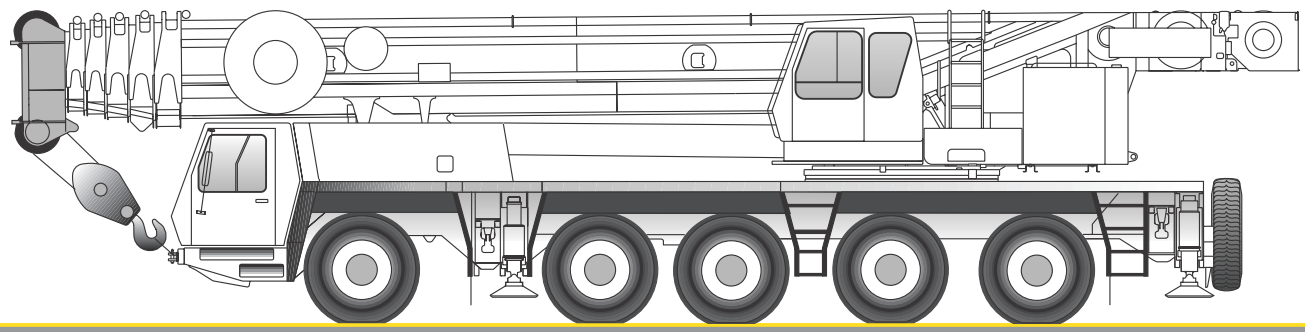
GROVE®

GMK5200



Maintenance Manual

Vehicle serial number:

2 084 876 en

25.06.2004

Important note

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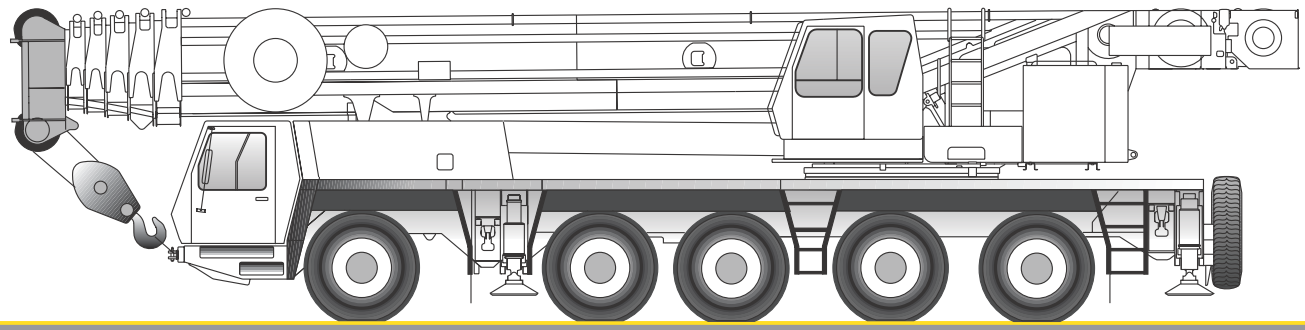
GMK5200



Correction sheets – Drives

Vehicle identification number:

2 084 955 en
04.02.2005

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04.02.2005

Correction sheets – Drives

Important information

Validity

These correction sheets apply only to GMK 5200 truck cranes whose operation and maintenance manuals bear the following identification nos.:

2 084 781	2 084 782
2 084 814	2 084 815
2 084 829	2 084 830
2 084 876	

The identification number of the operation and maintenance manual is on the cover sheet and in the centre of the footer on every page.

These correction sheets are an integral part of the GMK 5200 operation and maintenance manual supplied.

Reason for these correction sheets

These correction sheets describe changes to the possible drives of the GMK 5200 which therefore deviate from the information given in the *GMK 5200 operation and maintenance manuals* supplied.

These correction sheets only describe these changes.

Information

As the crane operator, it is your duty to inform everyone who works with your GROVE truck crane about this addition to the operation and maintenance manual.

04.02.2005

Correction

Depending on the delivery condition, your GMK 5200 is equipped with either a 10 x 6 x 10 drive or a 10 x 8 x 10 drive.

The formulation *Drive of the first axle line / longitudinal differential lock* in the operation and maintenance manuals should read ***Drive of the third axle line / longitudinal differential lock***.

9.1.3

Drive units

The truck crane is driven by a water-cooled diesel engine with exhaust gas turbocharger.

The axle lines are driven by a power shift gear with secondary transfer case. The electronically operated power shift gear can be switched to an E program (economy) for driving on flat, even surfaces and a P program (power) for driving uphill. The transverse differential locks can be activated on all driven axle lines. For driving off-road you can do the following:

– with 10 x 6 x 10 drive, also switch on the longitudinal differential locks in the transfer case and on the fourth axle line.

– with 10 x 8 x 10 drive, also switch on the longitudinal differential locks in the transfer case and on the fourth axle line, together with the drive of the third axle line.

Axle lines

Drive:	**10 x 6 x 10**
First axle line:	Steered axle line
Second axle line:	Steered axle line
Third axle line:	Steered and driven axle line
Fourth axle line:	Steered and driven axle line (steering can be switched on)
Fifth axle line:	Steered and driven axle line

Drive:	**10 x 8 x 10 (additional equipment)**
First axle line:	Steered and driven axle line
Second axle line:	Steered axle line
Third axle line:	Steered and driven axle line (drive can be switched on)
Fourth axle line:	Steered and driven axle line (steering can be switched on)
Fifth axle line:	Steered and driven axle line

04.02.2005

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Additional maintenance work

Validity

These additional pages apply to all truck cranes with main booms that are equipped with Twinlock systems.

Additional maintenance work

These truck cranes require additional maintenance work on the main boom locking system.

Risk of accidents if maintenance work is not carried out!
Have the additional maintenance work on the main boom locking system performed by your authorized GROVE dealer or ***CraneCARE*** regularly.
This prevents the inadvertent unlocking of a telescoping section in Emergency operation/Emergency program mode, which could cause serious accidents and damage to the truck crane.

These additional pages describe this additional maintenance procedure only and are part of the maintenance manual supplied.

5.2 Maintenance plan

5.2.6 M 12 maintenance plan: Every 12 months / after 1000 oper. hrs.

	M 12	
Maintenance work on the SUPERSTRUCTURE: Every 12 months / after 1000 oper. hrs.	**Oil / lubricant**	
	Amount (l)/ number	**Designation ➠ p. 6 – 1**
Main boom – Have the main boom locking system checked by your authorized GROVE dealer or ***CraneCARE***.	**4**	

23.02.2005

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The Maintenance Manual contains the following chapters:

25.06.2004

25.06.2004

1 General instructions

25.06.2004

25.06.2004

1 General instructions

1.1 Using the maintenance manual

This manual is not designed to replace proper training and instruction. Truck crane maintenance personnel are required to have relevant specialised knowledge of proper safety procedures!

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

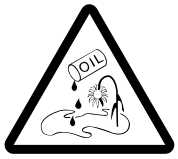
Maintenance work on the lattice extensions is described in the *Operating instructions lattice extension GMK 5200 / 6220-L*.

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 operation described which may cause personal injury. The type of hazard (e.g. life-threatening, personal injury, risk of crushing or electrocution) generally precedes the warning sign.

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



This symbol reminds you that you are working with substances which pose a risk to the environment. Take particular care.
The measures required for the corresponding maintenance work are indicated next to the symbol. You will find more detailed information in the Section *Handling substances which are harmful to the environment*, p. 2 - 3.

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

25.06.2004

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

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

25.06.2004

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 qualified repair personnel (e.g. the ***CraneCARE*** at the respective location).

Repair work also requires:

– appropriate workshop equipment

– special tools and

replacement parts authorized by Deutsche GROVE GmbH.

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

Please note that Deutsche GROVE GmbH can only uphold the warranty provided for the truck crane if the following conditions are met:

– it is used for the purpose for which it was intended

– care and maintenance is carried out as prescribed

– repair work / overhauling is carried out by professionals

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

– lack of oil, grease or antifreeze

– dirt

– rope damage

– defective compressed air and hydraulic systems

– hose damage or loose screw connections

– defective brakes

– defective 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. Notify ***CraneCARE*** at the respective location or your repair crew immediately should repair work become necessary. This work may only be carried out by trained, qualified personnel.

25.06.2004

A few **general maintenance instructions**:

- Clean the parts of the truck crane that are to be serviced, particularly the area around oil filler, oil inspection and drain openings, and lubricating nipples.
- When changing the oil, let the oil run out at operating temperature.
- Ensure that only oils and lubricants specified in the *Lubrication chart*, Chapter 6, are used.
- Replace all filters within the specified period if cleaning is not explicitly permitted.
- Replace all seals before assembly. Clean the sealing surfaces.
- Only tighten loose screw connections on hydraulic systems when the system is depressurized.
- Keep brake and clutch linings free of grease.
- Replace hydraulic hoses immediately once damage or penetration of moisture becomes visible.
- When handling hydraulic oil, cleanliness is imperative. Even new hydraulic oil must be filtered.
- Check fastening and retaining elements (bolts, nuts, lock washers) before re-using them and replace them if necessary.

Tightening torques may be found in the Sections 10.1 and 10.2.

Our training center at our plant in D-26389 Wilhelmshaven offers specialized training programmes. Ask your local ***CraneCARE*** at the respective location about this.

The vehicle must fulfil all current regulations before commissioning and use on public roads.

25.06.2004

1.4 Definition of positional references

Terms used to describe the location of components are defined in this section.

On the **carrier**, the driver's cab is always at the **front**. The terms **rear**, **right** and **left** are used in relation to the definition of the term "front" on the carrier.

On the **superstructure front** always refers to the direction of the main boom head, regardless of the superstructure position. The terms **rear**, **right** and **left** are used in relation to the definition of the term "front" on the superstructure.

25.06.2004

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25.06.2004

2 Safety and environmental protection

25.06.2004

25.06.2004

2 Safety and environmental protection

2.1 Safety rules

When carrying out maintenance work, it is imperative that you observe the applicable **accident prevention regulations**.
The following instructions are general safety rules for maintenance personnel:

- Familiarize yourself with the truck crane and its operation.
  Read the operating instructions carefully and request guidance from crane operator.
- Do not carry out maintenance work unless you are authorized to do so.
- Perform only the maintenance work on the brake system and steering that is described in this maintenance manual. Additional work may only be carried out by ***CraneCARE*** at the respective location or other qualified personnel. Risk of **accidents**
- Observe all safety and warning signs on the truck crane.
- Observe all safety instructions contained in this maintenance manual.
- Familiarize 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 prevented from rolling.
- Keep all handles, steps, landings and ladders free of dirt, grease, snow and ice.
- Use the proper access aids and working platforms when carrying out overhead work. Wear a harness when carrying out maintenance work high overhead.
- Walk only on those machine parts which are equipped with appropriate steps and railings and therefore guarantee safety. During rigging and maintenance work on machine sections above body height which have no apparatus for accessing, always use the supplied extension ladder (e.g. when lubricating telescopic slide faces).

25.06.2004

- Perform maintenance work only after the truck crane has been shut down. Always ensure that the truck crane is protected from unauthorized operation before beginning maintenance work. Remove the key and put up warning signs.

If, as an exception, the truck crane needs to be put into operation for certain types of maintenance work, great care must be taken where there are moving parts (superstructure, outrigger, cardan shafts, swivelling connections, motors, tiltable crane cabs, superstructure lock). There is a **risk of injury**.

- Ensure that all hydraulic components are returned to their initial positions (e.g. the boom) or locked (e.g. the outrigger).

Escaping hydraulic fluid or compressed air can cause severe injury. Remember that hydraulic and compressed air systems of the truck crane are pressurized even when the crane is not in operation. Only tighten loose screw connections when the system is in depressurized condition. Always depressurize the hydraulic and compressed air systems before opening them.

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

25.06.2004

2.2 Handling substances which are harmful to the environment

What do environmentally harmful substances include?

When you carry out maintenance work on the truck crane you will occasionally work with substances which are considered to be harmful to the environment according to the current national and local regulations.
This includes, amongst others, oil, fuel, grease, used oil and fuel filters as well as cloths which have come into contact with these environmentally harmful substances.

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

Use suitable equipment

Substances harmful to the environment can be corrosive. Therefore only use containers, hoses, pumps, funnels etc. which are resistant to the respective substance.

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 draining oil in a suitable container.
- Always use a drain hose when draining, and a funnel or a filling pump with hose suitable for the respective substance when filling.

Collect and store separately

Substances which are environmentally harmful should always be collected separately from other waste.

- Also collect the environmentally harmful substances divided according to solid materials (e.g. filter elements) and liquids. Disposal costs will be reduced if you collect liquids separately according to certain categories.
- Ask your local environmental protection authority about the different categories for the substances.
- Only store environmentally harmful substances 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 accumulated, have environmentally harmful substances disposed of only by disposal companies which are approved by the national or regional authority responsible.

25.06.2004

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25.06.2004

3 Cleaning

25.06.2004

25.06.2004

3 Cleaning

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

- During this period the truck crane may only be cleaned with cold water.
- Do not use high-pressure or steam-jet cleaning equipment during this period.
- Avoid water temperatures over 60 °C (140 °F), even after the first three months.
- Do not use corrosive cleaning agents that might corrode 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.

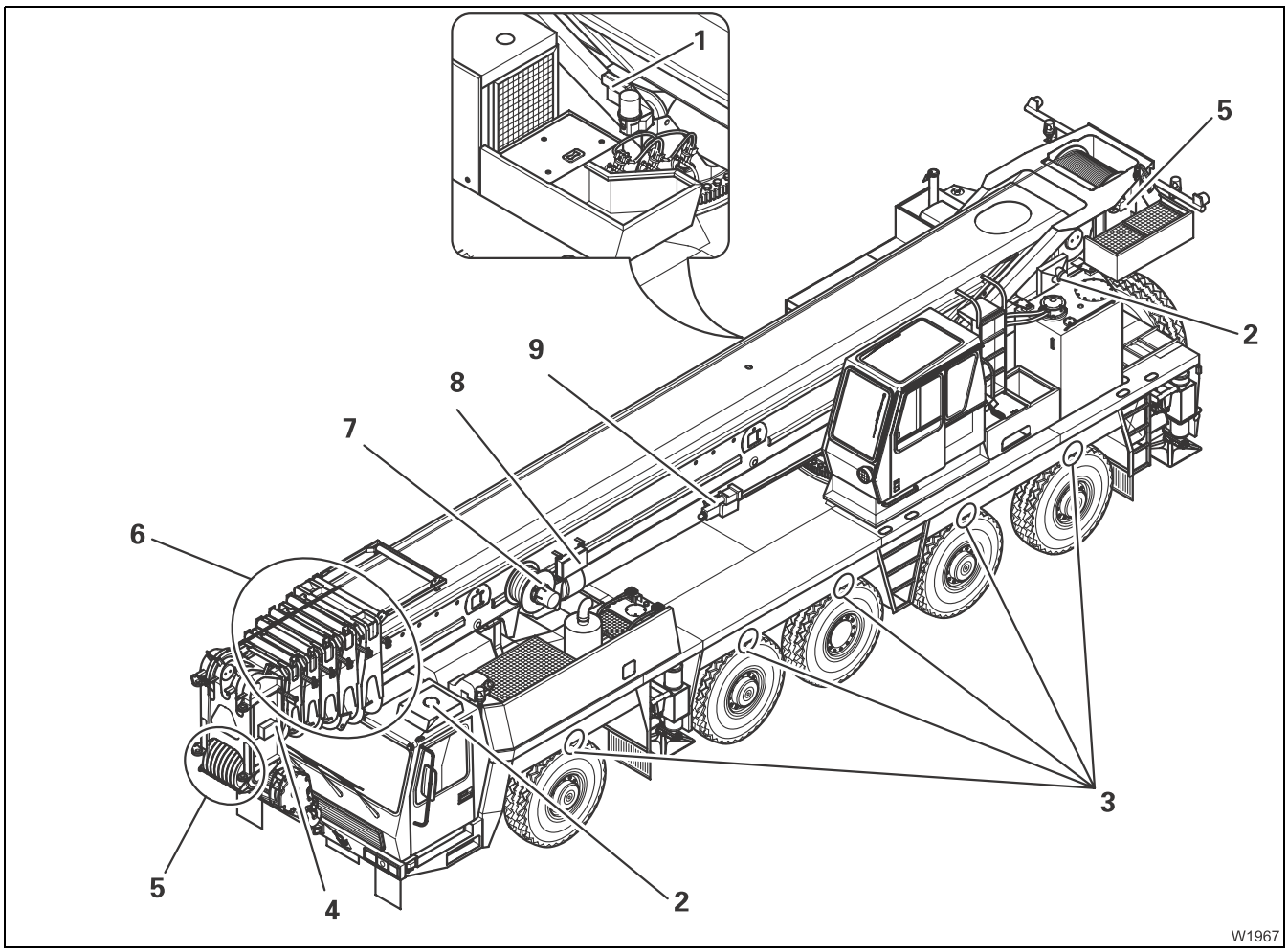
Risk of accidents from misdirected high pressure water jet
When working with high-pressure and steam jet cleaners, the water jet will be deflected by crane parts and could spray into your face and eyes at great speed and high pressure.
Always wear a face guard when cleaning the truck crane with high-pressure and steam-jet cleaning equipment.

- Never point the nozzle at electrical equipment, relay and control boxes, suction and venting filters or control elements and lubricated surfaces.

The components specified in the following section are to be cleaned with particular care.

25.06.2004

3.1 Overview of components easily damaged when cleaning



1 Pressure sensor switch box

2 Air conditioner capacitor, carrier/superstructure

3 Suspension cylinders (on both sides of the truck crane)

4 SLI terminal box

5 Lifting limit switch and lowering limit switch

6 Telescope slide faces

7 SLI length measuring unit

8 Angle sensor control box

9 Pressure sensors

Endangered parts on the lattice extension (additional equipment) are described in the *Operating instructions lattice extension GMK 5200 / 6220-L*.

25.06.2004

4 Run-in regulations

25.06.2004

25.06.2004

4 Run-in regulations

Special running-in instructions must be observed for individual components (hoist, gears, etc.)

– after initial start-up or

– after **part replacement** or

– after a general inspection

Special run-in instructions must be observed, i.e. **additional maintenance work** must be carried out on the **carrier** and the **superstructure** at **certain intervals**:

Operating hours (oper. hrs)	**driven km (mi)**	**Additional maintenance work on the CARRIER**
	After 50 (30)	Tighten wheel nuts (tightening torque; ➠ p. 10 - 1)
	After 150 (95)	Tighten wheel nuts (tightening torque; ➠ p. 10 - 1)
	After 8,000 (5,000)	Carry out first change of oil filter on automatic transmission; ➠ *Automatic transmission - changing the oil and oil filter*, p. 7 - 20.
After 20 [1)]		Carry out first oil change in transfer case; ➠ *Transfer case - changing the oil*, p. 7 - 24.
After 50		Tighten the clamps on all cooling water hoses (tightening torque 6.5 Nm (4.8 lbf ft)).
During the first 100		Check the hydraulic oil filters weekly; ➠ *Changing the hydraulic oil filters and cleaning the magnetic rod*, p. 7 - 48.

[1)] 1 oper. hr. corresponds to approx. 40 kilometers driven (25 miles).

Please observe the stipulations concerning run-in times / run-in regulations in the enclosed manufacturer's operating instructions for the vehicle engine.

25.06.2004

Operating hours (oper. hrs)	**driven km (mi)**	**Additional maintenance work on the SUPERSTRUCTURE**
After 50		Tighten the clamps on all cooling water hoses (tightening torque 6.5 Nm (4.8 lbf ft)).
During the first 100		Check the hydraulic oil filters weekly; ➠ *Changing the hydraulic oil filters and cleaning the magnetic rod*, p. 8 - 29.
After 100		Check tightness of retaining bolts (tightening torque ➠ p. 10 - 2).
After 200		Carry out first oil change on the hoist gears (auxiliary hoist only with additional equipment); ➠ *Hoists - Oil change*, p. 8 - 12.
After 200		Carry out first oil change in slewing gear transmission; ➠ *Slewing gear - oil change*, p. 8 - 19.
After 1,000 [1)]		Carry out second oil change on hoist gears (auxiliary hoist only with additional equipment); ➠ *Hoists - Oil change*, p. 8 - 12.

Observe the instructions concerning run-in times / run-in regulations in the enclosed manufacturer's operating instructions for the crane engine and in the crane engine maintenance booklet.

[1)] After 1,000 oper. hrs, after 12 months at the latest

25.06.2004

5 Maintenance overview

25.06.2004

25.06.2004

5 Maintenance overview

In this chapter, all periodic maintenance work is described in maintenance plans as:

- Maintenance plans **D** (= daily)
- Maintenance plans **W** (= weekly)
- Maintenance plans **M 1** (= once monthly) to **M 12** (= every 12 months) and
- Maintenance plans **Y 2** (= every 24 months) to **Y 6** (= every 72 months).

The maintenance plans are given in table form, differentiated by

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

In the tables you are directed p. 5 - 6 by cross references to the sections or pages in which the appropriate maintenance work is described.

Example: Check hydraulic oil level; ➠ p. 7 - 45.

25.06.2004

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25.06.2004

5.1 Maintenance intervals

The length of the interval depends on the operating conditions of the truck crane:

The next maintenance check must be carried out after

– a specified **time (maintenance deadline)** or

– a specified number of **km travelled** (or miles) for **carrier** components with driving functions or

– a specified number of **operating hours (oper. hrs.)** for **superstructure** (and carrier) components with crane functions

The **first maintenance interval** shall determine when maintenance work is next due.

The **km** (or miles) travelled may be taken from the trip recorder in the driver's cab (front instrument panel).

You can individually call up the **working hours (oper. hrs.)** of the superstructure's power units on the crane control display in the crane operator's cab (front instrument panel). The operating hours of the crane engine are simultaneously the total working hours of the superstructure.

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

mainte-nance plans	Maintenance interval	Kms travelled (mi) (carrier)	Operating hours (oper. hrs.) crane engine (superstructure)
D	daily / before start-up	—	—
W	weekly	—	—
M 1	monthly	approx. 2,000 (approx. 1,240)	100
M 3	every three months	5,000 – 6,000 (3,100 – 3,730)	300
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 (24,900 – 31,000)	—
Y 3	every 36 months	—	3,000
Y 6	every 72 months	—	6,000

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

25.06.2004

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25.06.2004

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 6** are provided for

– the **carrier** in chapter 7 and for

– the **superstructure** in chapter 8.

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

The section titles

– of the Chapter 7 *Description of maintenance work on the carrier* and

– of the Chapter 8 *Description of maintenance work on the superstructure*

contain the symbol (**D** to **Y 6**) of the relevant maintenance plan for better comprehension.

The description of some daily (**D**) and weekly (**W**) checks (preventive maintenance) can also be found in part in the operating instructions.

In addition to the maintenance work on the carrier and the maintenance work on the superstructure, the maintenance plans also contain:

– The **amounts** as approximate values for oil amounts (the exact oil amounts are always determined by the oil level openings, the dipstick or the oil level indicators) or the number of existing lubricating points **or** the **amount** of available lubrication points.

– The **descriptions** of the oils / lubricants in accordance with the table of lubricants, chapter 6.

Maintenance work for vehicle and crane engines which goes beyond the bounds of routine maintenance is **not** included in these maintenance instructions. Maintenance periods, instructions for the carrying out of maintenance work and a maintenance log can be found in the corresponding sections in the vehicle and crane engine operating instructions.
Maintenance of the vehicle and crane engines should be carried out according to the details in the operating instructions supplied for this engine.
Record maintenance work carried out in the maintenance log.

25.06.2004

5.2.1 Maintenance plan D: daily / before start-up

	D	
Maintenance work on the CARRIER	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Vehicle engine – Check the oil level; ➠ p. 7 - 2. – Check the refrigerant level; ➠ p. 7 - 5. – Check the dry air filter; ➠ p. 7 - 8. – Check the overall condition and check for leaks; ➠ p. 7 - 9. – Draining off water from the fuel filter; ➠ p. 7 - 10. – Visual inspection of the drive belt; ➠ p. 7 - 11.		**A 1**
Automatic transmission – Check the oil level; ➠ p. 7 - 13.		**F 4**
Wheels – Check tyres for damage and sufficient tread depth; ➠ p. 7 - 35.		
Carrier hydraulic system – Check hydraulic oil level; ➠ p. 7 - 45. – Checking contamination display for hydraulic oil filter; ➠ p. 7 - 48.		**G 2**
Carrier electrical system – Check lighting and indicators.		

25.06.2004

	D	
Maintenance work on the SUPERSTRUCTURE	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Crane engine – Check the oil level; ➠ p. 8 - 2. – Check the refrigerant level; ➠ p. 8 - 4. – Check the dry air filter; ➠ p. 8 - 5. – Check the overall condition and check for leaks; ➠ p. 8 - 6. – Draining off water from the fuel filter; ➠ p. 8 - 6.		**A 2**
Superstructure hydraulic system – Check hydraulic oil level; ➠ p. 8 - 21. – Check contamination display for hydraulic oil filter; ➠ p. 8 - 29.		**G 2**
Hoist ropes – Check the position of sheaves and rope drums; ➠ p. 8 - 49.		

25.06.2004

5.2.2 Maintenance plan W: weekly

	W	
Maintenance work on the CARRIER	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Vehicle engine Observe the maintenance intervals in the vehicle engine operating instructions. Record any maintenance work carried out in the enclosed maintenance log.		
Automatic transmission – Check the overall condition and check for leaks; ➠ p. 7 - 19.		
Transfer case / 3rd axle line – Check the overall condition and check for leaks; ➠ p. 7 - 23.		
Axle lines – Check the overall condition and check for leaks; ➠ p. 7 - 25.		
Wheels – Check the tyre pressure; ➠ p. 7 - 35.		
Steering – Check for leaks; ➠ p. 7 - 41.		
Carrier compressed air system (incl. brake system) – Drain compressed air system; ➠ p. 7 - 43. – Check for leaks; ➠ p. 7 - 43.		
Carrier hydraulic system – Check hydraulic hoses; ➠ p. 7 - 46. – Check tightness (suspension, steering and outrigger systems) while engine is running; ➠ p. 7 - 47.		
Carrier central lubrication system – Check the level of the grease container; ➠ p. 7 - 55.		**K**
Other maintenance checks – Check the function of the windscreen washing system of the operator's cab and the level of fluid in the supply reservoir.		

25.06.2004

	W	
Maintenance work on the SUPERSTRUCTURE	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Crane engine Observe the maintenance intervals in the crane engine operating instructions. Record any maintenance work carried out in the enclosed maintenance log.		
Main hoist / auxiliary hoist (additional equipment)		
– Check the oil level; ➠ p. 8 - 9. in transmission in the brake unit		**E 6** **G 5**
– Check for leaks; ➠ p. 8 - 10.		
– Check the hoist brake; ➠ p. 8 - 10.		
– Lubricate the hoist gear; ➠ p. 8 - 11.	**1**	**K**
Slewing gear		
– Check the oil level; ➠ p. 8 - 17.		**E 6**
– Check for leaks; ➠ p. 8 - 17.		
Superstructure hydraulic system		
– Check venting filter; ➠ p. 8 - 22.		
– Check hydraulic hoses; ➠ p. 8 - 21.		
– Check for leaks with the engine running; ➠ p. 8 - 22.		
Central lubrication system on superstructure		
– Check the level of the grease container; ➠ p. 8 - 65.		**K**
Hoist ropes		
– Check condition; ➠ p. 8 - 50.		
Other maintenance checks		
– Check the function of the windscreen washing system of the crane operator's cab and the level of fluid in the supply reservoir.		

25.06.2004

5.2.3 Maintenance plan M 1: monthly / after 100 oper. hrs. / approx. 2,000 km

	M 1	
Maintenance work on the CARRIER: monthly / after approx. 2,000 km	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Vehicle engine		
Observe the maintenance intervals in the vehicle engine operating instructions. Record any maintenance work carried out in the enclosed maintenance log.		
Transfer case / 3rd axle line		
– Check the oil level; ➠ p. 7 - 23.		**E 3**
Axle lines		
– Axle center drive - check oil level; ➠ p. 7 - 26.		**E 3**
– Final drive - check oil level; ➠ p. 7 - 29.		**E 3**
– Lubricate the cardan shafts of the axle lines; ➠ p. 7 - 31.	**18**	**K**
Wheels		
– Check tightness of wheel nuts; p. 7 - 36. Tightening torque; ➠ *Special tightening torques*, p. 10 - 2.		
Suspension		
– Check the oil level in the telescopic legs; ➠ p. 7 - 39.		**H**
– Check retaining bolts of the suspension cylinders; Tightening torque; ➠ *Special tightening torques*, p. 10 - 2.		
Carrier electrical system		
– Check the acid level in the batteries; ➠ p. 7 - 59.		
Towbar coupling (additional equipment)		
– Lubricate the towbar coupling [2)]; ➠ p. 7 - 65.	**2**	**J**
Superstructure air conditioning system		
– Check the moisture and level of the refrigerant; ➠ p. 7 - 61.		
– Clean the capacitor disks; ➠ p. 7 - 62.		
Other maintenance work		
– Check correct operation of the auxiliary heater (additional equipment); ➠ p. 7 - 71.		
– Lubricate the outrigger beams [1)]; ➠ p. 7 - 71.	**16**	**J**
– Lubricate the door hinges.	**4**	**J**
– Lubricate the connecting and socket pins.[1)]	**div.**	**J / M**

25.06.2004

[1)] after 100 oper. hrs.
[2)] Lubricate the towbar coupling after every high pressure cleaning.

	M 1	
Maintenance work on the SUPERSTRUCTURE: monthly / after 100 oper. hrs.	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Crane engine Observe the maintenance intervals in the crane engine operating instructions. Record any maintenance work carried out in the enclosed maintenance log.		
Hook blocks		
– Lubrication; ➠ p. 8 - 67.	**div.**	**J**
Superstructure electrical system		
– Check the acid level in the batteries; ➠ p. 8 - 69.		
Superstructure hydraulic system		
– Bleeding telescoping cylinders; ➠ p. 8 - 26.		
– Bleeding the derricking cylinder; ➠ p. 8 - 23.		
Superstructure air-conditioning system (additional equipment)		
– Check the moisture and level of the refrigerant; ➠ p. 8 - 71.		
– Clean the capacitor disks; ➠ p. 8 - 72.		
Other maintenance work		
– Lubricate piston rods, derricking cylinders; ➠ p. 8 - 25.		**Z**
– Check correct operation of the auxiliary heater (additional equipment); ➠ p. 8 - 75.		
– Lubricate cabin door track rollers.	**3**	**M**
– Lubricate the connecting and socket pins.	**div.**	**J / M**
– Lubricate the spring latch.	**div.**	**J / M**
– Lubricate the safety hooks on the 5.4 t base plate.	**1**	**J**

25.06.2004

5.2.4 Maintenance plan M 3: every 3 months / after 300 oper. hrs. 5,000-6,000 km

	M 3	
Maintenance work on the CARRIER: Every 3 months / after 5,000 oper. hrs.	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Vehicle engine Observe the maintenance intervals in the vehicle engine operating instructions. Record any maintenance work carried out in the enclosed maintenance log.		
Wheels – Checking wheel-bearing clearance; ➠ p. 7 - 36.		
Vehicle brakes – Check brake-lining thickness; ➠ p. 7 - 37.		
Carrier hydraulic system – Change the hydraulic oil filter, check the magnetic rods of the hydraulic oil filter for metal particles;[1)] ➠ p. 7 - 48.		
Carrier electrical system – Check acid concentration of batteries; ➠ p. 7 - 60.		
Towbar coupling (additional equipment) – Check the bearing; ➠ p. 7 - 66. – Check the cotter pin; ➠ p. 7 - 67. – Check the lower bushing; ➠ p. 7 - 68. – Check the initial tension of the springs; ➠ p. 7 - 69. – Check the function of the coupling jaw / reset central position; ➠ p. 7 - 69. – Check the support ring; ➠ p. 7 - 68.		

[1)] after 300 oper. hrs.

25.06.2004

	M 3	
Maintenance work on the SUPERSTRUCTURE: Every 3 months / after 300 oper. hrs.	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ⇒ p. 6 - 1**
Crane engine Observe the maintenance intervals in the crane engine operating instructions. Record any maintenance work carried out in the enclosed maintenance log.		
Superstructure hydraulic system – Change the hydraulic oil filter, check the magnetic rods of the hydraulic oil filter for metal particles;[1)] ⇒ p. 8 - 29.		
Superstructure electrical system – Check acid concentration of batteries; ⇒ p. 8 - 69.		
Ball slewing connection – Check tightness of retaining bolts; Tightening torque; ⇒ p. 10 - 2.		
Main boom – Lubricate locking bolts; ⇒ p. 8 - 37.		**Z**

[1)] after 300 oper. hrs.

25.06.2004

5.2.5 Maintenance plan M 6: every 6 months / after 500 oper. hrs. / 10,000-12,500 km

	M 6	
Maintenance work on the CARRIER: every 6 months / after 10,000 - 12,500 km	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Vehicle engine Observe the maintenance intervals in the vehicle engine operating instructions. Record any maintenance work carried out in the enclosed maintenance log.		
Transfer case / 3rd axle line		
– Change the oil; ➠ p. 7 - 24.	**19.0 (5.0)**	**E 3**
Axle lines		
– Lubricate the longitudinal cardan shafts between the gear units; ➠ p. 7 - 33.	**7**	**K**
– Lubricate the intermediate bearing of the longitudinal cardan shaft (only with additional equipment 10 x 8 x 10); ➠ p. 7 - 34.	**2**	**K**
Steering		
– Check tightness of screw connections and that the cotter pin has been fitted. – Check all track rods and drag links for play. – Check rubber sleeves for damage.		
Superstructure air conditioning system (additional equipment)		
– Check hoses; ➠ p. 7 - 62. – Check the refrigerant compressor; ➠ p. 7 - 63.		

25.06.2004

	M 6	
Maintenance work on the SUPERSTRUCTURE: **Every 6 months / after 500 oper. hrs.**	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Crane engine Observe the maintenance intervals in the crane engine operating instructions. Record any maintenance work carried out in the enclosed maintenance log.		
Slewing gears – Lubricate slewing gear pinion and gear rim; ➠ p. 8 - 18.	**for each 1**	**V**
Main boom – Lubricate telescopic slide faces; ➠ p. 8 - 42.	**20**	**L 2**
Superstructure air-conditioning system – Check hoses; ➠ p. 8 - 72. – Check refrigerant collector; ➠ p. 8 - 73. – Check refrigerant compressor; ➠ p. 8 - 73.		
SLI – Maintain the slip ring assembly in the cable drums; ➠ p. 8 - 61.		

25.06.2004

5.2.6 Maintenance plan M 12: Every 12 months / after 1,000 oper. hrs. / 20,000-25,000 km

	M 12	
Maintenance work on the CARRIER: every 12 months / after 20,000 - 25,000 km	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Vehicle engine Observe the maintenance intervals in the vehicle engine operating instructions. Record any maintenance work carried out in the enclosed maintenance log.		
Axle lines – Change the oil in the axle center drive; ➠ p. 7 - 27. 1. axle line (additional equipment with drive 10 x 8 x 10) 4. axle line 5. axle line – Final drive oil change; ➠ p. 7 - 30.	 **13.0 (3.4)** **16.5 (4.4)** **13.0 (3.4)** **every 4.1 (1.1)**	 **E 3** **E 3** **E 3** **E 3**
Carrier compressed air system – Replace the granulate cartridge of the compressed air dryer; ➠ p. 7 - 44.		
Carrier hydraulic system – Have suspension system pressure accumulators checked by ***CraneCARE*** at the respective location or by an authorized workshop.[1)] – Replace the vent filter for the hydraulic oil tank[2)]; ➠ p. 7 - 49. – Oil change[1)]; ➠ p. 7 - 52, (depending on the examination results of the oil sample; ➠ p. 7 - 50).	 **200 (52.8)**	 **G 2**
Superstructure air conditioning system – Monitor the entire air conditioning system; ➠ p. 7 - 63.		

[1)] every 3,000 oper. hrs., however at the latest every 12 months

[2)] after 1,000 oper. hrs.

25.06.2004

	M 12	
Maintenance work on the SUPERSTRUCTURE: **Every 12 months / after 1,000 oper. hrs.**	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Crane engine Observe the maintenance intervals in the crane engine operating instructions. Record any maintenance work carried out in the enclosed maintenance log.		
Main hoist / auxiliary hoist (additional equipment) – Oil change[1]; ➠ p. 8 - 12. in transmission in the brake unit Check the old oil; ➠ p. 8 - 14.	**7.0 (1.85)** **3.0 (0.8)**	**E 6** **G 5**
Slewing gears – Change the oil; ➠ p. 8 - 19.	**every 0.9 (0.24)**	**E 6**
Superstructure hydraulic system – Change vent filter of the hydraulic oil tank[2]; ➠ p. 8 - 32. – Oil change[2]; ➠ p. 8 - 34 (depending on the examination results of the oil sample, ➠ p. 8 - 32).	**1,200 (317)**	**G 2**

1) Carry out at least once per year

2) Operation under difficult conditions:

- in extremely sandy or dusty areas, change the vent filters earlier if necessary.
- The oil is to be changed every 500 operating hours for crane operation involving frequent loading and unloading.
- Oil change intervals are to be halved if the crane is used in tropical or very warm climates.

25.06.2004

5.2.7 Maintenance and inspection plan Y 2: every 24 months / after 2,000 oper. hrs. / after 40,000 - 50,000 km

	Y 2	
Maintenance work on the CARRIER: every 24 months / after 40,000 50,000 km	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Vehicle engine Observe the maintenance intervals in the vehicle engine operating instructions. Record any maintenance work carried out in the enclosed maintenance log.		
Automatic transmission – Change the oil filter; ➠ p. 7 - 20. – Change the oil; ➠ p. 7 - 20.	**46.0 (12.2)**	**F 4**

	Y 2	
Maintenance work on the SUPERSTRUCTURE: every 24 months / after 2,000 oper. hrs.	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
No maintenance work in this period. The long-term intervals always include the short-term intervals.		

25.06.2004

5.2.8 Maintenance and inspection plan Y 3: every 36 months / after 3,000 oper. hrs.

	Y 3	
Maintenance work on the CARRIER: every 36 months / after 3,000 oper. hrs.	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
No maintenance work in this period. The long-term intervals always include the short-term intervals.		

	Y 3	
Maintenance work on the SUPERSTRUCTURE: every 36 months / after 3,000 oper. hrs.	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Main hoist / auxiliary hoist (additional equipment) – Carry out partial inspection; ➠ p. 8 - 15.		

25.06.2004

5.2.9 Maintenance and inspection plan Y 6: every 72 months / after 6,000 oper. hrs.

	Y 6	
Maintenance work on the CARRIER: every 72 months / after 6,000 oper. hrs.	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
No maintenance work in this period. The long-term intervals always include the short-term intervals.		

	Y 6	
Maintenance work on the SUPERSTRUCTURE: every 72 months / after 6 000 oper. hrs.	**Oil / lubricant**	
	Amount (l) (gal)/ quantity	**Designation ➠ p. 6 - 1**
Main hoist / auxiliary hoist (additional equipment) – Carry out general inspection; ➠ p. 8 - 15.		

25.06.2004

5.3 Periodic inspections

Your GMK 5200 truck crane has been inspected before delivery.

– Cranes that are to be used in Germany are inspected in accordance with the regulations of the professional trade association as defined by BGV D 6 (VBG 6).
– 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 6).

According to VBG, one periodic inspection must be carried out annually. 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 inspections 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 components, where these are not already contained in the list of routine maintenance tasks:

– the hydraulic and electrical control and safety devices
– the safe load indicator (SLI)
– the mounting and safety devices of all screwed-on parts
– the hoist rope
– the load hook (➠ *Load hook inspection*, p. 5 - 22)
– the load-bearing structural steelwork (for tears, deformation, etc.), including a special check of all welds.

If damage is found in the structural steelwork, qualified specialists must determine the extent of the damage using the required material examination methods. They should then determine what sort of repair action could be done.

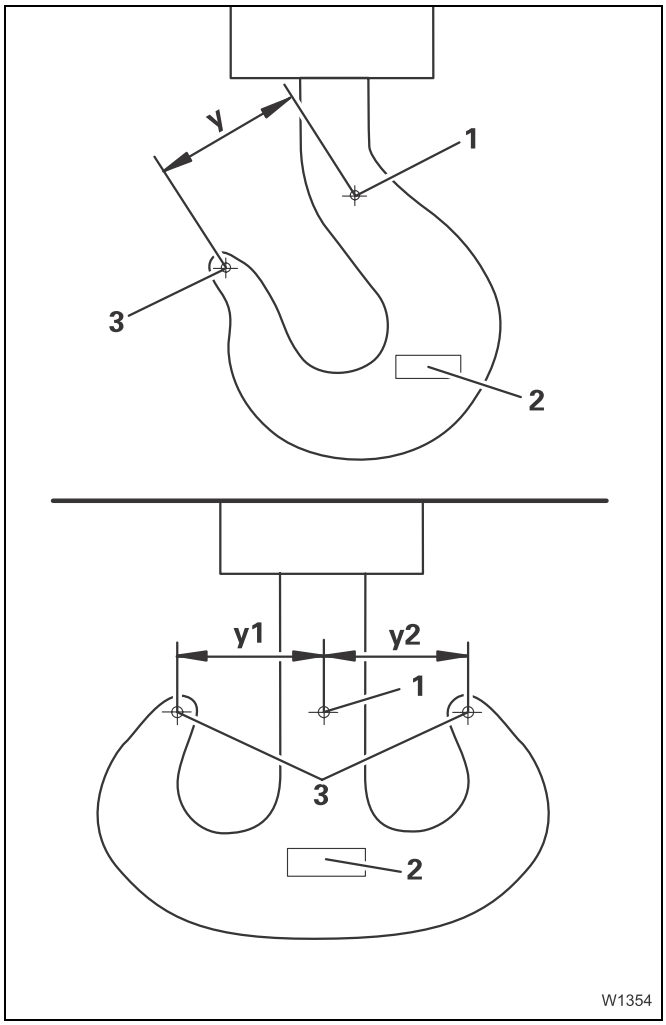
The inspector is to write a record containing the result of the annual inspection and the measures taken to repair any damage.

25.06.2004

5.3.1 Load hook inspection

The mouth of the load hook must be checked regularly for deformation.

The mouth of the hook may not be expanded by more than 10% of the original dimension **y**, **y1**, **y2**.



The original dimensions **y**, **y1**, **y2** are held 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 mouth has expanded by over 10% of the initial dimension.

The load hook must consequently be replaced.

Risk of accidents if the load is allowed to drop
Hook blocks with deformed load hooks are no longer operationally safe.
The load hooks could break and drop the load.
Deformed load hooks must always be replaced.

25.06.2004

5.4 Measures required for winch monitoring

Also observe the information on the general inspection of the hoists;
➠ *Carrying out general inspection of hoists*, p. 8 - 15.

These measures for monitoring the winches (hoists) were compiled by VDMA and are to be used for all vehicle cranes according to the *Accident Prevention regulations for Winches, Hoisting and Tractor Machines BGV D 6 (VGB 9*) and *BGV D 8 (VBG 8)*.

5.4.1 Theoretical service life

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

The winches of your crane are classified as follows (ISO 4301/1, FEM 1,001, DIN calculation rules for power units):

Power unit group:	M .....
Load spectrum:	Q .....; (L .....)
Collective load factor:	Km = ...
Theoretical service life:	D = ...

The power unit group M 3 and the collective load L1 (km = 0.125) are generally given for truck cranes in assembly mode, resulting in a theoretical service life of 3 ,200 hrs.

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

25.06.2004

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

1. Overloading caused by improper use of the crane.

2. Insufficient maintenance: oil is not changed at the specified intervals.

3. Operating errors: extreme acceleration or deceleration of the load, load drops and stops suddenly while suspended.

4. Improper maintenance: use of incorrect oil, 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 environments, dust and dirt.

5.4.2 Proportion of theoretical service life used

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

This includes establishing the proportion of theoretical service life that has been used. If required, the crane operator is to appoint an expert for this assessment.

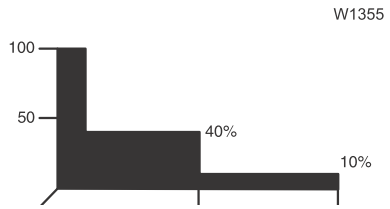
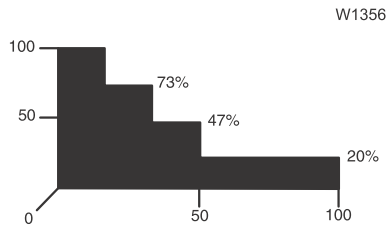
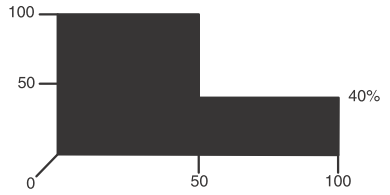
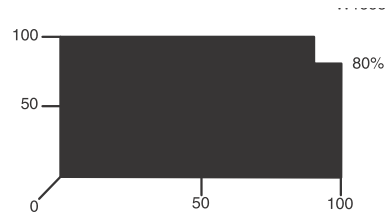
The actual operating conditions (load spectrum) and the operating hours of the hoists are to be determined for each inspection interval when establishing the proportion of theoretical service life that has been used. The operator is responsible for proper documentation in the crane logbook.

25.06.2004

Determining the operating conditions (collective load)

The collective load of the crane is divided into groups (also refer to ISO 4301/1, FEM 1.001).

When establishing the load spectrum, the existing wire cable is used as a standard, i.e. under certain circumstances, the 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	Operating time portions	Factor of the load spectrum Km =	Graphic representation
light Q 1 L 1	Power unit or parts of which, that are subject to high stress in exceptional situations, however when running experience only very little stress.	10% of the timing period with greatest load (dead weight + $^1/_1$ payload) 40% of the timing period with dead weight + $^1/_3$ payload 50% of the timing period with dead weight	0,125	
middle Q 2 L 2	Power unit or parts of which, that are subject to high stress quite often, however when running experience only very little stress.	$^1/_6$ of the timing period with greatest load (dead load + $^1/_1$ payload) $^1/_6$ of the timing period with dead load + $^2/_3$ payload) $^1/_6$ of the timing period with dead load + $^1/_3$ payload) 50% of the timing period with dead weight	0,25	
heavy Q 3 L 3	Power unit or parts of which, that are often subjected to high stress and when running are subjected to middle level of stress	50% of the timing period with greatest load (dead weight + $^1/_1$ payload) 50% of the timing period with dead weight	0,5	
very heavy Q 4 L 4	Power unit or parts of which, that regularly subjected to high stress from neighbouring stress sources	90% of the timing period with greatest load (dead weight + $^1/_1$ payload) 10% of the timing period with dead weight	1	

25.06.2004

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 L 1 and the load spectrum factor Km = 0.125 are generally applied to truck cranes in assembly mode.

Determination of the effective operating hours T_i

The effective operating hours, determined as follows, must be entered into the crane log book for the corresponding testing interval.

The following two of four possible cases apply to GROVE truck cranes:

Separate operating hours counter for crane operation
Single operating hours counter for driving and crane operation

Separate operating hours counter for crane operation

– The proportion of winch operating hours in relation to the total superstructure operating hours must be estimated.

It can generally be assumed for hoist winches that the percentage of winch operating hours in relation to the superstructure operating hours will be 20% for truck cranes in installation mode.

– The effective working hours T_i of the winch can be called up separately and are shown on a display (➠ *Operating instructions*, Part 2, Chapter *Crane operation* Section *Crane work with main boom*).

Single operating hours counter for driving and crane operation

The proportion of winch operating hours in relation to the total crane operating hours is to be estimated.

It can generally be assumed that the percentage of superstructure operating hours in relation to the crane operating hours will be 60% for truck cranes in assembly mode. If the percentage of hoist winch operating hours is assumed to be 20% in relation to superstructure operating hours (operating hours counter is functional for entire crane operation), the percentage in relation to the total operating hours of the crane will be 12%.

25.06.2004

Determining the proportion of theoretical service life used

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

$$S_i = \frac{Km_i}{Km} \times T_i$$

Km = Load spectrum factor established during winch calculation. This factor is given in the operating instructions.

Km_i = Load spectrum factor in inspection interval *i* in accordance with the section "Determining the operating conditions (collective load)"

T_i = effective operating hours in the inspection interval *i* according to Section "Determination of the effective operating hours T_i"

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

If a theoretical service life remains, which 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 - 23), the winch must not be operated until after a general overhaul has been performed.

A general overhaul must be performed at least once every 10 years after commissioning of the crane.

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

The manufacturer or his 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.

25.06.2004

Alternative provision

If, after ten years, theoretical service life is not over, the winch can continue to be operated without a general overhaul under the following conditions. The crane expert has confirmed that the used portion 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 expert must closely inspect the winch. As a minimum, this includes:

- a visual inspection of the exterior (for leaks, damage, deformations, etc.)
- an oil inspection (especially for metallic residue)
- a load inspection with minimum and maximum wire cable lengths and each with 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 test book by the crane expert and there must be a declaration of continued operation for the winch. The next inspection takes place before the 12th year of operation and must be repeated every year thereafter.

25.06.2004

5.4.3 Example

A truck crane with a separate operating hours counter for driving and crane operation is classified by the manufacturer according to the operating instructions as follows:

Power unit group: M 3

Load spectrum: light L 1, Km = 0.125

Theoretical service life: D = 3,200 h

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

1. Inspection (1st year)

The crane was used for assembly work during the previous year: Collective load L 1, i.e. Km1 = 0.125.

The superstructure operating hour counter reads 800 h. The winch was operated 20% of the time, i.e. T1 = 160 h.

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

$$S_i = \frac{0.125}{\dot{0}125} \times 160\ h = 160\ h$$

Remaining theoretical service life:

D1 = 3,200 h -160 h = 3,040 h.

The aforementioned values are entered in the table (see table example p. 5 - 31).

2. Inspection (2nd year)

The crane was used for unloading work on docks: Load spectrum: L 3, i.e. Km2 = 0.5.

The superstructure operating hour counter reads 2,000 h, i.e. during this period: 2,000 h -800 h = 1,200 h (800 h were used during the first year).

The winch was operated 40% of the time, i.e. T2 = 480 h.

25.06.2004

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

$$S_i = \frac{0,5}{0.125} \times 480 \text{ h} = 1,120 \text{ h}$$

Remaining theoretical service life:

D2 = 3,040 h -1,920 h = 1,120 h.

The aforementioned values are entered in the table (see table example p. 5 - 31).

3. Inspection (3rd year)

The crane was used for assembly work and occasional unloading work on docks: Load spectrum: L 2, i.e. Km3 = 0.25.

The superstructure operating hour counter reads 3,000 h, i.e. during this period: 3,000 h - 2,000 h = 1,000 h (2,000 h were used during the first two years).

The winch was operated 30% of the time, i.e. T3 = 300 h.

The used proportion S3 of theoretical service life after the third inspection interval is therefore:

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

Remaining theoretical service life:

D3 = 1,120 h - 600 h = 520 h.

These values are entered in the table (see table example p. 5 - 31).

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 found in the maintenance manual appendix for truck cranes that do not require a crane logbook or similar documentation according to the regulations of the respective country.

25.06.2004

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

Crane model: GMK 3045
Work number: 3045 42 06
Commissioned on: 10. 06.1990
Serial number of the winch in accordance with the type plate:13 301
Last general overhaul performed on: .....
Winch design data (see operating instructions):
Power unit group: M 3
Load spectrum: Q 1 (L1)
Factor of the load spectrum: Km = 0.125
Theoretical service life: D = 3,200 h

Testinterval no. (max. 1 year) "i"	Date of commissi-on/date of inspection	Operational condition since the last inspec-tion	Collective load factor Km_i	Operating hours of the entire crane [h]	Operating hours of the superstruc-ture [h]	Operating hours of the superstruc-ture since the last in-spection [h]	Operating hours of the winch [h]	Operating hours of the winch since the last inspection [h]	Used proportion of theoretical service life D: [h]	Remaining theoretical service life $D_i = D_{i-1} - S_i$ [h]	Name of competent person	Signature	Note	Name of the approved inspector	Signature
0(*)	10. 6. 90	–	–	–	0				0	3200					
1	5. 6. 91	L 1	0,125	–	800	800	–	160 (20% of 800)	160	3040	Müller				
2	20. 5. 92	L 2	0,5	–	2000	1200	–	480 (40% of 1200)	1920	1120	Huber				
3	18. 5. 93	L 3	0,25	–	3000	1000	–	300 (30% of 1000)	600	520	Schmitz				

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

Alternative provision, refer to Section p. 5 - 28.

Last general overhaul performed on .....

S_i = Used proportion of theoretical service life since the last inspection

D_i = Remaining theoretical service life

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

Km = Load spectrum factor established during winch calculation. This factor is given in the operating instructions.

Km_i = Load spectrum factor in the inspection interval "i" according to section 2.1

T_i = Effective working hours in the inspection interval "i" according to section 2.2

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25.06.2004

6 Lubricants and fuels

25.06.2004

25.06.2004

6 Lubricants and fuels

6.1 Lubricant table

Designation	Lubricating point	Type of lubrication	Designation according to DIN 51502	Specification, classification	Lubricant type, viscosity range
A 1	Vehicle engine	Circulatory lubrication		API CF-4 API CG-4[6]	SAE 15W-40 [1]
A 2	Crane engine			CC / CD MIL-L-45 199B	SAE 15W-40 [2]
E 3	Axle system		C - LPF	MIL-L 2105 B API-GL-5	SAE 90 ISO - VG 220
	Transfercase				
E 6 [4]	Slewing gear gearbox		C - LPF	MIL-L 2105 B API-GL-4/5	SAE 75 W-90 ISO - VG 220
	Hoist gearbox	Fill oil			
F 4	Automatic gearbox	Circulatory lubrication	GROVE part no. 6829 101 690 [3]		
G 2	Hydraulic system	Fill oil	H-LP	DIN 51524 T.2	ISO - VG 32
G 5	Hoist Second brake unit		Hydraulic oil ATF Type Suffix A		
H	Suspension cylinder	GROVE part no. 2 310 863 [3]			
J	Lubricating points (lubricating grease)	Grease gun and manually	K - L2K	DIN 51825	
K	Roller bearing	For repairs, use with grease	KP - L2K	DIN 51825	
L 2	Slideways		GROVE part no. 1373 458 [3]		

[1] See engine operating instructions

[2] See crane engine operating instructions

[3] Deliverable by ***CraneCARE*** at the respective location

[4] Synthetic oil filled at the factory; do not mix with mineral oil.

[5] CCMC = committee of common market automobile constructors

[6] Filled with API CG-4 at the factory.

25.06.2004

Designation	Lubricating point	Type of lubrication	Designation according to DIN 51502	Specification, Classification	Lubricant type, Viscosity range
M	Lubricating points (lubricating oil)	Oil can, high pressure squirt gun	like A 1/A 2 (vehicle/crane engine)		
V	Open-running gear wheels	Adhesive lubrication	GROVE part no. 0554 205 [3)]		
W	Mounting screws, bushings, etc.		GROVE part no. 1573 046 [3)]		
Z	Locking pins Derricking cylinder	Corrosion protection	Spray oil containing molybdenum disulphide (MoS_2)		

[3)] Deliverable by ***CraneCARE*** at the respective location

25.06.2004

6.2 Process materials

6.2.1 Fuel

The diesel fuels that are used and their respective specifications can be found in the engine operating instructions.

6.2.2 Engine coolant admixtures

The specifications and admixture ratios can be found in the operating instructions for the engine.

6.2.3 Windscreen washing system admixtures

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

6.2.4 Fuel for crane cab heating system

You should use either the fuel specified in section 6.2.1 or EL heating oil as heating fuel for the crane cab.

25.06.2004

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25.06.2004

7 Description of maintenance work on the carrier

25.06.2004

25.06.2004

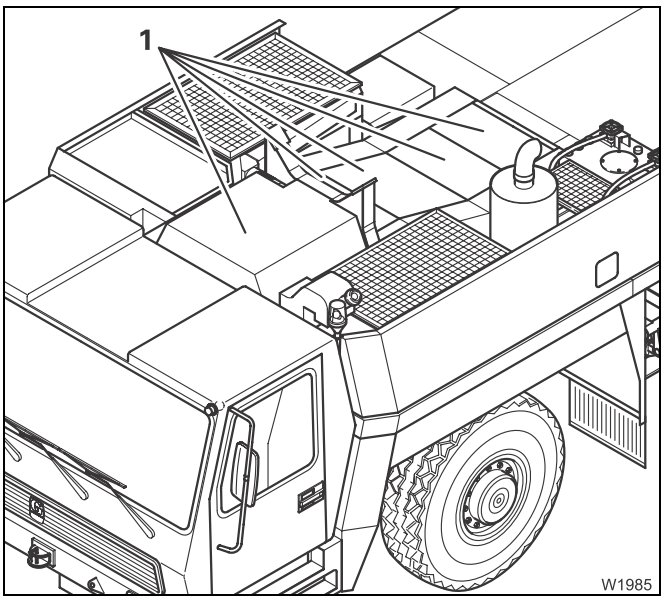
7 Description of maintenance work on the carrier

7.1 Vehicle engine

Follow the instructions in the supplied vehicle engine operating instructions for maintenance work which exceeds the scope of daily work.

Risk of engine damage
The vehicle engine is in maintenance group II (difficult operation) because of the high full-load rate and/or large fuel supply rate.
If driving operation is to be carried out using RME (rapeseed oil fatty acid methyl ester), the intervals between oil changes should be cut in half.
The release of engines for RME operation is regulated by the service information for the engine.

For various jobs (e.g. oil change) you must remove the guards on the carrier above the vehicle engine between the first and second axle lines.



- Open the plugs (**1**) on both sides with a square spanner and remove the covering.

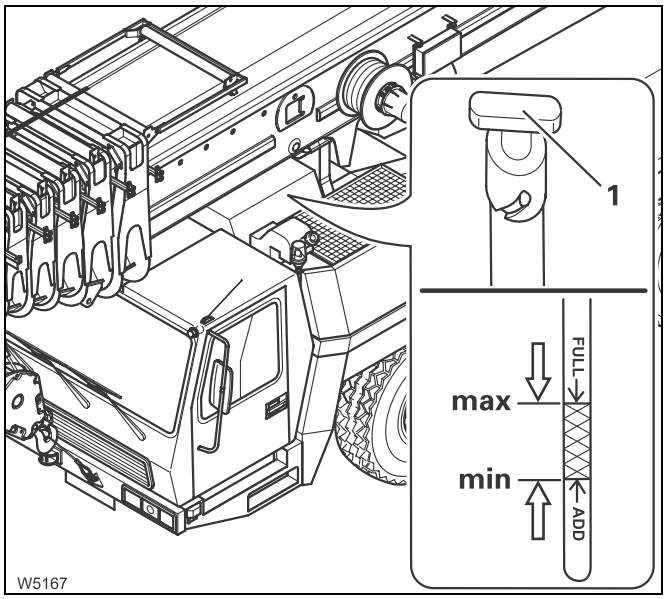
25.06.2004

7.1.1 Vehicle engine - checking the oil level

D

The truck crane must be on a horizontal surface when the oil is checked. The oil level is checked with the vehicle engine turned off.

Risk of burning when vehicle engine is hot.
During operation, the vehicle engine and add-on parts can heat up to 400 °C (750 °F). Wear appropriate protective gloves and be careful not to touch hot parts when adding oil to a hot engine.



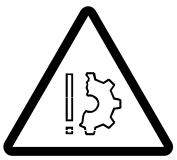
The dipstick (**1**) for the vehicle engine is located on the carrier behind the boom rest to the left (when viewed from the direction of travel).

- Check the oil level using the dipstick (**2**).

The oil level must be between **min** and **max** (arrow marks).

Top up engine oil if necessary, ➠ *Vehicle engine - topping up engine oil*, p. 7 - 3.

- Put the cover on the vehicle engine and secure it with the locks.



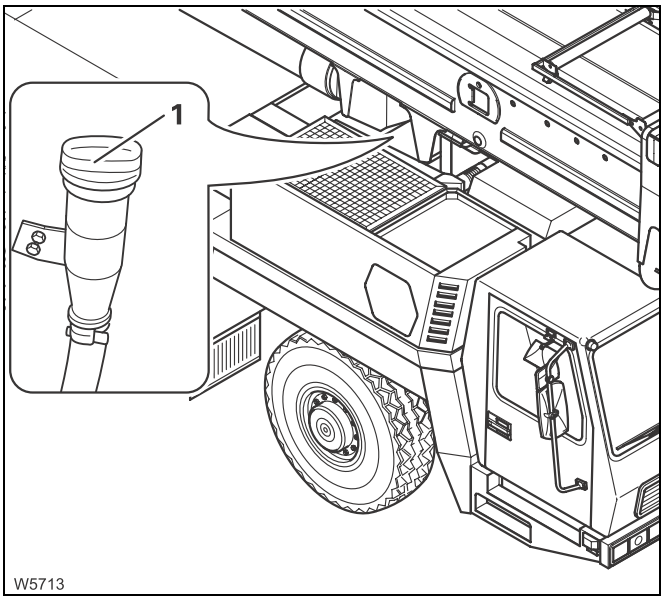
Damage may occur to the engine if the oil level is too high
Do not overfill; the oil level must not be higher than the highest arrow marking (**max.**). Drain oil if necessary; ➠ *Operating instructions of the vehicle engine manufacturer*.

25.06.2004

7.1.2 Vehicle engine - topping up engine oil

Please refer to the vehicle engine operating instructions for information on the prescribed oil specification.

Risk of burns when the crane engine is hot
During operation, the vehicle engine and attachments can reach temperatures of up to 400 °C (750 °F). Wear appropriate protective gloves and be careful not to touch hot parts when adding oil to a hot engine.



The oil filler for the vehicle engine is located on the carrier behind the boom rest to the right.

- Refill the engine oil through the filler neck (**1**).
- Check the oil level on the dipstick; ➠ *Vehicle engine - checking the oil level*, p. 7 - 2.

Damage may occur to the engine if the oil level is too high
Do not overfill; the oil level must not be higher than the highest arrow marking (**max.**). Drain oil if necessary; ➠ *Operating instructions of the vehicle engine manufacturer*.

25.06.2004

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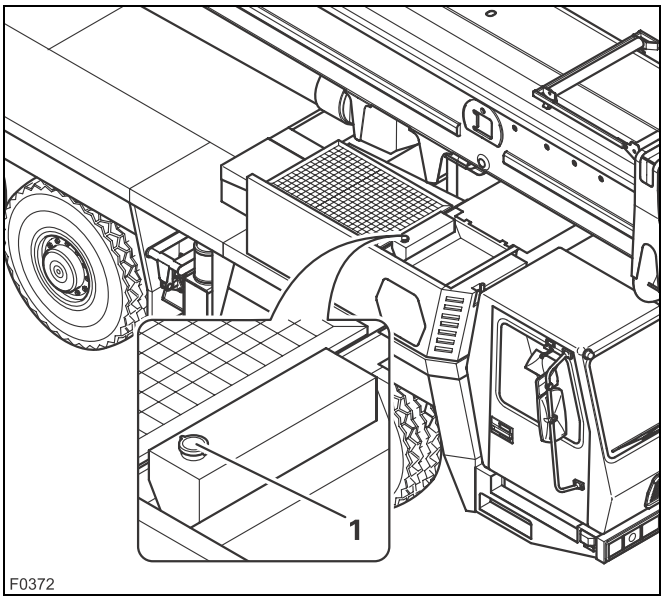
25.06.2004

7.1.3 Vehicle engine – Checking coolant level

D

The coolant reservoir is located on the right side of the carrier in front of the radiator.

Risk of scalding when vehicle engine is hot
The hot coolant circuit is under pressure. If you open the expansion tank while the cooling circuit is hot, you may be scalded by the hot steam and possibly the hot coolant which escapes.
Wear appropriate protective gloves and cover the plug on the expansion tank with a rag before you open it.
Turn the lid slowly to the first notch in order to allow the excess pressure to be released.



- Loosen (do not open!) the cap on the filling hole (**1**) when the coolant is at operating temperature, to release the pressure.
- Open the cap (**1**).
  The coolant must reach the lower edge of the pipe in the filler neck.

If the coolant level is too low:

- Top up the coolant.
  See the vehicle engine operating instructions for the composition of the coolant.
- Screw the filling hole cap (**1**) as tight as possible.

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 and repaired by ***CraneCARE*** at the respective location or your own repair personnel.

Topping up coolant after repair work (e.g. when radiator or hose line was replaced); ➠ *Vehicle engine – Topping up coolant*, p. 7 - 6.

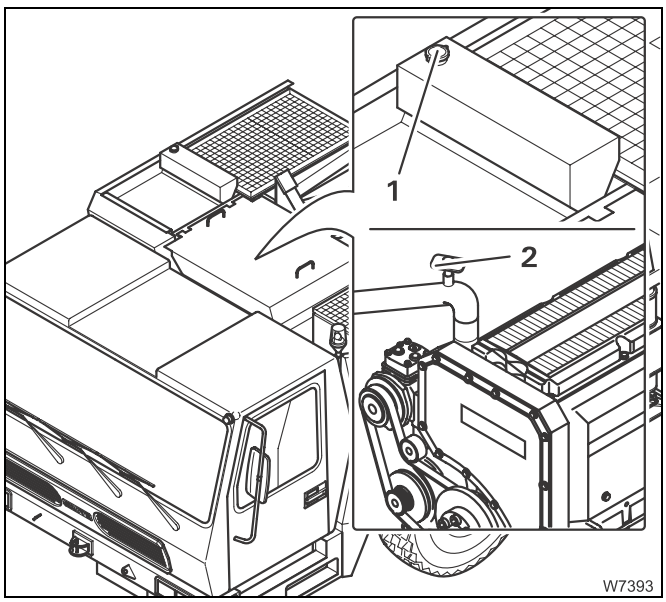
25.06.2004

7.1.4 Vehicle engine – Topping up coolant

This section describes how to top up coolant after repair work (e.g. when radiator or hose line was replaced).

Risk of burning when vehicle engine is hot
During operation, the vehicle engine and add-on parts can heat up to 400 °C (750 °F). Wear appropriate protective gloves and be careful not to touch hot parts when adding oil to a hot engine.

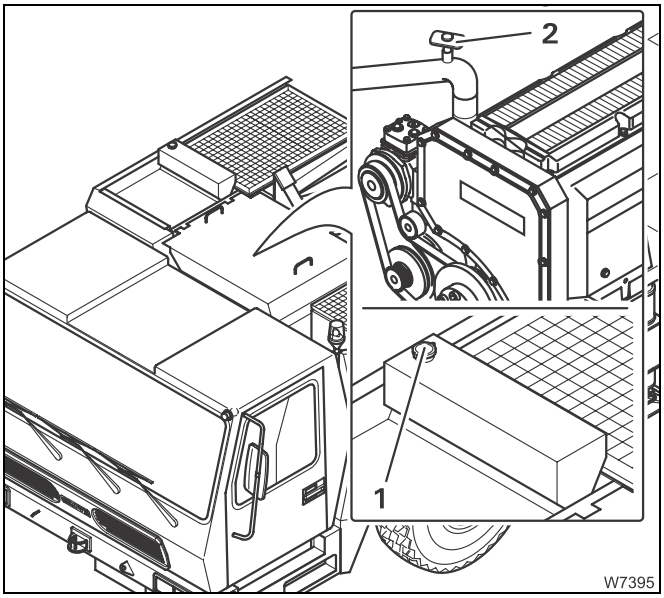
Risk of scalding when vehicle engine is hot
The hot coolant circuit is under pressure. If you open the expansion tank while the cooling circuit is hot, you may be scalded by the hot steam and possibly the hot coolant which escapes.
Wear appropriate protective gloves and cover the plug on the expansion tank with a rag before you open it.
Turn the lid slowly to the first notch in order to allow the excess pressure to be released.



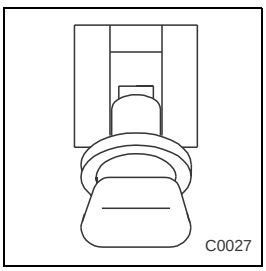
- Loosen (do not open!) the cap on the filling hole (**1**) when the coolant is at operating temperature, to release the pressure.
- Open the cap (**1**).
- Open the locks on both sides of the cover over the vehicle engine and detach them.
- Open the vent valve (**2**) in the coolant line.

  See the vehicle engine operating instructions for the composition of the coolant.

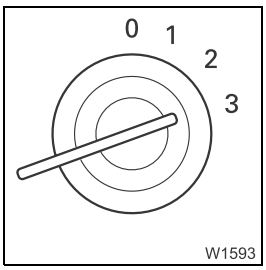
25.06.2004



- Slowly top up the coolant until it overflows from the vent valve (**2**).
- Close the vent valve (**2**).
- Continue to top up the coolant until it has reached the lower edge of the pipe in the filler neck.
- Wait about 1 minute. Add more coolant if necessary.
- Screw the filling hole cap (**1**) as tight as possible.
- Put the cover on the vehicle engine and secure it with the locks.



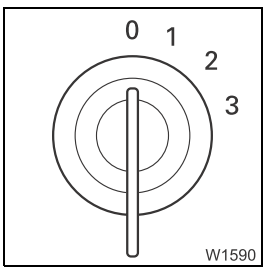
- Check whether the parking brake is locked (parking brake lever points toward the rear).



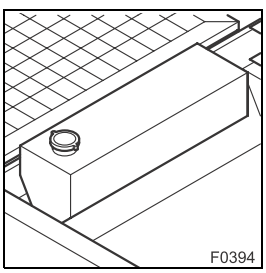
- Start the vehicle engine; ➠ *Operating instructions GMK 5200*, Chapter *Vehicle engine*.

N

- Let the vehicle engine run at idling speed for approx. 5 minutes in neutral position **N**.



- Start the vehicle engine; ➠ *Operating instructions GMK 5200*, Chapter *Vehicle engine*.



- Check the coolant level; ➠ *Vehicle engine – Checking coolant level*, p. 7 - 5.

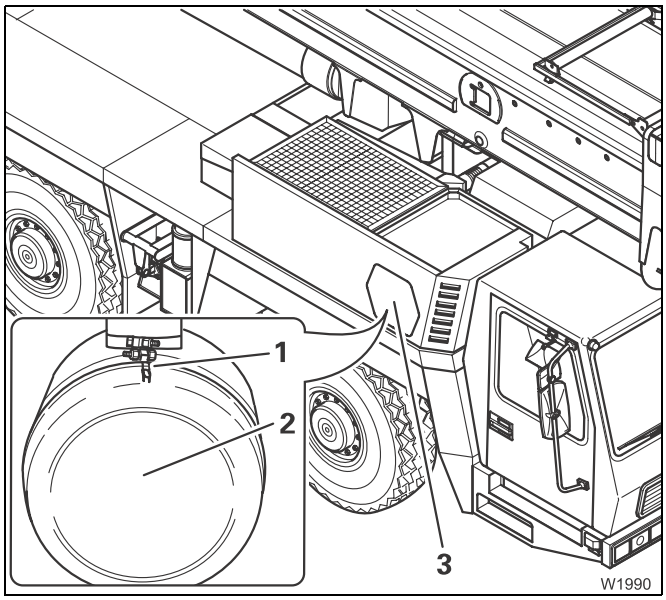
25.06.2004

7.1.5 Checking the dry air filter

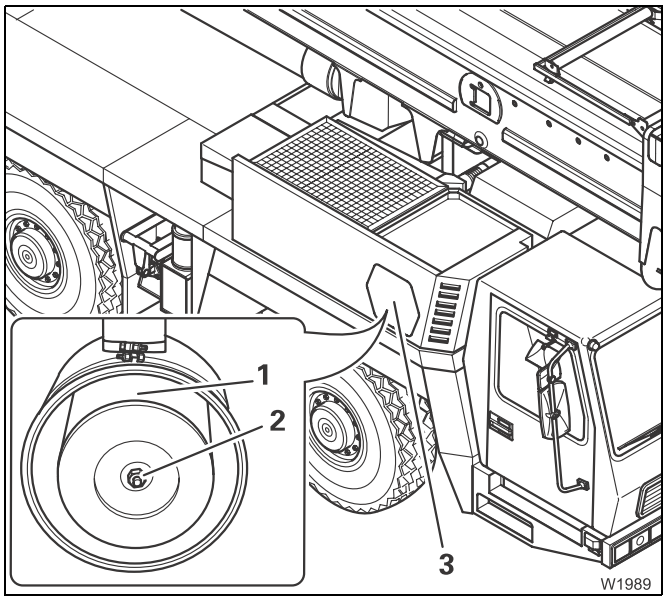
D

The dry air filter is on the right-hand side of the carrier, in front of the first axle line.

The indicator lamp *Vehicle engine air filter* is located on the front instrument panel of the driver's cab. If this indicator lamp lights up, the dry air filter must be replaced.



- Unscrew the screws and remove the cover (**3**).
- Release all clamps (**1**) on the filter lid.
- Take off the filter cover (**2**).



- Unscrew the screw (**2**) and remove the filter insert (**1**).
- Insert a new filter insert and tighten the screw (**2**) again.

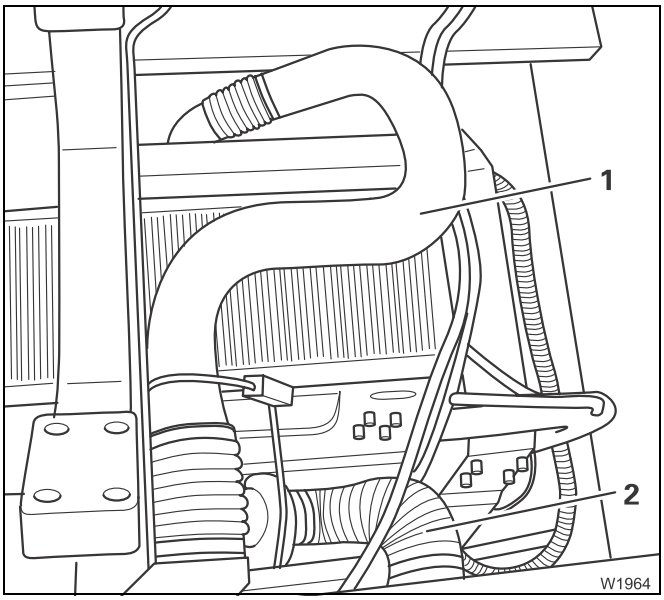
If the seal on the filter cover is worn:

- Change the seal.
- Put the filter cover back in place and secure it with all the clamps.
- Fix the cover with the screws (**3**).

25.06.2004

7.1.6 Checking general condition and for leaks

D



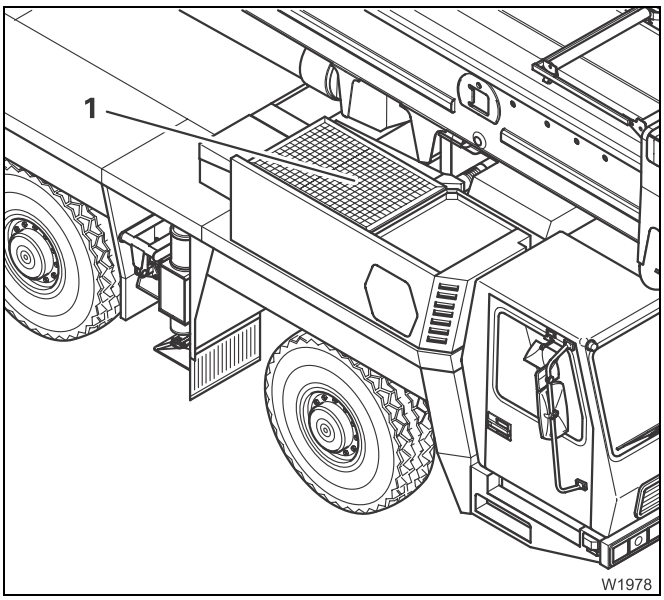
- Check the lines for charge air (**1**) and suction air (**2**).
- Check pipes and hoses for
  – tightness
  – leaks
  – worn areas
- Replace any damaged pipes and porous or swollen hoses.
- Tighten any connections that are leaking.

If the connection still leaks:

- Change the seal.
- Inspect the vehicle engine for any visually obvious impurities or leaks.
- Listen for any unusual noises when the vehicle engine is running.

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

- Inform ***CraneCARE*** at the respective location or your repair personnel.



- Check the charge air cooling system (**1**) for dirt, leakage or other damage.
- Ensure that the cool air can flow without hindrance. Clean the charge air system if necessary and remove any parts that hinder the flow of cool air.

If the charge air cooling system should become damaged:

- Inform ***CraneCARE*** at the respective location or your repair personnel.

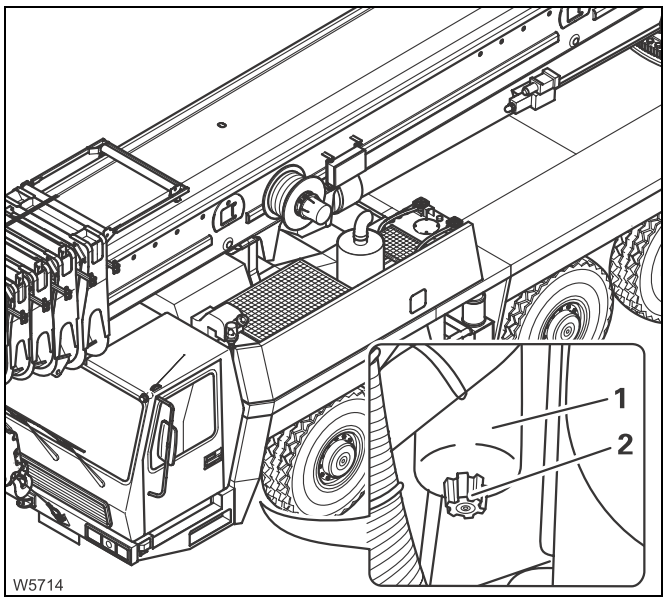
25.06.2004

7.1.7 Draining off water from the fuel filter D

See also the section for daily maintenance in the enclosed vehicle engine operating instructions.

The fuel filter is on the vehicle frame under the carrier's rear cover on the right hand side next to the automatic transmission.

Risk of pollution due to fuel and water mixture
Drain off fuel and water mixture only into a suitable container. Dispose of it properly.
Ask your local environmental protection authority about the current disposal regulations.



The fuel filter (**1**) is level with the first axle line on the left side of the vehicle engine and can be reached from below.

Drainage occurs when the vehicle engine is switched off.

- Place a suitable collecting vessel underneath the fuel filter (**1**).
- Open the drainage valve (**2**) manually.
- Drain off the mixture of fuel and water into the collecting vessel.
- Run off the fuel/water mixture until pure fuel appears.
- Close the drainage valve by hand by turning it to the right.

Risk of damage to the fuel filter
Do not force the thread of the drainage valve or overtighten it. Do not use any tools. Open and close the valve by hand.

25.06.2004

7.1.8 Visual inspection of the drive belt

D

The drive belts can be damaged due to:

– various operating conditions,
– incorrect belt tension,
– incorrect length of the drive belt,
– incorrect alignment of the belt pulleys,
– incorrect installation,
– oil or grease on the drive belt.

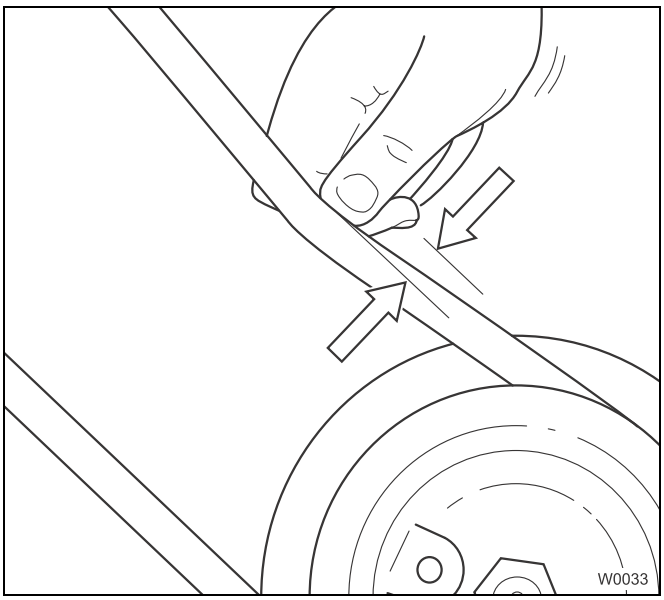
When the drive belt is installed correctly, the belt and the belt pulley have a smooth appearance.

- Check the external condition of the drive belts.
- Replace any drive belts that are torn, have frayed edges or worn areas.
- Retighten any drive belts which have a shiny surface.

Also check the tension of the drive belts.

- Measure the belt tension in the center between the belt pulleys. Take measurements according to the method described in paragraph 3 of the enclosed *Vehicle engine operating instructions*. Use only the measuring devices that are listed there and permitted by the vehicle engine manufacturer.

The alternative method described below is valid **only for V-belts, not for toothed belts or flat belts** (extension method). Check the tension of the belts as soon as possible using the prescribed method (➠ Section **A** of the enclosed *Vehicle engine operating instructions*).



Press the V-belt in the center between the belt pulleys using a force of approx. 110 Nm (25 lbs).

If the V-belt can be pressed between the belt pulleys more than one belt height per 300 mm (12 inch) center distance, it must be tightened (tightening ➠ Section **A** in the *Vehicle engine operating instructions*).

25.06.2004

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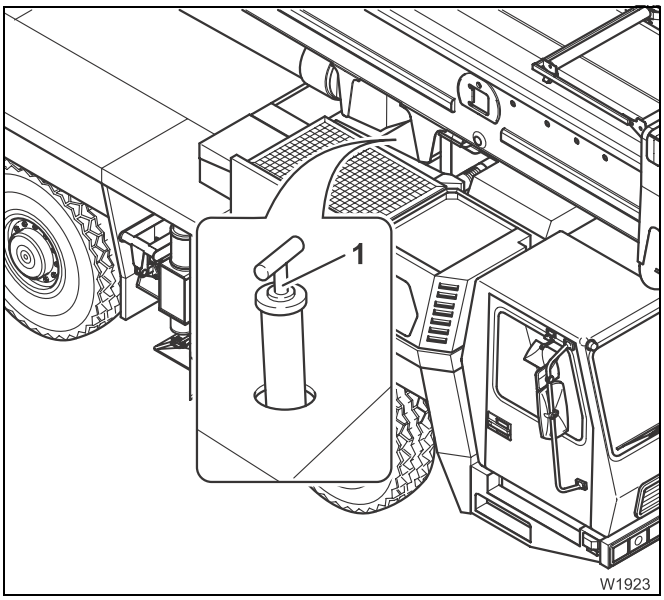
25.06.2004

7.2 Automatic transmission

The automatic transmission is located in the carrier between the first and second axle lines.

7.2.1 Automatic transmission - checking the oil level D



The dipstick (**1**) is on the right side of the carrier (looking in the direction of travel) behind the vehicle engine.
The dipstick tube is also for topping up the oil.

Risk of damage to the automatic transmission
The correct oil level must be maintained to ensure smooth operation of the automatic transmission:
– if the oil level is too low, malfunctions will occur in the gearbox.
– if the oil level is too high, loss of drive and overheating will occur.

Prerequisites:

In order for an oil level check to be carried out
– the precheck of the oil level must haven been carried out
– the truck crane must be aligned horizontally
– the parking brake must be engaged
– the automatic transmission must be in neutral position **N**
– the vehicle engine must be running
– the precheck of the oil level must be carried out

Three types of oil level control:

The oil level can be checked in three different ways, depending on the conditions:

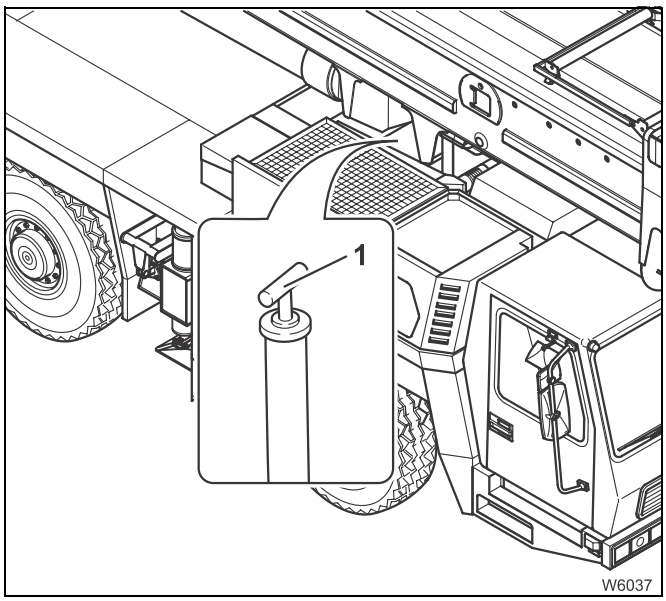
– when the gear oil is cold
– when the gear oil is warm
– via the oil level sensor

Check with warm gear oil for the most accurate reading of the oil level in the automatic transmission.

25.06.2004

Pre-checking the oil level in the automatic transmission

This check is carried out before the vehicle engine is started and helps to prevent gear damage caused by undetected loss of oil. The exact oil level can only be established when the engine is running.

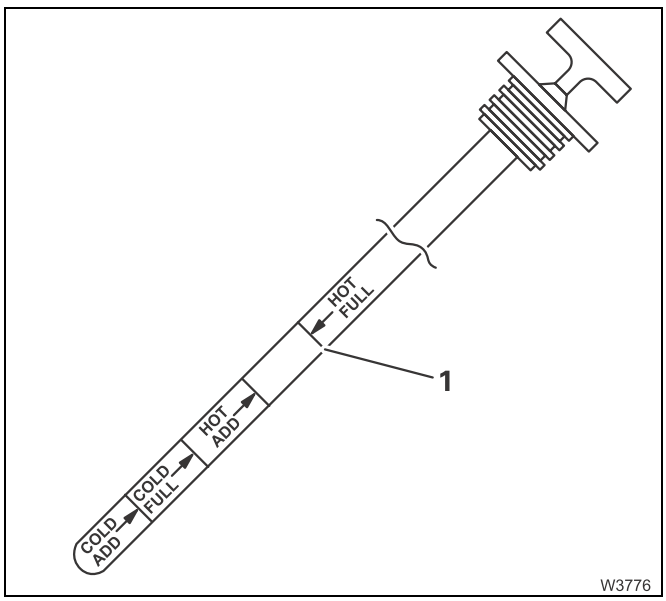


- Check the oil level in the automatic transmission daily before starting the vehicle engine. The truck crane must be on a level surface when the oil is checked.

The dipstick (**1**) is located on the right side of the carrier (looking in the direction of travel) behind the vehicle engine.

Gear oil is added at the filler neck.

Risk of damage to the transmission
This is a pre-check. If the oil level is not clearly above the warm range, the engine must not be started.



- Remove the dipstick from the dipstick tube.
- Clean the oil dipstick and check the oil level. It must be close to the top marking (**1**).
- Top up the oil via the dipstick tube as necessary. Information on the prescribed oil specification; ➠ *Wartungsplan*, S. 5 - 6.

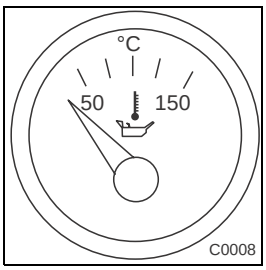
When you have topped up the oil, you must then check the oil level when the oil is warm; ➠ p. 7 - 16.

25.06.2004

Oil level check with cold gear oil (16 to 49 °C (60 to 120 °F))

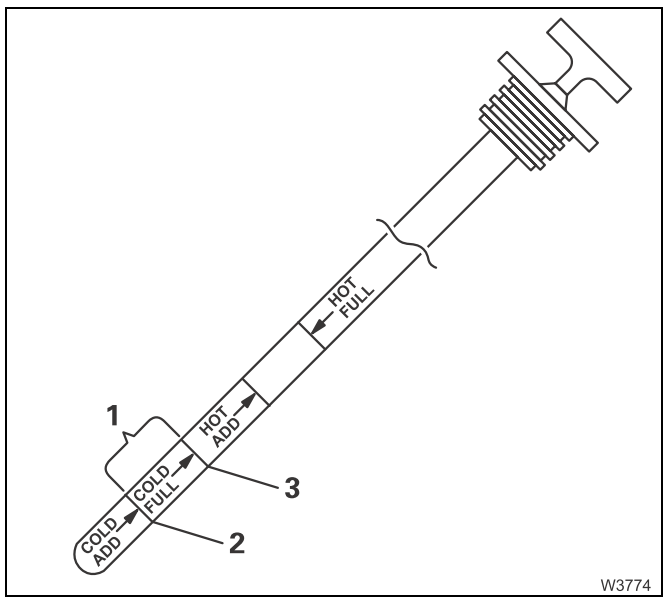
This method is only for the daily check before the truck crane is used.

- Pre-check the oil level in the automatic transmission daily before starting the vehicle engine; ➠ p. 7 - 14.
- Check the display *Coolant temperature of the automatic transmission* to see whether the operating temperature of 16 °C (60 °F) has been reached.



Risk of damage to the converter
When the wheels are locked (e.g. when warming up), the full engine output may only be applied in transmission mode **D** or **R** for a maximum of 30 seconds. Otherwise the converter could be damaged and the automatic transmission could overheat.

- Switch first to transmission mode **D** and then to **R** and allow the engine to run briefly at approx. 1200 - 1500 min^{-1} in each transmission mode in order to remove air from the hydraulics.
- Switch back into neutral position **N** and let the vehicle engine run at idling speed.



- Clean the oil dipstick and check whether the oil level is within the cold range (**1**). Only then is the automatic transmission ready for driving.

If the oil level is above the marking (**3**), oil must be drained off; ➠ p. 7 - 20.

If the oil level is below the marking (**2**), the oil must be topped up via the dipstick tube. Information on the prescribed oil specification; ➠ *Wartungsplan*, S. 5 - 6.

- Check the oil level when the oil is warm at the next available opportunity; ➠ p. 7 - 16.

Risk of damage to transmission due to incorrect oil level
If you have topped up or drained oil in accordance with the measurements taken with cold oil, you must carry out an oil level check with warm oil immediately.

25.06.2004

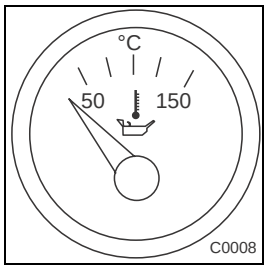
Oil level check with warm gear oil (71 to 93 °C (160 to 200 °F))

This oil level check should be carried out at oil operating temperature (71 to 93 °C (160 to 200 °F)) and when the motor is running (idling speed). It must be carried out in the following cases:

– after the oil level has been corrected out of necessity (filled or drained)
– after an oil change
– after repairing the automatic transmission

Risk of damage to transmission due to incorrect oil level
Check with warm oil for an accurate reading. A check should be carried out whenever there is any doubt whether or not the oil is at the correct level.

- Pre-check the oil level in the automatic transmission daily before starting the vehicle engine; ➠ p. 7 - 14.



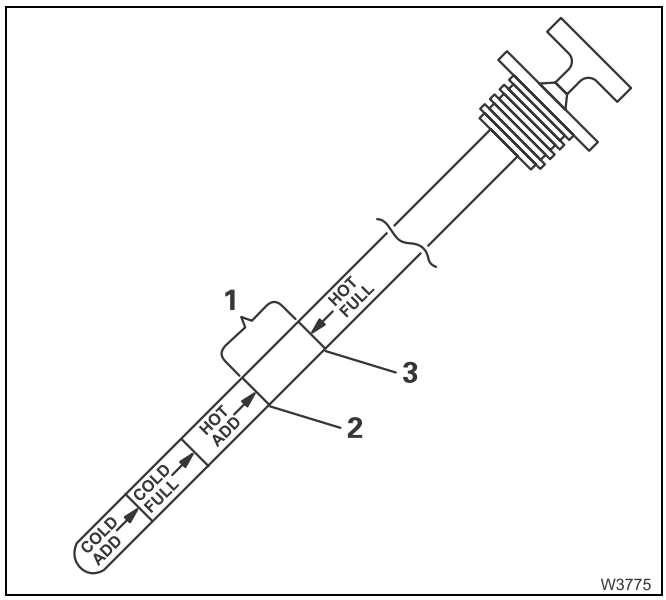
- Check the display *Coolant temperature of the automatic transmission* to see whether the operating temperature of 71 °C (160 °F) has been reached. If necessary, drive the truck crane a short distance until the temperature has risen to 71 °C (160 °F).

If the operating temperature of the vehicle engine has not been reached and you warm up the automatic transmission with the service brake activated, the coolant is heated and comes out of the equalizing reservoir.

To warm up the automatic transmission you can switch to transmission mode **D** with the service brake on and let the vehicle engine run at 1200 - 1500 min^{-1}.

Risk of damage to the converter
When the wheels are locked (e.g. when warming up), the full engine output may only be applied in transmission mode **D** or **R** for a maximum of 30 seconds. Otherwise the converter could be damaged and the automatic transmission could overheat.

25.06.2004



- Clean the oil dipstick and check the oil level.
- The oil level must be in warm range (**1**).

If the oil level is above the marking **(3)**, oil must be drained off; ➠ *Wartungsplan*, S. 7 - 20.

If the oil level is below the marking **(2)**, the oil must be topped up via the dipstick tube. Information on the prescribed oil specification; ➠ *Wartungsplan*, S. 5 - 6.

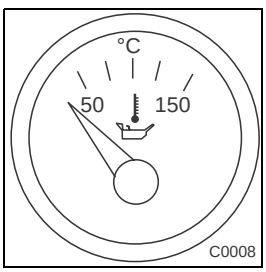
Checking the oil level via the electronic gear system

The oil check for the gears of the GMK 5200 can also be carried out through the electronic gear system.

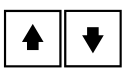
A sensor integrated in the automatic transmission means the electronic gear system can calculate the current oil level in the automatic transmission. The current oil level is shown via a code in the *Transmission* display.

Using the dipstick, check when oil is warm for an accurate reading. A check should be carried out whenever there is any doubt whether or not the oil is at the correct level.

- Pre-check the oil level in the automatic transmission daily before starting the vehicle engine; ➠ p. 7 - 14.
- Start the vehicle engine and let it run at idling speed.

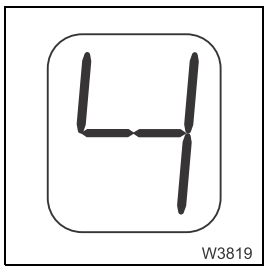


- The gear oil is at operating temperature (71 to 93 °C (160 to 200 °F)) to accelerate the warming of the oil; ➠ p. 7 - 16.
- The automatic transmission is in shift position **N**.



- Start the oil level check in the automatic transmission. Press the *Upshift* and *Downshift* selector switches on the *Automatic transmission* operating unit at the same time.

25.06.2004



The electronic gear system needs up to about 3 minutes to check the necessary requirements and then to determine the oil level. After a short time the number in the *Transmission* display starts flashing and the display counts down from 8 to 0 during the following few minutes.

The oil level calculated is then shown by the following codes:

Code	Meaning
o - L - o - K	Oil level correct
o - L - L - o - x	Oil level too low*)
o - L - H - i - x	Oil level too high*)
***) If an x appears, a numerical figure will also appear: this states the difference in litres.**	

These character strings are shown by every single character appearing one after the other for about 1 second in the *Transmission* display.

If one of the requirements is not met, the electronic gear system will abort the oil level check and shows an error code; ➠ p. 7 - 18.

N

- Press the *Neutral position N* switch once to end the oil level check.

Error messages during the oil level check

If one of the requirements for an oil level check through the electronic gear system is not met, the electronic gear system will abort the oil level check and shows one of the following error codes:

Code	Cause	Remedy
o - L - 5 - 0	Engine speed too low	Increase the engine speed
o - L - 5 - 9	Engine speed too high	Reduce the engine speed
o - L - 6 - 5	Transmission not in shift position **N**	*Switch transmission into neutral position*; ➠ *Operating instructions GMK 5200*, Chapter *Driving with the truck crane*.
o - L - 7 - 0	Oil temperature too low	Heat up the oil; ➠ *Operating instructions GMK 5200*, Chapter *Vehicle engine*.
o - L - 7 - 9	Oil temperature too high	➠ *Operating instructions GMK 5200*, Chapter *Malfunctions on the carrier*.
o - L - 8 - 9	Truck crane is moving	Close parking brake; ➠ *Operating instructions GMK 5200*, Chapter *Description of the truck crane - Vehicle section*.
o - L - 9 - 5	Oil level sensor errors	Check the oil level in the transmission using the dipstick. ***CraneCARE*** at the respective location should be notified.

25.06.2004

These character strings are shown by every single character appearing one after the other for about 1 second in the *Transmission* display.

Quitting the oil level check mode

N

To quit the oil level check mode, press the *Neutral position N* switch once.

When the oil level check mode has been switched off, the *Transmission* display switches back to the normal display.

If you don't press another button for a long time, the oil level check mode will be switched off automatically. If you still need to use the oil level check mode, you can switch it back on (press *Upshift* and *Downshift* selector switches once at the same time).

7.2.2 Checking general condition and for leaks W

- Make a visual inspection for leaks.
- Listen carefully for any abnormal noises when the transmission is engaged.

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

- Inform ***CraneCARE*** at the respective location or your repair personnel.

25.06.2004

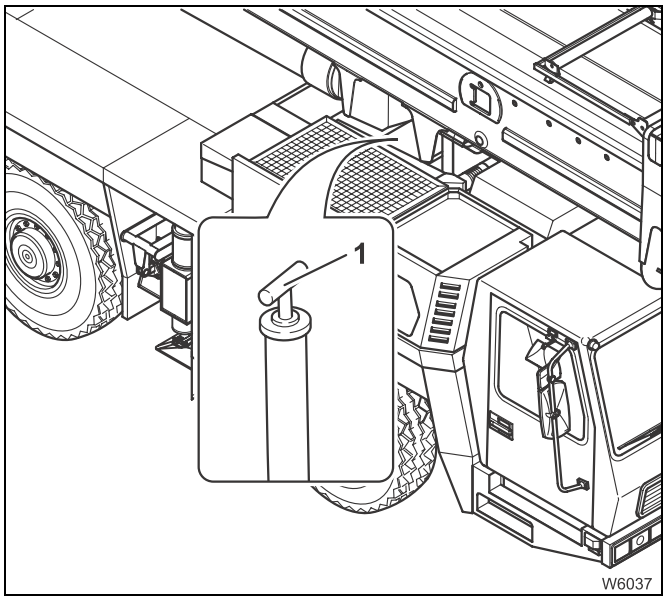
7.2.3 Automatic transmission - changing the oil and oil filter Y 2

The oil is drained via the automatic transmission oil drain opening and filled via the oil level measuring pipe.
Use only oil specified in the *Maintenance plan*, p. 5 - 6.

- Before you begin, lift the truck crane with the outrigger or park it over an inspection pit.
- Drain oil when at operating temperature.

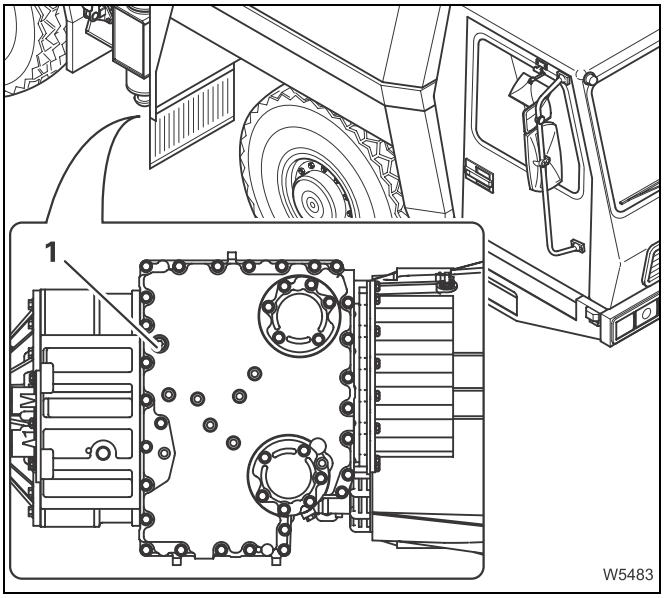
Risk of scalding
Do not let the oil at operating temperature escape unchecked.

Risk of damage to the environment from leaking fuel
Always use a collecting tray which is suitable for oil and which has a sufficient capacity when draining oil. When draining and filling make sure that no oil spills and soaks into the ground.



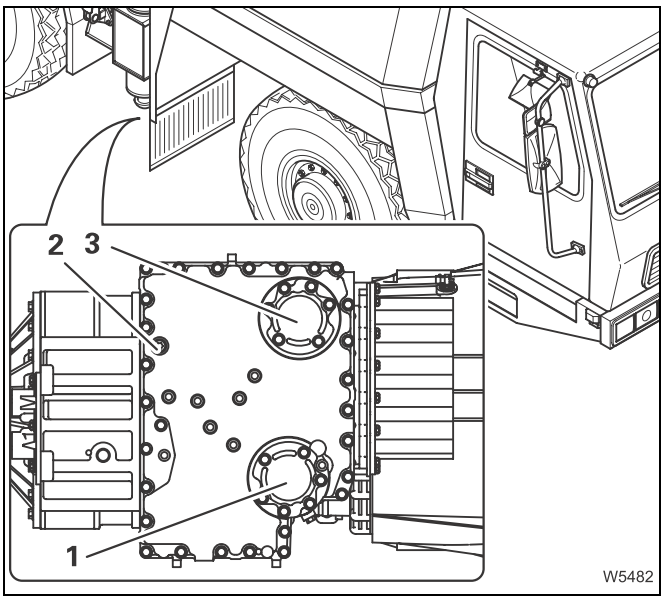
- Remove the dipstick (**1**) before changing the oil.

25.06.2004



Draining oil

- Place an oil collection vessel (with a capacity of approx. 50 l (13.2 gal)) under the oil drain plug (**1**).
- Unscrew the oil drain plug (**1**) and let the oil flow into the collection container.

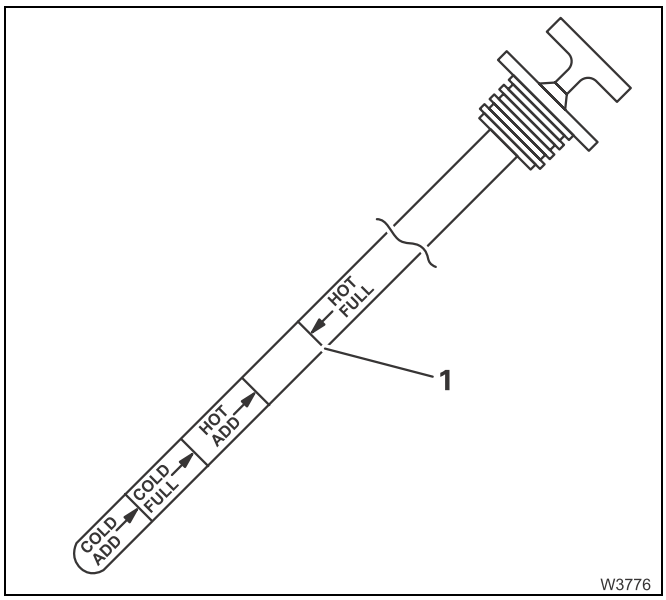


Changing the oil filter

The transmission is equipped with two oil filters. The filters can be reached from the underside.

- Unscrew the six hexagon bolts securing the filter cover (**1**).
- Remove the filter cover and filter cartridge from the transmission.
- Insert a new filter cartridge into the transmission.
- Replace the gasket and both O-rings of the filter cover.
- Put the filter cover back on and tighten the bolts.
  Tightening torque 51-61 Nm (38-45 lbs ft).
- Unscrew the hexagon bolts securing the filter cover (**3**) and replace the filter in the same way.
- Replace the O-ring of the oil drain plug (**2**) and screw the plug back into the oil drain opening.
  Tightening torque 25-32 Nm (18-24 lbs ft).

25.06.2004



Topping up the oil

- Pour the oil (46.0 l (12.2 gal)) through the oil level measuring pipe.
- Wait.
- Check the oil level on the dipstick. The oil level must be well above the upper mark (**1**). Otherwise, the engine must not be started.

After topping up the oil you must carry out the following checks for leaks:

- Start the vehicle engine and let it idle for approx. 2 minutes in neutral **N**.
- Fully depress the service brake pedal, even if the parking brake is on.
- Switch first to transmission mode **D** and then to **R** and allow the engine to run briefly at approx. 1200 - 1500 min^{-1} in each transmission mode in order to remove air from the hydraulics.
- Switch back into neutral position **N** and let the vehicle engine run at idling speed.
- Check the oil level on the dipstick.

Risk of accidents
Ensure that the parking brake is engaged and keep away from rotating parts because you will have to get underneath the truck crane to check the oil filter.

- Check the oil filters and oil drain plug for leaks.
- After every oil change you must first check the oil level when the gear oil is cold (16 to 49 °C (61 to 120 °F); ➠ p. 7 - 15.
- Afterwards, check the oil level when the gear oil is warm (71 to 93 °C (160 to 200 °F)); ➠ p. 7 - 16.

Risk of damage to the environment from leaking fuel
Collect old oil in approved containers and have used oil and oil filters disposed of properly.

25.06.2004

7.3 Transfer case / third axle line

The transfer case is located on the third axle line. The transfer case and the axle center drive of the third axle line share an oil top-up.

7.3.1 Checking general condition and for leaks W

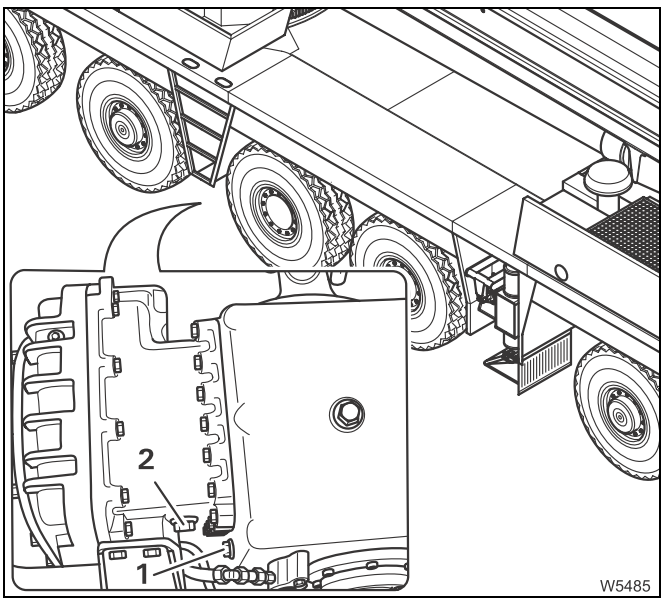
- Make a visual inspection for leaks.
- Listen for any unusual noises coming from the transfer case.

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

- Inform ***CraneCARE*** at the respective location or your repair personnel.

7.3.2 Transfer case - checking the oil level M 1

The oil level must be checked on the front of the transfer case with the engine turned off.



- Remove the plug (**1**) from the inspection hole.
- Check the oil level. It must reach to just underneath the inspection hole.

If the oil level is too low:

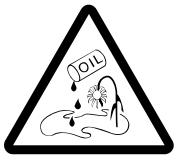
- Remove the plug (**2**) from the filling hole.
- Top up oil via the opening. Use only oil specified in the *Maintenance plan*, p. 5 - 10.
- Close the inspection hole with screw (**1**) and the filling hole with screw (**2**).

25.06.2004

7.3.3 Transfer case - changing the oil M 6

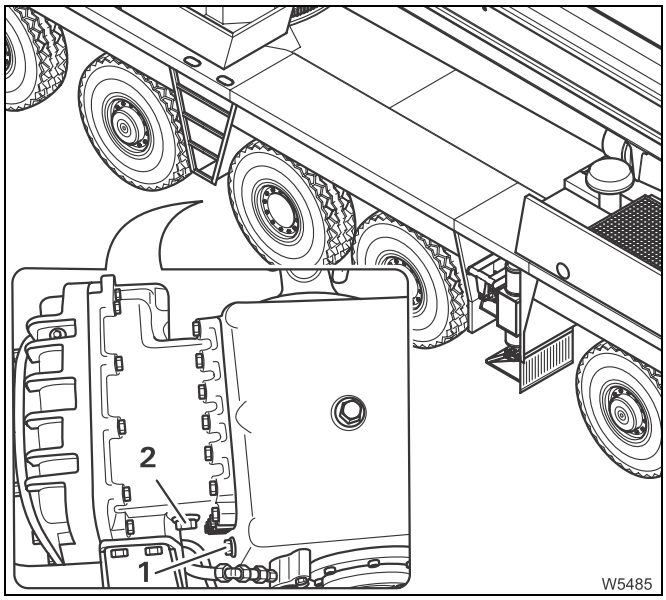
When changing oil, use only oil specified in the *Maintenance plan*, p. 5 - 14.

- Raise the truck crane with the outriggers or park it over an inspection pit.



Risk of damage to the environment from leaking fuel
Always use oil collection containers, funnels or filling pumps which are resistant to oil.
Wipe up spilled oil immediately.

The oil must be changed with the engine turned off. The oil drain plug is located on the underside of the transfer case.



- Place an oil collection vessel (with a capacity of approx. 20 l (5.3 gal)) under the oil drain plug (**3**).
- Remove the plug (**1**) from the inspection hole.
- Unscrew the oil drain plug (**3**) and let the oil flow into the collection container.
- Replace the sealing rings and reinsert the oil drain plugs.
- Fill up the oil via the opening (**2**). Use only oil specified in the *Maintenance plan*, p. 5 - 14.
- Check the oil level (➠ *Transfer case - checking the oil level*, p. 7 - 23).
- Replace the sealing rings and close the inspection hole with screw (**1**), and close the filling hole with screw (**2**).

Risk of damage to the environment from leaking fuel
Collect waste oil in approved containers and have it disposed of properly.

25.06.2004

7.4 Axle lines

Maintenance work on the axle center drive of the third axle line is conducted in conjunction with maintenance work on the transfer case; ➠ p. 7 - 23.

7.4.1 Checking general condition and for leaks W

- Make a visual inspection for leaks.
- Listen for any unusual noises coming from the axle center drives and final drives.

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

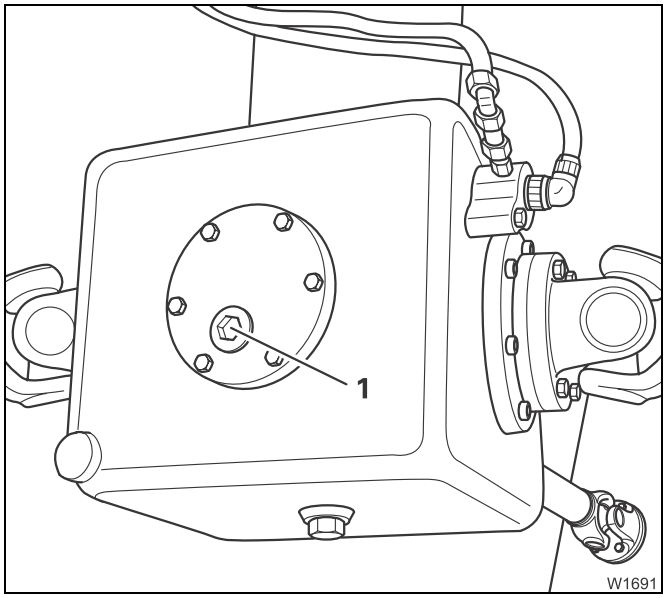
- Inform ***CraneCARE*** at the respective location or your repair personnel.

25.06.2004

7.4.2 Axle center drives - checking the oil level — M 1

The position and number of inspection holes can sometimes vary depending on the axle line.

The axle center drive on the 1st axle line is available only as additional equipment with a 10 x 8 x 10 drive.



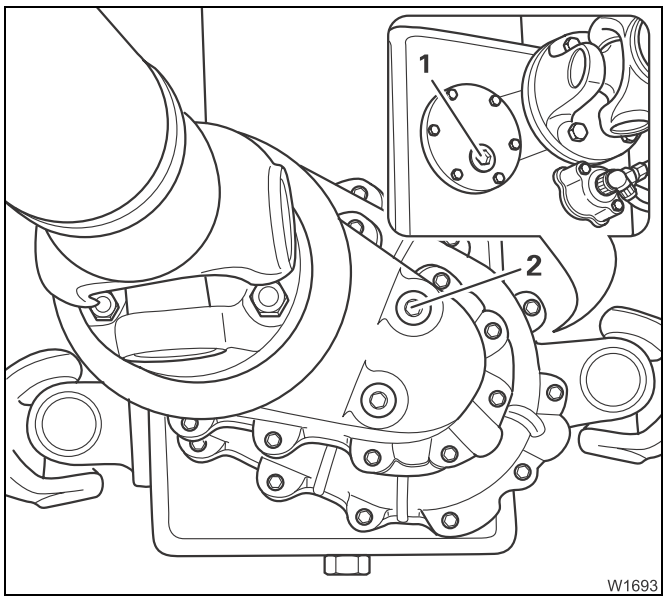
1. and fifth axle lines

The inspection hole is at the front of the first axle line.
The inspection hole is at the back of the fifth axle line.

- Remove the plug (**1**) from the inspection hole.
- Check the oil level. It must reach to just underneath the inspection hole.

If the oil level is too low:

- Top up oil through the inspection hole using only oil specified in the *Maintenance plan*, p. 5 - 10.
- Replace the sealing ring and screw the plug back into the inspection hole (**1**).



4. axle line

The axle center drive of the fourth axle line has two inspection holes:

front — the inspection hole (**2**)
rear — the inspection hole (**1**)

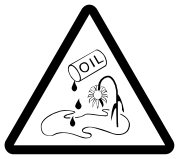
- Check the oil level in the same way as is described for the first and fifth axle lines.

25.06.2004

7.4.3 Axle center drives - changing the oil — M 12

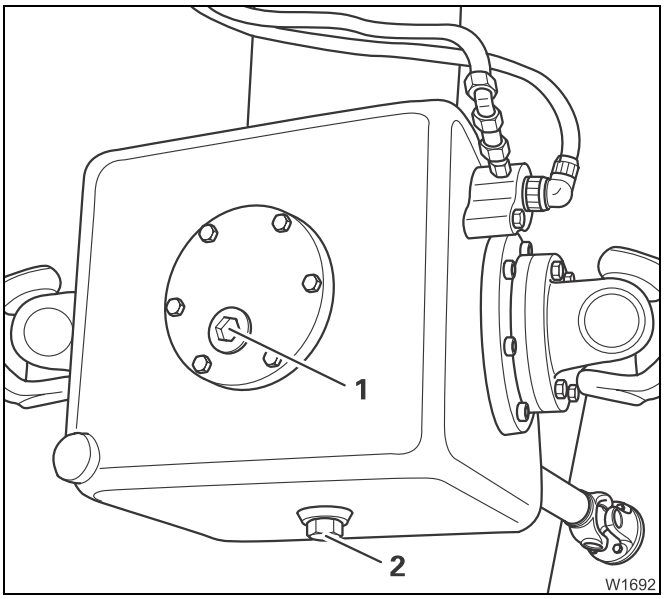
Use only oil specified in the *Maintenance plan*, p. 5 - 16.

- Raise the truck crane with the outriggers or park it over an inspection pit.



Risk of damage to the environment from leaking fuel
Always use oil collection containers, funnels or filling pumps which are resistant to oil.
Wipe up spilled oil immediately.

- Switch off vehicle engine to change the oil.

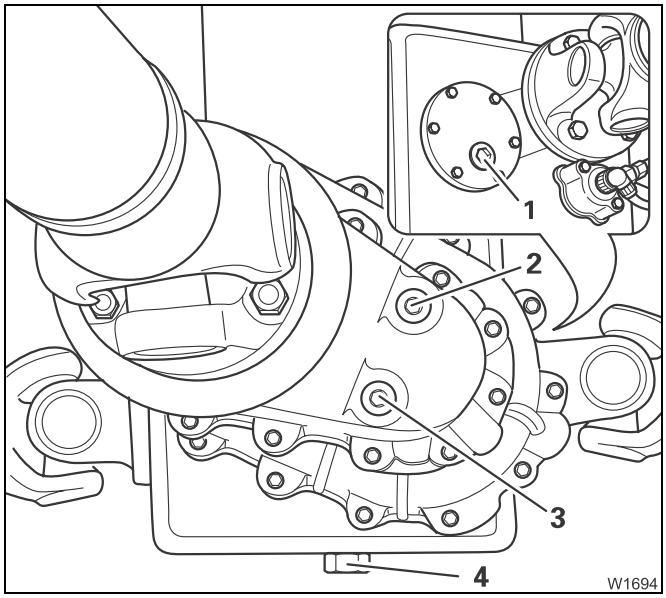


1. and fifth axle lines

- Place an oil collection vessel (with a capacity of approx. 20 l (6 gal)) under the oil drain plug (**2**).
- Remove the plug (**1**) from the inspection hole.
- Unscrew the oil drain plug (**2**) and let the oil flow into the collection container.
- Replace the sealing ring and reinsert the oil drain plug.
- Top up oil using only oil specified in the *Maintenance plan*, p. 5 - 16.
- Check the oil level (➠ *Axle center drives - checking the oil level*, p. 7 - 26).
- Replace the sealing ring and screw the plug back into the inspection hole (**1**).

Risk of damage to the environment from leaking fuel
Collect the old oil in authorized containers and only have it disposed of by certified disposal companies.

25.06.2004



4. axle line

- The axle center drive of the fourth axle line has two oil drain plugs:
  bottom - oil drain plug (**4**)
  front -oil drain plug (**3**).
- Place an oil collection vessel (with a capacity of approx. 20 l (6 gal)) under oil drain plugs (**3**) and (**4**).
- Change the oil on both oil drain plugs in the same way as is described for the axle drives on the first and fifth axle lines.

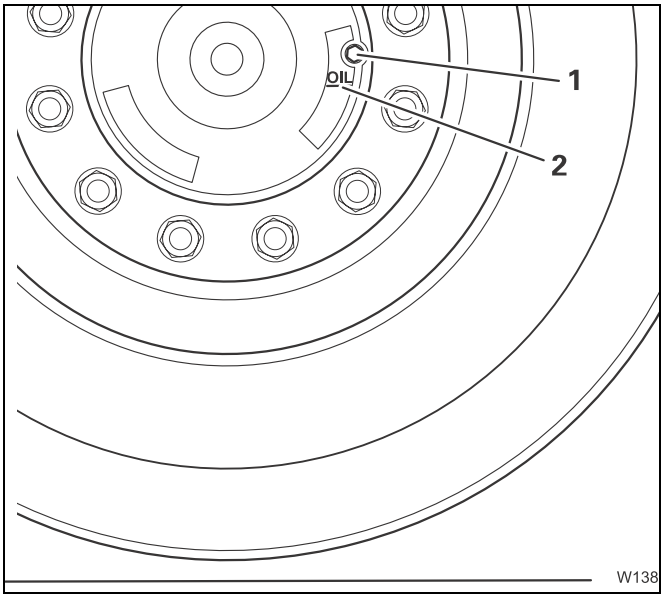
25.06.2004

7.4.4 Final drives - checking the oil level

M 1

Every final drive has an inspection hole.

- Raise the truck crane with the outrigger and release the parking brake.



- Turn the wheel so that the oil check mark (**2**) is horizontal and is on the right next to the center of the axle.
- Remove the plug (**1**) from the inspection hole.
- Check the oil level, the oil level must be at the check mark (**2**).

If the oil level is too low:

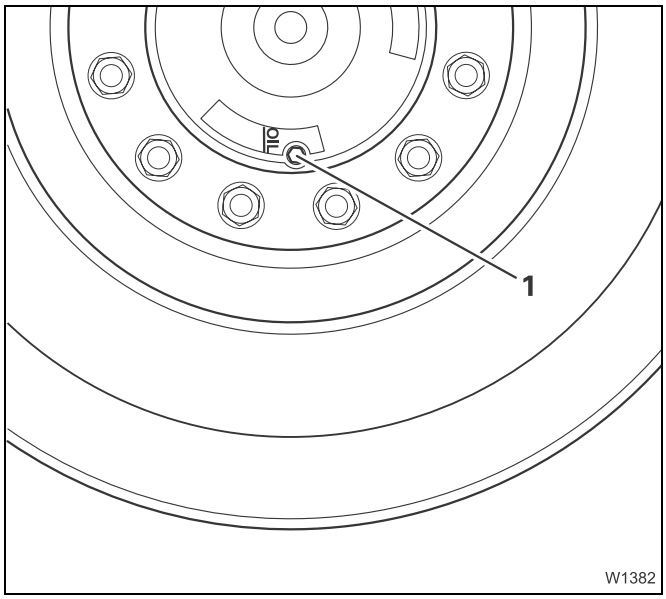
- Top up oil through the inspection hole using only oil specified in the *Maintenance plan*, p. 5 - 8.
- Replace the sealing ring and screw the plug back into the inspection hole (**1**).
- Also check the oil level on all other final drives.

25.06.2004

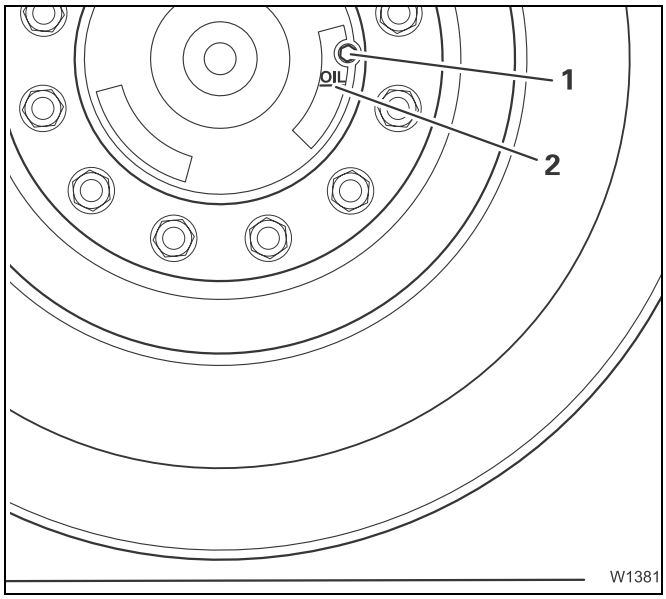
7.4.5 Final drives - changing the oil — M 12

- Raise the truck crane with the outrigger and release the parking brake.

Risk of damage to the environment from leaking fuel
Always use oil collection containers, funnels or filling pumps which are resistant to oil.
Wipe up spilled oil immediately.



- Place an oil collection vessel (with a capacity of approx. 4 l (1.5 gal)) under the wheel.
- Remove the bolt (**1**) from the inspection hole.
- Turn the wheel until the opening is pointing downwards and drain the oil into the collecting vessel.



- Turn the wheel back so that the oil check mark (**2**) is horizontal and is on the right next to the center of the axle.
- Top up oil through the inspection hole (**1**). Use only oil which is specified in the *Maintenance plan*, p. 5 - 16.
- Check the oil level. The oil level must be at the control mark (**2**).
- Replace the sealing ring and screw the plug back into the inspection hole (**1**).

Risk of damage to the environment from leaking fuel
Collect the old oil in authorized containers and only have it disposed of by certified disposal companies.

25.06.2004

7.4.6 Lubricating the cardan shafts on the axle lines M 1

The cardan shafts are between the axle center drives and the final drives.

If the cardan shaft was not equipped at the factory with a lubricating nipple, it is a maintenance-free version. Even after completing repair work on the cardan shafts, you should check whether or not maintenance-free cardan shafts have been reinstalled.
If this is the case, the activities described in this section are no longer applicable.

The cardan shafts must be lubricated with a grease gun. Only use lubricating grease specified in the *Maintenance plan*, p. 5 - 10.

Risk of damaging the lip seals
To avoid damage to the lip seals, do not apply hard lubricants.

Number and position of lubrication points

There are two cardan shafts on every driven axle line.
The following table shows the position and number of lubricating nipples on both cardan shafts for all driven axle lines.

Lubricating cardan shafts on	Lubricating nipple	
	inside [1]	outside [2]
1. axle line[3]	2	4
3. axle line	2	2
4. axle line	2	2
5. axle line	2	2

[1] Cardan shafts on axle center gearboxes

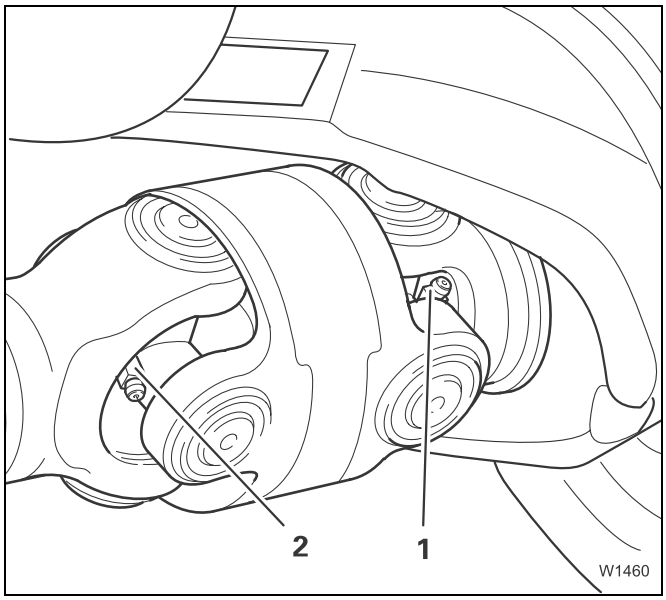
[2] Cardan shafts on final drives

[3] With 10 x 8 x 10 drive (additional equipment)

25.06.2004

Lubricating cardan shafts on 1.axle line lubricating

There are double joints on the first axle line.

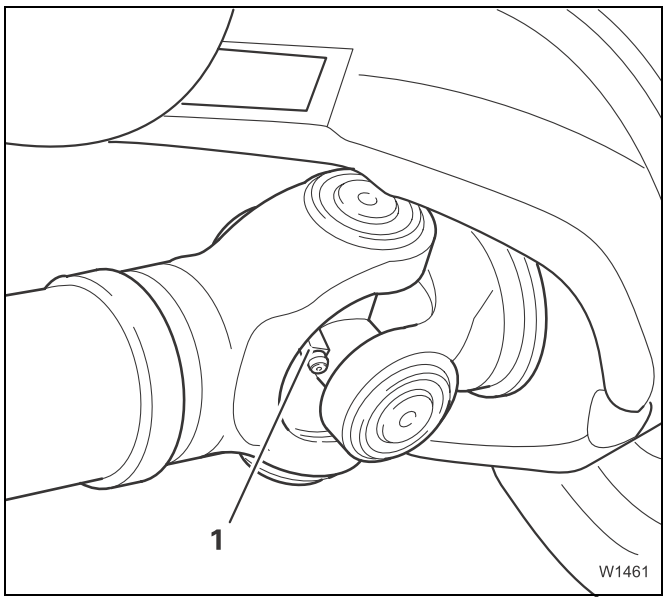


There are two lubricating nipples (**1**) and (**2**) on every double joint.
To lubricate the outer lubricating nipple (**1**) on the joints, the wheels must be turned to their fullest extent.

- Remove the old grease and dirt from the lubricating nipples.
- Press lubricating grease into the lubricating nipples until new grease comes out of the respective bearing points.
- Remove the surplus new grease.

Lubricating cardan shafts on 3., 4. and fifth axle lines

There are single joints on the third, fourth and fifth axle lines.



There is one lubricating nipple (**1**) on every single joint.

- Remove the old grease and dirt from the lubricating nipple.
- Press lubricating grease into the lubricating nipple until new grease comes out of the corresponding bearing point.
- Remove the surplus new grease.

25.06.2004

7.4.7 Lubricating the longitudinal cardan shafts between the gear units lubricating

M 6

The longitudinal cardan shafts are located between the automatic transmission and the transfer case, between the transfer case and the axle center drives, and between the axle center drives.

If the cardan shaft was not equipped at the factory with a lubricating nipple, it is a maintenance-free version. Even after completing repair work on the cardan shafts, you should check whether or not maintenance-free cardan shafts have been reinstalled.
If this is the case, the activities described in this section are no longer applicable.

The (longitudinal) cardan shafts must be lubricated with a grease gun. Only use lubricating grease specified in the *Maintenance plan*, p. 5 - 14.

Risk of damaging the lip seals
To avoid damage to the lip seals, do not apply hard lubricants.

Number and position of lubrication points

The following table shows the location and number of the lubricating nipples on the individual cardan shafts:

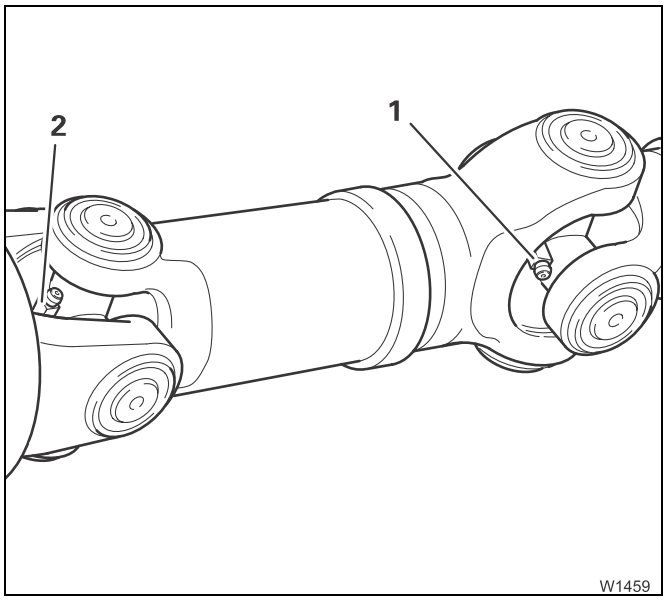
(Longitudinal) cardan shaft between ...	Lubricating nipple	
	front	rear
Automatic transmission and transfer case	1	1
3. axle line and intermediate bearings [1)]	1	1
intermediate bearing and 1st axle line[1)]	1	–
3. and 4th axle lines	1	1
4. and 5th axle lines	1	1

[1)] With a 10 x 8 x 10 drive (additional equipment), in this case also lubricate the intermediate bearing; ➠ p. 7 - 34.

25.06.2004

Lubricating longitudinal cardan shafts

Lubrication is carried out in the same way for all longitudinal cardan shafts.



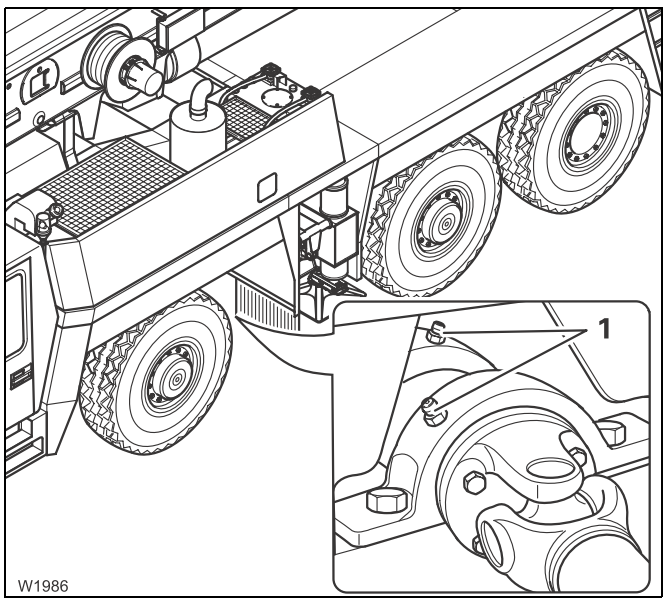
There are two lubricating nipples (**1**) and (**2**) on every longitudinal cardan shaft.

- Remove the old grease and dirt from the lubricating nipples.
- Press lubricating grease into the lubricating nipples until new grease comes out of the respective bearing points.
- Remove the surplus new grease.

7.4.8 Lubricating the intermediate bearing of the longitudinal cardan shafts

M 6

When fitted with a 10 x 8 x 10 drive as additional equipment, there is an intermediate bearing in the longitudinal cardan shaft between the 1st and 3rd axle lines.
The intermediate bearing is at the height of the front outrigger box.



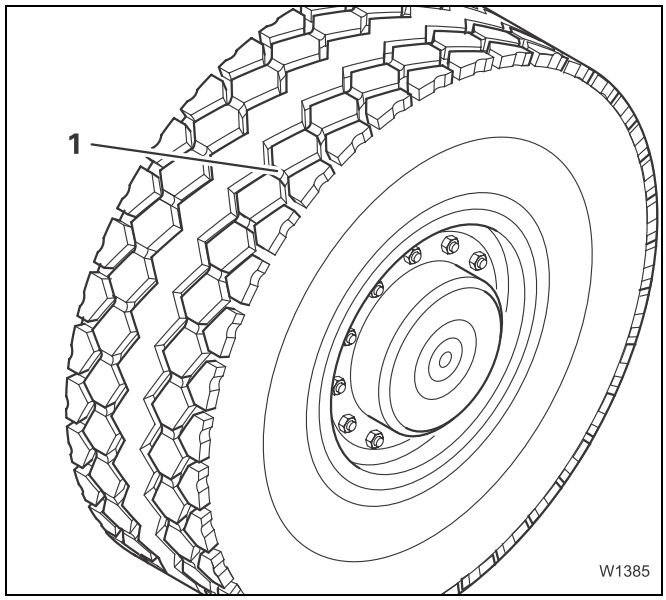
The intermediate bearing is equipped with two lubricating nipples (**1**).

- Remove the old grease and dirt from the lubricating nipples.
- Press lubricating grease into the lubricating nipples (**1**) until new grease comes out of the respective bearing points.
- Remove the surplus new grease.

25.06.2004

7.5 Wheels

7.5.1 Checking the tyres for damage D



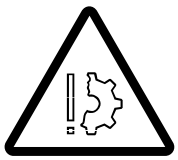
- Check the tyres for:
  - chunking
  - dents
  - areas with uneven wear
- Check whether the tyre has worn down to the wear mark (**1**).

If the tyre no longer has any tread at the wear marks:

- Change the tyres.

Risk of accidents due to uneven braking
Always replace all the tyres on an axle.

7.5.2 Checking the tyre pressure W



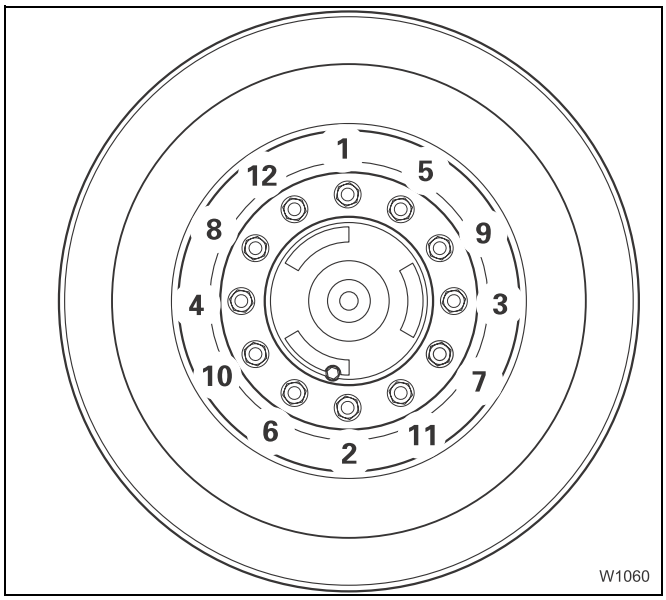
Risk of damage to the tyres
When replacing tyres, please note that tyres from other manufacturers must have the same load bearing capacity and thus the same tyre pressure as the initial equipment.

- Check that the new tyre pressures conform to the values in the table.

Tyres	Air pressure in bar (psi)
14.00 R 25	10.0 (145)
16.00 R 25 (additional equipment)	9.0 (130)
20.50 R 25 (additional equipment)	7.0 (102)

25.06.2004

7.5.3 Checking tightness of wheel nuts — M 1



- With a torque wrench, check that the wheel nuts are tight by moving crosswise in the order shown in the illustration.

  Torque for wheel nuts: 650 Nm (480 lbs ft)

Check the wheel nut torque after driving 50 km (30 mi) and 150 km (90 mi) with 650 Nm (480 lbs ft).

7.5.4 Checking the wheel-bearing clearance — M 3

- Raise the truck crane with the outriggers. Release the parking brake.
- Press against the bottom of the wheel with one foot and, using both hands, try to move the wheel in the bearing at the same time.

If the check shows there is too much play:

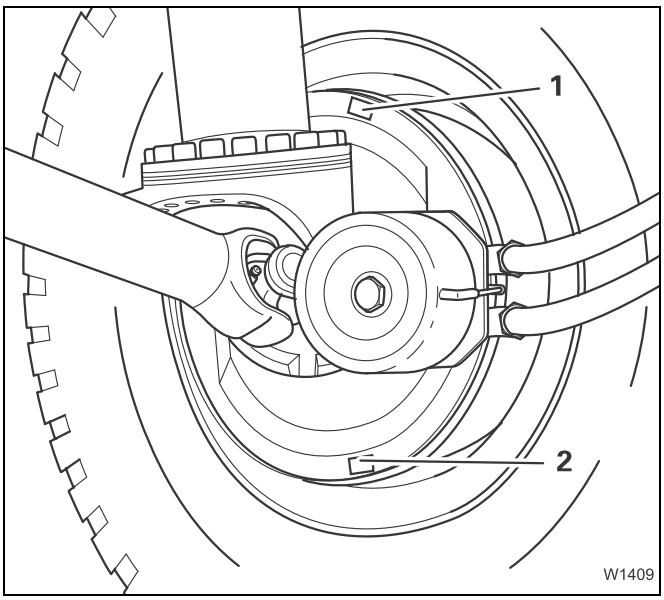
- Have the wheel-bearing clearance adjusted or wheel bearings replaced by ***CraneCARE*** at the respective location or by your own repair personnel.

25.06.2004

7.6 Vehicle brakes

7.6.1 Checking brake lining thickness M 3

There is an opening on the inside of each wheel (sealed with a rubber plug) through which the brake lining thickness can be checked.



- Remove rubber plugs (**1**) and (**2**) and shine a torch into the opening.

If the brake lining thickness has worn down to the wear mark (stepped edges or grooves) **or** the linings have worn down to 3 mm (0.12 in):

- Have the brake linings replaced by ***Crane-CARE*** at the respective location or an authorized workshop.

Risk of accidents due to uneven braking
Always replace all brake linings on an axle line. By doing so, it is possible to ensure that the brakes react in the same way and the truck crane stays in its track.

25.06.2004

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25.06.2004

7.7 Suspension

7.7.1 Checking the oil level in the suspension cylinders M 1

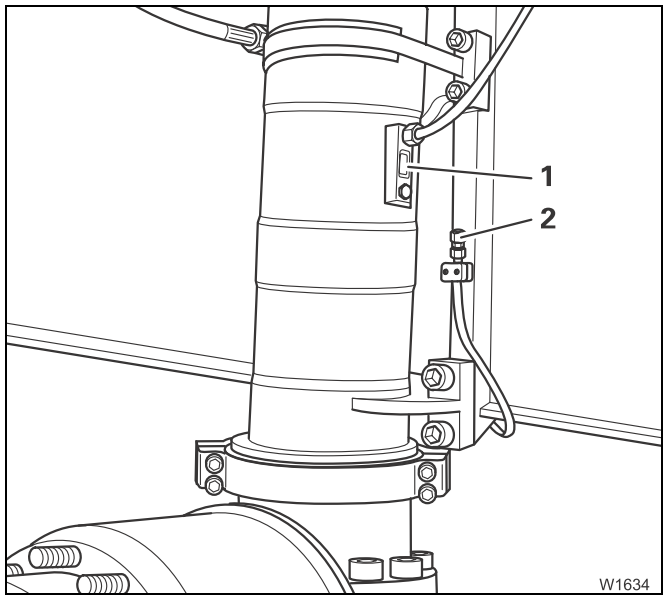
The suspension cylinders of the individual wheel suspension units are bolted to the vehicle frame (carrier).

- Use the level adjustment system to lower the truck crane completely and then raise it to on-road level again
  (➠ Operating instructions, Part 1, Chapter *Driving with the truck crane*, Section *Vehicle height control*).

To be able to ascertain the correct oil level, it is necessary to lower the truck crane completely.

If the oil level is above the upper marking on the inspection glass the suspension cylinder is defective and must be replaced.
Notify ***CraneCARE*** at the respective location.

The inspection glass on the left suspension cylinder of the fifth axle line is located on the back side of the suspension cylinder. Checking the oil level requires a mirror.



- Check the oil level at the relevant inspection glass (**1**).
  The oil level must be between the markings.

If the oil level is too low:

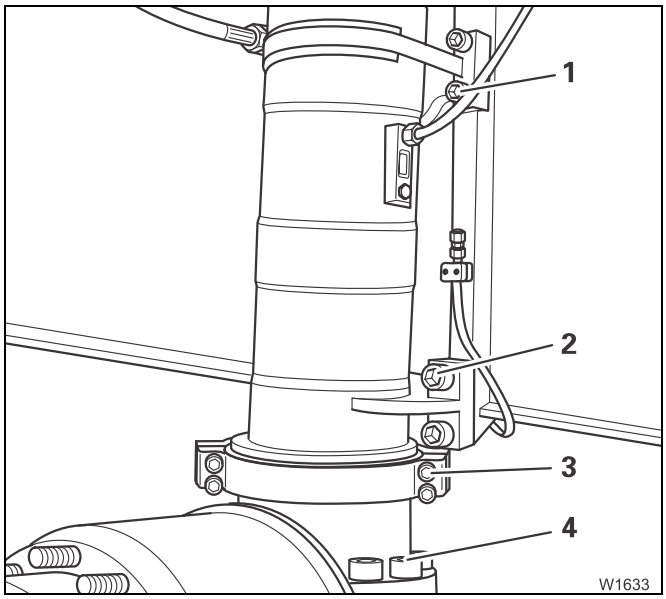
- Screw the high pressure squirt gun (supplied tool) to the filler connection (**2**).
- Inject oil up to the level of the lower marking.
  Use only oil specified in the *Maintenance plan*, p. 5 - 10.

25.06.2004

Risk of damage to the suspension cylinders due to insufficient lubrication
It is difficult to inject the oil. Even so, do not fill oil through the inspection glass connections. The oil will not reach all lubricating points through the inspection glass connections.

7.7.2 Checking the tightness of the retaining bolts on the suspension cylinders

M 1



- Check the tightening torques of the retaining bolts:

– vehicle frame/guide case; top (**1**)

– vehicle frame/guide case; bottom (**2**)

– support element/steering split shell (**3**)

– support element/operating head (**4**)

The tightening torques can be found in Section *Special tightening torques*, p. 10 - 2.

25.06.2004

7.8 Steering

7.8.1 Checking for leaks W

- Check the hydraulic steering system (steering cylinders, pipes and hoses, and all connections) for leaks.

Risk of accidents from hydraulic oil spraying out
Never tighten leaking connections when the system is under pressure. Only change pipes and hoses when the system is depressurized.

- Top up hydraulic oil (➠ *Checking the hydraulic oil level*, p. 7 - 45).

After changing pipes and hoses:

- Ventilate the carrier hydraulic system (➠ *Changing the hydraulic oil*, p. 7 - 52).

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

- Inform ***CraneCARE*** at the respective location or your repair personnel.

25.06.2004

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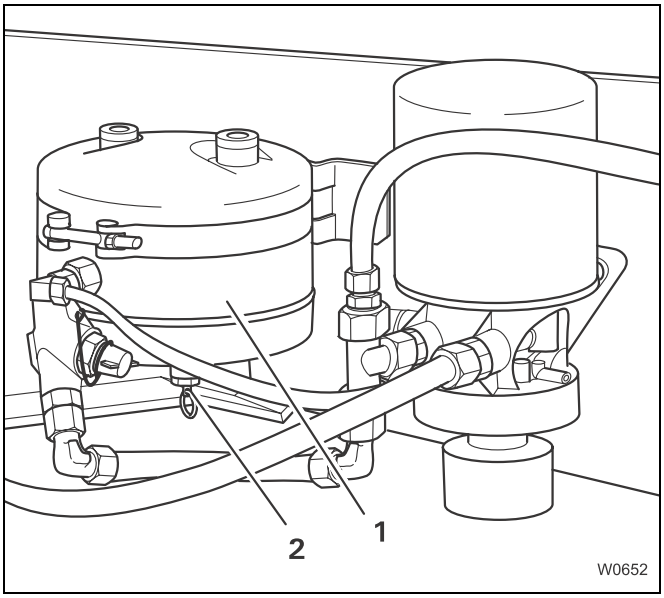
25.06.2004

7.9 Carrier compressed air system

7.9.1 Draining the compressed air system W

Moisture must be drained from the compressed air system through the drain valves of the four compressed air reservoirs and the conditioning unit. A functional check of the compressed air drier is carried out simultaneously. The compressed air reservoirs are located beneath the rear and front parts of the carrier. The conditioning unit is located on the left under the driver's cab and is accessible from below.



- Operate the drain valves (**2**). The drain valve of the conditioning unit (**1**) is shown here as an example.

If the respective drain valve does not close after being actuated several times:

- Change the drain valve.

If a lot of moisture escapes from the air reservoirs:

- Have the compressed air drier checked or replaced by your repair personnel.

7.9.2 Checking for leaks W

- Start up the compressed air system.
- Check all points in the compressed air system (connections, pipes, hoses and valves) where air could possibly escape.

Risk of accidents due to escaping compressed air
Never tighten connections when the system is under pressure. Only change seals, pipes and hoses when the system is depressurized.

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

- Inform ***CraneCARE*** at the respective location or your repair personnel.

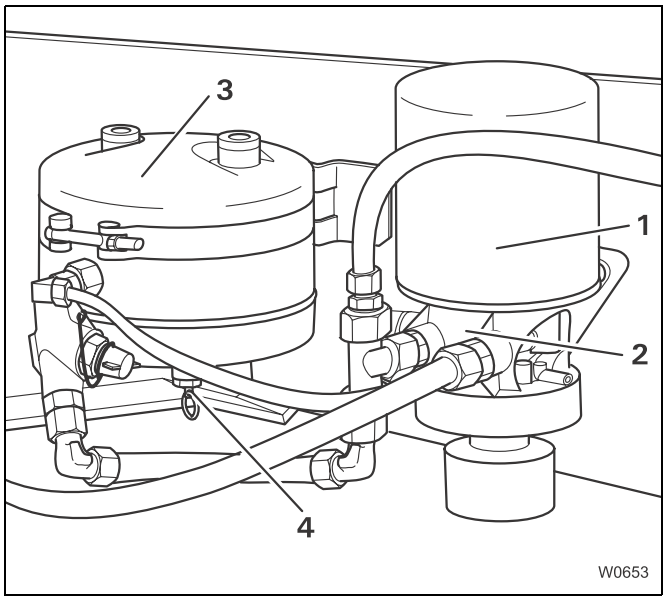
25.06.2004

7.9.3 Replacing the granulate cartridge of the compressed air dryer

M 12

The compressed air drier with granulate cartridge is located on the left under the driver's cab and is accessible from below.

Risk of injury from escaping compressed air
If the conditioning unit is not completely empty, the air drier will be under pressure.



- Release all the air from the conditioning unit (**3**) via the drain valve (**4**).
- Unscrew the granulate cartridge (**1**) (attached to the cover hood) using a strap wrench.
- Change the granulate cartridge.
  Grease the sealing ring lightly before screwing into place.

25.06.2004

7.10 Carrier hydraulic system

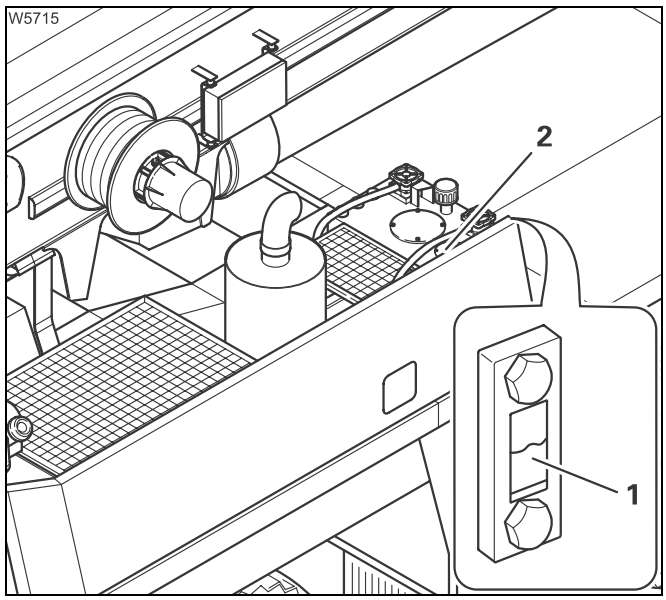
7.10.1 Checking the hydraulic oil level D

The hydraulic oil tank is on the left-hand side of the carrier behind the driver's cab.
The level can be checked through the inspection glass.

To check the oil level:

– the truck crane must be in *On-road driving* position (➠ *Operating instructions*, Part 1, Chapter *Driving with the truck crane*, Section *Vehicle height levelling*);

– the outrigger beams and cylinders must be retracted (➠ *Operating instructions*, Part 2, Chapter *Rigging work*, Section *Outrigger*).



- Check the level of the hydraulic oil tank through the inspection glass (**1**).
  The hydraulic oil must be visible in the center of the inspection glass.

If the level is too low:

- Top up the hydraulic oil through the filler opening (**2**).
  Only use hydraulic oil specified in the *Maintenance plan*, p. 5 - 6.

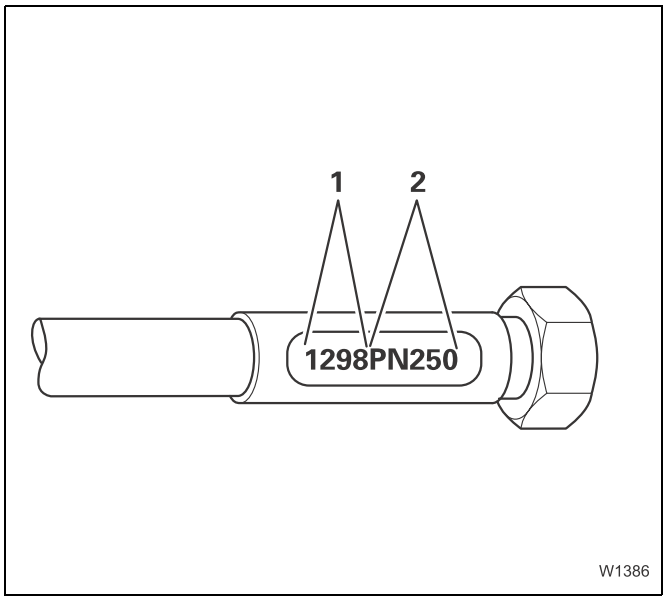
Risk of damage to hydraulic system
When handling hydraulic oil, cleanliness is imperative.
New oil must also be filtered.

25.06.2004

7.10.2 Checking the hydraulic hoses W

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

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



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

- The first 4 numbers (**1**) indicate the month and year in which the hose was manufactured.
- The letters **P** and **N** and the last 3 numbers (**2**) indicate the permitted operating pressure.

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

25.06.2004

7.10.3 Checking for leaks

W

- With the vehicle engine running, carry out a visual inspection for leaks and escaping hydraulic oil at the suspension cylinders, outriggers, hydraulic lines (hoses and pipes) and connections.
- If leaks are detected, check the hydraulic oil level and top up if necessary (➠ *Checking the hydraulic oil level*, p. 7 - 45).

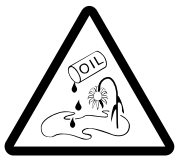
Risk of accidents from hydraulic oil spraying out
Never tighten any leaking connections when the system is under pressure. Only change pipes and hoses when the system is depressurized.

After parts have been changed:

- Ventilate the carrier hydraulic system (➠ *Changing the hydraulic oil*, p. 7 - 52).

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

- Inform ***CraneCARE*** at the respective location or your repair personnel.



Risk of damage to the environment from leaking fuel
Immediately repair or have leakages repaired in the hydraulic system to ensure that no hydraulic oil escapes, seeps into the ground or reaches water when the crane is being used.

25.06.2004

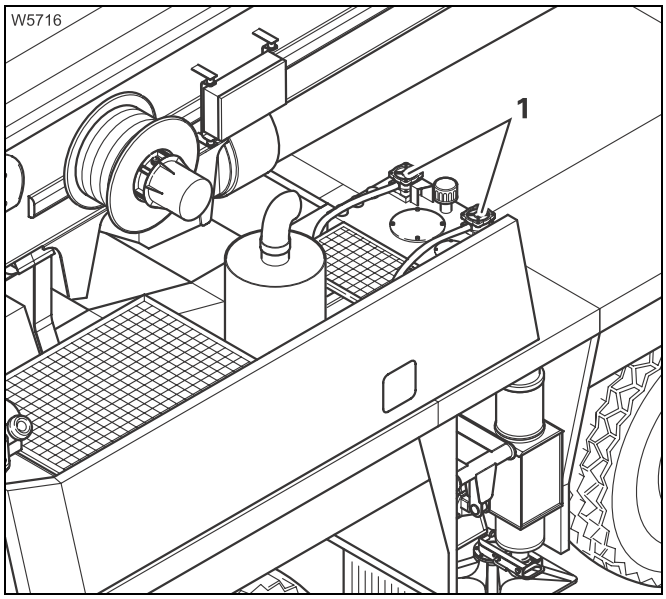
7.10.4 Changing the hydraulic oil filters and cleaning the magnetic rod

M 3

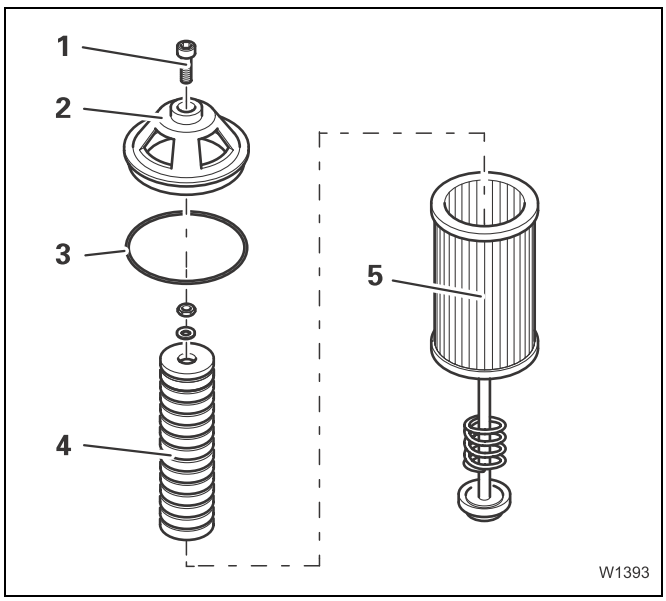
The hydraulic tank contains two hydraulic oil filters (return filters). The hydraulic oil filters must be changed:

– when the warning lamp *Hydraulic oil return filter* lights up on the front instrument panel of the driver's cab
– After every hydraulic oil change.

- Turn off the engine and depressurize the hydraulic system.



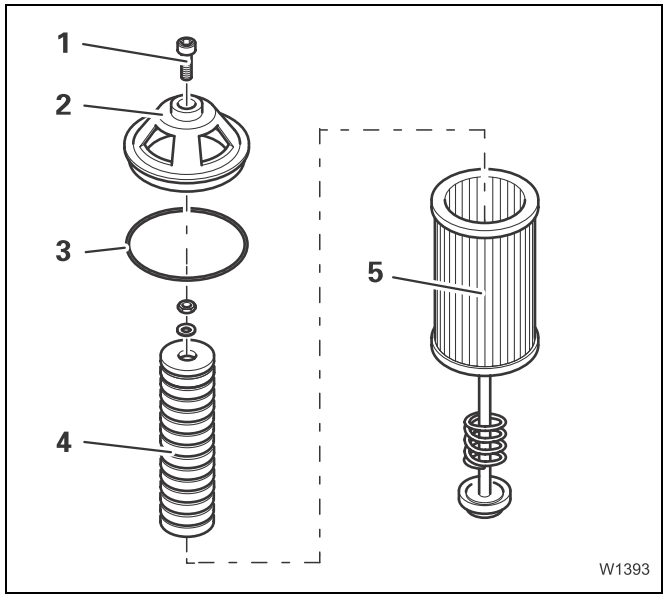
- Remove the nuts on the filter cover (**1**) and remove the hydraulic oil filters from the hydraulic oil tank.



- Unscrew screw (**1**) and remove the upper parts of the filter (**2**).
- Unscrew the magnetic rods (**4**) and clean them.

25.06.2004

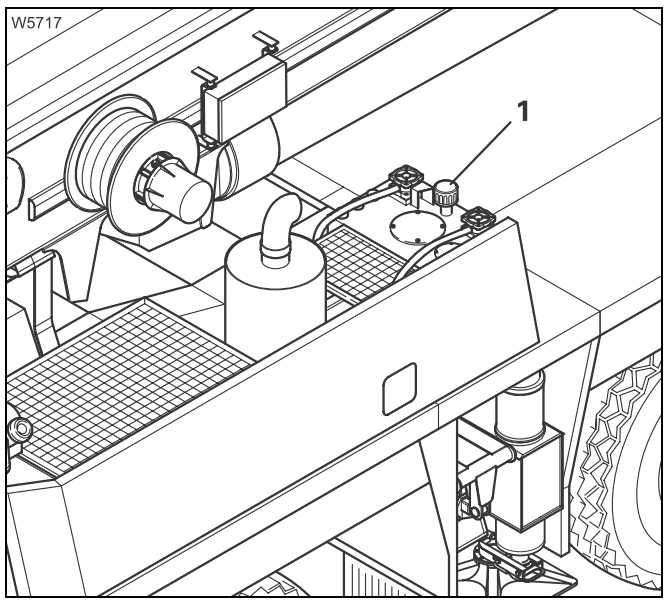
Risk of damage to hydraulic system
Large amounts of metal chips adhering to the magnetic rods are a sign of damage in the hydraulic system. Have the hydraulic system inspected by ***CraneCARE*** or by your repair personnel.



- Change the hydraulic oil filter elements (**5**).
- Replace the O-rings (**3**) on the bottom and top of the filter.
- Reassemble the hydraulic oil filters and replace them in the hydraulic oil tank.

Risk of damage to the environment from leaking fuel
Store used hydraulic oil filters in suitable containers and have them disposed of properly by qualified personnel.

7.10.5 Replacing the vent filter M 12



The venting filter is located on the cap of the filler opening of the hydraulic oil tank.

- Replace vent filter (**1**).

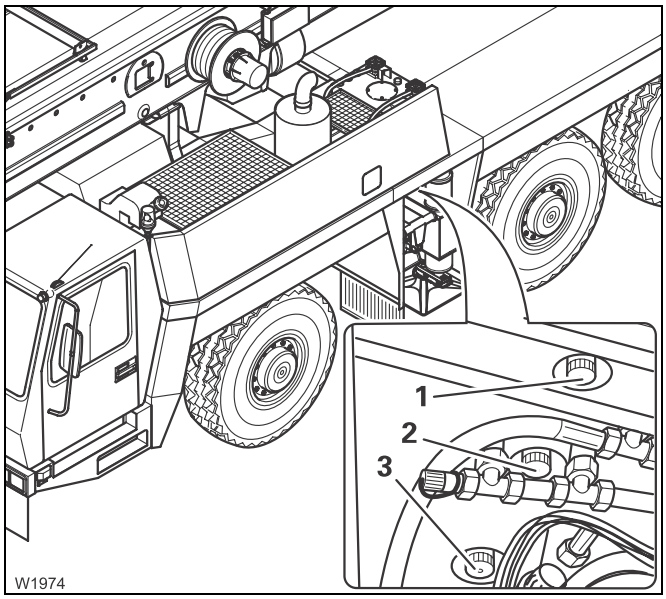
25.06.2004

7.10.6 Taking oil samples

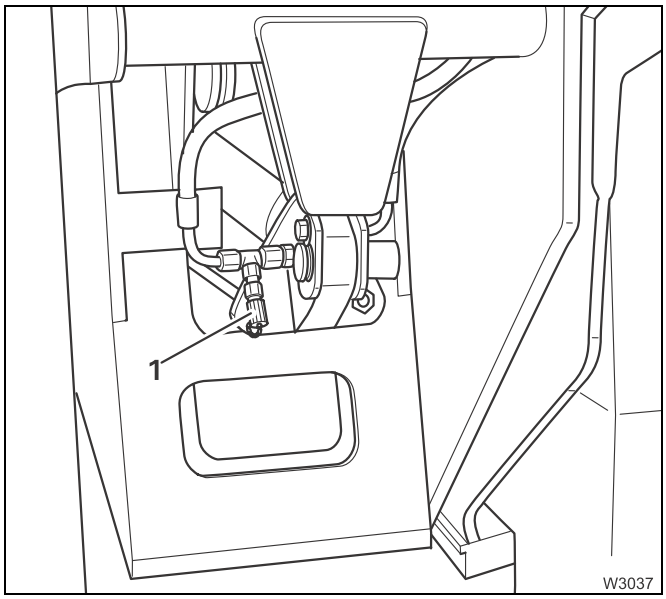
M 12

To determine the usability of the hydraulic oil, samples must be taken from the hydraulic oil tank and from the hydraulic system (➠ *Changing the hydraulic oil*, p. 7 - 52).

The drain valves can only be opened and closed using the ½ inch fittings. The connecting pieces are to be found in the tool box; ➠ *Handling the drain valves*, p. 7 - 51.



- Take one oil sample from each of the drain valves (**1**), (**2**) and (**3**) on the hydraulic oil tank.



The oil sample from the hydraulic system is taken via a gauge port (**1**), e. g. on an outrigger.

25.06.2004

Handling the drain valves

The drain valves can only be opened and closed using the ½ inch fittings. The fittings are located in the tool box.

Danger from escaping hydraulic oil.
When the connecting piece is screwed onto the drain valve, the valve opens and the hydraulic oil immediately flows out of the connecting piece. Place the connecting piece hose in an oil collection vessel before screwing on the connecting piece.

- Place an oil drain hose onto the fitting and put the other end of the hose into an oil collection container.
- Unscrew the cap from the drain valve.
- Screw the fitting onto the drain valve. The drain valve will open.
- Let the necessary amount of oil run into the collection container.
- Unscrew the fitting from the drain valve. The drain valve will shut.
- Screw the protective cap back onto the drain valve.

Taking oil samples

- Take one litre (0.26 gal) of hydraulic oil from each of the three drain valves and from one pressure gauge connection. Before taking the oil sample, allow 1 to 2 litres (0.26 to 0.5 gal) of the oil to drain into a separate container.
- Label each sample container with
  – date of sample
  – number of operating hours since last oil change
  – sampling location (hydraulic oil tank or gauge port)
- Send the samples to a specialist laboratory for analysis.
  Permissible limit values:
  –viscosity ISO-VG 32 in accordance with DIN 51524 T.2
  –contamination in accordance with NAS 1683 Class 9 or ISO 4406 Code 18/15

If these limits have been reached:

- Carry out oil change (➠ *Changing the hydraulic oil*, p. 7 - 52).

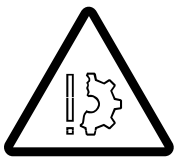
25.06.2004

7.10.7 Changing the hydraulic oil M 12

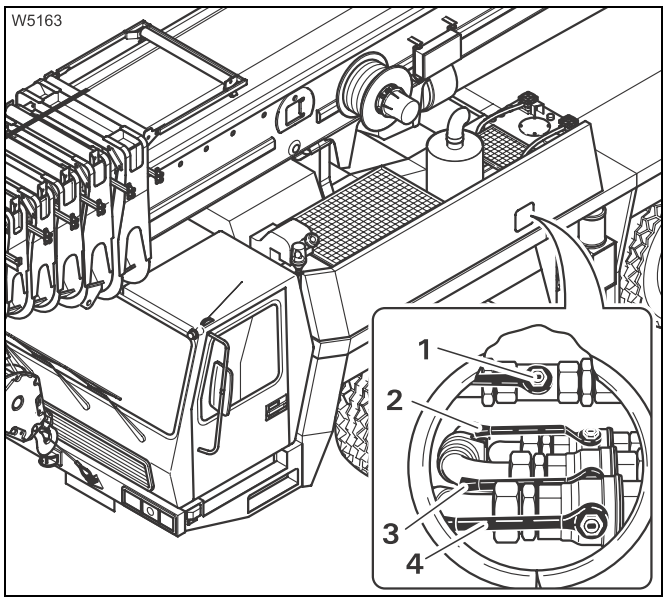
The hydraulic oil must only be changed if the laboratory analysis shows that the permissible limits have been exceeded (➠ *Taking oil samples*, p. 7 - 50) or the laboratory has recommended a date for an oil change.

Prerequisites:
– the truck crane must be ready for on-road driving,
– the engine must be stopped

Only use hydraulic oil specified in the *Maintenance plan*, p. 5 - 16.



Risk of damage to the hydraulic pumps
Ensure that the vehicle engine cannot be started by unauthorized personnel.
If the engine is started while the shut-off valves in the suction lines are closed, the hydraulic pumps will be damaged!



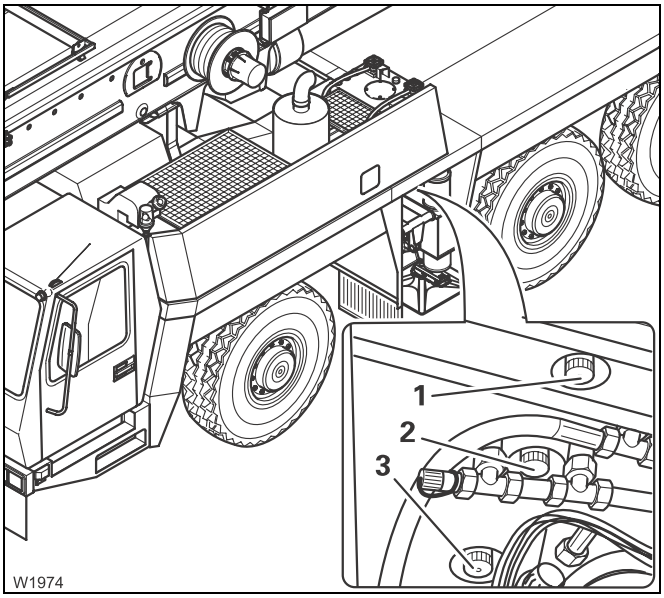
- Close the shut-off valves in the suction lines to the hydraulic oil tank.

The four hand valves (**1**) to (**4**) are located on the left side of the vehicle and are accessible through a hole in the side panelling.
The hand valves are closed when the grips are at right angles to the suction lines.

- Remove the hydraulic oil filters (➠ *Changing the hydraulic oil filters and cleaning the magnetic rod*, p. 7 - 48).
- Have a container ready to collect the oil (with a capacity of over 200 l (53 gal)).

Risk of damage to the environment from leaking fuel
Always use the supplied ½-inch connecting piece with an oil drain hose and an oil collection vessel with sufficient capacity to drain the hydraulic oil.

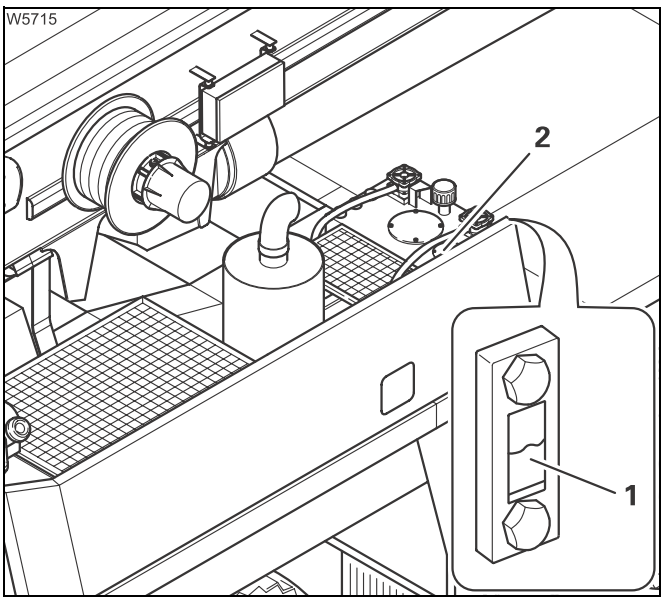
25.06.2004



- Drain the oil. To do this, screw the oil drain hose with connection plate onto each drain cock (**1**), (**2**) and (**3**) in turn and drain the oil from the three tank chambers (➠ *Taking oil samples*, p. 7 - 50).
- Change the filter elements in both filters and insert a new hydraulic oil filter (➠ *Changing the hydraulic oil filters and cleaning the magnetic rod*, p. 7 - 48).

Risk of damage to the environment from leaking fuel
Collect old oil in approved containers and have used oil and oil filters disposed of properly.

Risk of damage to hydraulic system
Cleanliness is of the utmost importance when handling hydraulic oil. New oil must also be filtered before it is filled into the tank.



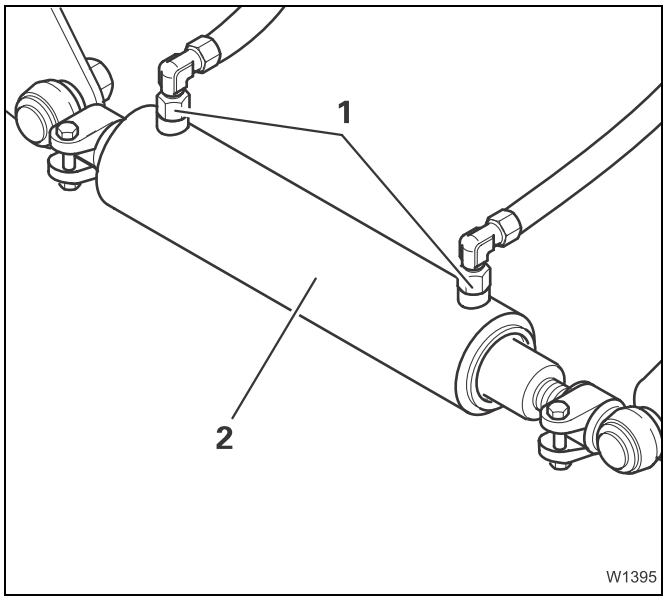
- Add new hydraulic oil through the filler opening (**2**) until the oil level is in the middle of the inspection glass (**1**).
- Open the four shut-off valves of the suction lines.
- Start the engine and put the hydraulic system into operation.
- Carry out all functions of the carrier hydraulic system several times to remove any air.
- Check the oil level in the hydraulic oil tank. Top up oil if necessary.
- Carry out a road test of the truck crane, turning the steering wheel several times to its fullest extent.

25.06.2004

If the steering is "loose" at the end of the test run you must ventilate the steering cylinders.

Risk of crushing.
When working between the wheels ensure that the steering wheel cannot be turned by an unauthorized party. The wheels turn when the steering wheel is operated.

Risk of accidents
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:

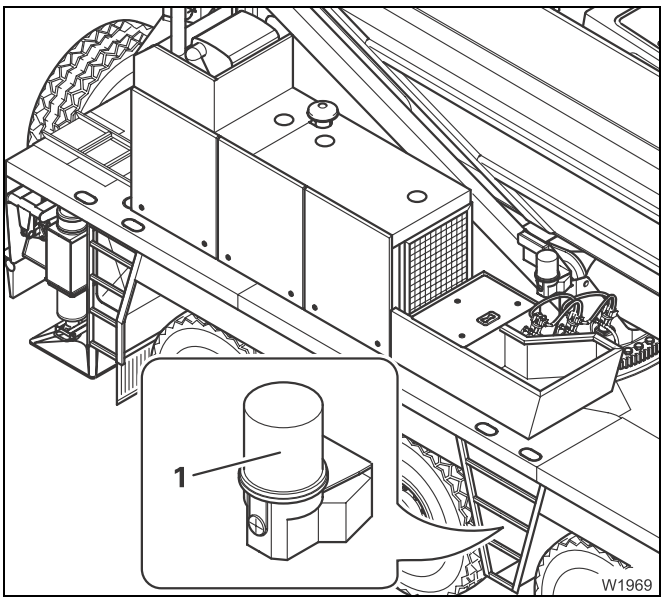
- Start the vehicle engine.
- Bleed each steering cylinder (**2**) by loosening the cap nuts (**1**) in turn until the oil coming out no longer contains any air bubbles.

If the steering system is still not operating properly:

- Contact ***CraneCARE*** at the respective location or an authorized workshop.

25.06.2004

7.11 Central lubrication system

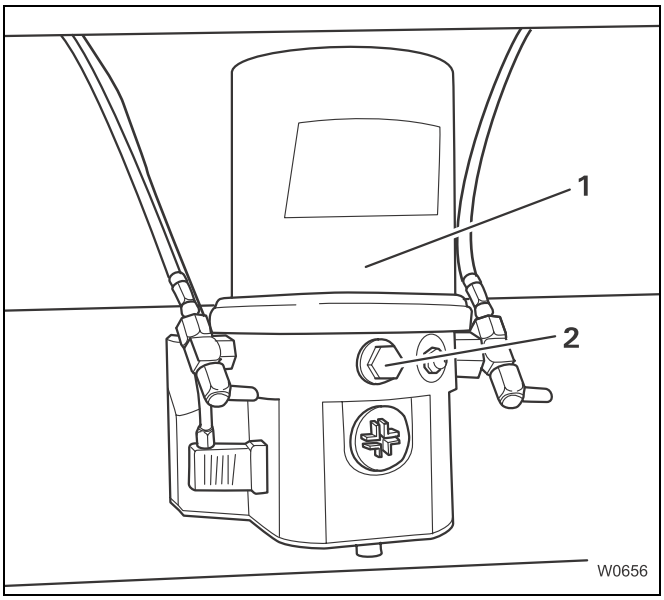


The grease container is located on the right side of the vehicle between the fourth and fifth axle lines.
Only fill with special grease as specified in the *Maintenance plan*, p. 5 - 8.

7.11.1 Checking the level of the grease container and topping up

M 1

Checking the level



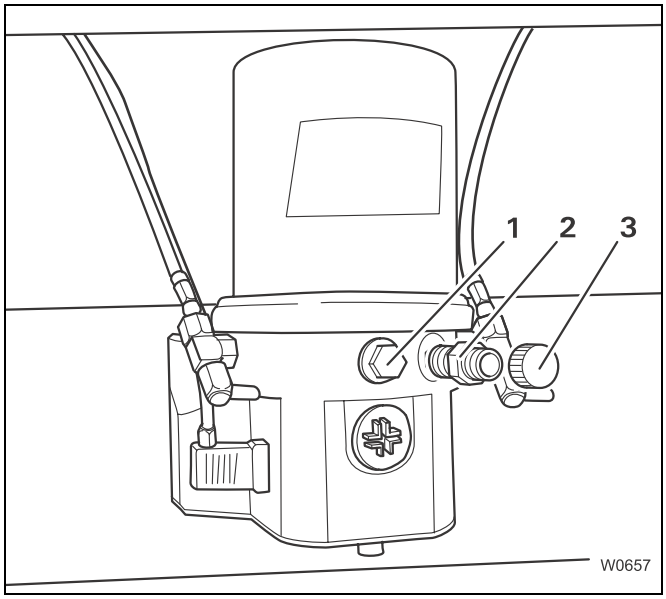
- Check the level of the grease container (**1**). The level must be near the **MAX.** mark.

If the level is too low, fill the grease container through the filler connection (**2**) using a charge pump.

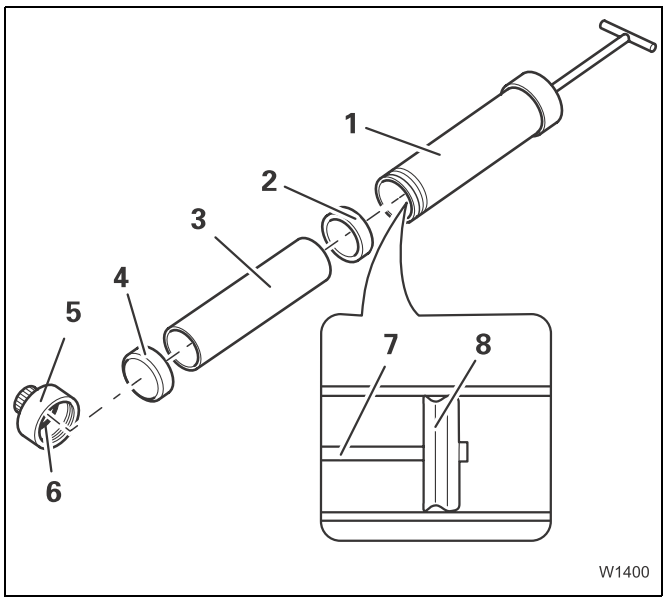
25.06.2004

Filling the grease container

You must connect a connecting piece to the grease container before refilling the container with the filling pump for the first time. This procedure is explained in the following. The connecting piece and a sealing cap are included with the filling pump.



- Unscrew the stopper (**1**) from the grease container.
- Screw the connecting piece (**2**) into the opening.
- Screw the sealing cap (**3**) onto the connecting piece.



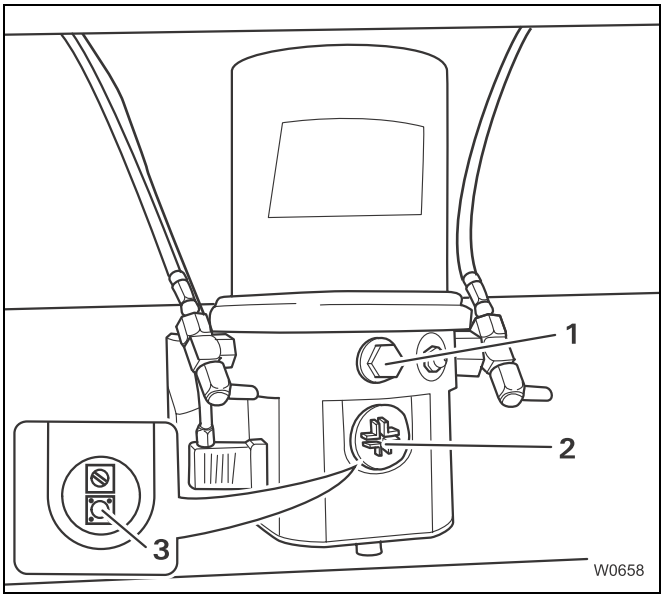
- Unscrew the cap (**5**) from the filling pump (**1**).
- Remove both caps (**2**) and (**4**) from the grease cartridge (**3**).

Ensure that the packing is in proper position in the filling pump (**8**). The packing must be folded toward the plunger rod (**7**).

- Push the grease cartridge (**3**) into the filling pump.
- Check that the seal (**6**) is in proper position in the cap (**5**).
- Screw the cap onto the filling pump.

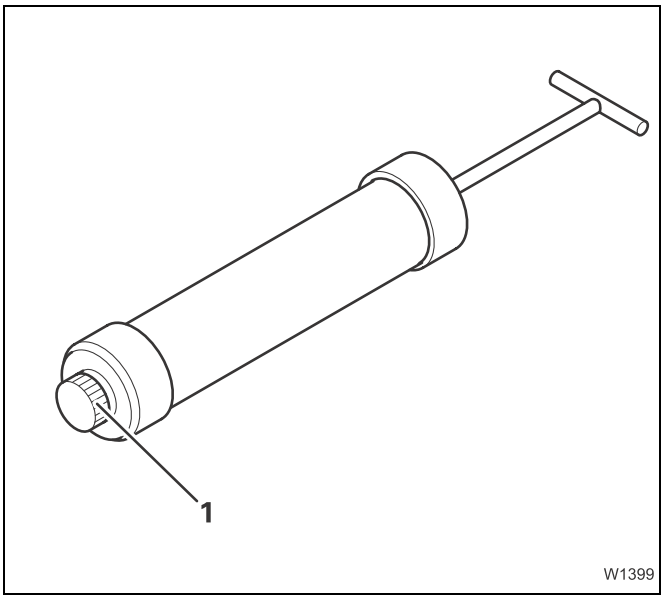
25.06.2004

The central lubrication system must be running while the grease container is being filled.



- Switch on the ignition of the vehicle engine.
- Unscrew the bottom sealing cap (**2**) on the grease container.
- Press the switch (**3**) behind the cap. This triggers a complete lubrication procedure.
- Remove the sealing cap on filler opening (**1**) of the grease container.

Risk of damage to the central lubrication system
Do not remove the sealing caps from the filler opening and filling pump until immediately before refilling the grease, as the grease could otherwise become contaminated. This prevents dirt particles from getting into the grease.

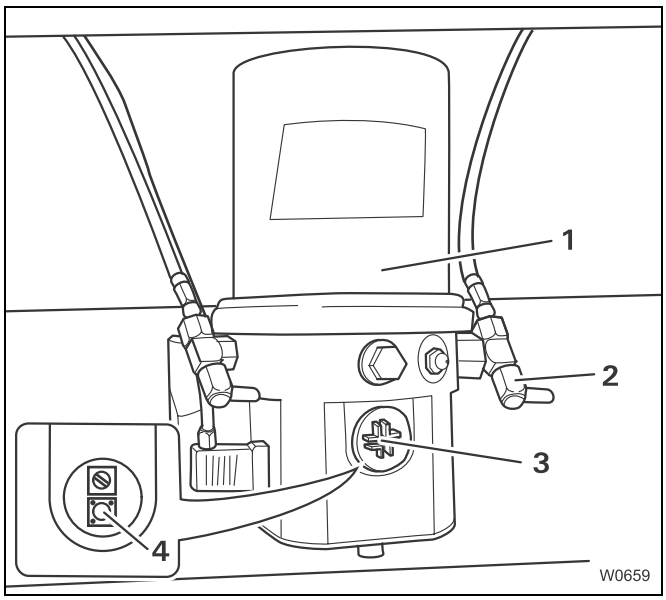


- Unscrew the sealing cap (**1**) from the filling pump.
- Screw the filling pump onto the filler opening of the grease container.
- Push the grease into the grease container through the filler opening using the plunger rod.
- Screw the appropriate sealing caps onto the filler opening of the grease container and the outlet of the filling pump.
- Seal the lower opening for the button with the sealing cap.

25.06.2004

Bleeding central lubrication system

The central lubrication system must be bled when the grease container is empty or air is trapped in the grease.



- Fill the grease container (**1**) (➠ *Checking the level of the grease container and topping up*, p. 7 - 55).
- Loosen the outlet screw fitting (**2**) of the pump element.
- Switch on the ignition of the vehicle engine.
- Press switch (**4**) to trigger additional lubrication.
- Let the pump run until the grease running out of the outlet screw fitting (**2**) no longer contains any air bubbles.
- Retighten the drain screw fitting (**2**) and screw the sealing caps back onto the filler opening of the grease container and the switch opening (**3**).
- Remove any excess grease.

25.06.2004

7.12 Carrier electrical system

7.12.1 Checking the acid level of batteries M 1

Danger! Battery components contain lead and lead compounds.
Battery poles, clamps, and parts of the battery itself contain lead and lead compounds.
Wash hands after working directly or indirectly with these parts.

- Keep the batteries clean and dry.
- Loosen any dirty terminals and clean them.
  Grease the terminals with an acid-free, acid-resistant grease.

Danger! Hydrogen escaping from the batteries is explosive
Do not place tools on the battery and keep unshielded light away from the battery.

It is particularly important to check the acid level during the warmer months.

- Check the acid level in the individual cells:
  –For batteries in which the acid level is visible, the acid must be approx. 15 mm (0.6 in) above the plates.
  –For batteries an overflow reservoir, distilled water must be present in the overflow reservoir.

If the acid is not at the required level or there is no distilled water in the overflow reservoir:

- Add only distilled water:
  – up to the required height over the plates or
  – until the water no longer drains from the overflow reservoir

25.06.2004

7.12.2 Checking the acid concentration of batteries M 3

Danger! Battery components contain lead and lead compounds.
Battery poles, clamps, and parts of the battery itself contain lead and lead compounds.
Wash hands after working directly or indirectly with these parts.

- Measure the acid concentration of each cell with an acid tester.

It is particularly important to check the acid concentration with the onset of the colder months.

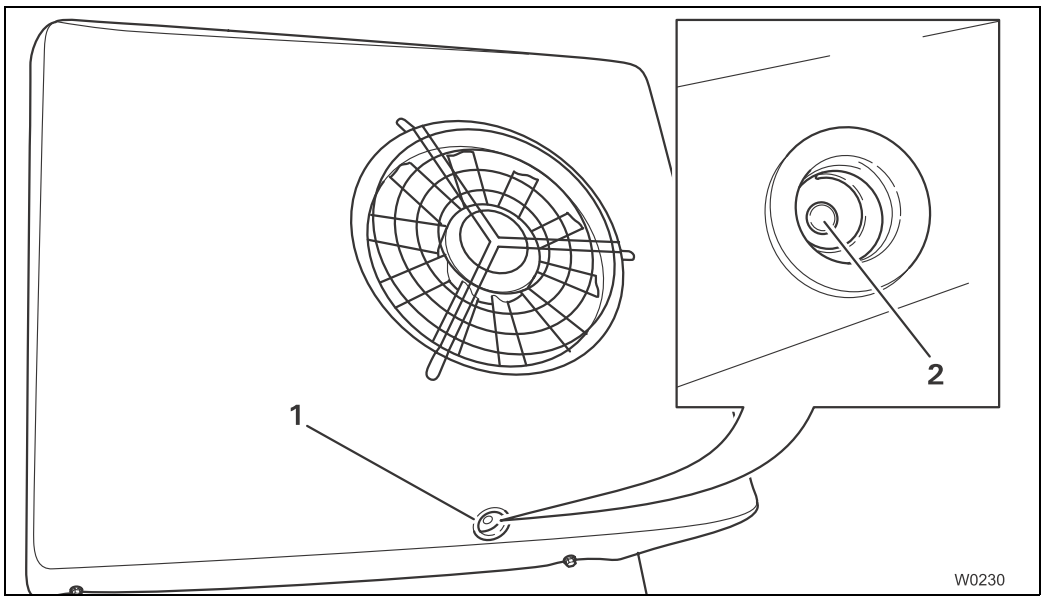
The following table gives a guide to battery charge levels.

Acid concentration (° Bé)	Specif. gravity (g/cm^3)	Charge level
32	1.28	good
24	1.20	half-charged; recharge
16	1.12	empty; recharge immediately

25.06.2004

7.13 Superstructure air conditioning system (additional equipment)

7.13.1 Checking the moisture and level of the refrigerant M 1



The coolant is checked through an inspection glass of the unit on the roof of the driver's cab while the air conditioning is on.

- Start the vehicle engine.
- Switch the air conditioning system on and let it run for about 10 minutes. (Switching on the air conditioning system ➠ *Operating instructions,* Part 1, Section *Air conditioning system* in Chapter *Driving with the truck crane*.
- Check the refrigerant filling level and the moisture content of the refrigerant through the inspection glass (**1**):
  – The flowing refrigerant must be visible and must not contain any large bubbles or foam.
  – A green dot (**2**) must be visible on the moisture indicator.

If the moisture indicator shows a yellow dot or if bubbles or foam are visible, the air conditioning system is defective.

If the air conditioning system is defective:

- To avoid further damage, switch the air conditioning system off and do not use it again.

Have the air conditioning system repaired as soon as possible by ***CraneCARE*** at the respective location.

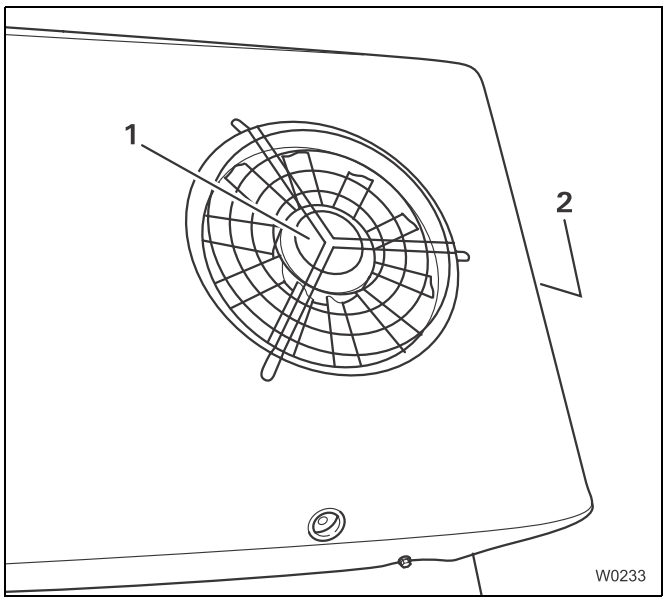
After checking:

- Switch the air conditioning system off and turn the vehicle engine off.

25.06.2004

7.13.2 Cleaning capacitor disks — M 1

Risk of damage to the capacitor and fan
Do not use a high pressure cleaner or steam jet cleaner. The hard water jet can damage the disks or the fan. Use only compressed air for cleaning.



- Switch the air conditioning system off.
- Clean the disks of the capacitor (**2**) and the fan wheel (**1**) with compressed air.

7.13.3 Checking hoses — M 6

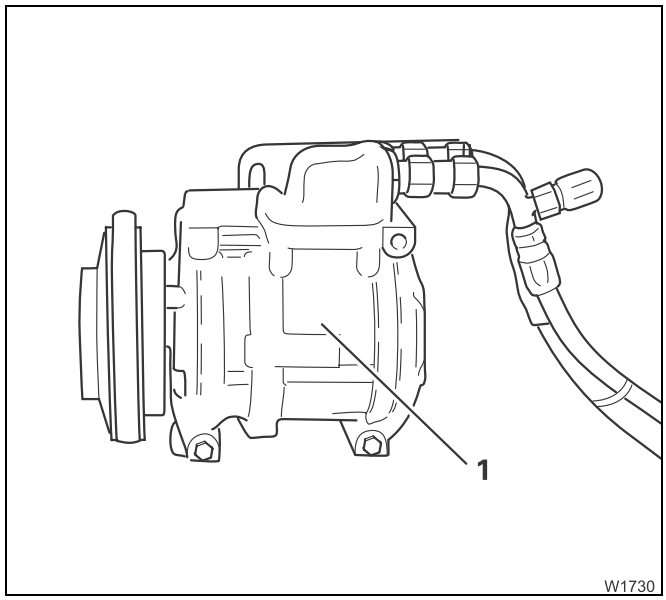
- Check all refrigerant hoses for damage and worn areas.

Only allow damaged hoses to be replaced by ***CraneCARE*** at the respective location.

25.06.2004

7.13.4 Checking the refrigerant compressor — M 6

This check may be carried out only by ***CraneCARE*** at the respective location!



- The refrigerant compressor (**1**) is at the front on the right side of the vehicle engine underneath the fuel filter.
- Have the refrigerant compressor checked for leaks. It is particularly important that the sealing of the drive shaft should be checked.

7.13.5 Monitoring the entire air conditioning system — M 12

This check may be carried out only by ***CraneCARE*** at the respective location!

- Have the whole air conditioning system checked for leaks and proper functioning.

25.06.2004

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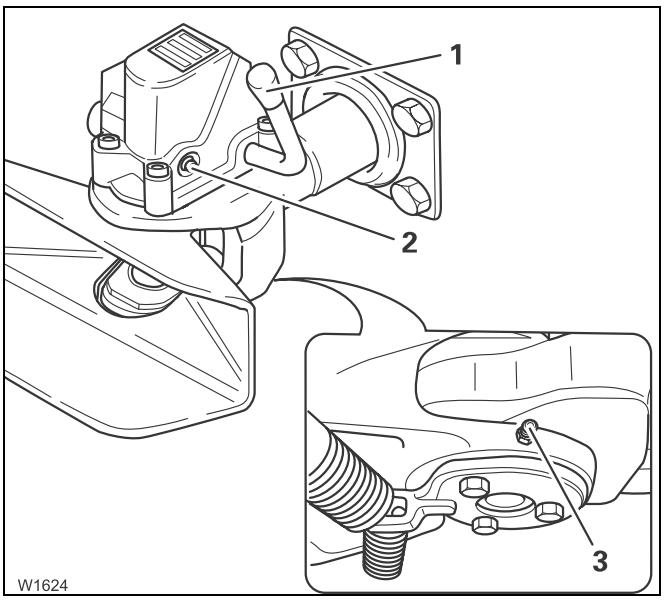
25.06.2004

7.14 Towbar coupling (additional equipment)

7.14.1 Lubricating the towbar coupling M 1

Risk of injury if the automatic closing device is actuated
Do not put your hand into the coupling jaw when the towbar coupling is open.
This can activate the automatic closing device, making the coupling pin move down with great force and seriously injuring your hand.

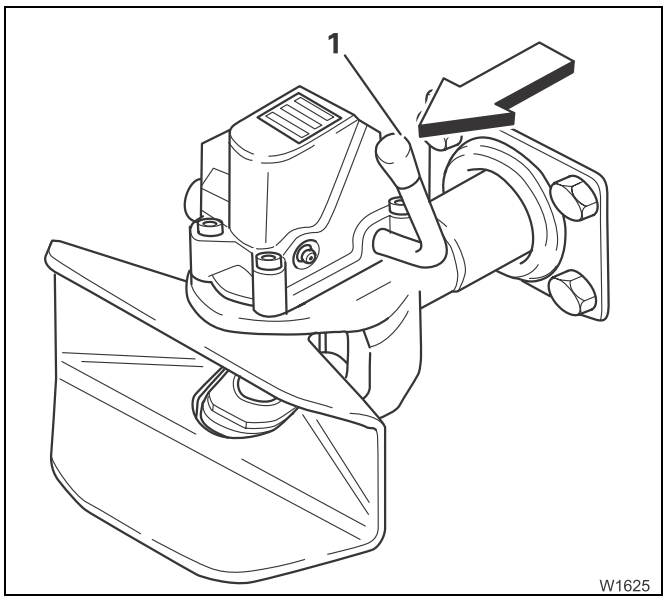
To avoid overlubrication, the towbar coupling should only be lubricated when open!



- Clean the two lubricating nipples (**2** and **3**) on the towbar coupling.
- Open the towbar coupling. To do this, move the hand lever (**1**) upward.
- Press grease as specified in the *Maintenance plan*, p. 5 - 10 into the two lubricating nipples one after the other using a grease gun.

Risk of injury when closing the towbar coupling by hand
When closing, the hand lever moves down with great force in the direction of the coupling jaw. Therefore start the closing process only by moving the lever briefly in the direction of the coupling jaw with the hand balls.
If you hold the hand lever and move it down, it may carry your hand with it and crush it.

25.06.2004



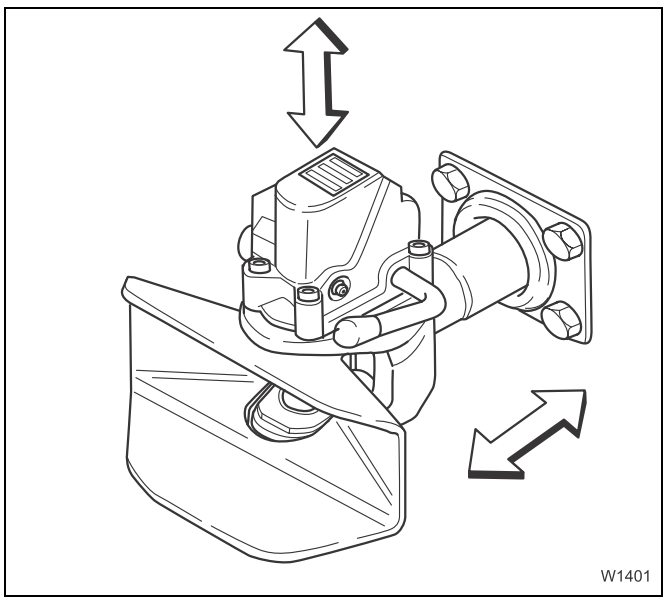
After lubrication you must close the towbar coupling.

- To do this move the hand lever knob (**1**) briefly in the direction of the coupling jaw (observe direction of arrow).
- Remove any excess grease.

7.14.2 Checking the bearing

M 3

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



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

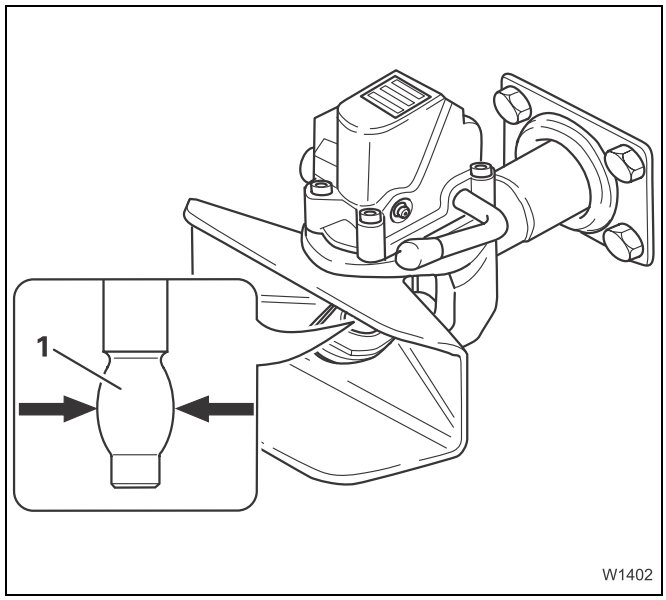
If you shake the coupling, you should not be able to see any side-to-side freeplay. Vertical freeplay may not exceed 3 mm (0.12 in) (as measured at the coupling head).

3 mm (0.12 in) vertical freeplay on the coupling head corresponds to 1 mm (0.04 in) bearing play.

25.06.2004

7.14.3 Checking the cotter pin M3

The coupling must be closed for the following checks. Before closing by hand, read the information contained in Section *Lubricating the towbar coupling*, p. 7 - 65.

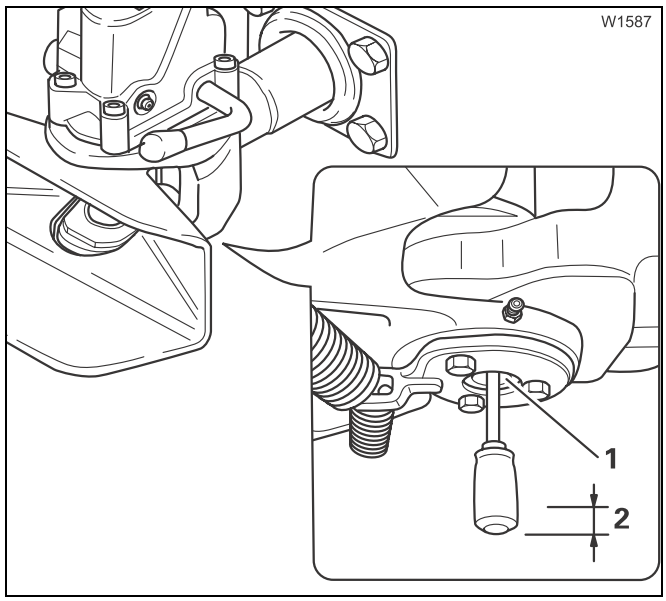


- Check the wear on the cotter pin (**1**). The diameter of the crowned section (arrows) must not be less than the following values:

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

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

If the diameter is less than 36.5 mm or 46.0 mm (1.44 in or 1.81 inch), the pin must be replaced.

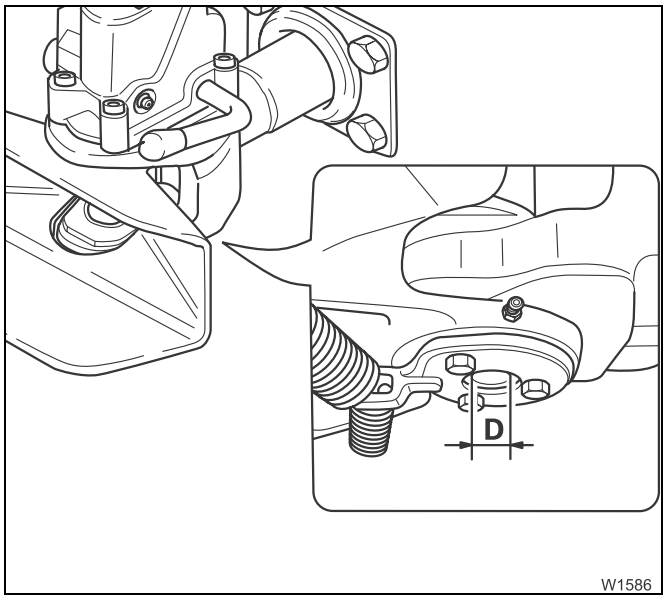


- Also check the cotter pin for the correct vertical clearance. Take a screwdriver and press the pin (**1**) upwards. Vertical freeplay (**2**) of the cotter pin must not exceed 4 mm (0.16 inch).

25.06.2004

7.14.4 Checking the lower bushing

M 3



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

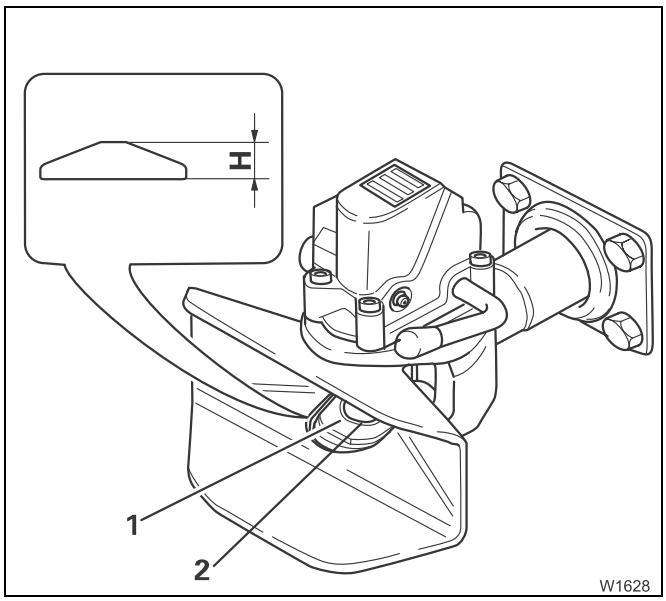
  Model series **400**: **31,5** mm (1.24 inch)

  Model series **700**: **34,2** mm (1.35 inch)

If the diameter is greater than 31.5 mm or 34.2 mm (1.24 or 1.35 inch), the bushing must be replaced.

7.14.5 Checking the support ring

M 3



- Check the support ring (**1**) for the draw eyelet at the bottom of the coupling jaw. When the trailer is coupled, the draw eyelet of the trailer may have slight contact with the lower bushing (**2**).

Have the support ring changed if:

– the trailer's draw eyelet touches the lower bushing because of wear or

– the support ring has reached its wear limit of **H** =14 mm (0.55 inch).

25.06.2004

7.14.6 Checking the initial tension of the springs — M 3

New couplings should show an initial axial torque of at least 100 Nm (73.8 lbs ft). The coupling head should require physical power to twist when checking the torque.

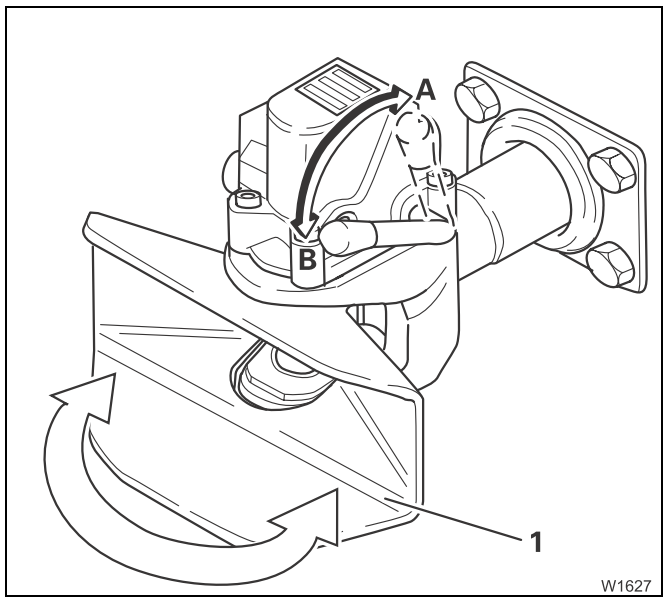
- Twist the coupling head clockwise and counterclockwise to check the initial tension of the rubber springs.

7.14.7 Checking the function of the coupling jaw / resetting central position — M 3

The following checks are required only on model series 700. If you need to close the coupling by hand for the checks, make sure you observe the data in section *Lubricating the towbar coupling*, p. 7 - 65.

Function check

If you need to close the coupling by hand for the checks, make sure you observe the data in section *Lubricating the towbar coupling*, p. 7 - 65.



- Close the coupling (position **B**).

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

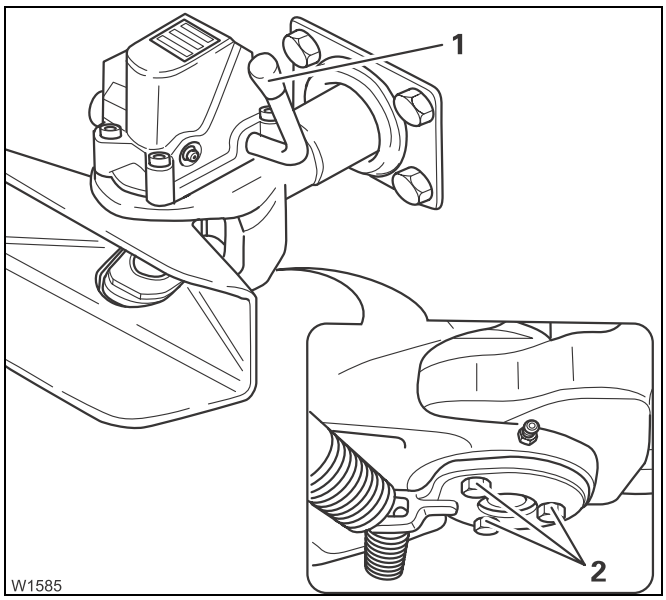
- Hold the coupling jaw (**1**) pressed slightly to the left or right.
- Open the coupling (position **A**) and let the coupling jaw go.

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

If the release lever does not automatically engage with the coupling jaw, the central position must be re-adjusted; ➠ *Resetting central position*, p. 7 - 70.

25.06.2004

Resetting central position



- Open the coupling (hand lever (**1**) up).
- Loosen the three bolts (**2**) at the bottom of the coupling.
- Push the coupling jaw to the right or left until the release lever snaps into place.
- Retighten the three screws (**2**) (tightening torque: 58 Nm (42.8 lbs ft)).
- After adjusting check the function of the coupling jaw; ➠ *Function check*, p. 7 - 69.

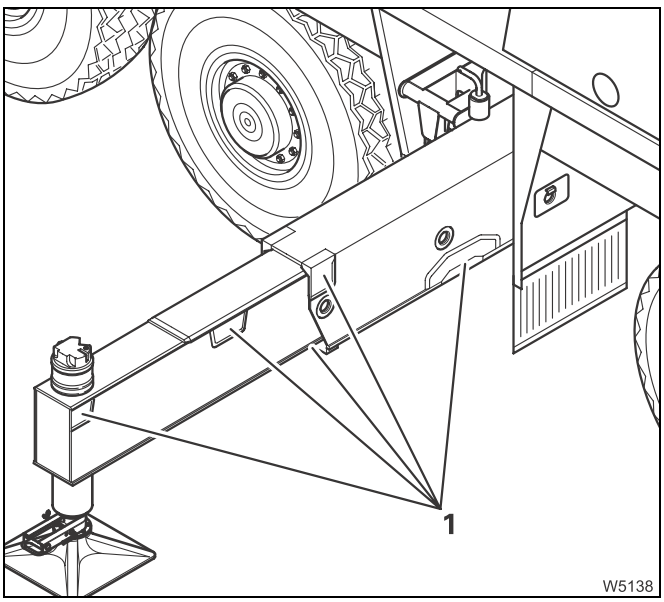
25.06.2004

7.15 Other maintenance work

7.15.1 Lubricating outrigger beam — M 1

The operation of the supports can be found in the *Operating instructions GMK 5200*, Part 2, Chapter *Rigging work*, Section *Outriggers*.
Please note the safety instructions given in that section.

Risk of crushing.
Ensure that there is sufficient room around the crane. Warn any persons nearby before extending the outriggers.



- Fully extend the outrigger beams.
- Apply the lubricating grease with a brush or spatula to both sides of the four slide faces and to the points of support (**1**). Only use lubricating grease specified in the *Maintenance plan*, p. 5 - 10.
- Extend and retract the outrigger beams several times in order to improve the lubrication effect.
- Lubricate the other outrigger beams using the same procedure.

7.15.2 Checking for correct operation of the auxiliary heater (additional equipment) — M 1

During the warm summer months, run the auxiliary heating system for 20 to 30 minutes (➠ *Operating instructions GMK 5200*, Chapter *Driving with the truck crane,* Section *Auxiliary water heating system (additional equipment)*.

- Check that the system is working properly. Also perform a functional check of the controls.

Notify ***CraneCARE*** at the respective location if the heating system is not working properly.

25.06.2004

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25.06.2004

8 Description of maintenance work on the superstructure

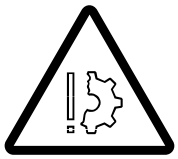
25.06.2004

25.06.2004

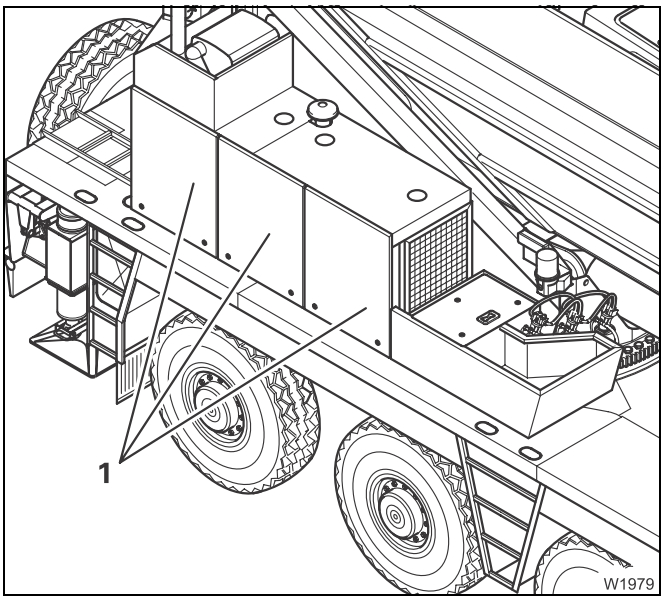
8 Description of maintenance work on the superstructure

8.1 Crane engine

For maintenance work, please consult the operating instructions for the crane engine supplied with this manual. Only selected types of work are described in this maintenance manual.



Risk of engine damage
The crane engine is in maintenance group II (difficult operation) because of the high full-load rate or large fuel throughput.
If the crane is operated with RME (rapeseed methyl ester), the intervals between oil changes must be cut in half.
The release of engines for RME operation is regulated by service information for the crane engine.



The crane engine is on the right-hand side of the superstructure. It is accessible via the service (**1**) flap.

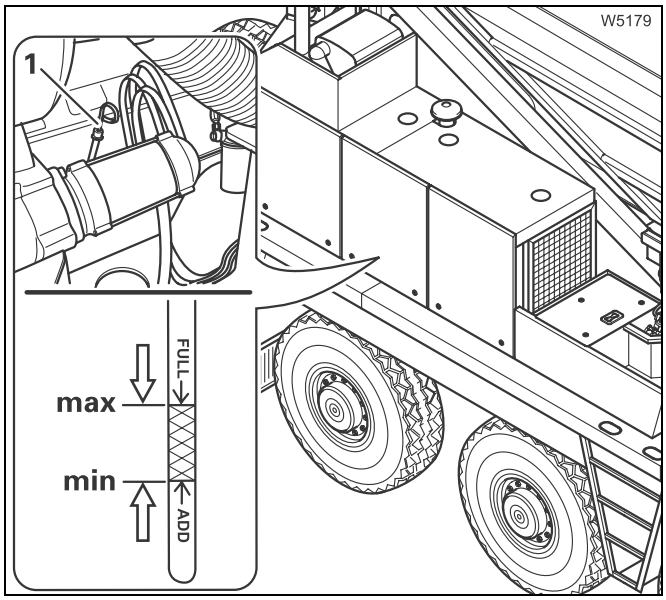
25.06.2004

8.1.1 Crane engine - oil level check

D

The oil level is checked with the crane engine turned off.

Risk of burns when the crane engine is hot
During operation, the crane engine and attachments can reach temperatures of up to 400 °C (750 °F). Wear appropriate protective gloves and be careful not to touch hot parts when opening the service flap of a hot engine.



- Open the center service flap.

The dipstick (**1**) is located directly on the crane engine, behind the starter.

- Start the crane engine and let it run for 2-3 minutes at idling speed. Monitor the oil pressure display.
- Switch off the crane engine.
- Check the oil level after approx. 2 minutes.

The oil level should always be between **min** and **max** (arrow marks).

- Top up engine oil if necessary, ➠ *Crane engine - topping up engine oil*, p. 8 - 3.

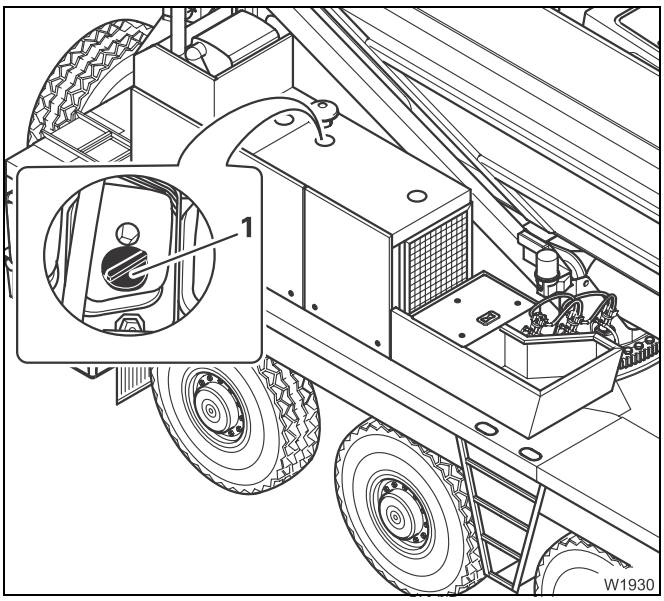
Damage may occur to the engine if the oil pressure is too low
If no oil pressure is displayed after 10 seconds, turn off the diesel engine and look for the cause; ➠ *Operating instructions,* Chapter *Carrier malfunctions on the superstructure,* Section *Crane engine malfunctions*.

25.06.2004

8.1.2 Crane engine - topping up engine oil

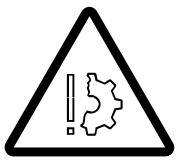
Use only oil specified in the crane engine operating instructions or in the *Maintenance plan*, p. 5 - 7.

Risk of burns when the crane engine is hot
During operation, the crane engine and attachments can reach temperatures of up to 400 °C (750 °F). Wear appropriate protective gloves and be careful not to touch hot parts when filling a hot crane engine.



The oil filler neck is located at the top of the crane engine and can be reached through an opening in the panelling.

- Fill the engine oil through the filler neck (**1**).
- Check the oil level again; ➠ p. 8 - 2.



Damage may occur to the engine if the oil level is too high
Do not overfill; the oil level must not be higher than the highest arrow marking (**max.**). Drain oil if necessary; ➠ *Operating instructions of the crane engine manufacturer*.

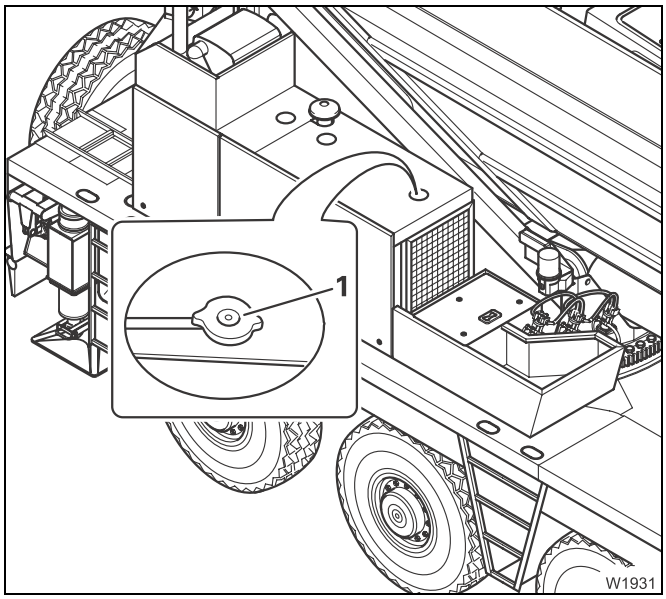
25.06.2004

8.1.3 Checking coolant level

D

The coolant reservoir is located on the crane engine under the front service flap.

Risk of scalding when the crane engine is hot
The radiator is hot and under pressure. If you remove the radiator cap when the crane engine is hot, you can be burned by the hot radiator or scalded by escaping steam or coolant.
Wear suitable protective gloves and cover the radiator cap with a cloth before opening it.
Turn the radiator cap lid slowly to the first notch in order to allow the excess pressure to be released.



- Loosen (do not open!) the cap on the filling hole (**1**) when the coolant is at operating temperature, to release the pressure.
- Open the cap.
  The coolant must reach the lower edge of the pipe in the filler neck.

If the coolant level is too low:

- Top up the coolant.
  See the crane engine operating instructions for the composition of the coolant.
- Screw on the filling hole cap as tight as possible.

Risk of damage to engine due to lack of coolant
If coolant has to be topped up frequently, the cooling system may be leaking. Have the cooling system checked and repaired by ***CraneCARE*** at the respective location or your own repair personnel.

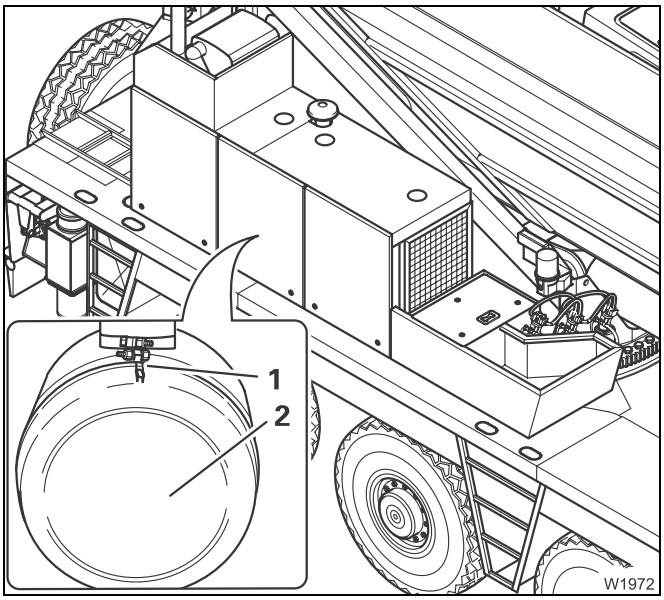
25.06.2004

8.1.4 Checking the dry air filter

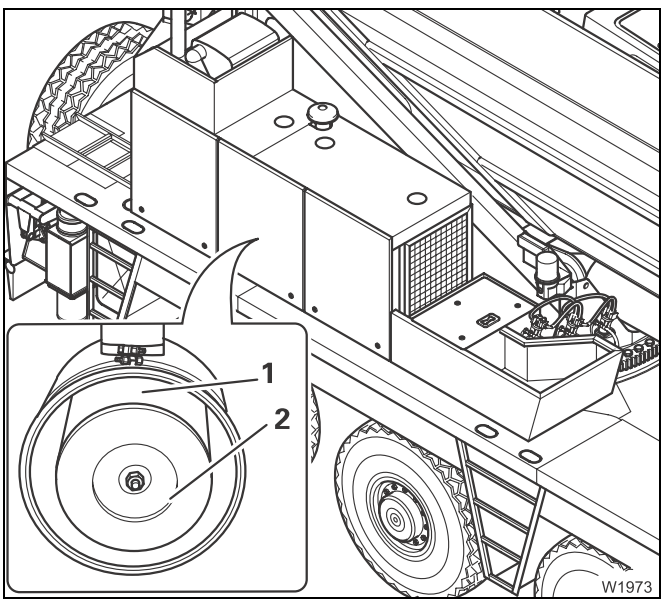
D

The dry air filter is located behind the center service flap on the crane engine.

The warning lamp *Crane engine air filter* is on the front instrument panel of the crane operator's cab. If this indicator lamp lights up, the dry air filter must be replaced.



- Release all clamps (**1**) on the filter cover.
- Take off the filter cover (**2**).



- Unscrew the screw (**2**) and remove the filter insert (**1**).
- Insert a new filter insert and tighten the screw (**2**) again.

If the seal on the filter cover is worn:

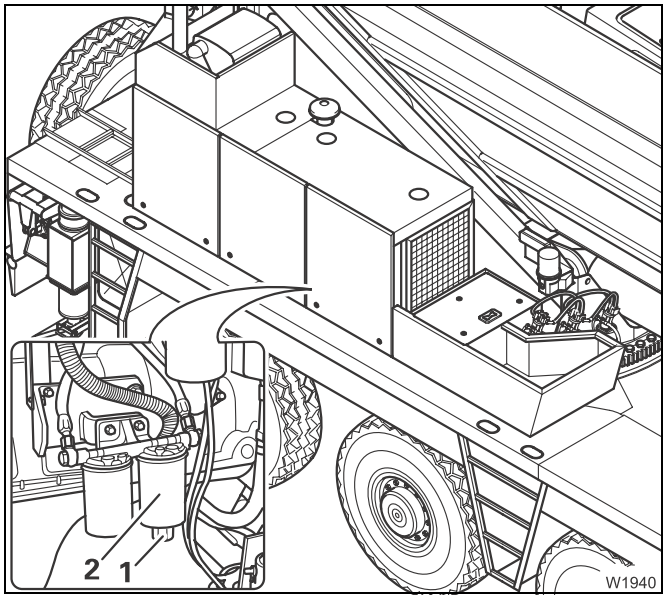
- Change the seal.
- Put the filter cover back in place and secure it with all the clamps.

25.06.2004

8.1.5 Draining off water from the fuel filter

D

See also the section for daily maintenance in the enclosed crane engine operating instructions.



The water must be drained off when the crane engine is off.

The fuel filter (**2**) is located on the right hand side of the crane engine. It is accessible upon opening the front service flap.

- Place a suitable collecting vessel underneath the fuel filter.
- Open the water drainage valve (**1**) by hand by turning it to the left.
- Drain off the mixture of fuel and water into the container.

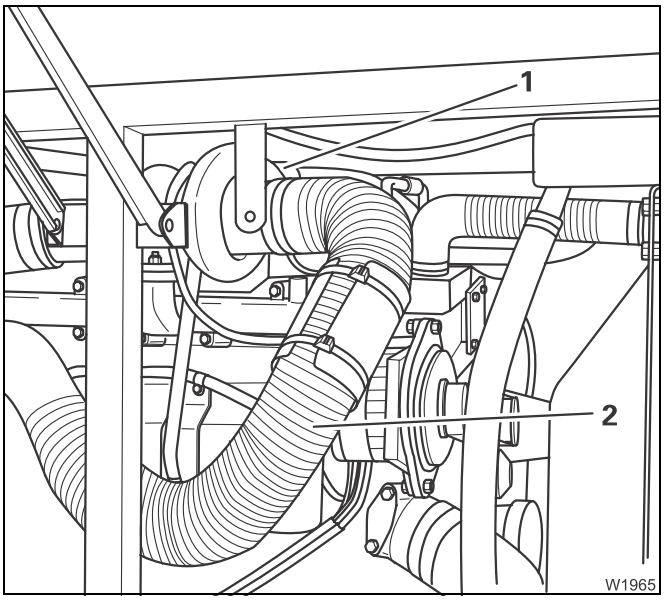
Risk of pollution due to fuel and water mixture
Drain off fuel and water mixture only into a suitable container. Dispose of it properly.
Ask your local environmental protection authority about the current disposal regulations.

- Run off the mixture until pure fuel appears.
- Close the drainage valve by hand by turning it to the right.

Risk of damage to the fuel filter
Do not force the thread of the drainage valve or overtighten it. Do not use any tools. Open and close the valve by hand.

25.06.2004

8.1.6 Checking general condition and for leaks W



- Check the lines for charge air (**1**) and suction air (**2**).
- Check pipes and hoses for
  – tightness
  – leaks
  – worn areas
- Replace any damaged pipes and porous or swollen hoses.
- Tighten any connections that are leaking.

If the connection still leaks:

- Change the seal.
- Inspect the crane engine for any visually obvious impurities or leaks.
- Listen for any unusual noises from the crane engine.

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

- Inform ***CraneCARE*** at the respective location or your repair personnel.

25.06.2004

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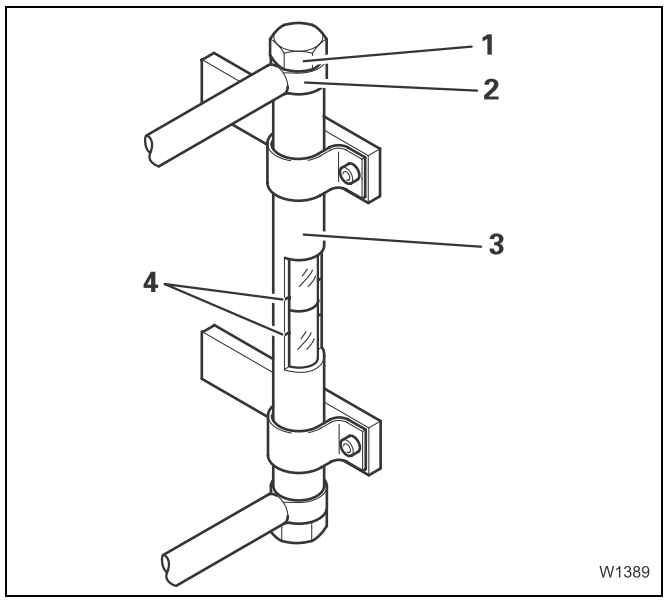
25.06.2004

8.2 Hoists

The main hoist and the auxiliary hoist of identical construction (additional equipment) are located on the superstructure turntable. The auxiliary hoist is located behind the main hoist.

8.2.1 Hoisting gear - oil level check W

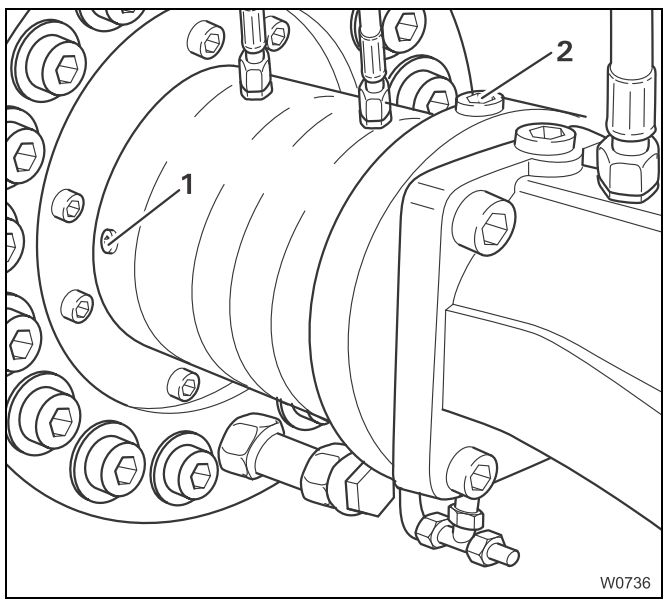
The standpipe used to read the oil level in the hoist gears is located on the hoist on the right side of the superstructure.



- Check the oil level of the hoist gears at the standpipe (**3**). The oil level must be between the **MAX** and **MIN** marks (**4**).

If the oil level is too low:

- Unscrew the upper screw plug (**1**) and remove the connecting hose (**2**) from the standpipe.
- Top up oil via the standpipe (**3**). Use only oil specified in the *Maintenance plan*, p. 5 - 9.
- Replace the sealing rings of the upper screw plug and screw the upper hose back on.



- Check the oil level of the brake unit by unscrewing the screw plug out of the overflow opening (**1**). The oil level must be visible under the opening.

If the oil level is too low:

- Unscrew the screw plug of the filling hole (**2**) and top up with oil.
  Use only oil specified in the *Maintenance plan*, p. 5 - 9.

25.06.2004

8.2.2 Hoists - Checking tightness W

- Make a visual inspection for leaks.
- If hydraulic oil or gear oil has been lost, check the oil levels and top up if necessary.

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

- Inform ***CraneCARE*** at the respective location or your repair personnel.

8.2.3 Checking the hoist brake W

Test correct function of the hoist brake by suspending a load on the load hook for a certain time and measuring whether the load lowers on its own.

Perform the test on the main hoist and the auxiliary hoist:

- Suspend the hook block on the singly reeved hoist rope.
- Lift a test load of approx. 9.5 t (2,944 lbs) to approx. 30 cm (12 inches) above the ground.
- Measure the distance from the ground when the test load is hanging completely still.
- Turn off the crane engine.

If the test load has not lowered after approx. 2 minutes, the brake is currently in working order.

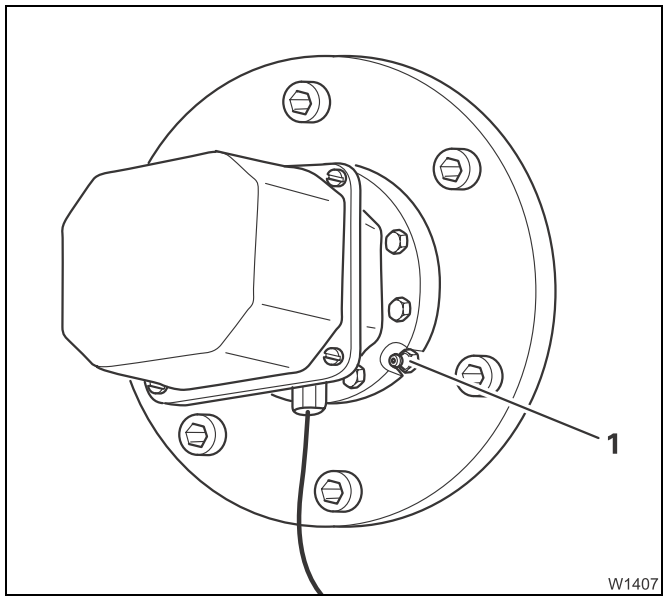
25.06.2004

8.2.4 Lubricating auxiliary hoist gears (additional equipment)

W

The following maintenance work is only for the auxiliary hoist.
This maintenance work is not done on the main hoist since it is connected to the central lubrication system.

Risk of crushing when hoist is turning
Keep yourself and other people away from the turning rope drum. If you take hold of the turning rope drum, your fingers and hands could be crushed between the rope drum and hoist frame or get caught and drawn in by the turning drum.



Each auxiliary hoist has a lubricating nipple (**1**). The lubricating nipple is on the left side of the superstructure on the auxiliary hoist.

Only use lubricating grease specified in the *Maintenance plan*, p. 5 - 9.

- Remove the old grease and dirt from the lubricating nipple.
- Use a grease gun to apply grease to the lubricating nipple.

25.06.2004

8.2.5 Hoists - Oil change M 12

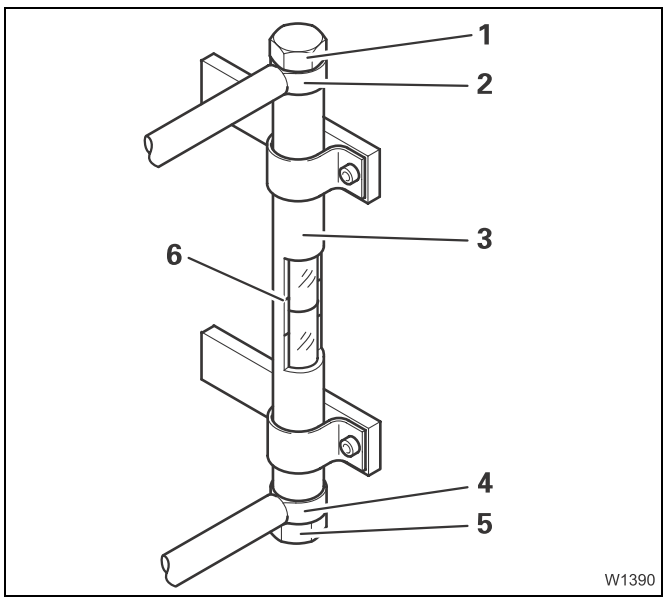
The hoists have separate oil chambers for the transmission and the clutch housing.
Use only oil specified in the *Maintenance plan*, p. 5 - 17.

Risk of damage to the hoist gearbox
The waste oil must be tested for abrasion particles. This examination serves to identify damage at an early stage.

Risk of damage to the environment from leaking fuel
Always use oil collection vessels which are oil-resistant.
Wipe up spilled oil immediately.

Changing the hoist gear oil

Oil change is carried out on the right side of the turntable via the connecting hoses to the standpipe.

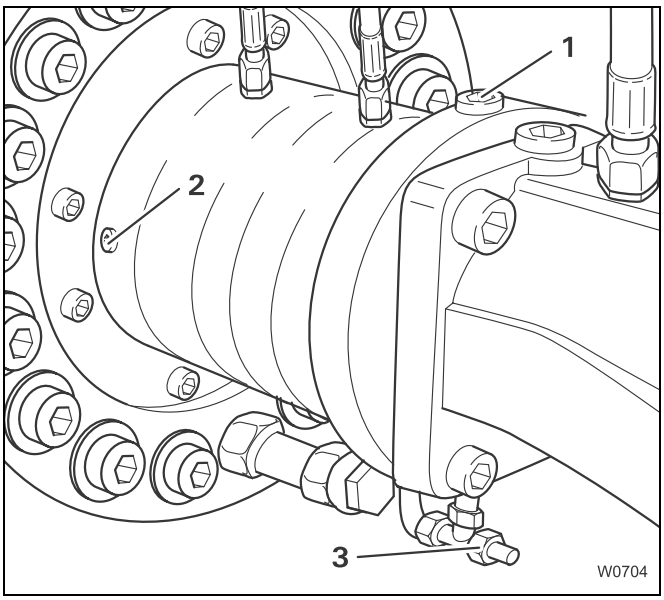


- Place an oil collection vessel (with a capacity of over 8 l (2.1 gal)) under the standpipe (**3**).
- Loosen the upper screw plug (**1**) and remove the upper hose (**2**).
- Unscrew the lower screw plug (**5**) and let the oil flow into the collection vessel.
- Replace the sealing rings of the lower screw plug and screw the lower hose (**4**) back on.
- Fill the oil up to the **MAX.** mark (**6**) through the standpipe.
- Replace the sealing rings of the upper screw plug and screw the upper hose back on.

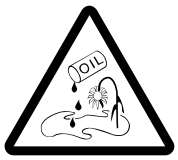
25.06.2004

Changing the oil in the brake unit

Since the oil only flows through slowly as the clutch housing is being filled, the oil level on the overflow opening will at first rise quickly and then subside a little; afterwards it will rise to the final filling level.



- Place an oil collection vessel (with a capacity of approx. 1 l (0.25 gal)) under the oil drain (**3**).
- Unscrew the screw plugs of the filling hole (**1**) and the overflow opening (**2**).
- Remove the screw connection (**3**) and drain the oil.
- Screw the screw connection (**3**) on again.
- Pour oil slowly through the filling opening (**1**) until it reaches the lower edge of the overflow opening (**2**).
- If necessary, replace the sealing rings for the screw plugs on the filling and overflow openings.
- Screw the screw plugs in again.



Risk of damage to the environment from leaking fuel
Collect waste oil in approved containers and have it disposed of properly.

25.06.2004

Checking the oil

Check the waste oil which was drained from the gear units during the oil change for abrasion particles or have it tested in a laboratory:

- Pour the used 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 gearbox must be removed for an inspection and inspected by the manufacturer.

Some abrasion particles may appear in the first oil filled. If you notice such particles upon the first oil change (after 200 oper. hrs), first consult ***Crane-CARE*** at the respective location before introducing any specific measures.

Risk of accidents if the load falls
If this inspection is not performed, there can be a risk of damage for the hoist gearbox and could lead to the load falling.

25.06.2004

8.2.6 Carrying out partial inspection of hoists — Y 3

Certain parts must be inspected for wear during the partial inspection:

- The multiple-disk brake
- The plug connections between the hydraulic engine and the multiple-disk brake
- The plug connections between the multiple-disk brake and the transmission unit (where applicable)

These parts must be replaced when worn.

Inspections and part replacements may only be carried out by trained, qualified personnel.

8.2.7 Carrying out general inspection of hoists — Y 6

When carrying out general inspection of the hoists, also observe the information contained in *Measures required for winch monitoring*, p. 5 - 23.

The hoist gears must undergo general inspection after the period of time indicated in the *Maintenance plan*. This inspection involves removal of the transmission and sending it to the manufacturer for testing.

The oil of new transmissions and transmissions which have undergone a general overhaul must be changed after 200 and 1 000 operating hours, in accordance with run-in times, before the yearly interval can be implemented.

25.06.2004

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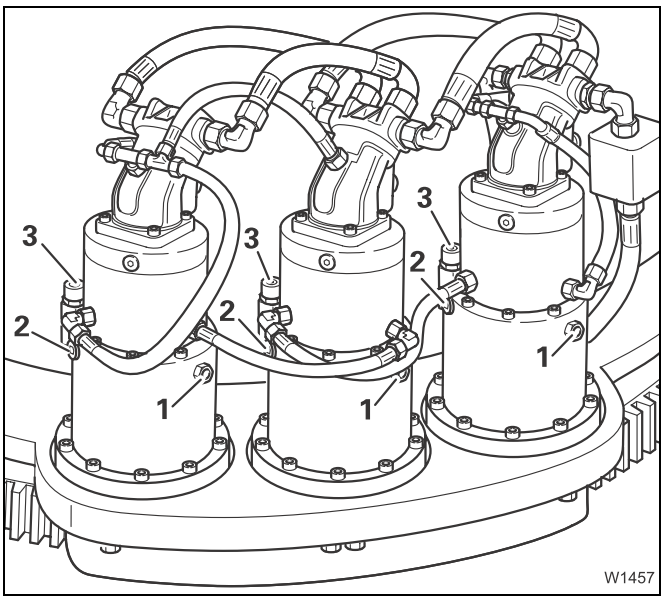
25.06.2004

8.3 Slewing gears

The slewing gears are on the right-hand side of the superstructure.

8.3.1 Slewing gear - oil level check W

The oil must be cool before carrying out an oil inspection. Therefore always check the oil level before using the crane.



- Check the oil level in the oil level sight glass (**1**). The oil must be visible in the sight glass.
- Always check the oil level for both slewing gear units.

If the oil level is too low:

- Unscrew the vent screw (**2**).
- Unscrew the ventilation filter (**3**) from the filler neck and top up with oil as specified in *Maintenance plan*, p. 5 - 11.
- Close both openings again.

8.3.2 Slewing gear - checking for leaks W

- Make a visual inspection for leaks.
- If hydraulic oil or gear oil has been lost, check the oil levels and top up if necessary.

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

- Inform ***CraneCARE*** at the respective location or your repair personnel.

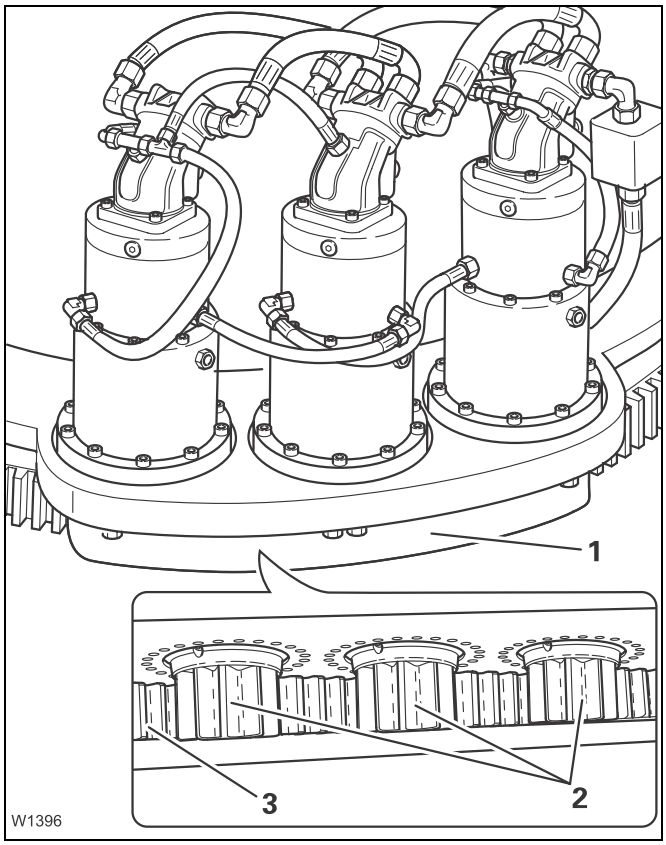
25.06.2004

8.3.3 Lubricating the slewing gear pinions and gear rim M 6

The slewing gear pinions and gear rim must be lubricated with special grease (➠ *Wartungsplan*, S. 5 - 15). The grease is applied to the gear teeth with a brush or sprayed on. There are different procedures for initial lubrication and subsequent lubrications.

Observe the instructions and safety information on the grease packaging.

Risk of being crushed by the slewing gear pinion
Fingers can be crushed or pieces of clothing can be pulled into an open, rotating slewing gear pinion. For this reason, be sure to mount the protective plate again after lubricating.



- Unscrew the screws and remove the protective plate (**1**) from in front of the slewing gear pinions (**2**).

First lubrication:

- Clean the gear teeth of the slewing gear pinions (**2**) and the gear rim (**3**) thoroughly to remove residue of old lubricants.
- Apply a thin layer of adhesive lubricating grease and leave to penetrate for approx. 10 minutes.
- Apply a second, thicker coat and leave to penetrate for approx. 30 minutes.
- Attach the protective plate (**1**) in front of the slewing gear pinions with the appropriate screws.

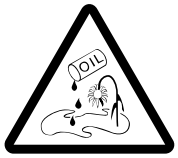
Subsequent lubrication:

- Apply a new layer over the existing layer of adhesive lubricating grease.
- Leave to penetrate for approx. 30 minutes.
- Attach the protective plate (**1**) in front of the slewing gear pinions with the appropriate screws.

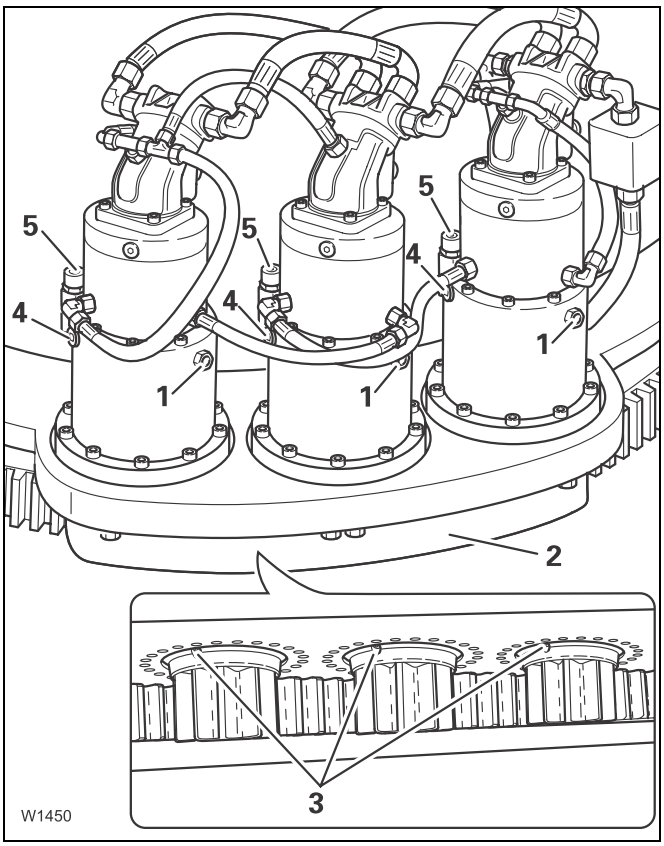
25.06.2004

8.3.4 Slewing gear - oil change M 12

The oil drain screws of the slewing gear are always above the gear rim of the slewing gear pinion. Use only oil specified in the *Maintenance plan*, p. 5 - 17.



Risk of damage to the environment from leaking fuel
Always use oil collection vessels which are oil-resistant.
Wipe up spilled oil immediately.



- Unscrew the protective plate (**2**) in front of the slewing gear pinions.
- Have an oil collection vessel ready (capacity for all three slewing gears approx. ca. 5 l (1.3 gal)).

Change the oil in the individual slewing gears one after the other:

- Unscrew the vent screw (**4**).
- Unscrew the ventilation filter (**5**) from the filler neck.
- Unscrew the oil drain screw (**3**) and drain the oil into the oil vessel.
- Replace the sealing ring on the oil drain screw and screw it back in.
- Top up oil and check the level on the oil level sight glass (**1**).
- Screw the ventilation filter and the vent screw back on with a new sealing ring.
- Attach the protective plate (**2**) in front of the slewing gear pinions with the appropriate screws.
- Change the oil in the other two slewing gears as well.

Risk of damage to the environment from leaking fuel
Collect waste oil in approved containers and have it disposed of properly.

25.06.2004

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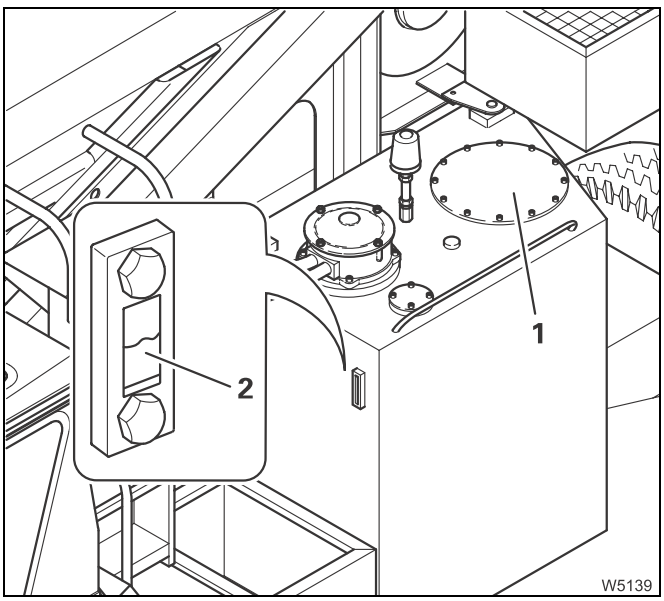
25.06.2004

8.4 Superstructure hydraulic system

8.4.1 Checking the hydraulic oil level D

The hydraulic oil tank is on the left-hand side of the superstructure. The level can be checked through the inspection glass.

To check the oil level properly:
– The main boom must be fully retracted and lying on the boom rest.
– The counterweight lifting cylinder must be retracted.



- Check the level of the hydraulic oil tank through the inspection glass (**2**).
  The hydraulic oil should be visible in the centre of the inspection glass when cold.

If the level is too low:

- Top up the hydraulic oil through the filler opening (**1**).
  Only use hydraulic oil specified in the *Maintenance plan*, p. 5 - 7.

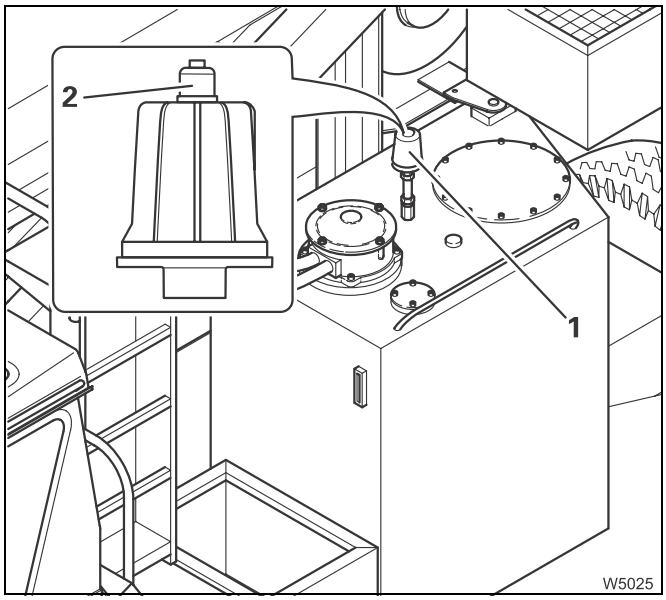
Risk of damage to hydraulic system
When handling hydraulic oil, cleanliness is imperative.
New oil must also be filtered before it is filled into the tank.

8.4.2 Checking the hydraulic hoses W

The inspection work is described in Section *Carrier hydraulic system - Checking the hydraulic hoses*, p. 7 - 46.

25.06.2004

8.4.3 Checking the vent filter W



The vent filter (**1**) is located on the hydraulic oil tank.

- Check the contamination display (**2**) at the top of the vent filter.

When the contamination display (**2**) is red:

- Replace the filter cartridge; ➠ *Vent filter - Changing the filter cartridge*, p. 8 - 32.

8.4.4 Checking for leaks W

- With the crane engine running, make a visual inspection for leaks and escaping hydraulic oil on the hydraulic components of the superstructure (hydraulic cylinders, lines, connections, hydraulic pumps, motors, valves, and control block).
- If leaks are detected, check the hydraulic oil level and top up if necessary (➠ *Checking the hydraulic oil level*, p. 8 - 21).

Risk of accidents
Never tighten leaking connections when the system is under pressure. Only change seals, pipes and hoses when the system is depressurized.

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

- Inform ***CraneCARE*** at the respective location or your repair personnel.

Risk of damage to the environment from leaking fuel
Immediately repair leakages 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 being used.

25.06.2004

8.4.5 Bleeding the derricking cylinder M 1

There are bleeder screws on the derricking cylinder for bleeding the cylinder chambers.
In the toolbox there is a special key with a transparent hose for opening the vent screws. Only this special key should be used to open the vent screws.

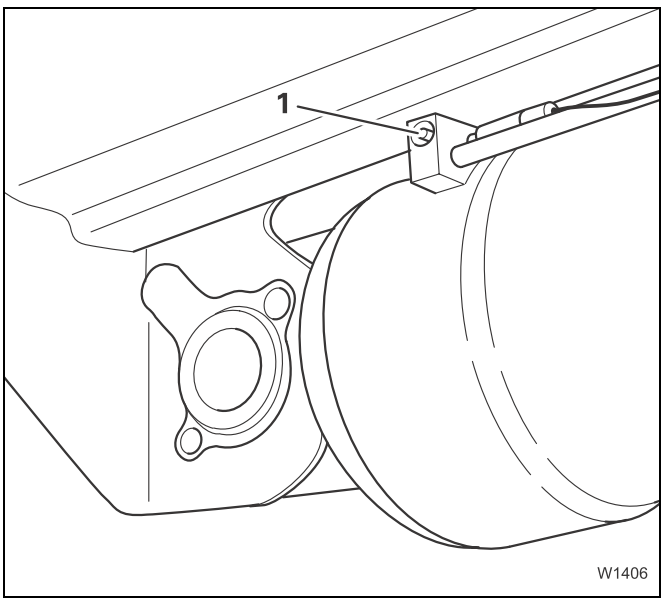
Prerequisites

With the following requirements it is assumed that the counterweight and lattice extension are not rigged.

- The truck crane must be standing on an even surface.
- The truck crane must be supported by an outrigger span of at least **8.50 m x 5.70 m** (27.9 ft x 18.7 ft).
- The main boom must be completely retracted.
- The code for **0 t** counterweight is set at the SLI.
- The superstructure must be turned to the rear or to the side.
- The boom must be lowered as far as it will go.

Bleeding the piston rod chamber

Risk of accidents from hydraulic oil spraying out
The hydraulic system is under pressure and the ventilation screws may therefore only be loosened. If you unscrew the vent screws, hydraulic oil will spray out under pressure.



- Remove the cap from the vent screw (**1**) on the piston rod chamber.
- Fit one end of a plastic transparent hose over the vent screw and hold the other end in a collection vessel filled with oil.
- Loosen the vent screw by 1 - 2 turns.

25.06.2004

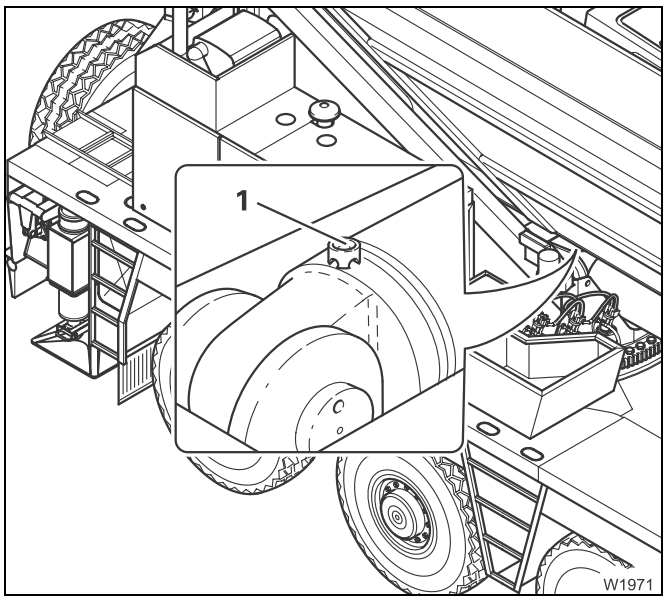
Risk of accidents when raising the main boom
Move the control lever very carefully. For bleeding, hydraulic oil only must be delivered into the derricking cylinder. The derricking cylinder must not move!

- Carefully extend the control lever in the *Raise* direction until the oil flowing through the transparent plastic hose no longer contains any air bubbles.
- Tighten the vent screw, remove the plastic hose and replace the cap on the vent screw.

Bleeding the piston head chamber

Before ventilation, the requirements listed at the start of this section must be fulfilled.

Risk of accidents from hydraulic oil spraying out
The hydraulic system is under pressure and the ventilation screws may therefore only be loosened. If you unscrew the vent screws, hydraulic oil will spray out under pressure.



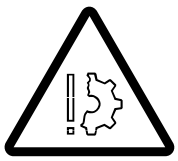
- Check that the boom is lowered as far as it will go.
- Remove the cap from the vent screw (**1**).
- Fit one end of a plastic transparent hose over the vent screw and hold the other end in a collection vessel filled with oil.
- Loosen the vent screw by 1 - 2 turns.

Risk of hands and arms being crushed
Move the control lever very carefully. For bleeding, hydraulic oil only must be delivered into the derricking cylinder. The derricking cylinder must not move!

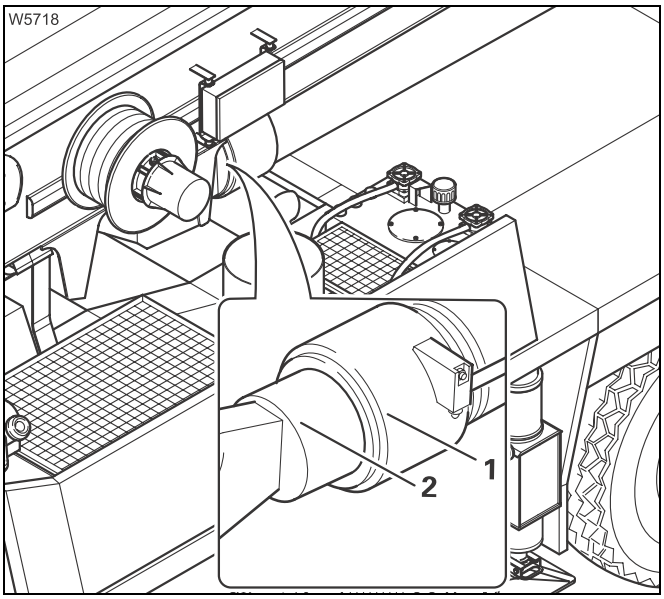
- Carefully extend the control lever in the *Raise* direction until the oil flowing through the transparent plastic hose no longer contains any air bubbles.
- Tighten the vent screw, remove the plastic hose and replace the cap on the vent screw.

25.06.2004

8.4.6 Lubricating the piston rod of the derricking cylinder M 1



Risk of damage to the derricking cylinder's gasket due to surface rust
Be sure that the uncovered end of the piston rod on the derricking cylinder is always kept lubricated. In this way, you can avoid surface rust, which damages the gasket in the derricking cylinder head when lowering completely.



- Clean the open end (**2**) of the piston rod of old grease, dirt particles and rust.
- Lubricate the open end (**2**) of the piston rod on the derricking cylinder head (**1**) so that it is evenly covered with grease.

You can also prevent surface rust if you turn the main boom to the side between maintenance intervals and completely lower it.

25.06.2004

8.4.7 Bleeding the telescoping cylinders — M 1

There are two vent screws on the telescoping cylinder for bleeding the cylinder chambers. The vent screws are accessible through hand holes in the telescopic sections.

In the toolbox there is a special key with a transparent hose for opening the vent screws. Only this special key should be used to open the vent screws.

Prerequisites

With the following requirements it is assumed that the lattice extension is not rigged.

- Park the truck crane on a flat, even surface.
- Create one of the two following rigging states:

– The truck crane is supported on a outrigger span of **8.50 m x 5.70 m** (27.9 ft x 18.7 ft) and has been rigged to at least **33.5 t** counterweight **or**
– the truck crane is supported on a outrigger span of **8.50 m x 8.30 m** (27.9 ft x 27.7 ft) and has been rigged to at least **22.5 t** counterweight.

- Enter the SLI code for the current rigging mode of the truck crane.
- Bring the main boom into telescoping mode *Driving*.

For telescoping mode *Driving*, the SLI switches automatically to the SLI rigging code.

If the main boom is completely retracted, the SLI rigging code must be entered for the current rigging mode in order to lower the boom.

- Slew the superstructure to the rear or to the side.
- Unreeve the hook block.
- Derrick the boom into horizontal position.

Bleeding procedure

Carry out the bleeding procedure on all vent screws in turn.

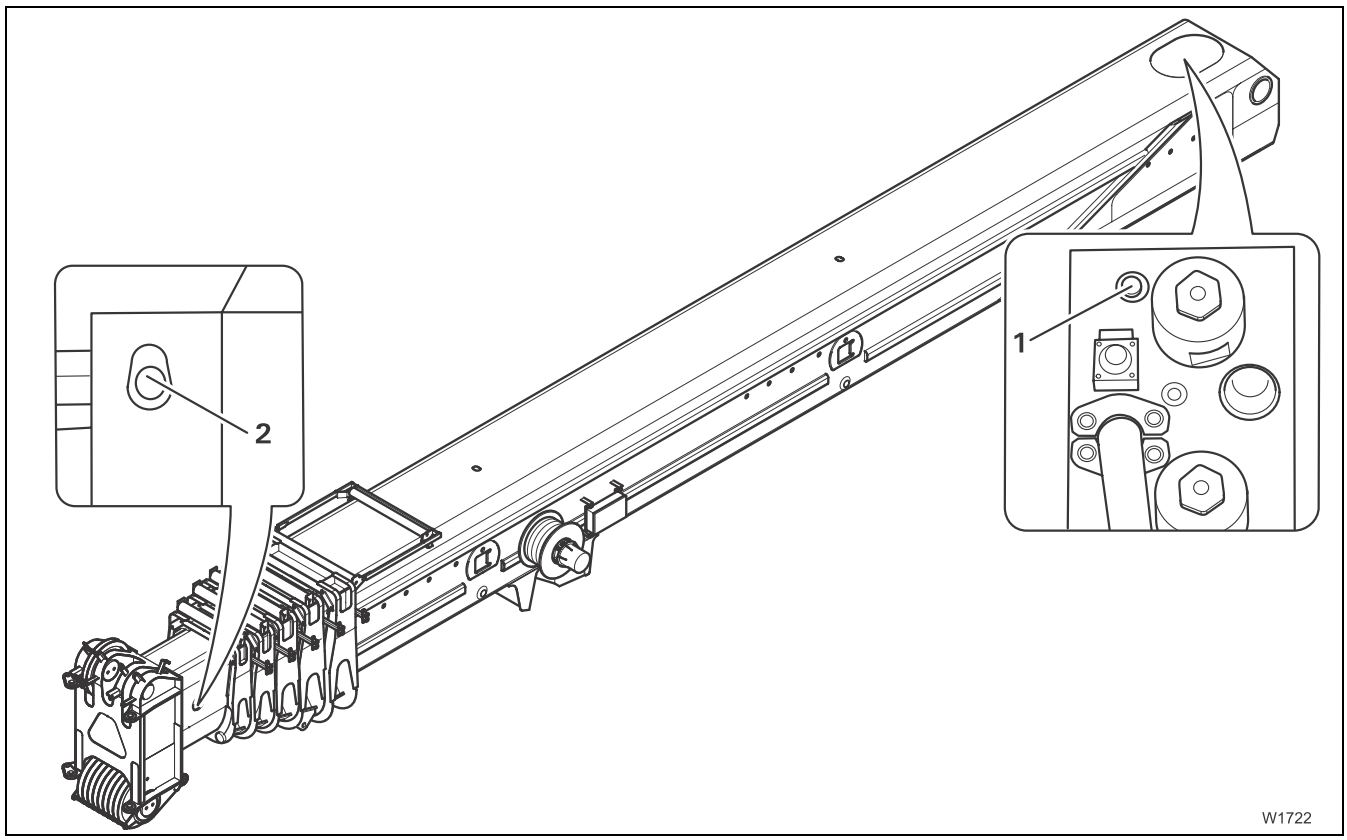
- Remove the cap from the relevant vent screw.
- Place the special key with the transparent hose onto the vent screw. Hold the other end of the hose in a container filled with oil.

25.06.2004

- Loosen the vent screw by 1 - 2 turns.
- Carefully fill the telescoping cylinder with hydraulic oil until the oil flowing through the hose no longer contains any bubbles. Carefully extend the relevant telescopic section in the direction specified.

The oil collected in the container must not be used again as it contains air.

Location of vent screws



Position no.	Vent for:	Access to vent on basic section via:
1	Set of piston rings	Manhole in top chord of the basic section
2	Piston chamber	Opening in telescopic section V, left side

25.06.2004

Telescoping status

The position numbers indicated below refer to the illustrations in *Location of vent screws* in this section; ➠ p. 8 - 27.

Vent screw position no. 1

Risk of crushing from retracting boom
Do not reach into the manhole until the boom has been secured so that it cannot retract inadvertently. If you are carrying out this operation with the help of someone else, communicate with the person in the crane cab by means of clear hand signals.

- Screw off the manhole cover plate.
- Extend telescopic section I approx. 2 m (6.6 ft) so that the access to the manhole is free.
- Fit the bleeder key through the manhole onto the vent screw (**1**) on the telescoping cylinder and open with one or two turns.
- Make sure nobody is in the manhole or is reaching into the manhole.
- Carefully move the control lever for *Telescoping* in the *Retract* direction so that the pressure in the set of piston rings increases and the air is pushed out through the plastic hose.
- Close the manhole again with the cover plate.

Vent screw position no. 2

- Extend telescopic section V by about 0.5 m (1.6 ft).
- Insert bleeder key through the opening on the left side of telescope section V onto the vent screw and open 1 or 2 turns.
- Carefully move the control lever for *Telescoping* in the *Extend* direction so that the pressure in the piston chamber increases and the air is pushed out through the plastic hose.

25.06.2004

8.4.8 Changing the hydraulic oil filters and cleaning the magnetic rod

M 3

Four hydraulic oil filters are built into the hydraulic system:

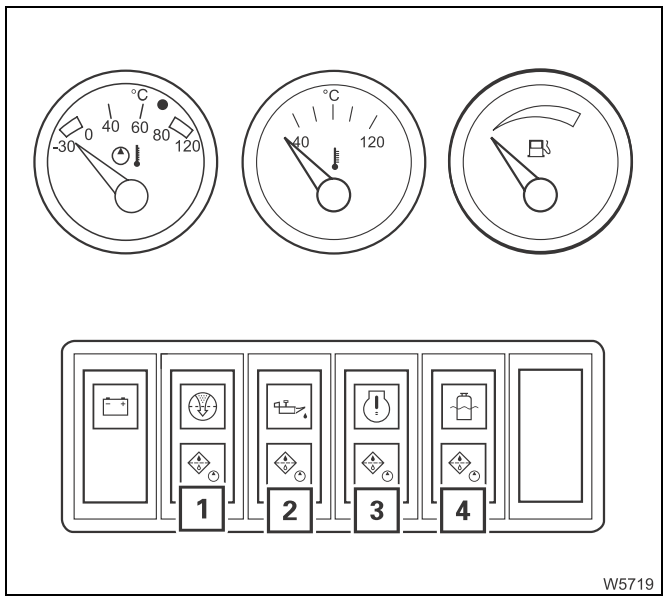
– A return flow filter and a fine filter in the oil tank

– Two pressure filters in the control oil circuit and feed oil circuit.

• The hydraulic oil filters must be replaced:

– If the *Hydraulic oil filter* warning lamp lights up on the front instrument panel in the crane cab,

– After every hydraulic oil change.



The warning lamps are attached to the front instrument panel:

– Warning lamp for *Hydraulic oil filter in control circuit* (**1**),

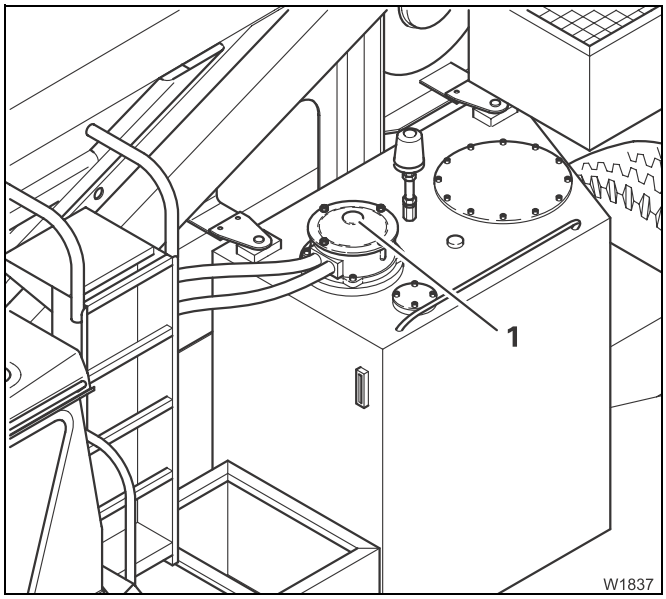
– Warning lamp for *Hydraulic oil filter in feed circuit* (**2**),

– Warning lamps for *Hydraulic oil return filter*, (**3**) and (**4**) (light up simultaneously).

Risk of damage to the environment from leaking fuel
When changing a filter, collect any oil as it runs out. Store used fuel filter cartridges in suitable containers and dispose of them properly.

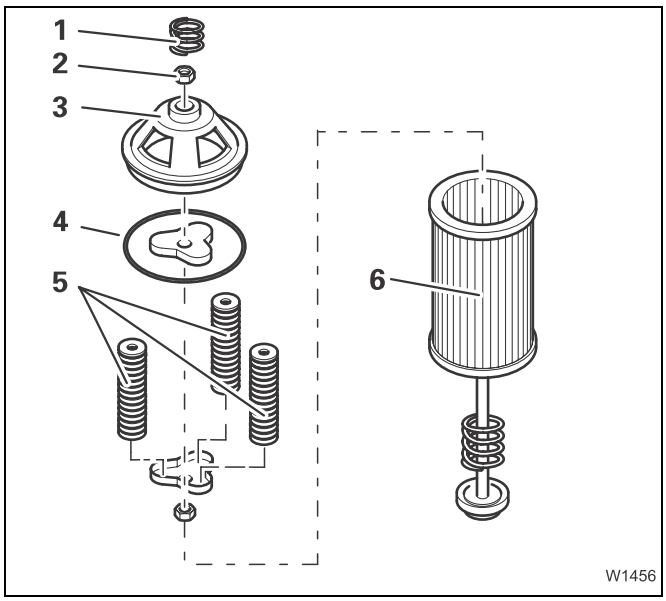
25.06.2004

Return filter

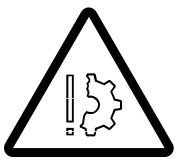


The return filter is on the hydraulic oil tank.

- Switch off the crane engine and secure it against being started by unauthorized persons (sign in the crane cab).
- Undo the screws on the lid (**1**), and draw the hydraulic oil filter out of the hydraulic oil tank.



- Remove the spring (**1**) from the top part of the filter (**3**).
- Remove the nut (**2**) and the top part of the filter.
- Unscrew the magnetic rods (**5**) and clean them.

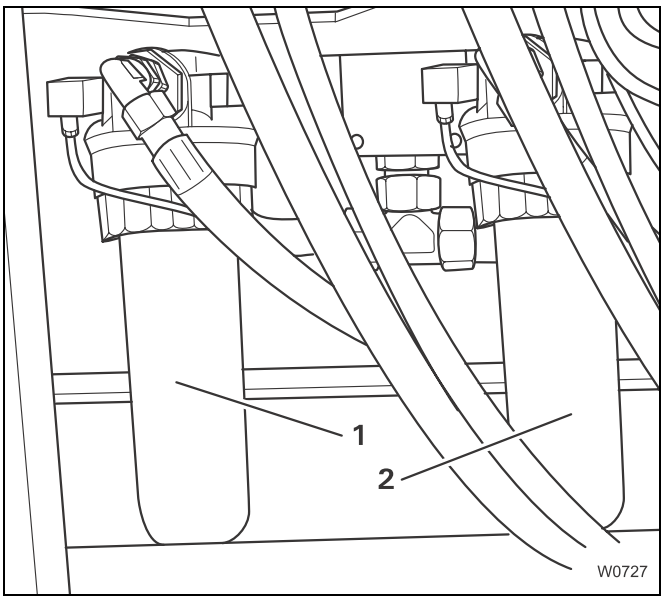


Risk of damage to the hydraulic system
Large amounts of metal chips adhering to the magnetic rods are a sign of damage in the hydraulic system.
Have the hydraulic system inspected by ***CraneCARE*** at the respective location or by your repair personnel.

- Change the hydraulic oil filter element (**6**).
- Replace the O rings (**4**) of the bottom and top part of the filter.
- Reassemble the hydraulic oil filter and replace it in the hydraulic oil tank.

25.06.2004

Hydraulic oil filter for feed circuit and control circuit

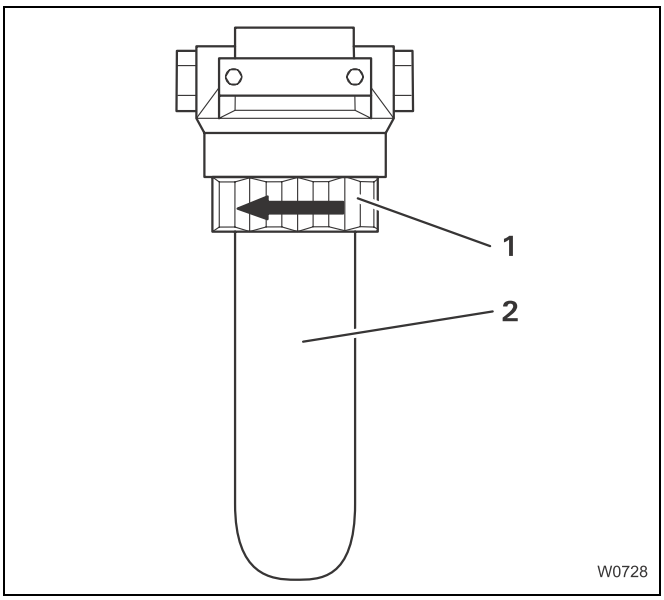


On the right side of the superstructure behind the rear service flap you will find:

– the feed circuit hydraulic oil filter (**2**) (on the outside, directly behind the service flap) and

– the control circuit hydraulic oil filter (**1**) (on the inside, on the turntable side).

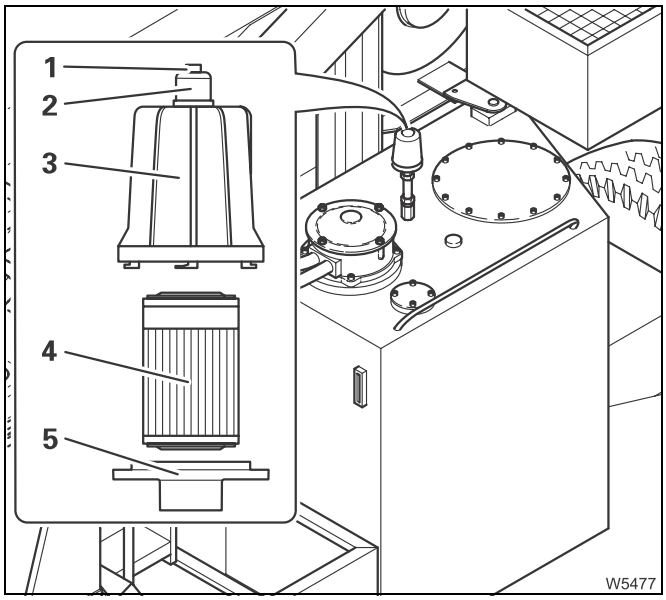
- Switch off the crane engine and secure it against being started by unauthorized persons (sign in the crane cab).



- Remove the ring (**1**).
- Take off the filter container (**2**).
- Remove the filter from the filter container.
- Insert the new filter into the filter container.
- Fill the filter container up to the edge with hydraulic oil.
- Screw the filter container on again.
- Start the crane engine and let it run in neutral gear for 3 minutes in order to bleed the system.

25.06.2004

8.4.9 Vent filter - Changing the filter cartridge M 12



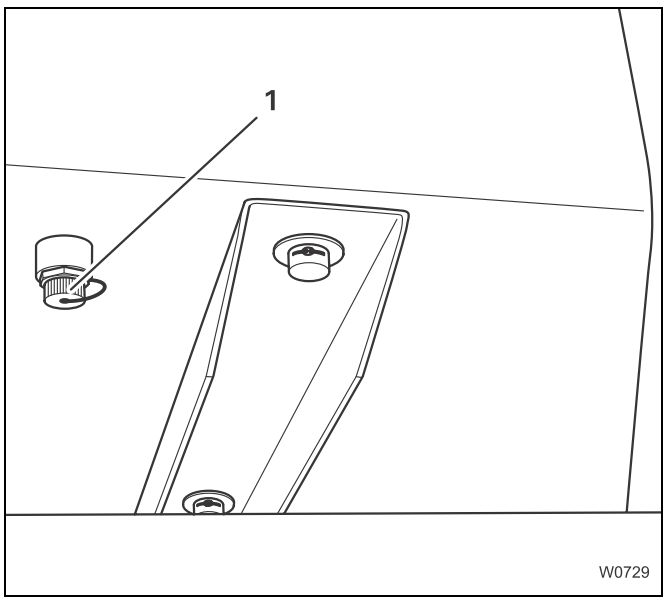
- Press down the bleed unit housing (**3**) and turn it to the left.
- Lift off the bleed unit housing.
- Replace the filter cartridge (**4**).
- Set down the bleed unit housing on the base plate (**5**).
- Press up the bleed unit housing and turn it as far as it will go to the right.
- Reset the contamination display (**2**). To do this, press in the pin (**1**) at the top of the bleed unit housing.

The coloured contamination display drops back into the contamination display.

8.4.10 Taking oil samples M 12

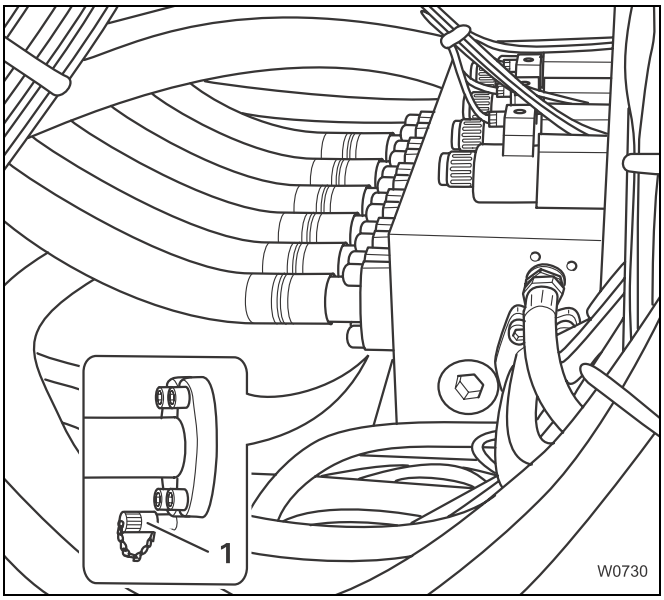
Take one oil sample from the hydraulic oil tank and one from the hydraulic system (➠ *Changing the hydraulic oil*, p. 8 - 34).

The drain valves can only be opened and closed using the ½ inch fittings. The connecting pieces are to be found in the tool box; ➠ *Handling the drain valves*, p. 7 - 51.



- The sample from the hydraulic oil tank is taken via the drain valve (**1**).

25.06.2004



- The oil sample from the hydraulic system is taken via a gauge port (**1**) on the control block. The control block is accessible via an opening in the turntable behind the crane cab.
- Continue as described in Section *Carrier hydraulic system - Taking oil samples*, p. 7 - 50.

25.06.2004

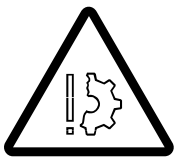
8.4.11 Changing the hydraulic oil — M 12

The hydraulic oil must only be changed if the laboratory analysis shows that the permissible limits have been exceeded (➠ *Taking oil samples*, p. 8 - 32) or the laboratory has recommended a date for an oil change.

Prerequisites:

– The boom must be fully retracted and resting on the boom rest.

– The crane engine is not running and is secured against unauthorized starting.



Risk of damage to the hydraulic pumps
Ensure that the crane engine cannot be started by an unauthorized party. If the engine is started while the gate in the suction line is closed, the hydraulic pumps will be damaged!

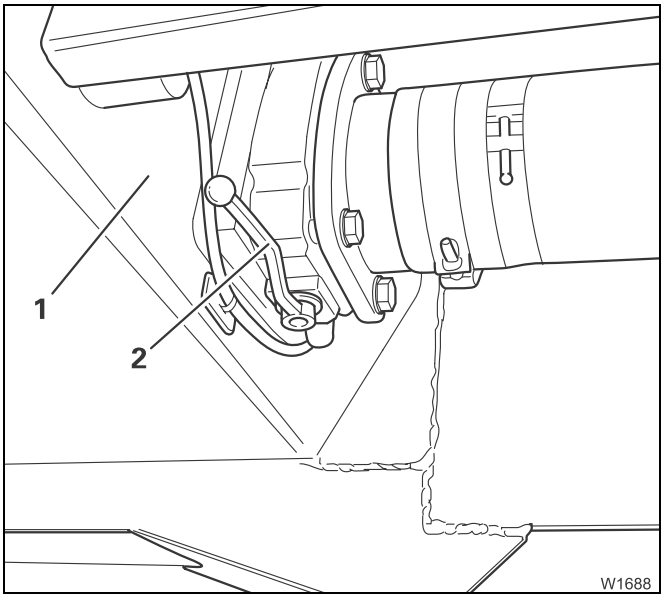
The drain valves can only be opened and closed using the ½ inch fittings. The connecting pieces are to be found in the tool box; ➠ *Handling the drain valves*, p. 7 - 51.

Danger from escaping hydraulic oil.
When the connecting piece is screwed onto the drain valve, the valve opens and the hydraulic oil immediately flows out of the connecting piece. Place the connecting piece hose in an oil collection vessel before screwing on the connecting piece.

Risk of damage to the environment from leaking fuel
Always use the supplied ½-inch connecting piece with an oil drain hose and an oil collection vessel with sufficient capacity to drain the hydraulic oil.

- Only use hydraulic oil specified in the *Maintenance plan*, p. 5 - 17.
- Remove the hydraulic oil filter and change the filter element. Do not yet replace the hydraulic oil filter (➠ *Changing the hydraulic oil filters and cleaning the magnetic rod*, p. 8 - 29).
- Have one or more oil collection vessels ready (tank volume: 1 200 l (317 gal)).

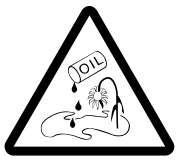
25.06.2004



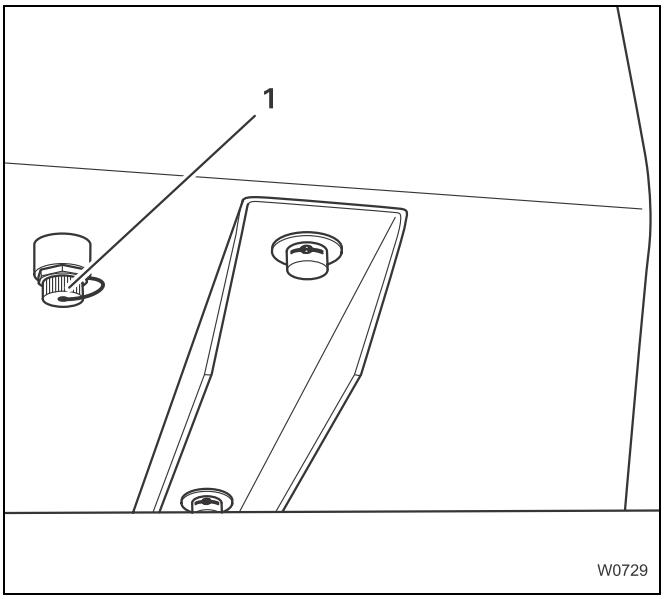
The shut-off valve (**2**) in the suction line of the hydraulic pump is located on the inner side wall of the hydraulic oil tank (**1**) for the superstructure, behind the cover plate.

- Shut the shut-off valve (**2**) to the hydraulic pumps.

The suction line is closed when the cock grip is at right angles with the line.



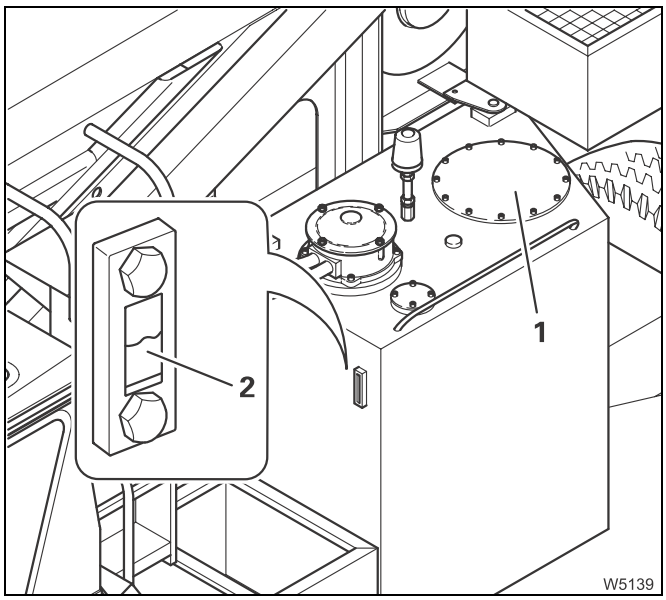
Risk of damage to the environment from leaking fuel
Collect waste oil in approved containers and have it disposed of properly by qualified personnel, along with used oil filters.



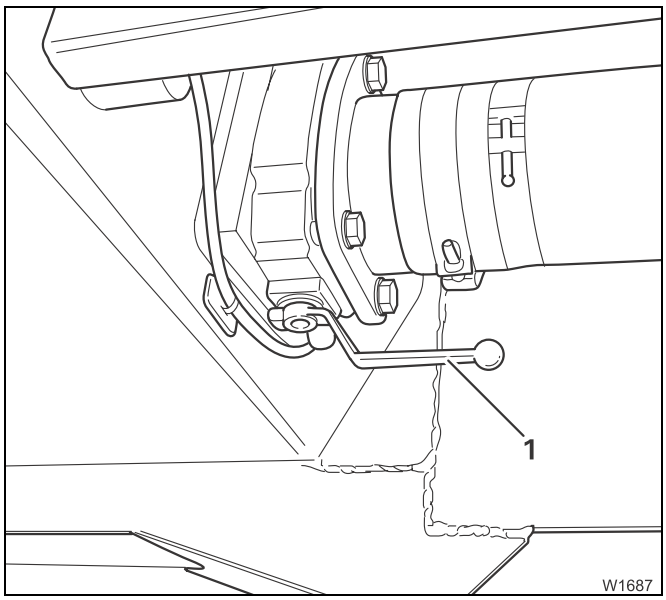
- Screw the connecting piece with the oil drain hose onto the connecting piece (**1**) on the tank and drain the oil into the collecting vessel ➠ *Handling the drain valves*, p. 7 - 51.
- Insert the new hydraulic oil filter (➠ *Changing the hydraulic oil filters and cleaning the magnetic rod*, p. 8 - 29).

25.06.2004

Risk of damage to hydraulic system
Cleanliness is of the utmost importance when handling hydraulic oil. New oil must also be filtered before it is filled into the tank.



- Fill in new hydraulic oil through the filler opening (**1**) up to the center of the inspection glass (**2**).



- Open the shut-off valve (**1**) in the suction line.

The suction line is open when the cock grip is parallel to the line.

- Start up the crane engine.
- Carry out all functions of the crane's hydraulic system to remove any air which may be enclosed in the system.
- Check the oil level through the inspection glass on the hydraulic oil tank (➠ *Checking the hydraulic oil level*, p. 8 - 21). Top up oil if necessary.

25.06.2004

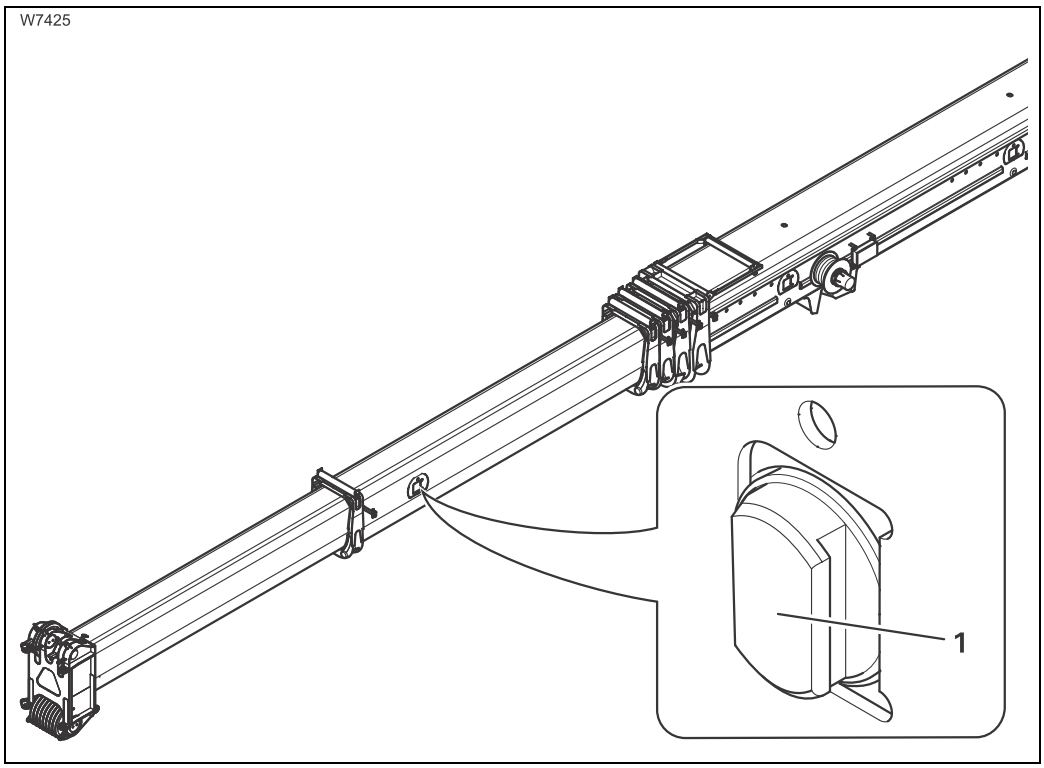
8.5 Main boom

8.5.1 Lubricating the locking pins M 3

To lubricate the locking pins, the main boom must be lowered to the horizontal position and the telescopic sections must be extended in a particular order to allow access to the locking pins.

Risk of overturning
Before the main boom is lowered or extended, observe the prerequisites set out in this section, ➠ p. 8 - 38.

Position of the locking pins



The locking pins are on both sides of the telescopic sections. To lubricate, extend the telescopic sections until the locking pins (**1**) are accessible. The illustration shows the degree of telescoping required to lubricate the locking pins on telescopic section V.

25.06.2004

Prerequisites

To lubricate the locking pins on the main boom, it must be partly extended in horizontal position.

Risk of overturning when extending in horizontal position
In the horizontal position the SLI blocks telescoping when there is an attempt to extend a second telescopic section.
Override the SLI only when you are prompted to do so in the following section and do not extend the main boom more than indicated.
Even with 70 t of rigged counterweight and the superstructure slewed to the rear you cannot extend all telescopic sections. The truck crane would first overturn.

Before lowering or extending the boom, the following conditions must be met:

– The truck crane must be standing on an even surface.

– One of the following two rigging modes has been established:

  The truck crane is supported on a outrigger span of **8.50 m x 5.70 m** (27.9 ft x 18.7 ft) and has been rigged to at least **33.5 t** counterweight.
  or
  The truck crane is supported on a outrigger span of **8.50 m x 8.30 m** (27.9 ft x 27.2 ft) and has been rigged to at least **22.5 t** counterweight.

– The SLI rigging code for the current rigging mode of the truck crane has been entered.

25.06.2004

Telescoping statuses

Telescoping telescopic section II - V

The following section describes the lubricating procedure for telescopic section V (example).

- Retract all telescopic sections.
- Enter the SLI rigging code for the current rigging mode of the truck crane.
- To lubricate the locking pins, extend telescopic section V to the fixed length of 100% and lock it.
- Mechanically lock the telescoping cylinder in the telescopic section IV.
- Override the SLI by turning the key-operated override switch to the right.
- Extend telescopic section IV ca. 1.5 m (5 ft) until the bores of the locking pins for telescopic section V are accessible.
- Spray the spray oil onto the lubricating points on the locking pins on both sides of telescopic section V; ➠ *Lubricating the locking pins*, p. 8 - 40.
- Fully retract telescopic section IV and lock it.
- Do not override the SLI anymore.
- Lock the telescoping cylinder in telescopic section V.
- Unlock and lock telescopic section V several times, so that the oil is distributed over the locking pin.
- Fully retract telescopic sectionV again.
- Proceed in the same way for telescopic sections IV, III and II.

Telescoping telescopic section I

Telescopic section I does not need to be extended for lubricating the locking pins, because the locking points with the main boom basic section are always accessible from the outside.

25.06.2004

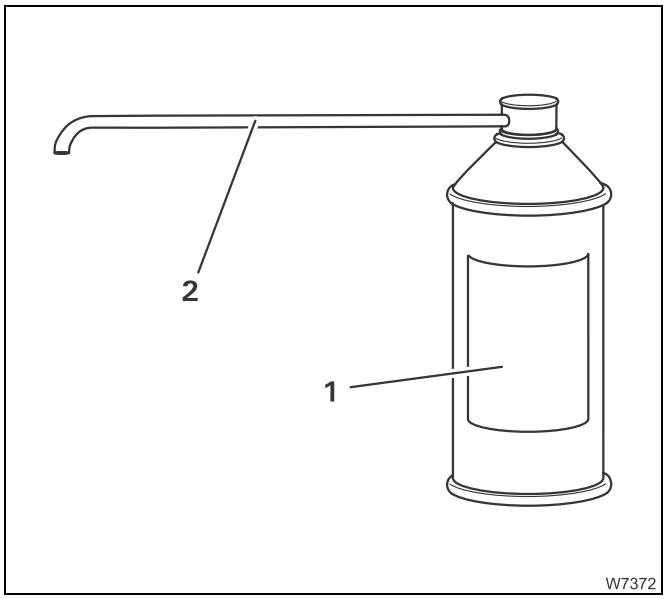
Lubricating the locking pins

Keep handy a spray oil containing molybdenum disulphide (MoS_2) and the spray extension from the tool box for lubricating the locking pins.

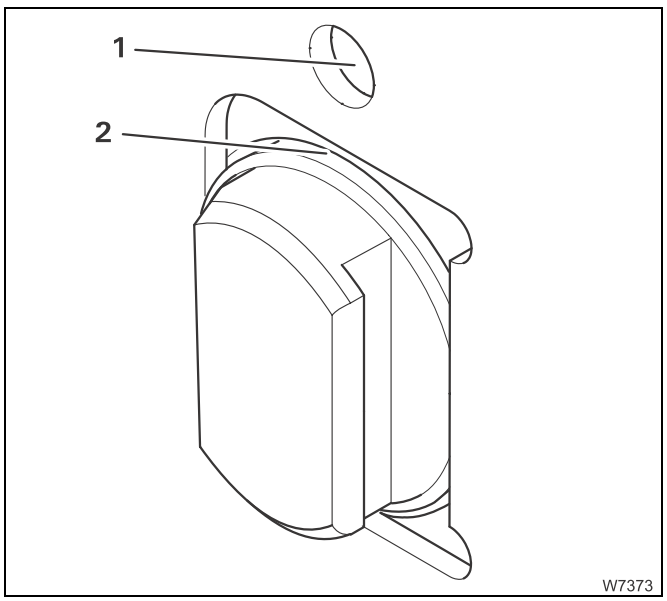
The pins are sprayed both inside and out.

To improve distribution of the sprayed oil, the pins must then be locked and unlocked a number of times.

Risk of accidents from slipping off the main boom
There is grease residue on the telescopic sections. For this reason, you must not climb onto the boom.
Use the extendable ladders provided with your crane!



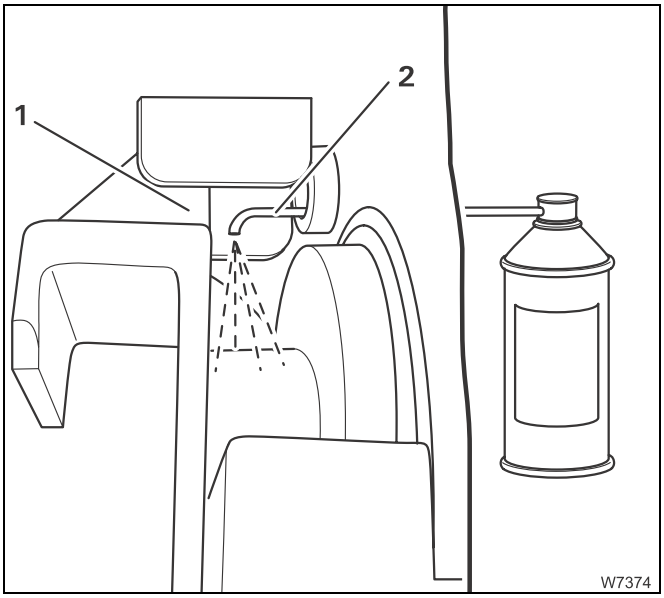
- The truck crane has one of the two rigging modes; ➠ p. 8 - 38.
- Place the spray extension (**1**) onto the spray can (**2**). To lubricate, use only special oil as specified in the *Maintenance plan*, p. 5 - 13.
- Extend the telescopic sections one after the other; ➠ p. 8 - 39.



Lubricating the outside

- Spray the oil into the gap (**2**) between the pins and the guide bushing.
- Unlock the telescopic section.
- Insert the spray extension into the bore (**1**). The curved end should point downwards.

25.06.2004



Lubricating the inside

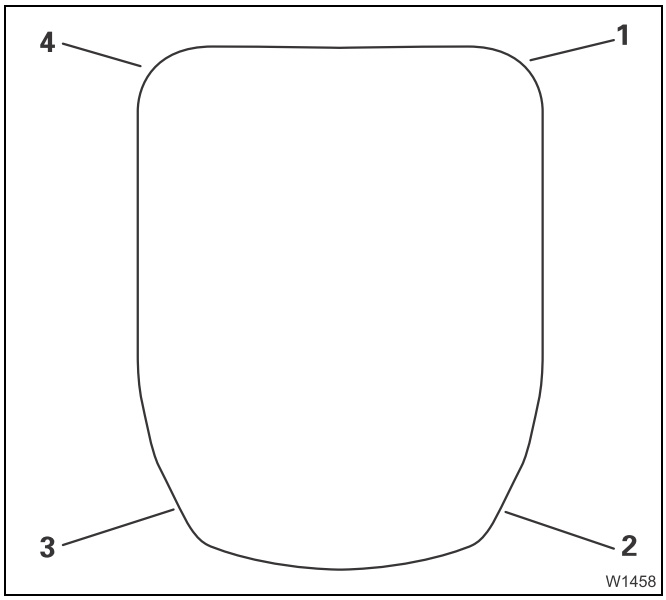
- Guide the spray extension (**2**) inwards until the tip touches the connector (**1**).
- Pull the spray extension back by approx. 1 to 2 cm (0.5 - 1.0 inch). This ensures that the oil reaches the pin.
- Spray two shots of oil onto the locking pin.
- Remove the spray extension from the bore.
- Also lubricate the locking pin on the other side.
- Lubricate the locking pins of the other telescopic sections in the same way.

25.06.2004

8.5.2 Lubricating the telescope slide faces — M 6

To lubricate the telescope slide faces, the main boom must be lowered to the horizontal position and the telescopic sections must be successively extended to allow access to the lubricating points.

Risk of overturning
Before the main boom is lowered or extended, observe the prerequisites set out in this section, ➠ p. 8 - 44.



There are four slide faces at the corners of telescopic sections I to V. The two lower slide faces (**2**) and (**3**) are lubricated from the outside in the extended state.

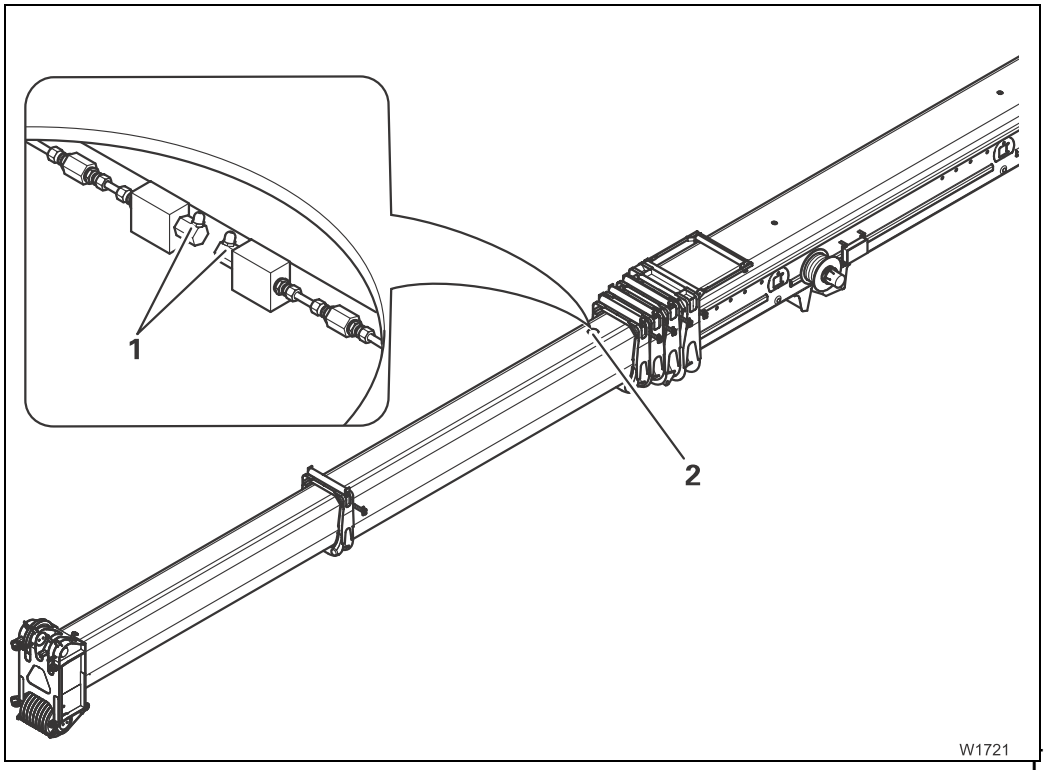
The two upper slide faces (**1**) and (**4**) are lubricated by one lubricating nipple each.

Position of lubricating nipples

The following section shows the position of the lubricating nipples.

Risk of crushing from retracting boom
Do not reach into the manhole until the boom has been secured so that it cannot retract inadvertently. If you are carrying out this operation with the help of someone else, communicate with the person in the crane cab by means of clear hand signals.

25.06.2004



TZhe lubricating nipples (**1**) are located on the top chords of the telescopic sections and are reached via corresponding lubrication holes (**2**) in the telescopic sections above. The diagram shows the telescope status for the lubrication of telescopic section V.

Lubricating nipples for	Quantity	Can be reached via the lubrication hole in
Telescopic section I	2	Top chord Basic section
Telescopic section II	2	Top chord Telescopic section I
Telescopic section III	2	Top chord Telescopic section II
Telescopic section IV	2	Top chord Telescopic section III
Telescopic section V	2	Telescopic section IV

Risk of accidents
Danger of slipping due to grease residue. Do not climb onto the boom. Use the extendable ladder provided with your crane!

25.06.2004

Prerequisites

The main boom must be partly extended in the horizontal position when carrying out maintenance.

Risk of overturning when extending in horizontal position
In the horizontal position the SLI blocks telescoping when there is an attempt to extend a second telescopic section.
Override the SLI only when you are prompted to do so in the following section and do not extend the main boom more than indicated.
Even with 70 t of rigged counterweight and the superstructure slewed to the rear you cannot extend all telescopic sections. The truck crane would first overturn.

Before lowering or extending the boom, the following conditions must be met:

– The truck crane must be standing on an even surface.

– One of the following two rigging modes has been established:

  The truck crane is supported on a outrigger span of **8.50 m x 5.70 m** (27.9 ft x 18.7 ft) and has been rigged to at least **33.5 t** counterweight.
  or
  The truck crane is supported on a outrigger span of **8.50 m x 8.30 m** (27.9 ft x 27.2 ft) and has been rigged to at least **22.5 t** counterweight.

– The SLI rigging code for the current rigging mode of the truck crane has been entered.

- Slew the superstructure to the rear or to the side.
- Unreeve the hook block.
- Derrick the boom into horizontal position.

To lubricate you must also telescope to intermediate lengths, so telescope the main boom in semi-automatic (➠ *Operating instructions*, Part 2, Chapter *Crane operation,* Section *Crane operation with main boom*).

25.06.2004

Lubricating the slide faces of the telescopic sections

- To lubricate, use only special grease as specified in the *Maintenance plan*, p. 5 - 15.
- Lower the retracted main boom to the lowest position.
- Start with telescopic section V.

Risk of accidents from slipping off
There is grease residue on the telescopic sections. For this reason, you must not climb onto the boom.
Use the extendable ladder provided with your crane!

Lubrication Telescopic section V

- Retract all telescopic sections.
- Enter the SLI rigging code for the current rigging mode of the truck crane.
- Telescope the telescopic section V into the middle locking position and lock it.
- Override the SLI by turning the Override key switch to the right.
- Extend telescopic section IV to approx. 58% until the lubricating hole for telescopic section V can be reached in the top chord.
- Inject approx. 100 ml (0,02 gal) of grease into each lubricating nipple (position **1**).
- Retract telescopic section IV completely.
- Do not override the SLI anymore.
- Fully extend telescopic section V.
- Apply a thin layer of grease to the bottom two slide faces of telescopic section V with a spatula.
- Extend and retract telescopic section V again so that the grease is evenly spread on the telescope slide faces.
- Retract telescopic section V.

Lubrication Telescopic section IV

- Retract all telescopic sections.
- Enter the SLI rigging code for the current rigging mode of the truck crane.

25.06.2004

- Telescope telescopic section IV to the middle locking position and lock it.
- Override the SLI by turning the Override key switch to the right.
- Extend telescopic section III to approx. 58% until the lubricating hole for telescopic section IV can be reached in the top chord.
- Inject approx. 100 mml (0,02 gal) of grease into each lubricating nipple (position **1**).
- Fully retract telescopic section III.
- Do not override the SLI anymore.
- Fully extend telescopic section IV.
- Use a spatula to apply a thin layer of grease to the two lower slide faces of telescopic section IV .
- Extend and retract telescopic section IV again so that the grease is distributed uniformly on the telescope slide faces.
- Retract telescopic section IV.

Lubrication Telescopic section III

- Retract all telescopic sections.
- Enter the SLI rigging code for the current rigging mode of the truck crane.
- Telescope telescopic section III to the middle locking position and lock it.
- Override the SLI by turning the Override key switch to the right.
- Extend telescopic section II to approx. 58% until the lubricating hole for telescopic section III can be reached in the top chord.
- Inject approx. 100 mml (0,02 gal) of grease into each lubricating nipple (position **1**).
- Fully retract telescopic section II.
- Do not override the SLI anymore.
- Fully extend telescopic section III.
- Apply a thin layer of grease to the bottom two slide faces of telescopic section III with a spatula.
- Extend and retract telescopic section III again so that the grease is distributed uniformly on the telescope slide faces.
- Fully retract telescopic section III.

25.06.2004

Lubrication Telescopic section II

- Retract all telescopic sections.
- Enter the SLI rigging code for the current rigging mode of the truck crane.
- Telescope telescopic section II to the middle locking position and lock it.
- Override the SLI by turning the Override key switch to the right.
- Extend telescopic section I to approx. 58% until the lubricating hole for telescopic section II can be reached in the top chord.
- Inject approx. 100 mml (0,02 gal) of grease into each lubricating nipple (position **1**).
- Fully retract telescopic section I.
- Do not override the SLI anymore.
- Fully extend telescopic section II.
- Use a spatula to apply a thin layer of grease to the bottom two slide faces of telescopic section II.
- Extend and retract telescopic section II again so that the grease is distributed uniformly on the telescope slide faces.
- Retract telescopic section II.

Lubrication Telescopic section I

- Retract all telescopic sections.
- Enter the SLI rigging code for the current rigging mode of the truck crane.
- Extend telescopic section I to 100%.

You can now reach the lubricating nipples via the front lubricating holes in the top chord of the basic section.

- Inject approx. 100 mml (0,02 gal) of grease into each lubricating nipple (position **1**).
- Use a spatula to apply a thin layer of grease to the bottom two slide faces of telescopic section I.
- Extend and retract telescopic section I twice so that the grease is evenly spread on the telescope slide faces.
- Retract telescopic section I.

25.06.2004

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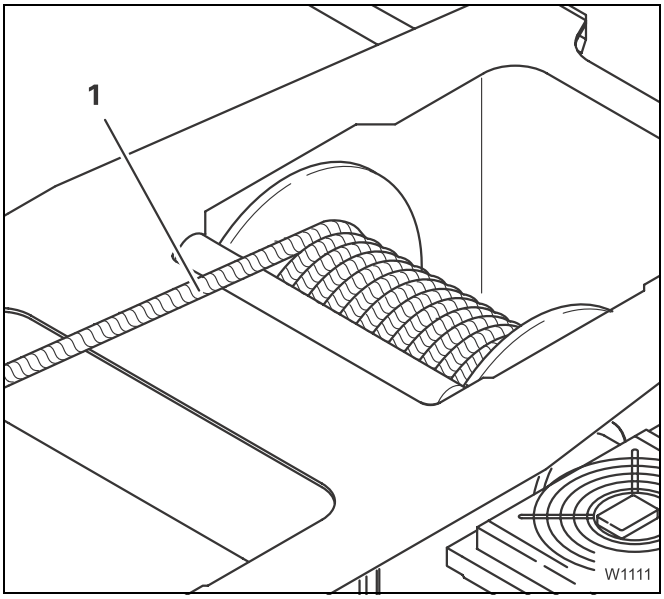
25.06.2004

8.6 Hoist ropes

8.6.1 Checking the position of sheaves and rope drums D

Risk of accidents due to turning rope drum
Keep yourself and other people away from the turning rope drum. If you take hold of the turning rope drum, your fingers and hands could be crushed between the rope drum and hoist frame or get caught and drawn in by the turning drum.



Check the position of the hoist ropes (**1**) on the rope drums of the main hoist and the auxiliary hoist (additional equipment).

- Slowly turn the rope drum at least one turn in the lowering direction. Watch the rope on the drum as you do this.
  - The rope must be wound evenly on the drum.
  - The rope turns on the drum must be evenly spaced at a distance of 0 to 2 mm (0 to 0.08 inches).
  - The cross-over points must be at an angle of approx. 180°.

The upper rope lines lie over the lower rope lines at the cross-over points.

- Check the position of the hoist ropes on the sheaves at the boom head and in the hook block.
- Check the sheaves for damage and wear, and check that they run freely.

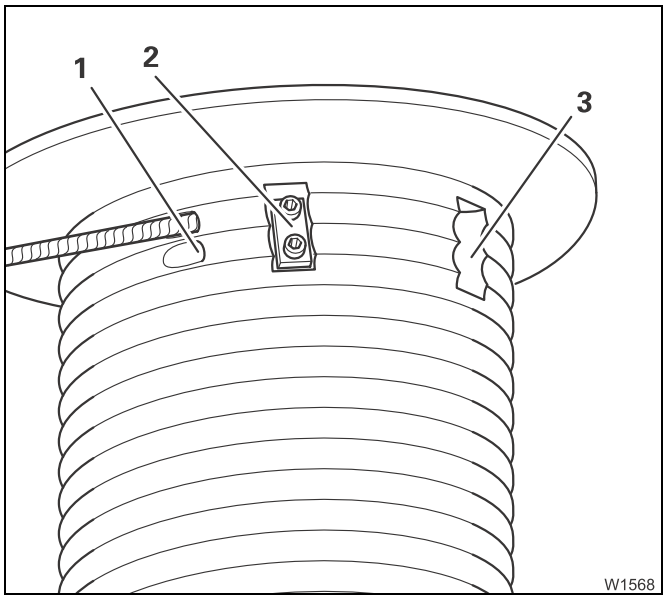
Risk of accidents from incorrectly set lowering limit switch
Never turn the free rope end under the drum. Turns on the drum which are unwound when the rope drum is stationary cannot be detected by the lowering limit switch. This causes the lowering limit switch to become set incorrectly and to switch off too late or not at all. Consequently the load may fall.

25.06.2004

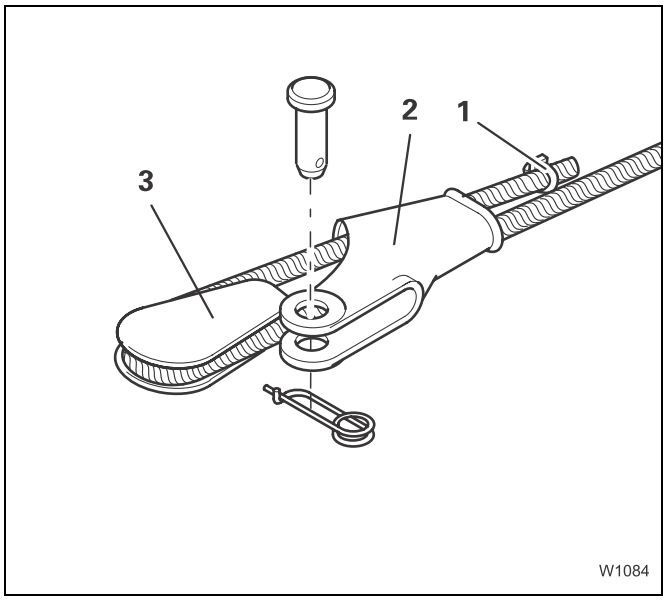
8.6.2 Checking status W

- Reeve the hoist rope on the hook block six times (➠ *Operating instructions*, Part 2, Chapter *Rigging work*, Section *Rigging work on the main boom*).
- Stabilize the truck crane and enter the SLI code for the current rigging mode.
- Raise the boom and extend it fully.
- Unreel the hoist rope and check that the rope is not damaged or improperly reeled
  (➠ *Assessing the condition of the hoist rope*, p. 8 - 51). 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 switches*, p. 8 - 59).



- Check the mounting of the rope clamp (**2**) on the rope drum for damage and ensure that it is securely attached (tightening torque; ➠ *Special tightening torques*, p. 10 - 2).
- Check whether the hoist rope can be wound without kinking or flattening:
  - The free rope end must not protrude out of the bore hole (**1**).
  - The entire rope loop with wedge must lie within the pocket (**3**) of the hoist drum.



- Check the securing of the rope end in the rope end clamp (**2**) for proper seating and correct positioning of rope.

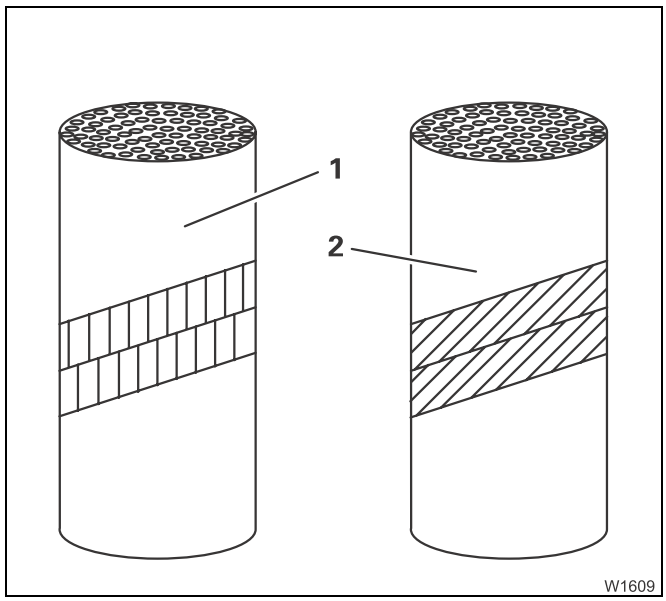
The rope end clamp (**1**) must be attached to the free end of the rope and the rope must secured around the rope wedge (**3**).

25.06.2004

Assessing the condition of the hoist rope

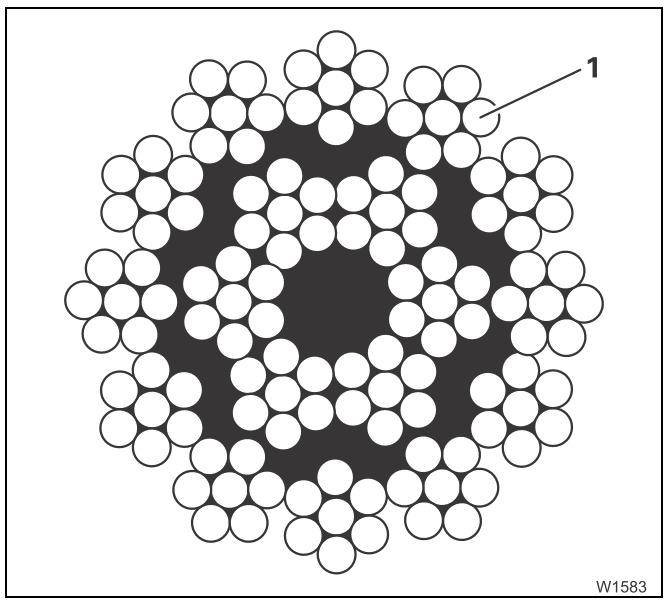
If in doubt about damage assessment, always consult an expert.

To assess the condition of the hoist rope, you must be familiar with the following:
- The type of rope (regular lay or long lay)
- The number of load bearing wires in the outer strand
- The rope diameter (➠ *Operating instructions*, Part 2, Chapter *Superstructure technical information*, Section *Superstructure technical information*).



In a regular lay rope (**1**), the wires run more or less in the longitudinal direction of the rope.

In a long lay rope (**2**), the wires run at an angle of approximately 45° to the longitudinal direction of the rope.



To calculate the number of load bearing outer wires (**1**), count the number of outer strands of the rope and multiply by 7.

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

25.06.2004

The following tables show the number of wire breaks in a length 6 times and 30 times the rope diameter which would require rope replacement, for the most common rope diameters.

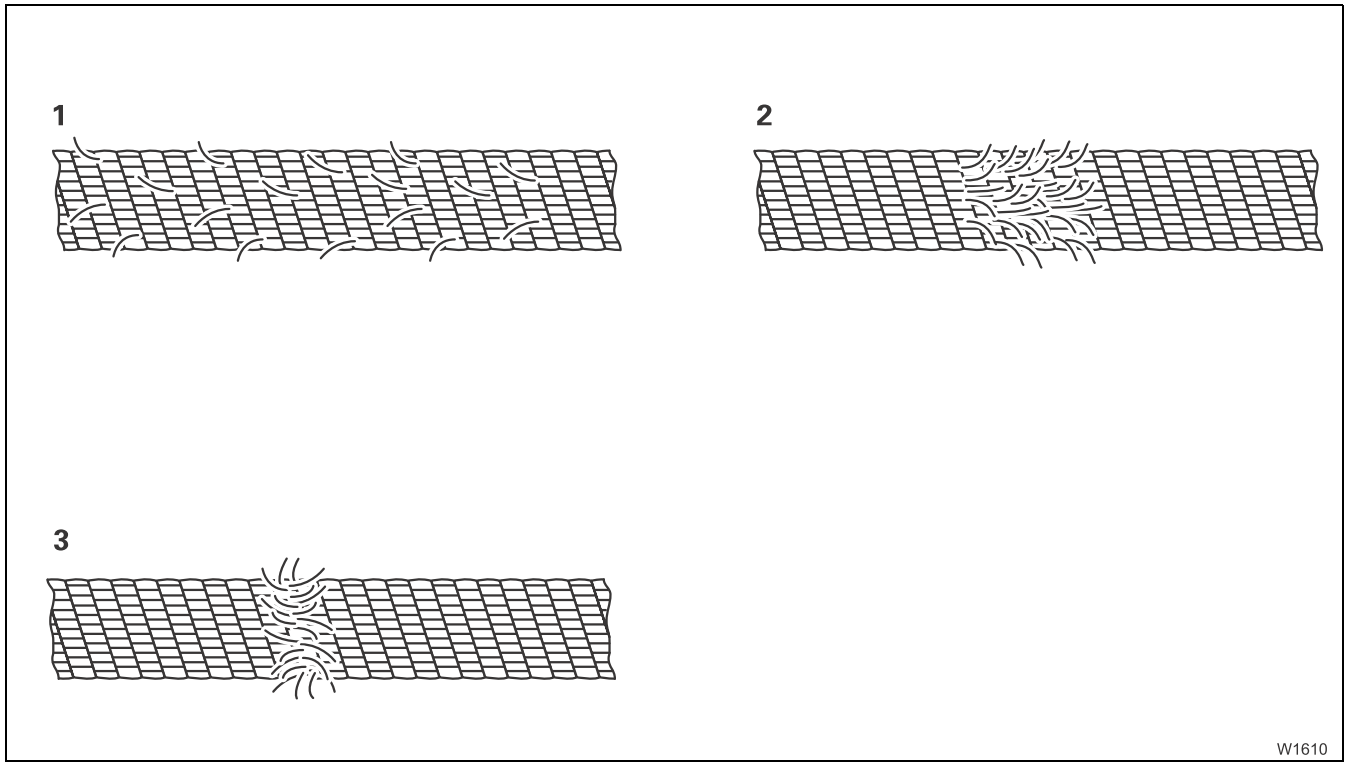
Number of load bearing outer wires	**Number of visible wire breaks**									
	Regular lay rope									
	∅ 13 mm		**∅ 16 mm**		**∅ 19 mm**		**∅ 22 mm**		**∅ 24 mm**	
	to 78 mm	to 390 mm	to 96 mm	to 480 mm	to 114 mm	to 570 mm	to 132 mm	to 660 mm	to 144 mm	to 720 mm
101-120	5	10	5	10	5	10	5	10	5	10
121–140	6	11	6	11	6	11	6	11	6	11

Number of load bearing outer wires	**Number of visible wire breaks**									
	Long lay rope									
	∅ 13 mm		**∅ 16 mm**		**∅ 19 mm**		**∅ 22 mm**		**∅ 24 mm**	
	to 78 mm	to 390 mm	to 96 mm	to 480 mm	to 114 mm	to 570 mm	to 132 mm	to 660 mm	to 144 mm	to 720 mm
101-120	2	5	2	5	2	5	2	5	2	5
121–140	3	6	3	6	3	6	3	6	3	6

The number of visible wire breaks indicated here only applies to the hoist ropes! This information only applies to the initial equipment and original spare parts!

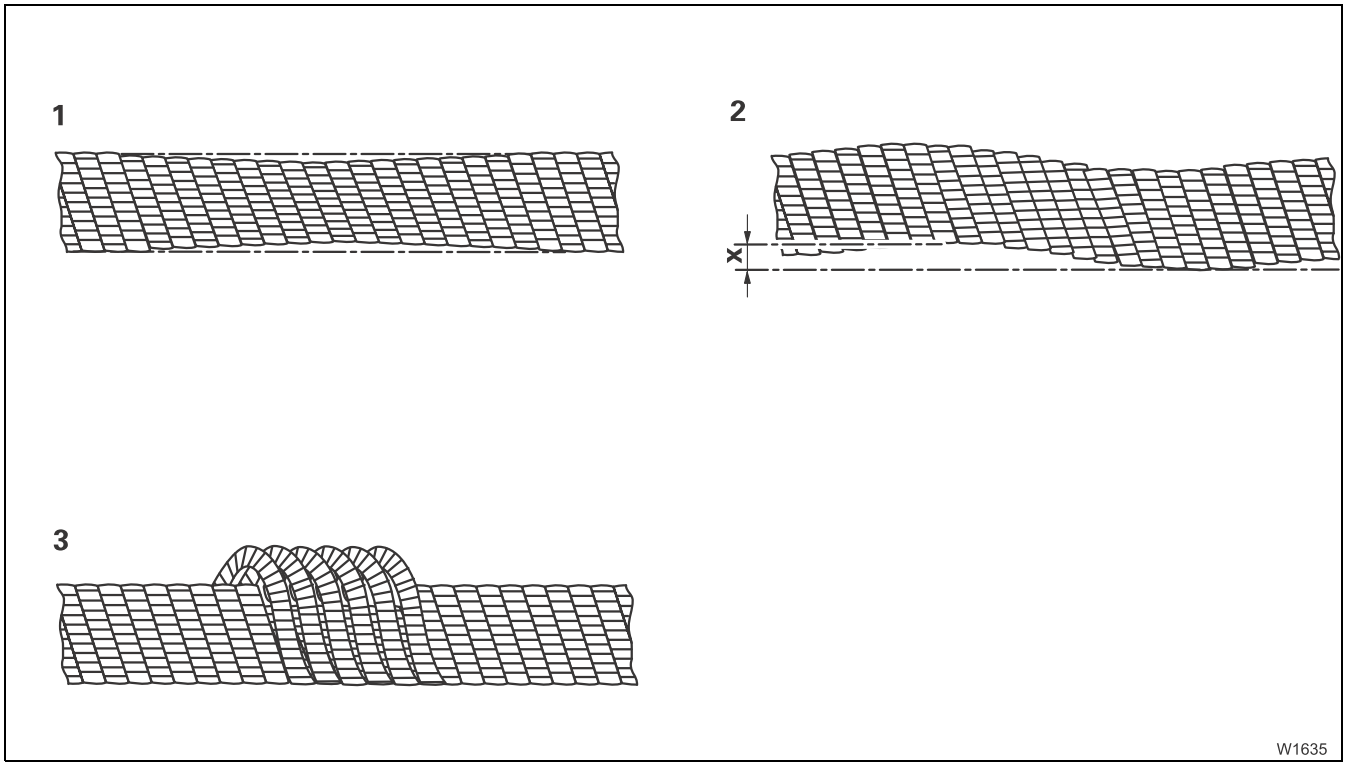
Remember that other factors may also make it necessary to replace the hoist rope before the number of wire breaks requiring rope replacement has been reached (age of rope, frequency of use or exceptional loading).

25.06.2004



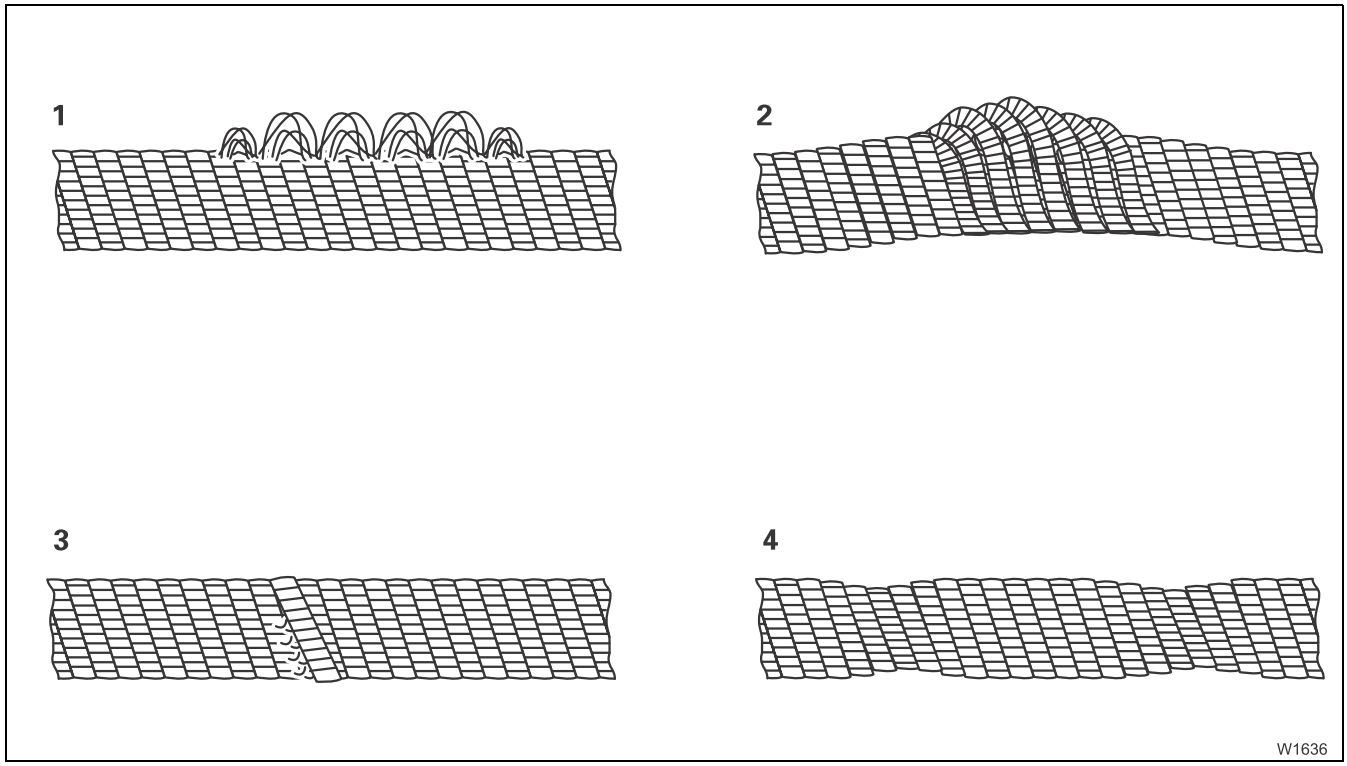
Damage	Description	Cause	Replacement
Wire breakage (1) **Wire breakage clusters (2)** **Strand breakage (3)**	Individual wires are broken; the broken ends of the wires are protruding from the rope.	General wear caused by aging of the rope or subsequent damage resulting from damage to the rope.	Replace hoist rope **at the latest** when the maximum permissible number of wire strand fractures according to the table are visible externally. Replace hoist rope **immediately** if wire breakage clusters or strand breakage occur. The frequency of wire breakage increases with rope age. For reasons of safety, it is advisable to replace the hoist rope while the number of broken wires is still low.
Effect of heat	Tarnishing colour is visible externally on the rope.	Rope has been subjected to strong heat.	Replace hoist rope **immediately**.

25.06.2004



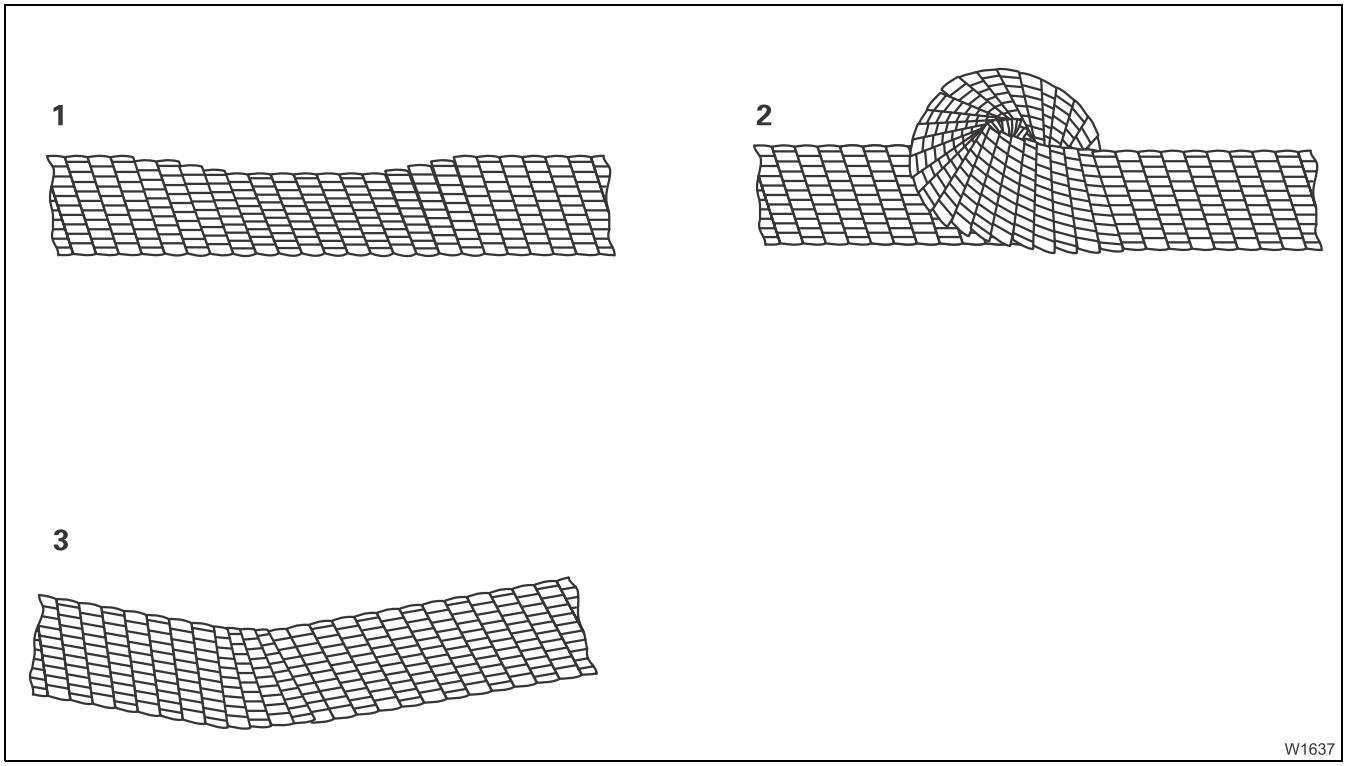
Damage	Description	Cause	Replacement
Diameter reduction (1)	The diameter of the rope has become smaller along large sections.	Structural changes	**Immediately** replace hoist rope if the diameter has decreased by 15% or more with respect to the nominal diameter.
		Corrosion or abrasion.	**Immediately** replace hoist rope if the diameter has decreased by 10% or more with respect to the nominal diameter.
Corkscrew deformation of rope (2)	The rope winds its way along its longitudinal axis in a way which 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 breakage and rough operation of the cable drive. If deformation 'x' at a position on the hoist rope is greater than a third of the rope diameter, the hoist rope must be replaced **immediately**.
Basket-type deformation (3)	Wires from the outer layer are protruding from the rope. In various areas of the rope, the ply has buckled or is protruding from the rope.	Outer and inner layers have been displaced in relation to each other.	Replace hoist rope **immediately**.

25.06.2004



Damage	Description	Cause	Replacement
Loop formation (1)	Outer layer wires in the form of hair pins are protruding from the rope on the side opposite the sheave.	General wear caused by aging of the rope or subsequent damage resulting from damage to the rope.	**Immediately** replace hoist 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 hoist rope **immediately**.
		Other causes.	The number of broken wires determines when the rope must be replaced.
Knot formation (3)	Repeatedly occurring knot-like thickening of rope; core often protrudes. Strands bear on each other at thin locations; increased frequency of wire breakage.	General wear caused by aging of the rope or subsequent damage resulting from damage to the rope.	Determine number of broken wires; If serious knot formation occurs, replace rope **immediately**.
Constriction (4)	Diameter reduction over short sections.	General wear caused by aging of the rope.	If serious constriction occurs, replace rope **immediately**.

25.06.2004



Damage	Description	Cause	Replacement
Flattening (**1**)	Crushed areas, mostly with wire breakage.	Mechanical damage, e.g. due to driving over the rope.	Determine number of broken wires; replace hoist rope **immediately** if serious crushing occurs.
Crinkling formation	Crinkle type rope deformation.	Loaded hoist rope was pulled over an edge.	Replace hoist rope **immediately**.
Kink (**2**)	Rope deformation with twisting and broken wires.	Rope was pulled straight while twisted and located in eyes.	Replace hoist rope **immediately**.
Buckle (**3**)	Buckled section in rope.	Mechanical damage	Replace hoist rope **immediately**.

25.06.2004

Replacing the hoist rope

The installation procedure can have a significant influence on the service life of a hoist rope. Errors during fitting reduce service life considerably, therefore:

– Make sure the hoist rope is not twisted when it is installed.

– Ensure they do not get dirty or damaged while being fitted.

– Wind the hoist rope up in the same direction in which the hoist rope is reeled onto the reel.

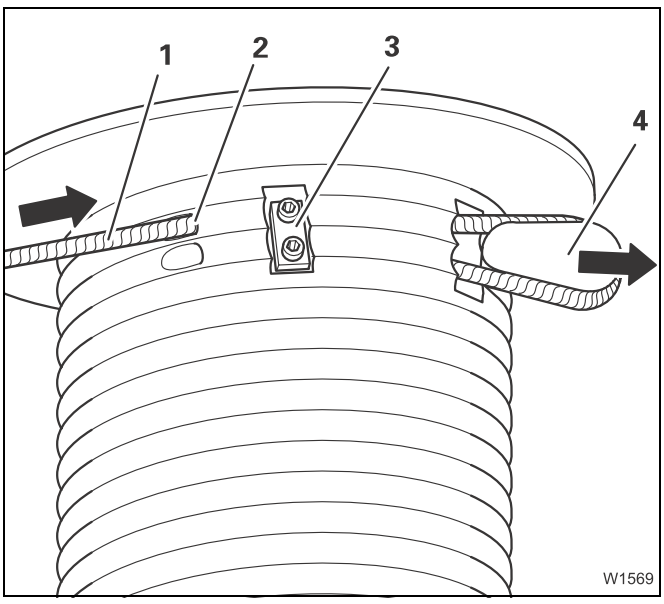
– Tense the rope slightly while reeling it up.

Risk of accidents if the load falls
Use only a replacement hoist rope which has the same technical specifications as the defective rope or an original replacement rope.

- Unreeve the hook block (➠ *Operating instructions*, Part 2, Chapter *Rigging work*, Section *Rigging work on the main boom - Setting down the hook block*).
- Wind out the hoist rope until the lowering limit switch switches off.
- Adjust the lowering limit switch so that you can unwind the hoist rope completely (➠ *Setting the lowering limit switches*, p. 8 - 59).
- Wind out the remaining layers from the hoist drum.

Ensure that the rope is not wound on again in the other direction.

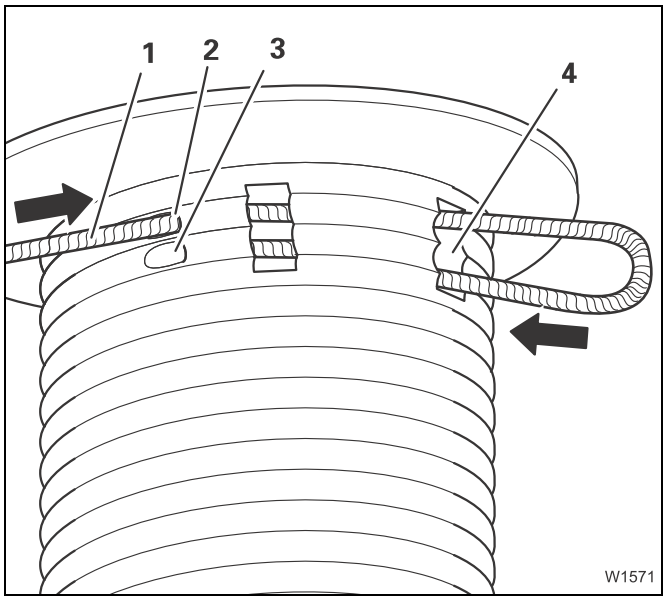
Risk of accidents from rotating rope drum
Turn off the crane engine and remove the ignition key so that no unauthorized operation of the hoist can occur.



- Remove the two bolts and the rope clamp (**3**).
- Push the hoist rope (**1**) through the bore hole (**2**) until the rope wedge (**4**) slides out of the pocket of the hoist drum.
- Take out the rope wedge and pull the free end of the hoist rope out of the pocket in the hoist drum.
- Pull the hoist rope from the boom and the sheaves at the boom head.

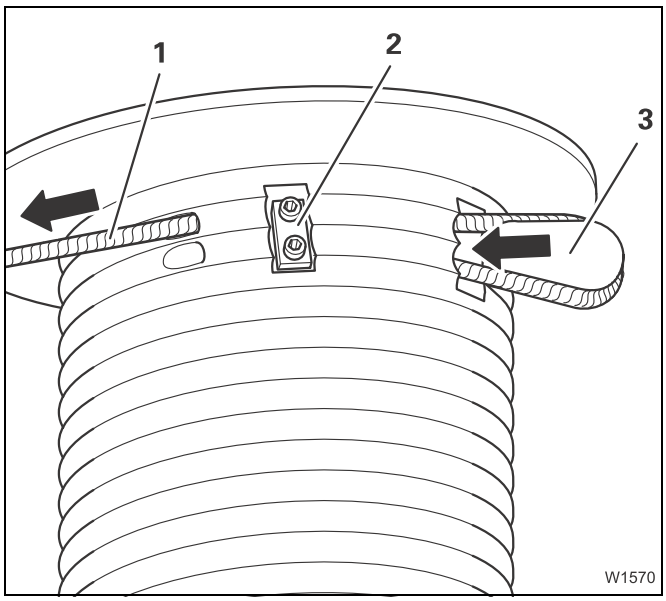
25.06.2004

- Place the rope reel with the new hoist rope on a reel stand.
- Place the reel stand in front of the boom head in such a way that the hoist rope can be guided straight over the boom head sheaves onto the boom.
- Pull the hoist rope over the boom to the hoist drum.

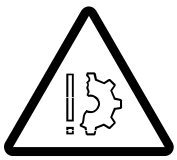


- Push the hoist rope (**1**) through the bore hole (**2**) until it extends approx. 1.5 m (5 ft) from the pocket (**4**).
- Feed the hoist rope back through the pocket (**4**) into the second bore hole (**3**).

The hoist rope must be approx. 50 mm (2 inches) into the bore hole (**3**) but must not protrude over the edge of the bore.



- Put on the rope clamp (**2**) and screw it down (tightening torques ➠ *Special tightening torques*, p. 10 - 2).
- Place the rope wedge (**3**) into the hoist rope loop and insert into the pocket in the hoist drum. The chamfered side of the rope wedge must point towards the center of the hoist drum.
- Using the free end of the hoist rope (**1**), pull the rope loop tightly until the rope wedge slides fully into the pocket in the hoist drum.



Risk of damage to the hoist rope
Ensure that the rope wedge, rope loop and rope end do not protrude beyond the diameter of the hoist drum. This protects the new hoist from being damaged through kinking or flattening even as it is reeled on.

- Restart the crane engine.

25.06.2004

- Reel the hoist rope slowly onto the drum, keeping the hoist rope tight.
- Reeve the rope on the hook block six times (➠ *Operating instructions*, Part 2, Chapter *Rigging work*, Section *Rigging work on the main boom – Reeving hoist rope*).
- Raise the boom to a steep position and extend it fully.
- Wind the hoist rope out until only five turns remain on the rope drum.

Watch the hook block when winding out.
The hook block must not rotate!

- Reset the lowering limit switch so that it switches off at five wound plies (➠ *Setting the lowering limit switches*, p. 8 - 59).
- Reel the hoist rope in by a few turns and lower it again to check the lowering limit switch.

When only five turns are left on the rope drum, the lowering limit switch must switch off the lowering movement.

Risk of accidents due to rope end fitting being overloaded
After installing a new hoist rope, the lowering limit switch must always be reset.

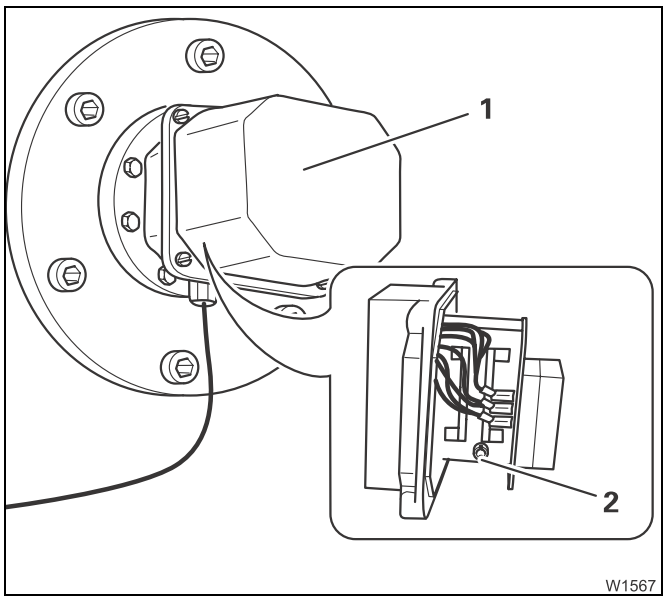
Setting the lowering limit switches

Risk of accidents due to rope end fitting being overloaded
The lowering limit switch must always be reset after repair work to the hoist and after rope replacement. A defective lowering limit switch must always be replaced!

- Reeve the hoist rope with 6 falls.
- Extend boom fully.
- Lower hook block until only five turns remain on the hoist drum.

25.06.2004

The lowering limit switch is located on the hoist on the left-hand side of the turntable.



- Remove the lowering limit switch cover (**1**).
- Turn the adjusting screw (**2**) until you hear the micro-switch activate.
- Attach the cover to the lowering limit switch again.
  Make sure that the seal fits properly.

You must check the functioning of the lowering limit switch after it has been set.

Lowering limit switch function control

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

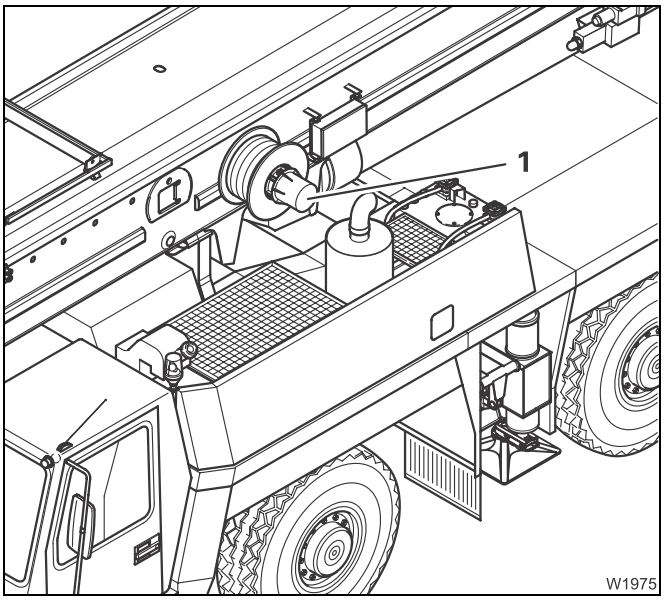
The lowering limit switch must switch off the hoist when five rope turns are still on the drum.

25.06.2004

8.7 Safe load indicator

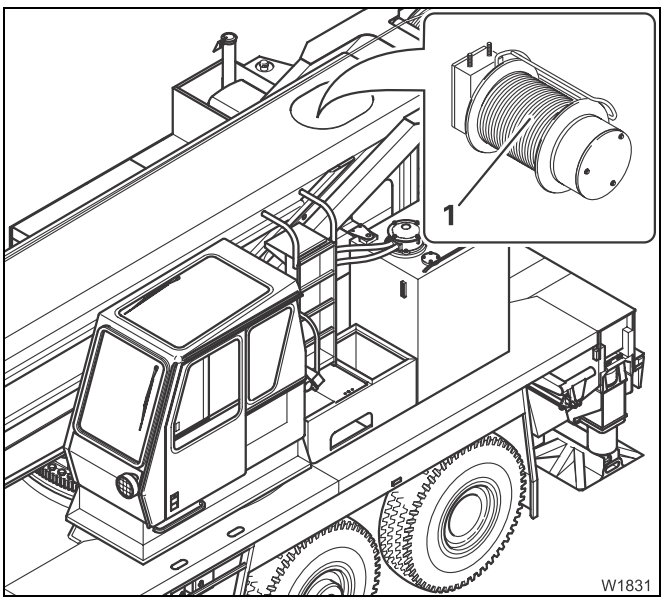
8.7.1 Maintaining the slip ring assembly of the cable drums M 6

Maintenance of the slip ring assembly is carried out in order to prevent contamination and corrosion and to prevent malfunctions on the SLI.
The GMK 5200 truck crane has two cable drums whose slip ring assemblies needs to be maintained.



There is a cable drum (**1**) on the left side of the main boom.

Risk of crushing due to extending or retracting boom
Secure the boom against unintentional movement, so that your fingers will not be crushed by retracting telescopic sections or by the turning slip ring unit. If you are carrying out this operation with the help of someone else, communicate with the person in the crane cab by means of clear hand signals.



The second cable drum (**1**) is located in the main boom underneath the telescoping cylinder.

You can reach the cable drum through the manhole if you first extend telescopic section I approx. 2 m (ca. 6.6 ft).

25.06.2004

The following sections describe the maintenance procedure for the outer cable drum. Maintenance on the cable drum in the boom is carried out in the same way.

Prerequisites

Before maintenance, the following requirements must be met:

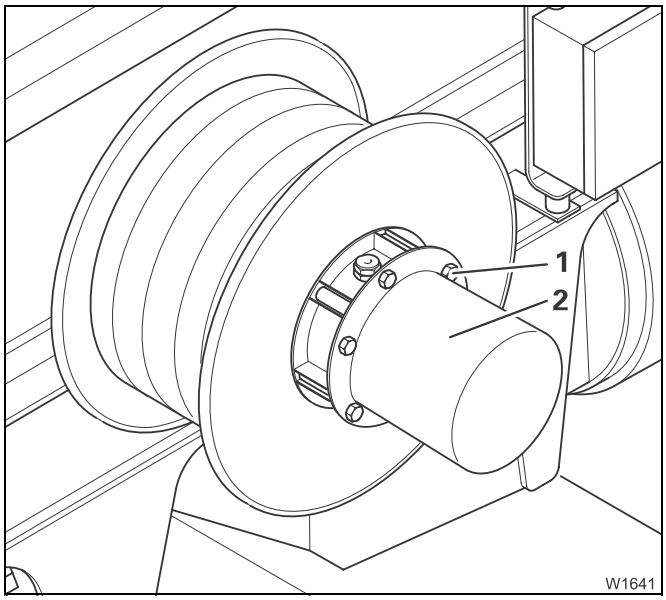
– The main boom must be resting in the boom rest.

– The battery master switch must be switched off; ➠ *Operating instructions*, Part 2, Chapter *Crane engine,* Section *Turning off crane engine*.

Risk of damaging the safe load indicator
Before maintenance work on the slip ring assembly, always switch off the battery master switch so that the cable drum is current-free.
This prevents short circuits which may lead to damage to the central unit.

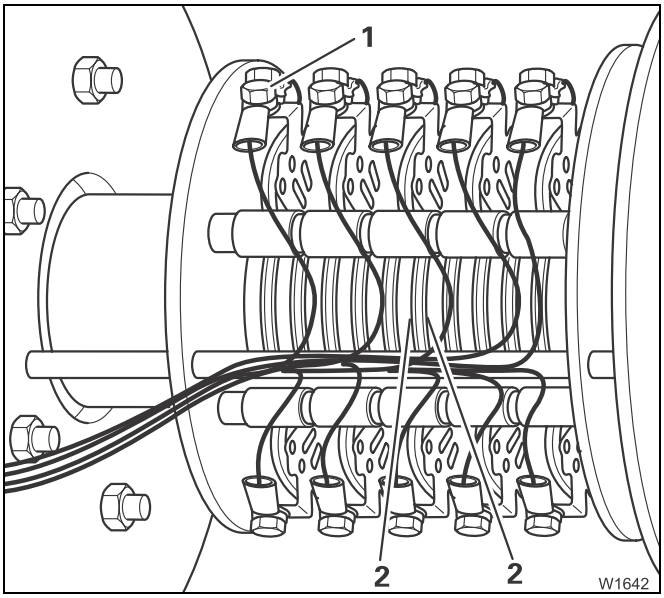
Maintenance of the slip ring assembly

To remove abrasion particles from the contact brushes, use only dry, oil-free air or a clean, lint-free cloth.

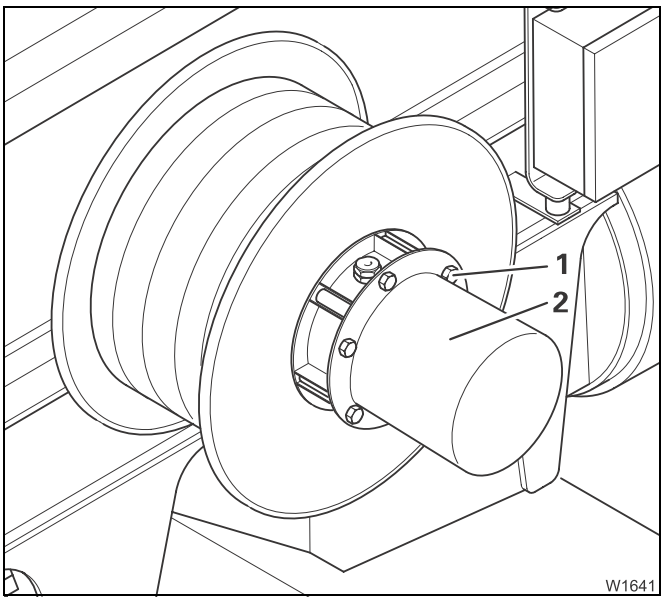


- Make sure that the cable drum is current-free.
- Unscrew all screws (**1**) and remove the casing (**2**).
- Check the seal on the casing for damage and replace it if necessary.
- Remove any moisture in the casing with a clean, lint-free cloth.

25.06.2004



- Remove visible dirt on the slip rings (**2**) with dry, oil-free air or a clean, lint-free cloth.
- Check to make sure all screws (**1**) are tight.



- Put the casing (**2**) back in place. Make sure that the seal is in the right place.
- Fasten the casing with all the screws (**1**).

25.06.2004

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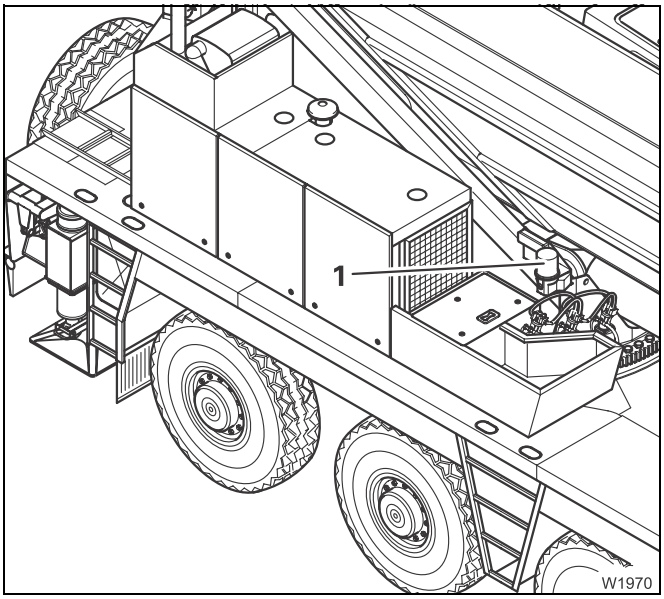
25.06.2004

8.8 Central lubrication system



The grease reservoir (**1**) is located on the right side of the turntable above the storage compartment and in front of the crane engine.

Only fill with grease as specified in the *Maintenance plan*, p. 5 - 9.

The maintenance of the central lubrication system on the superstructure is the same as the maintenance of the central lubrication system on the carrier (➠ *Central lubrication system*, p. 7 - 55).

25.06.2004

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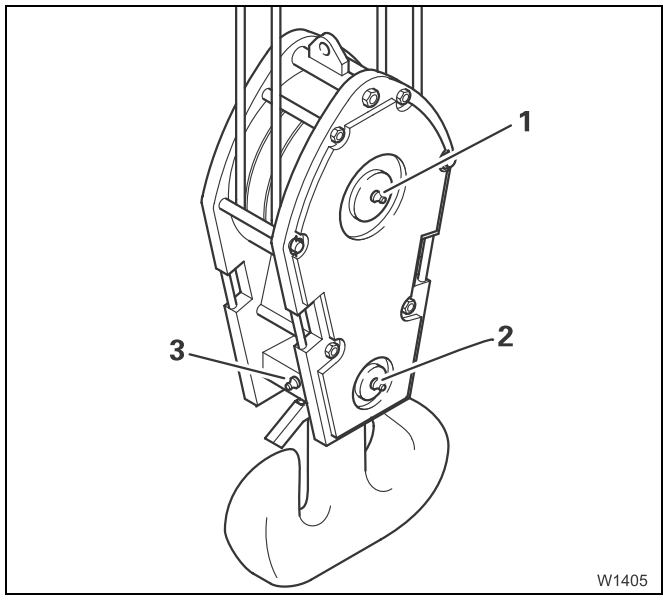
25.06.2004

8.9 Hook blocks

8.9.1 Lubrication M 1

The sheaves, cross heads and axial bearings of the load hook have to be lubricated on the hook block.
Use lubricating grease specified in the *Maintenance plan*, p. 5 - 11.



The diagram gives an example of the location of the lubricating nipples (**1**), (**2**) and (**3**) on a hook block. There are other lubricating nipples on the other side.

- Clean the lubricating nipples on all hook blocks supplied and on the hook tackle and lubricate them with a grease gun.

25.06.2004

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25.06.2004

8.10 Superstructure electrical system

8.10.1 Checking the acid level of batteries M 1

Maintenance work is described in Chapter *Description of maintenance work on the carrier*, Section *Checking the acid level of batteries*, p. 7 - 59.

8.10.2 Checking the acid concentration of batteries M 3

Maintenance work is described in Chapter *Description of maintenance work on the carrier*, Section *Checking the acid concentration of batteries*, p. 7 - 60.

25.06.2004

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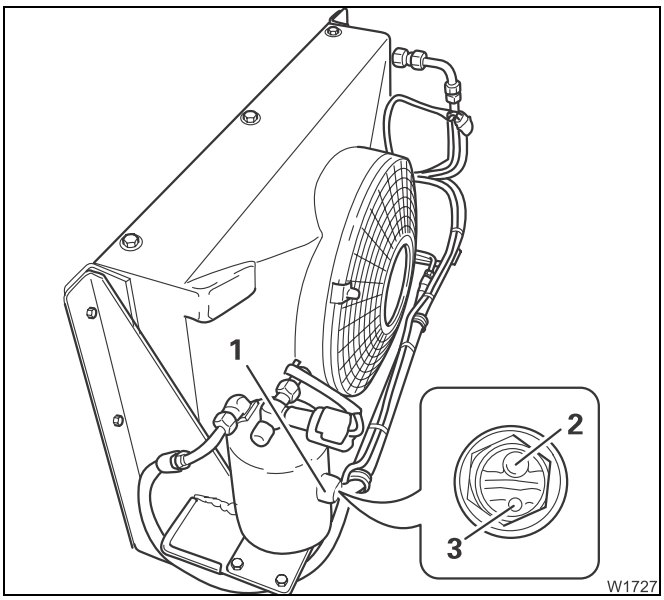
25.06.2004

8.11 Superstructure air-conditioning (additional equipment)

8.11.1 Checking the moisture and level of the refrigerant M 1



The refrigerant is checked through an inspection glass on the refrigerant collector while the air conditioning system is running. This is located next to the capacitor on the left of the turntable and above the hydraulic oil tank.

- Start the crane engine.
- Switch on the air-conditioning and let it run for ca. 10 minutes (Switching on the air-conditioning system ➠ *Operating instructions,* Section *Air-conditioning system* in Chapter *Crane operation*).
- Check the refrigerant filling level and the moisture content of the refrigerant through the inspection glass (**1**):
  – The float ball (**2**) must be located at the top and
  – The indicator pearl (**3**) must have a blue colour.

If the floater is at the bottom (no refrigerant can be seen in the inspection glass) or if the indicator pearl has a pink colour, the air conditioning system is defective.

If the air-conditioning is faulty:

- To avoid further damage, switch the air conditioning system off and do not use it again.

Have the air conditioning system repaired as soon as possible by ***CraneCARE*** at the respective location.

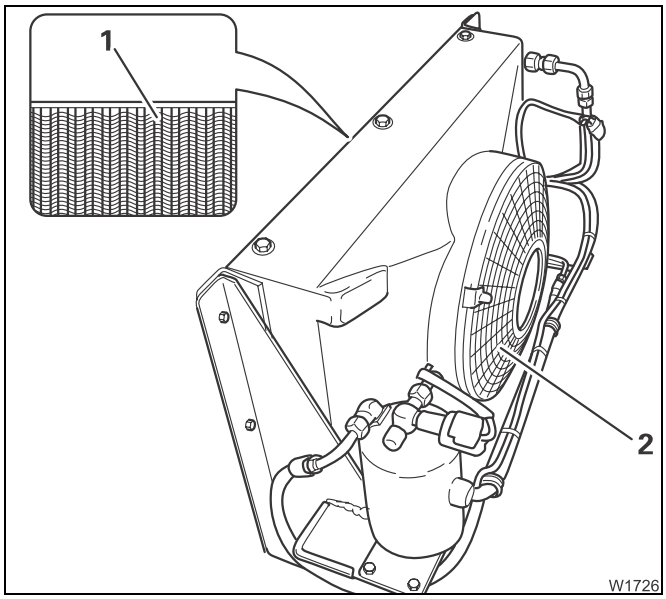
After checking:

- Switch off the air conditioning system and stop the crane engine.

25.06.2004

8.11.2 Cleaning capacitor disks — M 1

Risk of damage to the capacitor and fan
Do not use a high pressure cleaner or steam jet cleaner. The hard water jet can damage the disks or the fan. Use only compressed air for cleaning.



- Switch the air conditioning system off.
- Clean the disks of the capacitor (**1**) and the fan wheel (**2**) with compressed air.

8.11.3 Checking hoses — M 6

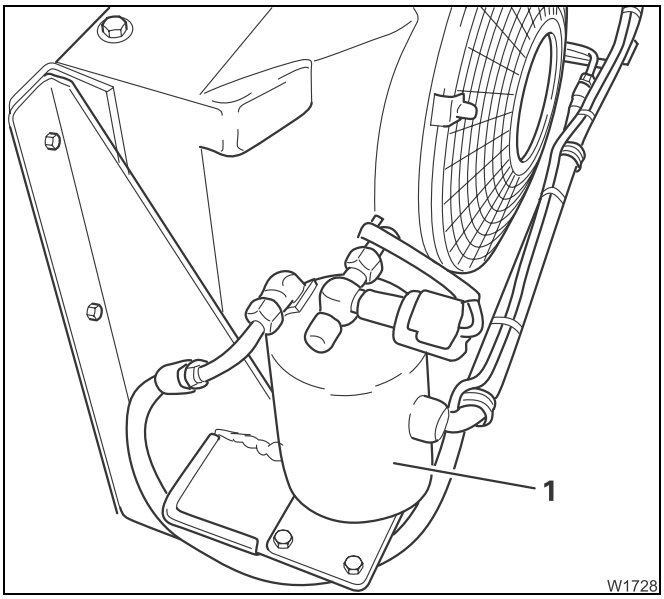
- Check all refrigerant hoses for damage and worn areas.

Only allow damaged hoses to be replaced by ***CraneCARE*** at the respective location.

25.06.2004

8.11.4 Checking the refrigerant collector

M 6

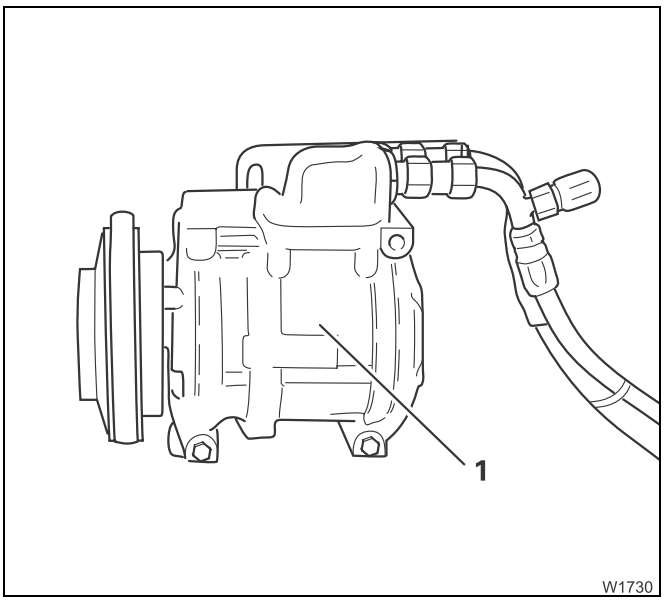


The refrigerant collector may only be checked by ***CraneCARE*** at the respective location!

For this, the refrigerant collector (**1**) must be checked externally for mechanical damage and corrosion by a qualified person according to the pressure container order (test group II). If the refrigerant collector is not in proper working condition, it must be replaced by ***CraneCARE*** at the respective location.

8.11.5 Checking the refrigerant compressor

M 6



The refrigerant collector may only be checked by ***CraneCARE*** at the respective location!

The refrigerant compressor (**1**) is directly on the engine underneath the fuel filter and can be reached through the opening on the right side of the turntable after the main boom has been raised.

- Have the refrigerant compressor checked for leaks. It is particularly important that the sealing of the drive shaft should be checked.

25.06.2004

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25.06.2004

8.12 Other maintenance work

8.12.1 Checking for correct operation of the auxiliary heater (additional equipment) M 1

Maintenance work is described in Section *Checking for correct operation of the auxiliary heater (additional equipment)*, p. 7 - 71.

For additional information, see *Operating instructions*, Chapter *Crane operation* in the Section *Crane cabin heating and ventilation, additional water heating system (additional equipment)*.

25.06.2004

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25.06.2004

9 Longer periods out of service

25.06.2004

25.06.2004

9 Longer periods out of service

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

Before the truck crane is put out of service

- Clean the crane thoroughly inside and outside.
- Remove rust and touch up the paintwork.
- Parts which are not painted must be lubricated with an acid-free grease or oil.
- If more than half of the oil change interval has passed:
- Change the oil according to the maintenance plans **M 3** to **M 12**.
- Seal all air filters.
- Increase the tyre pressure by 10% and mark the tyre setting or support the truck crane and let it stand with support.

When the crane is out of service

- Check the levels in the fuel tanks. Always keep the tanks filled.
- Check the batteries every week and recharge them if necessary.
- Check tyre pressure every week and inflate the tyres if necessary.
- Perform a full functional check of the truck crane every two weeks. (Open all air filters before the function test.)
  Run the hydraulic systems up to a fluid temperature of approx. 50 °C (122 °F) and check all functions of the carrier and superstructure hydraulic systems.
- Ensure that the tyre positioning is different each time the crane is parked (without outriggers).
- Seal all air filters again.

If the crane is out of service for more than 12 months:

- Carry out all maintenance work in accordance with maintenance plan **M12**.

25.06.2004

Before putting the truck crane back into operation

- Open all air filters.
- Inflate the tyres up to the prescribed pressure.
- Carry out periodic maintenance work in accordance with the maintenance plans in chapter *Maintenance overview*, p. 5 - 1.

25.06.2004

10 Tightening torques

25.06.2004

25.06.2004

10 Tightening torques

10.1 Tightening torques for retaining bolts

Metric standard screw-thread Metric fine screw-thread			Approximate value		
Thread size (mm)	Spanner width (mm)		Tightening torques (highest permitted screw tension) for oiled screws (Nm)		
			Screw quality		
	Hexagon screw	Cylinder screw	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	1080 1170
M 30	46	22	1300	1800	2160
M 33	50	24		2700	
M 36	55	27		3300	

25.06.2004

10.2 Special tightening torques

Description	Thread size (mm)	Spanner width (mm)		Tightening torque (Nm)
		Hexagon screw	Cylinderscrew	
Suspension strut:				
Between vehicle frame/upper guide case (above)	M 16	—	17	265
Between vehicle frame/upper guide case (below)	M 24	—	19	900
Support element / steering split shell	M 16	—	14	265
Support element / operating head	M 20	30	17	520
Locking screw for spherical-head connection steering linkage Head ∅ = 40 mm	M 12 x 1.5	19	—	70 - 90
Locking screw for spherical-head connection steering linkage Head ∅ = 50 mm	M 14 x 1.5	22	—	160 - 180
Wheel nut	M 22 x 1.5	32	—	650
Clamping bolt for the Ball slewing connection	M 27	41	—	1395
Rope clamp for the hoist drum	M 10	17	—	46

25.06.2004

Appendix

25.06.2004

25.06.2004

Appendix

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

Crane model: .....
Work number: .....
Commissioned on: .....
Winch serial number in accordance with model plate: .....
Last general overhaul performed on: .....
Winch design data (see operating instructions):
Power unit group: .....
Load spectrum: .....
Collective load factor: .....
Theoretical service life: .....

Inspection interval no. (max. 1/year)	Date of commission/date of inspection	Operational condition since the last inspection	Collective load factor Km_i	Operating hours of the entire crane [h]	Operating hours of the superstructure [h]	Operating hours of the superstructure since the last inspection [h]	Operating hours of the winch [h]	Operating hours of the winch since the last inspection [h]	Used proportion of theoretical service life: $S_i = \frac{Km_i}{Km} \times T_i$ [h]	Remaining theoretical service life $D_i = D_{i-1} - S_i$ [h]	Name of competent person	Signature	Note	Name of the approved inspector	Signature
(*)															

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

Alternative provision, refer to section 5.4.2, p. 5 - 28.

Last general overhaul performed on .....

S_i = Used proportion of theoretical service life since the last inspection

D_i = Remaining theoretical service life

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

Km = Load spectrum factor established during winch calculation.
This factor is given in the operating instructions.

Km_i = Load spectrum factor in the inspection interval "i" according to section 2.1

T_i = Effective working hours in the inspection interval "i" according to section 2.2

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

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

Crane model: .....
Work number: .....
Commissioned on: .....
Winch serial number in accordance with model plate: .....
Last general overhaul performed on: .....
Winch design data (see operating instructions):
Power unit group: .....
Load spectrum: .....
Collective load factor: .....
Theoretical service life: .....

Inspection interval no. (max. 1/year)	Date of commission/date of inspection	Operational condition since the last inspection	Collective load factor Km_i	Operating hours of the entire crane [h]	Operating hours of the superstructure [h]	Operating hours of the superstructure since the last inspection [h]	Operating hours of the winch [h]	Operating hours of the winch since the last inspection [h]	Used proportion of theoretical service life: $S_i = \frac{Km_i}{Km} \times T_i$ [h]	Remaining theoretical service life $D_i = D_{i-1} - S_i$ [h]	Name of competent person	Signature	Note	Name of the approved inspector	Signature
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CAUTION:
A general overhaul is to be performed every 10 years.

Alternative provision, refer to section 5.4.2, p. 5 - 28.

Last general overhaul performed on .....

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Km_i = Load spectrum factor in the inspection interval "i" according to section 2.1

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

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