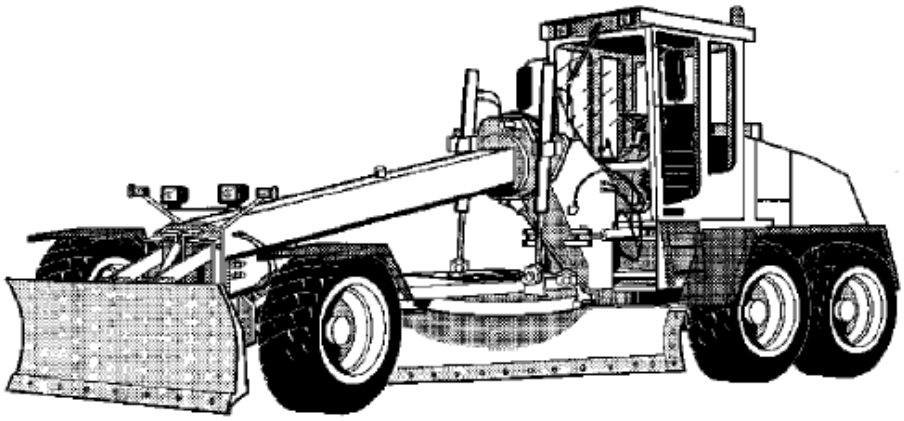
B A U M A S C H I N E N

HBM-NOBAS

Günter Papenburg AG

Maintenance instructions

BG 190TA-4



Motor Grader

Motorgrader

Niveleuse

englisch

01/2010

Motor Grader
Motorgrader
Niveleuse

BG 190TA-4

Maintenance instructions
Wartungsanleitung
Instructions d’entretien

01/2010 **HBM/NOBAS construction machine**

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1 Preface

Proper operation and care are important prerequisites for maintaining the serviceability of the building machine.
These maintenance instructions should always be within the machine operator’s reach.

Please read the maintenance instructions and safety rules carefully and follow them strictly. Carry out the inspections, checks and maintenance jobs at the specified intervals. Any guarantee claims will only be recognized if all the inspections, checks and maintenance work have been carried out properly and at the specified intervals before the date of damage/defect.

Be aware that regular maintenance and inspections can prevent unexpected and unnecessary downtimes.

Should troubles occur with the machine or equipment, report to the persons responsible for maintenance and repair. If a trouble may lead to consequential damage, put the machine out of operation and remedy the trouble.

Jobs marked with this symbol in the maintenance instructions should only be done by our agents’ expert staff.

At the printing date of this manual, the building machine described herein corresponded to the state of the art. In the interest of further development, we reserve the right to make changes to our products at any time without simultaneously updating these maintenance instructions. For this reason, we recognize no claims arising from technical data, descriptions and figures which deviate from those of the machine.

Note: The test, measuring, and diagnostic equipment mentioned in the maintenance instructions is not included in the machine's scope of supply. Please call your authorised service representative.

2 Safety regulations

As to the inspections, checks and maintenance of the building machine, the safety regulations of the country in which the machine is used and those of the trade association concerned are applicable.

The regulations specified in European standards EN 474-1 and EN 474-8 are applicable to this.

In the Federal Republic of Germany, the requirements are applicable in accordance with the material content of the "Operation" section in the accident prevention regulations for "earth-moving machinery" (VBG 40).

Control equipment may only be operated from the driver’s seat or operator’s stand.

Only the steps and platforms intended for climbing and walking may be used for the purpose. Their walksafe condition must be maintained.

Protections covering moving machine parts may only be opened after the drive has been stopped and secured against unintentional starting.

After the maintenance or repair work, all protections must be properly closed or replaced.
Such protections are, for example: engine covers, doors, safeguards, protective gratings, panels.

The breakdown coupling may only be used for towing vehicles which are not in working order. Towing a trailer with this coupling in road traffic is not permissible.

Keep out of the machine’s danger zone!

When the engine is running, keep also out of the frame articulation zone!

Do not stand under the lifted and unsecured grading equipment!

Before the execution of any welding work at the grader, make sure that the dynamo, the microprocessor and the battery are completely disconnected!

See also section 1.2 of the operation instructions for this machine; it is considered part of these maintenance instructions.

Original HBM-NOBAS parts are especially designed for HBM-NOBAS machines.

Please note that parts and accessories not supplied by us are not tested and approved by us. The use of such products may affect specific design characteristics of your machine negatively and, consequentially, have an adverse effect on the active and/or passive safety. The machine manufacturer is not liable for damage caused by the use of parts and accessories which are not original parts or accessories.

4 Drive engine

General Information

At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance.

Maintenance Schedule	
Daily or Refuelling - Maintenance Check [3]	**Section 4.1**
• Crankcase Breather Tube - Inspect	
• Fuel-Water Separator - Drain	
• Engine oil level - Check	
• Coolant Level - Check/Correct	
• Drive Belts - Check/Correct	
Every 250 hours or 3 months - Maintenance Check [3]	**Section 4.2**
• Air Cleaner Restriction - Check/Correct	
• Charge Air Cooler - Check/Correct	
• Charge Air Piping - Check/Correct	
• Radiator Hoses - Check	
• Air admission line - Check	
• Cooling Fan - Check	
Every 500 hours or 6 month - Maintenance Check [1, 2, 3]	**Section 4.3**
• Engine Coolant - Antifreeze Check	
• Fuel Filter, Spin-on-Type - Replace	
• Lubricating Oil and Filters - Change	
Every 1000 hours or 1 year - Maintenance Check [3]	**Section 4.4**
• Cooling Fan Belt Tensioner - Check/Correct	
• Fan Hub, Belt-Driven - Check/Correct	
Every 2000 hours, or 2 years - Maintenance Check [2, 3]	**Section 4.5**
• Cooling System - Drain, Flush, and Fill	

(1) The lubricating oil and lubricating oil filter interval can be adjusted based on application, fuel consumption, gross vehicle weight, and idle time. See the Oil Drain Intervals in this section.

(2) Antifreeze check interval is every oil change or 500 hours or 6 months, whichever occurs first. The operator **must** use a heavy-duty year-round antifreeze that meets the chemical composition of GM6038M. The antifreeze change interval is 2 years or 2000 hours whichever occurs first. Antifreeze is essential for freeze, overheat, and corrosion protection.

(3) Follow the manufacturer's recommended maintenance procedures for the starter, alternator, generator, batteries, electrical components, exhaust brake, charge air cooler, radiator, air compressor, air cleaner, freon compressor, and fan clutch. Refer to Procedure 203-001 (Component Manufacturers) in Section M.

Oil Drain Intervals		
American Petroleum Institute Classification (API)	**European Classification (ACEA)**	**Engine Rating is 260Hp [194] or less**
API CH-4/SJ	ACEA E-5	500 hours or 6 months

Maintenance Record

Maintenance Record	
Engine Serial No.:	Engine Model:
Owner's Name:	Equipment Name/Number:

Date	km [Miles], hours or Time Interval	Actual km [Miles] or hours	Maintenance Check Performed	Check Performed By	Comments

4.1 Daily Maintenance Procedures

4.1.1 Daily Maintenance Procedures - Overview

General Information

Preventative maintenance begins with day-to-day awareness of the engine and its system. Before starting the engine, check the oil and coolant levels. Look for:

- Leaks
- Loose or damaged parts
- Worn or damaged belts
- Any change in engine appearance.
- Odor of fuel

Engine Operation Report

The engine **must** be maintained in top mechanical condition if the operator is to get optimum satisfaction from its use. The maintenance department needs daily running reports from the operator to make necessary adjustments in the time allocated. The daily running reports also helps to make provisions for more extensive maintenance work as the reports indicate the necessity.

Report to the maintenance department any of the following conditions:

- Low lubricating oil pressure
- Low power
- Power increases or engine surge
- Erratic or no accelerator control or response
- Any warning lights flashing or staying on
- Abnormal water or oil temperature
- Unusual engine noise
- Excessive smoke
- Excessive use of coolant, fuel, or lubricating oil
- Any fuel, coolant, or lubricating oil leaks
- Loose or damaged parts
- Worn or damaged belts

Unusual Engine Noise

Fig. 4.1.1/1

During daily maintenance checks, listen for any unusual engine noise that can indicate that service is required.

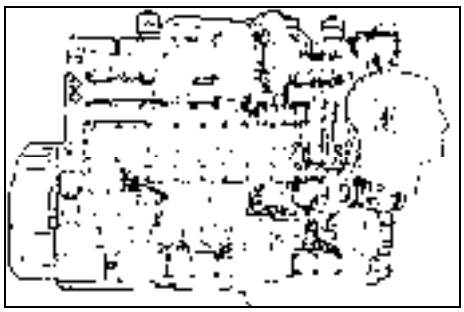


Fig. 4.1.1/1

4.1.2 Crankcase Breather Tube

Fig. 4.1.2/1

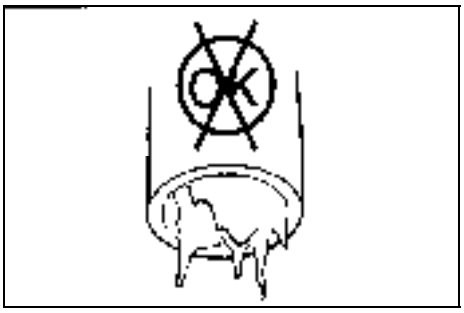


Fig. 4.1.2/1

Maintenance Check

Inspect the breather tube for sludge, debris, or ice in the tube.
The tube must be free.
Inspect the tube more frequently in icy conditions.
The line must be laid freely, and must not be kinked.

4.1.3 Fuel-Water Separator

Drain

Warning!
Drain the water-fuel separator into a container and dispose of in accordance with local environmental regulations.

Drain the water and sediment from the separator daily.

Spin-on Type

Fig. 4.1.3/1

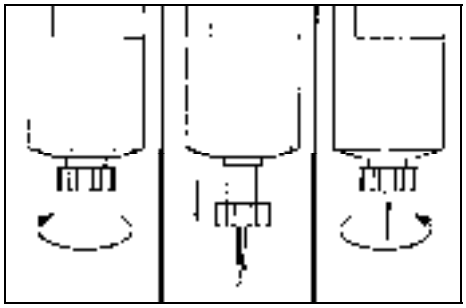


Fig. 4.1.3/1

Shut off the engine.
Use your hand to open the drain valve. Turn the valve **counterclockwise** approximately 3½ turns until the valve drops down 25,4mm [1in] and draining occurs.
Drain fluid from the filter bottom part until you see clear fuel flowing out.

Caution!
When closing the drain valve, do not overtighten the valve. Overtightening can damage the threads.

To close the valve, lift the valve and turn **clockwise** until it is hand-tight.

4.1.4 Lubricating Oil Level

Fig. 4.1.4/1

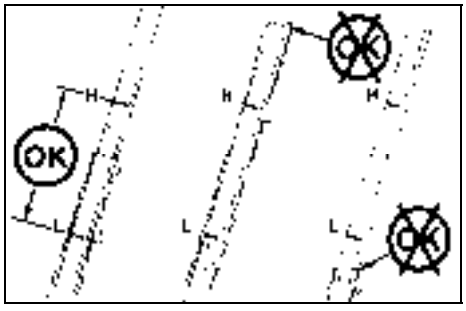


Fig. 4.1.4/1

Maintenance Check

Caution!
Never operate the engine with oil level below the L (low) mark or above the H (high) mark. Poor engine performance or engine damage can occur.

The engine **must** be level when checking the oil level to make sure the measurement is correct.
Shut off the engine for an accurate reading.
Wait at least 15 minutes after shutting off the engine to check the oil level. This allows time for the oil to drain into the oil pan.
For further recommendations on lubricating oil, see the maintenance specifications (chapter 20).

4.1.5 Coolant Level

Fig. 4.1.5/1 to Fig. 4.1.5/3

Maintenance Check

Warning!
Do not remove a pressure cap from a hot engine. Wait until the coolant temperature is below 50 °C (122 °F) before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

Caution!
Never use a sealing additive to stop leaks in the cooling system. This can result in cooling system plugging and inadequate coolant flow, causing the engine to overheat.

The coolant level **must** be checked daily.

Caution!
Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 50 °C (122 °F) before adding coolant.

Make up coolant added to the engine **must** be mixed with the correct proportions of antifreeze, supplemental coolant additive, and water to avoid engine damage.

Coolant recommendations and specification details on correct mixing of coolant can be found in Maintenance Specifications (Section 22).

Fill the cooling system with coolant to the bottom of the fill neck in the radiator fill or expansion tank.

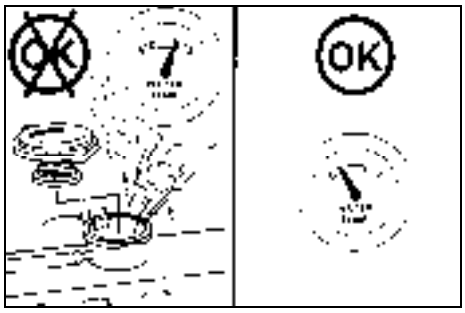


Fig. 4.1.5/1

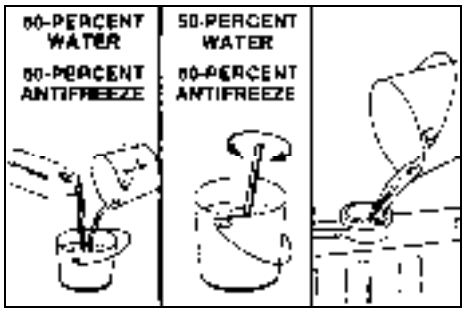


Fig. 4.1.5/2

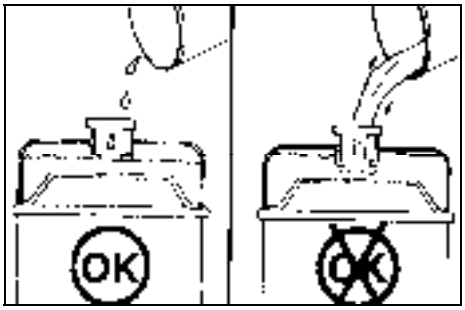


Fig. 4.1.5/3

4.1.6 Drive Belts

Fig. 4.1.6/1

Maintenance Check

Cogged Belt

Inspect the belts daily. Replace the belts if they are cracked, frayed, or have chunks of material missing. Small cracks are acceptable.

Adjust the belts that have a glazed or shiny surface, which indicates belt slippage. Correctly installed and tensioned belts will show even pulley and belt wear.

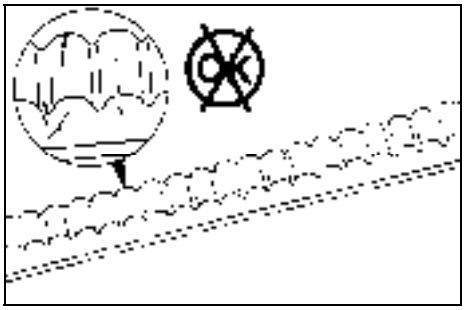


Fig. 4.1.6/1

Belt damage can be caused by:

- Incorrect tension
- Incorrect size or length
- Pulley misalignment
- Incorrect installation
- Severe operating environment
- Oil or grease on the belts

4.2 Maintenance Procedures at 250 hours or 3 months

4.2.1 Air Cleaner Restriction

Maintenance Check

Refer to item 6.1of the maintenance instructions.

Caution!
Never operate the engine without an air cleaner. Intake air must be filtered to prevent dirt and debris from entering the engine and causing premature wear.

4.2.2 Charge-Air Cooler

Fig. 4.2.2/1

Maintenance Check

Inspect the charge-air cooler (CAC) for dirt and debris blocking the fins. Check for cracks, holes, or other damage. If damage is found, refer to the vehicle, vessel, or equipment manufacturer.

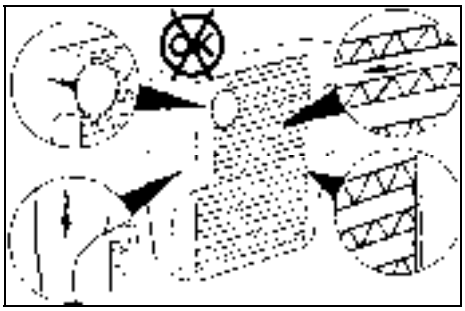


Fig. 4.2.2/1

4.2.3 Charge-Air Piping

Fig. 4.2.3/1

Maintenance Check

Inspect the charge-air piping and hoses for leaks, holes, cracks, or loose connections. Tighten the hose clamps if necessary.

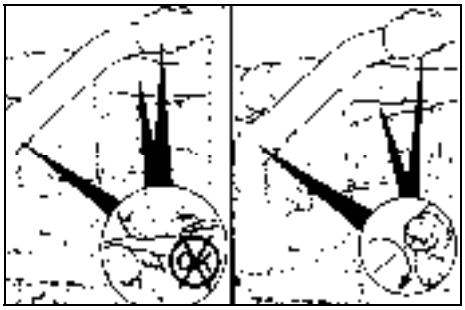


Fig. 4.2.3/1

4.2.4 Radiator Hoses

Fig. 4.2.4/1

Maintenance Check

Check all hoses for cracks, cuts, or collapsing.

Note: The silicone engine coolant hose will exhibit swelling due to the elasticity of the hose.

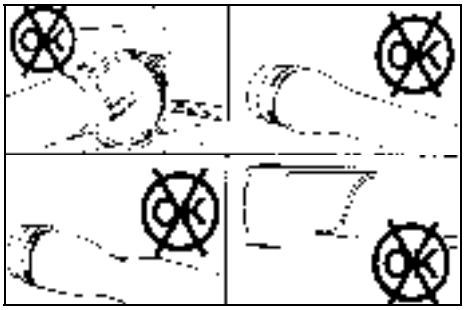


Fig. 4.2.4/1

4.2.5 Air Intake Piping

Fig. 4.2.5/1

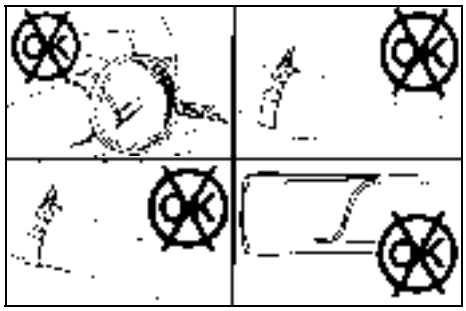


Fig. 4.2.5/1

Maintenance Check

Visually inspect the intake piping daily for wear points and damage to piping, loose clamps, or punctures that can damage the engine.

Replace damaged pipes, and tighten loose clamps, as necessary, to prevent the air system from leaking.

Torque Value: 8 Nm [72 in-lb]

Check for corrosion under the clamps and hoses of the intake system piping. Corrosion can allow corrosive products and dirt to enter the intake system. Disassemble and clean, as required.

4.2.6 Fan, Cooling

Fig. 4.2.6/1 to Fig. 4.2.6/3

Inspect for Reuse

Warning!
Do not rotate the engine by pulling or prying on the fan. The fan blade(s) can be damaged and cause the fan to fail and cause personal injury or property damage. Use the accessory drive shaft or the crankshaft barring tool to rotate the crankshaft.

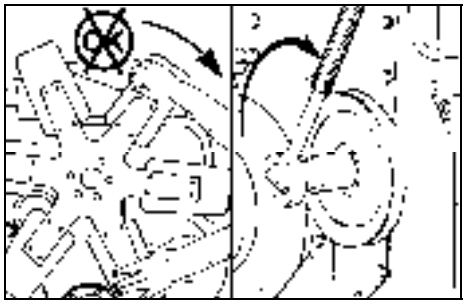


Fig. 4.2.6/1

Warning!
Do not straighten a bent fan blade or continue to use a damaged fan. A bent or damaged fan blade can fail during operation and cause personal injury or property damage.

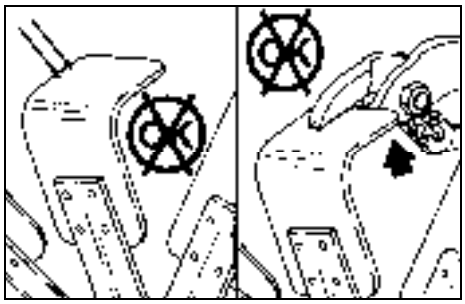


Fig. 4.2.6/2

Replace a damaged fan by a new fan with the same part number. Any other change or modification to the fan requires a prior authorization by the manufacturer to be covered by warranty.

The tightening torque for the hexagon bolt is 40 Nm.

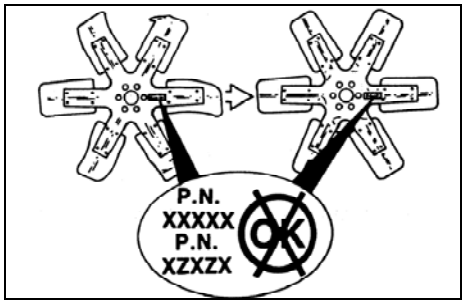


Fig. 4.2.6/3

4.3 Maintenance Procedures at 500 hours or 6 months

4.3.1 Cooling System

Maintenance Check - coolant

Refer to item 22 of the maintenance instructions.

4.3.2 Fuel Filter (Spin-On Type)

Remove

Fig. 4.3.2/1

Remove the spin-on fuel filter with fuel filter wrench.

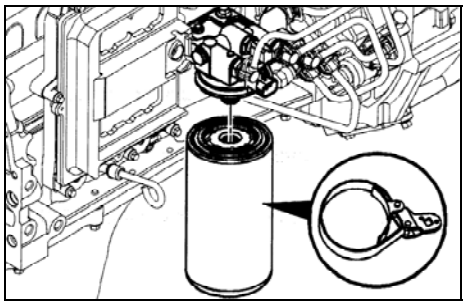


Fig. 4.3.2/1

Install

Fig. 4.3.2/2

Note: Do not prefill the fuel filter.

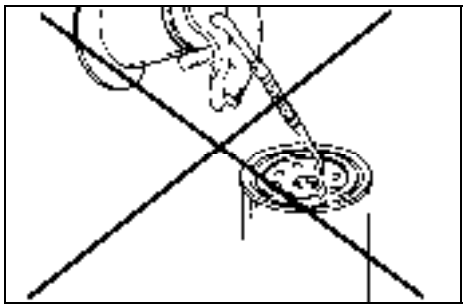


Fig. 4.3.2/2

Caution!
Do not pre-fill the on-engine fuel filter with fuel. The system must be primed after the fuel filter is installed. Pre-filling the fuel filter can result in debris entering the fuel system and damaging fuel system components.

Lubricate the o-ring seal with clean lubricating oil.

Caution!
Mechanical overtightening will distort the threads, filter element seal, or filter can.

Use the correct fuel filter (see spare parts catalogue, page 25.001).
Install the filter on the filter head. Tighten the filter until the gasket contacts the filter head surface.
After making contact, tighten the fuel filter by another ¾ turn.

Torque Value: 34 Nm [25 ft-lb]

Prime fuel system after fuel filter installation.

Prime

Fig. 4.3.2/3

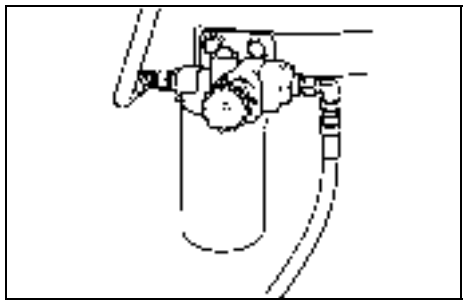


Fig. 4.3.2/3

Warning!
The fuel pump high-pressure fuel lines and fuel rail contain very high-pressure fuel. Never loosen any fittings while the engine is running. Personal injury and property damage can result.

Use the installed filling device to fill the engine. Typically, a priming pump is installed at or near the prefilter. Use lever movements (hand pump) to fill the low pressure system.

Note: It is **not** necessary to vent air from the high pressure system before starting the engine.

Note: It is **not** necessary to pre-fill the on-engine fuel filter.

Operate the engine and check for leaks.

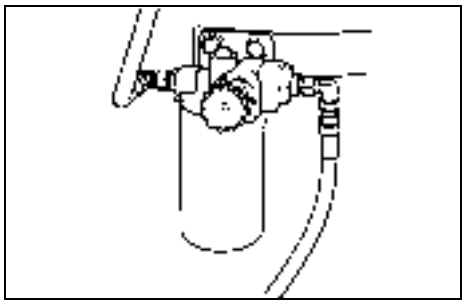


Fig. 4.3.2/3

4.3.3 Lubricating Oil and Filters

Drain

Fig. 4.3.3/1 and Fig. 4.3.3/2

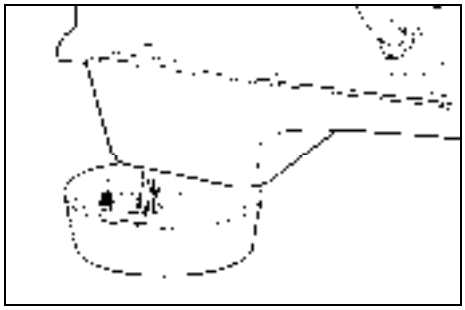


Fig. 4.3.3/1

Warning!
Some state and federal agencies have determined that used engine oil can be carcinogenic and cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil. If not reused, dispose of in accordance with local environmental regulations.

Warning!
To reduce the possibility of personal injury, avoid direct contact of hot oil with your skin.

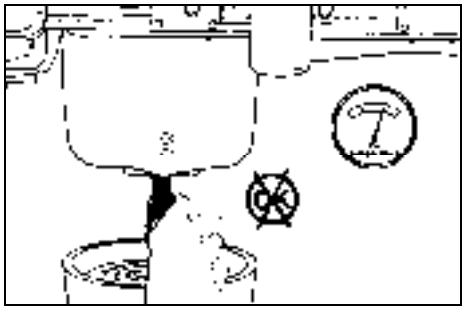


Fig. 4.3.3/2

Change the lubricating oil and filter(s) at the specified oil change interval. See the Maintenance Schedule to find the correct change interval for your application.

Note: The engine requires a tank with a capacity of not less than 18 litres of lubricating oil.

Operate the engine until the water temperature reaches 60 °C (140 °F).
Shut off the engine.
Remove the oil drain plug. Drain the oil immediately to be sure all the oil and suspended contaminants are removed from the engine.

Remove

Fig. 4.3.3/3

Clean the area around the lubricating oil filter head.

Use the oil filter wrench to remove the filter.

Clean the gasket surface of the filter head.

Note: The o-ring can stick on the filter head. Make sure it is removed before installing the new filter.

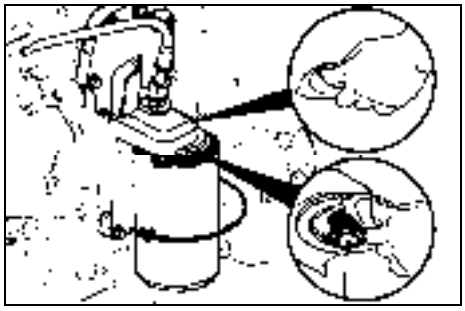


Fig. 4.3.3/3

Install

Fig. 4.3.3/4 to Fig. 4.3.3/6

Use the correct oil filter (refer to page 25.001 of the parts manual).

Caution!
The lack of lubrication during the delay until the filter is pumped full of oil at start- up can damage the engine.

Note: Do **not** prefill the oil filter.

Note: Be careful that **no** debris is poured into the filter. If using an oil supply with a metallic or plastic seal under the cap, be careful to peel the seal back. Puncturing the seal with a knife or sharp object can create debris in the oil container.

Caution!
Mechanical overtightening of filter can distort the threads or damage the filter element seal.

Den Install the filter on the oil filter head. Tighten the filter until the gasket contacts the filter head surface.
Tighten ¾ to 1 turn after gasket makes contact with the filter head.

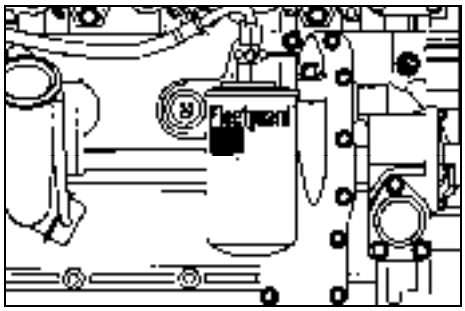


Fig. 4.3.3/4

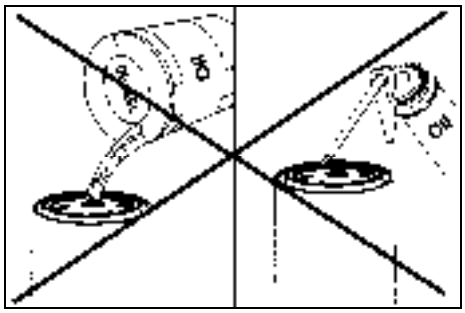


Fig. 4.3.3/5

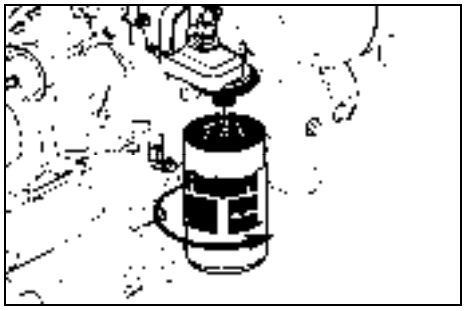


Fig. 4.3.3/6

Fill

Fig. 4.3.3/7

Fill the engine with clean lubricating oil to the proper level (H).

Note: Total system capacity assumes lubricating oil pan plus lubricating oil filter.

Idle the engine to inspect for leaks at the drain plug and, if replaced, the oil filter seal.

Stop the engine, and wait approx. 5 minutes.
Check the level again.
If necessary, top up oil until the top level mark (H) at the dip stick is reached.

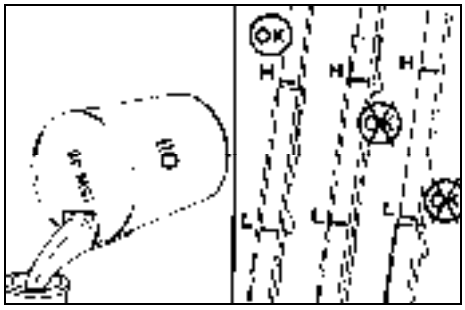


Fig. 4.3.3/7

4.4 Maintenance Procedures at 1000 hours or 1 year

4.4.1 Cooling Fan Belt Tensioner

Fig. 4.4.1/1 to Fig. 4.4.1/5

Maintenance Check

With the engine turned off, check that neither the top nor bottom tensioner arm stop is touching the cast boss on the tensioner body. If either of the stops is touching a boss, the alternator belt **must** be replaced. Check to make certain the correct belt part number is being used if either condition exists.

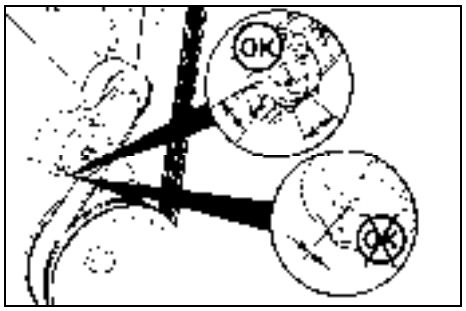


Fig. 4.4.1/1

Warning!
When using a steam cleaner, wear safety glasses or a face shield, as well as protective clothing. Hot steam can cause serious personal injury.

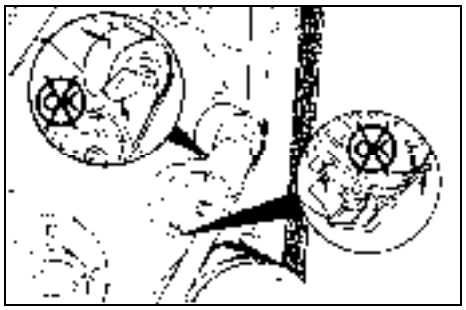


Fig. 4.4.1/2

Warning!
Wear safety glasses or a face shield, as well as protective clothing, to prevent personal injury when using a steam cleaner or high-pressure water.

Check the tensioner pulley and body for cracks. If any cracks are noticed, the tensioner **must** be replaced. Please ask your service representative.

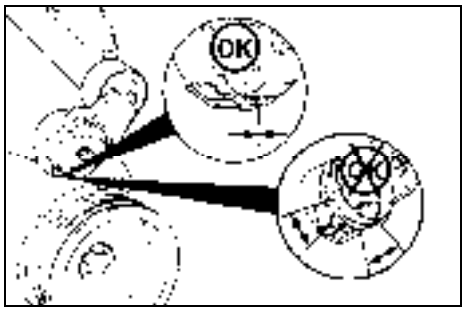


Fig. 4.4.1/3

Check the tensioner for dirt buildup. If this condition exists, the tensioner **must** be removed and steam cleaned.

With the cooling fan belt removed, check that the bottom tensioner arm stop is in contact with the bottom tensioner arm stop boss on the tensioner body. If these two are **not** touching, the tensioner must be replaced.

Inspect the tensioner for evidence of the pivoting tensioner arm contacting the stationary circular base. If there is evidence of these two areas touching, the pivot tube bushing has failed and the tensioner **must** be replaced.

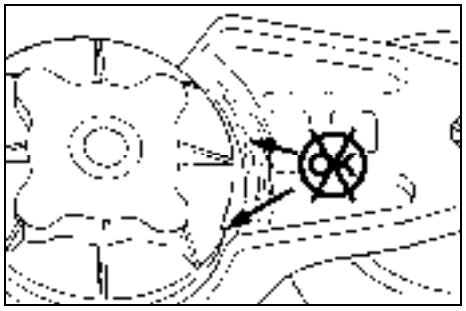


Fig. 4.4.1/4

The worn tensioner that has play in it or a belt that “walks” off its pulley possibly indicates pulley misalignment.

Note: Maximum pulley misalignment is 3 degrees.

This measurement can be taken with a straightedge and an inclinometer. Install the belt

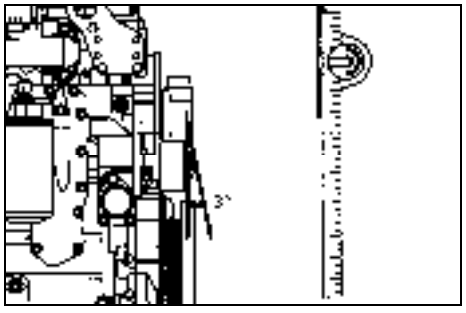


Fig. 4.4.1/5

4.4.2 Fan Hub, Belt Driven

Fig. 4.4.2/1 and Fig. 4.4.2/2

Maintenance Check

Remove the drive belt.

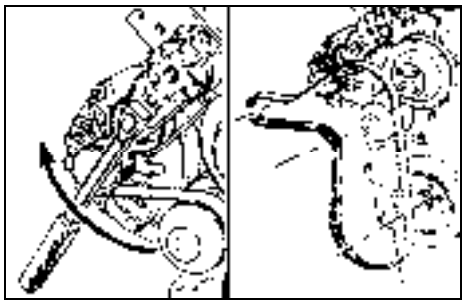


Fig. 4.4.2/1

Note: The fan hub **must** rotate without any wobble or excessive end play.

Fan Hub End Play		
mm		in
0.15	MAX	0.006

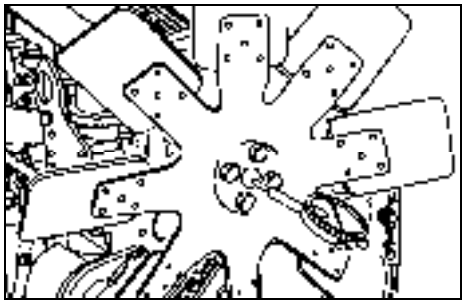


Fig. 4.4.2/2

4.5 Maintenance Procedures at 2000 hours or 2 years

4.5.1 Cooling System

Drain

Fig. 4.5.1/1 to Fig. 4.5.1/3

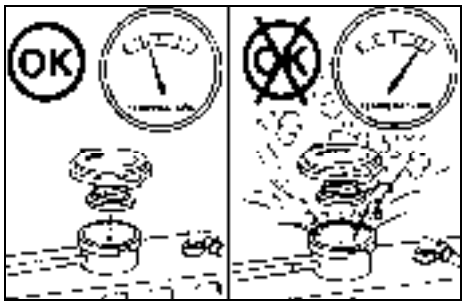


Fig. 4.5.1/1

Warning!
Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50 °C (122 °F) before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

Warning!
Coolant is toxic. Keep away from children and pets. If not reused, dispose of in accordance with local environmental regulations.

Drain the cooling system by opening the drain valve on the radiator and removing the plug in the bottom of the water inlet. A drain pan with a capacity of 19 liters will be adequate in most applications.

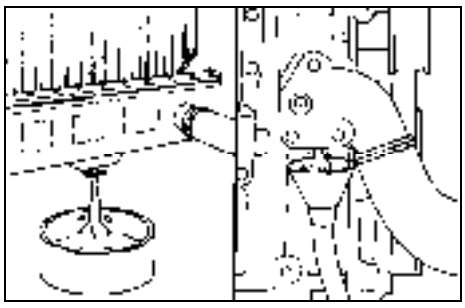


Fig. 4.5.1/2

Check for damaged hoses and loose or damaged hose clamps. Replace as required. Check the radiator for leaks, damage, and buildup of dirt. Clean and replace as required.

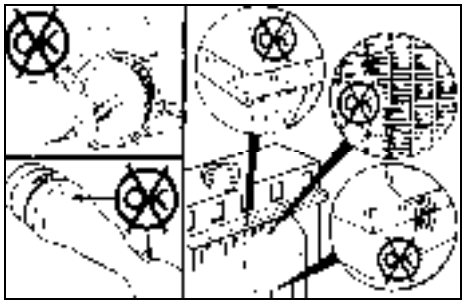


Fig. 4.5.1/3

Flush

Fig. 4.5.1/4 to Fig. 4.5.1/7

Caution!

The system must be filled properly to prevent air locks. During filling, air must be vented from the engine coolant passages. Wait 2 to 3 minutes to allow air to be vented; then add mixture to bring the level to the top.

Note: Adequate venting is provided for a fill rate of 19 liters/minute.

Caution!

Do not install the radiator cap. The engine is to be operated without the cap for this process.

Fill the system with a mixture of sodium carbonate and water (or a commercially available equivalent).

Note: Use 0.5 kg of sodium carbonate for every 23 liters of water.

Warning!

Coolant is toxic. Keep away from children and pets. Dispose of in accordance with local environmental regulations.

Operate the engine for 5 minutes with the coolant temperature above 80 °C (176 °F).

Shut the engine off, and drain the cooling system.

Fill the cooling system with good- quality water.

Note: Be sure to vent the engine for complete filling.

Note: Do **not** install the radiator cap.

Operate the engine for 5 minutes with the coolant temperature above 80 °C (176 °F).

Shut the engine off, and drain the cooling system.

Note: If the water being drained is still dirty, the system **must** be flushed again until the water is clean.

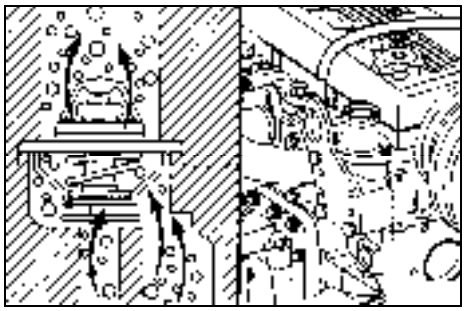


Fig. 4.5.1/4

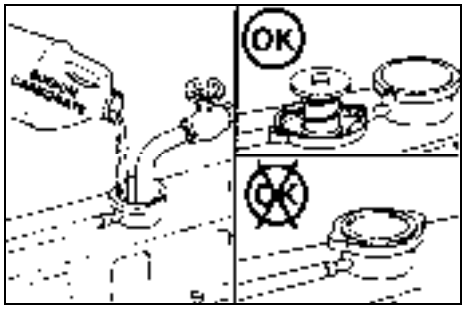


Fig. 4.5.1/5

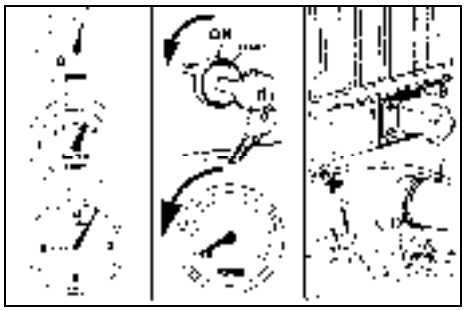


Fig. 4.5.1/6

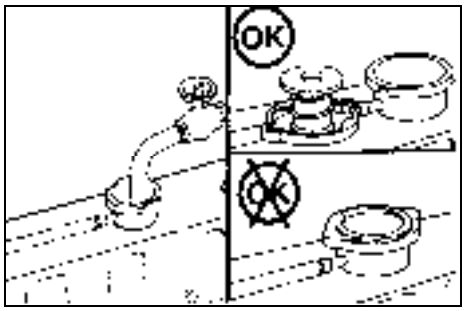


Fig. 4.5.1/7

Fill

Fig. 4.5.1/8 to Fig. 4.5.1/10

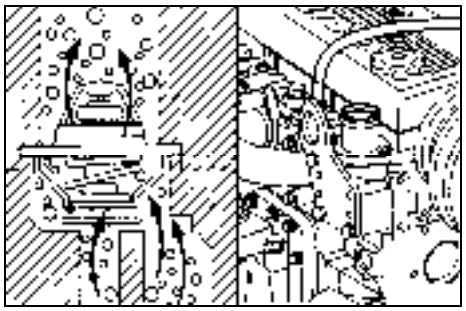


Fig. 4.5.1/8

Caution!

The system must be filled properly to prevent air locks. During filling, air must be vented from the engine coolant passages. Wait 2 to 3 minutes to allow air to be vented; then add mixture to bring the level to the top.

The system has a design fill rate of 19 liters per minute.

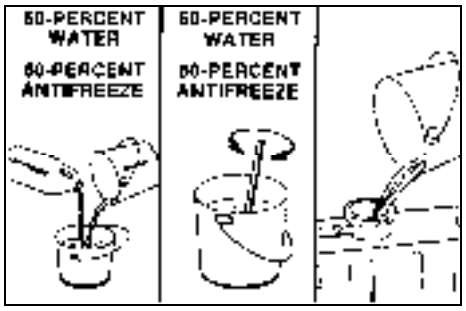


Fig. 4.5.1/9

Caution!

Never use water alone for coolant. Damage from corrosion can be the result of using water alone for coolant.

Use a mixture of 50-percent water and 50-percent ethylene glycol or propylene glycol antifreeze to fill the cooling system. Refer to the cooling system specifications in Section 19 for system capacity.

Install the pressure cap. Operate the engine until it reaches a temperature of 80 °C (176 °F) and check for coolant leaks.

Check the coolant level again to make certain the system is full of coolant or that the coolant level has risen to the hot level in the recovery bottle on the system, if so equipped.

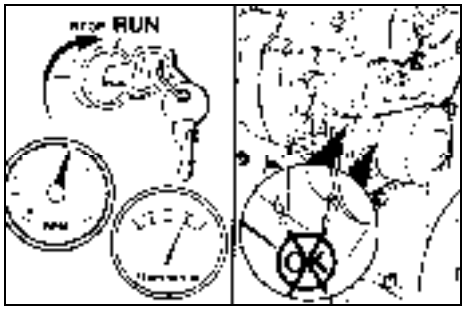


Fig. 4.5.1/10

5 Cooling system

5.1 Checking the coolant level

Fig. 5.1/1

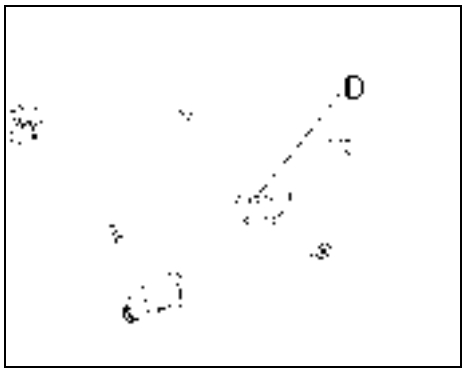


Fig. 5.1/1

Put down the engine horizontally, and turn off the engine. Slowly unscrew and remove the balance tank cover (D).

When the engine is cold, the coolant level should be at the lower end of the filler neck (water must be always visible). If required, top up coolant mix.

Let the engine run in low idle run for 2-3 minutes, afterwards. The control valve of the heating and ventilation system must be opened during this running (adjust to ”hot”). Check the coolant level once more, and add water, if required.

Note: The cooling system is filled with a long-term coolant for temperatures up to -37 °C (-35 °F). It consists of a mixture of water, anti-freeze, and anti-corrosion agents. The little losses by evaporation can be balanced with clean, soft water.

⚠ Be careful when opening the cover lid (D)!
Danger of burning if the machine is hot!

When the machine is hot, loosen the balance tank cover only to its first catch, and release the overpressure. Afterwards screw off the cover lid and take it off.
Check the overpressure and underpressure valve of the cover lid. Replace any damaged or defective cover.

The cooling system should be checked before the beginning of the cold season, and should have a frost resistance of up to -37 °C (-35 °F). If lower temperatures are expected the portion of the anti-freeze has to be increased.

Note: At min. 80 °C (176 °F), the cooling system runs in the small circuit. The thermostat opening is in an order of 88°C (190°F). The complete opening is reached at 96 °C (205 °F). The heating system is connected to the small circuit.

5.2 External cleaning of the cooler

Fig. 5.2/1

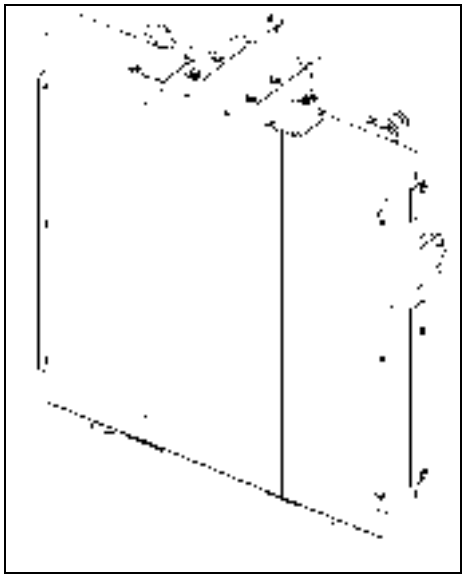


Fig. 5.2/1

Open the rear grid designed as a door.
The cooler contaminated on its outside can be cleaned by a water jet or by compressed air.
The water or are should be sprayed or blown against the blow direction of the fan through the cooler.

Note: The cleaning with water can only be carried out when the engine has cooled down. Do not spray against the insulation material.

6 Air filter system

Fig. 6/1 and Fig. 6/2

The air filter is a combined air filter with an integrated filter-element (1) and a safety cartridge. The rough dust is discharged through the dust discharge valve (S), almost free of maintenance. The discharge slot of the valve must be checked for cleanness daily. Remove possible dust accumulations; move the valve slightly for that purpose. The rubber piece must be always well seated and lay on the bottom.

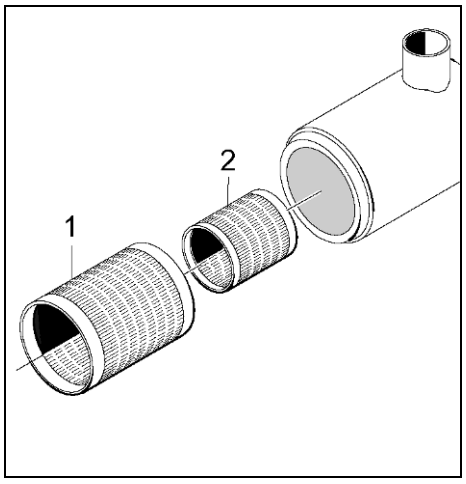


Fig. 6/1

6.1 Air filter

Fig. 6.1/1

The more the air filter insert is contaminated the higher becomes the underpressure in the suction line. If the extend of the contamination of the air filter insert becomes so high that the pressure drops below the permissible underpressure the warning lamp (2) in the cabin shines, and requests for the cleaning of the filter insert. To control the underpressure, an underpressure switch is installed in the suction line. It is adjusted to the permissible limit of underpressure.

The filter element has be cleaned. However, it has to be replaced not later than after the **6th cleaning** or after 2,000 operating hours, at the latest. The control light expires to start the engine, after the cleaning of the filter element.

Notwithstanding the indication by the control lamps, the filter insert should be checked for its state from time to time. A damaged or deformed filter insert must be replaced immediately. The safety filter is replaced after every **3rd cleaning** of the filter insert.

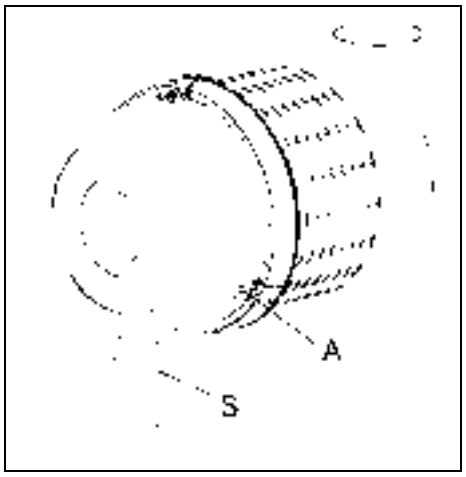


Fig. 6/2

The filter element must not be cleaned!

The maintenance of the air filter shall only be carried out with the engine switched off. The functioning of the indicator lamp in the cabin to check the filter must be checked every day, by operating the control switch (42). When the switch is operated, the control lamp (2) must shine.

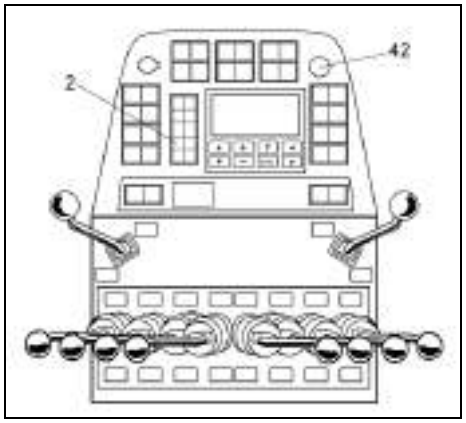


Fig. 6.1/1

6.1.1 Replacement, removal and insertion of the filter insert

Fig. 6/1 and Fig. 6/2

The air filter is opened by a locking system (toggle fasteners A). Remove the air filter casing component after opening the toggle fasteners.
The filter element (1) and safety cartridge (2) can now be removed, and cleaned or exchanged.
Check the seal and its seating face in the filter casing.
Check the seal on the filter cover.
The filter insert and the safety cartridge are fitted in the reverse order to their disassembly.

6.1.2 Blowing-off the filter insert
Fig. 6/6

The dry cleaning can be carried out with compressed air up to a maximum pressure of **6 bar** (87 Psi).

For this, the air nozzle is moved up and down at a minimum distance of approx. 3 cm (1.2 in.) from the paper.

The cleaning is made from the inside to the outside.

The cleaning is finished as soon as no dust is discharged any more.

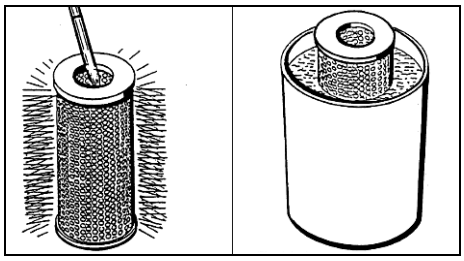


Fig. 6/6

⚠ **CAUTION!** Do not clean the filter insert by hitting it.

6.1.3 Checking the filter insert
Fig. 6/7

The filter paper is checked by a glow bulb which is inserted into the filter insert. The smallest damage can be seen by a light beam.
If the filter paper or the gasket are damaged the filter insert has to be replaced by a new one.

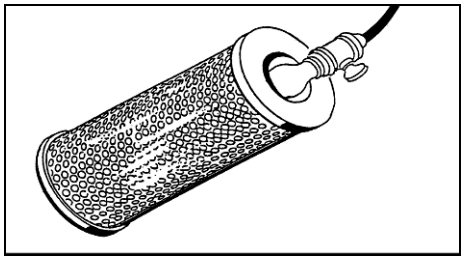


Fig. 6/7

6.1.4 Replacement of the safety cartridge
Fig. 6/8

The safety cartridge is replaced after every **3rd cleaning** of the filter insert.

⚠ The safety cartridge must not be cleaned!

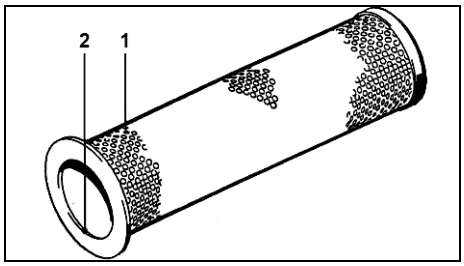


Fig. 6/8

Note: The filter has to be replaced with the engine being switch off only! A contaminated safety filter indicates a damaged filter insert.

Check the new safety filter (1) for damages by using a lamp.
Check the gasket (2) of the safety filter and its contact surface in the filter casing.
The installation is carried in reciprocal order.

7 Powershift transmission

7.1 Gear type 6 WG 160

Fig. 7.1/1 shows the schematic structure of the Ergopower gear.

For all activities at the gears, urgently comply with the prescribed safety regulations acc. to § 6 of the Regulation on the Prevention of Accidents at Propulsion Units.
For example, the machine must be secured by wedges against rolling away, and articulated vehicles additionally against unintended turning (frame lockage).

At the following operations, the ignition must be switched off and the control unit plug must be pulled off from Electronics:

At any kind of electrical operations on the vehicle.
At welding operations on the vehicle.
At insulation tests on the electrical system.

Installation scheme 6 WG-160
1 = Oil dipstick
2 = Power take-off
3 = Electro hydraulic control
4 = Output
5 = Converter bell
6 = Oil drain
7 = Parking brake

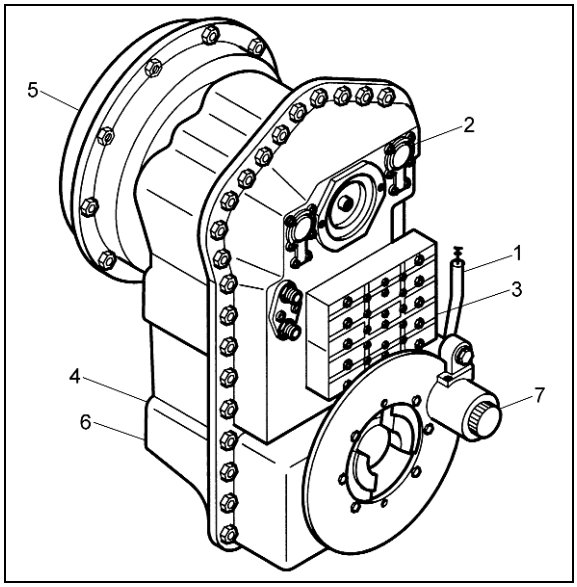


Fig. 7.1/1

Checking the oil level

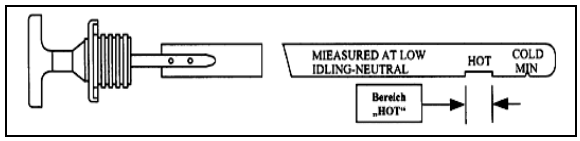


Fig. 7.1/2

The oil level check must be carried out as follows:

- Oil level check (weekly)
- At horizontally standing vehicle
- Transmission in Neutral position “N”
- In the cold start phase, the engine must be running about 2 - 3 minutes at idling speed, and the marking on the oil dipstick must then be lying above the cold start mark “COLD MIN” (see Fig. 7.1/2)
- At operating temperature of the transmission (about 80 – 90 °C (176 – 194 °F))
- For diesel engine idle speed.
- Loosen oil dipstick by counterclock rotation, remove and clean it
- Insert oil dipstick slowly into the oil level tube until contacts is obtained, and pull it out again.
- On the oil dipstick, the oil level must be lying in the zone “HOT” (see fig. 7.1/2)
- Insert the oil dipstick again, and tighten it by clockwise rotation.

If the oil level has dropped in operating temperature condition below the “HOT” Zone, it is absolutely necessary to replenish oil according to approved oil grades (refer to item 21). An oil level above the “HOT” marking, is leading to a too high oil temperature.

Oil change

Oil change and filter replacement interval:

- First oil change after 100 operating hours in application.
- Every further oil change after 1000 operating hours in application, however at least once a year!
- At every oil change, the Fine filter (pressure filter) has to be replaced.

The oil change must be carried out as follows:

- Park the vehicle at a horizontal position, and open the oil drain plug to drain used oil while the gearbox is still at operating temperature (approx. 50 °C (122 °F). Unscrew the closing screw at the cooler top side to allow the cooler to drain.
- Clean the oil drain plug with magnetic insert and the sealing surface on the housing, and install it along with new O-ring again.
- Fill in oil (about 34 litres). The indicated value is a guide value. Binding is in any case the marking on the oil dipstick!
- Start the engine - idling speed
- Transmission in Neutral position “N”
- Top up oil up to the marking “COLD - MIN”
- Brake the vehicle, and allow the gearbox to heat up. Turn off the all-wheel drive (front axle), press the foot brake (decelerate the vehicle), and change into 6th gear.
- When operating temperature is reached (50 °C (122 °F)), change to all gears.
- On the oil dipstick, the oil level must be lying in the Zone “HOT”
- Insert the oil dipstick again and tighten it by clockwise rotation

At the initial filling of the transmission has to be considered that the oil cooler, the pressure filter as well as the pipes must get filled with oil. According to these cavities, the oil capacity to be filled in is greater than at the later oil fillings in the course of the usual maintenance service.

It is imperative to pay attention to absolute cleanliness of oil and filter.
Use approved oil grades only!

At every oil change it will recommend, to start the automatic calibration of the shifting elements (AEB).

Filter replacement

At the replacement of the filter in the main oil stream, pay attention that no dirt or oil sludge can penetrate into the circuit. Besides, the parking brake has to be covered, resp. protected from oil wetting.
At the mounting of the filter, any exertion of force has to be avoided.

The filter pressure regulating valve (bypass valve) has a filter plugging switch warning the driver when the fine filter is clogged. The fine filter must be replaced when the error code (BA) lights up in the display.

Replace the filter cartridge with every oil change.

The mounting of the filter must be carried out as follows:

- Do not top up the filter
- Cover the gasket with a small amount of oil.
- Screw the filter in until contact with the sealing surface is obtained and tighten it now by hand about 1/3 to ½ turn.

Handling the filter

Handle the filter with care when mounting, transporting or storing it. Defective filters must not be used!

Oil temperature
Fig. 7.1/3

The oil temperature in the gearbox sump is monitored by a temperature sensor in the electrohydraulic controller. An operating temperature of between 60 and 90 °C (140 - 194 °F) must not be exceeded in the sump. The gearbox oil temperature icon will light up on the display (D) whenever an excessive gearbox temperature is reached (see chapter 1.4.6). A higher temperature will not be reached unless a fault occurs in the machine, or unless the machine is driven in an inexpert manner.

Whenever an error is displayed (see chapter 1.4), stop the vehicle, check for any outside oil loss, and have the engine run at a rotational speed of 1200 - 1500 rpm at the neutral gear position.

Then, the temperature should fall quickly to normal values (within 2 or 3 minutes, approximately). If a normal temperature is not reached, there is a fault which needs to be corrected before operations can be resumed.

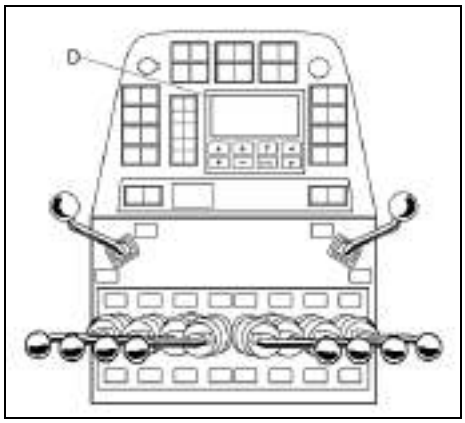


Fig. 7.1/3

8 Battery

Fig. 8/1

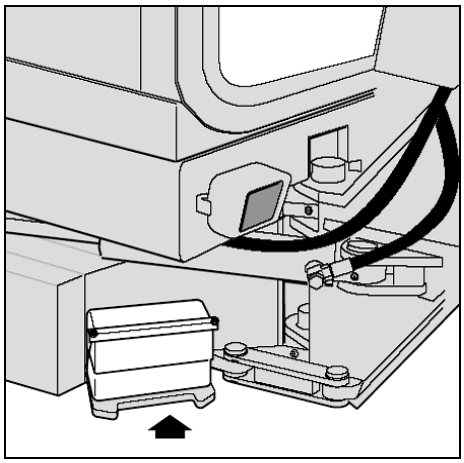


Fig. 8/1

Please also observe section 18 on the "Electric System".
The batteries are located at the rear part of the frame, to the left and right of the frame knuckle joint. There is easy access to the batteries after the fixing nuts of the protective hood have been loosened and the hood has been removed.
The batteries are maintenance-free acc. to DIN 43539-5.
Keep batteries clean and dry. Lubricate the clamp terminals with acid-free grease.

Checking of the acid level

Clean the batteries so that no dirt can reach into the cells after the plugs have been opened.
The level of the acid shall be at the acid-level mark or 15 mm (0.6 in.) above the upper edge of the plates.
Use distilled water for topping up. Do not use so-called improving agents.

Checking of the charging state

A fully charged battery has a density of 1.28 kg/l (10.68 lb/USgal) at 20 °C (68 °F), in tropical regions 1.23 kg/l (10.26 lb/USgal) with pure sulphuric acid for accumulators (acc. to VDE 0510). An insufficient charging state of the batteries requires a re-charging, as they do not ensure the starting of the engine, and can freeze at strong frost. The seating of the pole terminals must be straight, and they have to be coated with pole grease.

Caution:
Acid! Danger of burning! Danger of explosion! Do not use a naked flame, generate sparks or smoke in the near of it!
Do not place conducting items (tools) on the batteries.

Be sure to set the master switch to "Off" before starting any welding work.

Pull off the plug from the microcontroller (front axle) and from the power shift transmission control unit.
The plugs are located in the dashboard inside the driver's cab.

Pull off all contacts from the generator. During reinstallation, be sure to use the correct connection sequence.

9 Rear axle

Do not connect the (-) pole to the rear axle during any welding work carried out on the machine.

No welding is allowed at the rear axle!

9.1 Oil level checks

Checking the oil level in the axle transmission
Fig. 9/1

Park the machine in a horizontal position. Stop the engine. Slowly unscrew the checking screw (K).
The oil level should be at the bottom rim of the inspection hole. Top up oil if required.

Fig. 9/1

Checking the oil level in the tandems
Fig. 9/2

The oil level is shown at the inspection hole (K). The oil level should fill half the inspection hole. Top up oil if required.

Fig. 9/2

Checking the oil level in the wheel hubs (planetary gear set)
Fig. 9/3

Move the machine such that the wheel hub to a be checked is in a position where the closing screw (K) is horizontal. The oil level should be at the bottom rim of the borehole. Top up oil if required.

Fig. 9/3

9.2 Oil change at the rear axle

Always change the oil while it is warm. To do so, park the machine at a horizontal position. Do not allow any oil to drain into the soil. Always use containers to catch all oil. Replace the drain plug seal rings for every oil change.

⚠ Oil entering the soil will destroy human habitat.

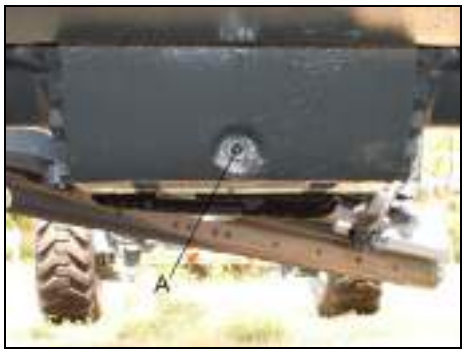


Fig. 9/4

Axle transmission oil change
Fig. 9/4 and Fig. 9.2/1

Unscrew drain plug (A) and fill plug (E), and drain oil to a container. Close the drain plug (A), and fill in oil. Check the oil level, and close the oil plug.

Fig. 9.2/1

Greasing the ball slewing ring
Fig. 9/5 and Fig. 9/6

Reminder: The ball slewing ring has 2 separate chambers for lubrication. Chamber 1 is a ball track, and chamber 2 is the antechamber with a protective grease fill.

The ball track (chamber 1) is already filled with grease. This is a so called "lifetime" grease fill, and does not need to be refilled.
The antechamber (chamber 2) must be regreased periodically using standard grease.

- Clean the areas around grease fitting (n° 90) and discharge screws (n° 92) 4x per ball slewing ring, and remove the black closing plugs.
- Open the closing screw n° II, and fill in grease through grease fitting (I) using a hand grease gun until grease comes out by about an inch at the closing screw (II).
- Then open the closing screw (IV), and fill in grease through grease fitting (III) using a hand grease gun until grease comes out by about an inch at the closing screw (IV).
- Close the opening again with closing screw and closing plug.

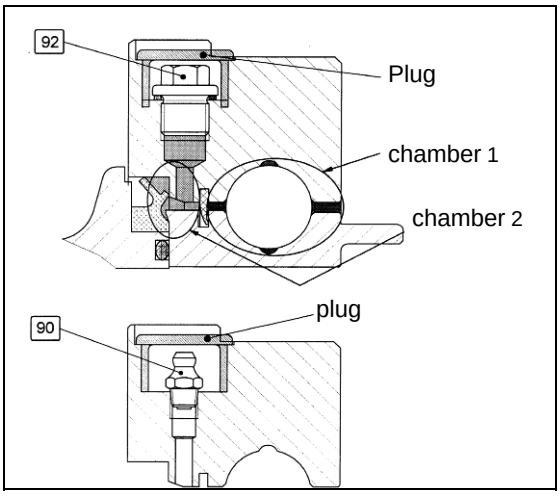


Fig. 9/5

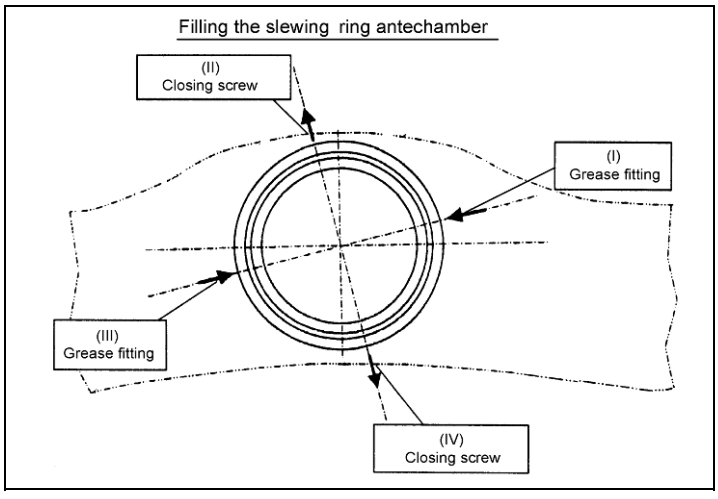


Fig. 9/6

Tandem oil change
Fig. 9/7 and Fig. 9/8

Unscrew the oil filler hole (E) cover, and unscrew the two oil drain plugs (A). Drain oil into a container. Close the drain plugs (A), and fill in oil until the level fills half the inspection hole (Fig. 9/2). Close the fill hole.

Fig. 9/7

Fig. 9/8

Wheel hub oil change (planetary gear set)
Fig. 9/3, Fig. 9/9 and Fig. 9/10

To drain oil, park the machine such that the oil drain plug (A) of the corresponding wheel is at the lowest position. Unscrew the drain plugs (A) and (B). Drain oil into a container. Close the drain ports (A) and (B). The torque used to tighten the drain plugs (A) and (B) is 45^{+5} Nm.

Fig. 9/9

Fig. 9/10

Oil drain plug (A) is checking screw (K).
To top up oil, park the machine to have the checking screw (K) in a horizontal position.
Unscrew oil plug (E) and checking screw (K).
Fill oil into the fill hole (E) until the oil level reaches the bottom edge of the checking screw (K).
Close oil plug (E) and checking screw (K) (use a torque of 45^{+5} Nm).

Fig. 9/3

Clean the area around the closing screws before unscrewing these screws.

9.4 Drive shafts

The drive unit must be in its rest position before working on the drive shaft(s). Stop the engine, block the grader to prevent it from rolling away, and prevent any restart of the drive unit by unauthorized third persons.

Fig. 9/9

Lubricate the joints as per lubrication chart during both installation and servicing. Relubrication is sufficient when fresh grease is flowing out at the gaskets.
Use only lithium soap grease of consistency grade 2 without MoS2 additives for relubricating the drive shafts.

The sliding sections should only be greased during installation. No further lubrication is needed after this.
Do not relubricate the sliding section unless the sliding section is pushed together!

Clean every grease fitting before greasing, and apply grease **slowly** using a grease gun.

When greasing, check the tight fit of screws and connecting flanges.

Drive shaft between engine and Ergopower transmission
Fig. 9.4/1

- 2 greasing points -

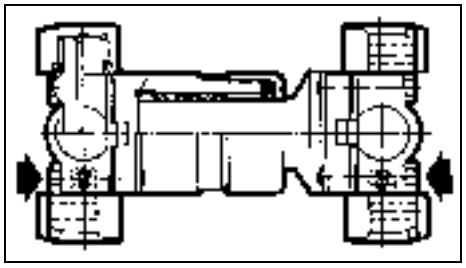


Fig. 9.4/1

Drive shaft between powershift transmission and rear axle differential

Lubrication is as for the drive shaft between engine and powershift transmission.

- 2 greasing points -

10 Front axle (not driven)

Fig. 10/1

The following points are to be greased at the intervals shown in the maintenance plan:

King pins (1) - 4 lubrication points
Axle (2) - 2 lubrication points
Tipping cylinder (3) - 2 lubrication points
Axles (4) - 4 lubrication points

Clean the lubricating nipple thoroughly before regreasing.

Wheel bearings

The grease level in the grease compartment of the wheel bearing must be checked after the number of operating hours shown in the maintenance plan, but in any case at least every two years. The covers must be unscrewed to do this. The grease compartment must be about 2/3 full with grease. The grease must be topped up as and when necessary.

When checking the grease fill in the wheel bearings, you should also check the wheel bearing clearance (tapered roller bearing), and readjust this clearance as follows. Tighten the tapered roller bearings with the slotted round nut against one another until no further rotation by hand is possible. Turn back the slotted round nut until the hub can be rotated freely (approx. 1/12 turn), and lock using a tab washer. Lock using both the 2nd slotted round nut and Loctite 648. Check whether the hub runs without stoppage and without tilting clearance.

The wheel bearing must be readjusted when the front axle is lifted, i.e. when the wheels do not touch the ground.

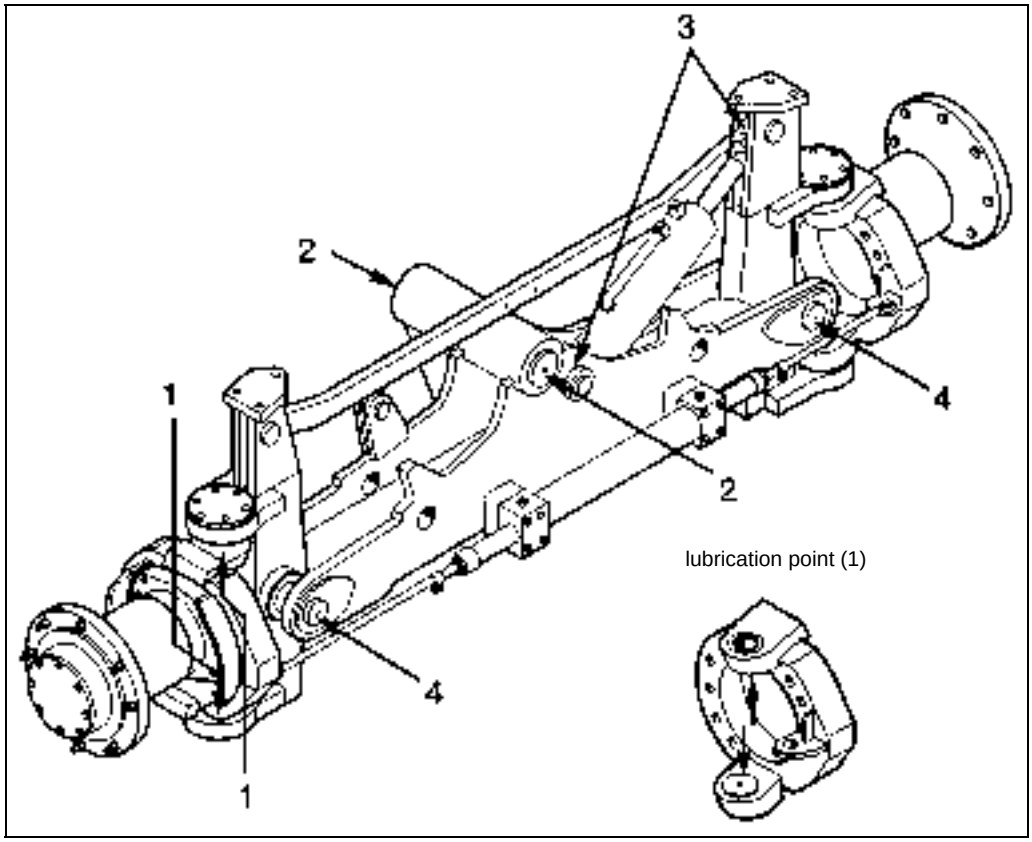


Fig. 10/1

11 Braking system

Fig. 11/1

The diagram of the operating brake system is shown in fig. 11/1. There is no specific maintenance obligation for the braking system.

Keep the whole system clean, and check it for leaks in compliance with the inspection schedule.

Four measuring points are provided for check measurements:

M1 = Storage pressure
M3 = Service brake pressure
M4 = Service brake pressure
M5 = Parking brake release pressure

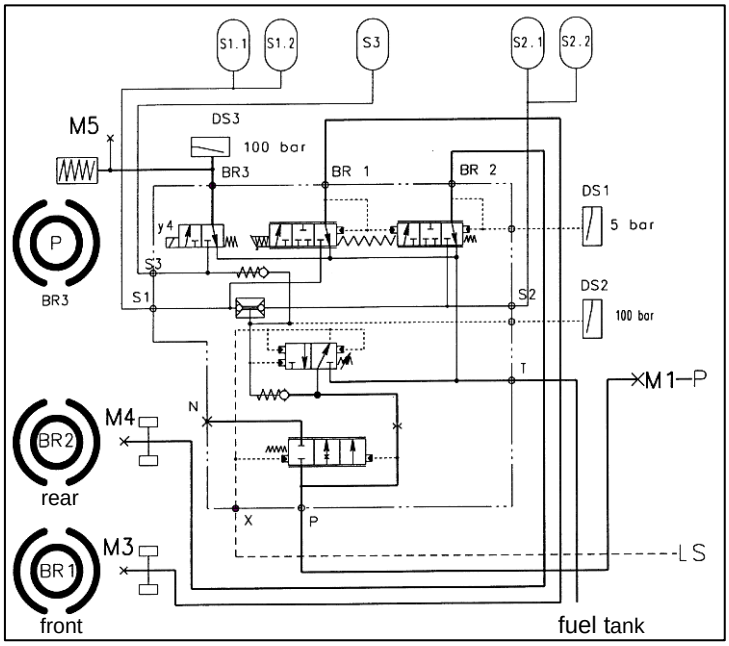


Fig. 11/1

Location of measuring points:

M1 = Right-hand control block output
M3 = Right-hand inside rear frame part (in the tandem rocker area)
M4 = Right-hand inside rear frame part (in the tandem rocker area)
M5 = Cab floor at the accumulator; connection BR3

Measured values:

M1 = Filled accumulators 24 bars during storage loading (short time) 123 - 150 bar
M3 = 90 - 5 bar
M4 = 90 - 5 bar
M5 = 123 - 150 bar

The complete brake valve will need to be changed when a fault occurs in the brake system.
The repair or modification of braking valves by unauthorised personnel is not permitted.
Irrespective of the brake pressure, priority is given to a pressure setting which achieves the specified deceleration rate of at least 5m/s².

Caution!
Maintenance and repair activities at the braking system shall be carried out by a specialist only, the safety regulations must be complied with.
The tanks of the braking system are exposed to high pressure.
Before lines are disconnected or before any other work at the hydraulic brake, the pressure in the pedal braking system must be reduced by pressing the brake pedal for 15 times, at least, with the engine turned off.

11.1 Parking brake

The parking brake is maintenance-free. It has to be checked for the wear of the brake lining in accordance with the maintenance and inspection schedule. The brake needs to be adjusted when the air gap is greater than 1.5 mm. Replace the brake lining if no further adjustment is possible.

11.1.1 Clearance adjusting

Fig. 11.1.1/1

1. Insert a setting gauge on both sides between the brake lining carrier and brake disc and hold them in position.

Note! The thickness of the setting gauge must be adjusted to the desired air gap.

Clearance in mm		Setting gauge in mm
min.	0,5	0,25
Nominal clearance	1,0	0,50
max.	1,5	0,75

2. Turn the adjusting screw (2) in a clockwise direction until the two setting gauges are clamped between the brake lining carriers and the brake disc.
3. Hold the adjusting screw (2) in position and lock using the locknut (1).

Caution!
The application pressure for clamping the setting gauges must be selected so that both gauges can be removed using a small amount of force after locking in position.

4. Release the locknut (4) and then turn the setting screw (3) in a clockwise direction until the end surface of the setting screw (3) is in contact with the surface provided for setting.
5. Hold the setting screw (3) in position and lock using the locknut (4).
6. Remove the setting gauges from both sides of the brake disc.

Note! The fitting procedure for the brake and the setting of the desired air gap is now complete. The brake is ready for use.

7. Turn the screw cap (5) in a clockwise direction and tighten hand-tight.

Note! The brake should be actuated and released several times to check that it is functioning properly.

1 Locknut (SW 24)
2 Setting screw (SW 8)
3 Adjusting screw (SW 6)
4 Counter nut (SW 13)
5 Screw cap
6 Pressure bolt
7 Guiding bolt
8 Bleeding screw (SW 11)
9 Piston

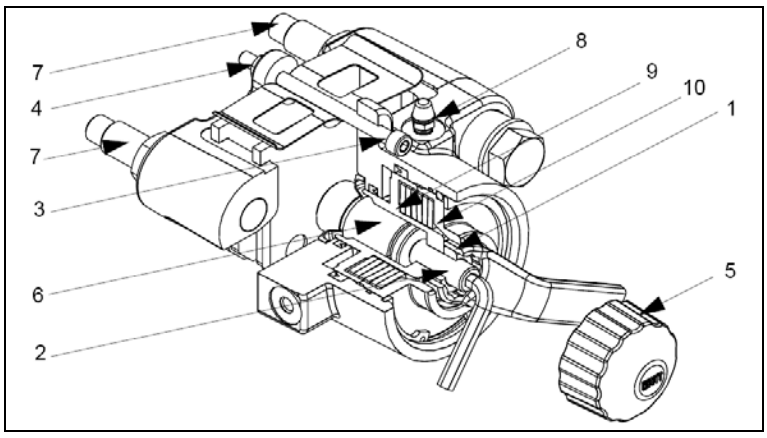


Fig. 11.1.1/1

11.2 Bleeding the brake

Fig. 11.2/1

Start bleeding at the left rear brake of the tandem axle. Continue with the right rear brake, then the left front brake and finally the right front brake.
Push a tube onto the nipple (N) beside the pipe connection and dip the tube into a container which is filled to half its capacity with hydraulic oil (see the consumable and lubricant table). Unscrew the breather plug, actuate the brake pedal and hold it in this position until the plug has been screwed in again. Continue the process until no air bubbles can be seen any more in the container. Two persons are required to bleed the brake.

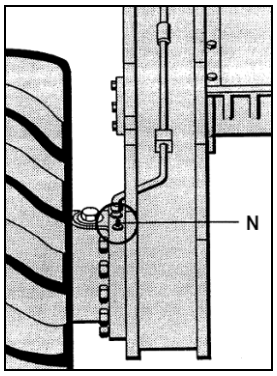


Fig. 11.2/1

Attention!
The braking system is a high-pressure system!

11.3 Servicing the wheel brake

The wet multidisk brakes installed in the wheel hubs are almost free of wear, and require no maintenance apart from the checking of the different wheel brakes.

However you should take the following facts into due consideration:

1. If the checking of the oil level at the wheel hub indicates a possibly rising oil level, this is caused by a leak of the hydraulically operated multidisk brake.
2. Unusual sounds in the wheel hubs during braking indicate possibly damaged brake disks.

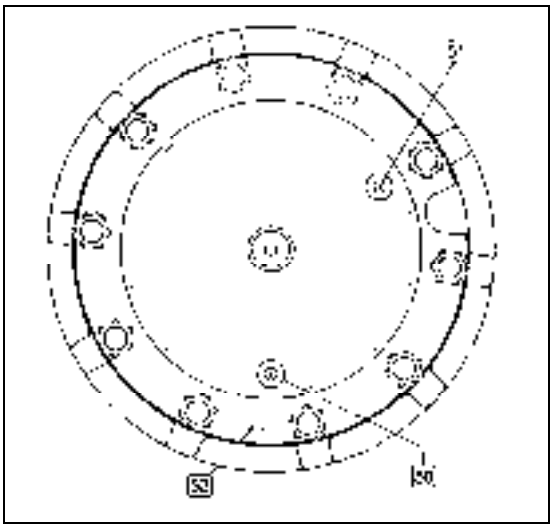
In these cases, consult the after-sales service facilities.

Check wear on multi-plates

Fig. 11.3/1

- Turn the wheel hub so that the aperture of the residual oil drain plug (52) comes to a standstill in the top half (above the oil level)
- Bring the multi-plate block into the braked state and check in the braked position.
- Remove the residual oil drain plug (52).
- Measure from the flat surface for the seal of the screw-plug (52 to the test lug of the third outer multi-plate with the caliper gauge. (Specified dimensions for new multi-plates 45,7 ± 0.55 mm)
  (Intervention dimensions for worn multi-plates 43 - 0.5 mm)

The replacement of multiple braking disks shall be carried out by authorised personnel.
De-airing the braking system afterwards, and carry out braking tests.



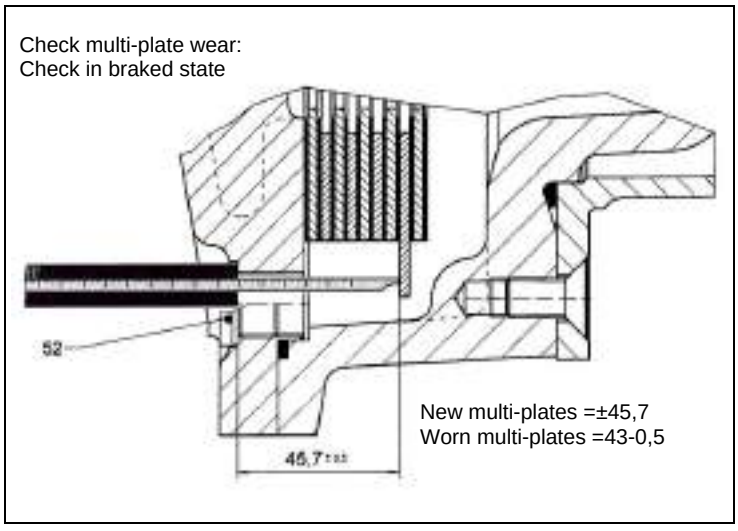


Fig. 11.3/1

11.4 Emergency release of the parking brake

Fig. 11.4/1

In the event of a failure in pressure supply the parking brake can be released mechanically in the following way:

1. Secure the vehicle against rolling away.
2. Rotate the screw cap in a counter-clockwise direction and unscrew it.
3. Release the locknut (1) and unscrew it back to the end of the setting screw (2).
4. Rotate the setting screw (2) in a clockwise direction until the brake disc is completely free.

For emergency release a torque of min. 70 Nm is required on the setting screw (2)!

5. Screw on the locknut (1) up to contact with the piston and apply a slight locking force to the setting screw (2).
6. Screw on the screw cap in a clockwise direction by a few threads. (dirt ingress protection)

In this condition the vehicle has no parking brake facility and thus must be protected from rolling away by different means. The brake must be adjusted before re-commissioning.

1 Locknut (SW 24)
2 Setting screw (SW 8)
S Peg spanner
G Ring spanner

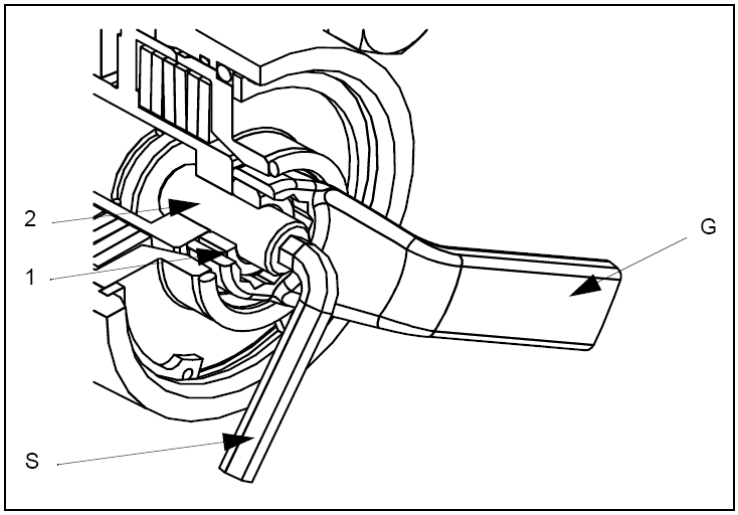


Fig. 11.4/1

12 Moldboard assembly

All sliding points and joints of the moldboard assembly shall always be well lubricated. Lubricate whenever necessary.

Before lubricating, clean the nipples and sliding faces to be greased carefully.

Lubricate until grease emerges from the gap points.

12.1 Lubricating the moldboard assembly

Fig. 12.1/1

Press grease into the nipples for the swing bearings of the lifting and swivelling cylinders in the forks, the fork
bearings in the bridge, the piston rod heads of the hydraulic cylinders, and the sliding face of the swivel bridge.

- 13 lubricating nipples -

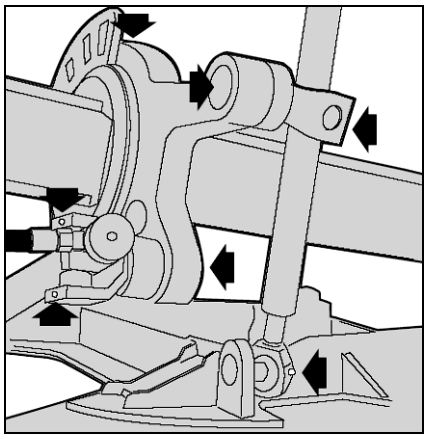


Fig. 12.1/1

Fig. 12.1/2
Lubricate the ball of the drawbar of the moldboard assembly.

- 1 lubricating nipples -

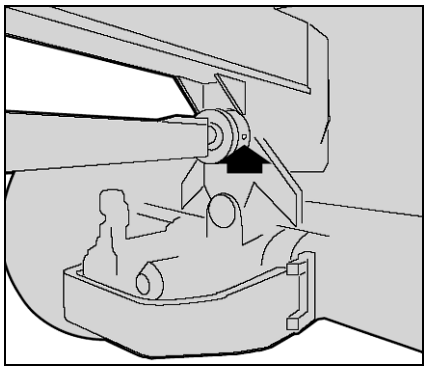


Fig. 12.1/2

Fig. 12.1/3
Grease the blade tilt cylinder bearing through the grease fittings.

- 2 lubricating nipples -

Fig. 12.1/3

12.2 Greasing the blade system (guided in babbitt bearings)

Fig. 12.2/1 and Fig. 12.2/2

Apply lubricating grease to the sliding surfaces at the slewing ring top and bottom sides, to the ring's gear teeth, and to the blade guide rails. Clean the sliding surface before greasing.

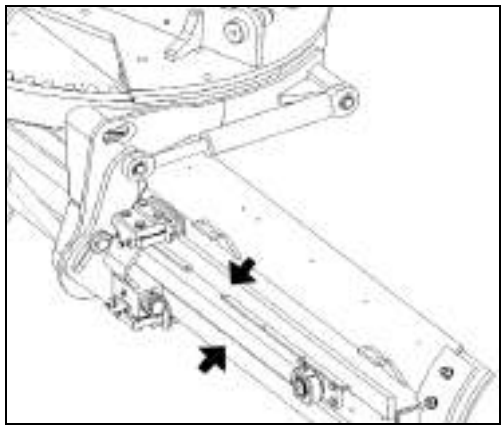


Fig. 12.2/1

⚠ Basically, you should grease the front of the crowd management, environmental conditions must be observed!
For example, when using the grader on a sandy bottom, the grease is not recommended.

12.3 Readjusting the blade guide

Fig. 12.3/1

The blade is guided by guide supports (1) using top (2) and bottom (3) holders. Wear plates (4) are located in the holders. Replace them if they are worn out.

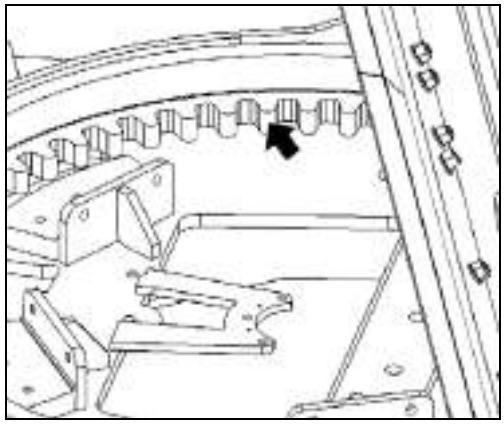


Fig. 12.2/2

Horizontal readjustment of the moldboard guide

Unscrew the locking screws (5) and the check nuts of the adjusting screws (6). Use the adjusting screws (6) to pull back the fastening (2, 3), and minimize the clearance (approx. 1 mm) until the blade slides without jamming. Tighten the locking screws (5), and lock the adjusting screw (6).

Vertical readjustment of the moldboard guide

Use shims B1 to B4 in the fastenings (2, 3) to compensate any vertical clearance.
Proceed as follows to compensate the vertical clearance:
If readjustment is required, remove the number of shims B1 to B4 from the top fastenings as required to compensate the backlash. Place the shims in the fastenings at the top, and secure them with the locking screws (5).

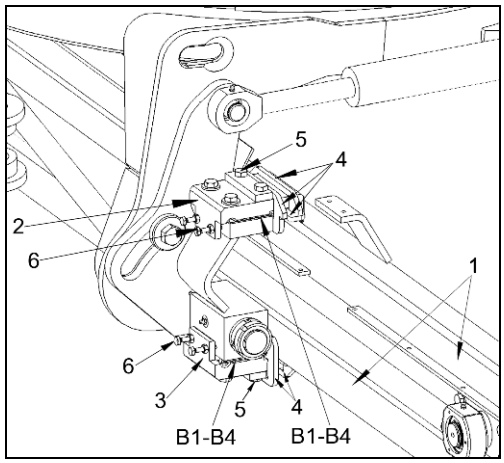


Fig. 12.3/1

⚠ Do not throw away the shims. They will be needed for further readjustments.

If all shims are used up, the wear angles (4 - Figure 12.3/1) must be replaced.

Note: Wear plates will not be worn out evenly because the fastenings are subjected to different loads. To achieve roughly equal wear, measure wear plate thickness after every third readjustment, and change the wear plates, placing thicker wear plates in the holders of thinner wear plates.
Before replacing wear plates, support the blade on a piece of squared timber in order to relieve the load from the guide.

12.4 Slewing ring readjustment (guided in babbitt bearings)

Fig. 12.4/1 to Fig. 12.4/3

The slewing ring (D) bottom side slides on 4 pads (P), and the slewing ring top side slides against set-on slide segments (G) of the draw beam. The pads (P) can be adjusted both horizontally and vertically.

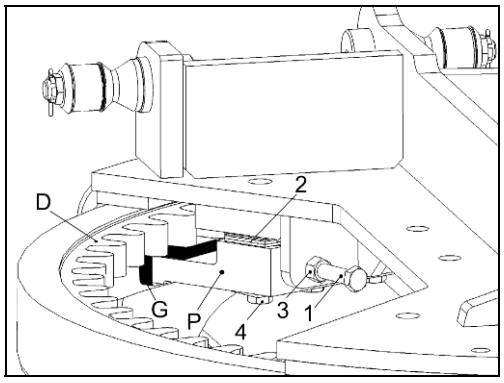


Fig. 12.4/1

Horizontal readjustment, circle centring

Loosen the lock nut (3) of the adjusting screw (1). Slacken the holding screw (4). Use screw (1) to shift claw (P) toward the external diameter until the air gap to the contact point lies between 0.5 and about 1.5 mm.
In the readjustment process, it is advisable to clamp sheet metal strips (thickness: 1.5 mm, i.e. like the air gap; 2 strips are needed for each claw) as spacers between the circle and claw.
When all claws are adjusted, tighten the holding screws (4). Then tighten the adjusting screws (1) and lock them with the nuts (3).
Remove the spacers.

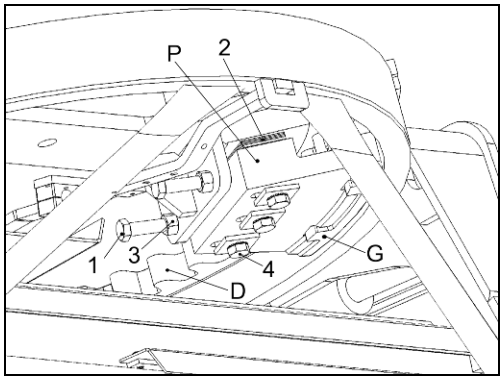


Fig. 12.4/2

⚠ The distance of the claw from the circle diameter shall be equal around the entire circumference, i.e. the claw must not be canted.

⚠ Check that the teeth mesh easily round the complete circumference.
The teeth of the pinion must **not** touch the bottom part of the slewing rim (H).

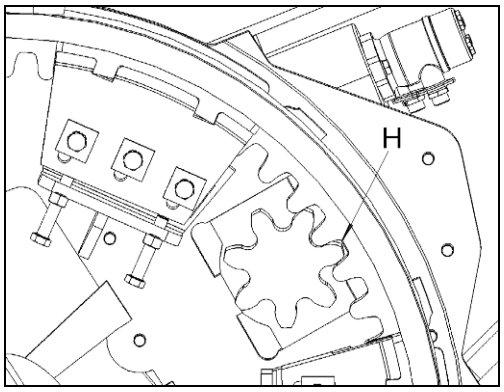


Fig. 12.4/3

Vertical readjustment of the circle

The vertical readjustment of the circle should always be followed by a horizontal readjustment. Put the moldboard on the ground. Loosen the adjusting screw (1) and the holding screws (4) of the first claw (P). Take out spacer 2. Screw-fasten the claw again. Proceed in the same way with the other claws. Then adjust the circle horizontally as described above.

Note: Adjust the circle when the drawbar is in horizontal position. Clean the sliding faces before adjustment. Regrease the sliding faces after the readjustment and make a test run. With the drawbar in horizontal position and correct adjustment, the hydraulic pressure required to turn the circle is approx. 6 MPa (870 psi).

12.5 Circle drive

Oil level check, oil change

Fig. 12.5/1

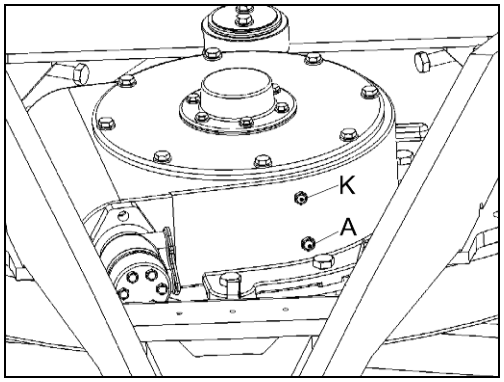


Fig. 12.5/1

Unscrew the control plug (K).
The oil level should be at the lower edge of the control bore.
Top up oil if needed.
To change the oil, drain the old oil by opening the drain bore (A). Fill the drive with new oil through the filler neck (K).

13 Hydraulic working system

The line scheme of the hydraulic working, braking, and steering systems is shown in the line diagram.
The pressure is checked at the measuring point M1. The measuring point is located at the control block.

13.1 Checking the oil level

Fig. 13.2/1

Place the machine horizontally. All operate cylinder bring in. Have the engine operate in idle run.
With cold oil, and the engine in idle run, the oil level shall fill the oil-level eye. The dipstick is accessible from the left engine compartment.

13.2 Refilling with oil

Fig. 13.2/1

Switch off the engine. Clean the cover area. Oil is topped up through the return filter (F). To do so, remove the screw from the cover of the return filter (F), and top up oil through the bore.
Put on the cover again, and screw in the screw plug.

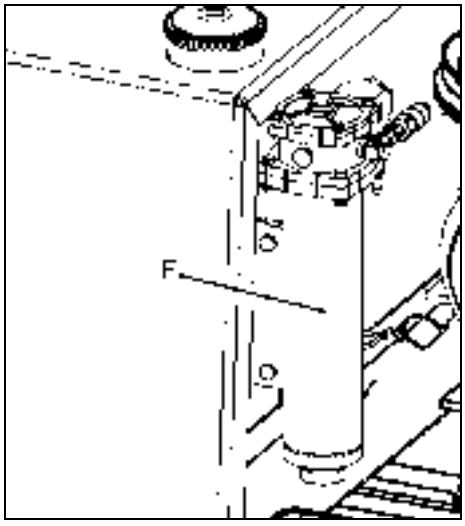


Fig. 13.2/1

⚠ Ensure that the correct type of oil is used. Do not remove the filter cartridge when filling up with oil.

13.3 Changing the oil

Fig. 13.3/1

Place the machine horizontally. Move all working devices into their highest position, i.e. all cylinders are drawn in.
Discharge the oil in hot state. Before that, screw off the oil dip-stick. Consider the note above!

The tank which is located below the Diesel engine, is equipped with a drain plug (A) having a self-closing valve so that no oil leaks into the environment. Screw on the oil drain hose. Collect the drained oil in a container (analogous procedure as for the exchange of engine oil with the same facility).
Close the drain facilities after the drainage of the oil again.
Fill in oil according to chapters 13.1 and 13.2.
Start the engine. Carry out all cylinder movements. Check the oil level once more, and refill if required (sections 13. and 13.2).

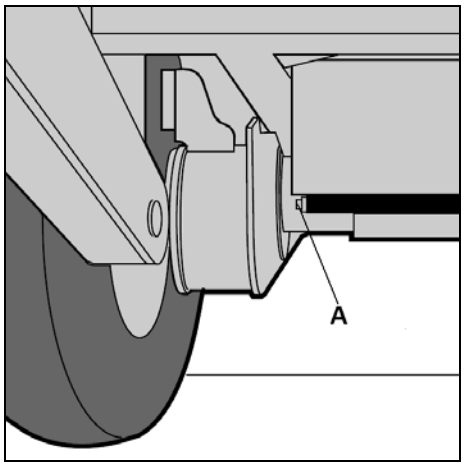


Fig. 13.3/1

⚠ Only use prescribed hydraulic-oil brands. See table ”Fuels and lubricants”
Ensure that the correct type of oil is used.

13.4 Replacement of the hydraulic filter

Stop the diesel engine before starting maintenance work, or before a filter change.

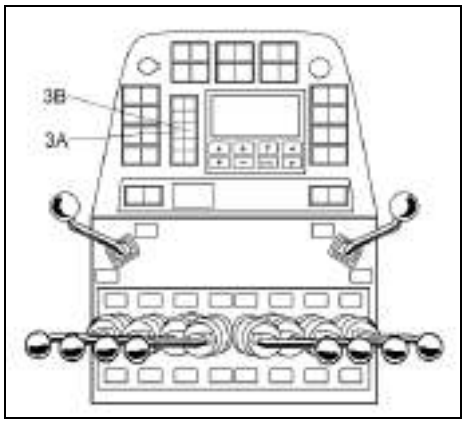


Fig. 13.4/1

13.4.1 Replacement of the filter cartridge of the backflow filter

Fig. 13.4/1 and Fig. 13.4.1/1

When the control lamp (3A) indicates that the filter is contaminated the filter element must be urgently replaced.

Make sure during the replacement of the filter element that no contamination can reach into the opened filter or tank during assembly.
Take off the filter cover of the filter (fig. 13.4.1/1) after the fixing nuts have been screws off.

1. Take out the pressure spring together with the complete set of inserts.
2. Screw off the bypass spring package (1), and take the filter element (2) from the support (3).
3. Clean the magnet column (4).
4. Mount the new filter element.
5. The assembly is carried out in reciprocal order
6. Turn the bypass spring package to the stop so that the prescribed bypass opening pressure is adjusted.

Check the gaskets and O-rings for damages.
Care for an even seating of the filter element at the support.
Carefully install the complete set of inserts into the tank so that the gasket of the support is not damaged.

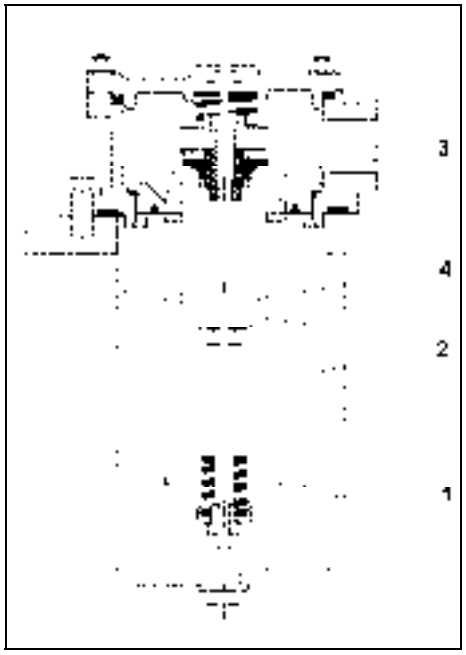


Fig. 13.4.1/1

13.4.2 High-pressure filter cleaning

Fig. 13.4.2/1

The filter (1) belongs to the steering system. Clean this filter as specified in the maintenance and inspection schedule. Unscrew the filter pot (T) and replace the filter cartridge. Before unscrewing the pot, again clean the parts in its vicinity. After changing the filter, screw the filter pot back on tightly, and then unscrew it 1/16th of a turn.

Do not damage the gaskets. Make a trial run and brake and steering test after any work on the braking and steering system.

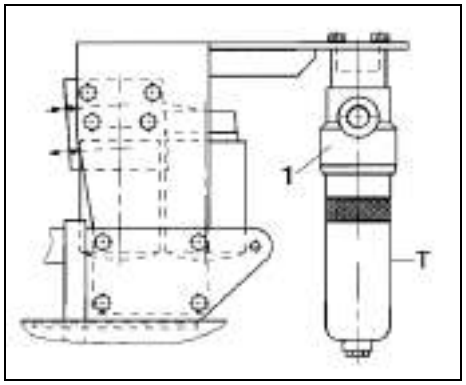


Fig. 13.4.2/1

13.4.2.1 Replace the filter cartridge of the high-pressure filter

Fig. 13.4/1 and Fig. 13.4.2.1/1

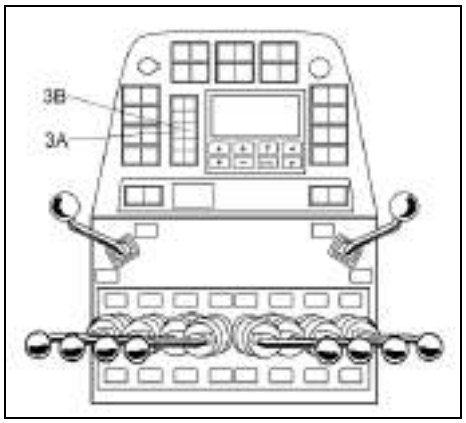


Fig. 13.4/1

⚠ When the control lamp (3B) indicates that the filter is contaminated the filter element must be urgently replaced.

Disassemble and replace the filter element (6) as follows:

1. Unscrew the filter bowl (5) from the filter head (2). Use a spanner with 30 mm width across flats, and apply it to the hexagon at the bowl bottom. To unscrew, turn counterclockwise (as seen from below). It is important to ensure that not load is applied to the bowl from the sides during unscrewing.
2. Remove and dispose of the filter element (6). The filter element cannot be cleaned.
3. Inspect filter head (2) and bypass valve (3) for any possible damage or malfunction. Replace any damaged parts. Clean any accumulated dirt, and make certain that no dirt reaches the filter's clean side through the outlet. Do not start the system unless a filter element is installed.
   Inspect the O-ring (4) in the filter bowl (5) for damages. Use a filter element (6) with a designation as indicated on the type plate.
4. Wetten the O-ring (4) in the element using clean system fluid, slide the element (6) with the open end straight onto the nipple in the filter head (2). Apply a slight amount of clean system fluid to wetten the filter bowl (5) thread, and use a torque spanner to tighten the bowl to a torque of 100 Nm at the hexagon.
   Do not overtighten the bowl as this will not improve the ring's sealing effect.

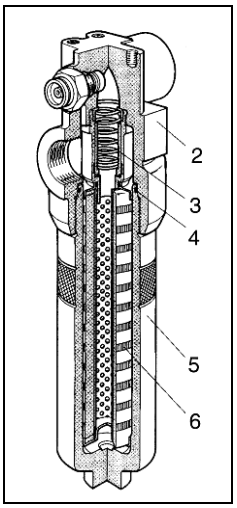


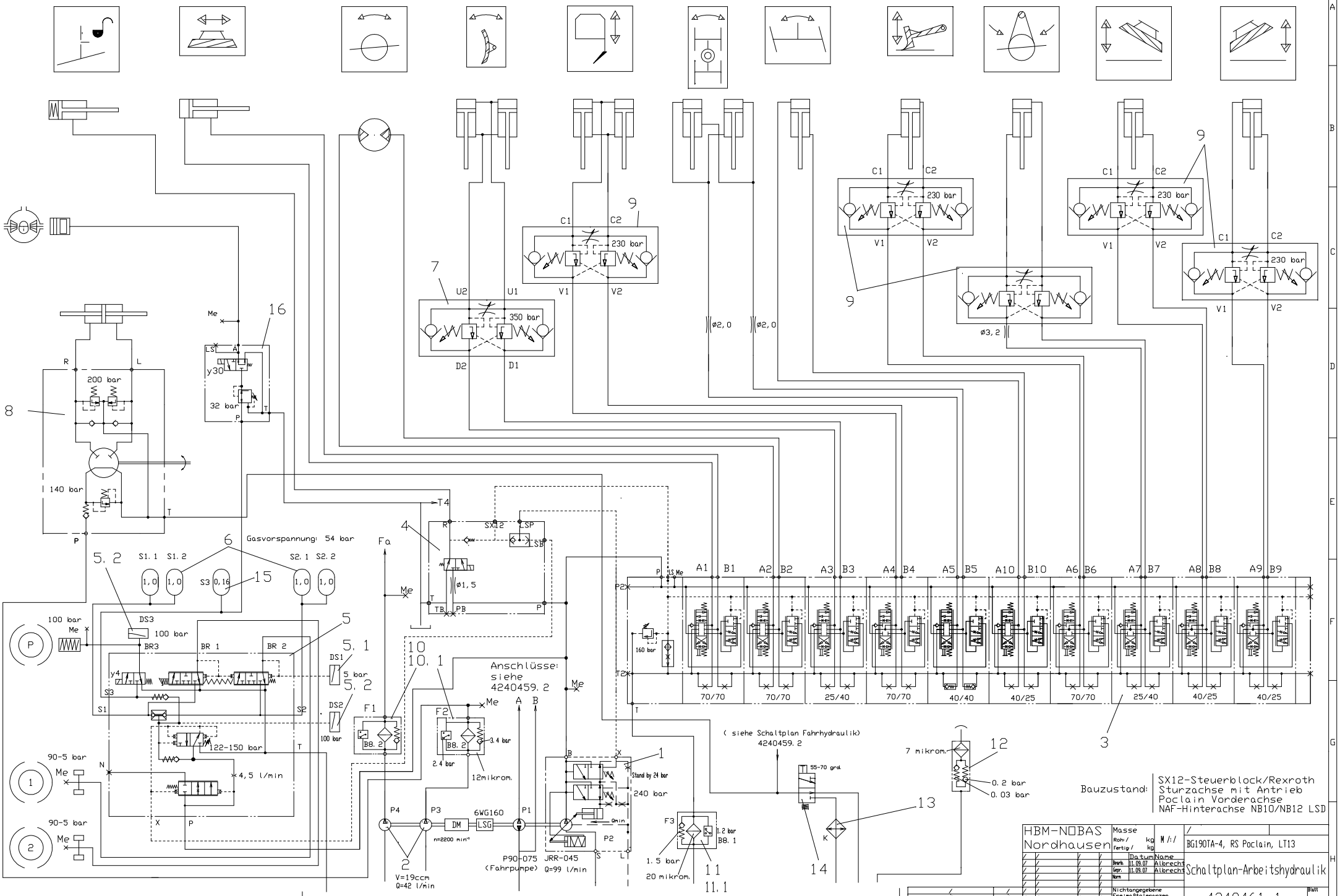
Fig. 13.4.2.1/1

13.5 Equipment list for the working hydraulics circuit diagram

Circuit diagram No.: 4240461

Status: 09/2007

Pos.	Description	Part NO.	additional information	QTY.
1	axial piston pump	5050104		1
2	gear pump	5060004	for steering, feeding, cross scavenging	1
3	way valve block	5067790		1
4	control block	9347068		1
5	compact brake valve	989341156	LT13	1
5.1	pressure switch	9442226	5 bar	1
5.2	pressure switch	9442256	100 bar	1
6	hydraulic accumulator	437706007	1,0 l	4
7	double load lock valve	5067797		1
8	steering aggregate	5070014		1
9	lowering brake valve	506779508		5
10	high pressure filter	5074200051	for steering, feeding, cross scavenging	2
10.1	indication to contaminate	9432502191		2
11	return line filter	507418005	for working hydraulic	1
11.1	pressure switch	507418010 oder 943250219	1,2 bar	1
12	breather filter	480502007		1
13	oil cooler	487510005		1
14	temperaturcontroller	6380060011		1
15	membrane accumulator	9306167		1



Bauzustand:
SX12-Steuerblock/Rexroth
Sturzachse mit Antrieb
Poclain Vorderachse
NAF-Hinterachse NB10/NB12 LSD

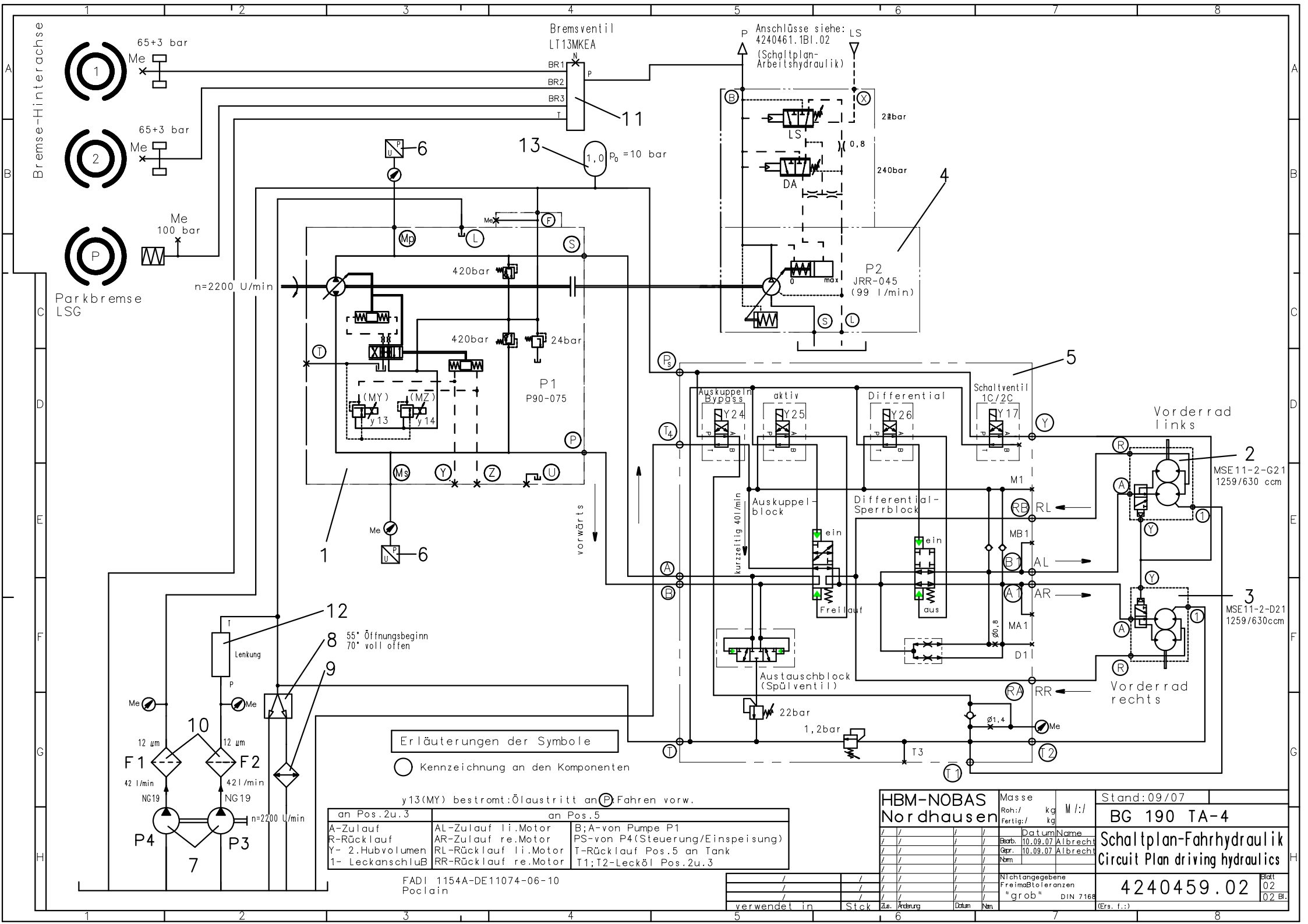
HBM-NOBAS Nordhausen				Masse			BG190TA-4, RS Poclain, LT13
				Roh/ kg	M /:/		
				Fertig/ kg			
				Datum	Name		Schaltplan-Arbeitshydraulik
				Bearb.	11.09.07	Albrecht	
				Gepr.	11.09.07	Albrecht	
				Norm			
				Nichtangegebene Freimaßtoleranzen "grob" DIN 7168			4240461. 1
verwendet in		Stck	Änd.	Änderung	Datum	Norm	(Ers. f.:)

13.6 Equipment list for the drive hydraulics circuit diagram

Circuit diagram No.: 4240459

Status: 09/2007

Pos.	Description	Part NO.	additional information	QTY.
1	axial piston pump	5050106		1
2	wheel hub motor	9303127	counter-clockwise rotation	1
3	wheel hub motor	9303126	clockwise rotation	1
4	axial piston pump	5050104	standby pressure: 24 bar working pressure: 240 bar	1
5	valve block	5070002		1
6	pressure sensor	5074160		2
7	gear pump	5060006	for steering, feeding, controlling	1
8	temperaturcontroller	6380060011		1
9	oil-air cooler	9345017		1
10	high pressure filter	5074200051	for steering, feeding, controlling	2
11	brake valve	989341156	LT13	1
12	steering aggregate	5070014		1
13	hydraulic accumulator		1,0 l	1


Bremse-Hinterachse
Bremsventil
LT13MKEA
BR1
BR2
BR3
T
N
P
11
65+3 bar
Me
1
2
P
Parkbremse
LSG
Me
100 bar
n=2200 U/min
6
13
1,0
P0 =10 bar
Anschlüsse siehe:
4240461.1Bl.02
(Schaltplan-
Arbeitshydraulik)
P
LS
B
X
LS
DA
22bar
0,8
240bar
4
P2
JRR-045
(99 l/min)
0
max
S
L
Mp
F
420bar
24bar
T
P1
P90-075
(MY)
(MZ)
y13
y14
Ms
Y
Z
U
Ps
T4
5
Auskuppeln
Bypass
aktiv
Differential
Schaltventil
1C/2C
Y24
Y25
Y26
Y17
Vorderrad
links
R
2
MSE11-2-G21
1259/630 ccm
A
1
Y
M1
RB
RL
Auskuppel-
block
kurzzeitig 40l/min
Differential-
Sperrblock
ein
MB1
B1
AL
A1
AR
Freilauf
aus
MA1
ø0,8
D1
3
MSE11-2-D21
1259/630ccm
Austauschblock
(Spülventil)
RA
RR
Vorderrad
rechts
22bar
1,2bar
ø1,4
T3
T2
T1
vorwärts
1
12
8
55° Öffnungsbeginn
70° voll offen
9
T
Lenkung
P
10
12 µm
F1
F2
42 l/min
NG19
n=2200 U/min
P4
P3
7
Erläuterungen der Symbole
Kennzeichnung an den Komponenten
y13(MY) bestromt:Ölaustritt an P:Fahren vorw.
an Pos.2u.3
A-Zulauf
R-Rücklauf
Y- 2.Hubvolumen
1- LeckanschluB
an Pos.5
AL-Zulauf li.Motor
AR-Zulauf re.Motor
RL-Rücklauf li.Motor
RR-Rücklauf re.Motor
B;A-von Pumpe P1
PS-von P4(Steuerung/Einspeisung)
T-Rücklauf Pos.5 an Tank
T1;T2-Lecköl Pos.2u.3
FADI 1154A-DE11074-06-10
Poclain
HBM-NOBAS
Nordhausen
Masse
Roh:/ kg
Fertig:/ kg
M:/:/
Stand:09/07
BG 190 TA-4
Schaltplan-Fahrhydraulik
Circuit Plan driving hydraulics
4240459.02
Blatt 02
02 Bl.
Datum Name
Bearb. 10.09.07 Albrecht
Gepr. 10.09.07 Albrecht
Norm
Nichtangegebene
FreimaBtoleranzen
"grob" DIN 7168
verwendet in
Stck
Zus. Änderung
Datum
Nam.
(Ers. f.:)

Key to symbols

○ Identifier on components
y13 (MY) Flows: oil leak at Ⓟ: Driving forwards

At pos. 2 and 3		At pos. 5			
A	Feed	AL	Feed left engine	B; A	from pump P1
R	Return	AR	Feed right engine	PS	from P4 (control / feed)
Y	2. Cubic capacity	RL	Return left engine	T	Return pos. 5 to tank
1	Leakage-fuel connection	RR	Return right engine	T1; T2	Leakage oil pos. 2 and 3

14 Articulated frame joint and articulated steering cylinder
Fig. 14/1

The articulated joint and the cylinder bearings have to be regularly lubricated in accordance with the inspection schedule.

- 6 lubrication points -

Thoroughly clean the grease nipples before the grease gun is attached. After a long-time operation with the articulated steering locked, the borings of the supporting fish-plate (H) may be widened. If the deviation from the nominal boring is $\geq$ 3 mm the supporting fish-plate has to be replaced.

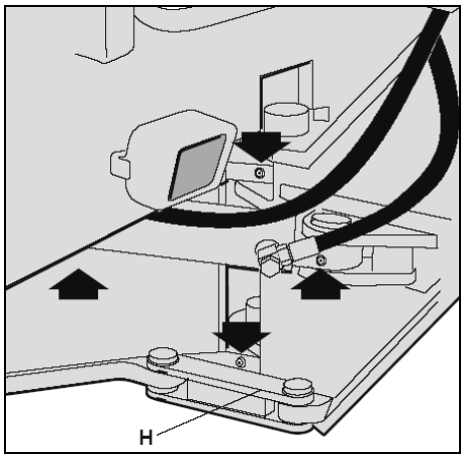


Fig. 14/1

15 Lubrication of the grading plate
Fig. 15/1

- 2 lubrication points -

Suspension of the hydraulic cylinder
Piston rod end of the hydraulic cylinder

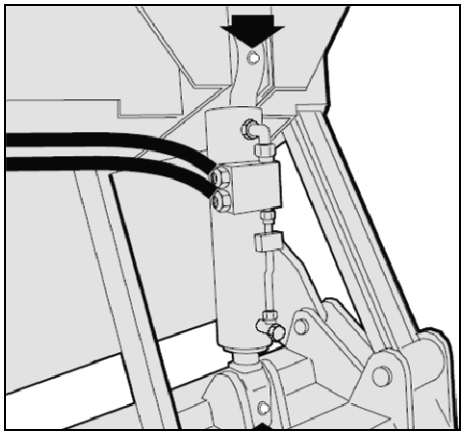


Fig. 15/1

16 Rear Ripper
Fig. 16/1

- 4 lubrication points -

Heads of the piston rods of the right and left cylinders.

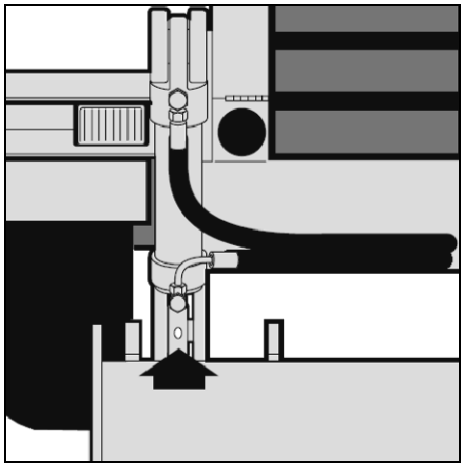


Fig. 16/1

17 Changing the tyres

The wheels must be removed from the machine in order to change the tyres. To do this, the machine must be raised so that the relevant wheel is clear of the ground. Loosen the wheel nuts one or two turns before lifting the grader. The grader can be lifted on one side with the aid of the hydraulics.
To change the rear wheels, set the tip of the blade down on the ground in front of the rear wheel on the side to be lifted, and lift the grader up with the lifting cylinder until the wheels are clear of the ground. The front wheels can be raised with the levelling blade or with the blade, the end of which is then placed on the ground behind the front wheel that is to be raised.

Never have the machine supported by the hydraulic system during the replacement of tyres. Support the machine by solid backings.

Unscrew the wheel nuts in crosswise order, and lift off the wheel.

Take care not to damage the threads of the wheel bolts when removing or changing the wheels.

Discharge the air from the tyre completely. Only after the air has been discharged completely the tyre may be disassembled. The tyres have to be levered out of the rim well.

Tyres should only be replaced in workshops specifically equipped for this purpose.

After the tyre has been attached to the rim pump in air to the prescribed pressure.

Table of air pressure:

Tyres - type	17,5-25	14.00-24	17,5 R25
Front wheels	2,5 bar	2,75 bar	3,0 bar
Rear wheels	2,5 bar	2,75 bar	3,0 bar

Screw the complete wheel to the machine.
Tightening torque for wheel nuts: 500 Nm - 550 Nm.
Tighten the wheel nuts in crosswise order.

Check the wheel nut for their straight seat after 5 operating hours, and retighten them if required. Afterwards do this in compliance with the "Maintenance and inspection schedule", chapter 25.

The retightening is necessary as the bolts and nuts need some time for setting.

Use a torque wrench to tighten, check, and retighten wheel nuts. The tightening torque applies to metallic-bright threads (black or phosphated). The thread must not be oiled.

18 Electrical system

18.1 Electrical system on the machine

Before you start any work at the electrical system of the machine, put the system out of operation. For this purpose, disconnect the negative and afterwards the positive cables from the battery. When you reattach the cables, start with the positive cable and then fix the negative cable.

Do not start the engine if the batteries are not properly connected to the machine's system.
Never disconnect the batteries, and never turn off the master switch when the engine is running.

The non-compliance with the above rules will lead to destruction of electrical and electronic components.
During each maintenance work, urgently check the cables for loose or contaminated contacts, for damages of the insulation or cable breaks.
Before the beginning of possible required welding activities at the machine urgently disconnect the dynamo.
Do not mix up the polarity of the auxiliary batteries in case of an external start.

Fuse allocation
Fig. 18.1/1

F2.8	fuse 5 A park light, right	(58)
F2.7	fuse 5 A park light, left, instrument lighting	(58)
F2.6	fuse 5 A dipped light, right	(56b)
F2.5	fuse 5 A dipped light, left	(56b)
F2.4	fuse 5 A distance light, right	(56a)
F2.3	fuse 5 A distance light, left	(56a)
F2.2	fuse 15 A front-drive control	(15)
F2.1	fuse 5 A Reserve	(15)

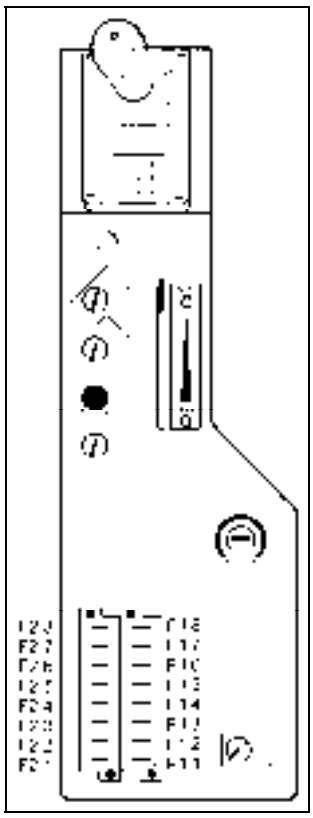
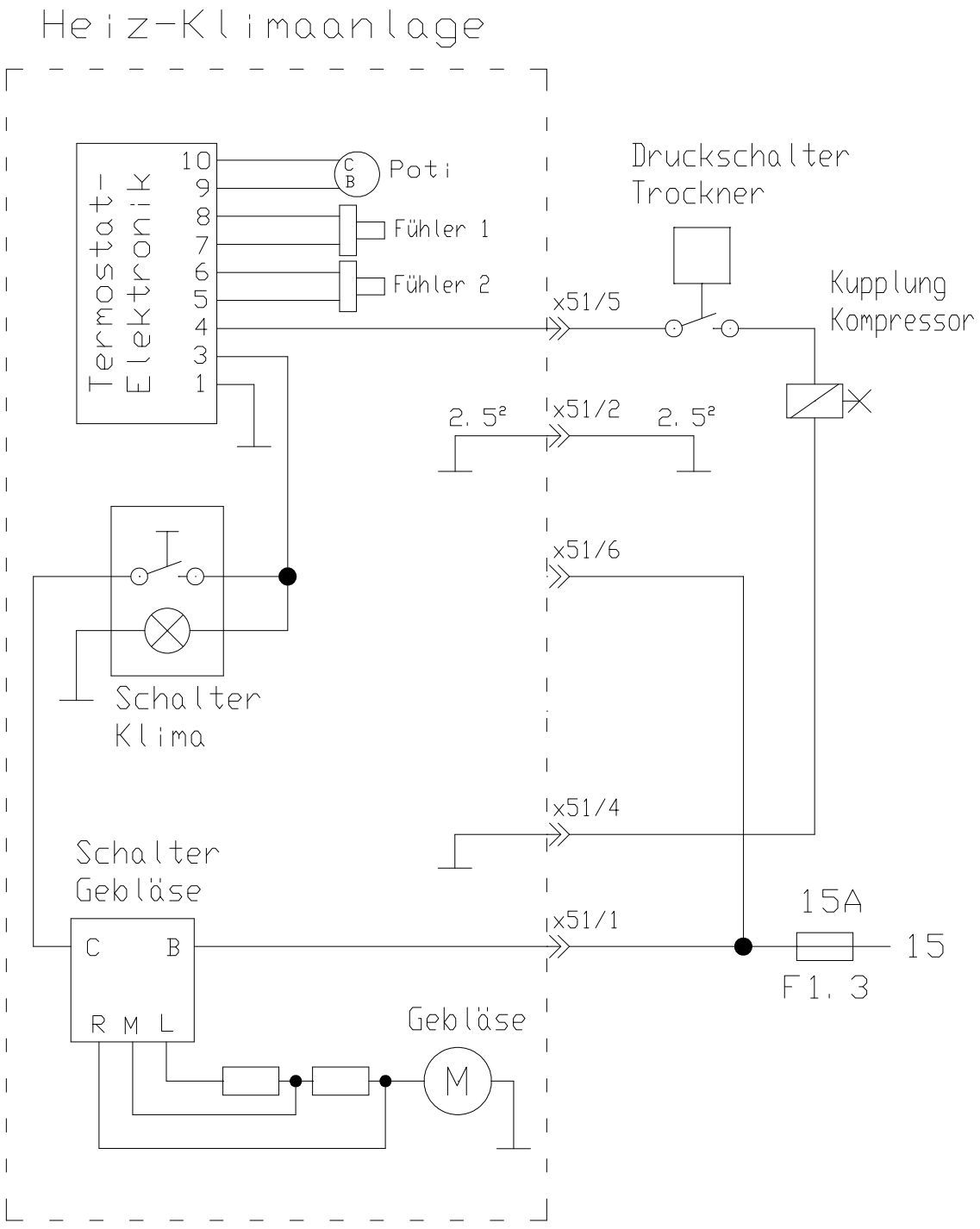


Fig. 18.1/1

F1.8	fuse 15 A working head lamps	(30)
F1.7	fuse 7,5 A horn, internal lamp, rotating flashing beacon, stop light, flash light, socket, indicating instrument	(30)
F1.6	fuse 7,5 A warning flasher device	(30)
F1.5	fuse 7,5 A power shift gear, engine-control	(30)
F1.4	fuse 5 A control lamps, indicating instr., locking slide	(15)
F1.3	fuse 15 A cabin heating	(15)
F1.2	fuse 7,5 A windscreen wiper, direction ind. lamps	(15)
F1.1	fuse 7,5 A power shift gear	(15)

Flat plug fuses are used which can be reached after the cover of the fuse box has been removed.



/	/
/	/
4418010. 1	1
verwendet in	Stck

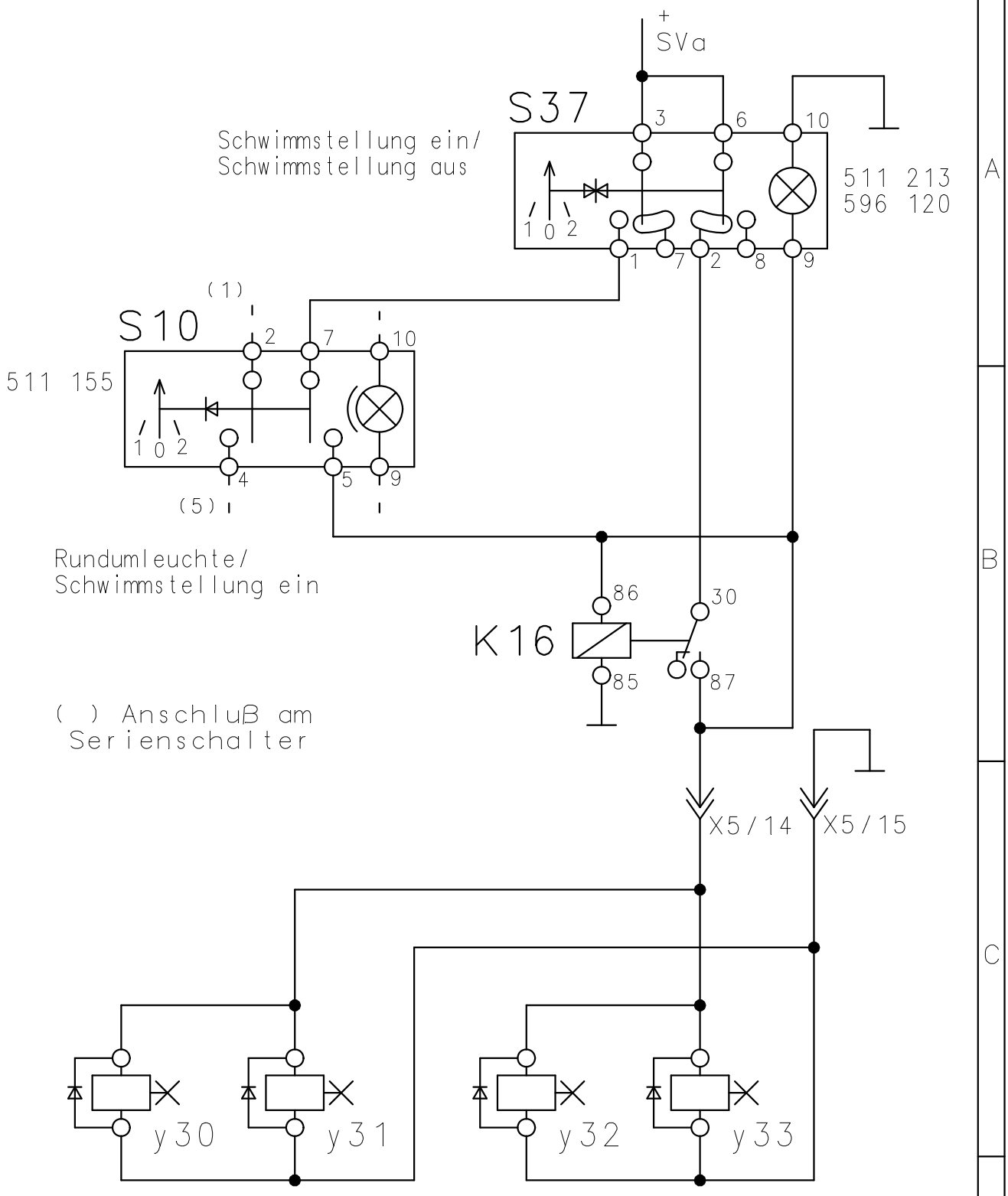
HBM-NOBAS Nordhausen				Masse Roh: / kg Fertig: / kg	M /: /	/
/	/	/	/		Datum	Name
/	/	/	/	Bearb.	02. 04. 09	Scharf
/	/	/	/	Gepr.	02. 04. 09	Scharf
/	/	/	/	Norm		
/	/	/	/			
/	/	/	/	Nichtangegebene Freimaßtoleranzen		
/	/	/	/	"grob" DIN 7168		
/	I-051/09	02. 04. 09	Scha			
Zus.	Änderung	Datum	Nam.			

Funktionsschaltplan
Heiz-Klimaanlage Wölfle

4618035. 4

Blatt 4
4 Bl.

(Ers. f.:)



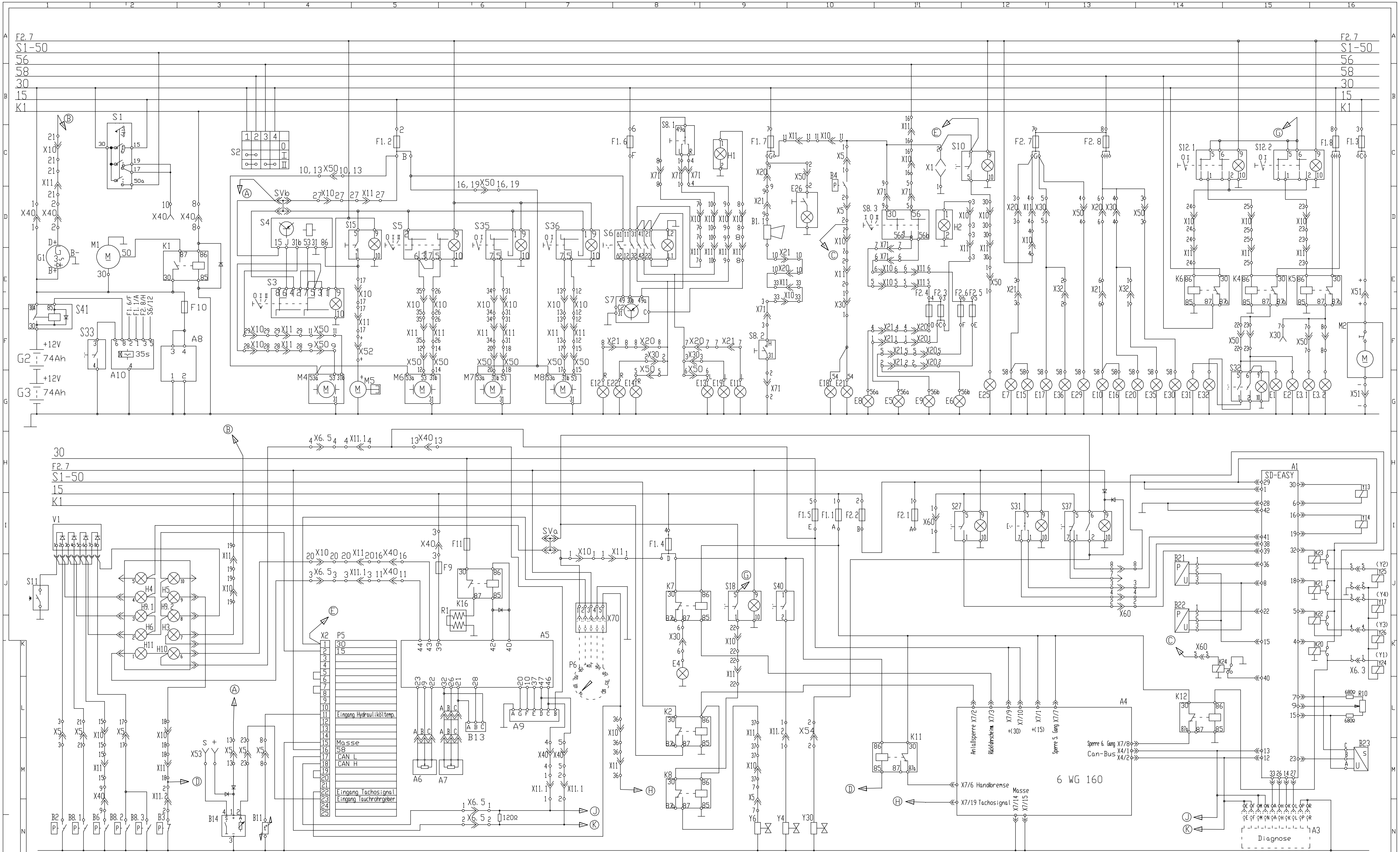
HBM-NOBAS Nordhausen	Masse Roh: / kg Fertig:/ kg	M /:/	/
		Datum	Name
	Bearb.	29.03.00	Scharf
	Gepr.	29.03.00	Scharf
	Norm		
Nichtangegebene Freimaßtoleranzen "grob" DIN 7168			
Zus. / Änderung / Datum / Nam.			(Ers. f.:)

Funktionsschaltplan
Schwimmstellung Hubzylinder

4440402.4

Blatt

Bl.



A1 Microcontroller SD-EASY
A3 Diagnosestecker VA
A4 Getriebe 6 WG 160
A5 Stecker Motorsteuerung
A6 Fußgas
A7 Handgas
A8 Stecker Motorsteuerung
A9 Diagnosestecker Motor
A10 Schaltautom. Hauptsch.

B1.1 Horn
B2 Druckschalter Bremsfehler
B3 Druckschalter Feststellbremse
B4 Druckschalter Stopplicht
B6 Druckschalter Luftfilter
B8.1 Druckschalter Rücklauffilter
B8.2 Druckschalter Druckfilter
B8.3 Druckschalter Druckfilter
B11 Temp. Geber Hydrauliköl
B13 Füllstand Kühlmittel
B14 Dieseltankgeber

B21 Drucksensor Vorderachse v.
B22 Drucksensor Vorderachse r.
B23 Wegsensor Pumpe

E1 Arbeitsscheinwerfer, vorn links
E2 Arbeitsscheinwerfer, vorn rechts
E3.1 Arbeitsscheinwerfer, hinten links
E3.2 Arbeitsscheinwerfer, hinten rechts
E4 Rückfahrscheinwerfer
E5 Fernlicht, links
E6 Abblendlicht, links
E7 Standlicht, links
E8 Fernlicht, rechts
E9 Abblendlicht, rechts
E10 Standlicht, rechts
E11 Blinklicht, vorn links
E12 Blinklicht, vorn rechts
E13 Blinklicht, mitte links
E14 Blinklicht, mitte rechts
E15 Begrenzungslicht, vo. li.
E16 Begrenzungslicht, vo. re.
E17 Schlußlicht, hi. li.
E18 Stopplicht, hi. li.
E19 Blinklicht, hinten links
E20 Schlußlicht, hinten rechts
E21 Stopplicht, hinten rechts
E22 Blinklicht, hinten rechts
E25 Rundumkennleuchte
E26 Kabinenbeleuchtung
E29 Umrißleuchte, links
E30 Umrißleuchte, rechts
E31 Arbeitsscheinwerfer, vo. ob.
E32 Arbeitsscheinwerfer, vo. ob.
E35 Nummernschildbel. li.
E36 Nummernschildbel. re.

F1.1 7,5 A
F1.2 7,5 A
F1.3 15 A
F1.4 5 A
F1.5 7,5 A
F1.6 7,5 A
F1.7 7,5 A
F1.8 15 A

F2.1 5 A
F2.2 15 A
F2.3 5 A
F2.4 5 A
F2.5 5 A
F2.6 5 A
F2.7 5 A
F2.8 5 A

F 9 5A
F10 30A
F11 125A

G1 Drehstromlima
G2/G3 Batterie

H1 Kontrolleuchte Blinker
H2 Kontrolleuchte Fernlicht
H3 Kontrolleuchte Batterieladung
H4 Kontrolleuchte Bremsfehler
H5 Kontrolleuchte Feststellbremse
H6 Kontrolleuchte Luftfilter
H9.1 Kontrolleuchte Rücklauffilter
H9.2 Kontrolleuchte Druckfilter
H10 Kontrolleuchte Motorfehler
H11 Kontrolleuchte Motordiagnose

K1 Anlaßrelais
K2 Relais Anlaßsperre
K4 Relais Arbeitsscheinwerfer vorn
K5 Relais Arbeitsscheinwerfer hinten
K6 Relais Standlicht
K7 Relais Rückfahrscheinwerfer
K8 Relais Riegelsteuerung
K11 Relais Handbremse
K12 Relais Sperre 6. Gang
K16 Relais Vorwärmung
K20 Relais VA zuschalten
K21 Relais Motor Vg halbe
K22 Relais Diff.-Sperre VA
K23 Relais VA aktiv
K24 Relais Fußbremse

M1 Anlasser
M2 Heizungsmotor
M4 Frontscheibenwischermotor
M5 Scheibenwaschpumpe
M6 Heckscheibenwischermotor
M7 Wischer unten links
M8 Wischer unten rechts

P5 Boardcomputer MERLIN
P6 Fahrtenschreiber

R1 Vorwärmung
R10 Potentiometer Zugkraft VA

S1 Zündschloß
S2 Lichtdrehschalter
S3 Schalter Scheibenwischer
S4 Impulsgeber
S5 Schalter Scheibenwischer hint.
S6 Warnblinkschalter
S7 Blinkgeber
S8 Kombischalter Lenksäule
S10 Schalter Rundumkennleuchte
S11 Schalter Leuchtentest
S12.1 Schalter Arbeitsscheinwerfer vorn
S12.2 Schalter Arbeitsscheinwerfer hinten
S15 Schalter Waschanlage
S18 Schalter Riegel Drehbrücke

S27 Schalter Allrad
S31 Schalter Notfahrbetrieb (Option)
S32 Schalter Arbeitsscheinwerfer oben
S33 Hauptschalter
S35 Schalter Wischer unten links
S36 Schalter Wischer unten rechts
S37 Schalter Differentialsperre
S40 Schalter Feststellbremse
S41 Batterie-Trennschalter

V1 Diodenblock Leuchtentest

X Steckverbinder

Y4 Magnetventil Feststellbremse
Y6 Magnetventil Riegel
Y13 Prop.-Ventil Pumpe Vorderachse vorwärts
Y14 Prop.-Ventil Pumpe Vorderachse rückwärts
Y17 Magnetventil Motor Vg halbe
Y24 Magnetventil Vorderachse zuschalten
Y25 Magnetventil Vorderachse aktiv
Y26 Magnetventil Differentialsperre VA
Y30 Magnetventil Differentialsperre HA

HBM-NOBAS Nordhausen	Masse Roh: / kg Fertig: / kg	/	/	
		Datum	Name	E-Schaltplan BG190TA-4 Sturz VA o. WK
	Bearb.	20.09.07	Scharf	
	Gepr.	20.09.07	Scharf	
	Norm			
verwendet in / Stck / Zus. / Änderung / Datum 20.9.07 / Nam. Scha.	Nichtangegebene Freimaßtoleranzen "grob" DIN 7168			4208023.2 Blatt 2 / 2 Bl.
	(Urspr.)			(Ers. f.:) (Ers. durch:)

18.2 Electrical symbols

A1	Microcontroller SC-EASY	Microcontroller SD-EASY
A3	Diagnosestecker Vorderachse	Diagnose plug front axle
A4	Getriebe 6 WG 160	Transmission 6 WG 160
A5	Stecker Motorsteuerung	Plug motor control
A6	Fußgas	Foot gas
A7	Handgas	Hand gas
A8	Stecker Motorsteuerung	Plug motor control
A9	Diagnosestecker Motor	Diagnose plug engine
A10	Schaltautomatik Hauptschalter	Main switch for automatic switching
B1.1	Horn	Horn
B2	Druckschalter Bremsfehler	Push button switch brake error
B3	Druckschalter Parkbremse	Push button switch parking brake
B4	Druckschalter Stopplicht	Push button switch stop light
B6	Druckschalter Luftfilter	Push button switch Air Cleaner
B8.1	Druckschalter Rücklauffilter	Push button switch reflux filter
B8.2	Druckschalter Druckfilter	Push button switch pressure filter
B8.3	Druckschalter Druckfilter	Push button switch pressure filter
B11	Temperatur Geber Hydrauliköl	Temperature transmitter coolant
B13	Füllstand Kühlmittel	Cooling fluid level
B14	Dieseltankgeber	Diesel tank giver
B21	Drucksensor Vorderachse vorwärts	Pressure sensor front axle forward
B22	Drucksensor Vorderachse rückwärts	Pressure sensor front axle backward
B23	Wegsensor Pumpe	Proximity sensor pump
E1	Arbeitsscheinwerfer, vorn links	Work slip thrower in front left
E2	Arbeitsscheinwerfer, vorn rechts	Work slip thrower in front right
E3.1	Arbeitsscheinwerfer, hinten links	Work slip thrower at the rear left
E3.2	Arbeitsscheinwerfer, hinten rechts	Work slip thrower at the rear right
E4	Rückfahrscheinwerfer	Back-up light
E5	Fernlicht links	High beam left
E6	Abblendlicht links	Headlight low beam left
E7	Standlicht links	Parking light left
E8	Fernlicht rechts	High beam right
E9	Abblendlicht rechts	Headlight low beam right
E10	Standlicht rechts	Parking light right
E11	Blinklicht, vorn links	Signal light in front left
E12	Blinklicht, vorn rechts	Signal light in front right
E13	Blinklicht, Mitte links	Signal light center left

E14	Blinklicht, Mitte rechts	Signal light center right
E15	Begrenzungslicht, vorn links	Boundary light in front left
E16	Begrenzungslicht, vorn rechts	Boundary light in front right
E17	Schlusslicht, hinten links	Tail light at the rear left
E18	Stopplicht, hinten links	Stop light at the rear left
E19	Blinklicht, hinten links	Signal light at the rear left
E20	Schlusslicht, hinten rechts	Tail light at the rear right
E21	Stopplicht, hinten rechts	Stop light at the rear right
E22	Blinklicht, hinten rechts	Signal light at the rear right
E25	Rundumkennleuchte	Rotary beacon
E26	Kabinenbeleuchtung	Passenger lighting
E29	Umrissleuchte, links	Outlining light left
E30	Umrissleuchte, rechts	Outlining light right
E31	Arbeitsscheinwerfer, vorn oben	Work slip thrower in front above
E32	Arbeitsscheinwerfer, vorn oben	Work slip thrower in front above
E35	Nummernschildbeleuchtung, links	Licence plate light left
E36	Nummernschildbeleuchtung, rechts	Licence plate light right
G1	Drehstromlichtmaschine	Three-phase generator
G2/G3	Batterie	Battery
H1	Kontrollleuchte Blinker	Control light turn signal
H2	Kontrollleuchte Fernlicht	Control light high beam
H3	Kontrollleuchte Batterieladung	Control light battery charge
H4	Kontrollleuchte Bremsfehler	Control light brake error
H5	Kontrollleuchte Parkbremse	Control light parking brake
H6	Kontrollleuchte Luftfilter	Control light air cleaner
H9.1	Kontrollleuchte Rücklauffilter	Control light reflux filter
H9.2	Kontrollleuchte Druckfilter	Control light pressure filter
H10	Kontrollleuchte Motorfehler	Control light engine error
H11	Kontrollleuchte Motordiagnose	Control light engine diagnosis
K1	Anlassrelais	Starting relay
K2	Relais Anlasssperre	Relay starter barrier
K4	Relais Arbeitsscheinwerfer vorn	Relay work slip thrower in front
K5	Relais Arbeitsscheinwerfer hinten	Relay work slip thrower at the back
K6	Relais Standlicht	Relay parking light
K7	Relais Rückfahrscheinwerfer	Relay back-up light
K8	Relais Riegelsteuerung	Relay latch plate price increase
K11	Relais Handbremse	Relay hand brake

K12	Relais Sperre 6. Gang	Relay barrier 6. course
K16	Relais Vorwärmung	Relay preliminary heating
K20	Relais Vorderachse zuschalten	Switch relay front axle
K21	Relais Motor Vg halbe	Relay engine Vg half
K22	Relais Differentialsperre Vorderachse	Relay differential lock front axle
K23	Relais VA aktive	Relay front axle active
K24	Relais Fußbremse	Relay service brake
M1	Anlasser	Starter
M2	Heizungsmotor	Heater engine
M4	Frontscheibenwischermotor	Windshield wiper engine
M5	Scheibenwaschpumpe	Disk washer pump
M6	Heckscheibenwischermotor	Rear windshield wiper engine
M7	Wischer unten links	Wiper down left
M8	Wischer unten rechts	Wiper down right
P5	Boardcomputer MERLIN	On-board computer MERLIN
P6	Fahrtenschreiber	Travel writer
R1	Vorwärmung	Preliminary heating
R10	Potentiometer Zugkraft Vorderachse	Potentiometer traction power front axle
S1	Zündschloss	Starter lock
S2	Lichtdrehschalter	Light spindle switch
S3	Schalter Scheibenwischer	Switch windshield wiper
S4	Impulsgeber	Pulse generator
S5	Schalter Scheibenwischer, hinten	Switch windshield wiper at the back
S6	Warnblinkschalter	Warning light switch
S7	Blinkgeber	Flasher
S8	Kombischalter Lenksäule	Combination switch steering column
S10	Schalter Rundumkennleuchte	Switch rotary beacon
S11	Schalter Leuchtentest	Switch light test
S12.1	Schalter Arbeitsscheinwerfer, vorn	Switch work slip thrower in front
S12.2	Schalter Arbeitsscheinwerfer, hinten	Switch work slip thrower at the back
S15	Schalter Waschanlage	Switch washing plant
S18	Schalter Riegel Drehbrücke	Switch latch plate swing bridge
S27	Schalter Allrad	Switch all wheel
S31	Schalter Notfahrbetrieb (Option)	Switch emergency driving (option)
S32	Schalter Arbeitsscheinwerfer, oben	Switch work slip thrower above
S33	Hauptschalter	Main switch

S35	Schalter Wischer unten links	Switch wiper down left
S36	Schalter Wischer unten rechts	Switch wiper down right
S37	Schalter Differentialsprerre	Switch differential lock
S40	Schalter Parkbremse	Switch parking brake
S41	Batterie-Trennschalter	Battery disconnector
V1	Diodenblock Leuchtentest	Diode block light test
X	Steckverbinder	Plug connector
Y4	Magnetventil Parkbremse	Single solenoid valve parking brake
Y6	Magnetventil Riegel	Single solenoid valve latch plate
Y13	Proportional-Ventil Pumpe Vorderachse vorwärts	Proportional-valve pump front axle, forward
Y14	Proportional-Ventil Pumpe Vorderachse rückwärts	Proportional-valve pump front axle, backward
Y17	Magnetnventil Motor Vg halbe	Solenoid valve Engine Vg half
Y24	Magnetventil Vorderachse zuschalten	switch on magnetic valve front axle
Y25	Magnetventil Vorderachse aktiv	magnetic valve front axle active
Y26	Magnetventil Differentialsperre Vorderachse	Single solenoid valve differential lock front axle
Y30	Magnetventil Differentialsperre Hinterachse	Single solenoid valve differential lock rear axle

19 Lubricants, fuels, filling quantities

lubricants, fuels, filling quantities	quantity in litres (USgal)	lubricants, fuels (international specification)*	temperature limits in °C (°F)	Viscosity classes
hydraulic system	approx. 200 (52,8)	H-LP 46 DIN 51524 Part 2	10° -50° (50° - 120°) -10° -30° (14° - 86°) 15° -20° (5° - 68°) -30° - 0° (-22° - 32°)	ISO VG 100 ISO VG 68 ISO VG 46 + ISO VG 22
Rear axle: - wheel hubs - axle gear - Tandems - rotary mechanism	 approx. 4 x 4 (4 x 1) approx. 13,5 (3,5) approx. 2 x 21 (2 x 5,5) approx. 6 (1,6)	 MIL-L-2105D/LS API-GL5		 SAE 90 LS + SAE 80 W 90 LS SAE 85 W 90 LS SAE 85 W 140 LS
fuel tank	approx. 386 (102)	diesel fuel acc. to DIN 51601	see ”diesel fuels	
cooling system	approx. 33 (8,7)	long-term coolant	see ”Long-term coolants”	
grease nipples and lubrication points		multi-purpose grease, addition of lithium	K2K to DIN 51825 Part 1 or KP2K to DIN 51825 Part 3	
Load shift gear ZP-6 WG 160 (1)	approx.34 (8,9)	API-CH4	15° - 40° (50° - 104°) -10° - 50° (14° - 120°) -30° --10° (-22° - 14°)	SAE 10W30 SAE 15W40 + (TYP A Suffix)
Engine: CUMMINS	approx. 18 (4,7)	API-CH4	10° -50° (50° - 120°) 0° -40° (32° - 104°) -5° -50° (23° - 120°) -15° -40° (-5° - 104°) -10° -50° (14° - 120°) -25° -20° (-13° - 68°)	SAE 40 + SAE 30 SAE 20W50 SAE 10W30 SAE 15W40 + SAE 5W20

The indicated filling quantities are for orientation only, the test devices are binding. The choice of the viscosity classes is determined by the outside temperature prevailing over long periods. The temperature limits shall be considered as orientation permitting a short-time exceeding or dropping below.

\+ factory filling

* API = American Petroleum Institute
MIL = US - Military Specification
SAE = Society of Automotiv Engineers

(1) For the corresponding lubricants and viscosity grades, please refer to the manufacturer's lubricant list. To find this, go to www.zf.com/schmierstoffe (German) or www.zf.com/interoele (English).

20 Lubricants

Only use lubricants which fulfil the specifications mentioned below and which are internationally known.

Do not mix engine, gear and hydraulic oils!

The viscosity limits (viscosity classes) mentioned in the table “”Lubricants, fuels and quantities”, e.g. ISO VG 46I correspond to the codes DIN 51 519 and ISO 3448.

Engine oils (specifications)

API-CH4

Hydraulic systems (specifications)

The hydraulic high-duty drive requires the use of oil according to the a.m. specifications for the hydraulic system.

Gear oils for wet brakes (specifications)

MIL-L-2105 D/LS
API-GL5 LS

Gear oils (specifications)

MIL-L-2105 D
API-GL5

Lubricating grease

lithium-saponified, drop point > 170 °C (338 °F)
walk penetration 275/295
under the addition of molybdenum (IV)-sulphide
NLGI class 2 (DIN 518 18)

Viscosity classes

The viscosity classes can be seen from the table ”Lubricants, fuels and quantities”. Their choice is determined by the outside temperature prevailing over long periods. The temperature limits shall be considered as orientation permitting a short-time exceeding or dropping below.

21 Diesel fuels

The engine will generate the specified power and show the required running properties only if high-quality fuel is used. The fuel recommended to be used with Cummins engines shall have the following characteristics:

Cetane number	min. 45
Viscosity	2.5/4.5 cSt at 40 °C (104 °F)
Density	0.835 to 0.855 kg/l
Sulphur content	max. 0.5 %
Boiling point curve	85 % at 350 °C (662 °F)

Cetane number
This number determines the ignition performance.
A low-cetane fuel may cause starting problems and affect combustion.

Viscosity
Viscosity is the flowability of the fuel and can affect - if outside the specified range - the running properties of the engine.

Density
A low density will reduce the engine power, a high density increases the engine power and exhaust gas turbidity.

Sulphur
A high sulphur content (normally not found in Europe, North America and Australasia) may result in increased engine wear. Where only fuel with a high sulphur content is available, either a high-grade oil must be used or the oil must be changed frequently.

Boiling point curve
Refers to the mixture of different hydrocarbons in the fuel. A high ratio can have an influence on the combustion characteristics.

The frost resistance of diesel fuels is an important prerequisite for trouble-free operation in winter. When the temperatures drop to a point where paraffin precipitates in the diesel fuel, the filterability and flowability are hampered; the fuel filter and fuel lines are clogged.

The European mineral oil industry offers a diesel fuel for summer operation and one for winter operation (both in compliance with DIN 51 601).

	Operation from - to	Frost resistant to
Summer diesel fuel	mid-March to mid-October	to 0 °C (32 °F)
Winter diesel fuel	mid-October to mid-March	to -20 °C (-4 °F)
ESSO POLAR FUEL	in cold areas in winter	below -20 °C (-4 °F)

In general, winter diesel fuels are frost resistant to a temperature of -20 °C (-4 °F). If frost occurs in transient periods or the winter temperatures are below -20 °C (-4 °F), special diesel fuels with an improved frost resistance have to be used (see table above).

22 Long-term coolants

The cooling system is factory-filled with a long-term coolant which is a mixture of water, antifreeze and anti-corrosive agents. For moderate climate territories, its frost resistance is set at -37 °C (-35 °F).
A tag on the radiator informs on the use of an antifreeze. For corrosion protection reasons and to prevent furring, the cooling system should have an antifreeze content of 50 % vol. (corresponds to a frost resistance to -37 °C (-35 °F) also in summer.
Change the coolant every 2 years. Check its condition once a year.

Antifreeze and anti-corrosive agents of renowned international mineral oil producers, e.g. ESSO, SHELL, BP, MOBIL, TEXACO, DEA, AGIP, ARAL, TOTAL and HAERTOL (Frostox), are permitted to be used.

The coolant quality has a great influence on the effectiveness and service life of the cooling system. The below-mentioned recommendations contribute to the protection of the cooling system against frost and corrosion.

If the required measures are not taken, the manufacturer cannot be held responsible for damage caused by frost or corrosion.

Use clean, soft water for the cooling system.

When replacing coolant, make certain that you are using coolant made on an ethylene glycol basis with an anti-corrosion agent.
The anti-corrosive agent you use should be based on nitric or benzoic sodium.
The mixture should ensure sufficient cooling at all ambient temperatures and protect against corrosion. It must meet the following standards:

UK: BS.6580:1985: „Specification for corrosion inhibiting engineering concentrate (antifreeze)“.

USA: ASTM D3306-74: „Ethylene glycol based engine coolant“.

Australia: AS 2108-1977: „Antifreeze compounds and corrosion inhibitors for engine cooling systems“.

Antifreeze mixtures which may be required but deviate from those filled in by the manufacturer can be taken from the following table.

Frost resistance to	Required antifreeze percentage
-20 °C (-4° F)	35 Vol. %
-25 °C (-13 °F)	40 Vol. %
-31 °C (-23 °F)	45 Vol. %
-38 °C (-36 °F)	50 Vol. % (factory-filled)
-46 °C (-50 °F)	55 Vol. %

In any case, the mixture ratio given by the antifreeze producer is binding.

The coolant should be an antifreeze mixture consisting of 50% water and 50% antifreeze agent. Avoid a higher percentage of antifreeze as this would affect the cooling capacity.

Caution!
Overconcentration of antifreeze or use of high silicate antifreeze can cause damage to the engine.

Even if there is no danger of frost, an antifreeze is recommended to be used because it provides corrosion protection and improves the cooling capacity.

In tropical regions where the air temperature lies above +35 °C (95 °F), the low thermal conductivity of the long-term coolant may lead to an overheating of the engine. In this case, use water instead of the long-term coolant, and add a corrosion inhibitor to the water to prevent corrosion and furring. Use the mixture ratio specified by the maker.

Change the water/corrosion inhibitor mixture every 6 months; in case of doubt, ask the supplier.

Add the antifreeze and/or corrosion inhibitor to a bucket-full of water (tap water) and mix. It is not sufficient just to pour the water and antifreeze successively into the radiator as thorough mixing in the cooling system would take too much time.

The cooling system features only little evaporation losses. The losses can be compensated by adding clean water with a low lime content.

Do not fill in too much coolant because it might overflow when it heats up. Moreover, if water is added too often, the concentrate would be impermissibly diluted (see Section „Changing the coolant“ in these instructions).

In emergency cases, also normal clean water may serve as coolant. However, it should be replaced as soon as possible with the required long-term coolant.

Check the latter for frost resistance before the cold season.

23 Winter operation

So as to ensure that the machine can be operated without any problems also in winter, a few precautionary measures must be taken before the cold season begins.

Cooling system	The cooling system must be sufficiently resistant to the low temperatures occurring in your region. If necessary, add antifreeze or replace the coolant with a frost-resistant coolant. Check the coolant regulator and the radiator cap valves for proper functioning.
Oil	Use an oil grade that is suitable for operation at the low temperatures occurring in your region and has the required viscosity (see „Lubricants, consumables, quantities“).
Fuel	Use diesel fuel for winter service. At low temperatures, paraffin may precipitate and clog the filters and fuel lines (see „Diesel fuels“).
Injection system, batteries, starter, alternator	Proper condition of the injection system, starter, batteries and alternator ensure easy starting and trouble-free operation of the engine also at very low temperatures. Have these important components checked by an authorized workshop before the cold season begins.
Compression	Insufficient compression pressure affects the starting behaviour of the engine, in particular pressure at low temperatures. Measure the pressure.
Starter in case of very low temperatures	Actuate the starter for not longer than 30 s. If the engine does not start, wait 30 s and try again.
Engine warm-up	Before using the machine, let the engine idle for a few minutes at increased speed. During warm-up, actuate the unloaded hydraulic equipment several times.
Cutting the engine off after working	In order to prevent components from sticking due to the cold, knock off any soil sticking them to after work, especially from the chassis.
Windscreen washer	Add conventional antifreeze to the water. If antifreeze is not available, add 25 % vol. alcohol (spirit) to the water.
Service brake	If the machine is shut down, do not switch on the parking brake. Rather, lay wedges to the wheels.

24 Shutting the machine down for a longer period

1. Drain the engine oil when it is still warm and fill up with the following slushing oil:
   a) Engines which are not supercharged (aspirating engines)
      - Slushing oil for piston engines, MIL-L 21 260, type 1 or type 2
      - SAE class 10 W for preservation in winter
      - SAE class 30 for preservation in summer
   b) Supercharged engines
      - Slushing oil for piston engines, MIL-L 21 260, type 2
      - SAE class 10 W for preservation in winter
      - SAE class 30 for preservation in summer
2. Add 4 to 6 % of the same slushing oil to the diesel fuel and mix thoroughly. To reduce the formation of condensation water, fill the fuel tank to the top.
3. Check the long-term coolant for frost resistance; add a sufficient amount of anti freeze, if necessary. If there is no antifreeze in the cooling system for climatic reasons, add an increased amount (5 % vol.) of corrosion inhibitor (see „Long-term coolant“).
4. Start the engine and let it idle for at least 15 minutes at various speeds. If gear or hydraulic oil is changed before shutdown, let the units concerned run for a while (till they are at operating temperature) in order to preserve them with the fresh oil.
5. Close the air intake of the air cleaner system and the exhaust pipe. Recommended is the use of sturdy plastic caps which cannot be sucked in.
6. Remove the starter battery and store it - filled and charged - in a dry room free from frost also in winter. Recharge the batteries at intervals of about one month. Follow the instructions of the battery manufacturer.
7. Protect the machine against moisture and dirt.
8. Apply a thick film of grease to all sliding faces (circle, moldboard) and lubricate all nipples, in particular the swivel system on the frame.
9. If the ground is uneven, and if it will be a long period of standstill, place the machine on trestles, reduce the air pressure in the tyres to approx. 50 %. Cover the tyres against sun radiation.
10. Fill the tank (with an admixture of anti-corrosion oil at a quantity of 10 % of the filling).

Depending on the climatic conditions, machines preserved in this way can be laid up for a maximum of one year. After a quarter of a year, however, all units should be activated and idle for approx. 15 minutes, and all nipples should be greased.

When the machine must be moved during the shutdown period, e.g. when it is intended to be brought to another place, the engine must not run for more than a total of 10 hours with the slushing oil. Make an oil change if this time is exceeded.

The machine must not be operated under load during the shutdown period.

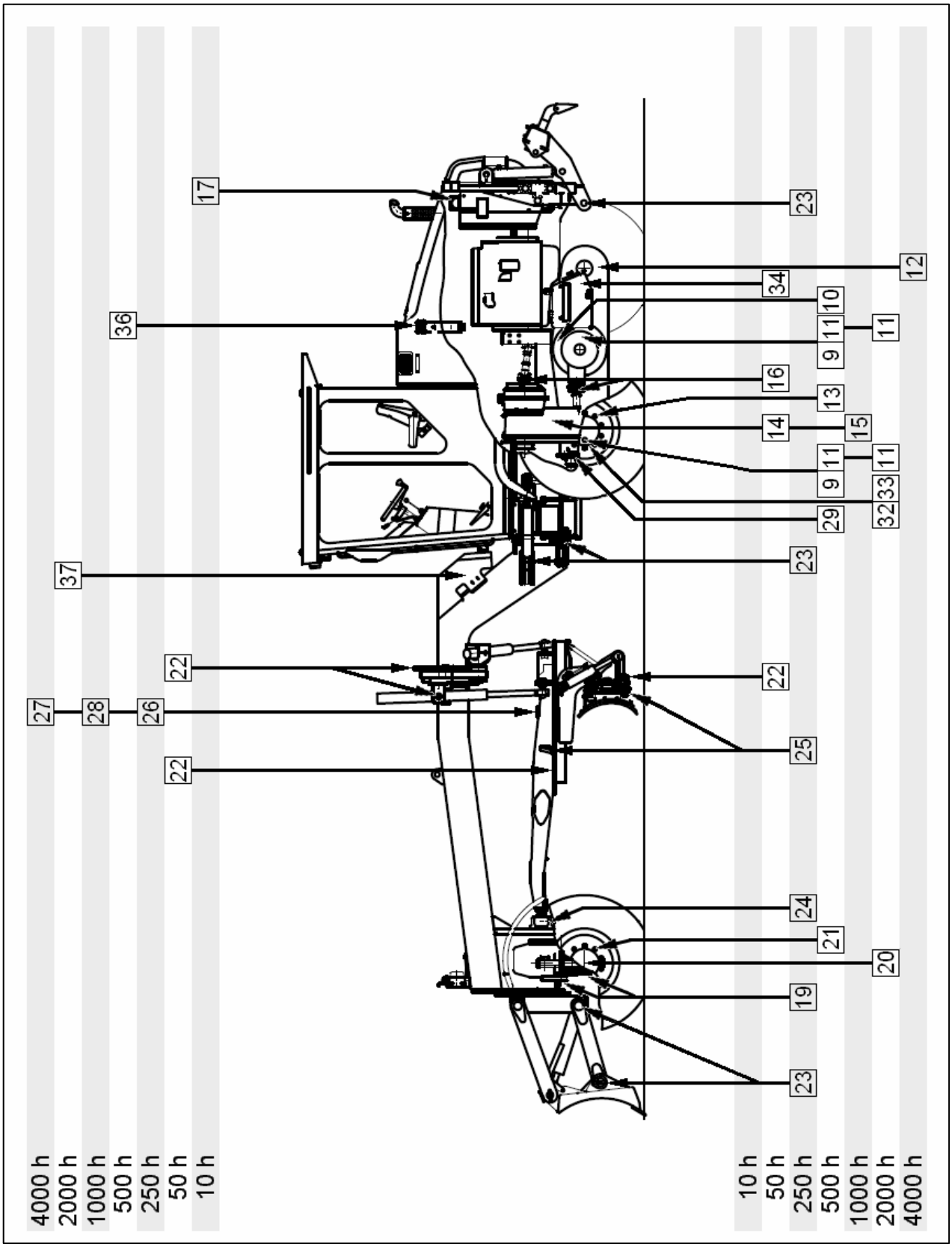
When putting the machine into operation again, take all measures and make all tests required to ensure proper operation. After a shutdown period of one year, also the gear and hydraulic oil must be changed.

25 Maintenance and inspection plan

For the first time after the following operating hours	Daily or every 10 operating hours or if required	Every 50 operating hours	Every 250 operating hours	Every 500 operating hours	Every 1000 operating hours	Every 2000 operating hours or annually	Every 4000 operating hours or max. 2,5 years		Pos.
								Rear axle:	
				●				Check the oil level in the wheel hubs, tandems, axle gears	9
				●				Lubricate the self-aligning bearings	10
				●				Replacement of oil in the wheel hubs, axle gears	11
							●	Replacement of oil in the tandems	12
5				●				Re-tighten the wheel nut	13
								Powershift transmission and cardan shafts:	
		●						Check the oil level	14
100					●			Replacement of oil and oil filter	15
		●						Lubricate the joints of cardan shafts	16
								Cooling system and air filter:	
	●							Check the coolant level	17
								Front axle (driven):	
			●					Lubricate joints	19
5				●				Re-tighten the wheel nuts	21
								Front axle (not driven):	
			●					Lubricate joints	19
						●		Replace the grease in the wheel bearings	20
5				●				Re-tighten the wheel nuts	21
								Blade system, grading plate, ripper, articulated frame joint, articulating cylinder:	
10		●						Lubricate slewing gear, guidance, bridge joint, cylinder joints	22
10			●					Lubricate grading plate, ripper joints, articulated frame joint, articulating cylinder	23
			●					Lubricate the ball of the draw rod	24
			●					Check the clearance of the slewing gear and blade guidance	25
			●					Check the oil level in the rotary mechanism	26
							●	Replace the oil in the rotary mechanism; retighten the fixing screws	27
					●			Check the safety coupling in the rotary mechanism for proper functioning	28
								Operating and parking brake:	
				●				Check the parking brake for lining wear	29
	●							Check the hoses and lines for leaks	
						●		Check the wear in the multiple brake disks	32
						●		Check the oil level in the brake system	33
								Hydraulic system:	
		●						Check the oil level; replacement of oil every 3000 hours or max. every 2,5 years	34
		●						Check the hoses, lines and screw connections for leaks	
50				●				Clean the oil filter and replace the insert; if the signal lamp lights or all 1000 operating hours	36
						●		Check the pressures of both circuits	37
								Around the machine:	
	●							Remove leaks; retighten screw and line connections, fixing components	
	●							Check the control lamps for proper functioning	
	●							Check the tyre air pressures	

Under extreme use conditions and at a high dust load, shorten the maintenance intervals. Maintain the machine always in a state that it complies with the regulations of operation, traffic and labour safety.

The maintenance and inspection schedule for the diesel engine is in chapter 4.


4000 h
2000 h
1000 h
500 h
250 h
50 h
10 h
17
36
37
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19
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10 h
50 h
250 h
500 h
1000 h
2000 h
4000 h

Fig. 25