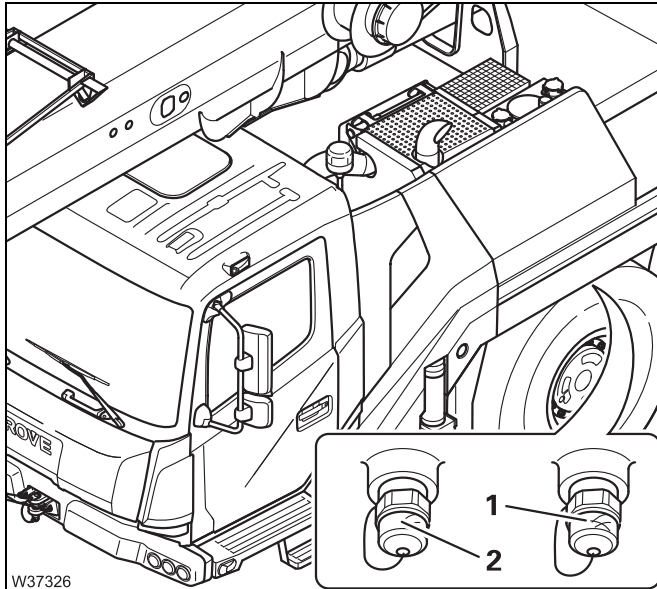


Draining oil



Risk of environmental damage due to leaking consumables

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



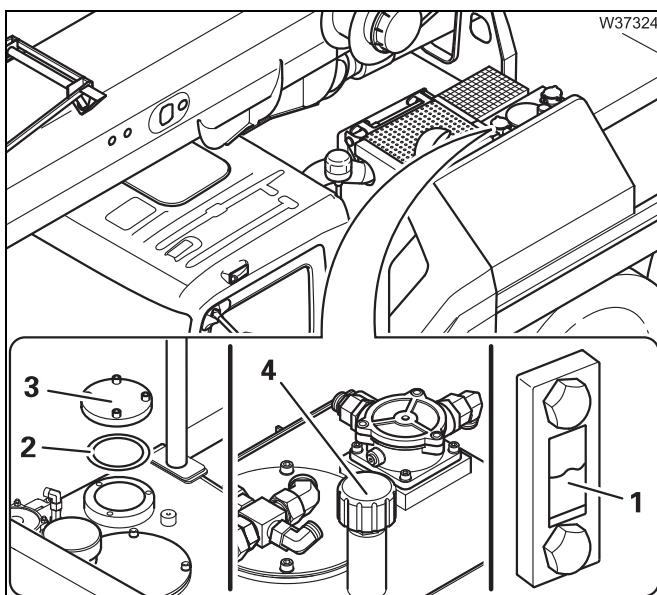
- Place a receptacle underneath the valves.
- One after the other, screw the connecting piece and hose onto the valves (1) and (2);
 ▣▣▣▣ Handling the valves, p. 7 - 102.
- Change the filters; ▣▣▣▣ p. 7 - 106.

Topping up the oil



Risk of damage to the hydraulic system

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



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

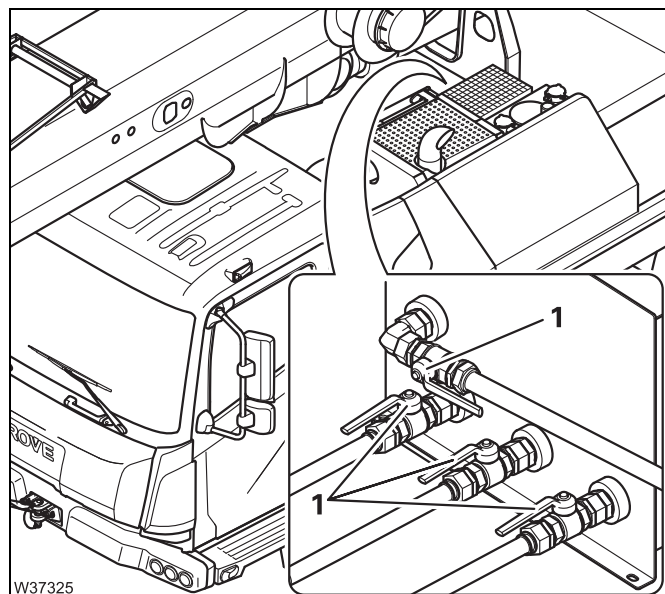
If no cap (3) is present

- 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 an operational status

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





Opening the valves

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



Risk of damage to the hydraulic pumps


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

- 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;  *Check the oil level*, p. 7 - 91.
- 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 is raised on outriggers;  *Operating manual*.
- The parking brake is engaged.



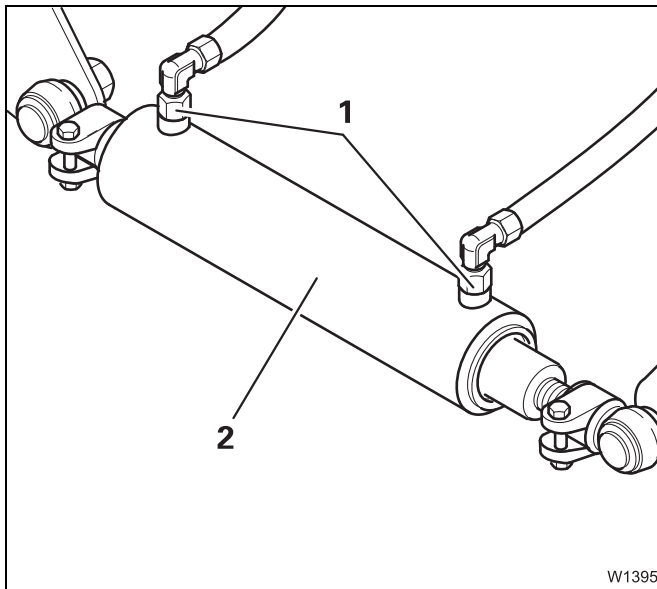
Risk of crushing from turning wheels

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



Risk of accidents from high oil pressure

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



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.

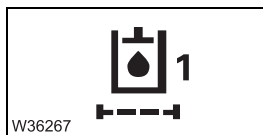
If the steering system is still not operating properly

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

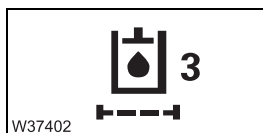
7.15.8

Changing the hydraulic oil filter

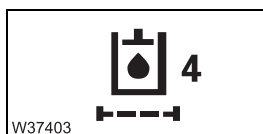
When changing the oil, all the oil filters must be replaced.



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



If a warning message appears the red symbol in the *Warning* submenu indicates that you must change oil filters 3.




If a warning message appears the red symbol in the *Warning* submenu indicates that you must change oil filters 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, about 5 l (1.5 gal);  p. 2 - 4.

Prerequisites

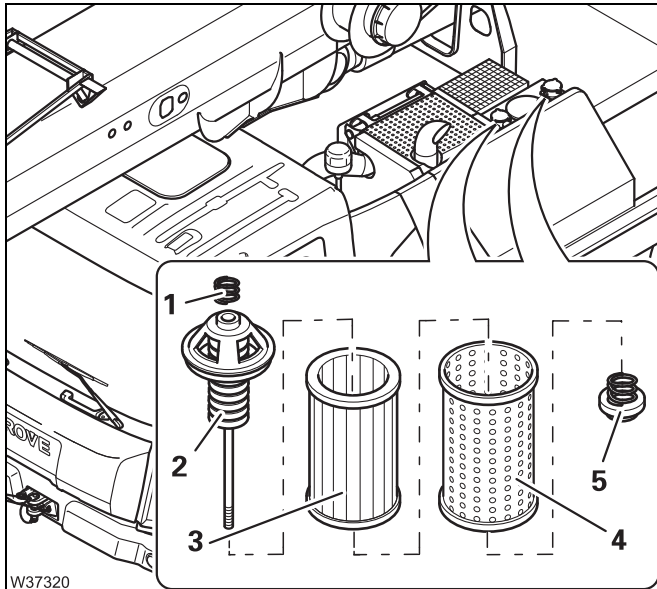
– The engine is not running and is secured against unauthorised use;
 p. 2 - 3.

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.



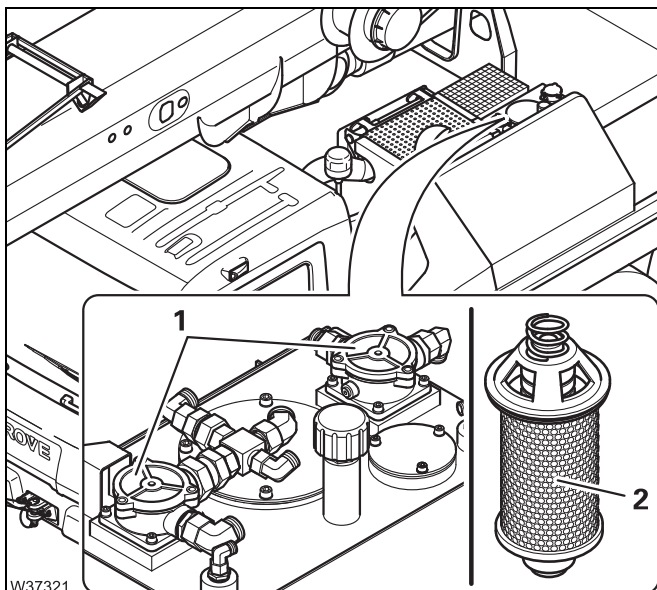
- Loosen the cover and pull out the filters.
- Place the filters in a receptacle.
- Remove the spring (1).
- Remove the nuts (5).
- Take the magnetic rod (2) and the filter (3) out of the filter cage (4).
- Clean the magnetic rod (2) and filter cage (4).
- Insert a new filter (3) into the filter cage (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.

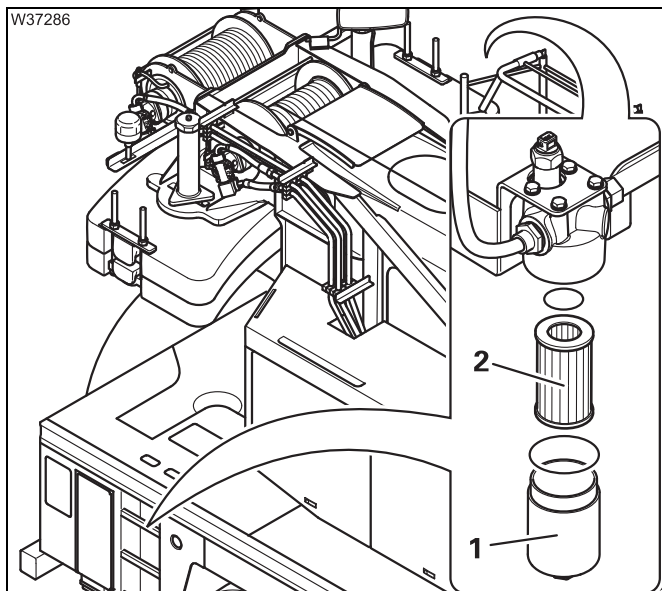


Changing filters 3 and 4



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.

7.16 Central lubrication system

7.16.1 Checking the filling level

W

Grease, spare parts, tools

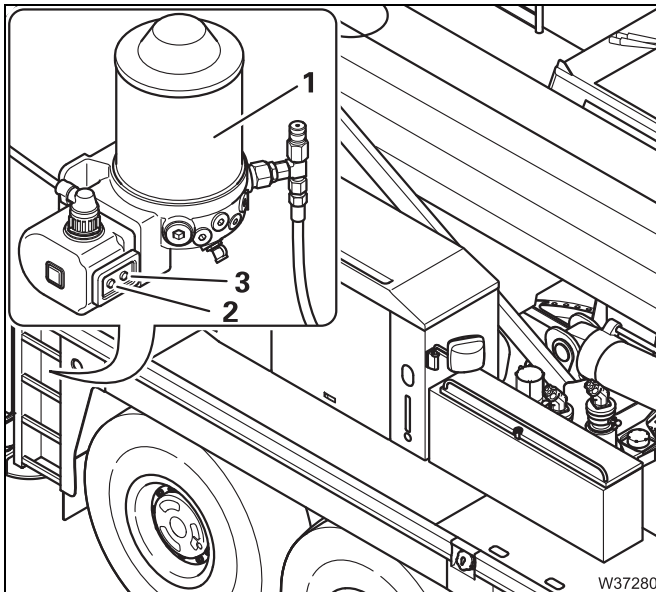
Lubricating grease	Designation acc. to DIN 51502	Specifications Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

- Filling pump from the tool set.

Prerequisites

- The parking brake is engaged.


Checking the filling 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 - 110.



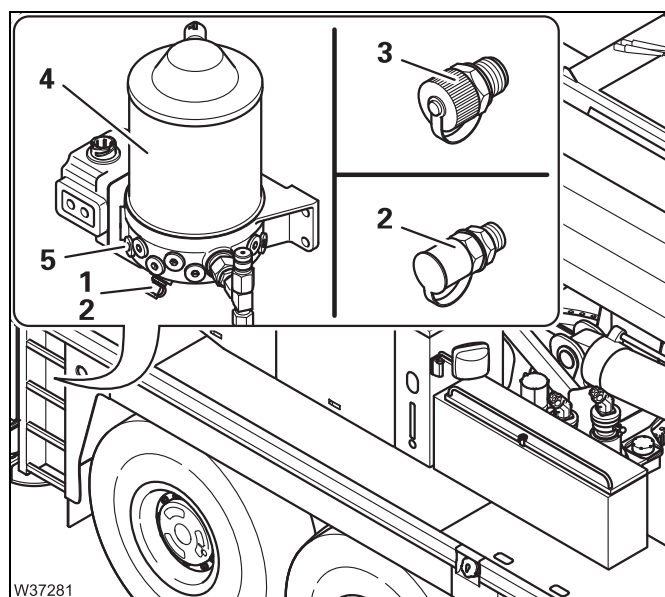
Topping up



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)

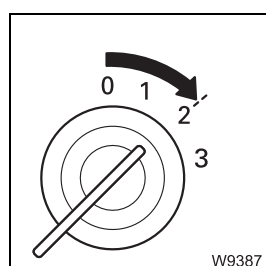
for connection of a manual grease gun.
GROVE part no. 04158709

2 Filling coupling plug (optional)

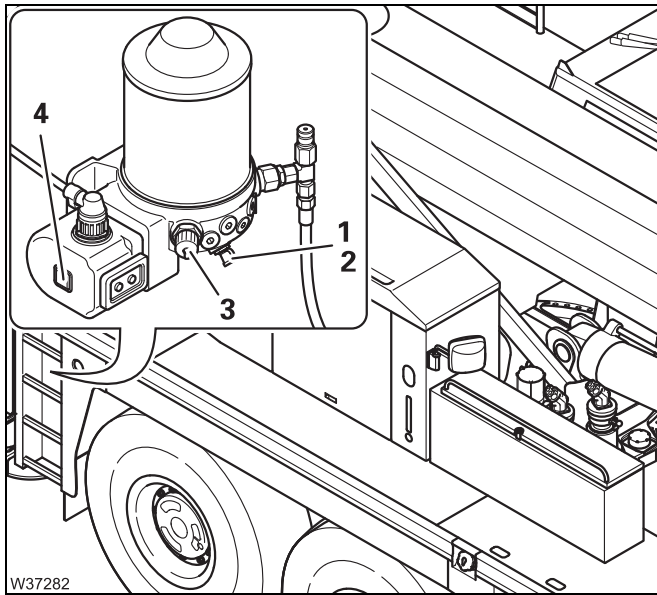
for connecting a the hose to a grease filling station with a drum.
GROVE part no. 04165389

3 Filler connection (optional)

for the filling pump from the tool set.
To use this, the plug (5) must be removed and the filler connection (3) 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.

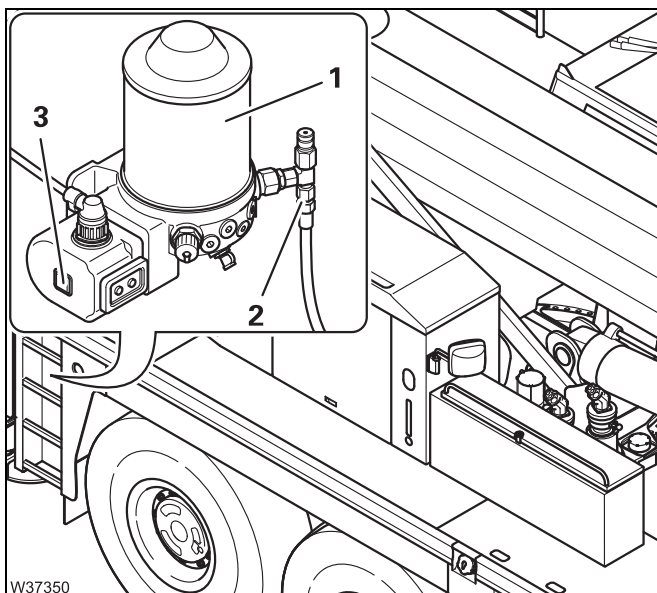
Intermediate lubrication will be triggered.

- 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.

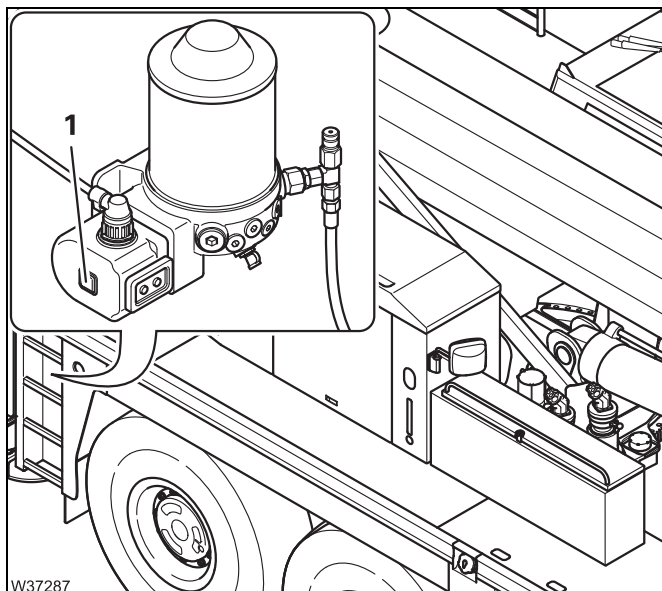
- Loosen the lubricating pipe at the connection (2).
- Switch on the ignition.
- Press the button (3).
Repeat the procedure until the grease flowing from the connection (2) no longer contains any bubbles.
- Tighten the lubricating pipe at connection (2).
- Remove any grease that has escaped.

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 about two 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

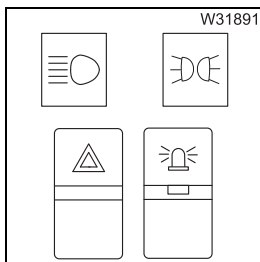
D



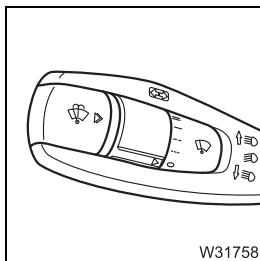
Risk of accidents in the event of faulty safety devices!

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

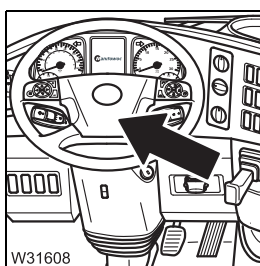
- Check the following functions every day before operating or driving the truck crane, and have faulty parts repaired:



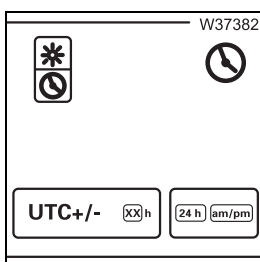
- Parking light/headlight, marker lights, rotating beacons, fog tail light, fog light, outrigger lights,
- Hazard warning system,
- Brake lights,
- Reversing lights,
- Warning buzzer,
- Reverse camera (additional equipment).



- Full-beam headlight, headlight flasher,
- Turn signal indicator
- Windscreen wipers
- Windscreen washing system



- Horn



- Date/Time on CCS display; *Operating manual*.

7.17.2

Checking the batteries

M 1



Risk of poisoning from storage batteries containing lead

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



Risk of explosion from escaping hydrogen

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



Risk of explosion from static charge

Only use antistatic cloth to clean the batteries.
This prevents the build-up of static charges which could cause hydrogen mixtures to explode.



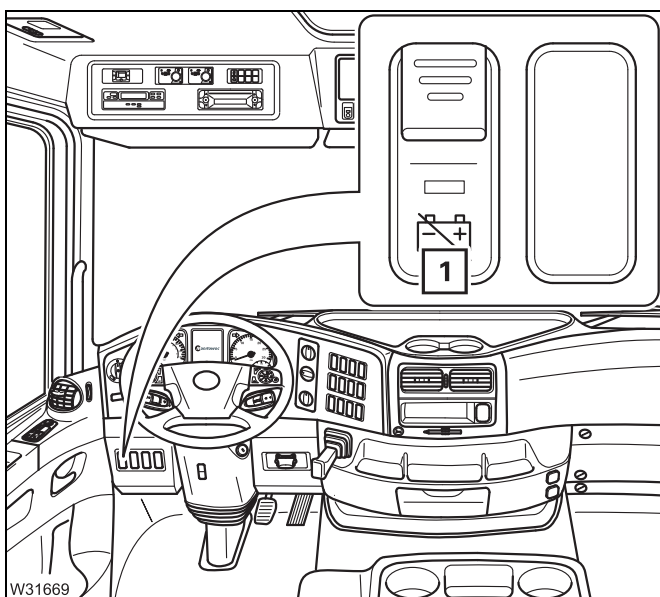
Risk of burns from battery acids

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



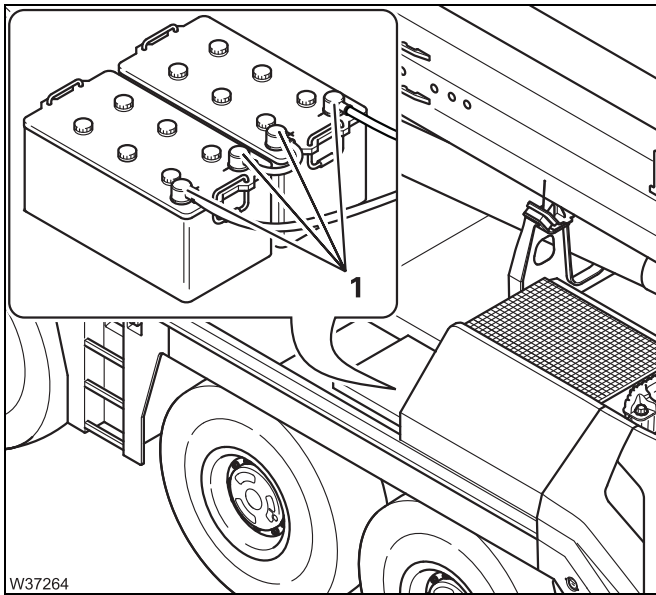
Risk of damage to the crane's electrical system

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



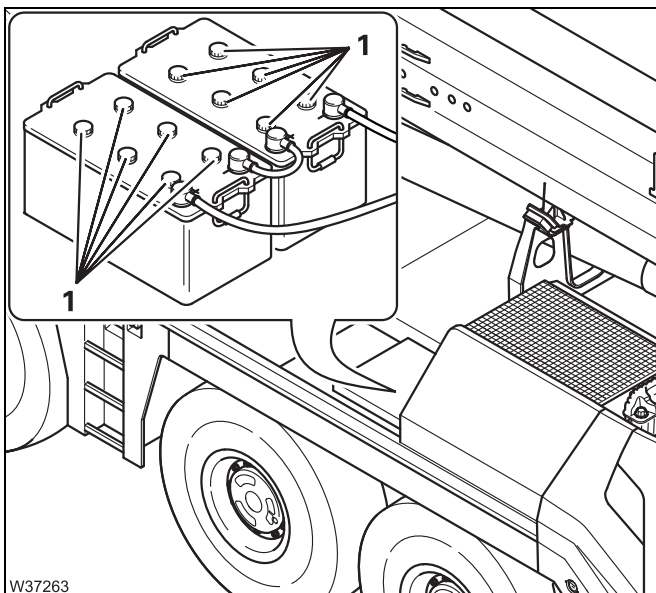
Before checking

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



Checking the connecting terminals

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



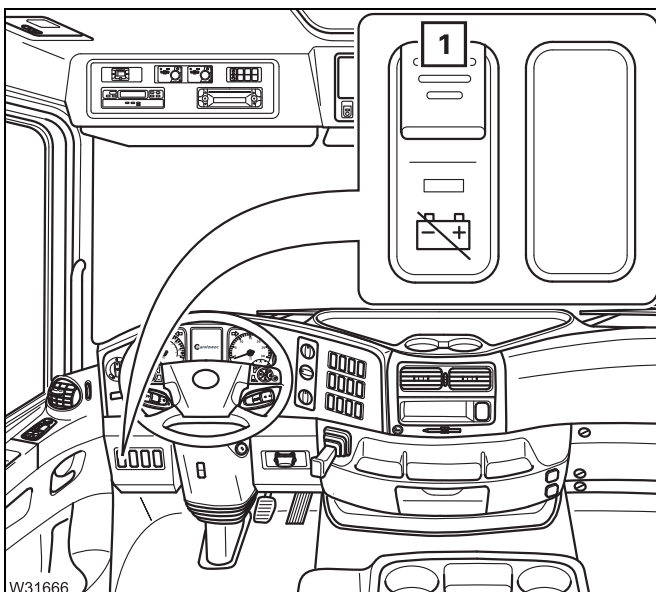
Checking the acid level

Batteries without covers (1) are maintenance-free.

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

If the acid level is too low

- Top it up using only distilled water until the plates are covered.
- Screw on all caps (1) tightly.



After checking


- Close the cover on the battery box.
- Switch on the battery master switch (1).
- Check the timers on the tachograph and the auxiliary heater; *Operating manual*.
- Enter the code for the radio; *Separate operating manual*.

7.17.3

Checking the charge level of the batteries

M 3

Spare parts and tools

- Battery charger (additional equipment);  p. 7 - 118; 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 storage batteries containing lead

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

Wash your hands after working on batteries.



Risk of explosion from escaping hydrogen

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



Risk of explosion from static charge

Only use antistatic cloth to clean the batteries.

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



Risk of burns from battery acids

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

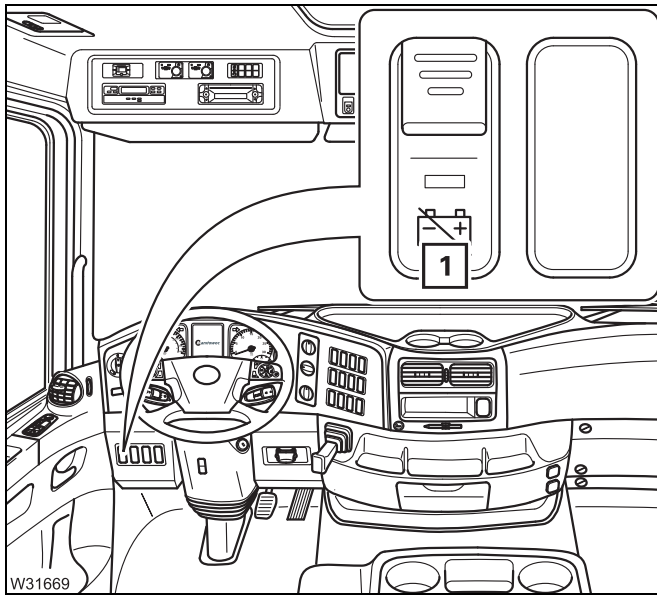
Do not tilt the battery. Rinse off or wash out any acid spray on the skin or clothing using soap suds.



Risk of damage to the crane's electrical system

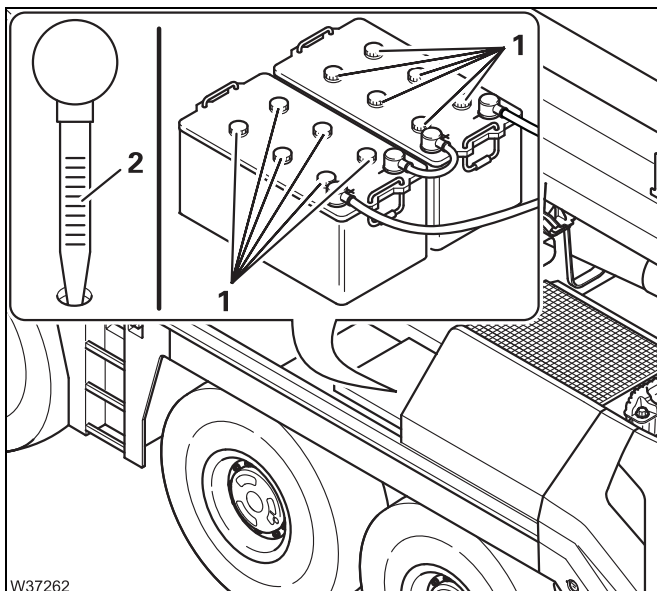
Always switch off the battery master switches before commencing work on the truck crane's electrical system.

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




Before checking

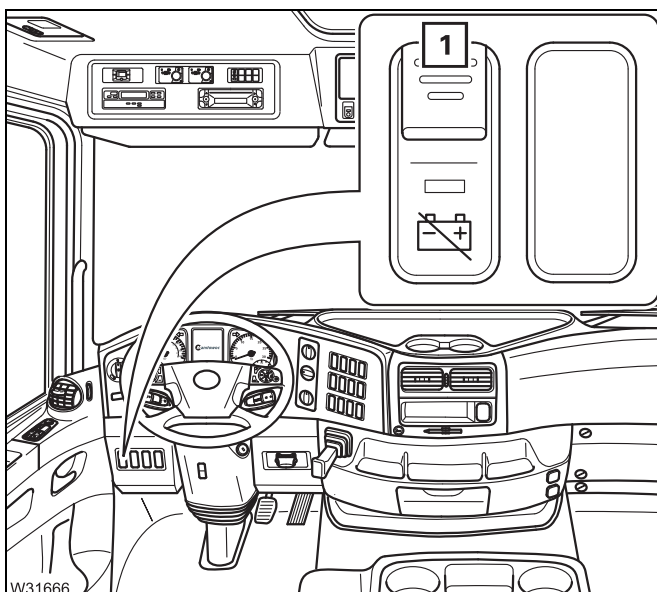
- Switch off the battery master switch (1).
- Open the cover on the battery box.





Checking the acid concentration

Batteries without covers (1) are maintenance-free.

- Remove all covers (1).
- Read off the cell value on the acid siphon (2) and compare the value with that in the table;  *Charge level table, p. 7 - 116.*
- Check all cells in the same way.
- Screw on all caps (1) tightly.



After checking

- Close the cover on the battery box.
- Switch on the battery master switch (1).
- Check the timers on the tachograph and the auxiliary heater;  *Operating manual.*
- Enter the code for the radio;  *Separate operating manual.*

7.17.4

Charging the batteries using the battery charger

M 3

Prerequisites

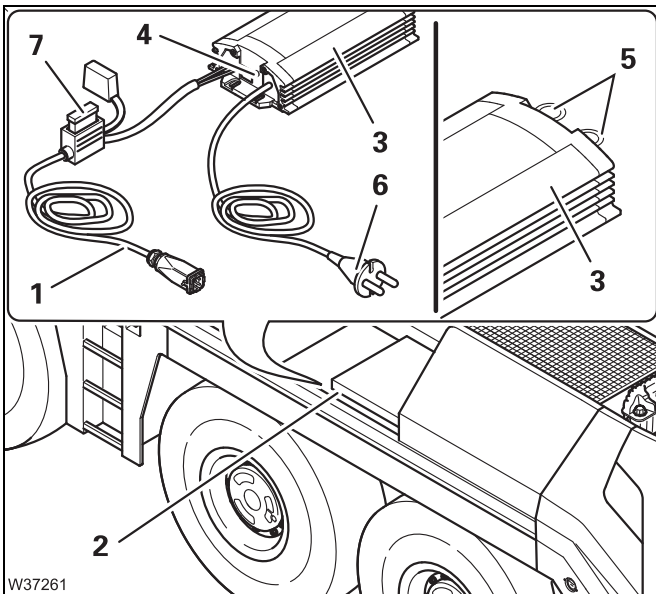
- The engine is not running and is secured against unauthorised use;
 ▮▮▮▶ p. 2 - 3.
- An external 230 V mains power supply must be available at the location.
- The battery charger (GROVE part no. 03320239; additional equipment) must be available.
- The location must be well ventilated and protected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

battery charger

- Familiarise yourself with the correct operation of the battery charger;
 ▮▮▮▶ *Separate operating manual.*

Connecting

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



- Insert the plug (1) into the socket (2) on the battery box.
- Place the battery charger (5) in a protected place where you can see the indicator lamp (3). 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.

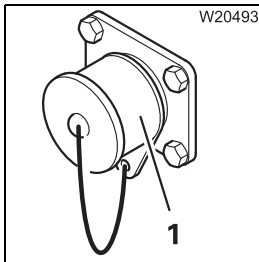
After completion of charging

- 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

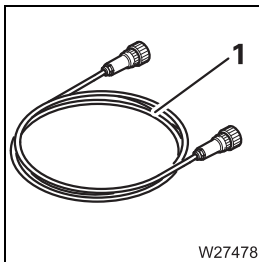
Check the external starting socket

M 3



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


Accessories



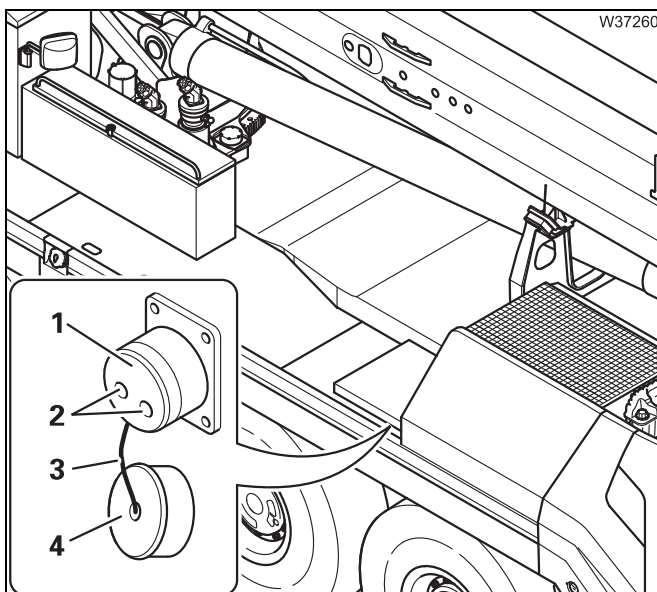
A connection cable (1) for the external starting socket is supplied with the truck crane (tool set).

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 manual*.

Check



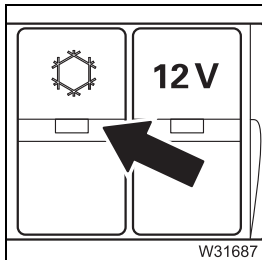
- Remove the cap (4) from the socket (1).
- Check that the cap is not damaged and is secured with the chain (3).
- If necessary, clean the poles (2).
- Attach the cap – the cap must be fitted tightly and compactly on the socket.


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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 manual*.
- Check that cooling takes place. If it does not, the air-conditioning system is defective.
- Switch the air conditioning system off.

If the air-conditioning system is defective

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

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

7.18.2 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.

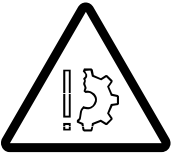
- Check all refrigerant hoses for damage and areas of wear.

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

7.18.3

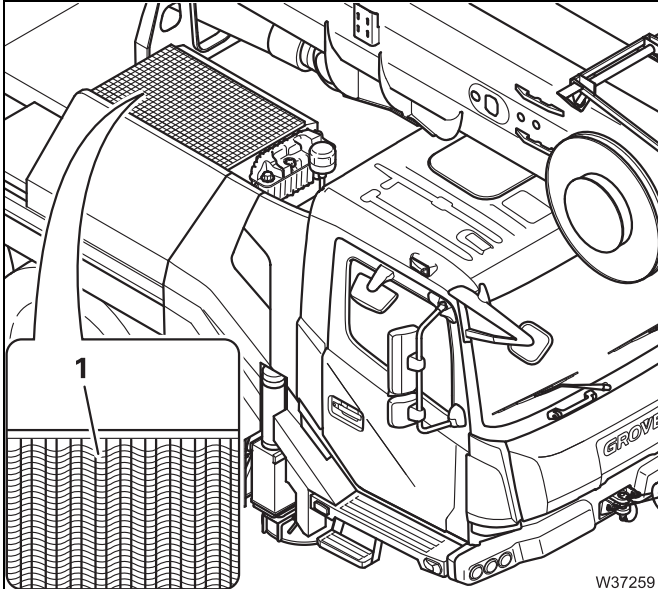
Cleaning the condenser fins


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.

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.

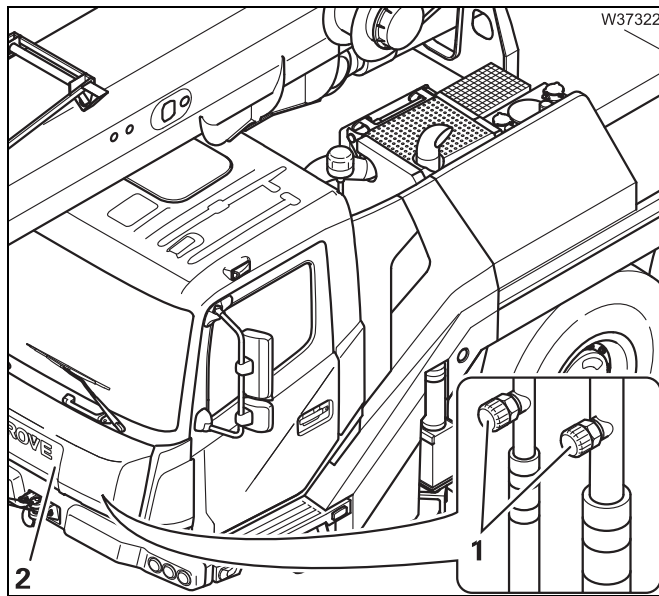
- Have the entire air conditioning system checked for leaks and proper functioning.
The inspection of the air conditioning system particularly includes the inspection of
 - the refrigerant collector, in accordance with the pressure container regulations (test group II) and
 - the refrigerant compressor.
- 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 55

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.

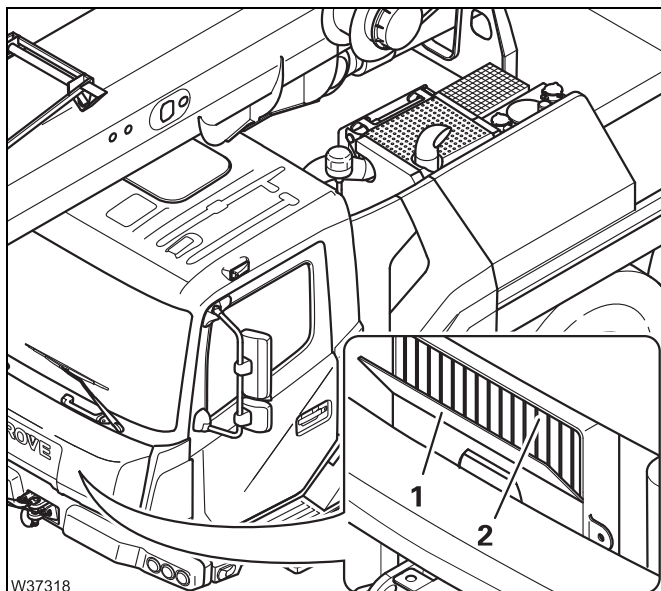
Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	03254375

Prerequisites

- The engine is not running and is secured against unauthorised use;
 ▶▶▶ p. 2 - 3.

Changing



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

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

– Grease gun from the tool set.



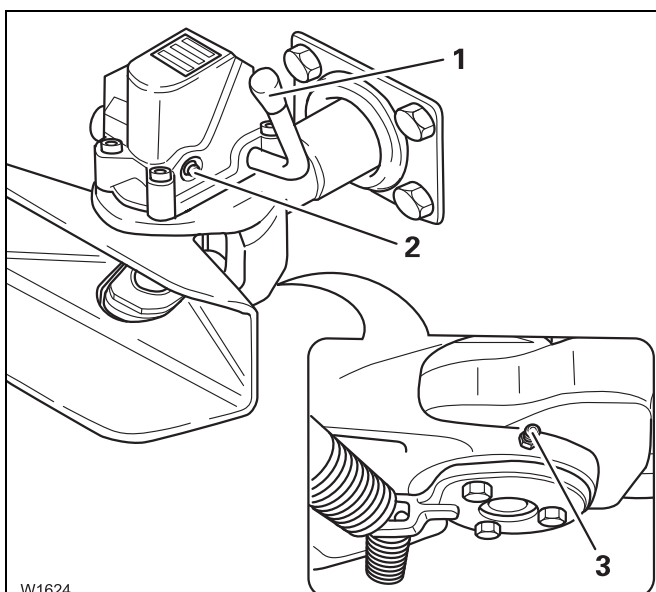
Risk of injury when the automatic closing device is triggered

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

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



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



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



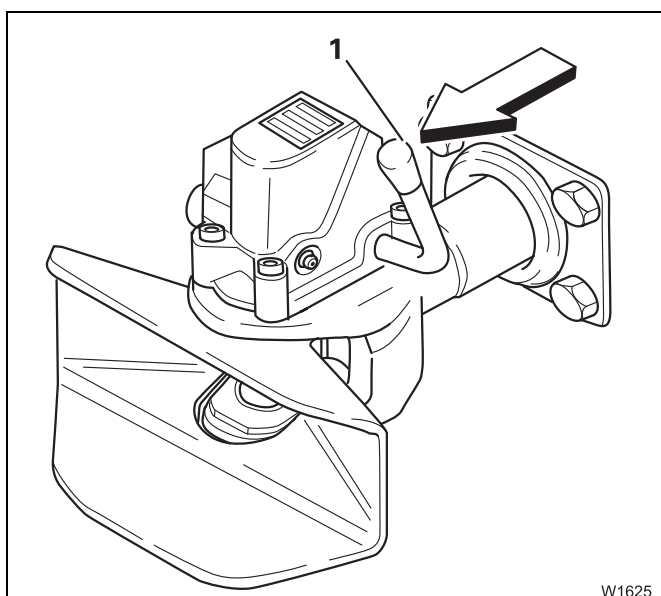
Closing the towbar coupling



Risk of injury when closing the towbar coupling by hand

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

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



After lubrication you must close the towbar coupling.

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


W1625

7.19.2

Checking the bearing

M 3

Prerequisites

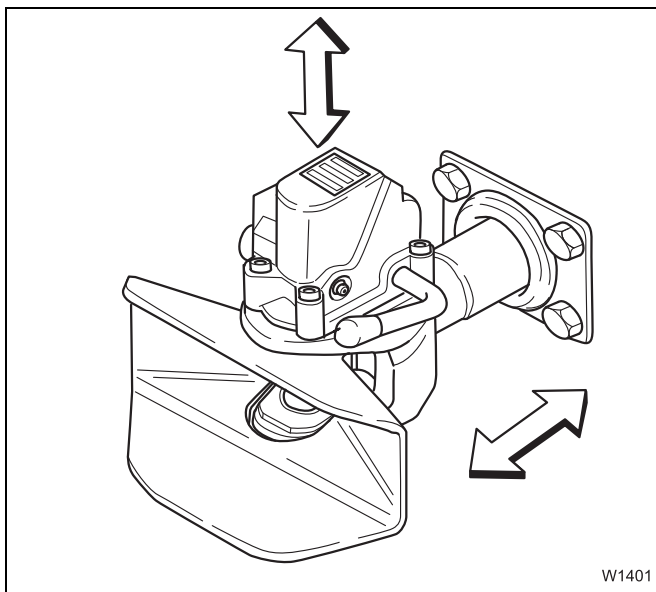
– The coupling is closed;  p. 7 - 126.

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).

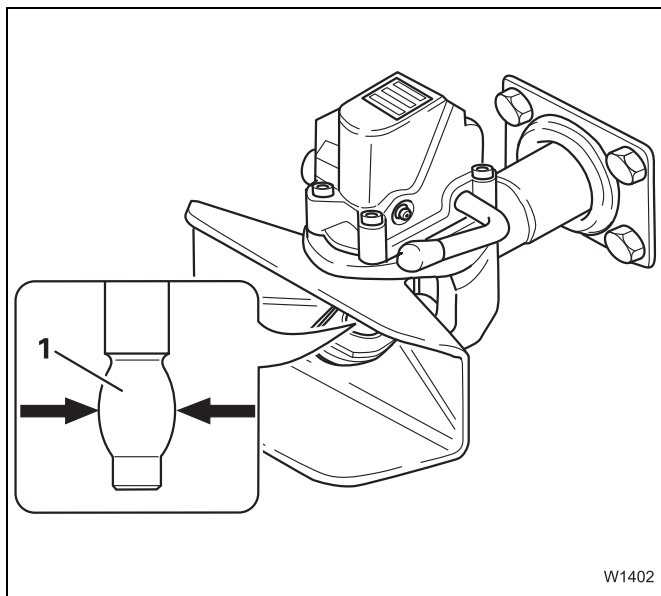
7.19.3

Checking the cotter pin

M 3

Prerequisites – The coupling is closed;  p. 7 - 126.

Checking the cotter pin

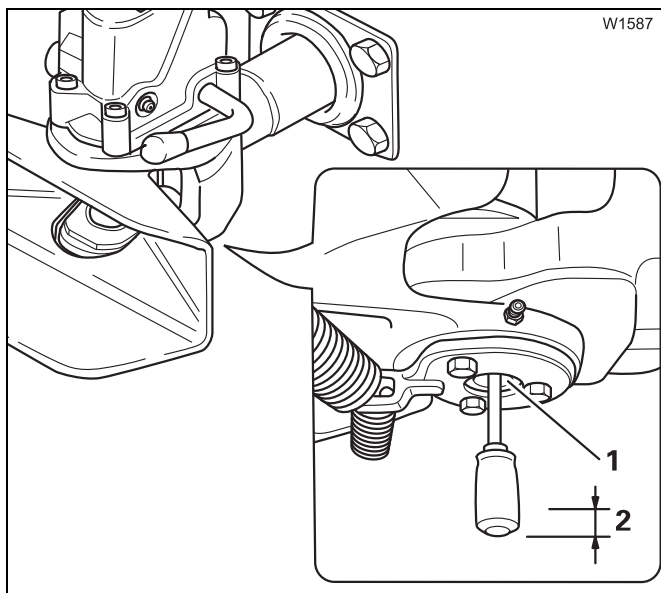


- Check the wear on the cotter pin (1). The diameter of the crowned section (arrows) must not be less than the following values:

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

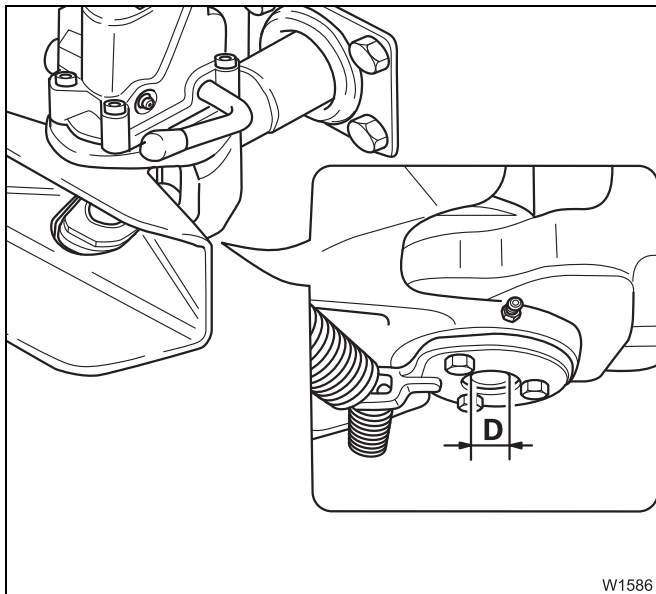
Checking the lower bushing

M 3

Prerequisites

– The coupling is closed; ■■■► p. 7 - 126.

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.

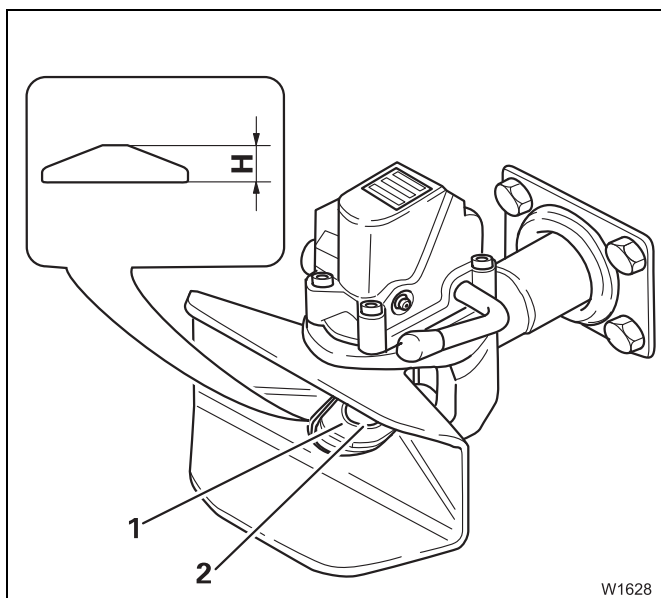
7.19.6

Checking the support ring

M 3

Prerequisites – The coupling is closed;  p. 7 - 126.

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

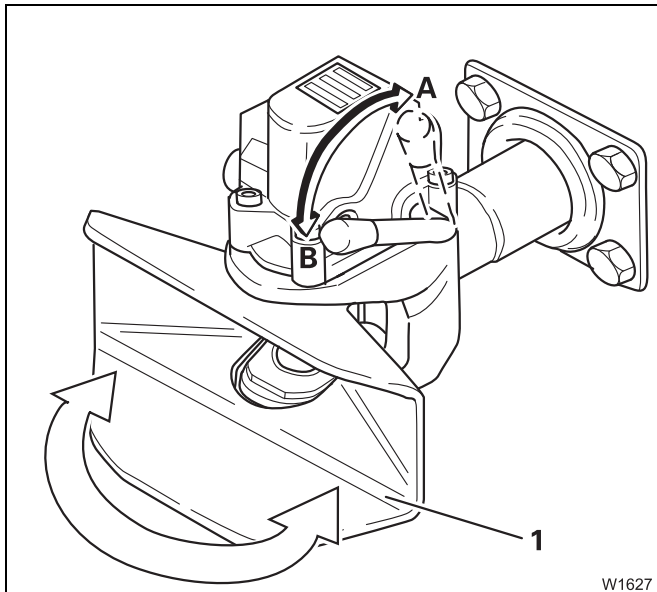
Checking the function of the coupling jaw/ resetting the middle position

M 3

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

Prerequisites – The coupling is closed;  p. 7 - 126.

Checking for correct functioning




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

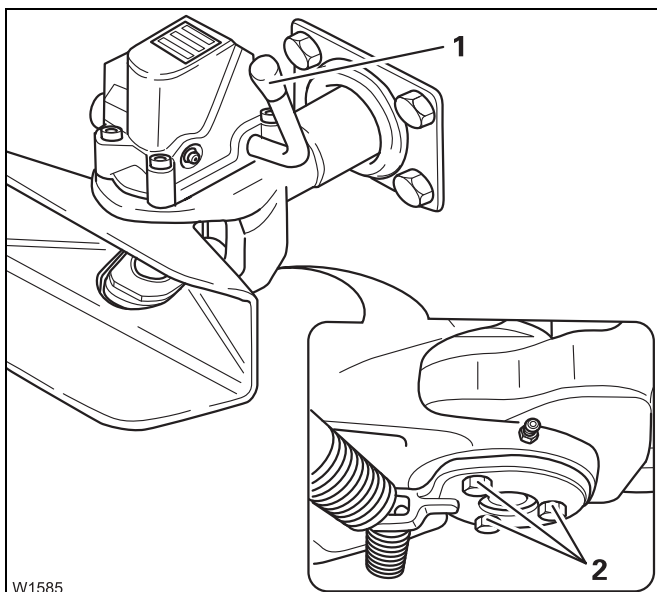
- Hold the coupling jaw (1) pressed slightly to the left or right.
- Open the coupling (position A) and let the coupling jaw go.


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 - 131.

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 function of the coupling jaw;  p. 7 - 130.

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7.20 Other maintenance work

7.20.1 Checking windscreen washing system

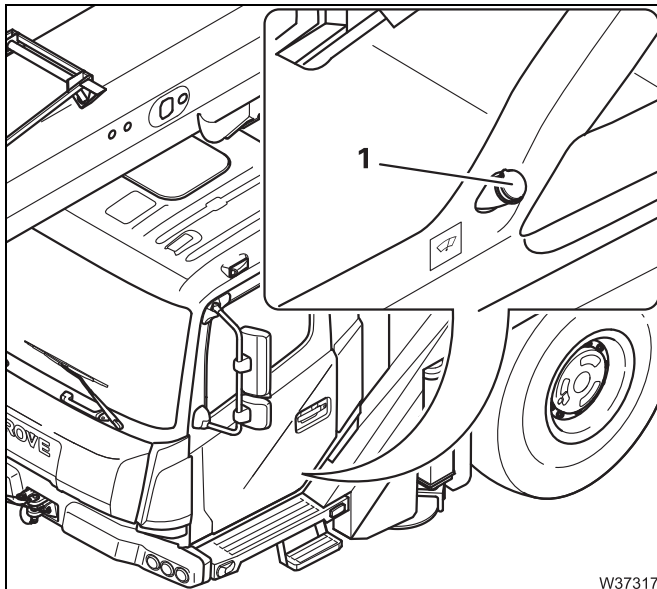
W

Water, spare parts, tool

Designation	Quantity	GROVE part no.
Wiper blades	2	04159795

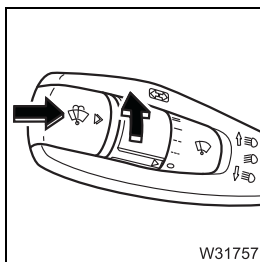
- Water; add commercially available detergent and antifreeze to it.
- A can for mixing and filling.


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 manual*.

- 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

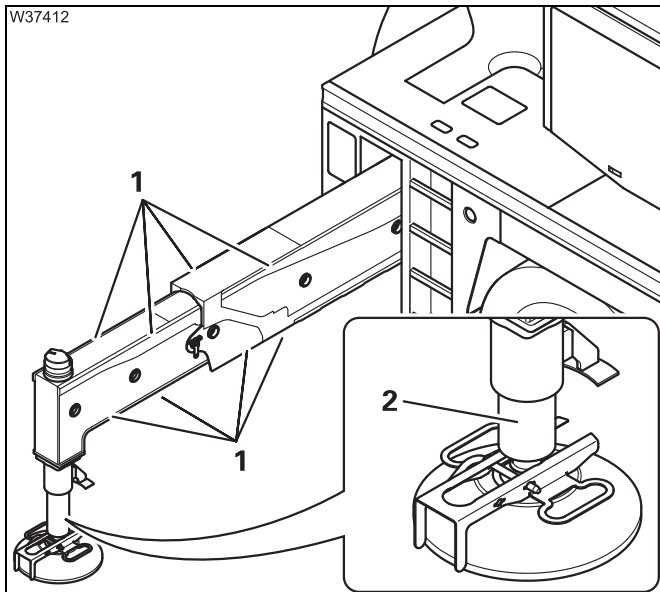
Lubricating grease	Designation acc. to DIN 51502	Specifications Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369
Spray	Spray on Berulub; 0.5 litres (spray-on)		01929824


– Brush or roller.



Danger of crushing by extending outrigger beams

Ensure that there is sufficient room around the crane. Warn any persons nearby before extending the outrigger beams. Observe the safety instructions in the operating manual.



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

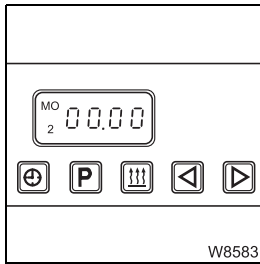
After every high-pressure cleaning of the truck crane

- Lubricate the outrigger beams.

7.20.3

Checking the auxiliary heater

M 1



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

Even during the warm summer months, run the auxiliary heater for 20 to 30 minutes; *Operating manual*.

- 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

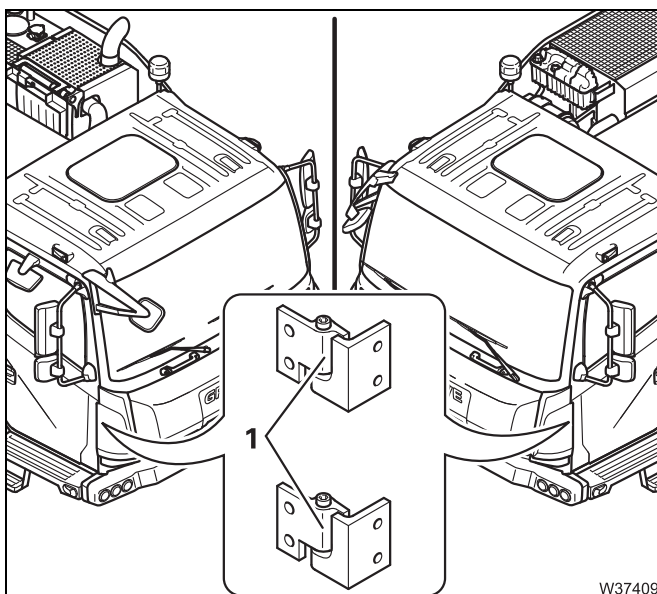
M 12

Grease, tools

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

– Brush.

Lubrication



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

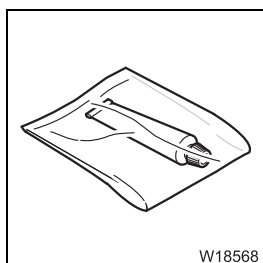
- Brush.

Check

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

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

Lubrication



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

7.20.6

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

Check

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.

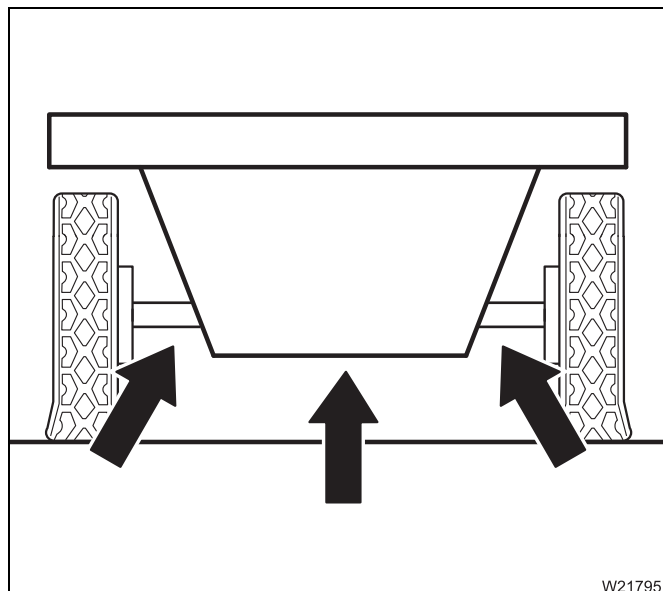


Spraying



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

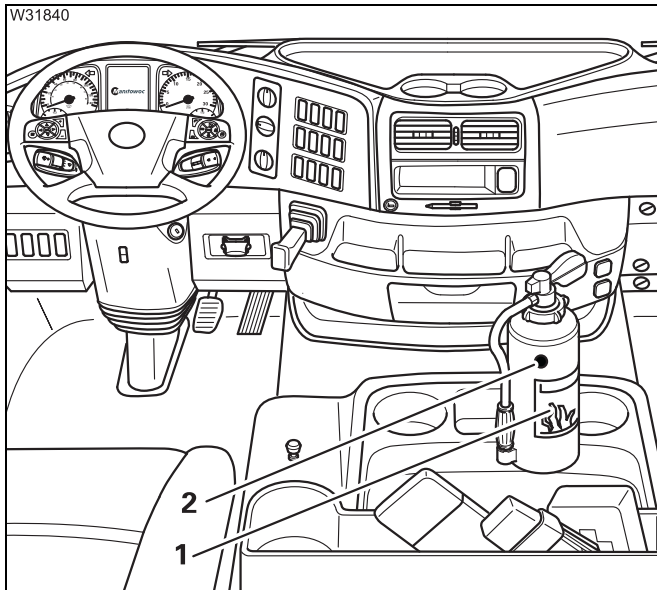
Having the fire extinguisher checked

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 is still working properly after the maintenance interval on the label has expired.

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8

Maintenance work on the superstructure

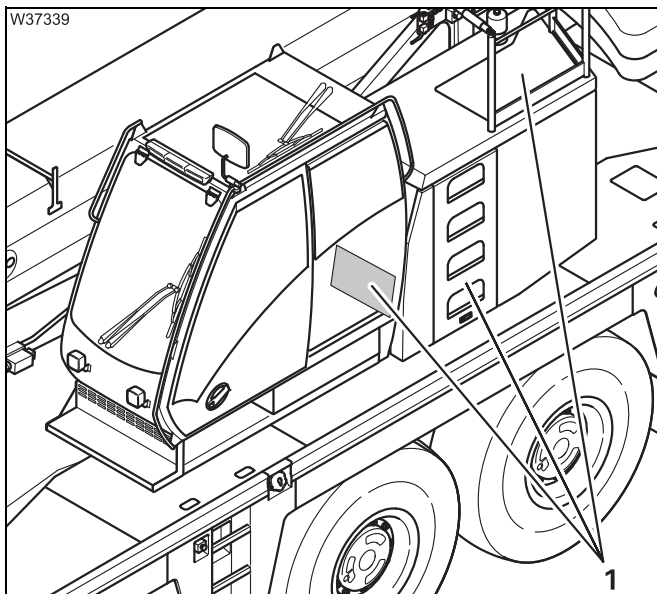
8.1

General instructions

8.1.1

Covers

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

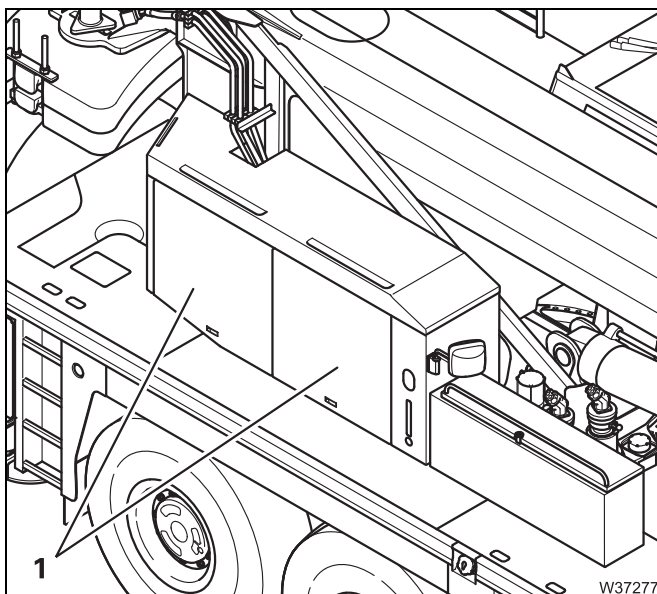


Before maintenance work

- Remove the covers (1).

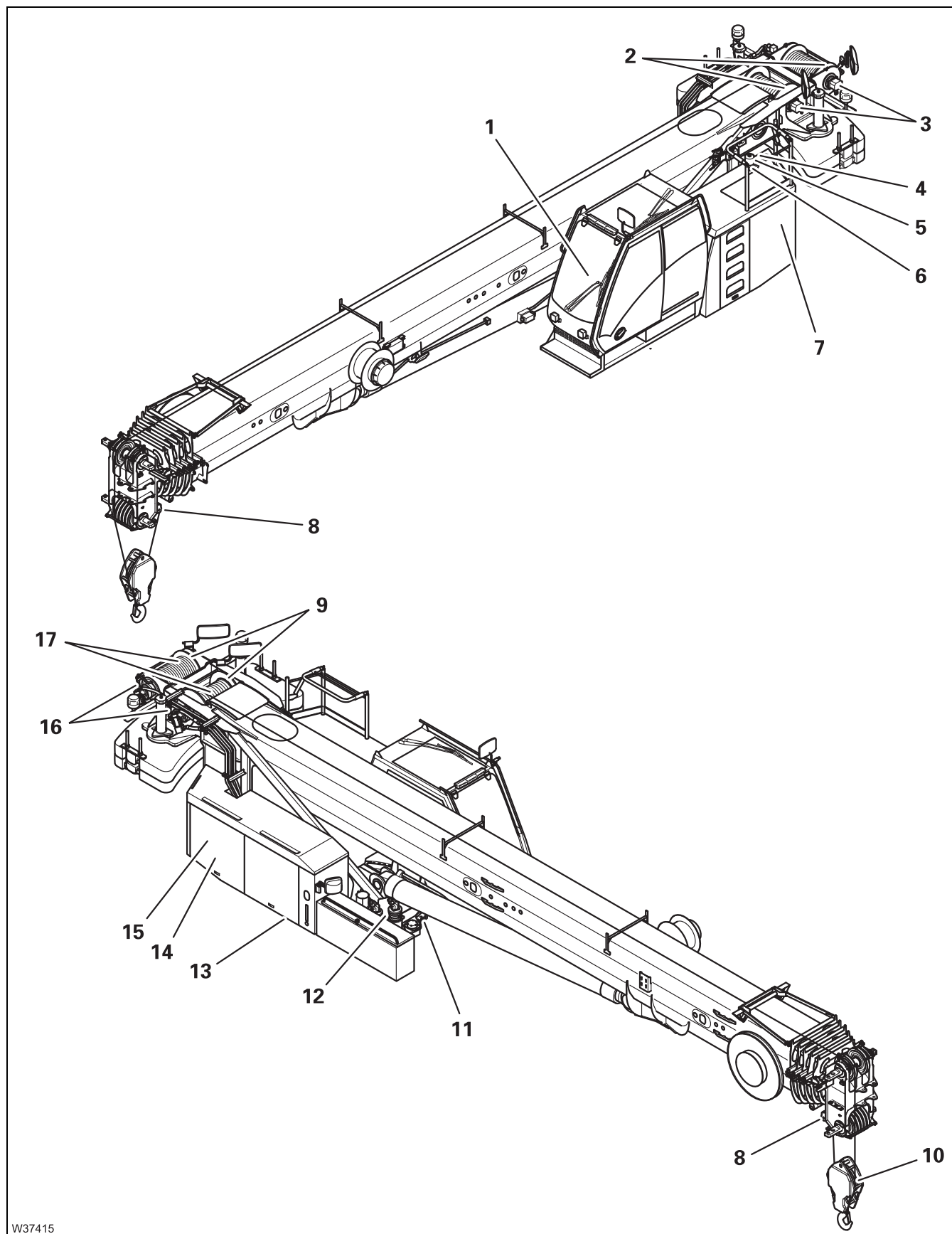
After maintenance work

- Fasten the covers (1) with the locks.



8.1.2

Overview of maintenance work on the superstructure



W37415

07.12.2017

Symbols for maintenance work

1 CCS (*Crane Control System*) control unit

▣▣▣▣ p. 8 - 7

▣▣▣▣ p. 8 - 7

Hoists

17 Hoist ropes

▣▣▣▣ p. 8 - 9

▣▣▣▣ p. 8 - 51

2 Rope wedges

▣▣▣▣ p. 8 - 52

9 Rope drums

▣▣▣▣ p. 8 - 51

16 Oil inspection glasses

▣▣▣▣ p. 8 - 9

10 Hook block

▣▣▣▣ p. 8 - 69

8 Rope end fitting

▣▣▣▣ p. 8 - 52

3 Lowering limit switch

▣▣▣▣ p. 8 - 63

Slewing gear

12 Oil inspection glasses

▣▣▣▣ p. 8 - 15

▣▣▣▣ p. 8 - 15

Slewing bearing

11 Gear teeth

▣▣▣▣ p. 8 - 21

▣▣▣▣ p. 8 - 25

13 Turntable lock¹⁾

▣▣▣▣ p. 8 - 30

Hydraulic system

7 Oil tank with sight glass

▣▣▣▣ p. 8 - 31

▣▣▣▣ p. 8 - 31

4 Oil filler opening

▣▣▣▣ p. 8 - 42

5 Ventilation filter

▣▣▣▣ p. 8 - 36

14 Pressure accumulator

▣▣▣▣ p. 8 - 37

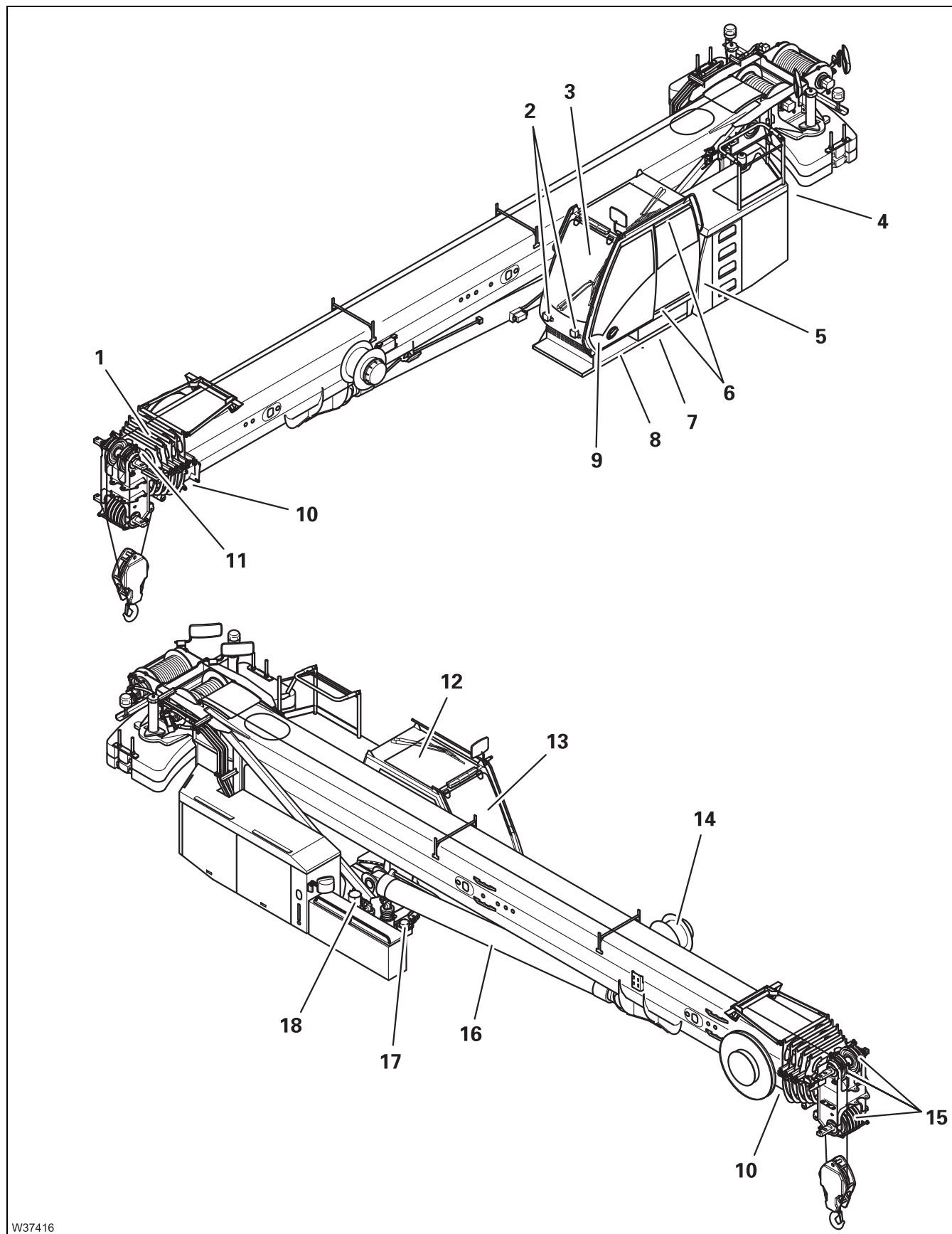
6 Oil filter 1

▣▣▣▣ p. 8 - 40

15 Oil filter 2

▣▣▣▣ p. 8 - 41





W37416

07.12.2017

Main boom	▣▣▣▣▶ p. 8 - 45
1 Telescopic sections 1 to 5 and basic section	▣▣▣▣▶ p. 8 - 46
16 Derricking cylinder	▣▣▣▣▶ p. 8 - 45
15 Sheaves	▣▣▣▣▶ p. 8 - 50
Cable drums	▣▣▣▣▶ p. 8 - 65
14 Cable drum 1	▣▣▣▣▶ p. 8 - 65
4 Cable drum 2	▣▣▣▣▶ p. 8 - 65
17 Slewing angle sensor	▣▣▣▣▶ p. 8 - 25
Central lubrication system	▣▣▣▣▶ p. 8 - 67
18 Centralised lubrication pump	▣▣▣▣▶ p. 8 - 67
Electrical system	▣▣▣▣▶ p. 8 - 73
2 Spotlights on the crane cab	▣▣▣▣▶ p. 8 - 73
10 Spotlights on the telescopic boom	▣▣▣▣▶ p. 8 - 73
11 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 reservoir	▣▣▣▣▶ p. 8 - 79
13 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
12 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 manual*.

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

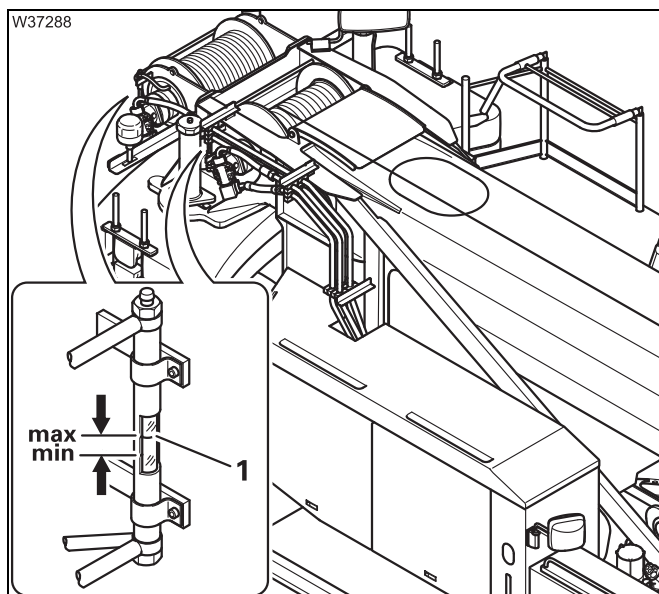
Spare parts and tools

Designation	Quantity	GROVE part no.
Gasket 18 x 24 Cu DIN 7603	4	01377793

Prerequisites


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

Checking the oil level



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

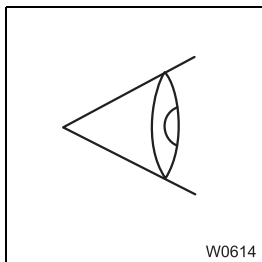
If the oil level is too low


- Top up the oil;  p. 8 - 11.

8.3.2

General inspection

W



- Pay attention to any unusual noises from the hoists while running.
- Check the hoists and the connections for leaks. In the event of leaking consumables;  *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 about 5.1 t (11,250 lbs) to about 30 cm (1.0 ft) above the ground.
- Measure the distance to the ground when the load is hanging completely still.
- Switch the engine off.


If the load has not lowered after 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 acc. to DIN 51502	Specifications 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.
Gasket 18 x 24 Cu DIN 7603	10	01377793

- Receptacle, about 8 l (2 gal);  p. 2 - 4.
- Torque wrench for a torque of 30 Nm (22.1 lbf ft).


Prerequisites

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

Changing the oil at the hoist



Risk of damage to the hoist gears

The waste oil must be checked for abrasion particles. This inspection is used to detect any damage at an early stage;  p. 8 - 12.



Risk of environmental damage due to leaking consumables

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

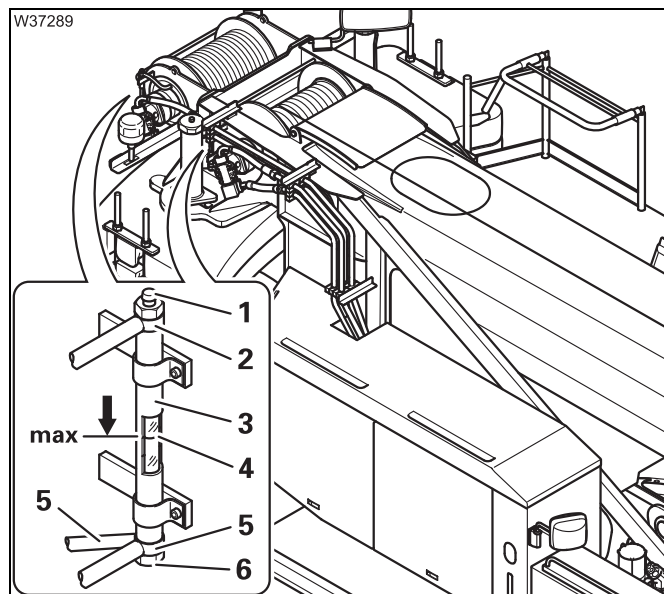
Store/dispose of consumables and any soaked equipment properly.

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 (3).
- Unscrew bolts (1) and (6) and allow the oil to drain.
- Replace the gaskets and secure the hoses (5) with the screw (6) – torque 30 Nm (22.1 lbf ft).

Topping up the oil

- Fill the oil through the pipe (3) up to the **Max.** mark (4).
- Replace the gaskets and secure the hose (2) with the screw (1) – torque 30 Nm (22.1 lbf ft).

Checking the oil



Risk of accidents due to falling loads

If this inspection is not performed, there is a risk of damage to the hoist gear which could lead to the load falling.



Check the waste oil for abrasion particles or have it tested in a laboratory:

- Pour the waste oil through a clean filter mat.
- Examine the oil or the residues on the filter mat using a magnifying glass.

If you find abrasion particles or solid materials on the mat, the hoist gear must be dismantled and inspected by the manufacturer.



Some abrasion particles may appear in the first oil filled. If you notice such particles during the first oil change (after 200 oper. hrs.), first consult **Manitowoc Crane Care** before introducing any further 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-disk brake
- the plug connections between the hydraulic motor and the multiple-disk brake
- the plug connections between the multiple-disk brake and transmission unit

and be permitted to exchange parts with signs of wear.

8.3.6

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, a first 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

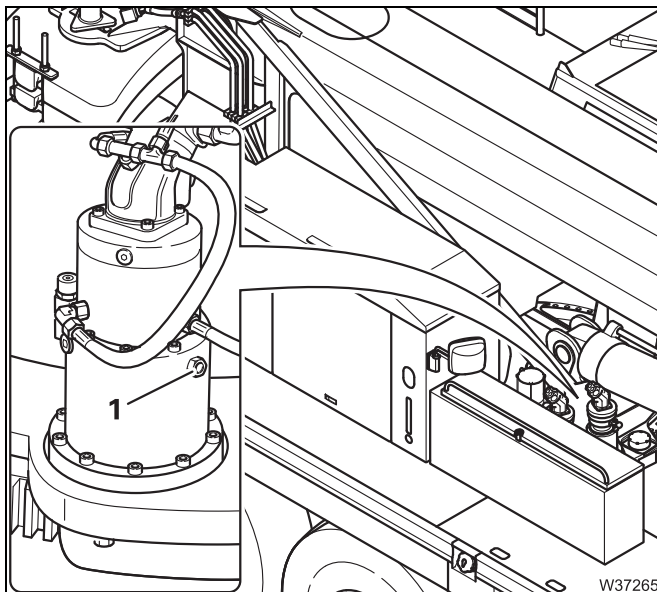
Spare parts and tools

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 manual*.
- The engine is not running and is secured against unauthorised use;
 p. 2 - 3.

Check the oil level Always check the oil level prior to using the crane.



- Check that oil is visible in the sight glass (1).
- Always check the oil level for all the slewing gears.

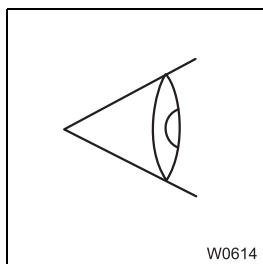
If the oil level is too low


- Top up the oil;  p. 8 - 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. In the event of leaking consumables;  *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 truck crane is rigged with a maximum outrigger span of **8.66 x 7.20 m (28.4 x 23.6 ft)** and is level;  *Operating manual*.
- 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 manual*.
- The current load must not exceed **1 t (2,200 lbs)** – if necessary unreeve the hook block.
- The slewing range 360° around the truck crane must be secured.
- The 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).



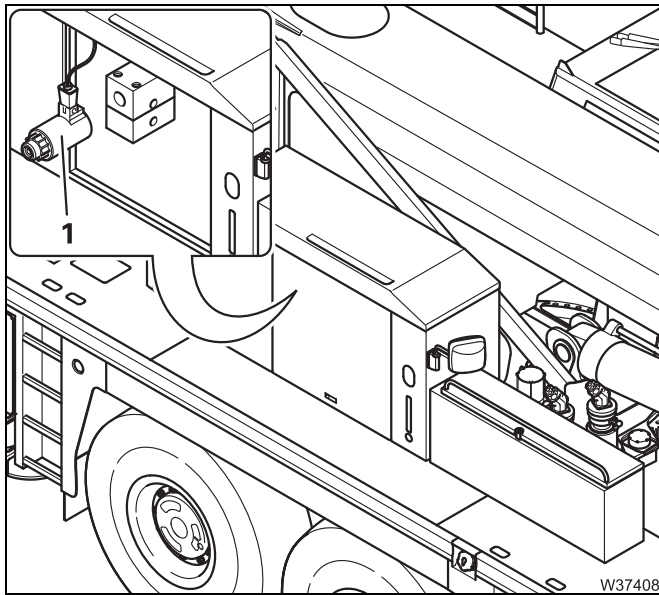
Risk of injury due to swinging hook block

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.

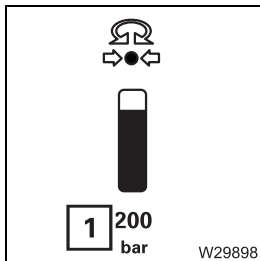
Secure the slewing range 360°, before you check the slewing gear brake.

Check

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

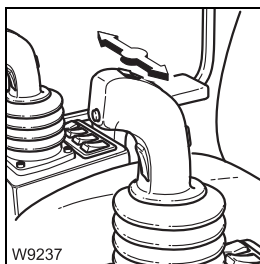


- Switch the engine off.
- Remove the coil (1) from the valve Y 2307 (release the slewing gear brake). The slewing gear brake will now not be released when the slewing gear is switched on.



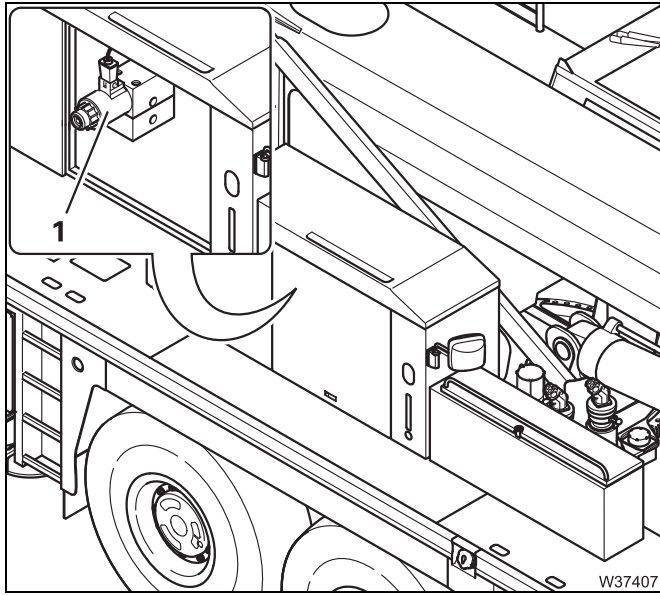
- Start the engine and switch on the slewing gear.
- Open the CCS menu *Hydraulic pressure*.

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 acc. to DIN 51502	Specifications Classification	GROVE part no.
0,9 (0,24) for each slewing gear	C - LPF	MIL-L 2105 B API-GL-4/5 Viscosity: SAE 75 W-90 EP ISO - VG 220	02313611 Synthetic oil; do not mix this with mineral-based oils.

Designation	Quantity	GROVE part no.
Gasket 10 x 14 Cu DIN 7603	2	00117125
Gasket 14 x 20 Cu DIN 7603	2	00117132

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

Prerequisites

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

Changing the oil



Risk of environmental damage due to leaking consumables

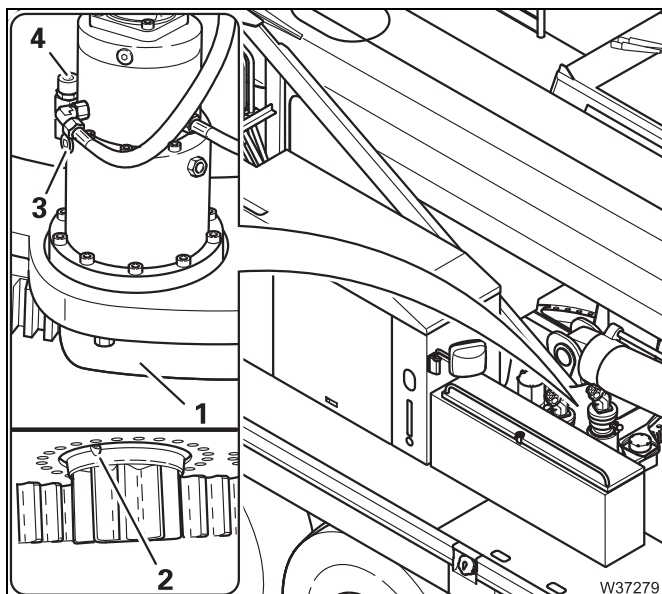
Always let consumables drain into suitable receptacles. Wipe up any consumables that escape.

Store/dispose of consumables and any soaked equipment properly.

Ask about the applicable regulations.

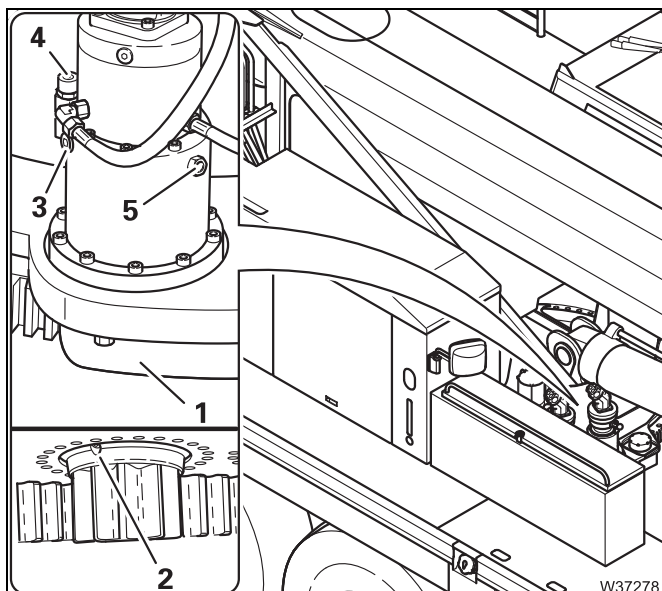
- Always change the oil in all slewing gears.





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 the oil

- Top up the oil through the filler neck (4) until oil is visible in the sight glass (5).
- Replace the gaskets and screw in the bolt (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 or the residues on the filter mat using a magnifying glass.

If you find abrasion particles or solid materials on the mat, the slewing gear transmission must be removed and inspected by the manufacturer.


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 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 manual*.
- The auxiliary hoist **or** alternatively the compensation weight **0.5 t (1,100 lbs)** is 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 66°;  *Operating manual*.
- The current load must not exceed **1 t (2,200 lbs)** – if necessary unreeve the hook block.
- The slewing range 360° around the truck crane must be secured.
- The engine is not running and is 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 bolts and re-tighten them, or completely unscrew and then reuse them.

If the superstructure has to be removed from the carrier, only a completely **new set of bolts** may be used to reinstall the superstructure. Only **original bolts** manufactured according to the factory specifications may be used.



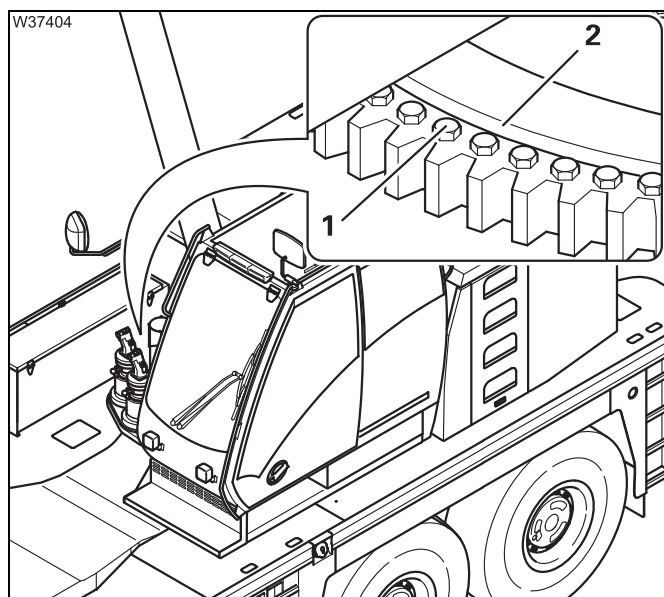


Danger of the slewing bearing being ripped off

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**.

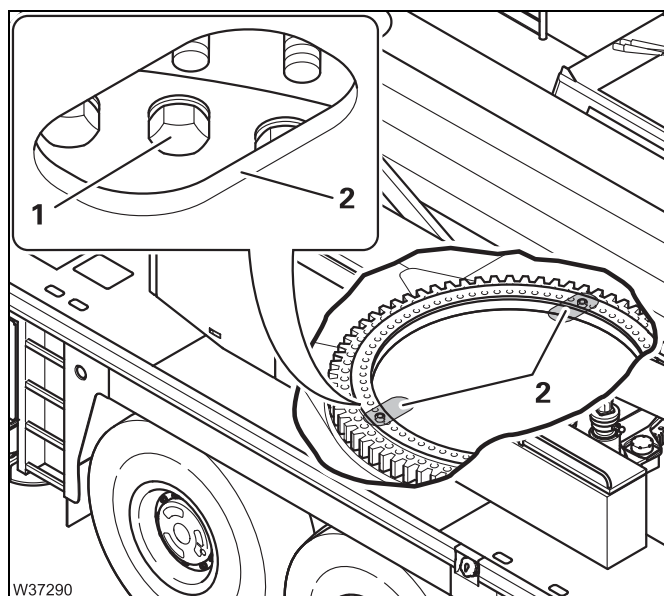
Access



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

- Check all 68 bolts (1) from **above**.

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

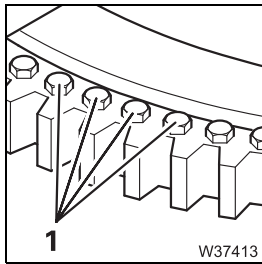


The **inner ring** is attached to the turntable by the bolts (1).

- Check all 67 bolts (1) from **below**.

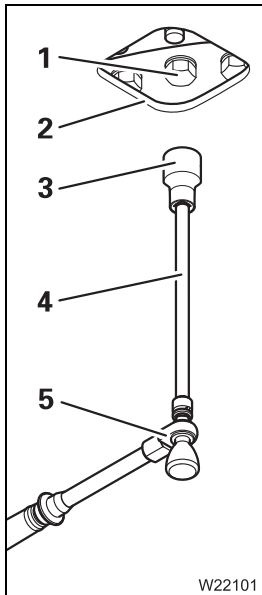
To do this, you must rotate the turntable gradually to gain access to a pair of bolts (1) opposite one another, through the openings (2) in the carrier.

Selecting the tools



Outer ring

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

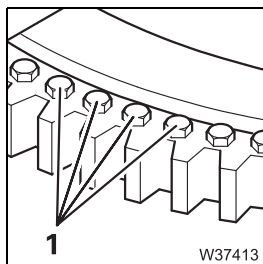
A **manual torque tool (5)** is recommended so that it can be tightened gently, and slipping from the screw head (1) is avoided.

Torques

Screw type	GROVE part number	Torque Nm (lbf ft)
Ball slewing bearing Bearing type: KDV, single-row	03056048 Model plate: Inside the inner ring.	
M 24 x 120: 68 pieces on the outer ring	04170750	790 (583)
M 24 x 125: 67 pieces on the inner ring	04170752	790 (583)

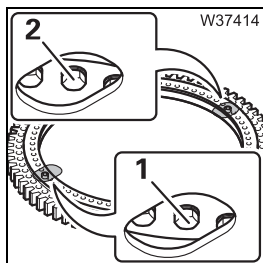


Checking the outer ring



- Divide the checking of the 68 bolts into 17 working steps of 4 bolts each (1). Between each of the 17 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 67 bolts into 33 work steps with 2 bolts each and 1 work step with one bolt. Between each of the 34 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 bolts 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

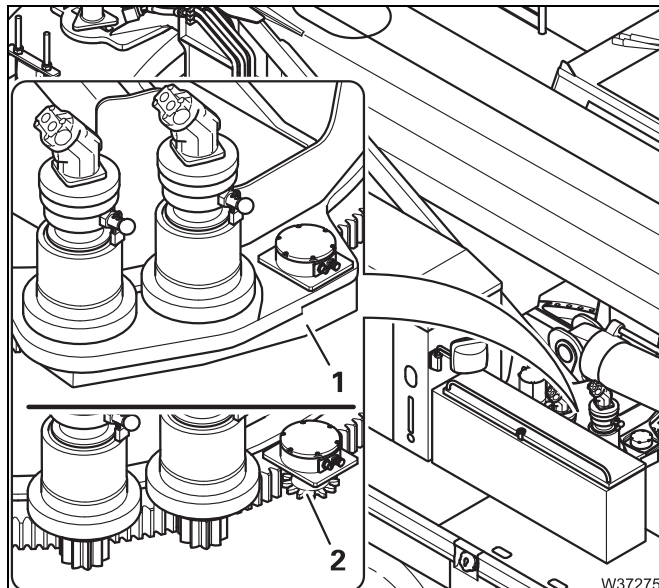
- The truck crane must be level and on outriggers; *Operating manual*.
- The main boom must be fully raised; *Operating manual*.
- The engine is not running and is secured against unauthorised use; p. 2 - 3.

Check



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.

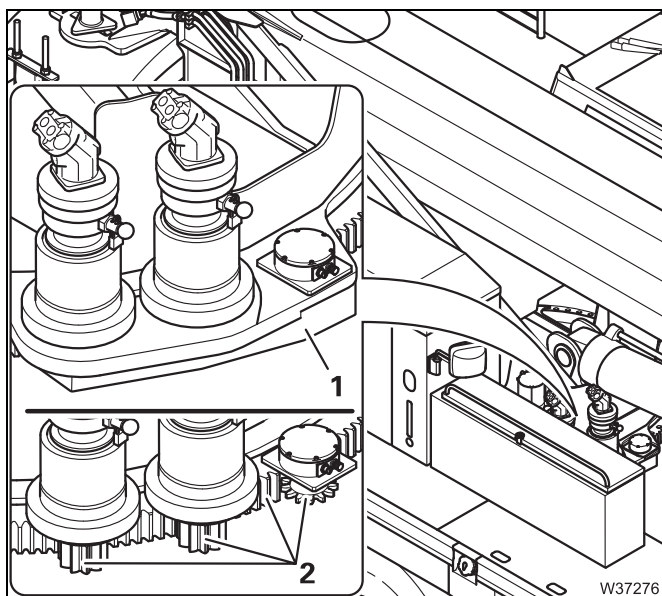


Checking the slewing angle sensor

- Remove the plate (1).
- Check whether the pinion (2) is undamaged and lies straight and firmly against the gear teeth of the slewing bearing.
- If need be, remove dirt and foreign bodies from the pinion (2).
- If any damage is found, report it to **Manitowoc Crane Care** or an authorised GROVE-dealer.
- Attach the plate.

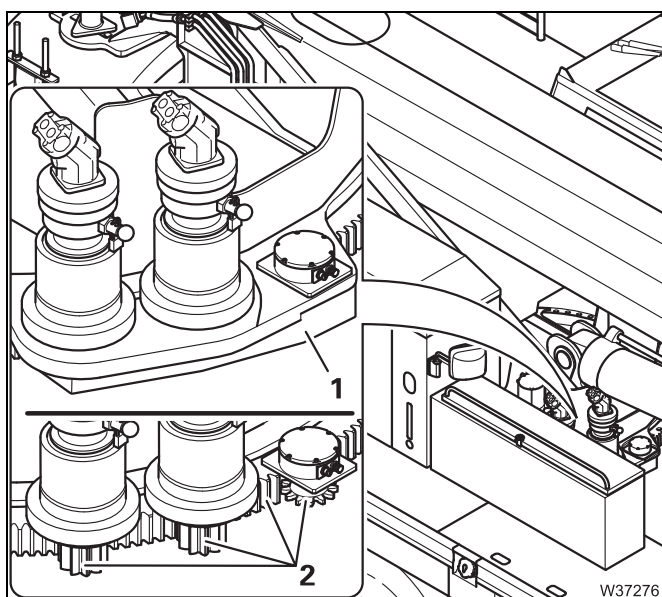


Lubrication



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.



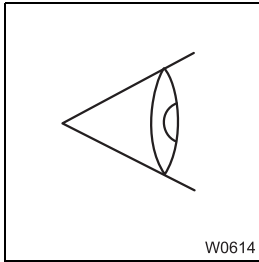
Subsequent lubrication

- 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 (**M 3**).

Spare parts and tools

- Dial gauge (precision 0.01 mm (0.00039 in)) with tripod.
- Measurement report from when the truck crane was put into operation;  *Delivery receipt*.

Prerequisites

- The slewing bearing has 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 3.80 m (28.4 x 12.5 ft)** and be level;  *Operating manual*.
- The auxiliary hoist **or** alternatively the compensation weight **0.5 t (1,100 lbs)** is rigged.
- The counterweight combination of **4.5 t (9,920 lbs)** must be maximally rigged according to the *Lifting capacity table* and equipment on the truck crane.
- The lattice extension must have been removed.
- The main boom is telescoped to 0-0-0-50.
- The load being lifted must not exceed **0.5 t (1,100 lbs)** – where necessary unreeve the hook block.

Type

The GMK4090 truck crane is equipped with a slewing bearing of the bearing type: KDV, single-row.

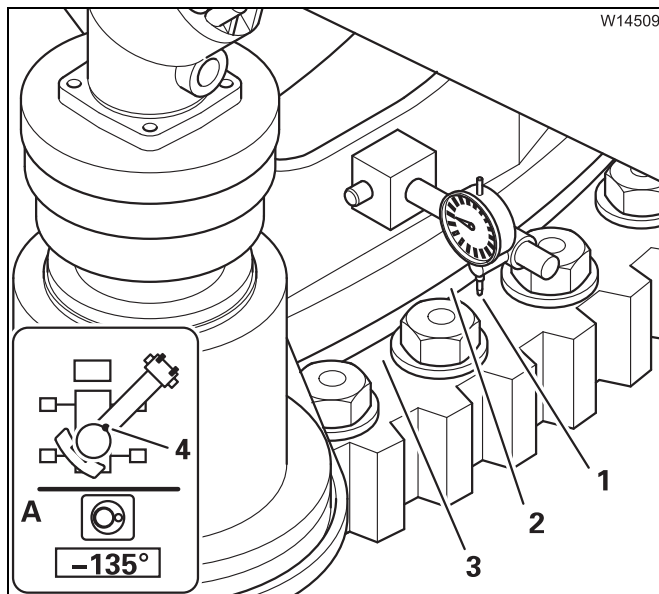
Type of slewing bearing	GROVE part number
Ball slewing bearing Bearing type: KDV, single-row	03056048 Model plate: Inside the inner ring.

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.

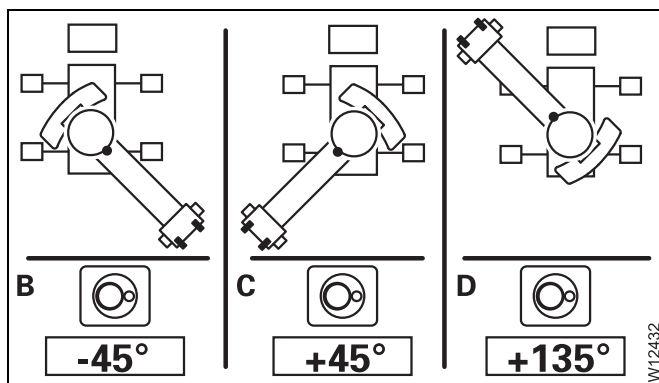
The maximum permissible wear is 3.2 mm (0.126 in).
This results in the maximum permissible tilting play.

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 80° 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 derrick the main boom to 20°. 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



The truck crane GMK4090 can be fitted with a turntable lock as additional equipment.

Grease, spare parts, tools


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

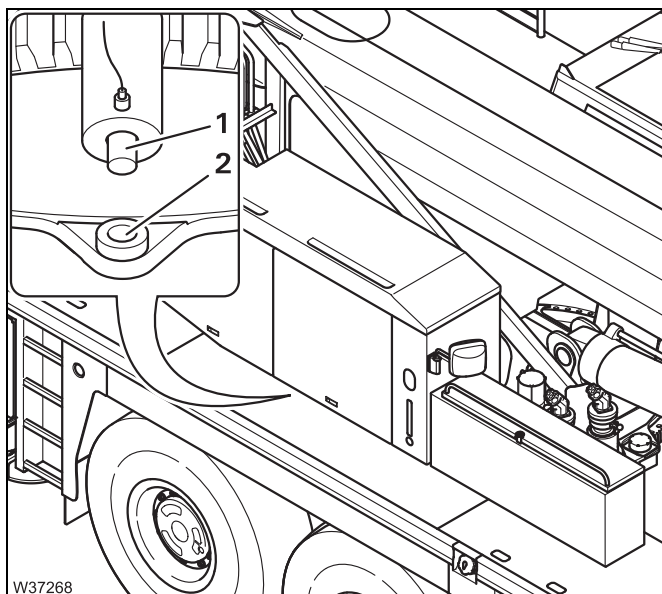
- Brush.

Prerequisites

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

Lubrication

- Familiarise yourself with the correct operation of the turntable lock;  *Operating manual*.



- 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

Check the oil level

D

Prerequisites

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

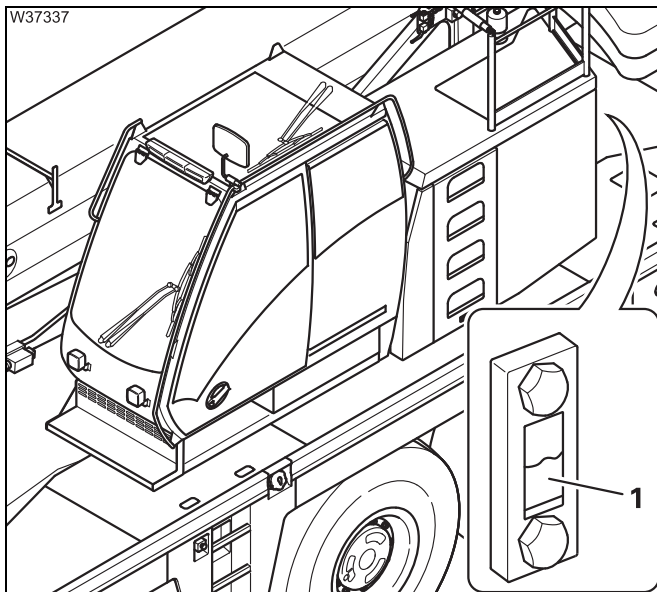
Check the oil level



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 with oil; p. 8 - 43.

8.6.2

Checking the hydraulic hoses

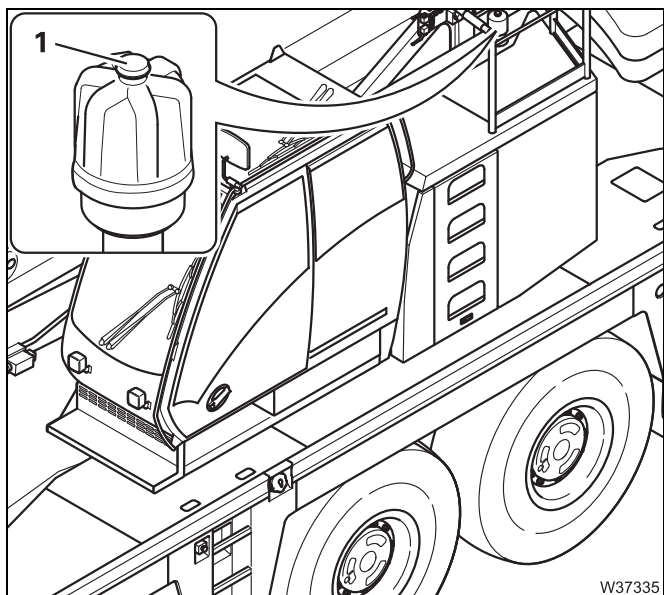
W

The inspection work is described in section *Checking the hydraulic hoses*, p. 7 - 92.

8.6.3

Checking ventilation filters

W



- Check the display (1) on the ventilation filter.

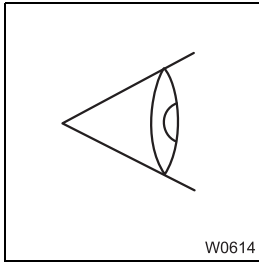
If the indicator is coloured

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

After hydraulic components have been changed

- Bleed the hydraulic system; *Establishing the operating condition*, p. 8 - 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, about 5 l (1.5 gal); ■■■► p. 2 - 4.

Prerequisites

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



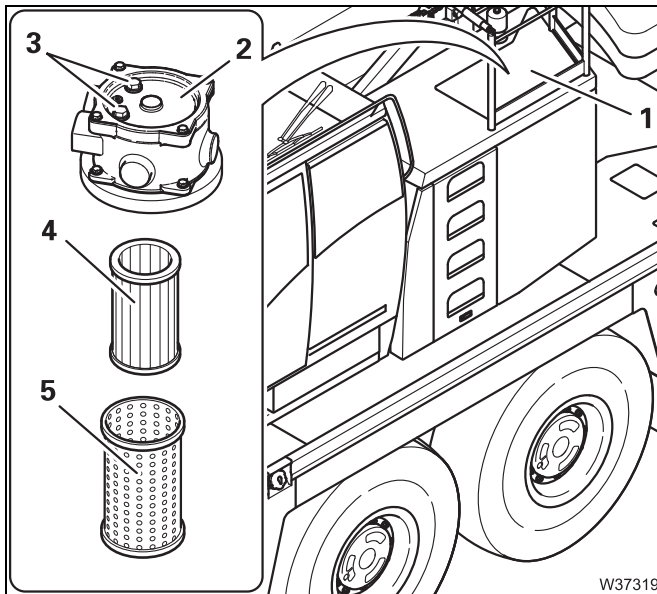
Risk of environmental damage due to leaking consumables

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



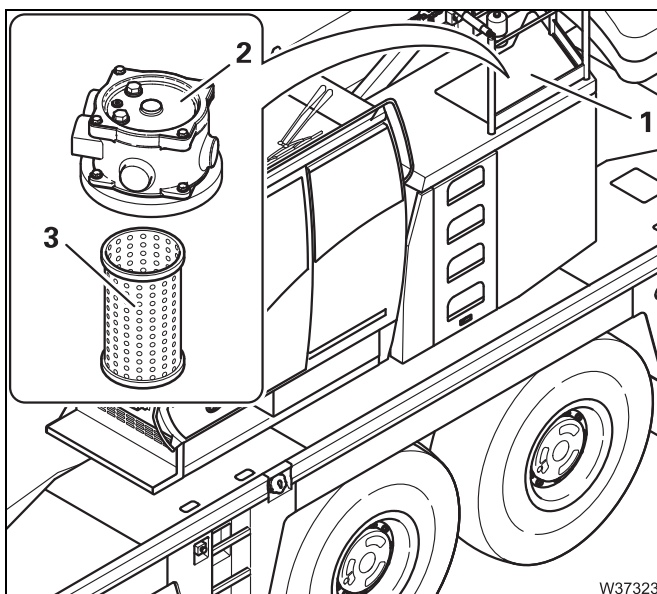
- Remove the cover (1).
- Remove the cap (2) and pull out the hydraulic oil filter.
- Place the filter in a receptacle.
- Remove the filter (4) from the filter cage (5).
- Clean the filter cage (5) and the magnetic rod (3).
- Replace the filter (4) if necessary.



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.
- Fasten the lid (2).
- 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

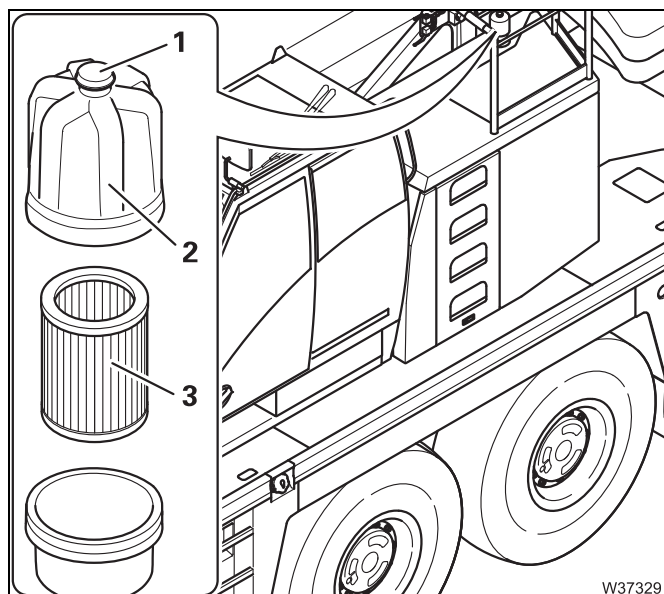
Prerequisites

- The engine is not running and is secured against unauthorised use;
 ▶ p. 2 - 3.



Risk of damage to the environment from filter residues

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



- Remove the cap (2).
- Change the filter (3) and screw on the cap tightly.
- Reset the display by depressing the pin (1) on the housing.

8.6.7

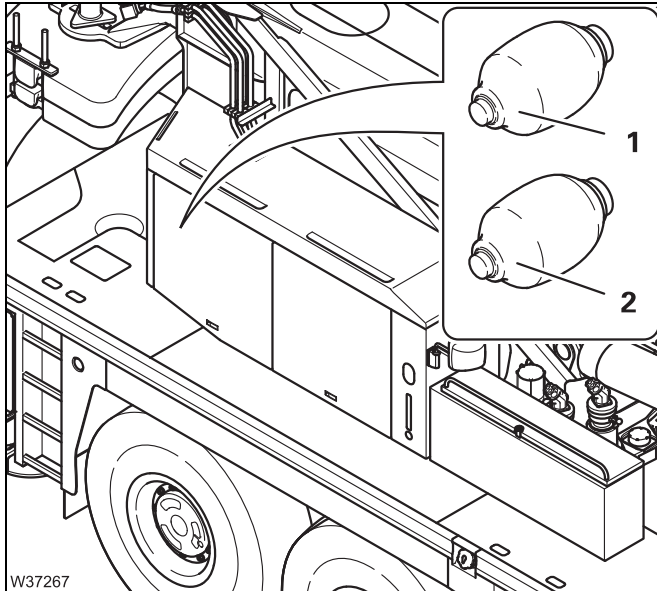
Pressure accumulator – checking the gas pressure

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** 20 bar (290 psi)
- 2 Pressure accumulator** 180 bar (2610 psi)


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

8.6.8


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 - 96.

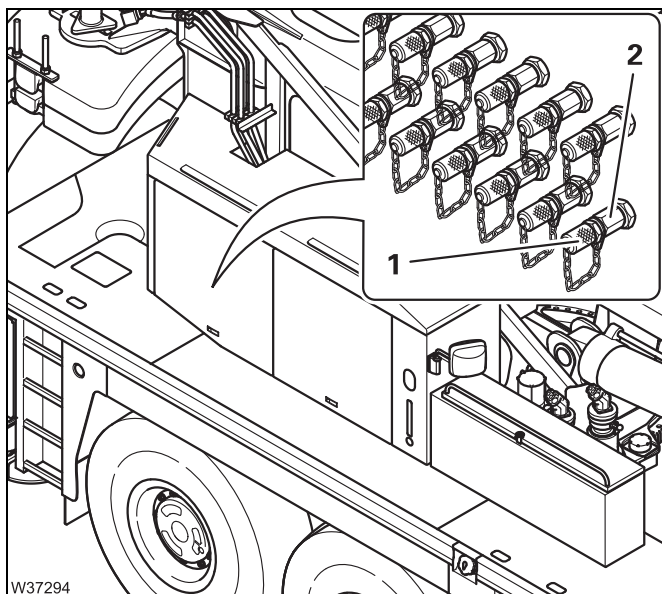
Prerequisites

- The engine is not running and is 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.

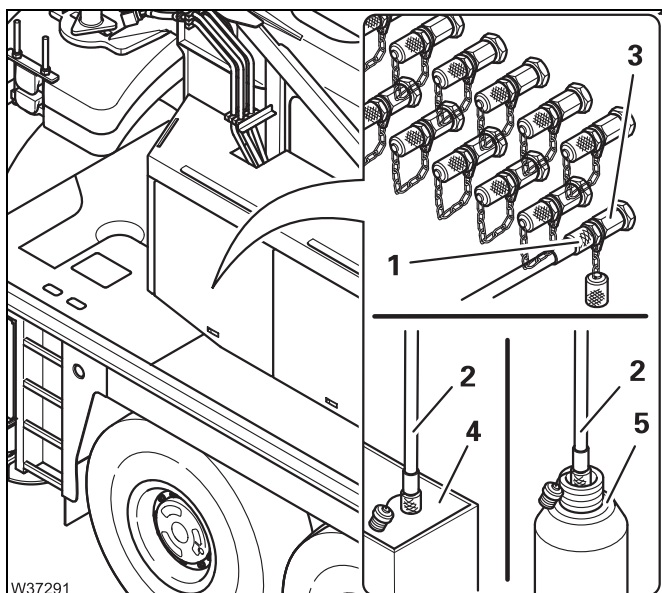








The *MLS* gauge port (1) is located on the bracket (2). When a hydraulic function is run (tilt the crane cab), oil can be taken at the gauge port.

- 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 - 97.
- 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.

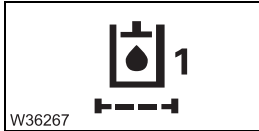
- Switch the engine off.
- Remove the hose;  *Disconnecting the hose*, p. 7 - 98.
- Seal the sample container and dispatch it;  *Dispatch the oil sample to the laboratory*, p. 7 - 99.
- Determine the condition of the oil;  *Determining the quality of the oil*, p. 7 - 99.

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

Prerequisites

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



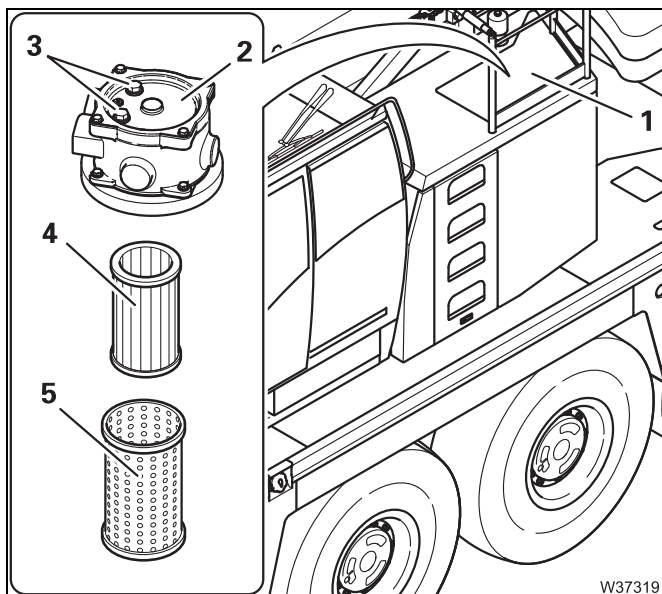
Changing oil filter 1



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.



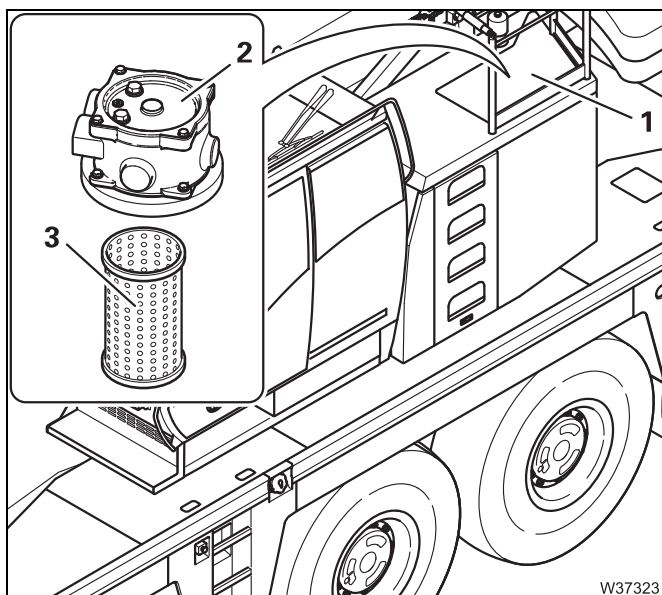
- Remove the cover (1).
- Remove the cap (2) and pull out the hydraulic oil filter.
- Place the filter in a receptacle.
- Remove the filter (4) from the filter cage (5).
- Clean the filter cage (5) and insert a new filter (4).
- Clean the magnetic rods (3).
- Replace any damaged parts, where necessary.



Risk of damage to the hydraulic system

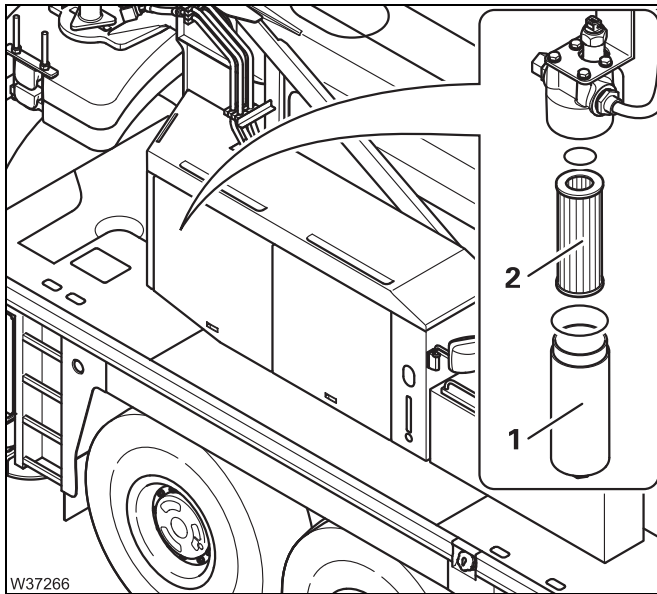
Large amounts of metal particles are a sign of damage in the hydraulic system.

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.
- Fasten the lid (2).
- Attach the cover (1).

Changing oil filter 2





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

After changing 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

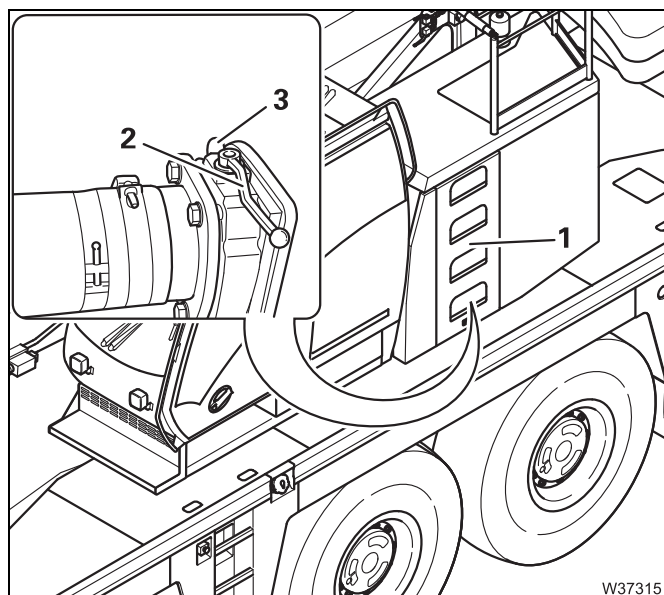
Hydraulic oil in litres (gal)	Designation acc. to DIN 51502	Specifications Classification	GROVE part no.
505 (134)	HVLP	DIN 51524-3 Viscosity: ISO-VG 32	04162158 Castrol Hyspin AWH-M 32

- Connecting piece and hose (tool box);  p. 7 - 102.
- One or more receptacles, about 505 l (134 gal);  p. 2 - 4.

Prerequisites

- The truck crane must be level and in on-road mode;  *Operating manual*.
- The engine is not running and is secured against unauthorised use;  p. 2 - 3.
- The oil filters also have to be replaced;  p. 8 - 39.

Closing the valve



- 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).
- Close the flap (1).
- Be sure to secure the engine against unauthorised use.



Risk of damage to the hydraulic pumps

Be sure to secure the engine against unauthorised use.

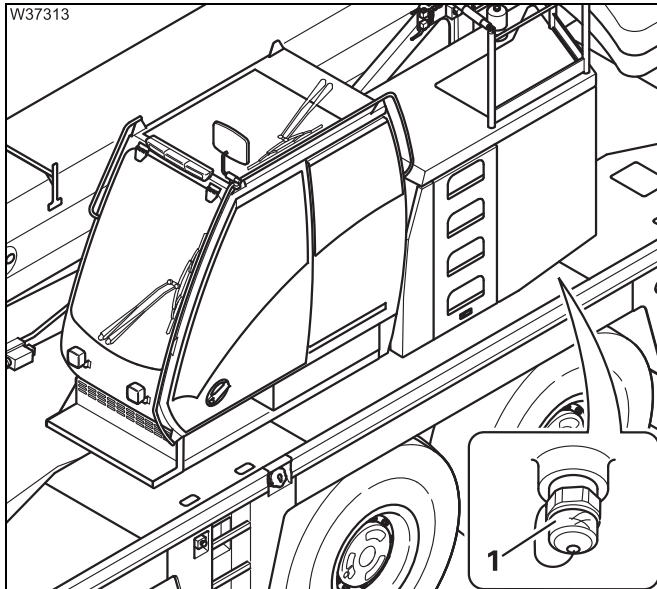
If the engine is started while the valve in the suction line is closed, the hydraulic pumps will be damaged.

Draining oil



Risk of environmental damage due to leaking consumables

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



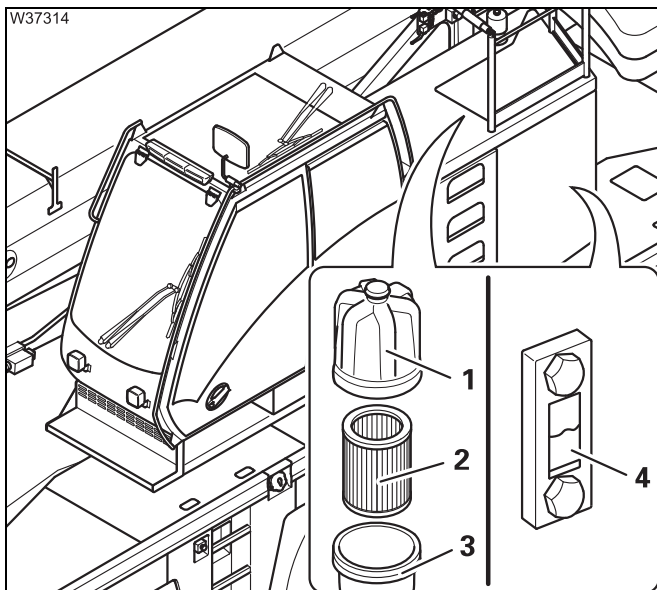
- Place a receptacle underneath the valve.
- Screw the connecting piece and hose onto the valve (1) and drain the oil; Handling the valves, p. 7 - 102.
- Change the oil filter; p. 8 - 39.

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.

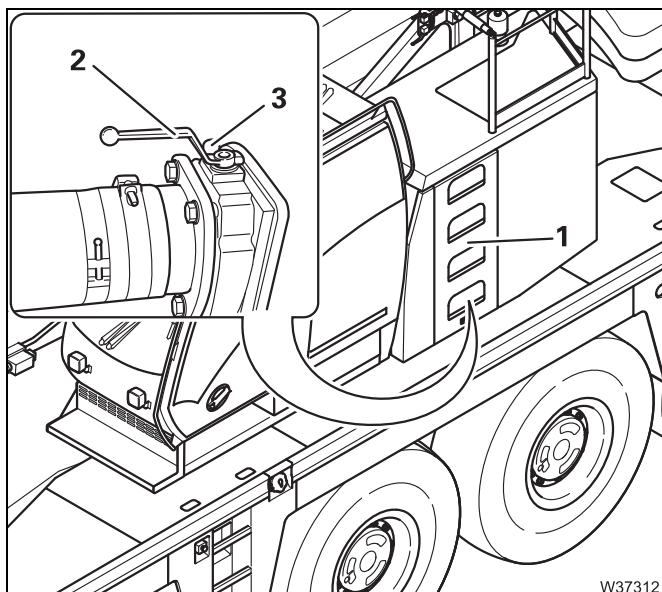


- Remove the cap (1) and the filter (2).
- Add new oil via the filler neck (3) through a filter until the level reaches the centre of the sight glass (4).
- Tighten the cap and filter.



Establishing the operating condition

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




Opening the valve

- Open the flap (1).
- Pull the locking bar (3).
- Open the valve – lever (2) parallel to the line.
- Insert the locking bar (3).
- Close the flap (1).



Risk of damage to the hydraulic pumps

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

- 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

Grease the piston rod of the derricking cylinder

M 1

Grease, spare parts and tools

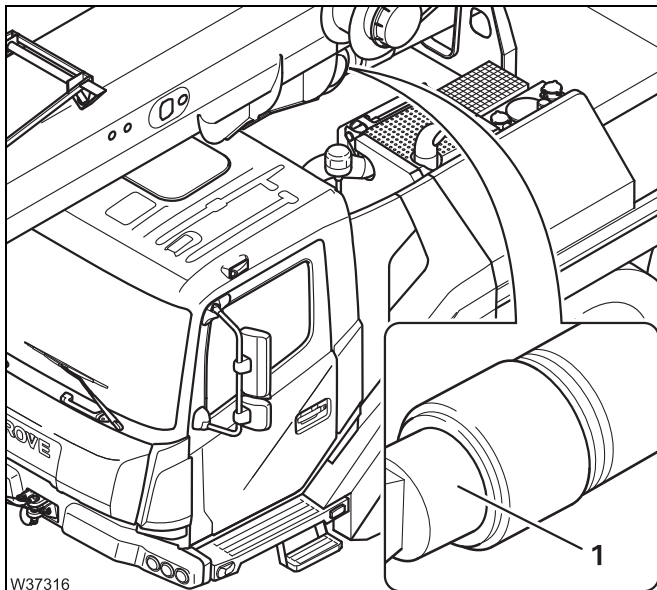
Designation	GROVE part no.
Lubricant RHUS SW 2; 1 kg (Apply the grease with a brush)	03325215
or	
Spray on Berulub; 0.5 litres (spray-on)	01929824

– 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 gasket in the derricking cylinder head when lowering fully.



- Clean the uncovered end (1) of the piston rod by removing old grease, dirt particles and rust.
- Grease the uncovered end, making sure the grease coating is evenly distributed.

After every high-pressure cleaning of the truck crane

- Grease the piston rod.



You can hinder the formation of rust if you turn the main boom to the side between maintenance intervals and completely lower it.

8.7.2

Lubricating the telescopic sections

M 3

Grease, spare parts, tools

Designation	GROVE part no.
Lubricant for the locking pins: RHUS 2 AF, 1 kg can	03325215
Slide paste for the telescopic slide faces: PAL1, 25 kg bucket	02314698

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



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 is set up for which the rigging tables contain the telescoping statuses required for maintenance; *Lifting capacity table*.
- The RCL code for the current rigging mode must be entered.



If at the start you set up a rigging mode under which the telescope positions 50/100/0/0/0 are released in the context of the corresponding lifting capacity table, this rigging mode allows you to perform the complete maintenance work on the main boom.

Notes



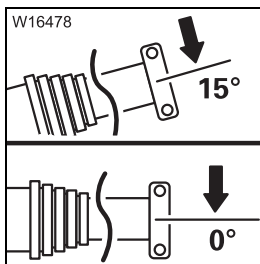
Risk of overturning when telescoping if the RCL is overridden

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



Risk of accidents from slipping 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 ladder provided with your crane.

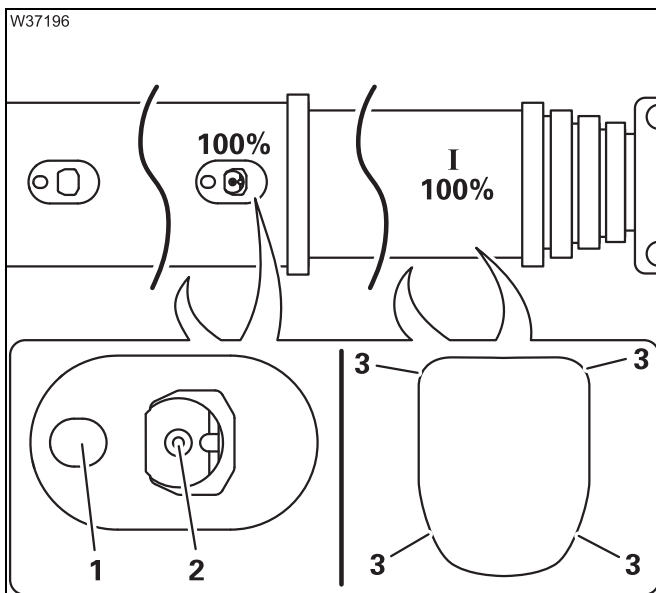


If the main boom has been telescoped several times, the telescoping mechanism and derricking gear can be so heavily loaded that the main boom can be neither telescoped nor derricked. Therefore note the following instructions:

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

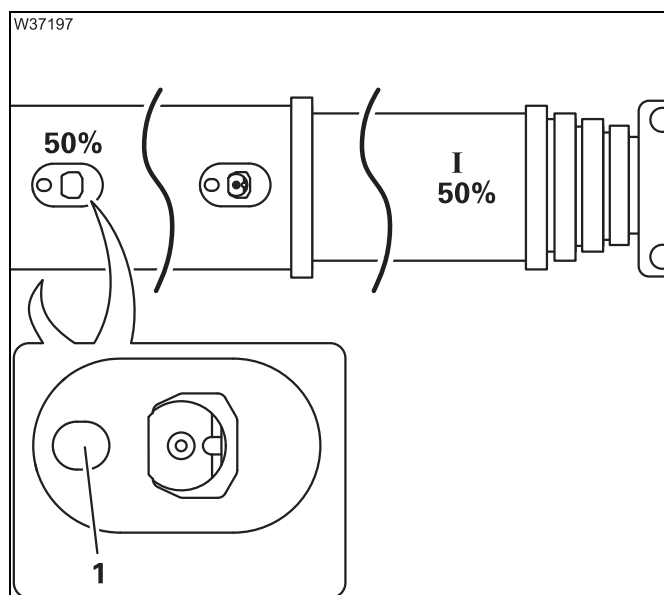
Telescopic section I

- 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 2 AF) 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.



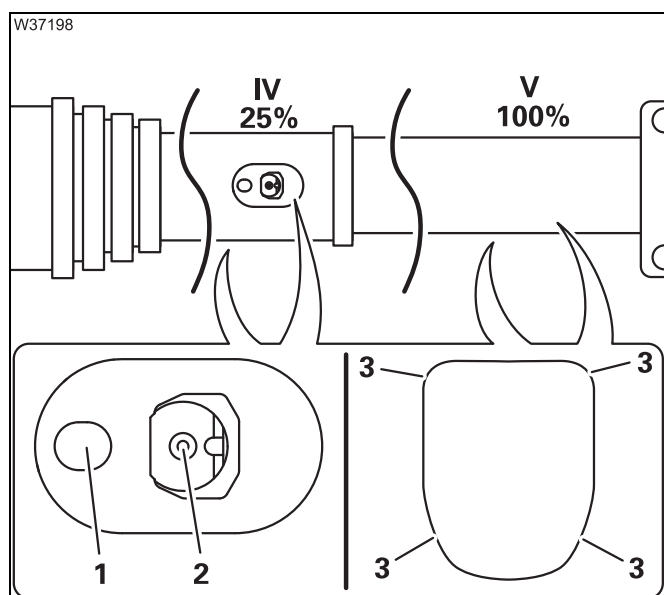


- Extend the telescopic section **I** to 50%.
- Use the grease gun (PAL1) to lubricate the upper inner slide faces at the lubricating nipples (1) on both sides.
- Fully retract telescopic section **I**.
- Fully extend and retract telescopic section **I** again so that the grease is distributed over the telescope slide faces.

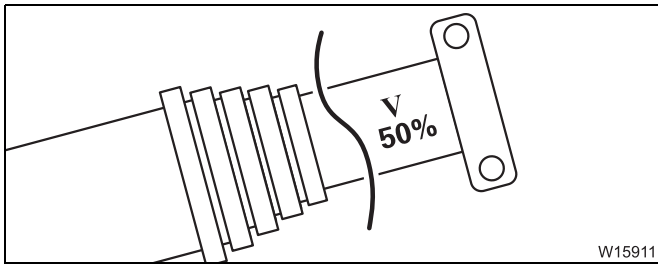
Telescopic section II-V

- Observe the following instructions regarding maintenance work.

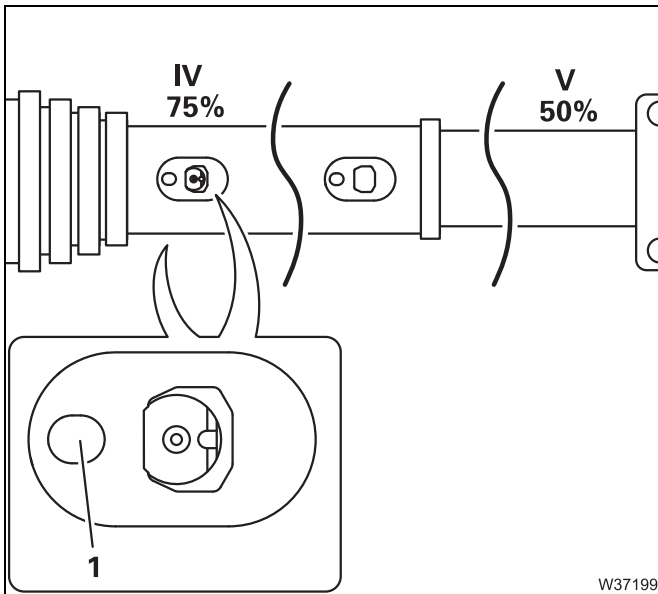
The following diagrams show the lubrication of telescopic section **V**. The telescopic sections **IV**, **III**, **II** are lubricated in the same way.



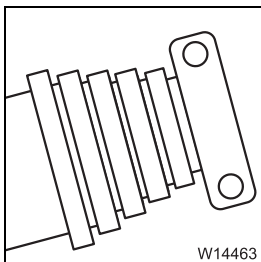
- Extend telescopic section **V** to 100% and telescopic section **IV** to about 25%.
- Use a brush or a roller (PAL1) to lubricate the outer, upper and outer, lower slide faces (3).
- Use the grease gun (PAL1) to lubricate the upper inner slide faces at the lubricating nipples (1) on both sides.
- Use the grease gun (RHUS 2 AF) to lubricate the locking pins at the grease nipples (2) on both sides.
- Lock and unlock telescopic section **V** several times, so that the grease is distributed over the locking pins.



- Raise the main boom to 15°.
- Extend telescopic section **IV** to 0% and telescopic section **V** to 50%.



- Lower the main boom to 0° – do not lower to below 0°.
- Extend telescopic section **IV** to about 75%.
- Use the grease gun (PAL1) to lubricate the upper inner slide faces at the lubricating nipples (**1**) on both sides.



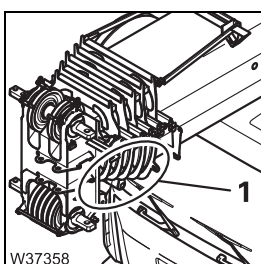
- Raise the main boom to 15°.
- Retract telescopic sections **IV** and **V** to 0%.
- Fully extend and retract telescopic section **V** again so that the grease is distributed over the telescope slide faces.
- Lower the main boom to 0°.

- Lubricate telescopic sections **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**).

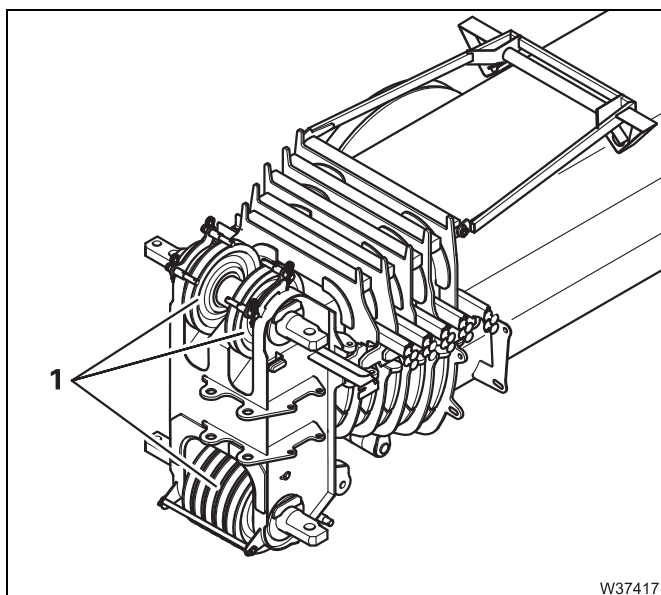
- Remove any excess lubricant paste from the collar (**1**). This is to prevent any lumps dropping off on to the windscreen and suddenly obstructing the view when driving.



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 due to rotating rope drum

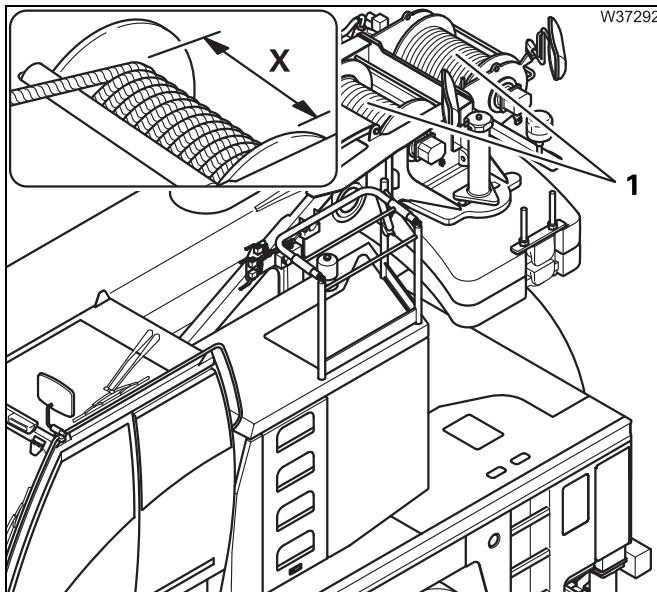
Keep away from the rope drum while it is turning.

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

Prerequisites

- The hoist mirrors must be folded out; *Operating manual*.
- One hook block must be reeved; *Operating manual*.
- The main boom must be raised to about 30°; *Operating manual*.
- The engine has been started.

Check



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

- Slowly perform the *Lower* movement until the rope has moved over the complete width (X) of the rope drum.
 - The rope must be evenly wound.
 - The rope turns on the drum must be evenly spaced, 0 to 2 mm (0 to 0.08 in) apart.
 - The cross-over points must be offset by about 180°.



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

8.8.2




Checking the hoist ropes

W


Spare parts and tools


- Torque wrench for 79 Nm (58 lbf ft).

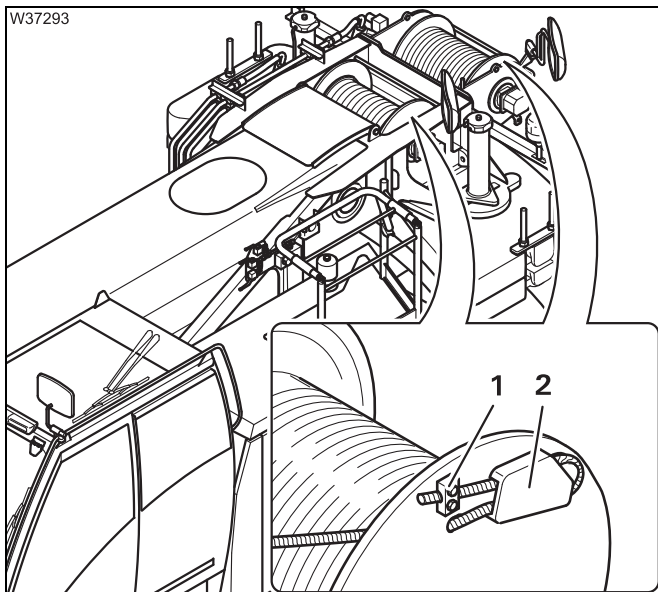
Prerequisites

- Establish a rigging mode in accordance with the *Lifting capacity table* and enter the RCL;  *Operating manual*.
- A hook block must be reeved with five lines;  *Operating manual*.
- The main boom is raised and fully extended;  *Operating manual*.

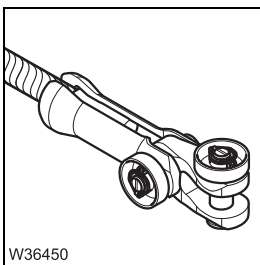
Checking the ropes


- Start the engine.
- Unreel the rope and check the rope and the rope spooling;  *Assessing the condition of the hoist rope*, p. 8 - 54. When five 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 79 Nm (58 ft lbf).
- The free end of the rope must not project above the flanged wheel.
- The rope wedge must be in the pouch (2).
- The rope end on the rope wedge must not show any signs of wear.
- Reel in the rope. At the same time, the rope may not show any signs of kinking or being flattened.



- Check the end of the rope and the rope end fitting for damage.
- Make sure the rope end is correctly fitted in the rope end fitting;  *Operating manual*.

8.8.3

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.



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

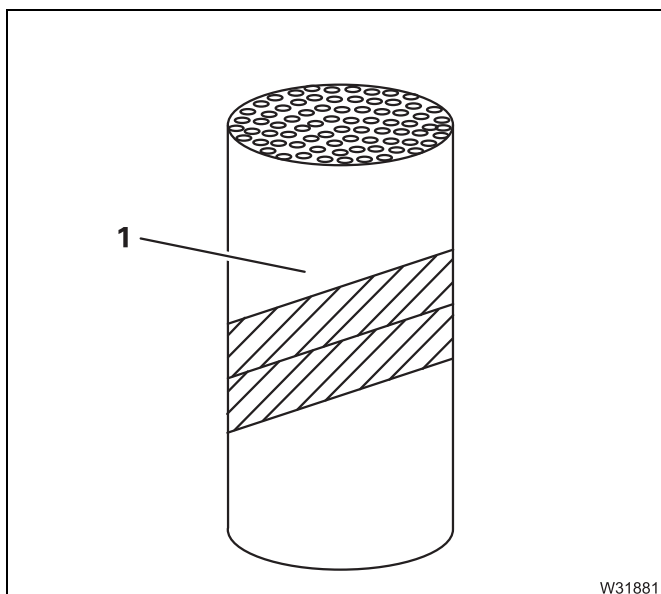
Assessing the condition of the hoist rope



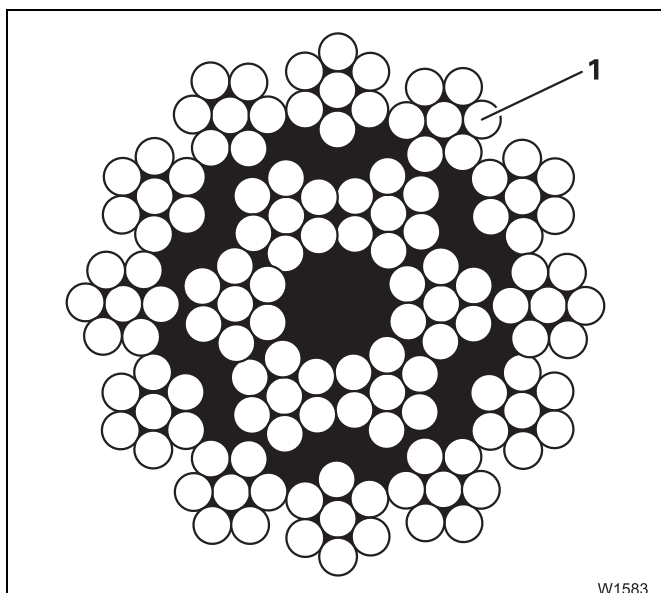
If in doubt about damage assessment, always consult an approved inspector.

To assess the condition of the rope, you must be familiar with the following:

- the type of rope (lang lay rope)
- the number of load-bearing wires in the outer strands
- The rope diameter (▮▮▮▮▶ *Operating manual*).



In a lang lay rope (**1**) the wires run at an angle of approximately 45° to the longitudinal direction of the rope.



The number of load-bearing outer wires (**1**) is found by counting the number of outer strands of the rope and multiplying by 7.



If there are multiple layers of strands, only the outer layer is counted.

The **tables** show by rope diameter the number of wire breaks in a length 6 times and 30 times the rope diameter which if reached would require replacement of the rope.

- Familiarise yourself with DIN ISO 4309:2013-06 (rotation-resistant ropes).

This table applies only to the **hoist ropes** fitted as initial equipment and original replacement ropes!

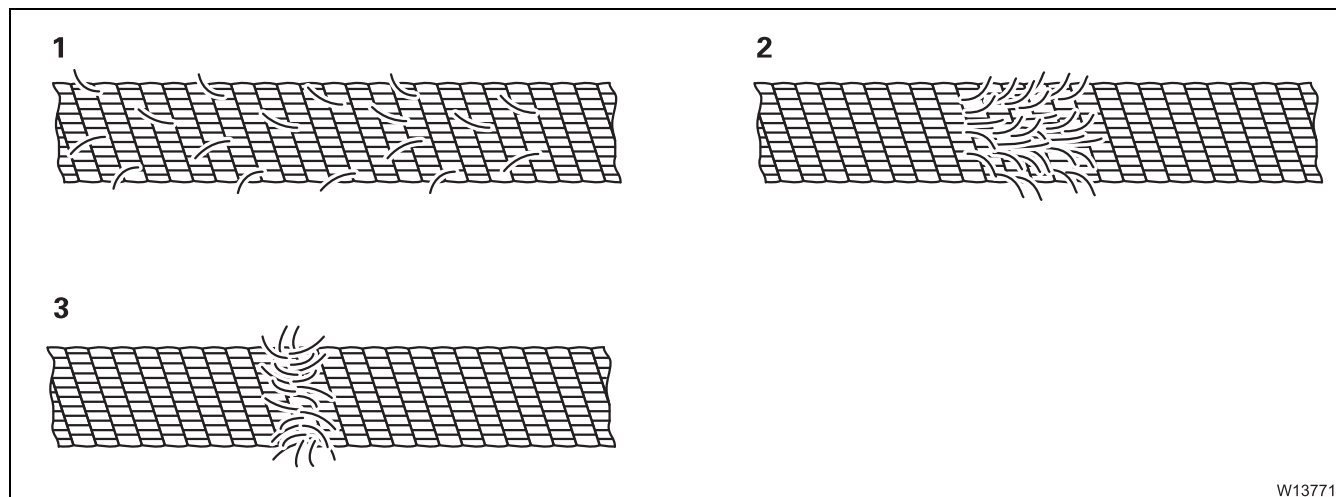
Number of visible wire breaks on a rotation-resistant hoist rope						
The rope section runs over a rope disc or on a drum wound as a single layer						
Number of load-bearing outer wires	Ø 13 mm		Ø 16 mm		Ø 17 mm	
	to 78 mm	to 390 mm	to 96 mm	to 480 mm	to 102 mm	to 510 mm
101-120	3	5	3	5	3	5
121-140	3	5	3	5	3	5
The rope section is running on a drum wound as multiple layers						
	Ø 19 mm		Ø 22 mm		Ø 24 mm	
	to 114 mm	to 570 mm	to 132 mm	to 660 mm	to 144 mm	to 720 mm
101-120	3	5	3	5	3	5
121-140	3	5	3	5	3	5
The rope section is running on a drum wound as multiple layers						
	Ø 13 mm		Ø 16 mm		Ø 17 mm	
	to 78 mm	to 390 mm	to 96 mm	to 480 mm	to 102 mm	to 510 mm
101-120	5	10	5	10	5	10
121-140	6	11	6	11	6	11
	Ø 19 mm		Ø 22 mm		Ø 24 mm	
	to 114 mm	to 570 mm	to 132 mm	to 660 mm	to 144 mm	to 720 mm
101-120	5	10	5	10	5	10
121-140	6	11	6	11	6	11





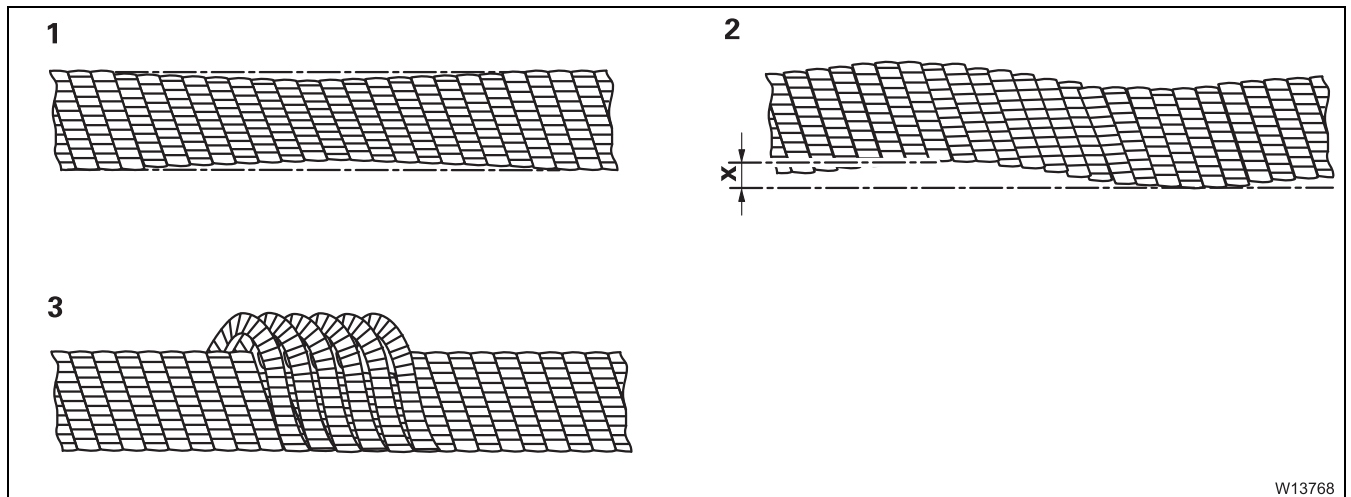
Risk of accidents due to reduced load bearing capacity

Remember that other factors may also make it necessary to replace a rope before the number of wire breaks requiring rope replacement has been reached (age of rope, frequency of use or exceptional loading).



W13771

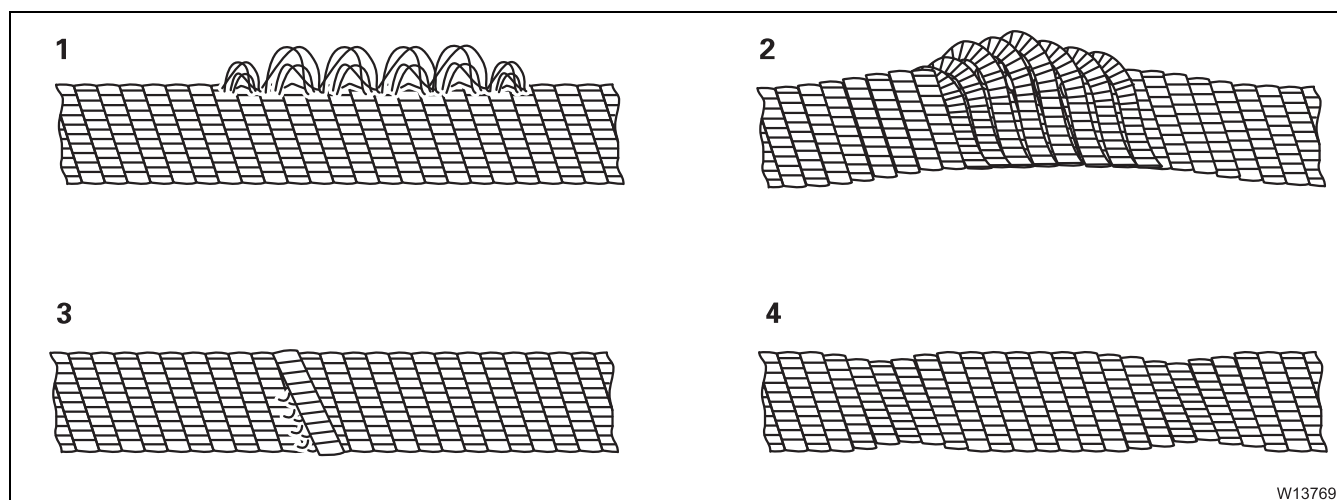
Damage	Description	Cause	Replacement
Wire break (1)	Individual wires are broken; the broken ends of the wires are protruding from the rope.	General wear caused by ageing of the rope or Subsequent damage resulting from damage to the rope.	Replace the rope at the latest when the maximum permissible number of wire breaks according to the table are visible externally. Replace the rope immediately if wire breakage clusters or strand breakages occur. The frequency of wire breaks increases as the rope ages. For reasons of safety, it is advisable to replace the rope while the number of wire breaks is still low.
Wire break-age cluster (2)			
Strand break-age (3)			
Effect of heat	Tarnished colour is visible externally on the rope.	Rope has been subjected to excessive heat.	Replace the rope immediately .



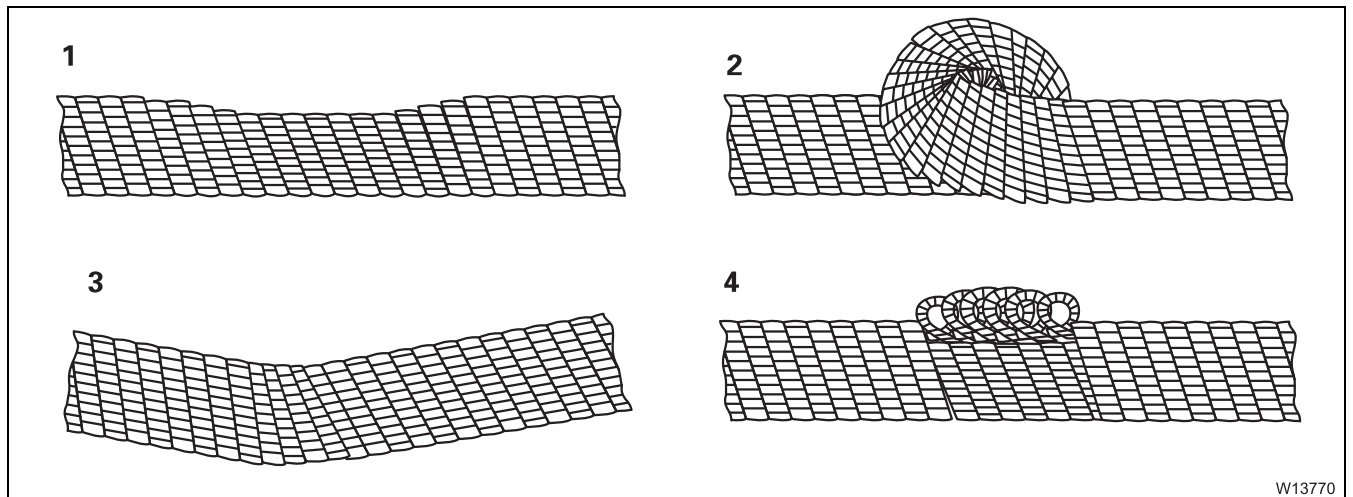
W13768

Damage	Description	Cause	Replacement
Reduced diameter (1)	The diameter of the rope has become smaller along large sections.	Structural changes	Replace the rope immediately if the diameter has decreased by 15% or more compared to the nominal diameter.
		Corrosion or abrasion.	Replace the rope immediately if the diameter has decreased by 10% or more compared to the nominal diameter.
Corkscrew-type rope deformation (2)	The rope winds its way along its longitudinal axis in a way that is similar to a corkscrew. Deformation is measured with suspended hook block.	Damage resulting from overloading.	Even a small amount of deformation leads to increased abrasion, wire breaks and rough operation of the rope drive. If deformation 'x' at a position on the rope is greater than a third of the rope diameter, the rope must be replaced immediately .
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 the rope if the rope structure has been substantially altered by the loop formations.
Loosening of wires or strands (2)	Outer wires or strands have become loose. Only the inner strands continue to bear the load.	Corrosion or abrasion.	Replace the rope immediately .
		Other causes.	The number of wire breaks determines when the rope must be replaced.
Knot formation (3)	If there is repeatedly occurring knot-like thickening of the rope; the insert comes out frequently. Strands bear on each other at thin points; increased frequency of wire breaks.	General wear due to ageing of the rope or consequential damage as a result of damage to the rope.	Determine number of wire breaks; replace rope immediately if serious knot formation occurs.
Constriction (4)	Diameter reduction over short sections.	General wear caused by ageing of the rope.	Replace rope immediately if serious constrictions are detected.




Damage	Description	Cause	Replacement
Flattening (1)	Crushed areas, mostly with wire breaks.	Mechanical damage, e. g. due to driving over the rope.	Determine number of wire breaks; replace rope immediately if serious crushing has occurred.
Kinks (2)	Rope deformation with twists and wire breaks.	Rope in the eyelets was pulled straight while twisted.	Replace the rope immediately .
Buckling (3)	Buckled section in the rope.	Mechanical damage.	Replace the rope immediately .
Crinkling (4)	Crinkling rope deformation.	Loaded rope was pulled over an edge.	Replace the rope immediately .

8.8.5

Replacing the hoist rope

Spare parts and tools


- An original replacement part;  *Rope certificate*.
- A reel stand with braking block.
- Torque wrench for 79 Nm (58 lbf ft).





Risk of accidents due to falling loads

Use only a replacement rope that has the same technical specifications as the defective rope, or an authentic replacement rope.

Prerequisites

- The truck crane must be level.
- The main boom has been set down on the boom rest.
- The hook block is unreeved;  *Operating manual*.

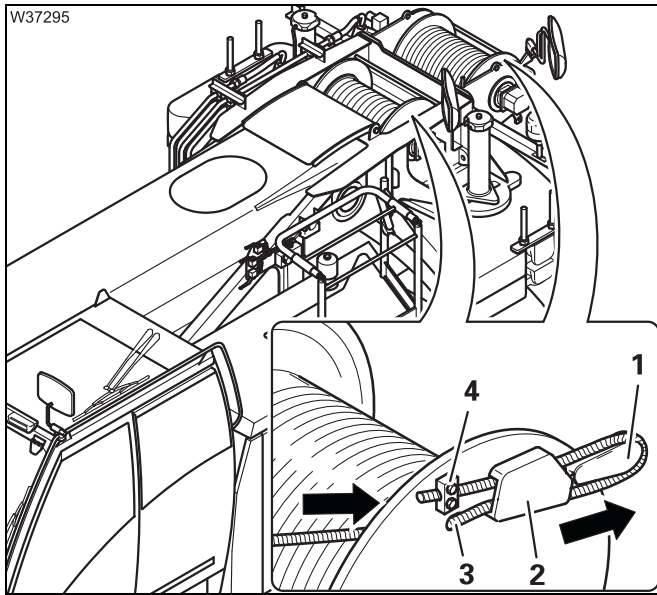
Replacing the old rope

- 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 rotating rope drum

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

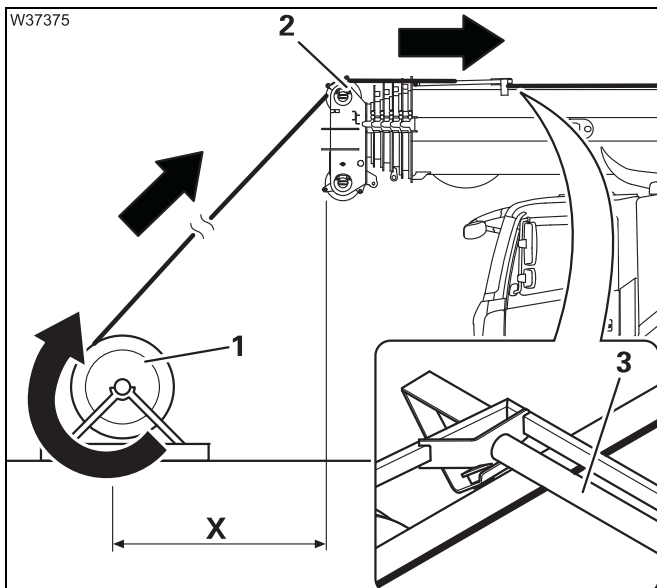


- Remove the clamp (4).
- Push the rope through the hole (3) until the rope wedge (1) slides out of the pouch (2).
- Remove the rope wedge and place the old rope away from the truck crane.

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.

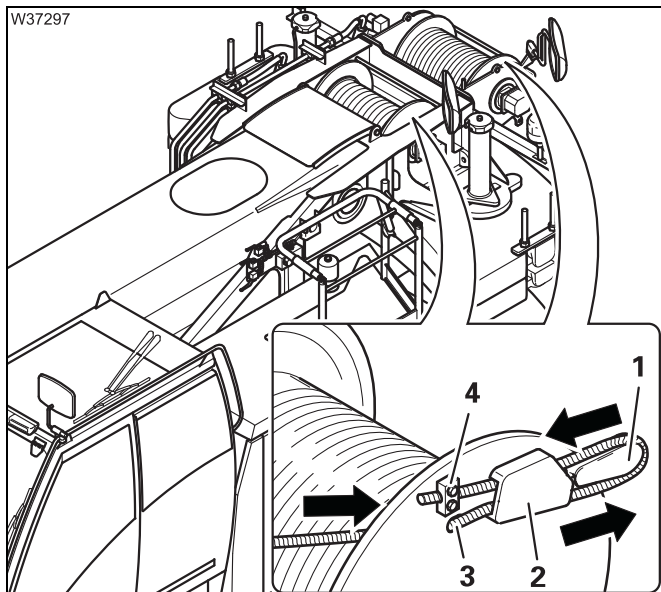


- Place the reel stand (1) with the new rope in front of the main boom head. The distance (X) between the reel stand (1) and the head sheave (2) must be at least 30 m (100 ft), so that the rope runs over the head sheave as straight as possible.

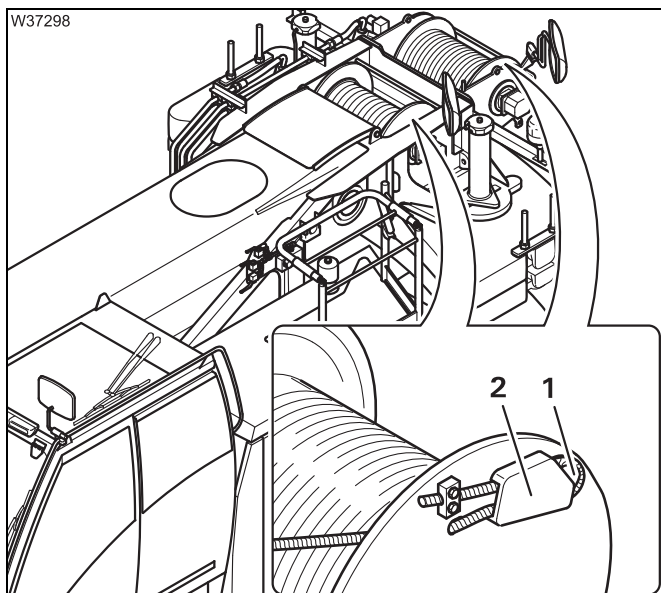
Ensure that the rope is being rolled on to the drum with the right slewing direction.

- Guide the rope over the head sheave (2) and under the bracket (3) up to the hoist drum.






- Guide the rope through the hole (3) until it protrudes about 1.5 m (5.0 ft) beyond the pouch (2).
- Feed the free end of the rope back through the pouch.
- Secure the clamp (4) and tighten it – torque to 79 Nm (58 ft lbf).
- Place the rope wedge (1) in the loop.



- Push the rope back until the rope wedge (1) is fully in the pouch (2).
- Ensure that the rope wedge, loop and rope end do not protrude beyond the flanged wheel. This will prevent damage.

- Start the engine (from the crane cab).
- Hold the rope taut and wind up the rope slowly.
- Reeve a hook block – reeve it with at least five lines;  *Operating manual*.
- Raise the main boom to a steep position and extend it fully.
- Unwind the rope until only five turns remain on the rope drum.



Observe the hook block when unreeling.
The hook block must not rotate.



Risk of accidents from incorrectly set lowering limit switch

After inserting a new rope, the lowering limit switch must always be reset. In this way you avoid the lowering limit switch switching off too late or not at all, the rope being damaged and the load being dropped.

- Set the lowering limit switch; p. 8 - 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 with five lines; *Operating manual*.
- The main boom is fully raised and extended; *Operating manual*.
- The hook block is lowered until only five turns of the rope remain on the hoist drum.

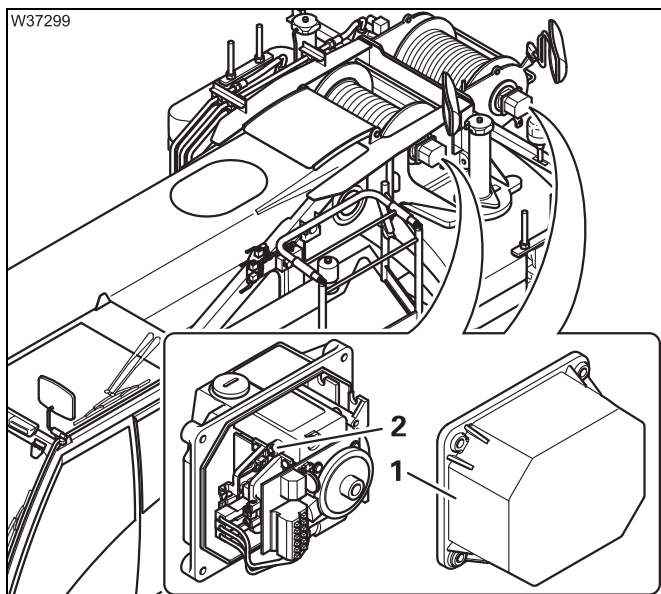


Setting the lowering limit switch



Risk of accidents due to rope end fitting being 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 cap (1).
- Turn the screw (2) until you hear the switch activate.
- Screw the cap on again.
Replace the gasket if necessary.
- Check that the lowering limit switch switches off the hoist correctly.

Checking switch-off

- Raise the hook block until there are about 10 turns on the hoist drum.
- Lower the hook block and check whether the lowering limit switch switches off properly.

The lowering limit switch must switch off the hoist while five rope turns are still on the hoist drum.

- Correct the setting of the lowering limit switch if necessary.

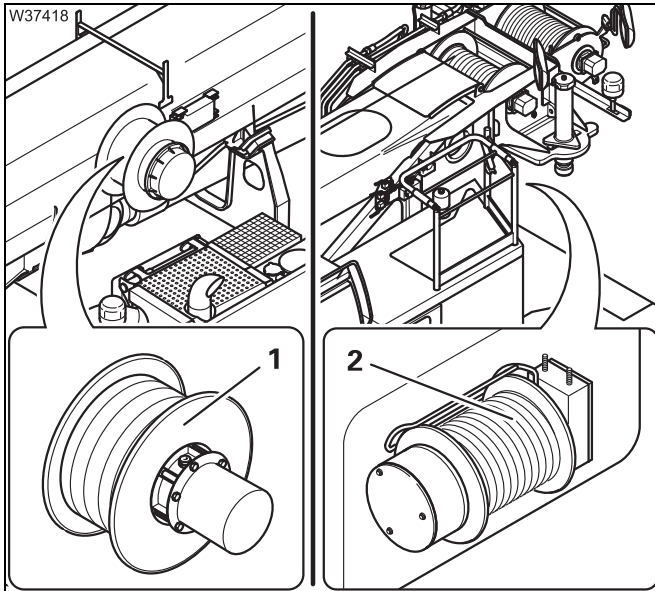
8.9

Cable drums

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 manual*.
- The main boom is set down on the support; *Operating manual*.
- The engine is not running and is secured against unauthorised use; p. 2 - 3.
- The battery master switch must be switched off in the driver's cab; *Operating manual*.





Risk of damage to the RCL

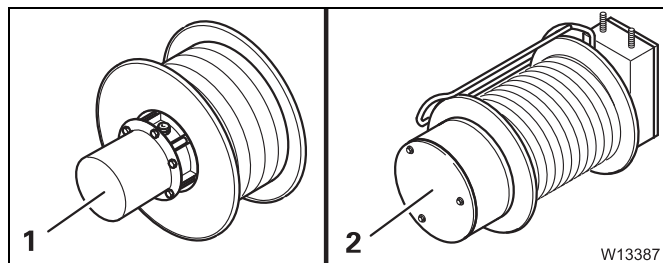
Before maintenance work on the slip ring assemblies, always switch off the battery master switch so that the cable drum is without power. This prevents short circuits which may lead to damage to the rated capacity limiter (RCL).



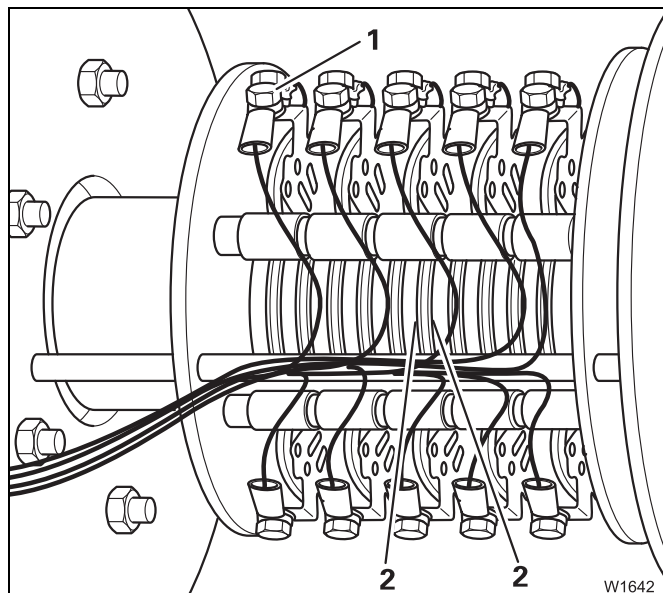
Risk of crushing from movement of the main boom

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 cap (1) or (2).
- Clean and dry the cap.
- Replace the gasket if necessary.



- Only use a cloth and compressed air to remove any dirt on the slip rings (2).
- **Do not** use spray oil.
- Check to make sure all screws (1) are tight.
- Attach the cap to the cable drum.

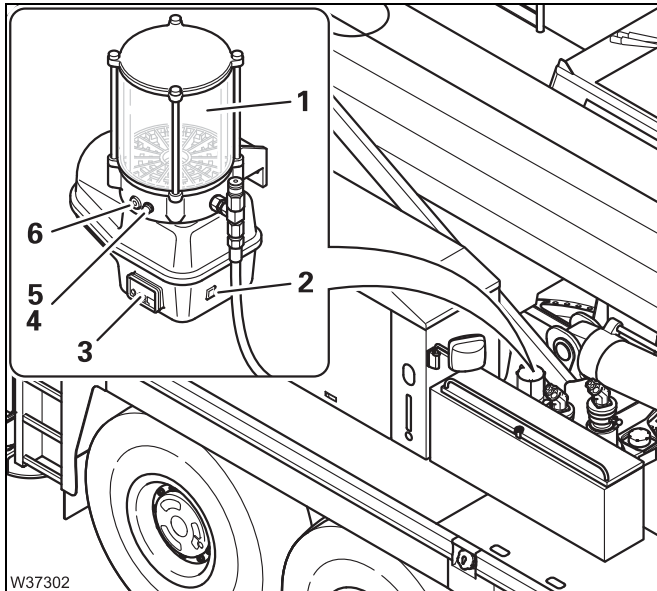
8.10

Central lubrication system

8.10.1

Checking the filling level

W



The maintenance of the pump (1) is similar to the maintenance on the carrier; → *Central lubrication system*, p. 7 - 109.

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 hook blocks

M 12


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

Grease, spare parts, tools

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

- Grease gun from the tool set.

Prerequisites

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

Lubrication

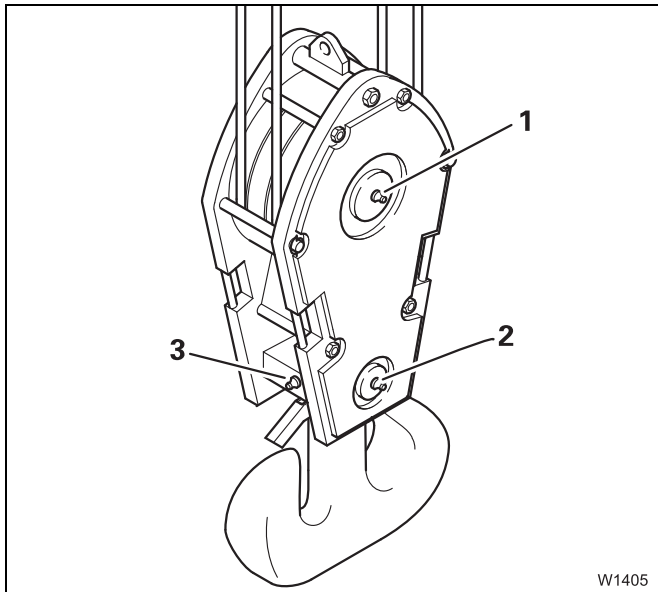
On the hook blocks supplied, the sheaves, crossheads and load hooks of the axial bearings are greased.



The sheaves on the hook block often have no grease nipple and are maintenance-free.

- Check all hook blocks for grease nipples. Hook blocks with grease nipples must be serviced, hook blocks without grease nipples are maintenance-free.





The diagram gives an example of the arrangement of the grease nipples (1), (2) and (3) on a hook block.

There are more grease nipples on the other side.

- Clean the grease nipples on all hook blocks and grease them using a grease gun.

Checking the fastenings



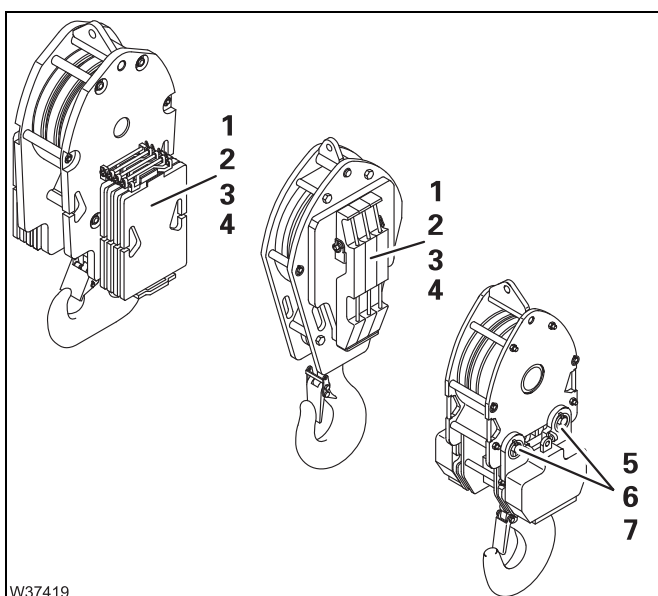
The truck crane GMK4090 can be equipped with hook blocks that can be fitted with **ballast** and can be **separated**.

Risk of accidents due to non-secured hook block components

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

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

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



Ballast weight

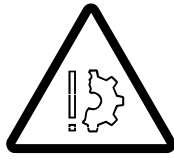
- Check the surfaces (1) for the ballast weights (2) for damage.
- Check the bolts (3) and the retaining pins (4) for damage.

Separable hook block

- Check the separable joints (5) for damage.
- Check the bolts (6) and the retaining pins (7) for damage.

Information on crane operation

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



Risk of damage to the hook blocks

Check the retainers for the ballast plates regularly for corrosion and conditions. This applies in particular if

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

In this way, you avoid damaging the retainers, which can lead to the hook blocks falling over.

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.

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8.12

Electrical system

8.12.1

Checking the lighting and indicators

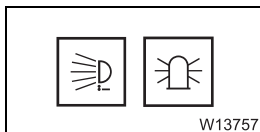
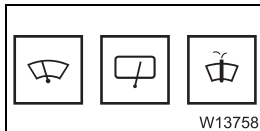
D



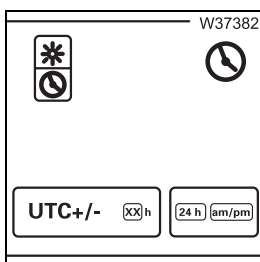
Risk of accidents in the event of faulty safety devices

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

- Check the symbols and indicator lamps on the *CCS (Crane Control System)* control unit; *Operating manual*.



- Check the following functions:
 - Windscreen wipers, windscreen washing system
 - Spotlight on the crane cab, air traffic control light
 - Spotlight at the main boom
 - Horn, anemometer
 - Camera lights on the main and auxiliary hoists



- Date/time on CCS display; *Operating manual*.

- 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.

- If necessary, find out whether your mobile crane has headlamps with xenon light.
- Have faulty lamps replaced only by qualified personnel.

8.12.2

Have the battery on the electronics board replaced

Y 10

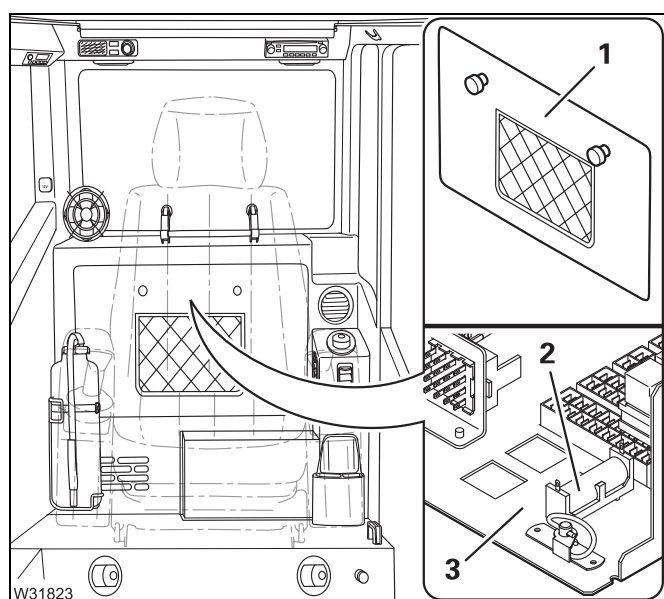
Spare parts and tools

Designation	Quantity	GROVE part no.
Lithium battery 3.6 V	1	03143172

Prerequisites

- The engine is not running and is 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 - 121.

8.13.2 Cleaning the condenser fins

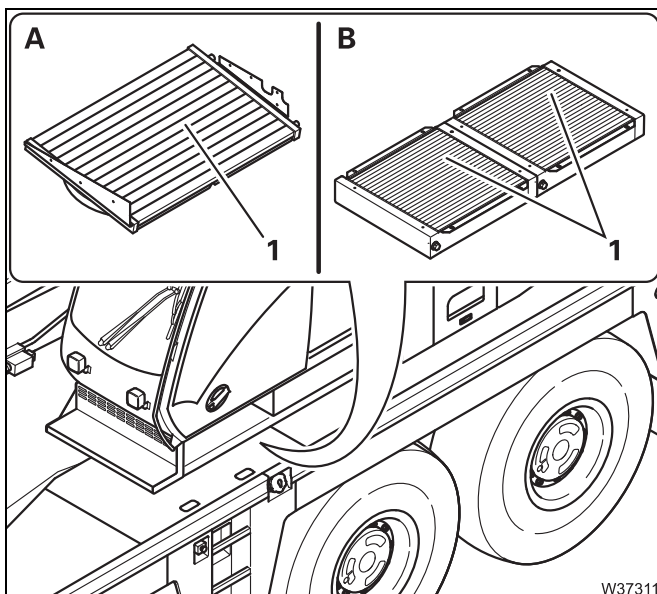
M 1



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.

Depending on the power of the air-conditioning system (3 KW or 6 KW), different condensers are installed (type **A** or **B**).



- 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.

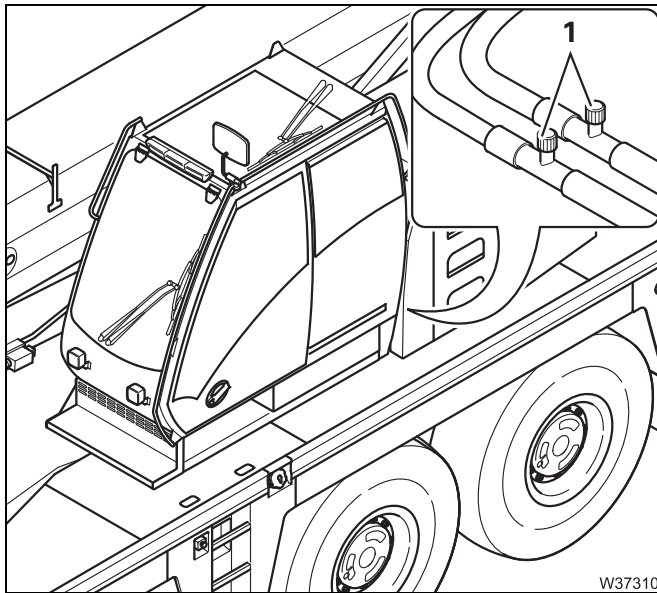
Only allow the system to be topped up with suitable refrigerant.

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.

8.13.5

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.

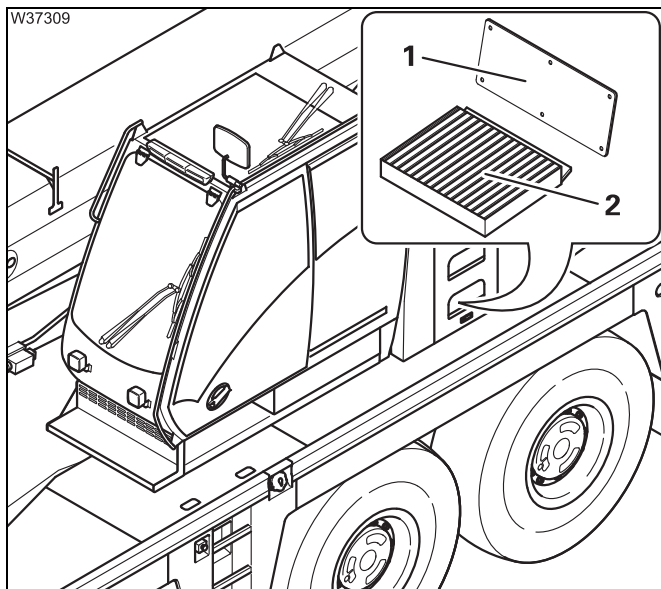
Spare parts and tools

Designation	Quantity	GROVE part no.
Filter	1	04163620

Prerequisites

- The engine is not running and is 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 (1).

8.14 Other maintenance work

8.14.1 Checking windscreen washing system

W

Water, spare parts, tool

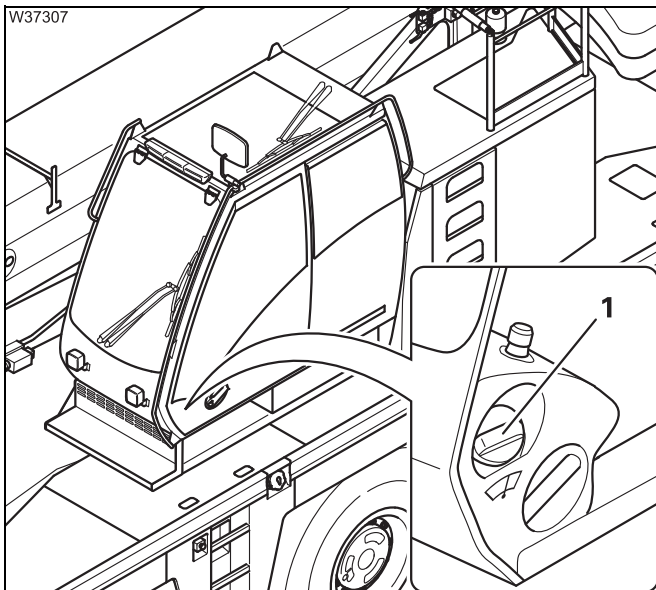
Designation	Quantity	GROVE part no.
Windscreen wiper blade	1	03268512
Roof wiper blade	1	03326121

- 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




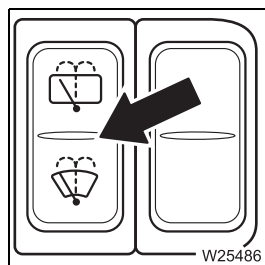
If the tank is empty

- 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.

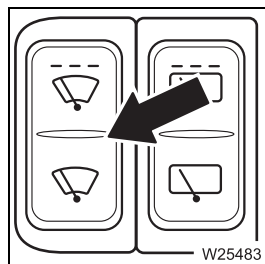


Wiping

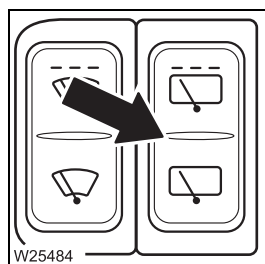
The wiping/washing system operation is described in the accompanying operating instructions;  *Operating manual*.



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



- Switch on the **windscreen wiper** – press the switch **down** for continuous operation.
- Also check intermittent operation – press the switch **up**.
- Switch off the **windscreen wiper** – press the switch into the middle position.



- Switch on the **roof window wiper** – press the switch **down** for continuous operation.
- Also check intermittent operation – press the switch **up**.
- Switch off the **roof window wiper** – press the switch into the middle position.

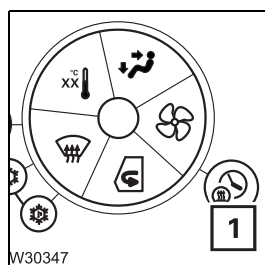
In case the windscreen/skylight is not wiped clean


- 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 - 135.

- Familiarise yourself with the CCS Heating/Air-conditioning system menu in the crane cab;  *Operating manual*.

8.14.3

Lubricating the crane cab door


M 12

Grease, spare parts, tools

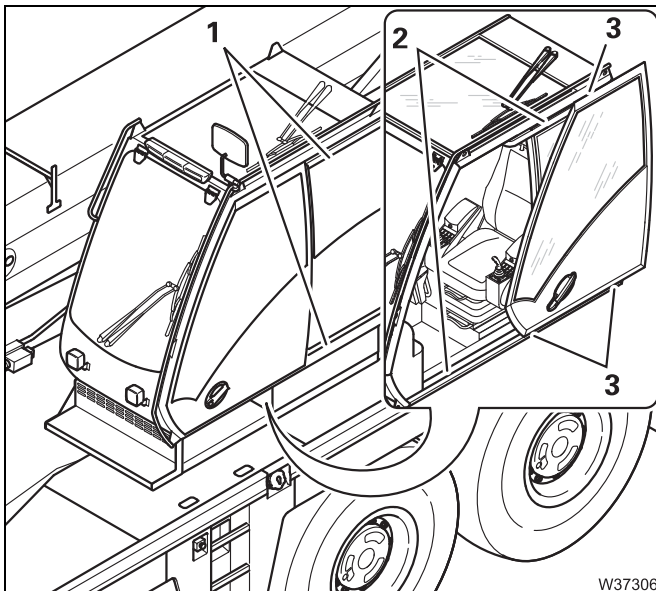
Designation	GROVE part no.
Grease: RHUS 2 AF, 1 kg can	03325215

- Brush.

Prerequisites

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

Lubrication



- With the door closed, clean the rails (1) outside.
- Lubricate the rails (1) lightly with a brush.
- Open the door and slide it fully open – the door locks in place.
- Clean the rails (2).
- Grease 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

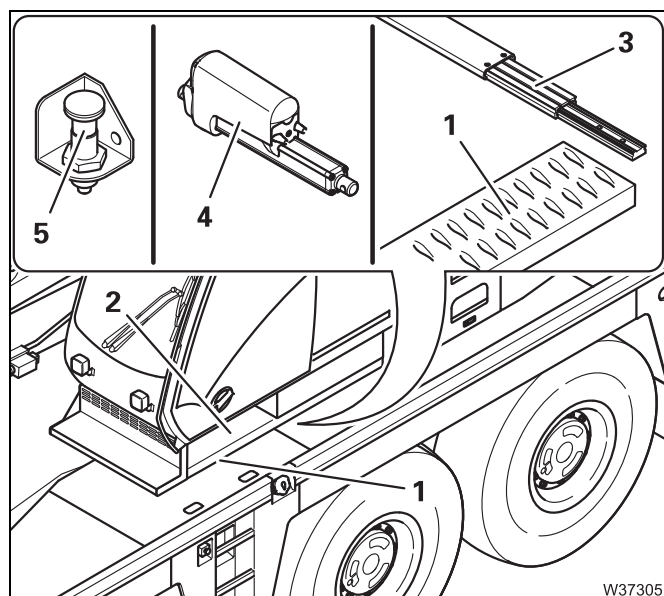
- The turntable is locked.
- The engine is not running and is secured against unauthorised use;  p. 2 - 3.

Retracting/ extending

- Familiarise yourself with the retracting/extending the step in the operating manual;  *Operating manual*.
 - **manual** (series equipment): about the spring pin (5) or
 - **electrical** (additional equipment): from the crane cab or at the outrigger control unit via the electrical spindle motor (4).

Lubrication

- Pull the spring pin (5) – the step is unlocked.
- 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.
- Fully retract and extend the step several times. Whilst doing so, check that the step is moving easily on the rails.
- Check that the electric spindle motor (4) is running smoothly and without jerking (additional equipment).
- Attach the step (1) and the grille (2).

- Fully retract the step.
- Check whether the spring pin (5) is engaged in 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 acc. to DIN 51502	Specifications Classification	GROVE part no.
Grease	KP - 1K - 50	DIN 51825	03233369

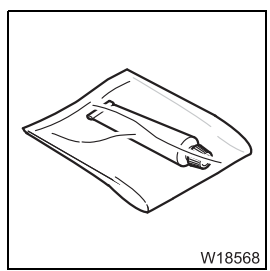
- Brush.

Check

Depending on the equipment, the **superstructure** can have 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.

Lubrication



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

07.12.2017

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

Check

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

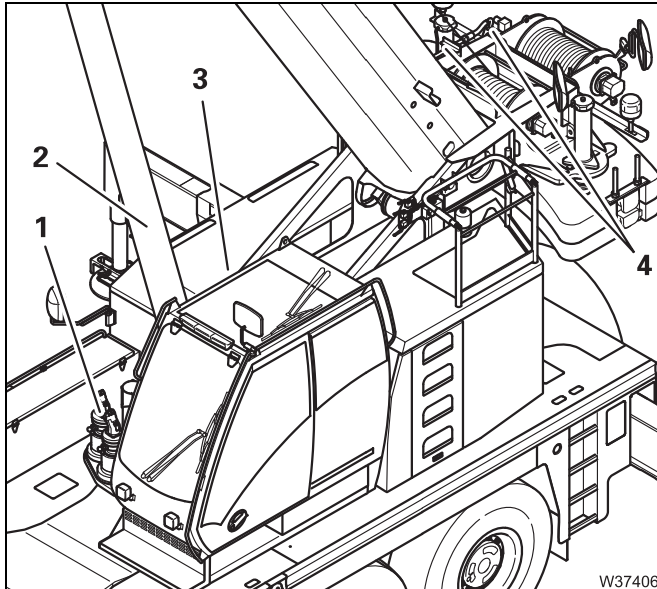
- Observe the processing instructions for corrosion protection;
 ▶ *Processing instructions*, p. 7 - 137.

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

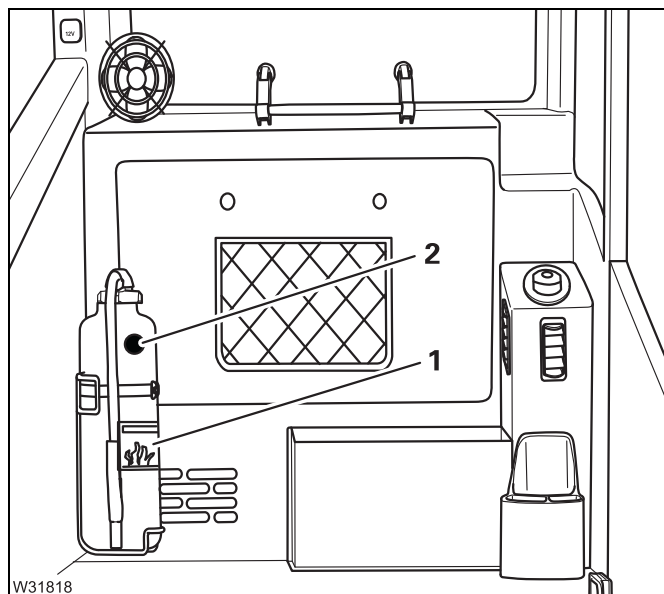
Having the fire extinguisher checked

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 is still working properly after the maintenance interval on the label has expired.

9

Longer out-of-service periods

Carry out the following jobs if the truck crane is 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 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 put out of service for more than 12 months:

- Carry out all maintenance work in accordance with the maintenance plan **M 12**.
- Observe the specifications on preservation in the *Engine manufacturer's documentation*.

Putting the truck crane into operation

- Open the air filter.
- Inflate the tyres up to the prescribed pressure.
- Carry out periodic maintenance work in accordance with the maintenance plans in chapter 5.
- Observe the specifications on preservation and putting the truck crane back into service in the *Engine manufacturer's documentation*.

10 Torques

10.1 Torques for retaining bolts

Metric screw thread Metric fine thread			Approximate values		
Thread size (mm)	Size across flats (mm)		Torques (maximum permissible pre-tensioning for bolts) for oiled bolts (Nm)		
	Hexagon head screw	Cylinder screw	Bolt quality		
			8.8	10.9	12.9
M 8 M 8 x 1	13	6	23 24	32 34	36 41
M 10 M 10 x 1.25	17	8	44 47	62 66	75 79
M 12 M 12 x 1.5	19	10	78 81	110 113	130 135
M 14 M 14 x 1.5	22	12	120 135	170 189	210 225
M 16 M 16 x 1.5	24	14	165 203	190 284	320 342
M 18 M 18 x 1.5	27	14	260 293	365 414	435 495
M 20 M 20 x 1.5	30	17	370 414	520 576	620 693
M 22 M 22 x 1.5	32	17	500 549	700 774	840 945
M 24 M 24 x 1.5	36	19	640 702	900 990	1,080 1,170
M 30	46	22	1,300	1,800	2,160
M 33	50	24		2,700	
M 36	55	27		3,300	

07.12.2017

10.2 Special torques

Description	Thread size (mm)	Spanner size (mm)		Torque (Nm)
		Hexagon head screw	Cylinder screw	
Suspension strut:				
– Bracket for the vehicle chassis, top	M 16	—	14	265
– Bracket for the vehicle chassis, bottom	M 24	—	19	900
– Suspension strut flange, bottom	M 20		17	520
– Half shell steering lever	M 16		14	265
– 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	19	—	79

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.

Listed here are only the spare parts required for the maintenance work described.

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

An overview of the required lubricants can be found in:

- *Lubricants list*, p. 6 - 2,
- *Lubricant applications list*, p. 6 - 3.

11.2

Lighting

Lamps are listed according to the installation point. The list includes standard and additional lighting equipment for the truck crane.

Lighting specific to certain countries can be found in the accompanying *Spare parts list*, in the section on country-specific packages.



Risk of accidents from exploding glass bodies and high voltage.

The glass bodies of gas discharge lamps (xenon lights) are pressurised. If the lamp breaks, the glass splinters explosively and shards scatter. Xenon lights operate at high voltage. While changing the lamp, there is still a danger of residual voltage discharging (electric shock) even when the battery master switch is switched off.

Have faulty lamps replaced only by properly qualified personnel who use the relevant protective equipment.



Installation point	GROVE part number	Designation	Output (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 24 V	70
– Low-beam + full-beam headlights (USA)	03143584	H9 12 V	65
– Indicator light	03327578	PY21W 24 V	21
– Parking light (in the direction indicator light)	03140908	LED	
Front, side indicator lights: (under the access ladder to the driver's cab)			
– Additional indicator	04163927	LED	
– Yellow side marker light	03320937	LED	
Tail lights: (at the rear of the chassis)			
– Marker light	03137450	R5W 24 V	5
– Number plate light	03137450	R5W 24 V	5
– Rear light	03137450	R5W 24 V	5
– Brake light	03328445	P21W 24 V	21
– Indicator light	03327578	8GA 006841241	24 V / 21 W
– Fog tail light	03328445	P21W 24 V	21
– Reverse light	03328445	P21W 24 V	21
Reversing lamp: (at the rear of the chassis)			
– Reversing lamp; complete	03143180	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	Output (W)
Red triple light strip for USA: (at the rear of the chassis)			
– Triple light strip	7581100056	LED	
White front marker lights: (at the top on the driver's cab)			
– Marker light	01207144	R10W 24 V	
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	24 V	24 V / 15 W
– Reading light	03135111	24 V	24 V / 15 W
Dashboard light: (in the driver's cab; socket 12 V)			
– Filament lamp	04159964	Xenon	12 V / 6 W



Installation point	GROVE part number	Designation	Output (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 24 V	10
– Reading light	00550434	K 24 V	10
Spotlight, angular-shaped, permanently installed: (at the front of the crane cab)			
– Filament lamp	01573349	H3 24 V	70
Spotlight, electrically adjustable: (at the front of the main boom)			
– LED spotlight; complete	04160078	LED	

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
Set with both filters 1 + 2	04183793	Alternative				
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 (per axle lines)						
1. and 2nd axle line (duplex brake):		only in the case of wear on the drum brakes				
Brake shoe with brake lining	03322112					4
Spring	03322110					4
Brake drum	01925703					2
3. and 4th axle line (simplex brake)						
Brake shoe with brake lining	03322121					4
Spring	02315393		4			
Brake drum	01925703		2			
Suspension						
Ventilation filter (collecting container)	03324588		1	Only if clogged		
Compressed air system						
Valve (if defective)	01570750	(8)				
Gasket 22 x 27 Cu DIN 7603	00117142	(8)				
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						
Gasket 18 x 24 Cu DIN 7603	01377793	(4)	(if damaged)			
Gasket 18 x 24 Cu DIN 7603	01377793					10
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 piece (if damaged) for every rope change on the hoist				
Cable drums						
Cover gasket for cable drum 1	03138891	(if damaged)			(1)	
Cover gasket for cable drum 2	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
Electrical system						
Lithium battery 3.6 V	03143172					1

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

IMPORTANT:

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

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

General overhaul performed on.....

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	Operating hours of the winch since the last inspection	Used proportion of theoretical service life D:	Remaining theoretical service life	Name of the expert	Signature	Comment	Name of the approved inspector	Signature
"1"			Km _i	[h]	[h]	[h]	[h]	[h]	$S_i = \frac{K m_i}{K m}$ x T _i	D _i = D _{i-1} - S _i					

IMPORTANT:

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

General overhaul performed on.....

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

