BOMAG

FAYAT GROUP

Operating Instructions
Maintenance Instructions

BW177D-50 / BW177DH-50 / BW177PDH-50

SN: 901582301001 > SN: 901582311001 >
SN: 901582321001 >

Single Drum Vibratory Roller

Catalog Number
0852820

4/12

SYMBOLS USED IN THIS MANUAL

The following symbols have been used in THIS Manual to help communicate the intent of instructions. When one of the symbols appears, it conveys the meaning defined below:

DANGER:  **Serious personal injury, death, and/or extensive property damage can result if the DANGER instructions are not followed.**

CAUTION:  **Minor personal injury can result or a part, an assembly, or the engine can be damaged if the CAUTION instructions are not followed.**

WARNING:  **Serious personal injury and/or extensive property damage can result if the WARNING instructions are not followed.**

NOTE: **Gives additional, and/or clarification details, which are to be used in conjunction with previously presented information.**

CALIFORNIA
Proposition 65 Warning

WARNING: Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.

CALIFORNIA
Proposition 65 Warning

WARNING: Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the state of California to cause cancer, birth defects, and other reproductive harm.
Wash hands after handling.

BOMAG machines are products from the wide range of BOMAG compaction equipment.

BOMAG's vast experience in connection with state-of-the-art production and testing methods, such as lifetime tests of all important components and highest quality demands guarantee maximum reliability of your machine.

This manual comprises:

- Safety regulations
- Operating instructions
- Maintenance instructions
- Trouble shooting

Using these instructions will

- help you to become familiar with the machine.
- avoid malfunctions caused by unprofessional operation.

Compliance with the maintenance instructions will

- enhance the reliability of the machine on construction sites,
- prolong the lifetime of the machine,
- reduce repair costs and downtimes.

BOMAG will not assume liability for the function of the machine

- if it is handled in a way not complying with the usual modes of use,
- if it is used for purposes other than those mentioned in these instructions.

No warranty claims can be lodged in case of damage resulting from

- operating errors,
- insufficient maintenance and
- wrong fuels and lubricants.

Please note!

This manual was written for operators and maintenance personnel on construction sites.

Always keep this manual close at hand, e.g. in the tool compartment of the machine or in a specially provided container. These operating and maintenance instructions are part of the machine.

You should only operate the machine after you have been instructed and in compliance with these instructions.

Strictly observe the safety regulations.

Please observe also the guidelines of the Civil Engineering Liability Association "Safety Rules for the Operation of Road Rollers and Soil Compactors" and all relevant accident prevention regulations.

For your own personal safety you should only use original spare parts from BOMAG.

In the course of technical development we reserve the right for technical modifications without prior notification.

These operating and maintenance instructions are also available in other languages.

Apart from that, the spare parts catalogue is avail-able from your BOMAG dealer against the serial number of your machine.

Your BOMAG dealer will also supply you with information about the correct use of our machines in soil and asphalt construction.

The above notes do not constitute an extension of the warranty and liability conditions specified in the general terms of business of BOMAG. We wish you successful work with your BOMAG machine.

Copyright by BOMAG

Please fill in

.....

Machinetype(Fig. 1)

.....

Serial No. (Fig. 1 and 2)

.....

Engine type (Fig. 3)

.....

Engine No. (Fig. 3)

Note: **Fill in the above listed data when receiving the machine.**

Upon receipt of the machine our organization will instruct you about correct operation and maintenance.

Please observe strictly all safety regulations and notes on potential dangers!

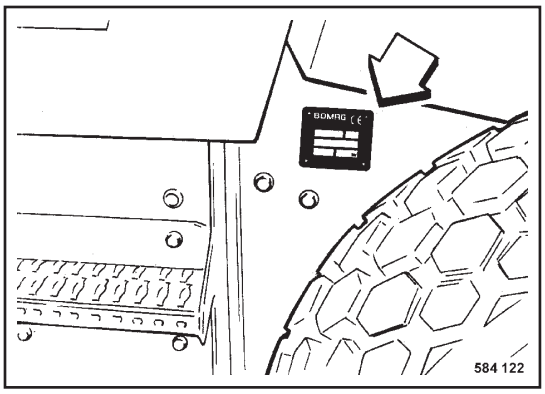

Fig. 1

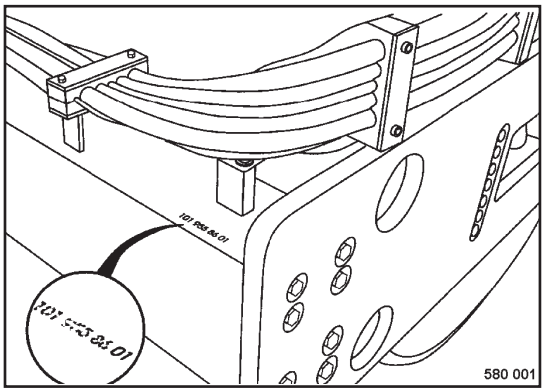

Fig. 2

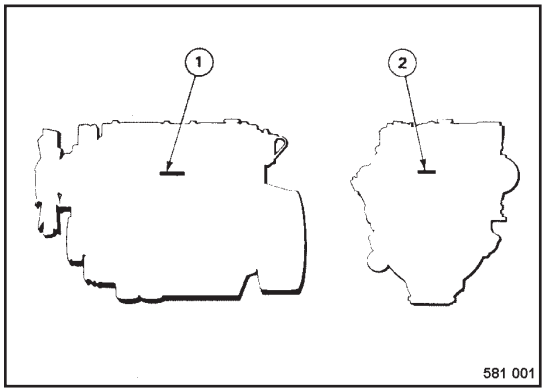

Fig. 3

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TECHNICAL DATA

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TECHNICAL DATA

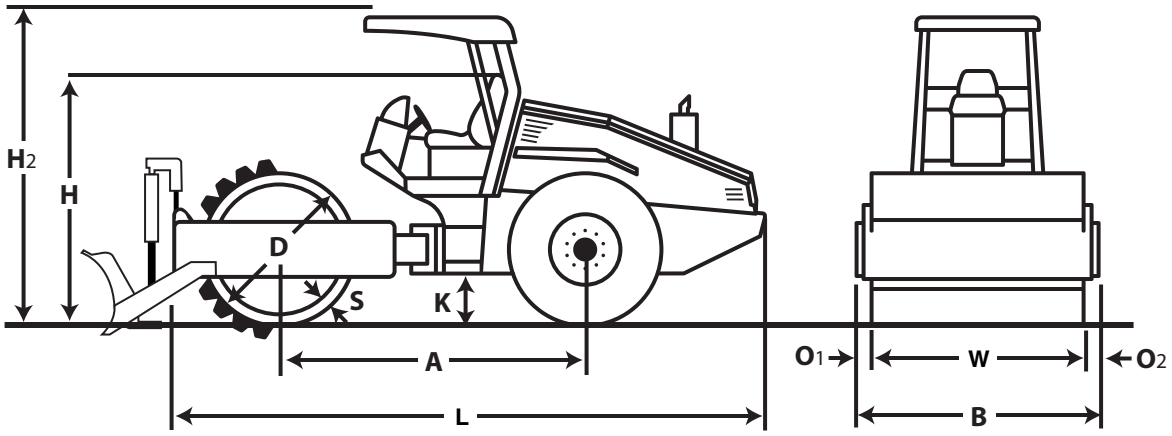

Fig. 4

Dimensions in mm (in)	A	B	D	H	H2	K	L	O1	O2	S	W
BW 177D-50	2500 (98.4)	1816 (71.5)	1228 (48.3)	2225 (87.6)	2860 (112.6)	375 (14.7)	4913 (193.4)	65 (2.6)	65 (2.6)	25 (1.0)	1686 (66.4)

*		**BW 177 D-50**
Weights		
Operating weight (CECE) with ROPS	kg(lbs)	6965 (15,355)
with Cabin	kg(lbs)	7205 (15,880)
Axle load, drum (CECE) with ROPS	kg(lbs)	4100 (9,040)
Rear axle load (CECE) with ROPS	kg(lbs)	2865 (6,315)
Static linear load with ROPS	kg/cm (lbs/in)	24.3 (136.1)
Travel characteristics		
Travel speed (1)	km/h(mph)	0 ... 7 (0-4.3)
Travel speed (2)	km/h(mph)	0 ... 11 (0-6.8)
Max. gradability (depending on soil)	%	45
Engine		
Engine manufacturer		Cummins
Type		B3.3T
Cooling		Water
Number of cylinders		4
Rated power DIN ISO 14396	kW (hp)	55 (74)
Rated speed	1 rpm	2600
Fuel		Diesel

*		BW 177 D-50
Electrical equipment	V	12
Drive system		hydrostatic
Driven axles		2
Brakes		
Service brake		hydrostatic
Parking brake		hydr.-mech.
Steering		
Type of steering		articulated
Steering operation		hydrostatic
Vibration		
Vibrating drum		1
Drive system		hydrostatic
Frequency	Hz (VPM)	30/40 (1,800/2,400)
Amplitude	mm (in)	1,8/0,9 (.071/.035)
Tires		
Tire size		14.9-24/6PR
Tire tread		Diamond (R3)
Air pressure	bar (psi)	1,9 (27.6)
Filling capacities		
Engine Oil**	Litres (gal)	8.5 (2.24)
Fuel	Litres (gal)	150 (40)
Hydraulic oil	Litres (gal)	60 (16)
Coolant W/O Heating	Litres (gal)	23.5 (6.2)
Coolant W/ Heating	Litres (gal)	25.5 (6.73)

* The right for technical modifications remains reserved
** With filter

Section 1
TECHNICAL DATA

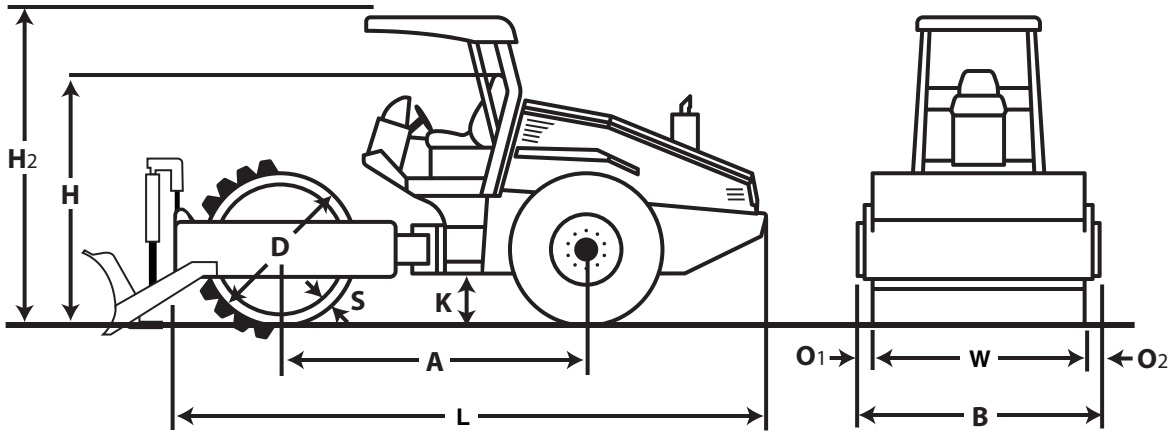

Fig. 4

Dimensions in mm (in)	A	B	D	H	H2	K	L	O1	O2	S	W
BW 177DH-50	2500 (98.4)	1816 (71.5)	1228 (48.3)	2225 (87.6)	2860 (112.6)	375 (14.7)	4913 (193.4)	65 (2.6)	65 (2.6)	25 (1.0)	1686 (66.4)
BW 211PDH-50	2500 (98.4)	1816 (71.5)	1228 (48.3)	2225 (87.6)	2860 (112.6)	375 (14.7)	4913 (193.4)	65 (2.6)	65 (2.6)	25 (1.0)	1686 (66.4)

*		BW 177DH-50	BW 211 PDH-50
Weights			
Operating weight (CECE) with ROPS	kg(lbs)	7095 (15,640)	7310 (16,115)
with Leveling Blade	kg(lbs)	N/A	7910 (17,440)
with Cabin	kg(lbs)	7340 (16,160)	7550 (16,640)
Axle load, drum (CECE) with ROPS	kg(lbs)	4115 (9,070)	4330 (9,545)
with Leveling Blade	kg(lbs)	N/A	4835 (10,660)
Rear axle load (CECE) with ROPS	kg(lbs)	2980 (6,570)	2980 (6,570)
Static linear load with ROPS	kg/cm (lbs/in)	24.4 (136.6)	—
Travel characteristics			
Travel speed (1)	km/h(mph)	0 ... 4.0 (2.5)	0 ... 4.0 (2.5)
Travel speed (2)	km/h(mph)	0 ... 6.5 (4.0)	0 ... 6.5 (4.0)
Travel speed (3)	km/h(mph)	0 ... 13.0 (8.0)	0 ... 13.0 (8.0)
Max. gradability (depending on soil)	%	55	55
Engine			
Engine manufacturer		Cummins	Cummins
Type		B3.3T	B3.3T
Cooling		Water	Water
Number of cylinders		4	4
Rated power DIN ISO 14396	kW (hp)	55 (74)	55 (74)
Rated speed	1 rpm	2600	2600
Fuel		Diesel	Diesel

*		BW 177 DH-50	BW 177 PDH-50
Electrical equipment	V	12	12)
Drive system		hydrostatic	hydrostatic
Driven axles		2	2
Brakes			
Service brake		hydrostatic	hydrostatic
Parking brake		hydr.-mech.	hydr.-mech.
Steering			
Type of steering		articulated	articulated
Steering operation		hydrostatic	hydrostatic
Vibration			
Vibrating drum		1	1
Drive system		hydrostatic	hydrostatic
Frequency	Hz (VPM)	30/40 (1,800/2,400)	30/40 (1,800/2,400)
Amplitude	mm (in)	1,8/0,9 (.071/.035)	1,70/0,9 (.064/.035)
Tires			
Tire size		14.9-24/6PR	14.9-24/6PR
		Diamond (R3)	Tractor (R1)
Air pressure	bar (psi)	1,9 (27.6)	1,6 (23.2)
Filling capacities			
Engine Oil **	Litres (gal)	8.5 (2.24)	8.5 (2.24)
Fuel	Litres (gal)	150 (40)	150 (40)
Hydraulic oil	Litres (gal)	60 (16)	60 (16)
Coolant W/O Heating	Litres (gal)	23.5 (6.2)	23.5 (6.2)
Coolant W/ Heating	Litres (gal)	25.5 (6.73)	25.5 (6.73)

* The right for technical modifications remains reserved
** With filter

NOTES

Section 2
SAFTEY REGULATIONS

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Section 2
SAFTEY REGULATIONS

General

This BOMAG machine is built in accordance with the latest technical standard and the valid technical rules and regulations. There is, however, a risk of danger for persons and property if:

- the machine is used for purposes other than those it is intended for
- the machine is operated by untrained personnel
- the machine is modified or converted in an unprofessional way
- the applicable safety regulations are not observed.

Each person involved in operation, maintenance and repair of the machine must therefore read and apply these safety regulations. This should be confirmed by obtaining the signatures of the customer, if necessary.

Furthermore the following regulations and instructions are obviously also valid:

- applicable accident prevention instructions
- generally acknowledged safety and road traffic regulations
- country specific safety regulations. It is the duty of the operator to know and observe these regulations. This applies also for local regulations and the regulations for various types of manual work. If the recommendations in this manual differ from the regulations valid in your country, you must strictly observe the regulations in your country.

Intended use

This machine must only be used for:

- compaction of bituminous materials, e.g. road surface layers. (AC and AD machines only)
- medium and heavy compaction tasks in earth work (road sub-bases)
- This machine must only be operated with fully functional safety equipment.
- The machine should be checked by an expert once every year.

Unintended use

Dangers may, however, arise from the machine if it is used by untrained personnel in an unprofessional way or if it is used for purposes other than those mentioned in these instructions.

Do not work with vibration on hard concrete, on a cured concrete layer or heavily frozen ground.

Starting and operation of the machine in an explosive environment is prohibited.

Who is allowed to work with the machine?

The machine must only be operated by trained and authorized persons which are at least 18 years of age. The responsibilities for the operation of the machine must be clearly specified and complied with.

Persons under the influence of alcohol, medication or drugs must not operate, service or repair the machine.

Maintenance and repair tasks require specific knowledge and must therefore only be carried out by trained and qualified personnel.

Conversions and alterations to the machine

Unauthorized conversions to the machine are prohibited for safety reasons.

Original parts and accessories have been specially designed for this machine. We wish to make expressly clear that we have not tested or authorized any original parts or special equipment not supplied by us. The installation and/or use of such products can impair the active and/or passive driving safety. The manufacturer expressly excludes any liability for damage resulting from the use of non-original parts or accessories.

Safety notes in the operating and maintenance instructions:

DANGER: 

Sections marked like this point out possible dangers for persons.

Section 2
SAFTEY REGULATIONS

CAUTION: **Sections marked like this point out possible dangers for the machine or for parts of the machine.**

Note: **Sections marked like this provide technical information concerning the optimal economical use of the machine.**

Environment **Sections marked like this highlight activities for the safe and environmental disposal of fuels and lubricants as well as replaced parts.**

Observe all environment protection regulations.

Information and safety stickers/decals on the machine

Keep stickers/decals complete (see spare parts catalogue) and fully legible and observe their meaning.

Replace damaged or illegible stickers/decals immediately.

Loading the machine

Use only strong and stable loading ramps. The ramp inclination must be lower than the gradability of the machine.

Secure the machine against turning over or slipping off.

Secure the machine on the transport vehicle against rolling off, slipping and turning over.

Persons are highly endangered if:

- they step or stand under loads being lifted
- they remain in the drive range of the machine during a demonstration or during loading.

The machine must not swing about when lifted off the ground.

Use only safe lifting gear of sufficient load bearing capacity.

Attach the lifting gear only to the specified lifting points.

Towing the machine

Since the machine is notfitted with a towing hitch, the machine cannot be towed with a tow bar.

If the machine has to be towed urgently out of the danger zone because of other risks, this must only be done on level ground or uphill using chains and ropes. For this purpose towing ropes of sufficient tensile strength must be fastened on the lifting eyes.

After releasing the brake the machine can only be braked by the towing vehicle.

Before releasing the brake block the machine with chocks to prevent unintended rolling.

Checking the Roll Over Protection Structure (ROPS)

The machine frame must not be distorted, bent or cracked in the area of the ROPS structure.

The ROPS structure must not show any rust, damage, hairline cracks or open fractures.

The ROPS must not rattle about when driving the machine. This would mean that the fastening screws are insufficiently fastened. All screwed connections must be tight and in accordance with the specifications (observe the tightening torques). Screws and nuts must not be damaged, distorted or deformed.

No additional parts must be welded or bolted on and no holes must be drilled without the permission of the dealer, since this may impair the strength of the structure.

Starting the machine

Before starting

Operation of the machine is only permitted when sitting in the operator's seat.

Use only machines which have been properly serviced at regular intervals.

Become acquainted with the equipment, the control elements, the working mode of the machine and the area you will be working in.

Use your personal protective outfit (hard hat, safety boots etc.).

Check before mounting the machine if:

- there are persons or obstructions beside or under the machine

- the machine is free of any oily and combustible material
- all handrails, steps and platforms are free of grease, oils, fuels, dirt, snow and ice
- the engine compartment hood is closed and locked

To climb onto the machine use steps and handrails.

Check before starting, whether:

- the machine shows any obvious defects
- all protective devices are properly secured in their place
- steering, brakes, control elements, lighting and warning horn are in order
- the seat is correctly adjusted
- the mirrors (if available) are clean and correctly adjusted.

Do not start the machine if any gauges, control lights or controls are defective.

Do not take any loose objects with you or fasten them to the machine.

On machines with ROPS you should always wear your seat belt!

Starting

Start and operate the machine only from the operator's seat

For starting set all control levers to "neutral position".

Do not use any starting aids such as Start Pilot or ether.

After starting check all gauges.

Starting with jump leads

Connect plus with plus and minus with minus (ground cable) - always connect the ground cable last and disconnect it first! Wrong connections may cause severe damage in the electric system.

Never start the engine by bridging the electrical connections on the starter, because the machine would probably start to move immediately.

Starting in closed rooms

Exhaust gases are toxic! Always ensure an adequate supply of fresh air when starting in closed rooms!

Driving the machine

Persons in the endangered area

If the machine has turned over and the cabin door is jammed, use the right hand cabin window as an emergency exit.

Check if there are persons or obstacles in the danger area before starting or resuming work, especially when driving in reverse.

If necessary give warning signals. Stop work immediately if persons remain in the danger area despite the warning.

Do not step or stand into the articulation area of the machine while the engine is running. Danger of injury!

Driving

In events of emergency actuate the emergency stop switch immediately. Do not use the emergency stop push button as service brake.

Restart the machine only after the danger, that has caused the actuation of the emergency stop, has been eliminated.

If the machine has come in contact with high-voltage power lines:

- do not leave the operator's stand
- warn others from coming too close to the machine or touching it
- if possible drive the machine out of the danger zone
- have the power shut off.

Operate the machine only from the operator's seat.

Keep the cabin doors closed.

Do not adjust the operator's seat while driving.

Do not climb onto or off the machine while driving.

Change the travel direction only while the machine is standing.

Do not use the machine to transport persons.

Stop the machine if you notice unusual noises or the development of smoke. Investigate the cause and have the fault corrected.

Always keep a safe distance to excavations and embankments and avoid all activities which could impair the stability of the machine.

Do not work with vibration on hard concrete, on a cured concrete layer or heavily frozen ground.

When passing under flyovers, bridges, tunnels, electric power lines etc. keep a sufficient distance.

Driving on slopes and gradients

Do not drive up and down gradients, which exceed the maximum gradability of the machine.

Always drive extremely carefully on slopes and always directly up or down the slope, never diagonally. Change to the lower speed range before approaching the inclination.

Wet and loose soils reduce the ground adhesion of the machine and inclinations and slopes considerably. Higher risk of accident!

Behaviour in traffic

Match the speed of the machine to the working conditions.

Always allow loaded transport vehicles to pass.

Switch the lights on when the visibility is poor.

Keep clear of edges and embankments.

Check the effect of vibration

When compacting with vibration check the effect of the vibration on nearby buildings and underground supply lines (gas, water, sewage, electric power supply), stop vibratory compaction if necessary.

Never use the vibration on hard (frozen, concrete) ground. Risk of bearing damage!

Parking the machine

Park the machine on level and firm ground.

Before leaving the machine:

- straighten the articulated joint to allow easy access to and from the machine.
- return the travel lever to neutral position
- apply the parking brake
- shut the engine down and pull the ignition key out.
- lock the cabin door
- secure the machine against unauthorized use.

Do not jump off the machine, use access steps and hand rails.

Always secure parked machines, which could be in the way, with appropriate measures.

Parking on slopes and gradients

Secure the machine against rolling, place metal chocks in front of and behind the drums.

Filling the fuel tank

Do not inhale fuel fumes.

Refuel only after shutting the engine and the auxiliary heater down.

Do not refuel in closed rooms.

No open fire, do not smoke.

Do not spill any fuel. Catch running out fuel, do not let it seep into the ground.

Wipe off spilled fuel. Keep fuel free of dirt and water.

Leaking fuel tanks can cause explosions. Ensure tight fit of the fuel tank filling cover, replace it if necessary.

Fire protection measures

Make yourself acquainted with the location and the operation of fire extinguishers. Observe fire warning and fire fighting installations.

Maintenance work

Strictly apply the specified maintenance tasks, including the changing of parts.

For service and repair work in the engine compartment support the engine compartment hood

Maintenance work must only be carried out by qualified and authorized personnel.

In case of maintenance and assembly work over-head make sure to use the prescribed or other safe access steps, ladders and gangways. Do not use parts of the machine as access steps. Keep unauthorized persons away from the machine.

Keep unauthorized persons away from the machine.

Do not perform maintenance work with the machine driving or the engine running.

Park the machine on horizontal, level and stable ground.

Pull the key out of the ignition switch.

Lock the articulated joint with the articulation lock.

Working on hydraulic lines

Always relieve the pressure in the hydraulic circuit before working on hydraulic lines. Hydraulic oil escaping under pressure may penetrate through the skin and cause severe injury. In case of being injured by hydraulic oil you should immediately seek medical advice, as otherwise this may lead to serious infections.

When adjusting the hydraulic system do not stand behind or in front of the drum/wheels.

Do not change the setting of high pressure relief valves.

Drain hydraulic oil at operating temperature - danger of scalding!

Catch running out hydraulic oil and dispose of environmentally.

Always catch and dispose of biological hydraulic oils separately.

Do not start the engine after draining off the hydraulic oil.

Once all work is completed (with the system depressurized!) check all connections and fittings for tight and leak-free fit.

Changing hydraulic hoses

All hydraulic hoses must be inspected visually at regular intervals.

Hydraulic hoses must be changed immediately if:

- damage to the outer surface down to the lining (e.g. chafings, cuts, cracks)
- embrittlement of the outer layer (development of cracks in the hose material)
- deformation under pressurized and depressurized condition, which are not in accordance with the normal shape of the hydraulic hose
- deformation in bends, e.g, squeezes, kinks, layer separation, formation of blisters
- leakages.
- non-observance of the installation requirements
- separation of the hydraulic hose from the fitting
- corrosion of the fitting, which impairs the function and the strength.
- Do not mix up hoses by mistake.
- damage or deformation of the fitting, which impairs the function and strength of the hose/ hose connection.

Only genuine BOMAG hydraulic hoses ensure that the correct type of hose (pressure range) is used at the right place.

Working on the engine

Shut the engine down before opening the engine compartment hood.

Drain the engine oil at operating temperature - danger of scalding!

Wipe off spilled oil, catch running out oil and dispose of environmentally.

Store used filters and other oily materials in a separate, specially marked container and dispose of environmentally.

Do not leave any tools or other objects, which could cause damage, in the engine compartment.

Idle speed and full load speed must not be changed, since this would have a negative effect on the exhaust gas values and cause damage to engine and drive.

Turbo chargers work with high speeds and high temperatures. Keep hands, tools and materials away from the intake and outlet openings of the turbo charger and do not touch any hot surfaces. Check and replace the coolant only when the engine is cold.

Catch running out coolant and dispose of environmentally.

Working on electrical equipment

Before working on electrical equipment disconnect the battery and cover it with insulating material.

Do not use any fuses with higher ampere ratings or repair a fuse with a piece of wire. Fire hazard!

Always disconnect the battery before starting to weld on the machine.

Working on the battery

When working on the battery do not smoke, do not use open fire.

Do not let acid come in contact with skin and clothes. If being injured by acid flush off with clear water and seek for medical advice.

Metal objects (e.g. tools, rings, wrist watches) must not contact the battery poles - danger of short circuit and burns!

When recharging maintenance free batteries remove the plugs to avoid the accumulation of explosive gases.

When using an external battery to start the machine follow the respective instructions.

Dispose of old batteries environmentally.

Switch the charging current off before removing the charge clamps.

Ensure good ventilation, especially when charging the battery in a closed room.

Working on the fuel system

Do not inhale fuel fumes.

No open fire, do not smoke, do not spill any fuel.

Catch running out fuel, do not let it seep into the ground and dispose of environmentally.

Working on wheels and tires

Explosion like bursting of tires and parts of rims and tires can cause severe or even deadly injuries.

The assembly of tires must only be carried out by experienced personnel and with the correct equipment. If necessary have the tires assembled in a qualified workshop.

Ensure correct tire pressure and do not exceed the highest specified pressure.

Check wheels and tires every day for specified pressure, cuts, bulges, damaged wheel rims, missing wheel studs and nuts. Do not drive with damaged tires or wheels.

Anti-stick emulsions for tires must only be mixed using water and concentrated anti-stick agent according to the specifications of the manufacturer of the anti-stick agent. Observe the regulations for the protection of the environment.

Cleaning

Do not clean the machine while the engine is running.

Do not use gasoline or other combustible substances for cleaning purposes.

When using steam cleaning equipment do not subject electrical components and insulating materials to the direct water jet, but cover them beforehand.

- Do not guide the water jet into the exhaust or into the air filter.

After maintenance work

Reinstall all protective devices after completing the maintenance work.

Repair

Attach a warning tag to the steering wheel if the machine is defective.

Repairs must only be performed by qualified persons who have been instructed for this purpose. Use our repair instructions.

Exhaust gases are highly dangerous! Always ensure an adequate supply of fresh air when starting in closed rooms!

Test

Depending on the type of application and the operating conditions vibratory equipment has to be examined by a specialist whenever required, but at least once every year.

Section 3
INDICATORS AND CONTROLS

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Section 3
INDICATORS AND CONTROLS

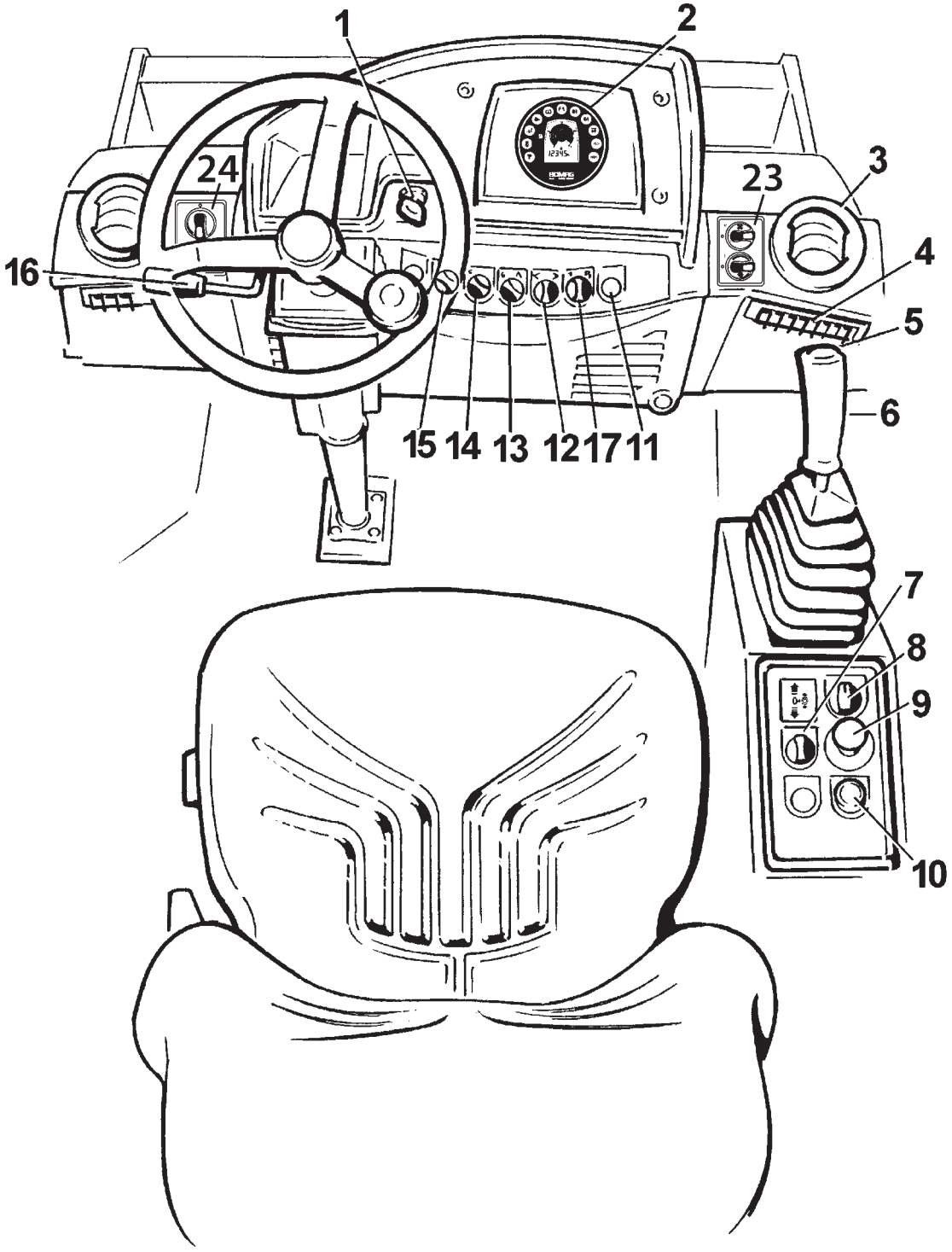

Fig. 6

1 Ignition switch

2 Instrument cluster

3 Vent for heating and ventilation, driver[3]

4 Vent for heating and ventilation, footwell[3]

5 Push button vibration

6 Travel lever

7 Rotary switch vibration, high/low frequency

8 Rotary switch for speed limitation control

9 Emergency stop push button

10 Push button for warning horn

11 Warring light "ASC" Anti-Spin-Control[1]

12 Rotary switch for direction indicators left/right[3]

13 Rotary switch for hazard light system[3]

14 Rotary switch for lighting (StVZO)[3]

15 Rotary switch for working lights[3]

16 Steering wheel adjustment lever[3]

17 Rotary momentary contact switch for engine speed and engine diagnotics inc/dec.

1 BW177DH/PDH-50
2 Not Available
3 Optional Equipment

Section 3
INDICATORS AND CONTROLS

General notes

Please read this section thoroughly before operating this machine if you are not yet conversant with the indicators and control elements. All functions are described in detail hereunder.

Paragraph 4 Operation contains only concise descriptions of the individual operating steps.

Description of indicators and control elements

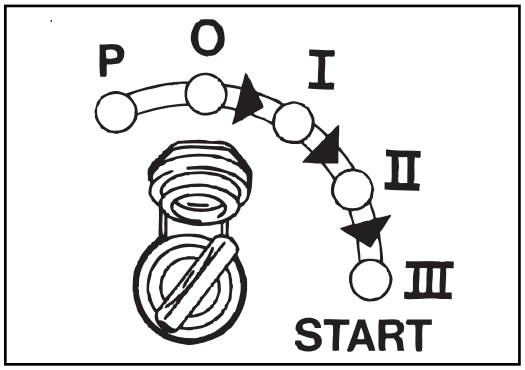

Fig. 7

No. 1 = Ignition switch

Position "P"	=	accessories on, ignition off, the key can be pulled out, engine not running.
Position "0"	=	ignition off, the key can be pulled out, engine not running.
Position "I"	=	ignition on, all control and warning lights on the fault monitoring board light up for a moment. The lighting can be switched on.
Position "II"	=	not used
Position "III"	=	turn further against spring pressure, the engine starts. Allow the ignition key to return to the "I" position when the engine starts.

NOTE: **The engine can only be started when the travel lever is in braking position.**

The ignition switch is provided with a lock against repetitive starting. To repeat the starting procedure you must first turn the ignition switch back to "0"- position.

CAUTION: **Run the engine warm for a short while before starting to work. Do not let the engine run at idling speed for longer than 10 minutes.**

Do not shut the engine down all of a sudden from full speed, but let it idle for a while for temperature equalization.

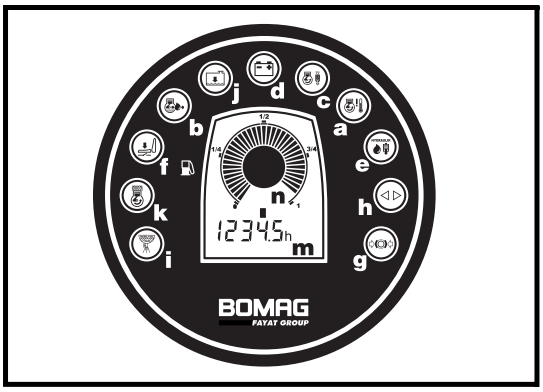

Fig. 8

No. 2 = Instrument cluster

NOTE: **With the ignition switch in position I all gauges and instruments are switched on for 3 seconds.**

a red = flashes when the engine overheats, the warning buzzer sounds, the engine is shut down after 2 minutes. Switch off vibration, run engine with idle speed or shut down engine if necessary, clean engine oil cooler and radiator, if necessary repair engine.

b red = flashes if engine oil pressure too low, engine is shut down after 10 seconds. Check engine oil level, repair the engine if necessary.

c yellow = N/A

d yellow = Charge control light, lights if battery is not being charged. Check V-belt, if necessary repair the generator.

e yellow = lights if the hydraulic oil filter is contaminated, the engine is shut down after 2 minutes. Check hydraulic system, replace hydraulic oil filter.

f yellow = N/A

g red = Parking brake, with lever shifted to parking brake position, with driver's seat unoccupied.

h green = Direction indicator*, flashes when the direction indicator switch is actuated.

i yellow = Water separator in fuel pre-cleaner. Lights when the water proportion in the fuel filter reaches the contacts.

j red = N/A

k yellow = Glow Plugs indicator lights when temperature is low (pre-heating for starting)

l red = Hazard light*, flashes when the hazard light is activated.

m = Operating hour meter, counts the operating hours while the engine is running. All maintenance work must be performed according to the indicated operating hours.

n = Fuel tank filling level.

No. 3 = Vents for air conditioning, heating and ventilation, driver*

No. 4 = Vents for air conditioning, heating and ventilation, footwell*

* Optional equipment

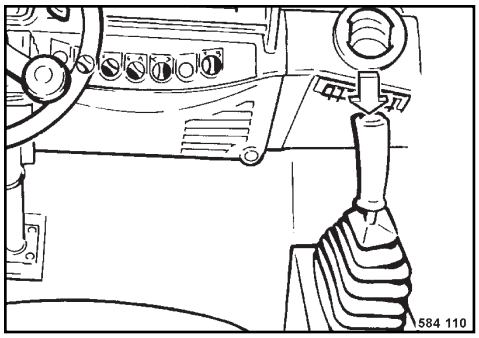

Fig. 9

No. 5 = Push button for vibration

- Select or actuate the frequencies with the vibration selector switch.
- Switch the vibration on or off by pressing the push button.

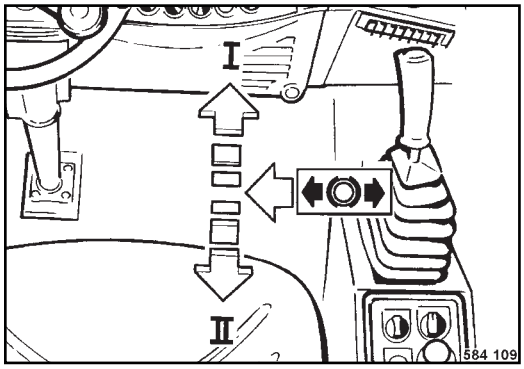

Fig. 10

No. 6 = Travel lever

Position “middle”	=	Braking position sevice brake
Position “middle, right”	=	Parking brake, to start the engine
Position “I”	=	Forward travel
Position “II”	=	Backwards travel

NOTE: **If the engine speed drops under load when driving on steep gradients, take the travel lever slightly back towards neutral. This relieves the hydraulic system and reduces the load on the diesel engine.**

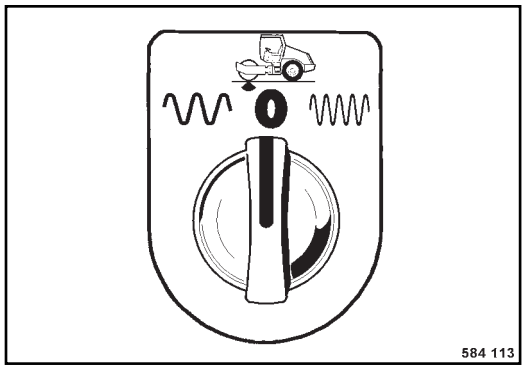

Fig. 11

No. 7 = Rotary switch for vibration

Position “middle”	=	Vibration off
Position “Right”	=	low amplitude, high frequency
Position “Left”	=	high amplitude, low frequency

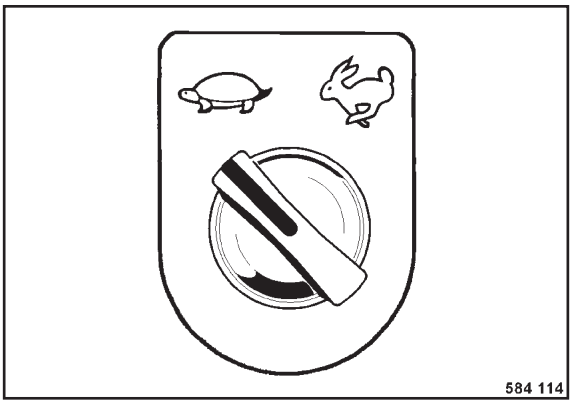

Fig. 12

No. 8 = Rotary Switch for speed range selection BW177 D-50

Position "turtle" = Working speed

Position "rabbit = Transport speed

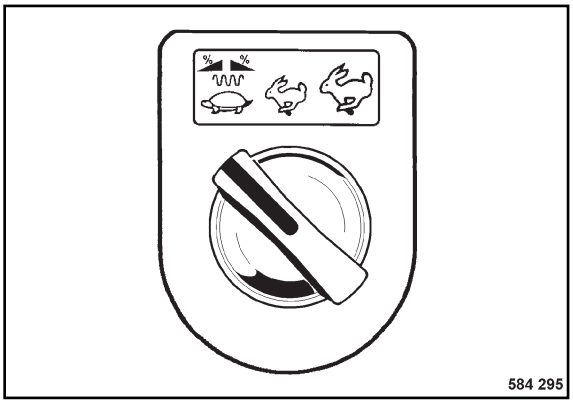

Fig. 13

No. 8 = Rotary Switch for speed range selection BW177 DH-50/PDH-50

Position "turtle" = Working speed range on level ground or on inclinations steeper than 15%

Position "rabbit, low" = Working speed range on level ground and on inclinations, with high working speed

Position "rabbit, high" = Transport range, e.g. to drive to the work location, vibration not possible

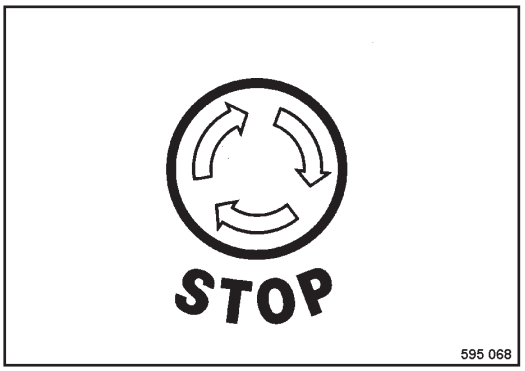

Fig. 14

No. 9 = Emergency stop switch

The engine will be shut down and the brake will close.

DANGER: **Danger of accident!**

Operate only in emergency situations during operation, do not use as a service brake.

The machine should only be started again after the danger, that caused the actuation of the emergency stop switch, has been removed.

operate = push the button completely down, it will automatically lock in end position.

unlock = turn the button clockwise and release it.

to drive = move the travel lever first to braking position, then start the engine and choose the travel direction.

For safety reasons the travel system of the machine will only be enabled after the travel lever has been shifted back to braking position.

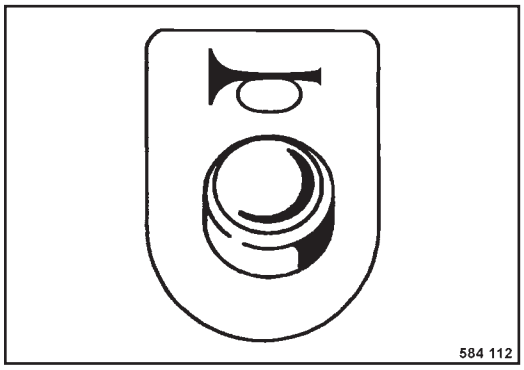

Fig. 15

No. 10 = Push button for warning horn

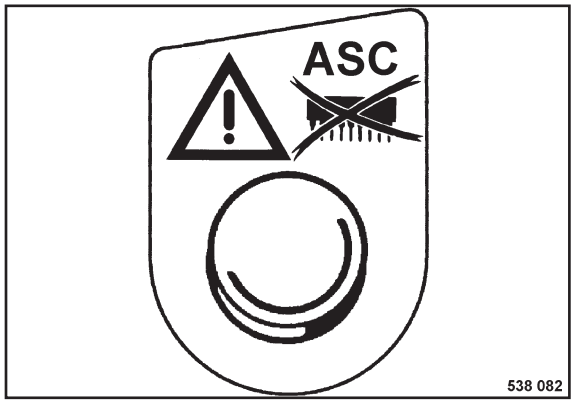

Fig. 16

No. 11= Fault warning light "ASC" Anti-Spin-Control BW177 DH-50/PDH-50

NOTE: **Further trouble shooting by means of flashing codes on the ASC-control board in the electric junction box.**

Operation of the machine can be continued, but you should inform the after sales service of BOMAG.

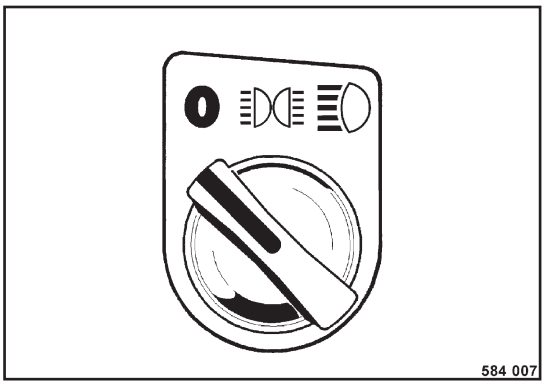

Fig. 17

No. 14 = Rotary switch for light system (StVZO)*

Position "Left"	=	Light off
Position "Middle"	=	Sidelights on, with ignition switch in position "I" or "P"
Position "Right"	=	Travel light on, with ignition switch in position "I".

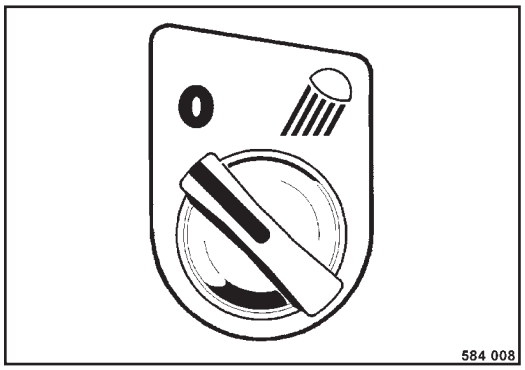

Fig. 18

No. 15 = Rotary switch for working lights *

Position "Left"	=	Light off
Position "Right"	=	Working lights on, with ignition switch in position "I"

* Optional equipment

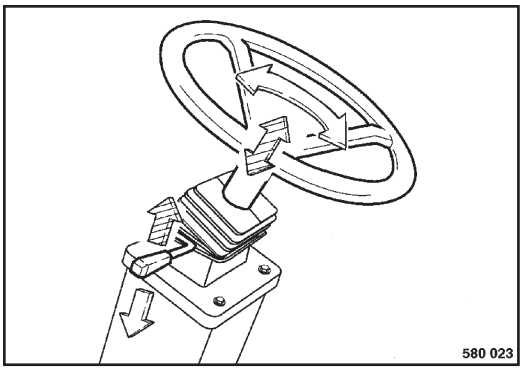

Fig. 19

No. 16 = Lever, steering wheel adjustment *

DANGER: **Danger of accident!**

Do not adjust the steering wheel while driving.

Pull up = Adjust height of steering wheel

Press down = Adjust inclination of steering wheel

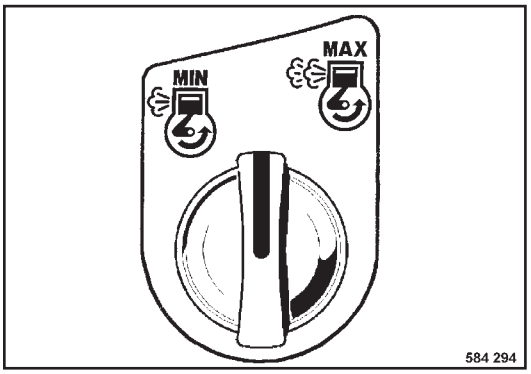

Fig. 20

No. 17 = Rotary momentary contact switch for engine speed

Electric engine speed adjustment

Turn anti-clockwise = Idle speed position

NOTE: **Normal position for engine start.**

Turn clockwise = Full throttle position, operating position for driving and vibration

CAUTION: **Always drive and vibrate with max. engine speed! Control the travel speed with the travel lever.**

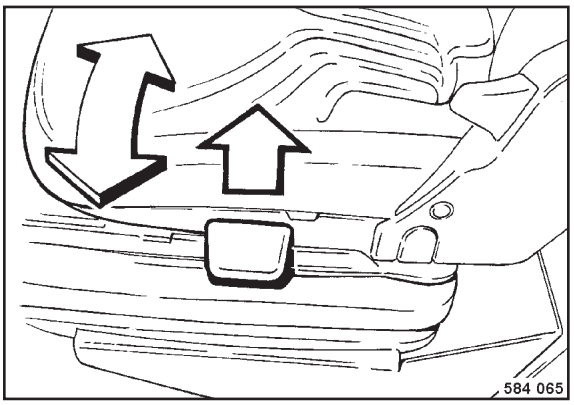

Fig. 21

Lever, swivelling of driver's seat *

DANGER: **Danger of accident!**

Always lock the driver's seat in one of the locking positions while driving.

Do not swivel the driver's seat while driving.

Swivel = Stop the machine and apply the parking brake. Pull the lever up and swivel the driver's seat to the desired position.

NOTE: **Swivelling angle max. 20° to either side.**

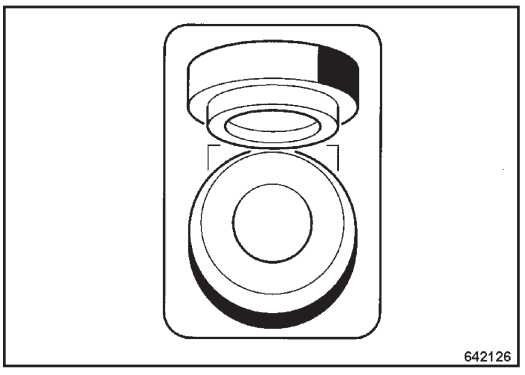

Fig. 22

2-pole socket

Current only with the ignition switch in position "I" or when the engine is running.

* Optional equipment

* Optional equipment

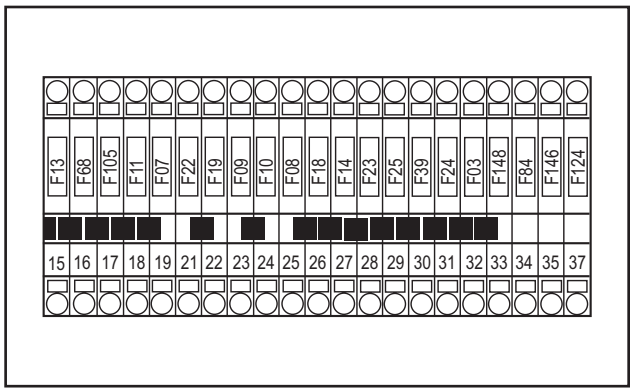

Fig. 24

No. 20 = Fuses in electric installation box BW177 D-50

F13, 30A	=	Ignition switch
F68, 5A	=	Burglary protection*
F105, 20A	=	Engine speed
F11, 15A	=	Headlight front, StVZO*
F07, 15A	=	Hazard light, StVZO*
F22, 15A	=	Working lights rear*
F19, 15A	=	Working lights front*
F09, 15A	=	Parking and tail light L-H, StVZO*
F10, 15A	=	Parking and tail light R-H, StVZO*
F08, 15A	=	Directional indicators, StVZO*
F18, 10A	=	Working head lights, relay*
F14, 15A	=	Engine shutoff off solenoid
F23, 10A	=	Signal horn
F25, 10A	=	Solenoid valve, neutral start and backup horn
F39, 15A	=	Cab*
F24, 10A	=	Monitoring-module, indicators
F03, 15A	=	Vibration
F148, 10A	=	Controller MESX***
F84, 10A	=	Controller MESX***
F146, 15A	=	Controller MESX***
F124, 25A	=	Fuel-pre-heating*

DANGER: **Fire hazard!**

Do not use fuses with higher ampere ratings and do not bridge fuses.

* Optional equipment

** DASA = Data Collector

*** MESX = BMU-measuring technology control

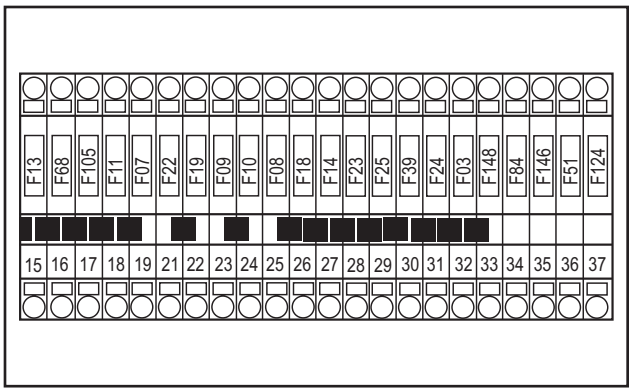

Fig. 25

No. 20 = Fuses in electric installation box BW177 DH-50/PDH-50

F13, 30A	=	Ignition switch
F68, 5A	=	Burglary protection*
F105, 20A	=	Engine speed
F11, 15A	=	Headlight front, StVZO*
F07, 15A	=	Hazard light, StVZO*
F22, 15A	=	Working lights rear*
F19, 15A	=	Working lights front*
F09, 15A	=	Parking and tail light L-H, StVZO*
F10, 15A	=	Parking and tail light R-H, StVZO*
F08, 15A	=	Directional indicators, StVZO*
F18, 10A	=	Working head lights, relay*
F14, 15A	=	Engine shutoff off solenoid
F23, 10A	=	Signal horn
F25, 10A	=	Solenoid valve, neutral start and backup horn
F39, 15A	=	Cab*
F24, 10A	=	Monitoring-module, indicators
F03, 15A	=	Vibration
F148, 10A	=	Controller MESX***
F84, 10A	=	Controller MESX***
F146, 15A	=	Controller MESX***
F51, 10A	=	Antispin Control (ASC)
F124, 25A	=	Fuel-pre-heating*

DANGER: **Fire hazard!**

Do not use fuses with higher ampere ratings and do not bridge fuses.

* Optional equipment

** DASA = Data Collector

*** MESX = BMU-measuring technology control

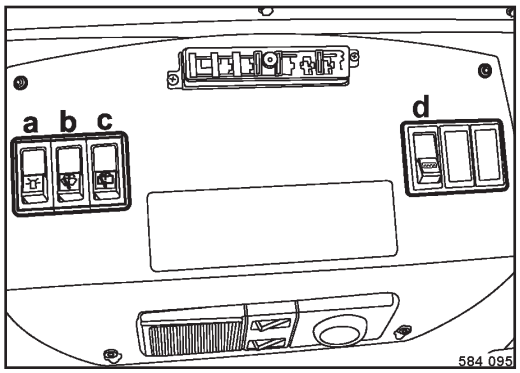

Fig. 26

a = **toggle switch for flashing beacon***

b = **toggle switch for front windscreen wiper / washer***

Up	=	Windscreen wiper moves to end position and stops.
Down	=	Switches on wiping of front windscreen.
Push button	=	Front windscreen is sprayed during wiping.

c = **toggle switch for rear windscreen wiper/ washer**

Up	=	Windscreen wiper moves to end position and stops.
Down	=	Switches on wiping of front windscreen.
Push button	=	Rear windscreen is sprayed during wiping.

d = **toggle switch for rear windscreen heating***

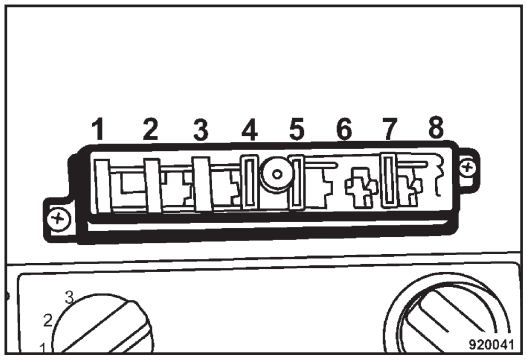

Fig. 27

No. 21= **Fuse box, cabin***

DANGER: **Fire hazard!**

Do not use fuses with higher ampere ratings and do not bridge fuses.

(1), 15A	=	(F43) wiper/washer, rear*
(2), 15A	=	(F44) wiper/washer, front*
(3), 10A	=	(F130) relay for rear windscreen heating, reading light*
(4), 25A	=	(F31) cabin fan*
(5), 10A	=	(F41) flashing beacon*
(6), 15A	=	(F144) cab socket*
(7), 15A	=	(F143) rear windscreen heating*
(8), 10A	=	(F42) potential 30, cab light*

Fig. 28

No. 22 = **Control panel for cabin fan and AC***

e = **Rotary switch for cabin ventilator***

Position ”0“	=	Cabin ventilator switched off.
Position 1, 2 and 3	=	Ventilator stages of different strengths

f = **Rotary switch for Air Conditioning Temperature***

Position ”0“	=	Cabin AC switched off.
Postion blue range	=	Temperature selection for air conditioning.

* Optional equipment

Fig. 29

No. 23 = Heat Temperature Control

g = Rotary switch for cabin heater (temperature selector switch)*

Position "0" = Cabin heater switched off.

Position red range = Temperature selection for cabin heater.

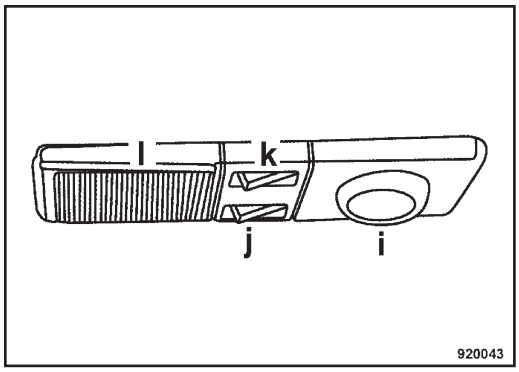

Fig. 30

No. 24 = Cabin light*

i = reading and dashboard light*

j = toggle switch for reading and dashboard light*

k = toggle switch for cabin light*

l= cabinlight*

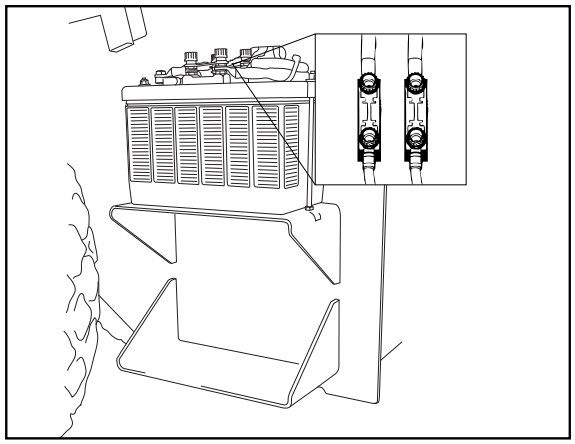

Fig. 31

No. 25 = Main fuse for battery and Grid Heater

125A = (F00) Main Fuse (Inner Fuse)

125A = (F48) Glow Plugs (Outer Fuse)

Note: **Battery with main fuse is located on the side of the BW177-50**

TABLE OF CONTENTS

Section 4
OPERATION

General notes

Please read section 3 Indicators and Control Elements thoroughly before operating the machine if you are not yet fully familiar with the indicators and control elements of the machine.

All indicators and control elements are described in detail in this chapter.

Tests before starting to operate

The following tests must be performed before each work day or before a longer work period.

DANGER: **Danger of accident!**

Please observe strictly the safety regulations in chapter 2 of these operating and maintenance instructions!

- Park the machine on level ground.

Check:

- Fuel tank and fuel lines for leaks
- Bolted connections for tight fit
- Function of the steering
- Check the machine for cleanliness and damage
- Availability of the appropriate operating and maintenance instructions,
- Check if the machine has been properly serviced.

NOTE: **For a description of the following work refer to the section "maintenance every 10 operating hours"**

- Engine oil level

NOTE: **Hydraulic systems, which are filled with Panolin HLP Synth. 46, the same oil must be used for filling up. In case of any other ester based oil consult the lubrication service department of the respective oil manufacturer.***

- Check the hydraulic oil level, top up if necessary.
- Check the coolant level, top up if necessary.

DANGER: **Fire hazard!**

Do not refuel in closed rooms

- Check the fuel level, top up if necessary.
- Check water separator in the fuel system, drain if necessary.

* Optional equipment

- Adjust the scrapers if necessary
- Tire pressure. Pressure see technical data.

CAUTION: **Ensure equal pressure in both tires.**

Starting the engine

DANGER: **Danger of accident!**

Always wear your seat belt.

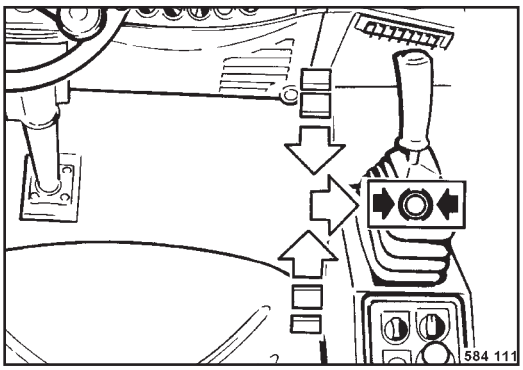

Fig. 33

- Check, whether the travel lever (Fig. 33) is engaged to the right in brake position.

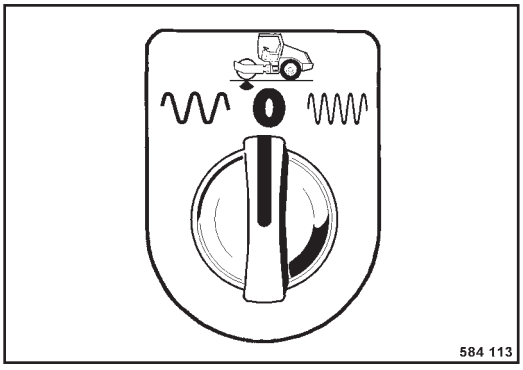

Fig. 34

- Turn the rotary vibration selector switch (Fig. 34) to position “0”, vibration off.

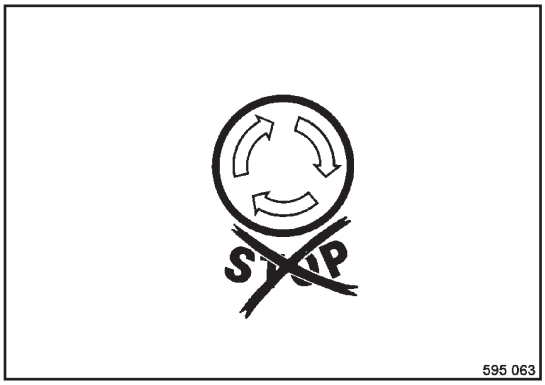

Fig. 35

- Check, whether the emergency stop switch (Fig. 35) is unlocked.

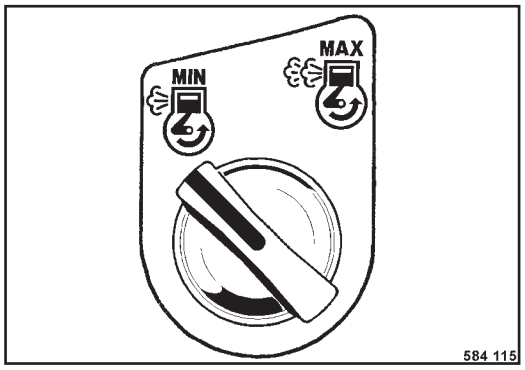

Fig. 36

- Turn rotary switch (Fig. 36) to position “Min” (idle speed).

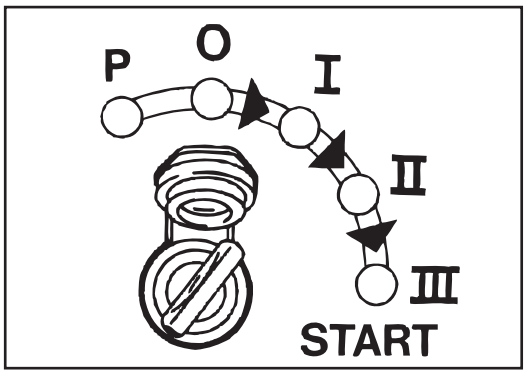

Fig. 37

- Turn the ignition key (Fig. 37) to position “I”.

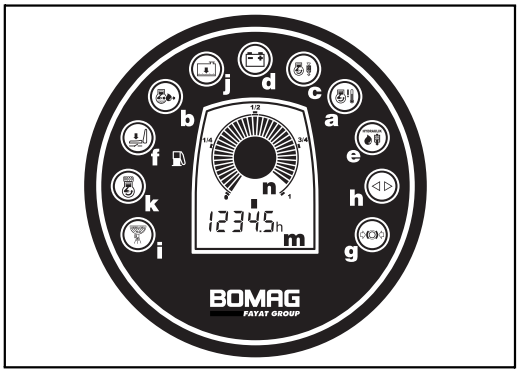

Fig. 38

All control and warning lights (Fig. 38) in the fault monitoring board light up for a moment.

The battery control (d) and brake warning lights (g) light up, the engine oil pressure warning light (b) flashes.

Cold Weather Starting BW177D/DH/PDH-50

The BW177D/DH/PDH-50 is equipped with a automatic cold weather assist starting system. This consisted of a glow plug attached to the engine. When the key is turned to the I position during cold weather the glow plug lamp will continue to be illuminated after the majority of the other lamps have turned off. WAIT until the grid heater lamp turns off before attempting to start the engine. The amount of time for the grid heater lamp to turn off is dependent on the temperature at the sensor.

CAUTION: **Perform the starting process for maximum 20 seconds without interruption and pause for a minute between starting attempts.**

If the engine has not started after two attempts perform trouble shooting.

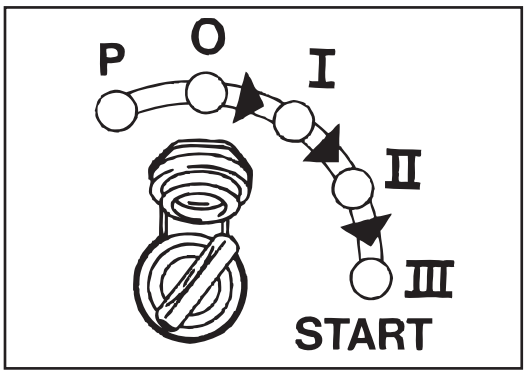

Fig. 39

Five [5] position switch is used to start engine and turn electrical systems off. (Fig 39)

- Turn the ignition key to position “III” (Fig. 39), the starter will crank the engine.
- As soon as the engine ignites return the ignition key to position “I”.

The ignition switch is provided with a lock against repetitive starting. To repeat the starting procedure you must first turn the ignition switch back to the 0 position.

NOTE: **The engine can only be started if the travel lever is in “neutral”.**

CAUTION: **Do not allow the engine to run longer than 10 minutes with idle speed.**

Starting with jump wires

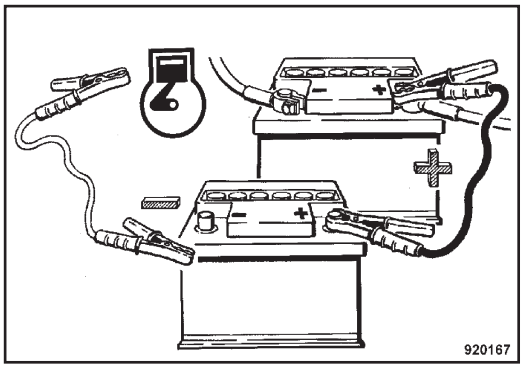

Fig. 40

CAUTION: **A wrong connection will cause severe damage in the electric system.**

- Bridge the machine only with a 12 Volt auxiliary battery.
- When jump starting with an external battery connect both plus poles first.
- Then connect the ground cable first to the minus pole of the current supplying auxiliary battery and then to engine or chassis ground, as far away from the battery as possible (Fig. 40).
- Start as described under “Starting the engine”.
- Once the engine is running switch on a powerful consumer (working light, etc.).

CAUTION: **If no powerful consumer is switched on voltage peaks may occur when separating the connecting cables between the batteries, which could damage electrical components.**

- After starting disconnect the negative poles (ground cable) first and the positive poles after.
- Switch off the consumer

Driving the machine

DANGER: **Danger of accident!**

Wet and loose soils considerably reduce the ground adhesion of the machine on inclinations and slopes.

Soil conditions and weather influences impair the gradability of the machine.

Do not drive up and down inclinations exceeding the maximum gradability of the machine (see technical data).

Do not drive without wearing your seat belt.

Always give way to loaded transport vehicles! Before starting to drive make sure that the drive range is absolutely safe.

CAUTION: **Always keep the cabin door closed while driving with the machine. With the door opened and the machine fully articulated extreme oscillations of the machine may damage the door.**

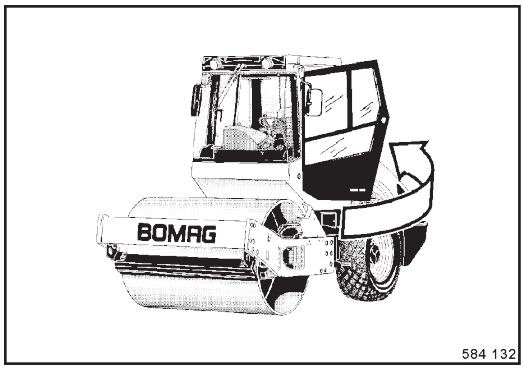

Fig. 41

- Close the cabin door (Fig. 41).

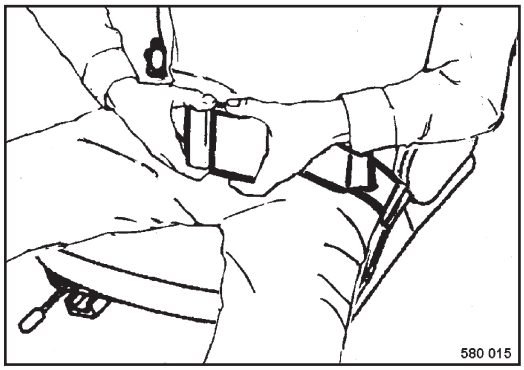

Fig. 42

- Fasten your seat belt (Fig. 42).
- “Start engine”, see previous sections.

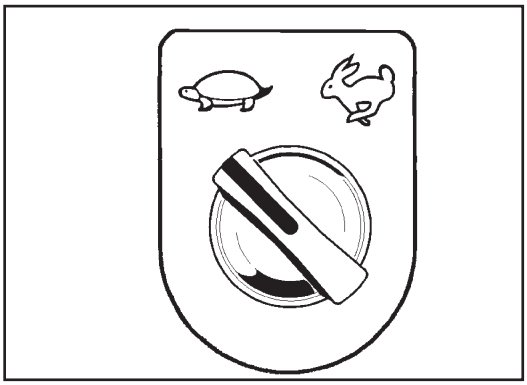

Fig. 43

- Select the desired travel speed range (Fig. 43).
  BW177 D-50

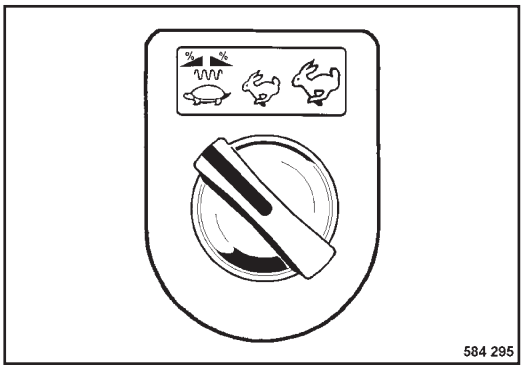

Fig. 44

- Select the desired travel speed range (Fig. 44).
  BW177 DH/PDH-50

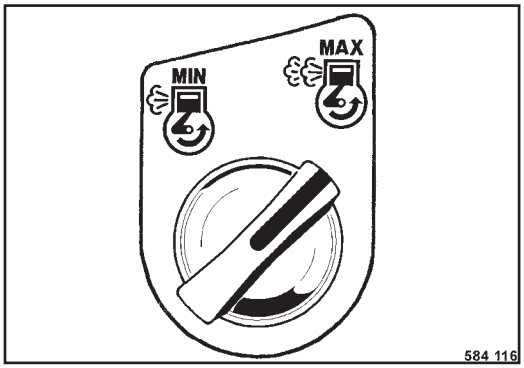

Fig. 45

- Turn the rotary switch (Fig. 45) to “Max” position (full throttle).

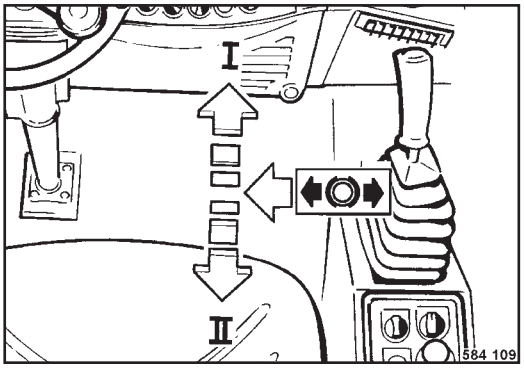

Fig. 46

- Push the travel lever (Fig. 46) to the left out of braking position and move it slowly to the desired travel direction.

NOTE: **Shift the travel lever out of "0"- position slowly to forward or reverse, the machine will drive forward or reverse at a speed which corresponds with the displacement of the travel lever.**

Returning the travel lever towards neutral will brake the machine and in "0"- position of the travel lever the machine will stop.

DANGER: **Danger of accident!**

When stopping on inclinations and slopes pull the travel lever to the right and lock it in braking position.

Important notes on travel operation

CAUTION: **When changing the travel direction hold the travel lever for a moment in "0"- position, until the machine has stopped, before actuating to the new travel direction.**

Do not operate jerkily!

When driving up and down inclinations move the travel lever slowly back towards neutral to brake the machine.

If the engine speed drops when driving up extreme inclinations move the ravel lever slightly back, if necessary change to the lower speed range.

Switching the vibration on and off

DANGER: **Risk of damage!**

When compacting with vibration you must check the effect of nearby buildings and underground supply lines (gas, water, sewage, electric power), if necessary stop compaction with vibration.

Do not activate the vibration on hard (frozen, concrete) ground. Danger of bearing damage!

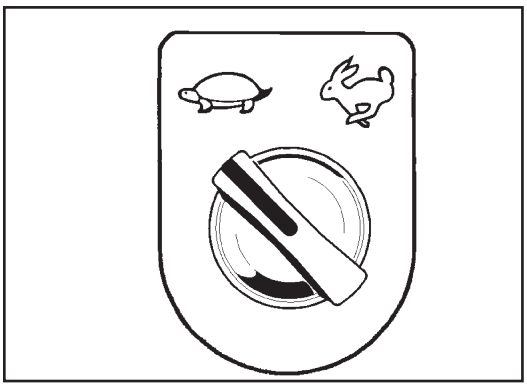

Fig. 47

- Select the desired travel speed range (Fig. 47). BW177 D-50

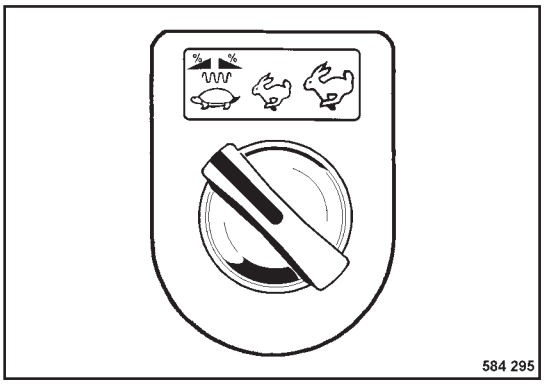

Fig. 48

- Switch to working speed (Fig. 48) (turtle). BW177 DH-50/PDH-50.

Pre-selecting the vibration

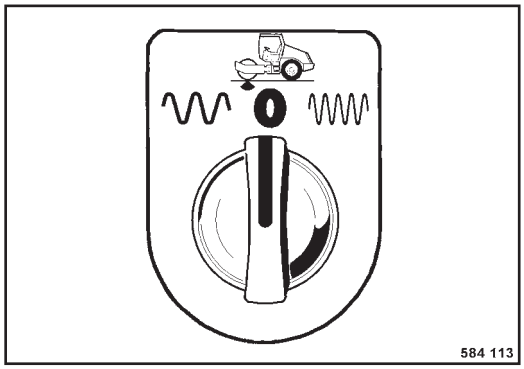

Fig. 49

- Pre-select amplitude/frequency with the rotary switch (Fig. 49).

Switch the vibration on

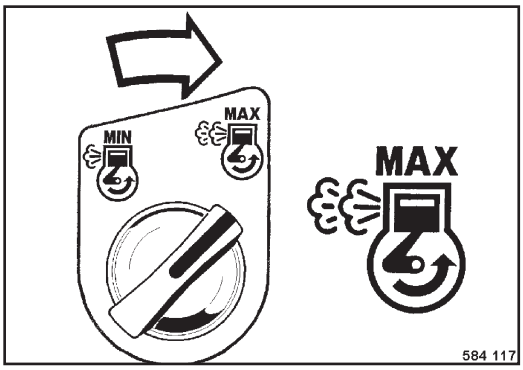

Fig. 50

- Turn the rotary switch (Fig. 50) to position “Max” (full throttle).

CAUTION: **Switch the vibration on only at max. engine speed.**

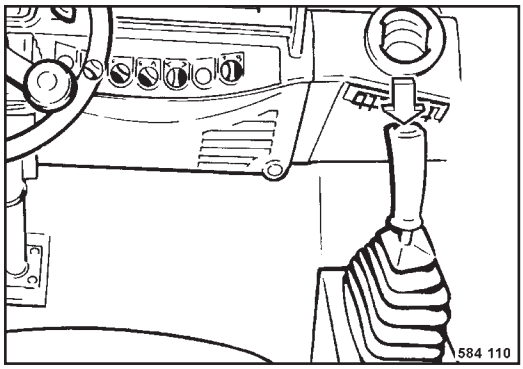

Fig. 51

- Press the push button (Fig. 51) in the travel lever while driving, the drum will vibrate.

Switching the vibration off

- Press the push button again and after work switch the rotary vibration switch to position “0”.

Operating the parking brake, stopping the machine

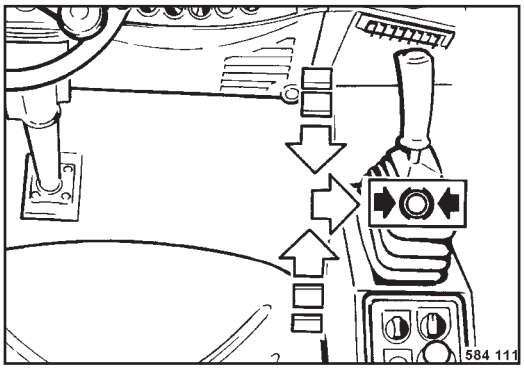

Fig. 52

- Return the travel lever (Fig. 52) slowly to “neutral” -position and engage it to the right parking brake position.

The machine is automatically braked by the hydrostatic drive and parking brake closes.

NOTE: **The parking brake also closes automatically when shutting the engine down.**

Shutting the engine down

CAUTION: **Straighten the articulated joint to provide easier access to the machine.**

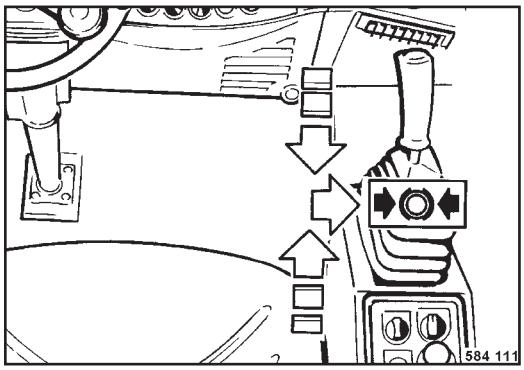

Fig. 53

- Return the travel lever (Fig. 53) slowly to "neutral"- position and engage it to the right in braking position.

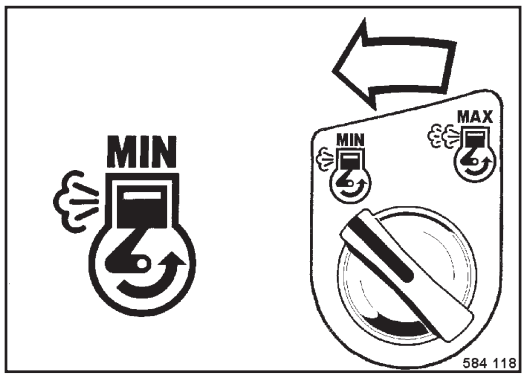

Fig. 54

- Turn rotary switch (Fig. 54) to position "Min" (idle speed).

NOTE: **Do not shut the engine down all of the sudden from full speed, but let it idle for a while for temperature equalization.**

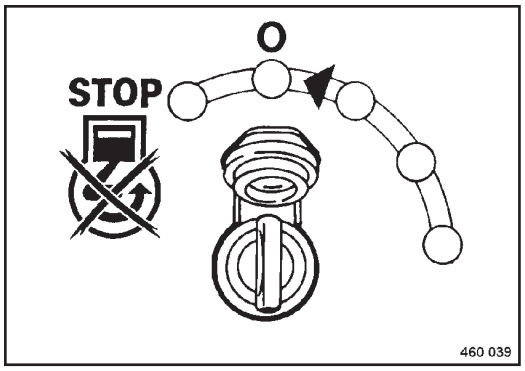

Fig. 55

- Turn the ignition switch (Fig. 55) to position "0" or "P" and pull the ignition key out.

NOTE: **The parking brake closes automatically when shutting the engine down.**

DANGER: **Danger of accident!**

Secure the machine against unauthorized use, pull the ignition key out, lock the cabin door.

Emergency exit

If the machine should turn over and the cabin door is closed, the right hand side cabin window can be used as an emergency exit.

Adjusting the steering wheel*

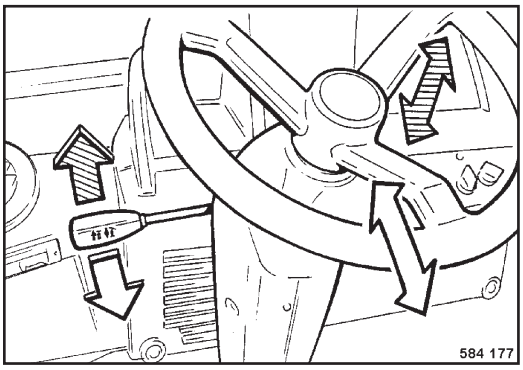

Fig. 56

- Adjustment of steering wheel in height, pull lever (Fig. 56) up and move the steering wheel to the desired height.
- Adjustment of steering wheel inclination, press lever down and adjust the inclination of the steering wheel.

DANGER: **Danger of accident!**

After the adjustment make sure that the steering wheel adjustment is securely locked in place.

* Optional equipment

Adjusting the seat

DANGER: **Danger of accident!**

Do not adjust the seat while driving.

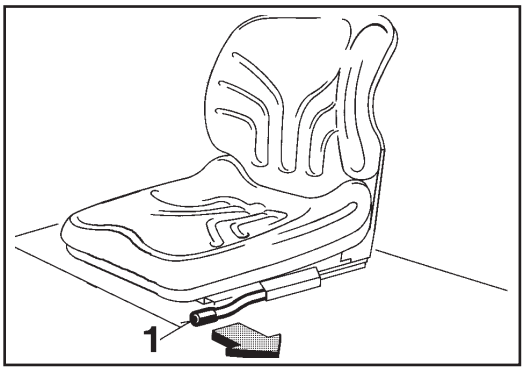

Fig. 57

Fig. 57a

- To adjust the seat in longitudinal direction disengage the lever 1 (Fig. 57) and slide the seat forward or back.
- To adjust the weight actuate the lever (3) (Fig. 57a).
- To adjust the inclination of the backrest actuate the lever (2) (Fig. 57a) and tilt the backrest forward or back.

Adjusting the optional seat *

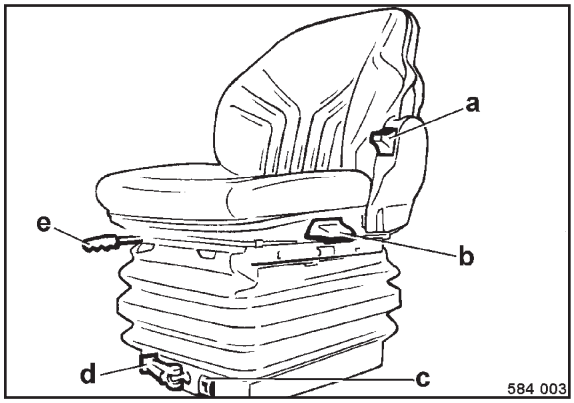

Fig. 58

- To adjust the seat in longitudinal direction disengage lever e (Fig. 58) upwards and push the seat forward or back.
- To adjust the weight turn lever (d) and read the weight in sight glass (c).
- To adjust the inclination of the backrest oper-ate lever (a) and tilt the backrest forward or back.
- To swivel the seat pull lever (b) up and turn the seat to the desired direction.

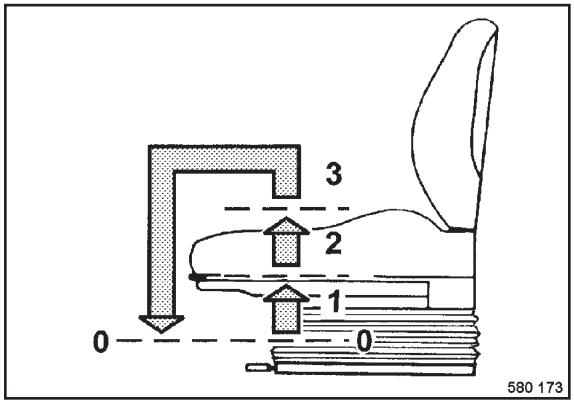

Fig. 59

- To adjust the height of the seat lift the seat up (Fig. 59) until it engages at the desired level.

When lifting the seat completely it will sink down to lowest position.

* Optional equipment

Operating the hood

DANGER: **Danger of accident!**

If the hood needs to be opened further for maintenance or repair work, support it safely.

Bottom position

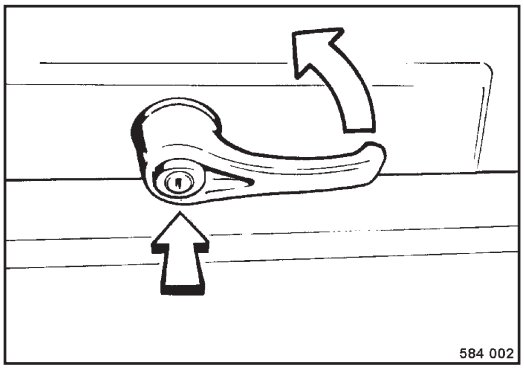

Fig. 60

- Unlock the lock (Fig. 60).
- To open the hood press in the button and turn the handle.

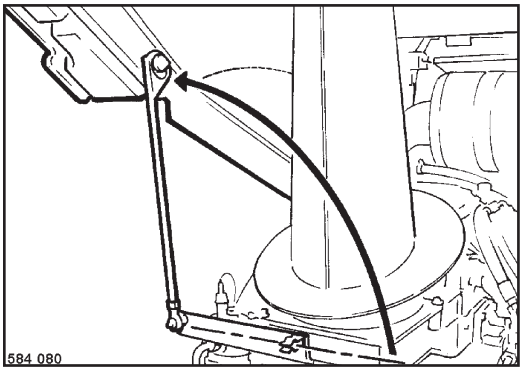

Fig. 61

- Pull the support out of the bracket and support the hood (Fig. 61).

Top position

- Push the hood to top position.

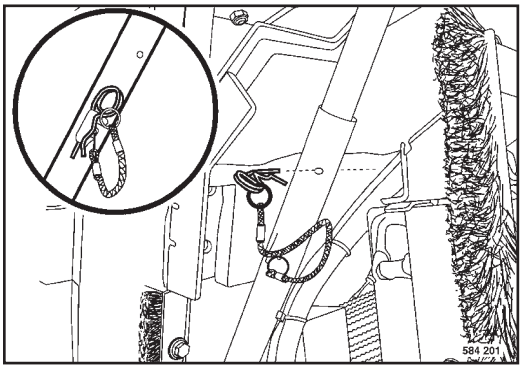

Fig. 62

- Pull the spring pin (Fig. 62) out of the bracket.
- Secure the hood in the protection tube with spring plug.

Towing in case of an engine failure BW177 D-50

DANGER: **Secure the machine with wheel chocks against unintentional rolling.**

Danger of accident!

When using towing ropes tow the machine only uphill.

When towing downhill you must use a rigid towing device.

The machine cannot be steered.

- Secure the machine with wheel chocks against unintentional rolling.

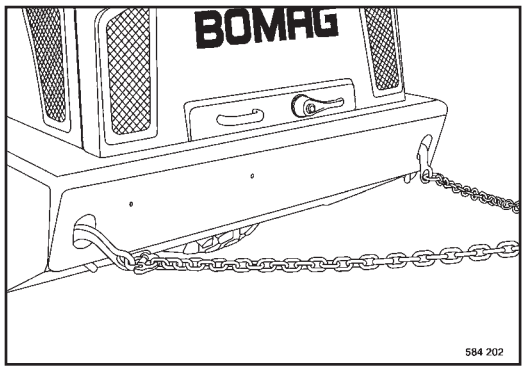

Fig. 63

- Attach chains (Fig. 63) or towing ropes to the lifting hooks.

CAUTION: **Towing speed 1 km/h, max. towing distance 500 m.**

- Open the tailgate.

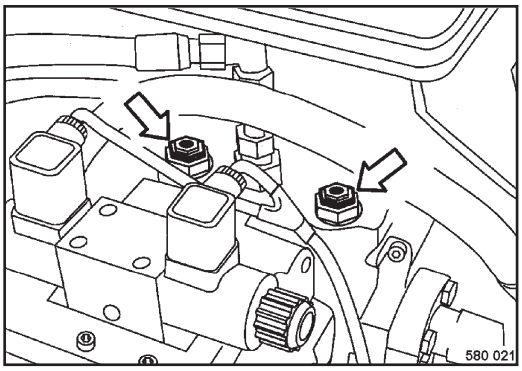

Fig. 64

- Slacken the counter nuts on the spindles of both high pressure relief valves (Fig. 63) to create a by-pass around the travel pump.
- Turn the threaded spindle in until it is flush with the nut.
- Retighten the counter nut.

CAUTION: **Do not turn the valves out completely.**

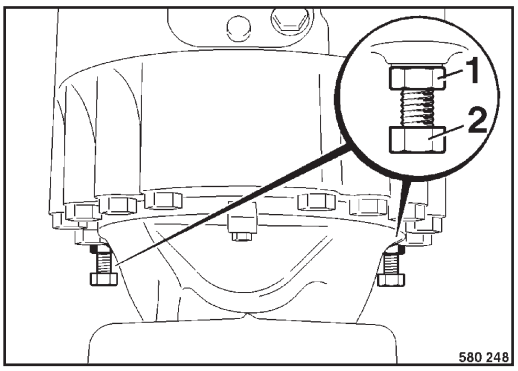

Fig. 65

- To release the brake turn counter nuts 1 (Fig. 66) approx. 8 mm back.
- Turn the brake releasing screws (2) completely in against the stop

CAUTION: **From this stop turn the screw in for maximum another turn to release the brake!**

Turn the screws in evenly on both sides.

- Turn the screws in alternately for 1⁄4 turn at a time.
- Repeat this procedure on the opposite wheelside.

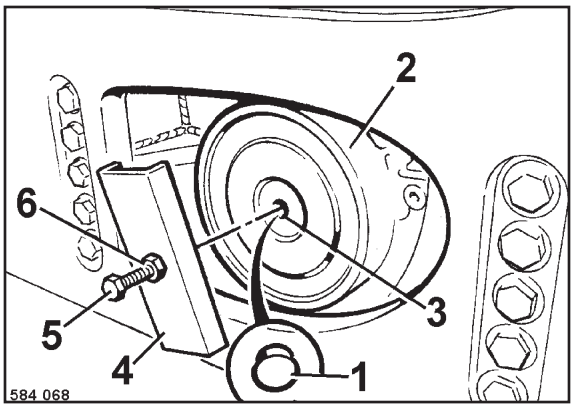

Fig. 66

- Remove plug 1 (Fig. 66).
- Place an U-section (4) across the brake housing (2) and turn the screw (5) into the tapped bore (3), untilit bottoms.
- Turn the nut (6) down and tightenit approx. one revolution. The drum must rotate freely.

Towing in case of an engine failure BW177 DH/PDH-50

DANGER: **Secure the machine with wheel chocks against unintentional rolling.**

Danger of accident!

When using towing ropes tow the machine only uphill.

When towing downhill you must use a rigid towing device.

The machine cannot be steered.

- Secure the machine with wheel chocks against unintentional rolling.

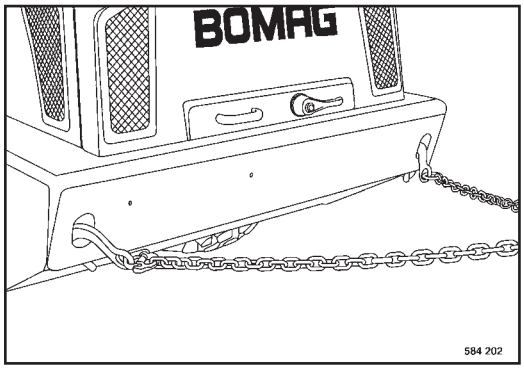

Fig. 69

- Attach chains (Fig. 69) or towing ropes to the lifting hooks.

CAUTION: **Towing speed 1 km/h, max. towing distance 500 m.**

- Open the tailgate.

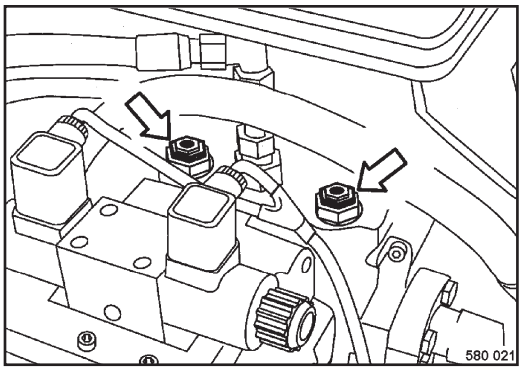

Fig. 70

- Slacken the counter nuts on the spindles of both high pressure relief valves (Fig. 70) to create a by-pass around the travel pump.
- Turn the threaded spindle in until it is flush with the nut.
- Retighten the counter nut.

CAUTION: **Do not turn the valves out completely.**

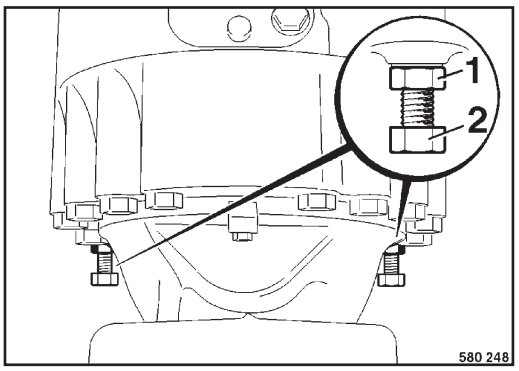

Fig. 71

- To release the brake turn counter nuts 1 (Fig. 71) approx. 8 mm back.
- Turn the brake releasing screws (2) completely in against the stop

CAUTION: **From this stop turn the screw in for maximum another turn to release the brake!**

Turn the screws in evenly on both sides.

- Turn the screws in alternately for 1⁄4 turn at a time.
- Repeat this procedure on the opposite wheelside.

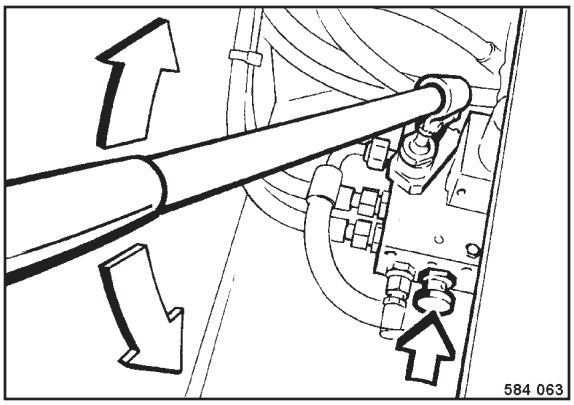

Fig. 72

- Press the emergency operation button (Fig. 72) completely down.

NOTE: **Use a suitable pipe.**

After starting the engine the emergency operation button returns automatically to initial position.

- Insert the owner supplied pump lever and operate the pump, until the brakes in the axle and drum are released.

After towing

CAUTION: **Before detaching the tow bar block the machine with chocks to prevent unintended rolling.**

- Turn the threaded spindle of the high pressure relief valves completely out again and tighten the counter nuts.
- Turn all brake releasing screws of the axle evenly back out, until they are light moving again.

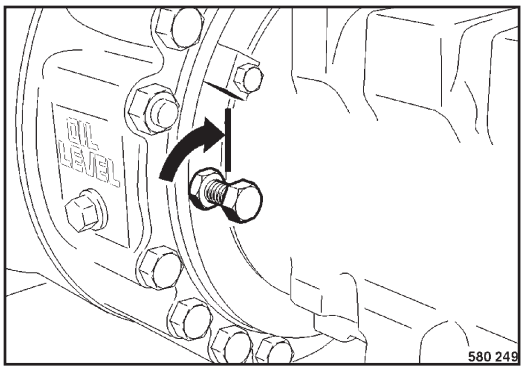

Fig. 73

- Turn the brake releasing screws (Fig. 73) back in again, until they abut against the brake piston.

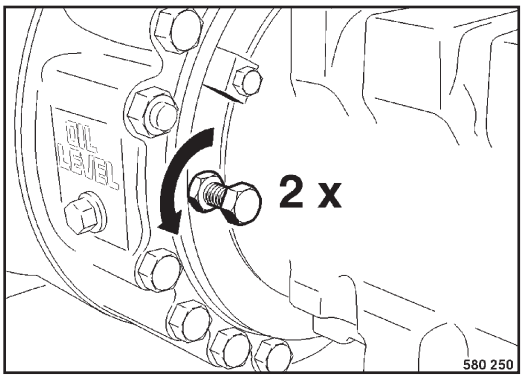

Fig. 74

- Unscrew the brake releasing screws (Fig. 74) for two turns and tighten the counter nuts.
- Repeat this adjustment procedure on the opposite wheel side.

NOTE: **If necessary replace the seal ring under the counter nut if it is leaking.**

For this purpose completely unscrew the brake releasing screw, replace the seal ring and lubricate the screw with silicone grease.

Reinstall the screw with a new seal ring and adjust the protrusion as described above.

Transport

DANGER: **Danger of accident!**

Use only stable loading ramps of sufficient load bearing capacity. Make sure that persons are not endangered by the machine tipping or sliding off.

Lash the machine down, so that it is secured against rolling, sliding and turning over.

Do not stand or step under loads being lifted. Always use shackles on the lifting points for loading, tying or lifting the machine.

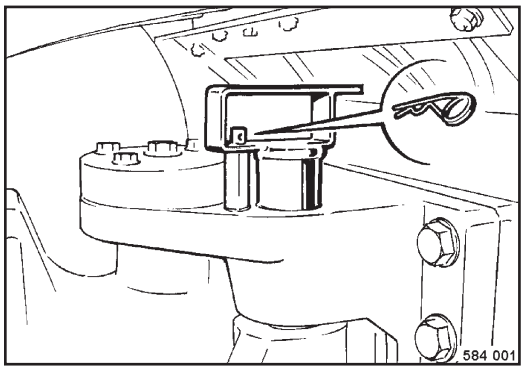

Fig. 75

- Pull the spring pin (Fig. 75) out.
- Engage the articulation lock and secure it with the spring pin.

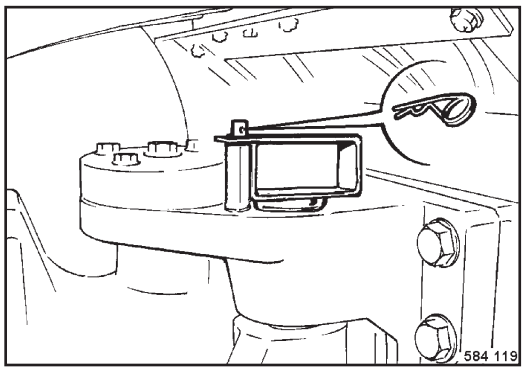

Fig. 76

- Engage the articulation lock and secure it with the spring pin (Fig. 76).

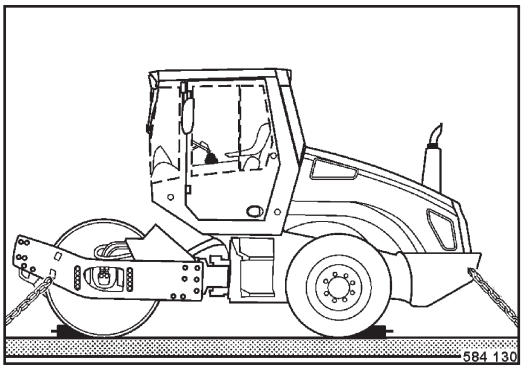

Fig. 77

- Lash the machine on the transport vehicle (Fig. 77), use the four lashing eyes on front and rear frame for this purpose.
- Support the front frame to avoid overstressing of the rubber buffers.

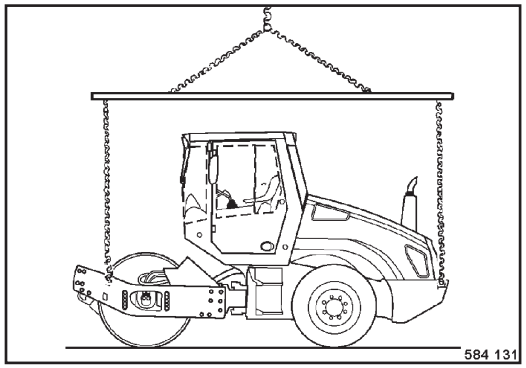

Fig. 78

- For lifting use also the four lifting eyes (Fig. 78) and appropriate lifting gear.

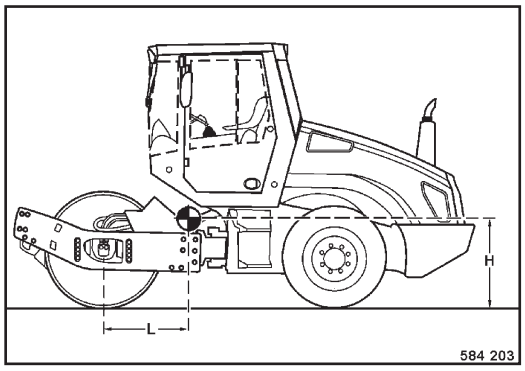

Fig. 79

- Position of centre of gravity (Fig. 79).

Machine	L	H
BW 177	990±180mm (39.0±7.0in)	800±80mm (31.5±3.1in)

NOTE: **The tolerances account for all possible options, such as cabin, additional weight etc.**

Weights: See technical data.

DANGER: **Danger of accident!**

The machine cannot be steered if the articulation lock is applied.

- After transport release the articulation lock again and store it in the receptacle.

Operating the optional Dozer Blade *

DANGER: **Do not use the dozer blade to transport per-sons. Danger to life!**

Moving other vehicles with the dozer blade is prohibited!

NOTE: **Always lower the dozer blade to the ground before shutting the engine down.**

Dozer Blade inoperable at low idle.

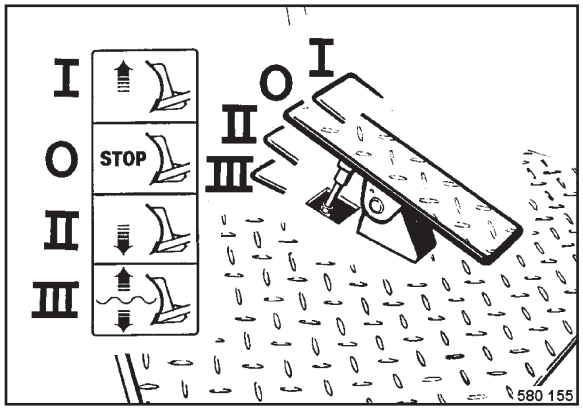

Fig. 61

- Lift or lower the dozer blade by means of the pedal (Fig. 61).

Position 'I' = lifting the dozer blade Position
Position '0' = neutral position, the pedals returns automatically to "0"-position
Position 'II' = lowering the dozer blade Position
Position 'III' = float position, for levelling the soil during reverse travel.

* Optional equipment

NOTES

TABLE OF CONTENTS

Section 5
MAINTENANCE

Section 5
MAINTENANCE

General notes on maintenance

When servicing the machine pay careful attention to all applicable safety instructions.

Thorough maintenance of the machine ensures maximum reliability and prolongs the lifetime of important components. The necessary effort can by no means be compared with the problems and malfunctions that could occur if this is not observed.

The terms left/right are always related to travel direction forward.

- Clean machine and engine thoroughly before starting maintenance work.
- For maintenance work park the machine on level ground.
- Maintenance work must generally be carried out with the engine shut down.
- Depressurize hydraulic lines before working on them.
- Disconnect the battery and cover it with insulation material before starting to work on electrical components.
- Always attach the articulation lock (transport lock) before starting to work in the articulation area of the machine.

Environment

Catch running out oils, coolant and fuel and do not let them seep into the ground or into the sewage system. Dispose of oils, coolant and fuels environmentally.

Notes on the fuel system

The lifetime of the diesel engine is decisively depending on the cleanliness of the fuel.

- Keep the engine free of dirt and water as this could damage the injection elements of the egine.
- Zinc lined drums are not suitable for storing fuel.
- The fuel drum should rest for a longer period of time before drawing off fuel.
- Do not let the suction hose disturb the sludge on the bottom of the drum.
- Do not draw off fuel from near the bottom of the fuel drum.
- Fuel left in the fuel drum is not suitable for the engine and should only be used for cleaning puposes.

Notes on the engine performance

Combustion air and fuel injection rates of the diesel engine have been carefully adjusted and determine the engine's performance and temperature level as well as the quality of the exhaust gas. If your machine has to operate permanently in "thin air" (at high altitudes) and with full power, you should consult the after sales service of BOMAG or the service department of the engine manufacturer.

Notes on the hydraulic system

During maintenance work in the hydraulic system cleanliness is of utmost importance. Make sure that no dirt or other impurities can enter into the system. Small particles can flute valves, cause pumps to seize and block restrictors and pilot bores, thereby causing costly repairs.

- If during the daily oil level check the oil level is found to have dropped, check all lines, hoses and components for leakages.
- Seal external leaks immediately. If necessary inform the responsible service department.
- Do not store drums with hydraulic oil outside, or at least keep them under a cover. During weather changes water may penetrate through the bunghole.
- Always fill the hydraulic system using the filling and filtering unit (BOMAG part-no. 007 610 01). This unit is equipped with a fine filter, which filters the hydraulic oil and prolongs the lifetime of the system filter.
- Clean fittings, filler caps and their immediate surrounding area before removing them, so that no dirt can fall in.
- Do not leave the tank opening unnecessarily open, cover it so that no dirt can fall in.

Notes on the cooling system

On water cooled engines the preparation and monitoring of the coolant is of utmost importance, as otherwise engine failures caused by corrosion, caviation and freezing may occur.

The coolant is a mixture of water and a cooling system protection agent.

The cooling system must be permanently monitored. Apart from the coolant level inspection this includes also the inspection of the concentration of cooling system protection agent.

The concentration of the cooling system protection agent can be checked with commercially available test instruments (glycomat).

DANGER: **Health hazard!**

The mixing of nitride based cooling system protectionagents with amine based agents will cause the generation of highly toxic nitrosamines.

Environment

Cooling system protection agents must be disposed of environmentally.

Fuels and lubricants

Engine oil

Oil quality

Lubrication oils are classified according to their performance and quality class. Oils according to other comparable specifications may be used.

The exact assignment of the approved oil qualities and oil change intervals can be taken from the following section "Lubrication oil change intervals".

Consult your local service station if in doubt.

Oil viscosity

Multi-purpose oils should be generally used.

Since lubrication oil changes its viscosity with the temperature, the ambient temperature at the operating location of the engine is of utmost importance when choosing the viscosity class (SAE-class) .

Optimal operating conditions can be achieved by using the opposite oil viscosity chart (Fig. 93) as a reference.

Occasionally falling short of the temperature limits will impair the cold starting ability, but will not cause any engine damage. In order to keep the occurring wear as low as possible, occassional exceeding of the limits should not happen over a longer period of time.

Approved engine oils

Cummins Engine Standard Classifications (CES)	American Petroleum Institute Classification (API)	International Classifications	Comments
N/A	API CD, API CE, API CG-4/SH	ACEA E-1	**OBSOLETE DO NOT USE**
CES-20075	API CF-4/SG	ACEA E-2, ACEA E-3, JAMA DH-1	Minimum acceptable oil classification for Midrange engines.
CES-20071, CES-20076	API CH-4/SJ, API CH-4	Global DHD-1	Acceptable oil classification for Midrange engines
CES-20072, CES-20077	API CH-4	ACEA E-5, Global DHD-1	Similiar in performance to CES-20071 but validated under European test standards. Excellent oil for midrange engines
CES-20078	API CI-4/SK, API CI-4	N/A	Excellent oil for midrange engines

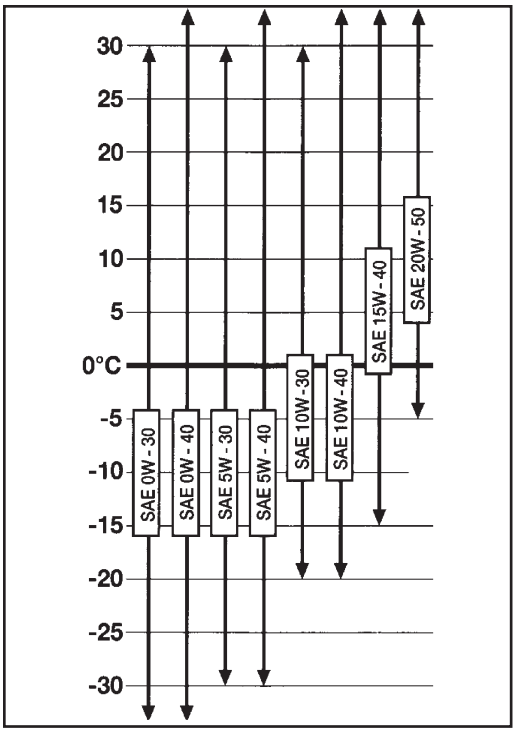

Fig. 93

With their better temperature and oxidation stability synthetic lubrication oils offer quite a few benefits.

Oil change intervals

The longest permissible time a lubrication oil should remain in an engine is 1 year. If the following oil change intervals are not reached over a period of 1 year, the oil change should be performed at least once per year, irrespective of the operating hours reached.

ACEA* = 500 operating hours
E-5
E-7

API** = 500 operating hours
CH-4/SJ
CI-4/SK

CAUTION: **These intervals apply only when using a diesel fuel with maximum 0.5 % sulphur by weight and for ambient temperatures higher than -10 °C.**

* European Engine Oil Sequences
** American Petroleum Institute

Fuels

Fuel quality

You should only use commercially available brand diesel fuel with a sulphur content below 0.5% (5000 ppm)[1] and ensure strict cleanliness when filling in. Use only winter-grade diesel fuel under low ambient temperatures. The fuel level should always be topped up in due time so that the fuel tank is never run dry, as otherwise filter and injection lines need to be bled.

Cummins Inc. recommends that the cetane number of diesel fuel be a minimum of 45 for engines that are expected to operate at temperatures below 0°C [32°F] and a minimum of 42 for engines that are operated at temperatures above 0°C [32°F].

Using diesel fuel with lower than recommended cetane number can cause hard starting, instability, and excessive white smoke. To maintain satisfactory operation at low ambient temperatures, it is important to specify diesel fuel of the correct cetane number.

Cummins Inc. recommends the use of ASTM number 2D fuel. The use of number 2D diesel fuel will result in optimum engine performance. At operating temperatures below 0°C [32°F], acceptable performance can be obtained by using blends of number 2D and number 1D.

For a list of acceptable substitute fuels contact the engine manufacturer.

Winter fuel

DANGER: **Fire hazard!**

Diesel fuels must never be mixed with gasoline.

For winter operation use only winter diesel fuel, to avoid clogging because of paraffin separation. At very low temperatures disturbing paraffin separation can also be expected when using winter diesel fuel.

1. Regional, national, or international regulations can require lower sulfur content. U.S. EPA and California regulations for model year 2011 and later non-road diesel engines require use of low sulfur diesel fuel (LSD) with 500 ppm maximum or ultra low sulfur diesel fuel (ULSD) with 15 ppm maximum.

In most cases a sufficient cold resistance can also be achieved by adding flow enhancing fuel additives. Consult the engine manufacturer.

BioDiesel

Due to the extreme quality differences of bio-diesel fuels available on the market, BOMAG recommends that the use of biodiesel fuels be done in strict accordance with engine manufactures guidelines. Refer to the engine manufactures operation, maintenance and service manuals for certified fuel usage and specifications.

Oil for drive axle

For the drive axle use only multi-purpose transmission oil of API-class GL5 with viscosity class SAE 90.

The additives in this oil ensure low wear lubrication under all operating conditions.

Lubrication grease

For lubrication use only EP-high pressure grease, lithium saponified (penetration 2).

Hydraulic oil

The hydraulic system is operated with hydraulic oil HV 46 (ISO) with a kinematic viscosity of 46 mm2/s (cSt) at 40°C. For topping up or for oil changes use only high-quality hydraulic oil, type HVLP according to DIN 51524, part 3, or hydraulic oils type HV according to ISO 6743/3. The viscosity index (VI) should be at least 150 (observe information of manufacturer).

OR

The hydraulic system is operated with hydraulic oil similar to an ISO VG68 but with a kinematic viscosity of 60 mm2/s (cSt) at 40°C. For topping up or for oil changes use only high-quality hydraulic oil, of type Multipurpose Tractor Lubricant similar to a Mobil 424 or CITGO Trans Guard. The viscosity index (VI) should be at least 140 (observe information of manufacturer).

Bio-degradable hydraulic oil

On request the hydraulic system can also be filled with ester based biodegradable hydraulic oil (Panolin HLP Synth. 46). The biologically quickly degradable hydraulic oil meets all demands of a mineral oil based hydraulic oil according to DIN 51524.

In hydraulic systems filled with Panolin HLP Synth. 46 always use the same oil to top up. When changing from mineral oil based hydraulic oil to an ester based biologically degradable oil, you should consult the lubrication oil service of the oil manufacturer for details.

Check the filter more frequently after this change.

CAUTION: **Oil change biodegradable hydraulic oil:**

Perform regular oil analyses for content of water and mineral oil.

Replace the hydraulic oil filter element every 500 operating hours.

Coolant, anti-freeze agent

Use only soft tap water (drinking water) to prepare the coolant mix.

As a protection against frost, corrosion and boiling point anti-freeze agents must be used under any climatic conditions.

The proportion of cooling system protection agent must be between min. 35% and max. 45% to the water.

CAUTION: **Do not mix different coolants and additives of any other kind.**

Environment

Cooling system protection agents must be disposed of environmentally.

Coolant

As a protection against frost, corrosion and boiling point anti-freeze agents must be used under any climatic conditions.

CAUTION: **Do not mix different coolants and additives of any other kind.**

If no cooling system protection agent is available in tropical zones, you may also use a corrosion protection agent (CUMMINS Liquid DCA).

Do not mix in more than 50% cooling system protection agent, except when a lower frost protection is required. However, the proportion of cooling system protection agent should never exceed 68%. A higher concentrations the frost protection effect drops again. Use only soft tap water (drinking water) to prepare the coolant mix.

The water should not contain more than 100 ppm of sulphates (SO_4) or 40 ppm of chlorides (CL).

The cooling system must be permanently monitored. Besides the inspection of the coolant level this includes also the inspection of the concentration of cooling system protection agent.

The concentration of cooling system protection agent must be checked with a refractometer (Fleetguard part-no. C2800). Other measuring equipment is not suitable for high-performance diesel engines.

Coolant must be changed every two years. Anti-freeze concentration

Ethylene Glycol

40 % = -23 °C (-10 °F)

50 % = -34 °C (-34 °F)

60 % = -54 °C (-65 °F)

68 % = -71 °C (-90 °F)

Propylene Glycol

40 % = -21 °C (-6 °F)

50 % = -33 °C (-27 °F)

60 % = -49 °C (-56 °F)

Environment

Cooling system protection agents must be disposed of environmentally.

Specification for cooling system protection agent

ASTM 4958 (GM6038M)

Table of fuels and lubricants

Assembly	Fuel or lubricant		Quantity approx.
	Summer	Winter	**Attention:** Observe the level marks
Engine	**Engine oil** API CH-4/SJ, CI-4/SK or ACEA: E5,E7 SAE 10W/40 -4°F to +104°F (-20 °C to +40 °C) SAE 15W/40 +5°F to +104°F (-15 °C to +40 °C)		approx. 8.5 litres, (9.0 qt) without oil filter
	Fuel		
	Diesel	Winter diesel fuel	approx. 150 litres (39.6 gal)
	Hydraulic oil (ISO), HV 46, kinem. viscosity 46 mm^2/s (cSt) at 40 °C viscosity index greater than 150 or Similar to an ISO VG68 60mm^2/s (cSt)at 40 °C viscosity index greater than 140		approx. 60 litres (15.8 gal)
Vibration bearings	Engine oil SAE 15W/40		approx. 3.2 litres (3.4 qt)
Drive axle	Gear oil SAE 90, API GL5		approx. 7.3 litres (7.7 qt)
Wheel hubs	Gear oil SAE 90, API GL5		approx. .75 litres (0.8 qt)
Gear Box Drum Drive (DH/PDH Only)	Gear oil SAE 90, API GL5		approx. 2.5 litres (2.6 qt)
Air conditioning system	Refrigerant R134A		approx. 1400 g (3.8 lb)
Engine cooling system	Cooling system protection agent		approx. 16 litres (16.9 qt)

Running-in instructions

The following maintenance work must be performed when running in new machines or overhauled engines:

CAUTION: **Up to approx. 250 operating hours check the engine oil level twice every day.**

Depending on the load the engine is subjected to, the oil consumption will drop to the normal level after approx. 100 to 250 operating hours.

After a running-in time of 30 minutes

- Retighten the V-belt

After 250 operating hours

- Retighten bolted connections on intake and exhaust tubes, oil sump and engine mounts.
- Retighten the bolted connections on the machine.
- Retighten all wheel fastening screws with the specified tightening torque.
- Changing engine oil and oil filter
- 1. Oil change vibration bearings
- Oil change in drive axle
- Oil change in wheel hubs

After 500 operating hours

- 2. Oil change vibration bearings
- Oil change drum drive gear (only DH and PDH machines)

After 1000 operating hours

- Ajusting the valve clearance

Maintenance chart

With all maintenance intervals perform also the work for shorter preceding service intervals.

Designation	Note
Every 10 operating hours	
Check the engine oil level	Dipstick mark
Checking, cleaning the water separator	
Check the fuel level	
Check the coolant level	
Check the hydraulic oil level	Inspection glass
Checking the V-belt	
Every 50 operating hours	
Check the tire pressure	see technical data
Adjust the scrapers	
Every 250 operating hours	
Clean the cooling fins on engine and hydraulic oil cooler	min. 1x per year
Check the oil level in the drive axle	
Check the oil level in the planetary gears	
Check the oil level in the vibration bearings	
Check the oil level in the drum drive gear	DH and PDH machines
Every 500 operating hours	
Changing engine oil and oil filter cartridge	min. 1x per year
Servicing the battery	distilled water, pole grease
Drain the sludge from the fuel tank	
Change the fuel filter cartridge	
Changing the fuel pre-filter cartridge	
Checking V-belt tension, idler pulley and fan hub	

Designation	Note
Every 1000 operating hours	
Change the oil in the drive axle	min. 1x per year
Change the oil in the planetary gears	min. 1x per year
Changing the oil in the drum drive gear	DH and PDH machines, at least 1x per year min. 1x per year
Change the oil in the vibration bearings	
Check the engine mounts	
Check the fastening of the axle on the frame	
Tighten the wheel nuts	
Check the ROPS	
Every 2000 operating hours	
Check, adjust the valve clearance	Intake = 0,35 mm (0,014IN), exhaust = 0,5mm (0.020 IN, with hot or cold engine) at least every 2 years
Changing hydraulic oil and breather filter*	at least every 2 years
Changing the hydraulic oil filter*	at least every 2 years
Change the coolant	at least every 2 years
As required	
Cleaning, changing the combustion air filter	min. 1x every year, safety cartridge at leastevery 2 years
Bleed the fuel system	
Adjust the parking brake	
Change the tires	
Chang the fresh air filter in the cabin	
Tightening torques	
Engine conservation	

* Also in case of repairs in the hydraulic system.

Check the engine oil level

NOTE: **The machine must stand on level ground. Shut the engine down and wait for approx. 15 minutes until all oil has run back into the oil sump.**

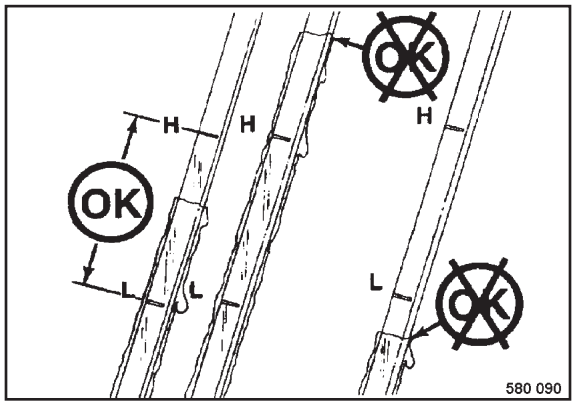

Fig. 94

- Pull the dipstick (Fig. 94) out, wipe it off with a lint-free, clean cloth and reinsert it until it bottoms.
- Pull the dipstick back out again.
- The oil level must be between the “L” and “H”-marks.
- Top up oil immediately if the oil level is too low.
- If the oil level is too high detect the cause and drain the oil off.

CAUTION: **Before longer work periods you should always top the oil up to the ”MAX”-mark.**

For quality and quantity of oil refer to the table of fuels and lubricants.

Check, clean the water separator

DANGER: **Danger of injury!**

Support the engine hood for all maintenance and repair work.

NOTE: **The service intervals for the water separator depend on the water content in the fuel and can therefore not be determined precisely. After taking the engine into operation you should therefore check the water separator every day for signs of water.**

If a to high quantity is drained off, the filter must be refilled with fuel. See chapter “maintenance as required”, bleeding the fuel system.

Environment

Catch running out fuel and dispose of environmentally.

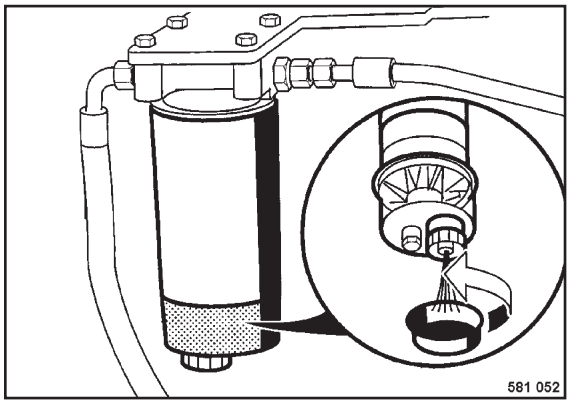

Fig. 95

- Slacken the drain plug (Fig. 95) for a few turns and catch running out fuel / water. Drain the filter sump until clear fuel is visible.
- Tighten the drain plug again and check for leaks, if necessary replace the seal ring.
- When closing the drain valve, do not overtighten the valve. Overtightening can damage the threads.

Checking the fuel level

DANGER: **Fire hazard!**

When working on the fuel system do not use open fire, do not smoke, do not refuel in closed rooms, do not inhale any fuel fumes.

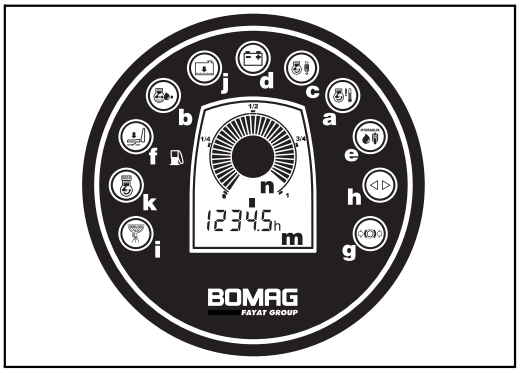

Fig. 96

- Check the fuel level on the fuel level gauge “n” (Fig. 96) with the ignition switched on.

NOTE: **Never drive the fuel tank empty, because this would required bleeding of the entire fuel system.**

- Clean the area around the filler opening.

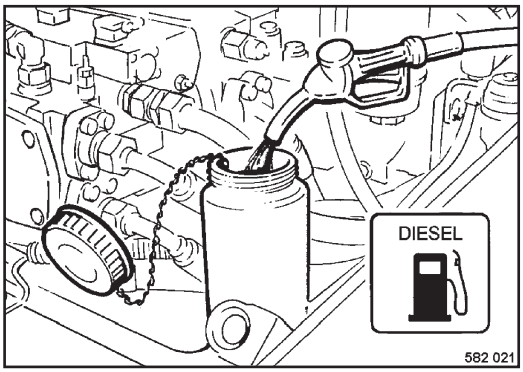

Fig. 97

- Open the fuel tank cover (Fig. 97).

CAUTION: **Contaminated fuel can cause malfunction or even damage of the engine.**

If necessary fill in fuel through a screen filter.

- If necessary top up fuel (diesel or winter diesel).

For quality of fuel refer to the table of fuels and lubricants.

Checking the coolant level

DANGER: **Danger of scalding!**

Never remove the cap from the compensation tank when the engine is hot.

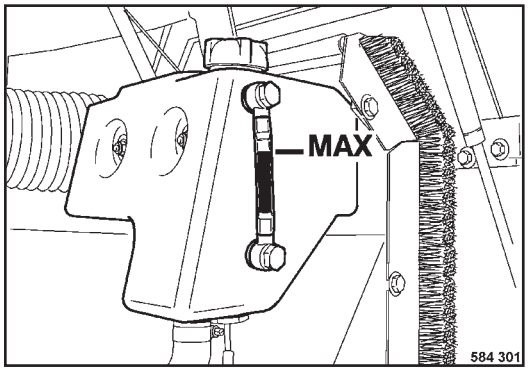

Fig. 98

- Check the coolant level (Fig. 98).

CAUTION: **If, during the daily inspection the coolant level is found to have dropped, check all lines, hoses and engine for leaks.**

Do not use any radiator sealing agents to seal leakages.

Do not fill any cold liquids into a hot engine.

- To top up unscrew the filler cap and fill in coolant up to the MAX-mark.

For quality of coolant refer to the chapter, fuels and lubricants.

Checking the hydraulic oil level

CAUTION: **In hydraulic systems filled with HV68 (TDHType) always use the same oil to top up.**

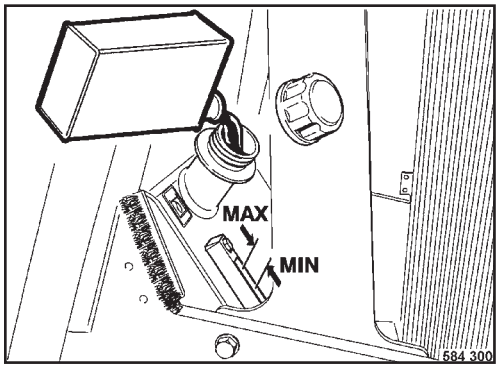

Fig. 99

- Check the hydraulic oil level in the inspection glass (Fig. 99).

Normal level

approx. 3 cm below the top edge of the inspection glass.

Minimum level

Middle of inspection glass.

CAUTION: **If, during the daily inspection of the oil level the hydraulic oil level is found to have dropped, check all lines, hoses and components for leaks.**

- If necessary fill in hydraulic oil through the filler neck.

For quality and quantity of oil refer to the table of fuels and lubricants.

Checking the V-belt

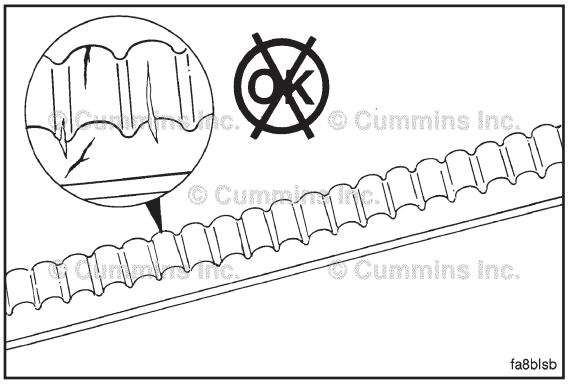

Fig. 100

- 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. Refer to Section 5.29 for belt adjustment and replacement procedures.

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

Checking the tire pressure

CAUTION: **Since the tires are filled with water, you should always turn the inflation valve to top position to check the tire pressure!**

Always close the valves with the dust cap.

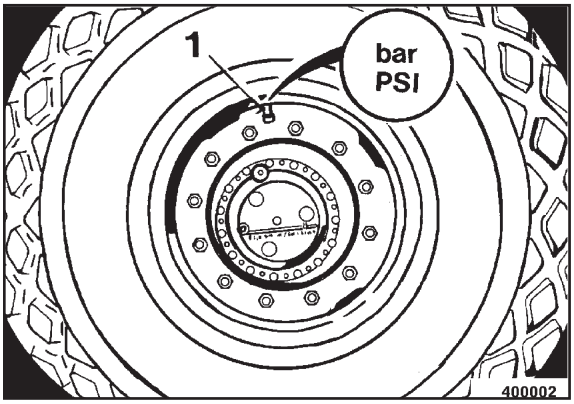

Fig. 101

- Check the tire pressure with a pressure gauge and the tire inflation valve 1 (Fig. 101) in top position.

Nominal value see "Technical Data".

NOTE: **Ensure even pressure in all tires.**

- Screw the valve caps back on.

Adjusting the scrapers

smooth drum only

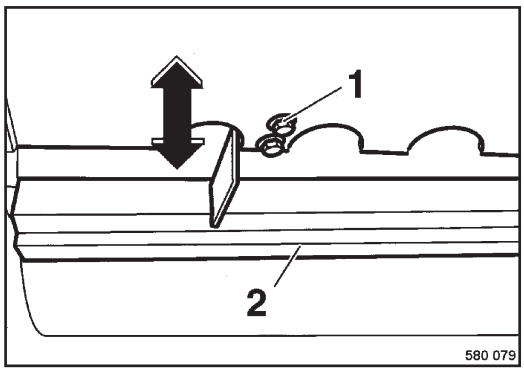

Fig. 102

- Check the condition and adjustment of the front and rear scrapers, adjust or replace the scraper rubber if necessary.
- To adjust the scrapers 1 (Fig. 102) loosen the fastening screws (2) in the slots and push the scraper bracket towards the drum until the scraper touches.
- Retighten the fastening screws.

padfoot drum only

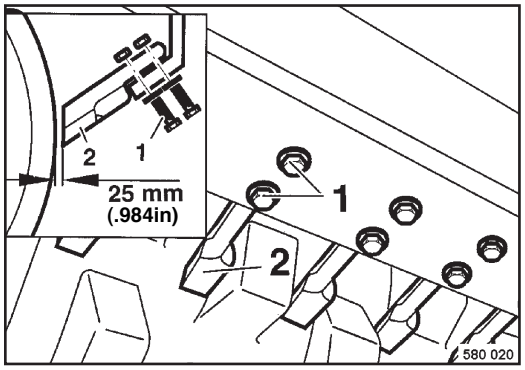

Fig. 103

- Check condition and adjustment of scrapers 2 (Fig. 103), adjust or replace the teeth if necessary.
- To adjust the scrapers (2) slacken the fastening screws (1) in the slots and move the scraper towards the drum, leaving a gap of approx. 25 mm.
- Retighten the fastening screws.

Changing engine oil and oil filter cartridges

CAUTION: **The oil change at 500 operating hours refers to the use of fuels with a sulphur content of less than 0.5%.**

When using fuels with a sulphur content higher than 0.5 % the oil change intervals must be halved (see section fuels and lubricants).

Drain the engine oil only when the engine is warm.

DANGER: **Danger of scalding!**

When draining off hot oil.

Environment

Catch running out oil and dispose of environmentally together with the engine oil filter cartridge.

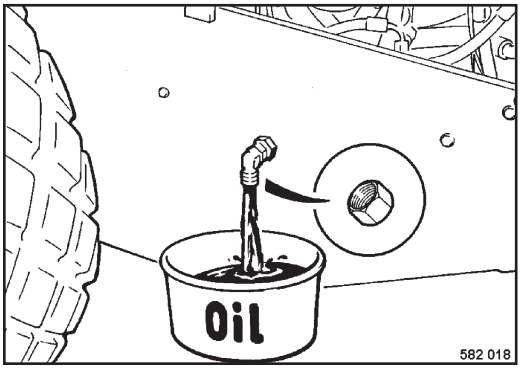

Fig. 104

- Unscrew the drain plug (Fig. 104) and catch running out oil.
- Turn the drain plug tightly back in.

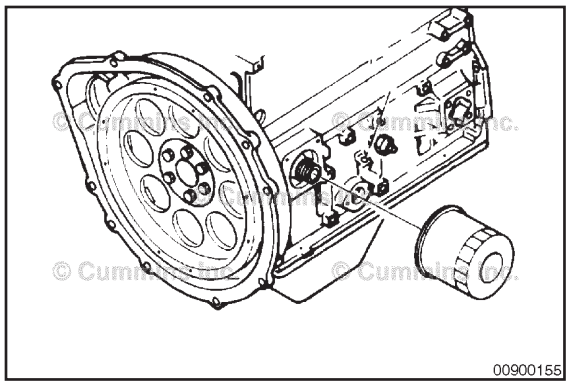

Fig. 105

- Unscrew the filter cartridge (Fig. 105) using an appropriate filter wrench.
- Clean the sealing face on the filter carrier from any dirt.

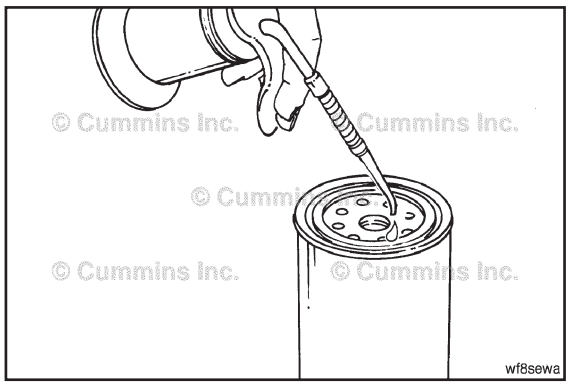

Fig. 106

- Slightly oil the rubber seal on the new filter cartridge.

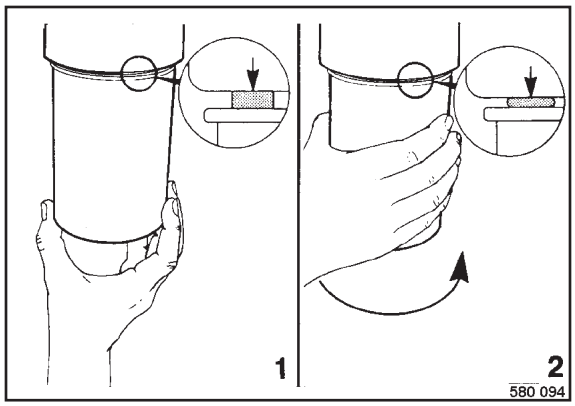

Fig. 107

- Turn the new filter cartridge (Fig. 107) on by hand, until the seal contacts.
- Tighten the filter element for another half turn.

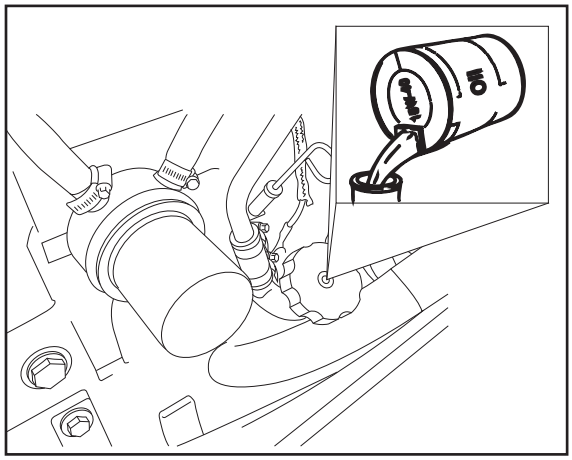

Fig. 108

- Fill in new engine oil (Fig. 108).

For quality and quantity of oil refer to the table of fuels and lubricants.

- Tighten the oil filler cap properly.
- After a short test run check the oil level on the dipstick, if necessary top up to the top dipstick mark.
- Check filter cartridge and drain plug for leaks after a short test run.
- Shut the engine down and wait for about 15 minutes, so that all oil can flow back into the oil sump.

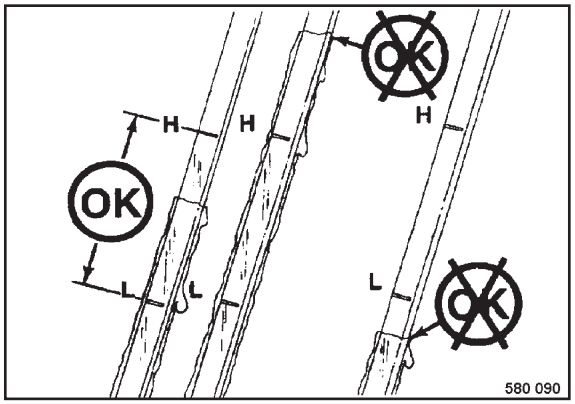

Fig. 109

- Check the oil level again (Fig. 109), if necessary fill up to the Max.-mark.

Clean the cooling fins on engine and hydraulic oil cooler

DANGER: **Danger of injury!**

Perform cleaning work only after the engine has cooled down and with the engine stopped.

CAUTION: **Do not damage any cooling fins on the cooler core when cleaning.**

NOTE: **Dirt on fan blades and oil cooler reduce the cooling effect. Dirt deposits in these areas are substantially supported by oil and fuel on these surfaces. For this reason you should always seal any oil or fuel leaks in the vicinity of the cooling fan or the oil cooler and clean the cooling surfaces after.**

Cleaning with compressed air

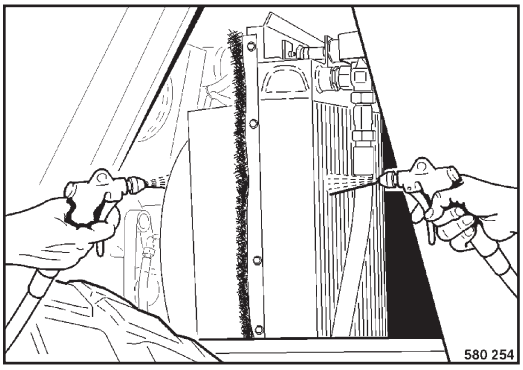

Fig. 110

NOTE: **Start to blow out from the exhaust side.**

- Blow the cooler (Fig. 110) out with compressed air.

Cleaning with cold cleansing agent

CAUTION: **Protect electrical equipment such as generator, regulator and starter against the direct water jet.**

- Spray the engine with a suitable cleansing agent, e.g. cold cleanser, let it soak in for a while and spray it off with a strong water jet.
- Run the engine warm for a while to avoid corrosion.

Check the oil level in the drive axle

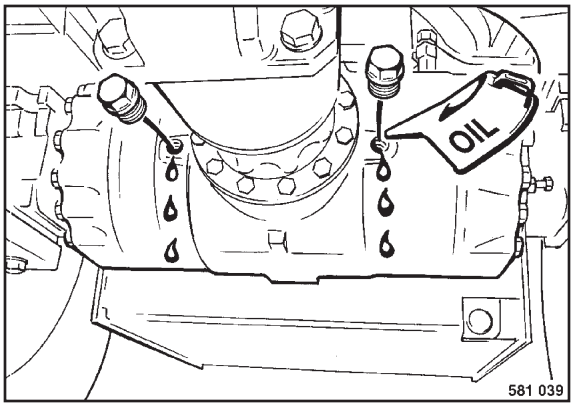

Fig. 111

- Unscrew the oil level inspection plug (Fig. 111) and check the oil level.

The oil level must reach the bottom edge of the level bore.

- Top up oil, if necessary.

For quality of oil refer to the table of fuels and lubricants.

- Turn the level inspection plug tightly back in.

Checking the oil level in the left/right hand planetary drives

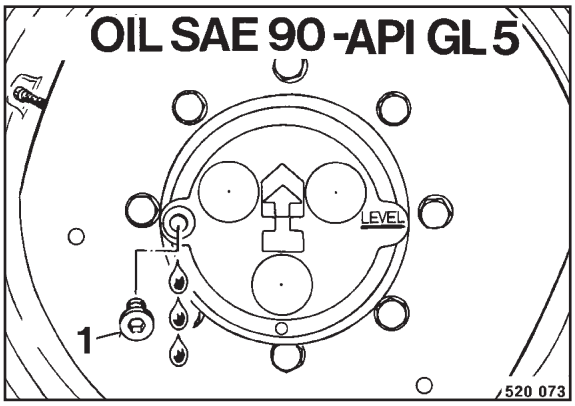

Fig. 112

- Drive the machine, until both plugs 1 (Fig. 112) are in horizontal position.
- Clean the plug and screw it out.

The oil level must reach the lower edge of the bore, top up oil if necessary.

For quality of oil refer to the table of fuels and lubricants.

- Screw the plug tightly back in.
- Repeat the same procedure on the opposite side.

Checking the oil level in the vibration bearing

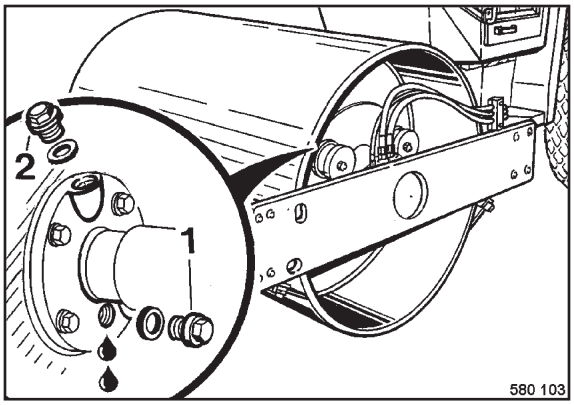

Fig. 113

- Drive the machine until the oil level control plug 1 (Fig. 113) is vertically below the hub.
- Clean the plug and screw it out.

The oil level must reach the lower edge of the bore

- If necessary top up oil through the filler and drain bore (2).

For quality of oil refer to the table of fuels and lubricants.

Checking the oil level in the drum drive gear

Only DH and PDH machines

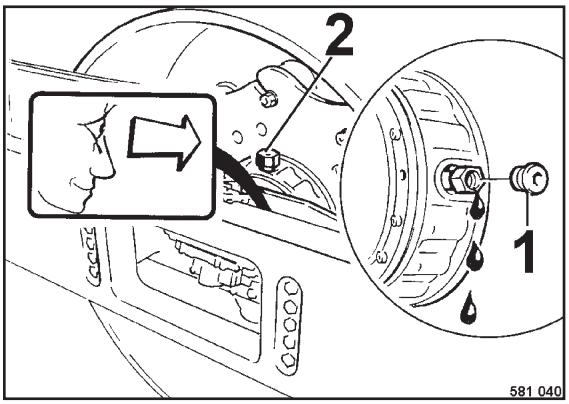

Fig. 114

- Move the machine until one plug 1 (Fig. 114) is in horizontal and one plug (2) in top position.
- Clean and unscrew plug (1).

The oil level must reach the bottom edge of the bore.

- If necessary clean and unscrew plug (2) and fill in oil.

For quality of oil refer to the table of fuels and lubricants.

Service the battery

DANGER: **Danger of cauterisation! Danger of explosion!**

When working on the battery do not use open fire, do not smoke!

The battery contains acid. Do not let acid come in contact with skin or clothes!

Wear protective clothing!

Do not lay any tools on the battery!

Environment

Dispose of the old battery environmentally.

NOTE: **Maintenance free batteries also need care. Maintenance free only means that the fluid level does not need to be checked. Each battery suffers under self-discharge, which may, in not checked occasionally, even cause damage to the battery as a result of exhaustive discharge.**

The following therefore applies for the service life:

- Switch off all consumers (e.g. ignition, light, inside light, radio).
- Check open-circuit voltage of the battery at regular intervals. At least once per month.

Reference values: 12.6 V = fully charged; 12.3 V = 50% discharged.

- Recharge the battery immediately after an open-circuit voltage of 12.25 V or less is reached. Do not perform boost charging.

The open-circuit voltage of the battery occurs approx. 10 hours after the last charging process or one hour after the last discharge.

- After each charging process allow the battery to rest for one hour before taking it into service.
- For resting periods of more than one month you should always disconnect the battery. Do not forget to perform regular open-circuit voltage measurements.

CAUTION: **Exhausted batteries (batteries with formation of suphate on the plates are not covered under warranty!**

- Remove the four screws holding the cover to expose the battery.

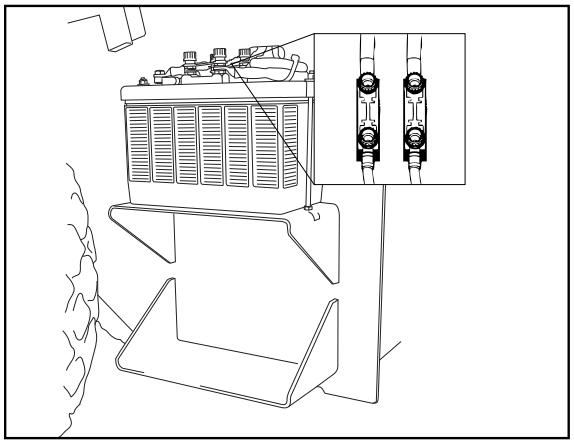

Fig. 115

- Remove the battery (Fig. 115) and clean the battery compartment.
- Clean the outside of the battery.
- Clean battery poles and pole clamps and grease them with pole grease (Vaseline).
- Check the fastening of the battery.
- On serviceable batteries check the acid level, if necessary top up to the filling mark with distilled water.

Charging voltage recommendation

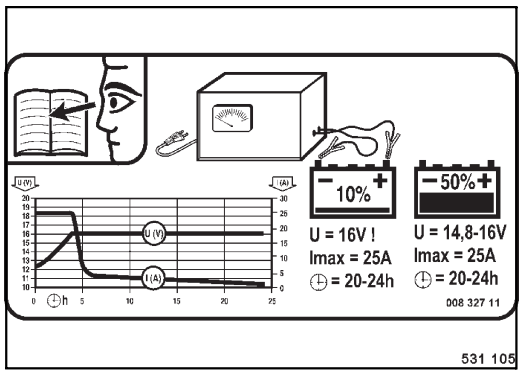

Fig. 116

Draining the fuel tank sludge

DANGER: **Fire hazard!**

When working on the fuel system do not use open fire, do not smoke.

Do not spill any fuel.

Catch running out fuel, do not let it seep into the ground.

Do not inhale any fuel fumes.

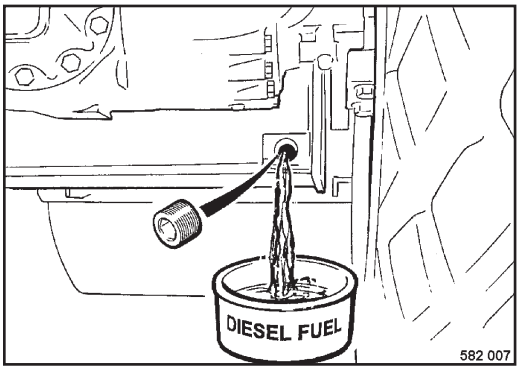

Fig. 117

- Unscrew the drain plug (Fig. 117) from the bottom of the fuel tank and drain off approx. 5 litres of fuel.
- Screw the drain plug back in with a new sealing ring.

Change the fuel filter cartridge

DANGER: **Fire hazard!**

When working on the fuel system do not use open fire, do not smoke and do not spill any fuel.

Catch running out fuel, do not let it seep into the ground.

Do not inhale any fuel fumes.

- Loosen and unscrew the fuel filter cartridge (Fig. 118) using an appropriate filter wrench.
- Clean the sealing face on the filter carrier from any dirt.
- The fuel filter has a electrical water in fuel sensor located in the water drain assembly located on the bottom of the fuel filter. Disconnect the electrical connection to the bottom of the fuel filter at the electrical pigtail.

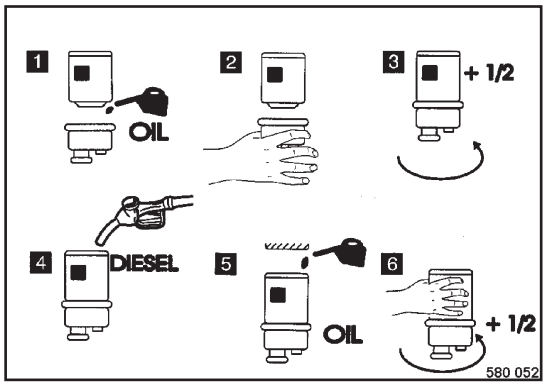

Fig. 118

- Unscrew the fuel filter cartridge using an appropriate filter wrench.
- Clean the sealing face on the filter carrier from any dirt.
- Unscrew the water separator from the filter cartridge.
- Apply a thin coat of oil to the rubber seal of the water separator 1 (Fig. 121).
- Screw the water separator on by hand (2), until the seal contacts.
- Tighten the water separator for another half turn (3).

Fig. 119

- 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.
- Apply some oil to the rubber seal of the filter element (4) and screw it on by hand, until the seal contacts.
- Tighten the filter element for another half turn (5). Torque Value: 34 N•m [25 ft-lb]
- Check the filter cartridge for leaks after a short test run.
- Mechanical overtightening will distort the threads, filter element seal, or filter can. Use the correct fuel filter.
- To prime the engine use the OEM installed priming device. The priming pump is installed at the prefilter. Turn priming valve counterclockwise until pump moves freely. Pump until resistance is felt, then turn priming valve clockwise until snug. DO NOT USE TOOLS.

Fig. 121

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

- 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 propertydamage can result.

Change the fuel pre-filter cartridge

DANGER: **Fire hazard!**

When working on the fuel system do not use open fire, do not smoke and do not spill any fuel.

Catch running out fuel, do not let it seep into the ground.

Do not inhale any fuel fumes.

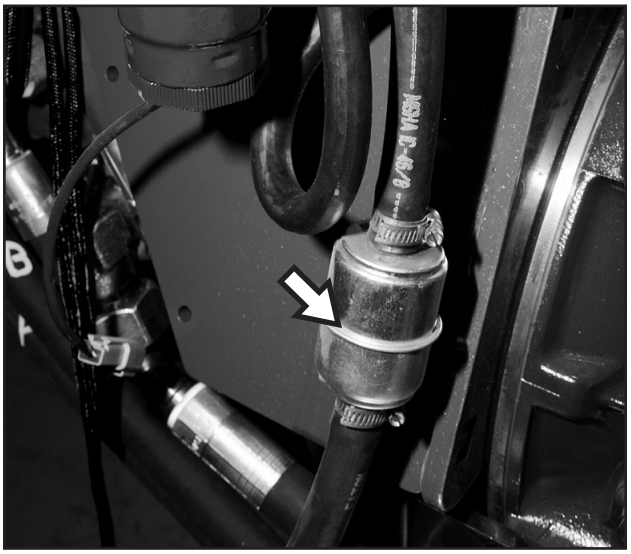

Fig. 122

- Restrict the fuel line before and after the pre fuel filter by clamping.
- Loosen the hose clamps before and after the pre fuel filter.
- Remove the old pre fuel filter and replace with a new pre fuel filter.
- Replace and secure the hose clamps.
- Remove the clamps restricting the fuel lines.

Cooling Fan V-belt, Removal and Installation

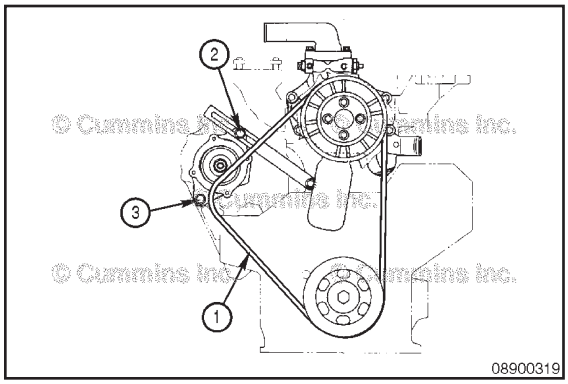

Fig. 123

- Remove the drive bet by loosening the alternator mounting capscrew (3) and the belt tension adjustment capscrew (2).
  Move the alternator down the adjustment bar until the drive belt is loose.
  Remove the drive belt.

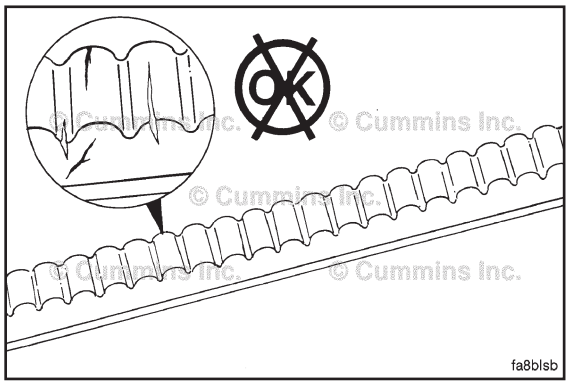

Fig. 124

- Check the condition of the V-belt (Fig. 124).
  Small cracks in transverse direction are permitted.
  Cracks in longitudinal direction are not permitted.
  Replace the V-belt in case of broken out material, intersecting cracks in longitudinal and transverse direction or fraying.

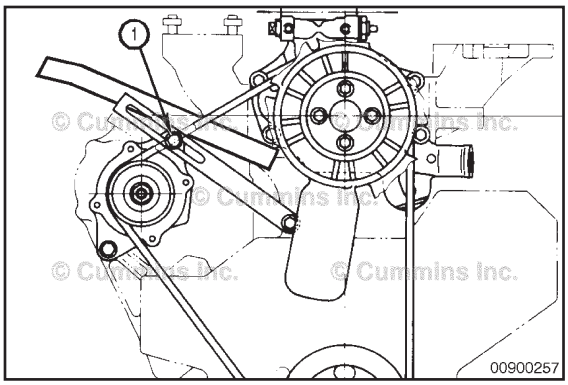

Fig. 125

- Install the drive belt
  Using a breaker bar, raise the alternator on the adjustment bar (1), and adjust the fan belt tension to specifications.

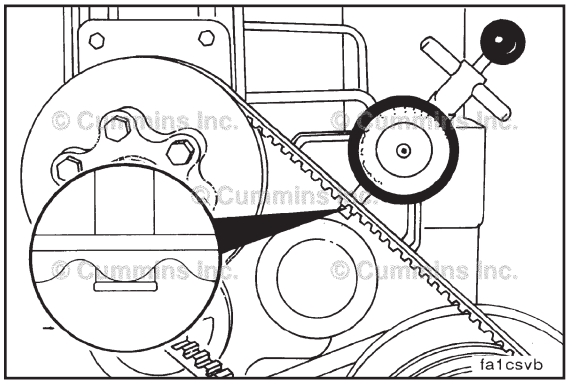

Fig. 126

- We recommend using the Cummins V-belt tension tester (Fig. 126) Cummins Part. No. 322524 or a Burroughs gauge Part. No. ST-1138.

- For cogged belts, make sure that the belt tension gauge is positioned so that the center tensioning leg is placed directly over the high point (hump) of a cog. Other positioning will result in incorrect measurement.

Nominal value:

400 to 467 N (90 to105 lb) New Belt

266 to 233 N (60 to 75lb) Used Belt

Check condition and tension of refrigerant (optional) compressor V-belt, replace the V-belt

DANGER: **Danger of injury!**

Work on the V-belt must only be performed with the engine shut down.

Checking the V-belt

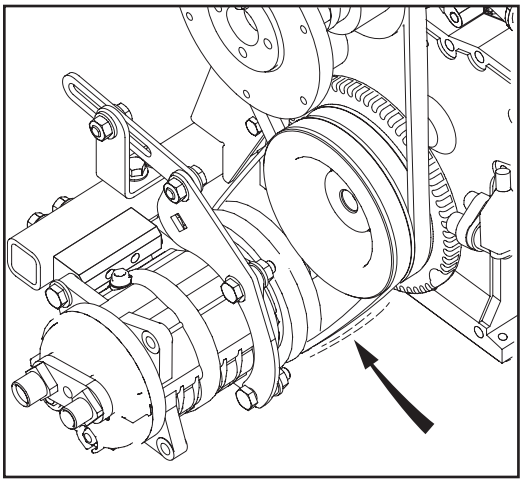

Fig. 127

- Inspect the entire circumference of the V-belt (Fig. 127) visually for damage and cracks. Replace damaged or cracked V-belts.
- Check with thumb pressure whether the V-belt can be depressed more than 10 to 15 mm (0.4 – 0.6 inches) between the V-belt pulleys, retighten if necessary.

Tensioning the V-belt

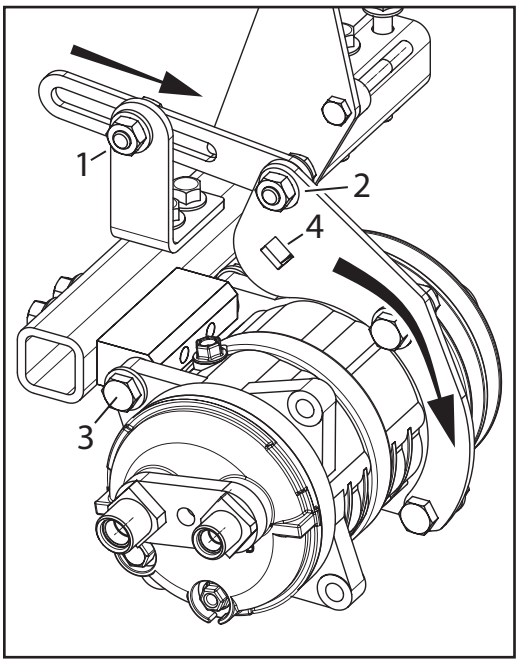

Fig. 128

- Slightly slacken the fastening screws 1, 2 and 3 (Fig. 128).
- Insert a 1/2-inch drive into the 1/2-inch square bracket hole (4), then rotate in the direction of the arrows until the correct V-belt tension is reached.
- Retighten all fastening screws.

Changing the V-belt

- Slightly slacken the fastening screws 1, 2 and 3.
- Release the V-belt tension.
- Take the old V-belt off.
- Fit the new V-belt to the V-belt pulleys.
- Tension the V-belt as previously described.

CAUTION: **Check the V-belt tension after a running time of 30 minutes.**

* Optional equipment

Change the oil in the drive axle

NOTE: **On other axle versions drain and filler plugs are of slightly different design. Perform the oil change accordingly.**

CAUTION: **Drain oil only at operating temperature.**

Environment

Catch old oil and dispose of environmentally.

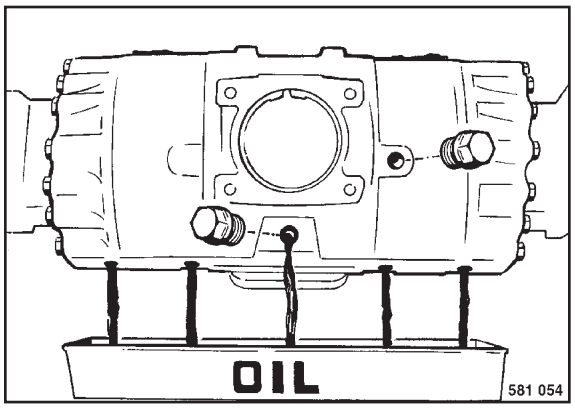

Fig. 129

- Clean and unscrew all level inspection and drain plugs (Fig. 129).
- Drain and catch all oil.
- Clean the drain plug and turn it back in with a new seal ring.

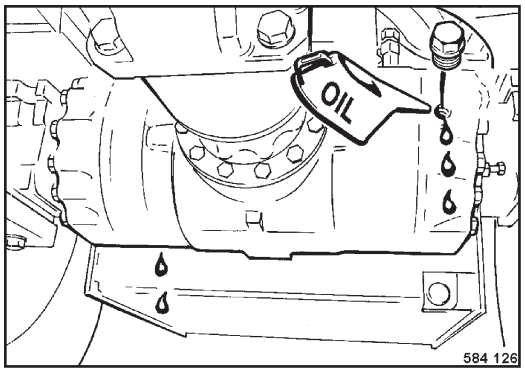

Fig. 130

- Fill in oil through the oil level inspection bores (Fig. 130), until it has reached the bottom edge of the bore.

For quality and quantity of oil refer to the table of fuels and lubricants.

- Retighten the filler and level inspection plug.

Change the oil in the planetary drive

CAUTION: **Drain the oil only at operating temperature.**

Change the oil on both sides of the axle.

Environment

Catch the old oil and dispose of environmetally.

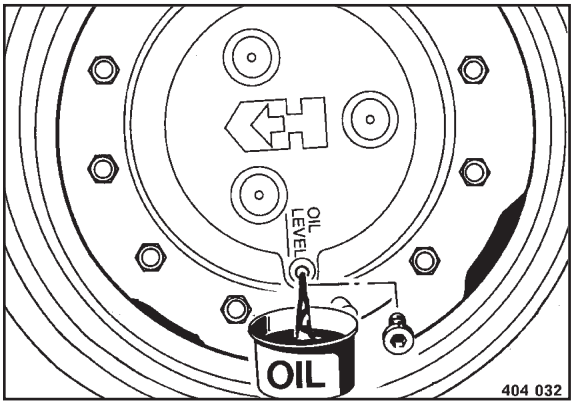

Fig. 131

- Move the drive wheel until the plug (Fig. 131) is in lowest position.
- Clean the plug and screw it out.
- Drain the oil off and catch it.

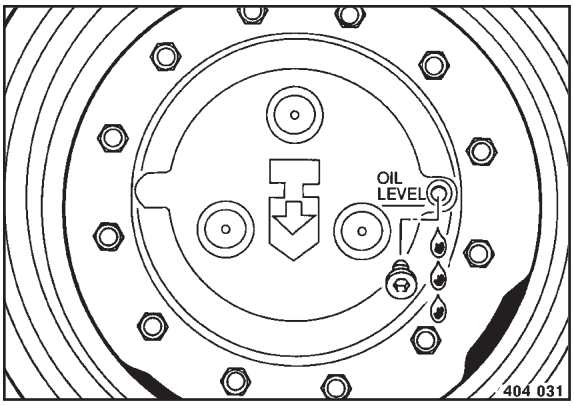

Fig. 132

- Move the drive wheel until the plug (Fig. 132) in the housing is in horizontal position.
- Fill in oil, until it reaches the lower edge of the bore.

For quality and quantity of oil refer to the table of fuels and lubricants.

- Screw the plug back in.
- Repeat the oil change on the opposite side.

Change the oil in the drum drive gear

Only DH and PDH machines

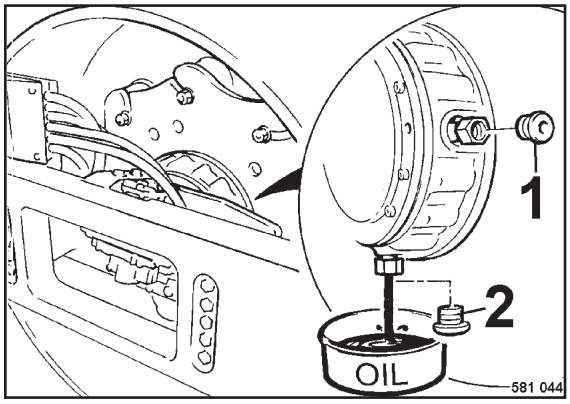

Fig. 133

Move the drum, until the drain and level inspection plug 2 (Fig. 133) is in bottom position.

Clean and unscrew the oil filler plug (1) as well as the drain and level inspection plug.

Environment

Catch running out oil.

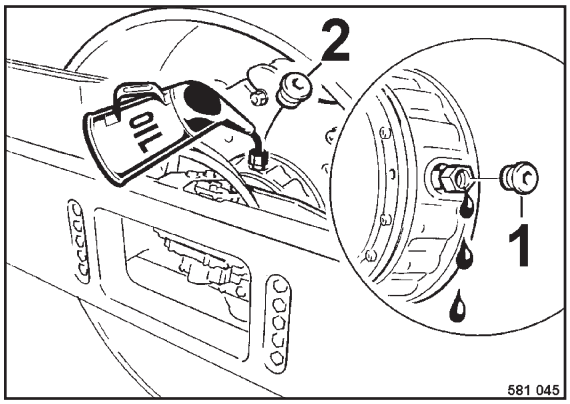

Fig. 134

- Once all oil has been drained off move the drum, until the oil filler plug 2 (Fig. 134) is in top position and the drain and level inspection plug (1) is in horizontal position.
- Fill in oil, until it starts to run out through the level inspection bore.

For quality and quantity of oil refer to the table of fuels and lubricants.

- Turn filler plug (2) and drain and level inspection plug (1) tightly back in.

Changing the oil in the vibration bearings

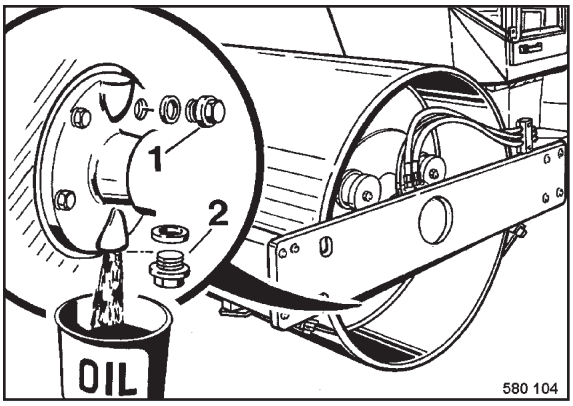

Fig. 135

- Move the drum until the drain plug 2 (Fig. 135) is in lowest position.
- Clean the oil level control plug (1) as well as the drain and filler plug and screw them out.

Environment

Catch running out oil.

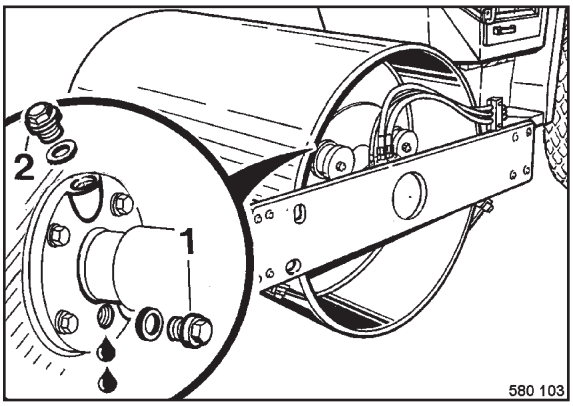

Fig. 136

- Once the oil has run out move the drum until the oil level control opening 1 (Fig. 136) is vertically below the hub.
- Fill in oil until it starts to run out through the oil level control bore.

For quality and quantity of oil refer to the table of fuels and lubricants.

- Fit oil level control plug (1) and drain and filler plug (2) with new sealing rings and screw them back in.

Checking the fastening elements on the engine

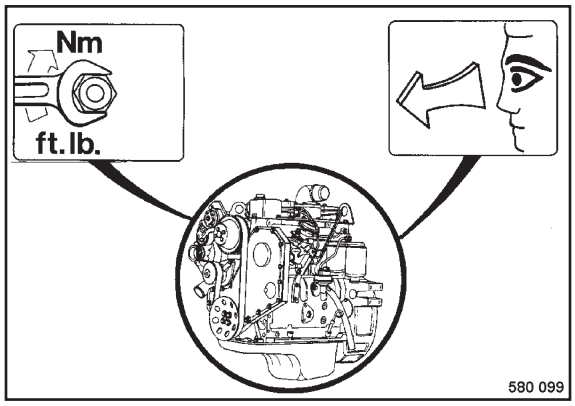

Fig. 137

- Check the fastening of air intake and exhaust tube (Fig. 137) on the cylinder heads for tight fit.
- Check the bellows and clamps between air filter, turbo charger and charge air line as well as the lubrication oil line for tight fit.
- Check the fastening screws for the oil sump and the engine mounts for tight fit.

Retighten the fastening of the axle on the frame

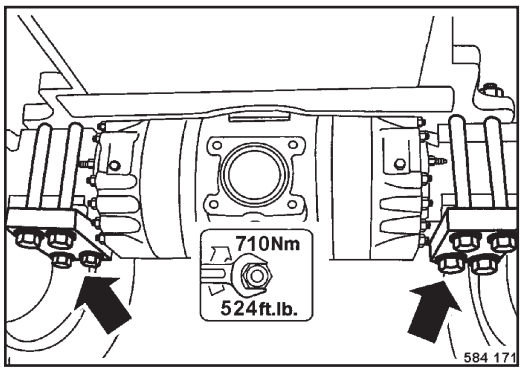

Fig. 138

- Check all fastening nuts on axle mounting bolts (Fig. 138) for tight fit.

Tightening the wheel nuts

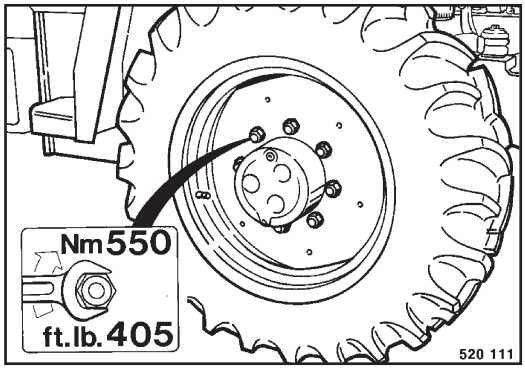

Fig. 139

- Tighten the wheel nuts (Fig. 139) in a cross-type pattern.

Checking the ROPS

NOTE: **On machines with a fitted cabin the ROPS (Roll Over Protection Structure) is integrated in the cabin.**

Please observe also the respective section in the safety regulations in this manual.

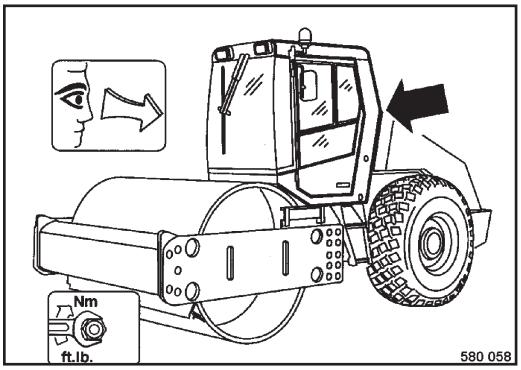

Fig. 140

- Check the cabin, especially the ROPS (Fig. 140) for cracks, corrosion, damage and missing fastening elements.

NOTE: **Unusual movements and noises (vibrations) during operation indicate damage or loose fastening elements.**

- Check the fastening screws for the cabin (ROPS) to the operator's platform for tight fit.
- Check the suspension buffers for the operator's stand for tight fit.
- Check the condition and the fastening of the seat belt.

Checking, adjusting the valve clearance

CAUTION: **Before checking the valve clearance let the engine cool down for at least 30 minutes. The engine temperature should be lower than 60 °C.**

- Remove the air filter.

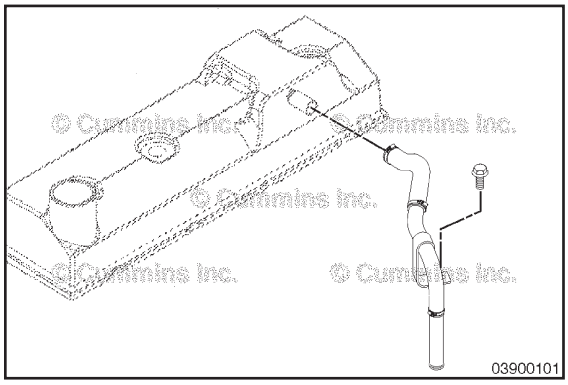

Fig. 141

- Remove the crankcase breather tube from the rocker lever cover.

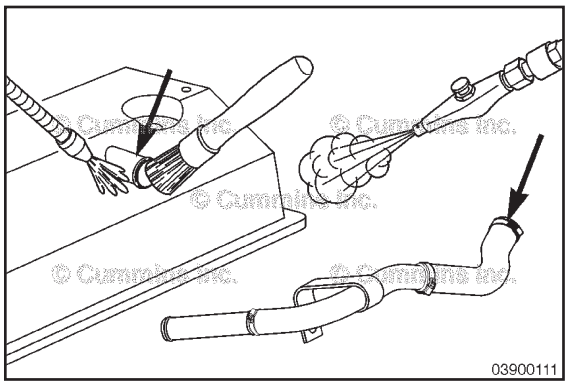

Fig. 142

- Clean and Inspect for Reuse

DANGER: **Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.**

If the crankcase breather tube is blocked with obstructions or sludge buildup, the tube must be cleaned with a strong solution of detergent in hot water or replaced to prevent excessive crankcase pressure buildup. Dry the crankcase breather tube with compressed air. Inspect the crankcase breather tube for cracks, or other debris, that can obstruct the tube.

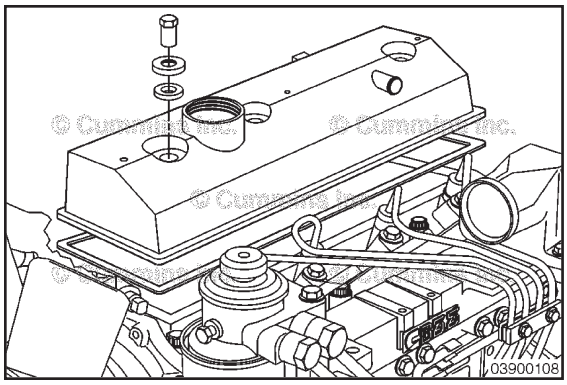

Fig. 143

- Removing the Rocker Lever Cover Remove the three locknuts, isolator assemblies, o-rings, and rocker lever cover. Remove the gasket. Discard the gasket.

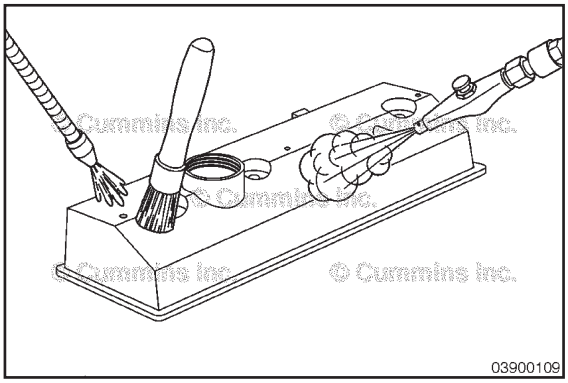

Fig. 144

- Clean and Inspect for Reuse

DANGER: **Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.**

Clean the rocker lever cover with a strong solution of detergent in hot water. Dry the rocker lever cover with compressed air.

Inspect the rocker lever cover for cracks and other damage.

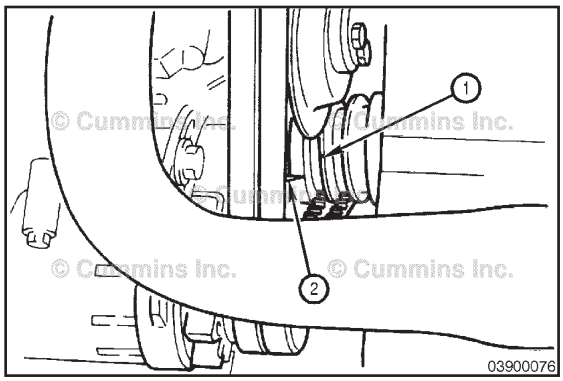

Fig. 145

- **Overhead Set Adjustment**
  Rotate the crankshaft in the normal direction **(Clockwise).**
  Check the movement of the intake valve number 4 cylinder. The number 4-cylinder intake valve will start to open when the number 1 cylinder comes near the compression top dead center (TDC).
  Rotate the number 1 cylinder into compression top dead center (TDC) position.
  Align the "TOP" engraved mark on the crankshaft pulley (1) with the pointer (2). The engraved mark on the crankshaft pulley will read "1.4 TOP".

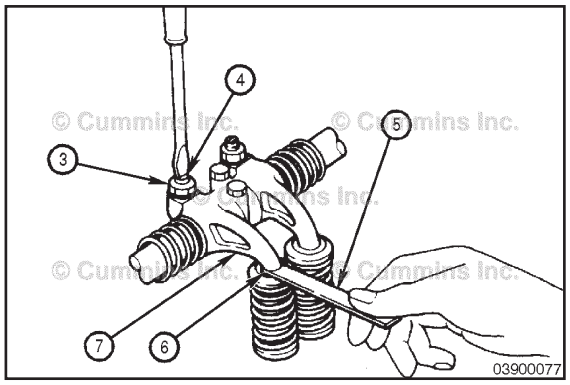

Fig. 146

- Loosen the locknut (3) on the adjustment screw (4). Insert the feeler gauge (5) between the valve stem (6) and the rocker arm (7). Adjust the clearance with the adjustment screw until slight drag is felt on the feeler gauge.

Valve Clearance (Engine Hot or Cold)	
Intake Valve	**Exhaust Valve**
0.35 mm [0.014 in]	0.50 mm [0.020 in]

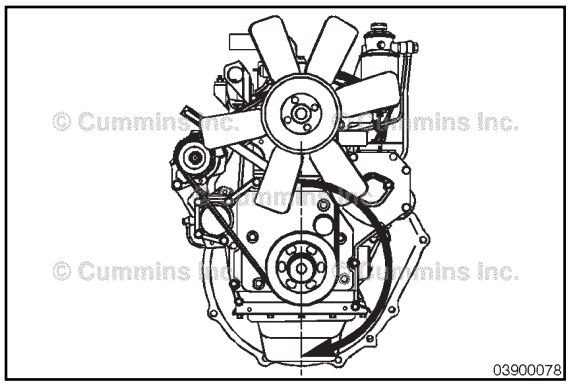

Fig. 147

- Adjust intake and exhaust clearances in the following firing order by rotating the crankshaft 180 degrees clockwise (1-2-4-3 firing order) or use the following procedure to adjust in two locations:
  1. Number 1 cylinder at top dead center (TDC)
  2. Rotate 360 degrees.

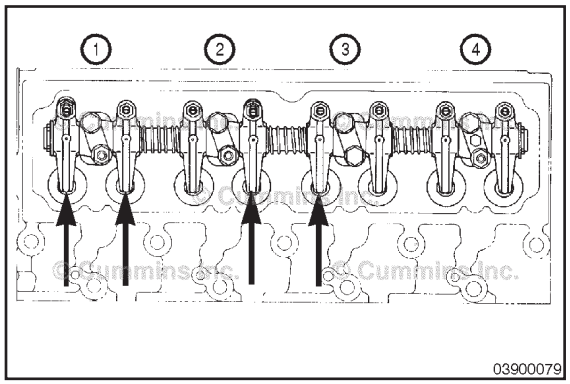

Fig. 148

- Adjust the valve clearance for the intake valves number 1 and number 3.
  Adjust the valve clearance for the exhaust valves number 1 and number 2.

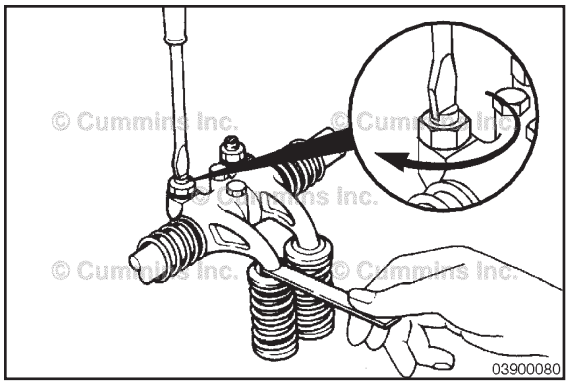

Fig. 149

- Tighten the locknut to secure the adjustment screw.

Locknut Torque Value		
N•m		ft-lb
39	MIN	29
49	MAX	36

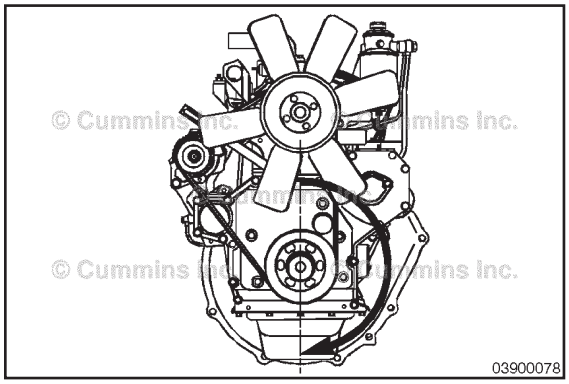

Fig. 150

Rotate the crankshaft in the normal direction one revolution. Adjust the valve clearance for the intake valves number 2 and number 4.
Adjust the valve clearance for the exhaust valves number 3 and number 4.

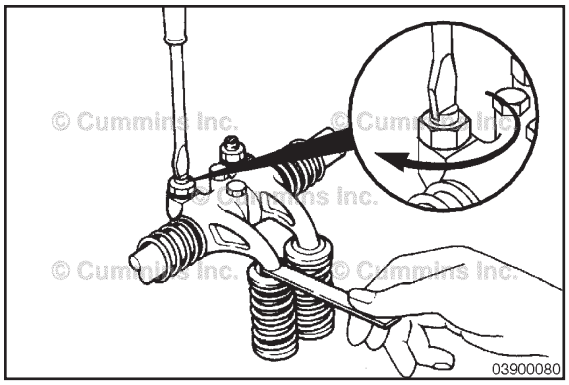

Fig. 151

- Tighten the locknut to secure the adjustment screw.

Locknut Torque Value		
N•m		ft-lb
39	MIN	29
49	MAX	36

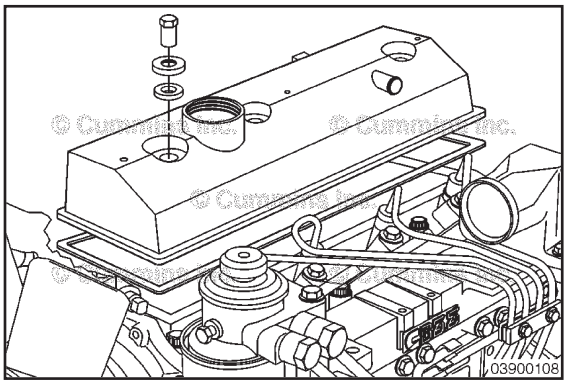

Fig. 152

- Reinstalling the rocker lever cover.
  Install the new gasket.
  Install the rocker lever cover, o-rings, isolator assemblies, and locknuts.
  Torque Value: 9 N•m [80 in-lb]

Changing the hydraulic oil and the breather filter

NOTE: **See also section "Notes on the Hydraulic System".**

CAUTION: **Apart from the normal oil change intervals the hydraulic oil must also be changed after major repairs in the hydraulic system.**

Change the hydraulic oil only at operating temperature.

Clean the area around the hydraulic oil tank, the filler opening and the breather filter.

Do not use any detergents to clean the system.

Do not start the engine after draining the hydraulic oil.

Change the hydraulic oil filter element with every hydraulic oil change.

DANGER: **Danger of scalding!**

Danger of scalding by hot oil.

Environment

Catch running out oil and dispose of environmentally.

NOTE: **The hydraulic oil filter element should only be changed after the test run.**

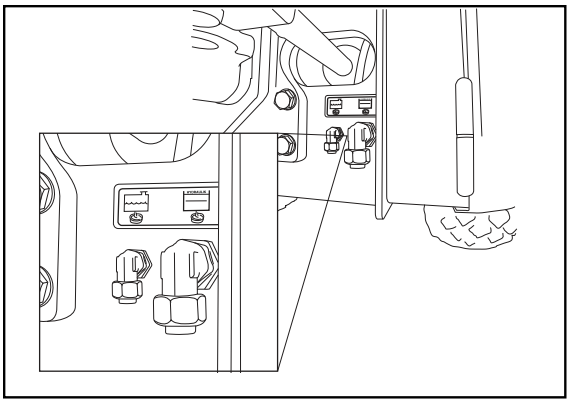

Fig. 153

- Unscrew the plug (Fig. 153) and drain the hydraulic oil off.
- Check the sealing ring (1), replace if necessary and screw the plug tightly back in.

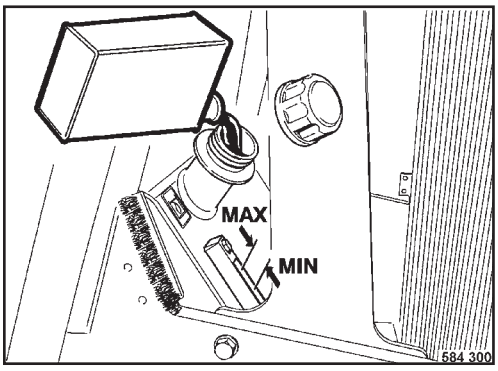

Fig. 154

- Take the filler cap (Fig. 154) off.
- Fill in hydraulic oil through the screen.

NOTE: **We recommend to use the filling and filtering unit (part-no. 079 930 35) with fine filter to fill the hydraulic system. This filters the hydraulic oil, prolongs the service life of the hydraulic oil filter and protects the hydraulic system.**

- Check the oil level in the inspection glass.

Nominal value:

approx. 3 cm below the upper edge of the inspection glass

For quality and quantity of oil refer to the table of fuels and lubricants.

NOTE: **The breather filter for the hydraulic tank is located in the filler cap and must therefore be replaced with the filler cap.**

- Close the tank with the new filler cap.

Changing the hydraulic oil filter

DANGER: **Danger of scalding!**

There is a danger of scalding by hot oil when unscrewing the filter.

CAUTION: **If the filter has to be changed together with the hydraulic oil, the filter should in any case be changed after the oil change and the test run.**
Do not use the oil in the filter bowl.

Environment

Catch running out oil, dispose of oil and filter element environmentally.

NOTE: **The filter element must be changed with every hydraulic oil change and after major repairs in the hydraulic system.**

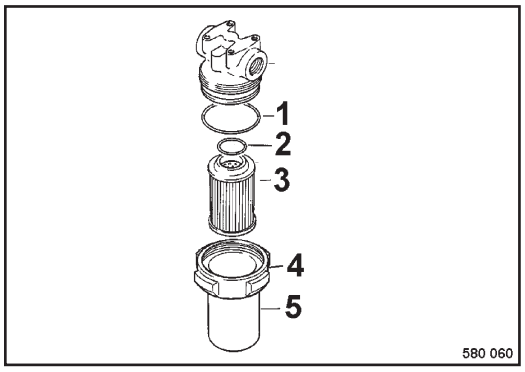

Fig. 155

- Unscrew the cap nut 4 (Fig. 155) and take the filter bowl (5) with the filter element (3) off.
- Examine the sealing face on the filter element thoroughly for any visible dirt.

CAUTION: **Visible impurities can be an early indicator for a premature failure of system components and a possible malfunction of parts. In such a case perform trouble shooting and, if necessary, replace or repair defective components. Negligance may damage the complete hydraulic system.**

Do not clean or reuse the filter element.

- Take the old filter element (3) out and clean the filter bowl and the thread.
- Reinstall the filter bowl with the new filter element, check the condition of the O-rings (1) and (2), replace if necessary.
- After a test run check the filter for leaks.

Changing the coolant

DANGER: **Danger of scalding!**

Change the coolant only when the engine is cold.

Environment

Catch running out coolant and dispose of environmentally.

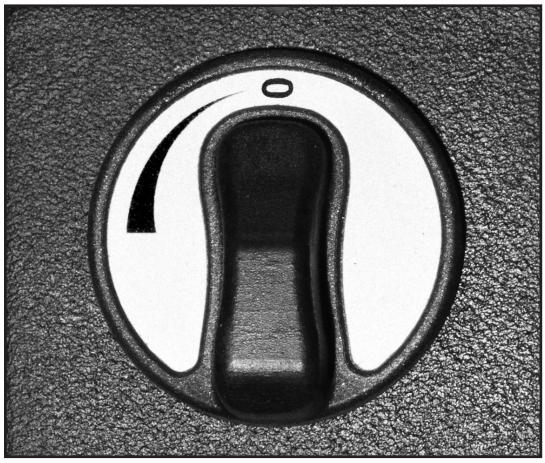

Fig. 156

- Switch the control valve (Fig. 156) for the cabin heater to “warm”.

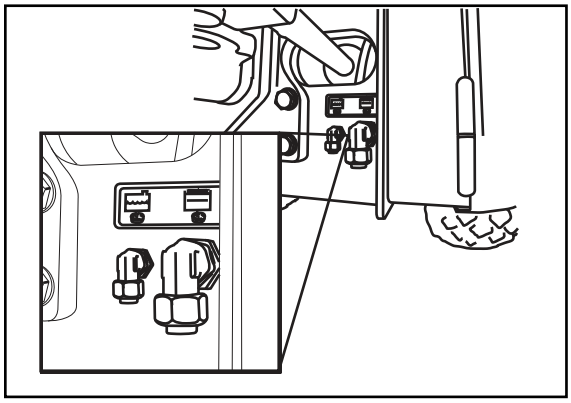

Fig. 157

- Unscrew the drain plug, drain all coolant off and catch it.
- Screw the plug back in after all coolant has been drained off.

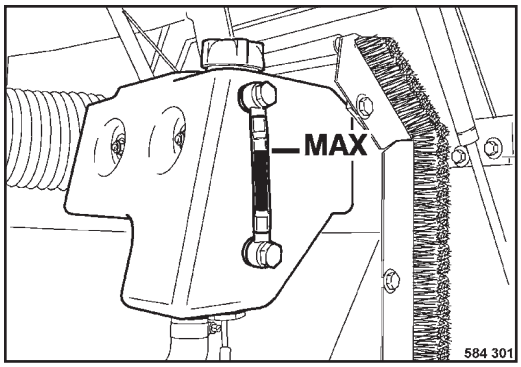

Fig. 158

- Unscrew the cap and fill in coolant up to the MAX-mark. (Fig. 158)

For quality of coolant refer to the chapter, fuels and lubricants.

- Start the diesel engine and run it warm to operating temperature.
- Let the engine cool down and check the coolant level again, top up if necessary.

Cleaning, changing the dry air filter cartridge

CAUTION: **Perform cleaning, maintenance and repair work only with the engine shut down. Do not start the engine after removing the filter element.**

Do not use gasoline or hot fluids to clean the filter element.

After cleaning the filter element must be inspected for damage using a torch.

Air filter elements with damaged paper bellows or seal lips must be replaced in any case.

The main filter element must be replaced after 3 times cleaning, but at the latest after one year, irrespective of the operating hours.

Each cleaning interval must be marked with a cross on the cover of the filter element.

Cleaning does not make sense if the air filter element is covered with a sooty deposit. Use a new filter element.

Incorrectly handled filter elements may become ineffective because of damage (e.g.: cracks) and cause engine damage.

Fig. 159

Maintenance of the dry air filter is due when indicated by the Air filter restriction indicator located on the side of the engine. (Fig. 159) Maintenance of the Air filter must minimally occur after one year.

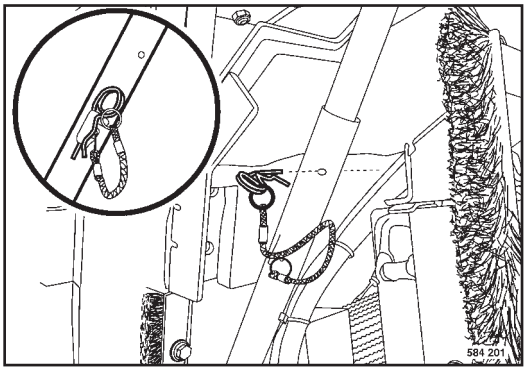

Fig. 160

- Open the engine hood (Fig. 160) completely and secure it.

Removing the main filter element

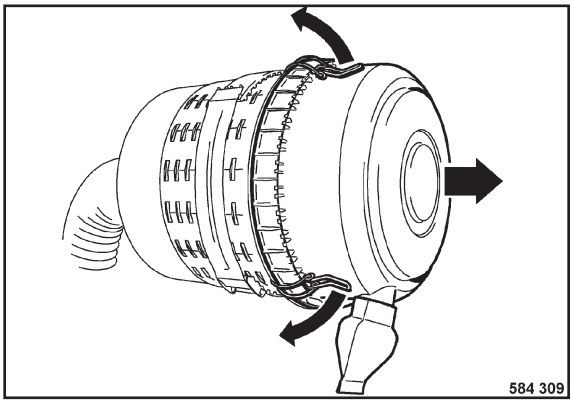

Fig. 161

- Loosen both locking hooks (Fig. 161) on the housing cover and take the cover off.

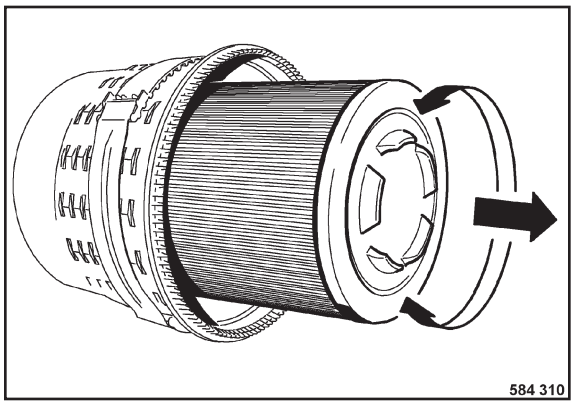

Fig. 162

- Pull out the main filter element (Fig. 162) with light turning movements.

Cleaning the main filter element

CAUTION: **If necessary, the main filter element may be cleaned up to five times. It must be renewed at the latest after a maximum utilization period of two years.**

The number of cleaning intervals of the main filter element can be marked on the safety element with a ballpoint pen or a felt pen.

Cleaning does not make sense if the main filter element is covered with a sooty deposit. Use a new filter cartridge.

Incorrectly handled inserts may be ineffective because of damage (e.g. cracks) and cause damage to the engine.

Replace the safety cartridge if the main filter element is defective!

Additional cleaning intervals between two filter services signalized by the fault monitoring board are not necessary.

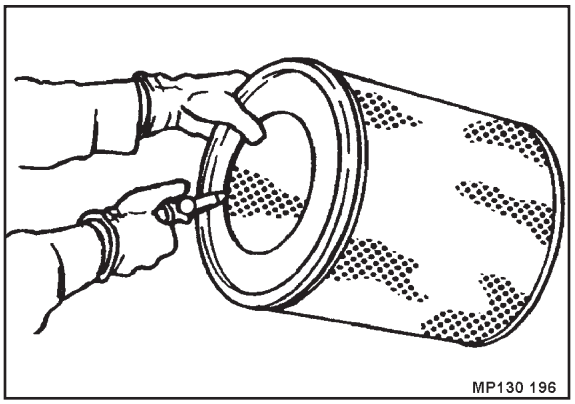

Fig. 163

- Blow the filter cartridge out from inside to outside with dry compressed air (max. 5 bar) (Fig. 163), until all dust has been removed.

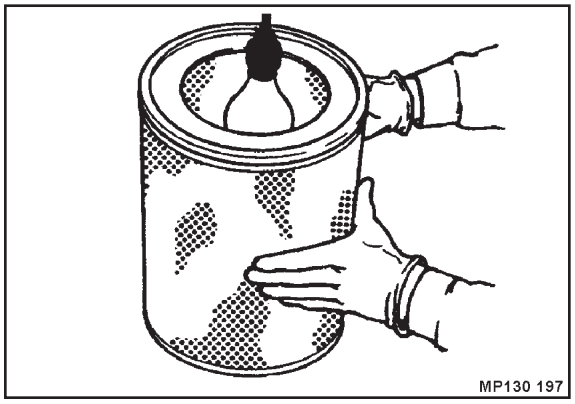

Fig. 164

- Examine the filter cartridge with a lamp for cracks and holes in the paper bellows (Fig. 164).

CAUTION: **Do not continue to run the machine with a damaged main filter element. If in doubt use a new main filter element.**

Cleaning the dust bowl

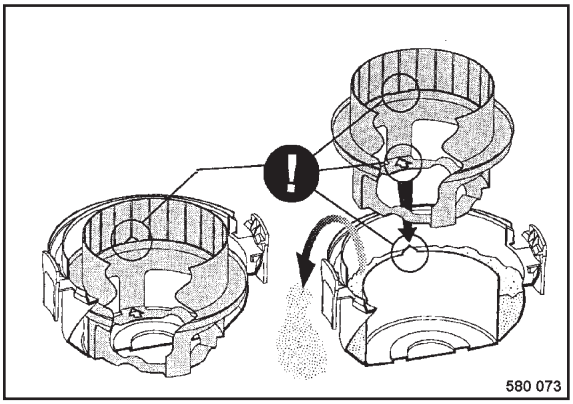

Fig. 165

- Pull the internal part (Fig. 165) out and remove the dust from the cover.
- Reinsert the inner part.

CAUTION: **When assembling the inner part make sure that the notch in the cover engages in the opening of the inner part.**

Installing the main filter element

- Slide the main filter element carefully into the housing.

When closing the housing cover the main filter element is automatically forced in the correct position.

Changing the safety filter element

CAUTION: **The safety filter element must not be cleaned and should not be used again after it has been removed.**

Break the seal only to replace the safety filter element.

The safety filter element must be replaced:

If the main filter element is defective. after five service intervals of the filter cartridge,

at the latest after 2 years, if the warning light comes on again after servicing the main filter cartridge.

- Remove the housing cover and pull the main filter element off.

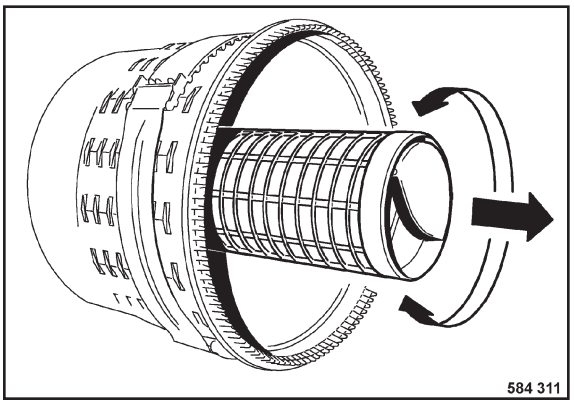

Fig. 166

- Pull the safety element (Fig. 166) out by slight turning movements.
- Push in a new safety filter element.
- Reassemble main filter element and cover.

CAUTION: **Make sure that the cover locks engage correctly.**

Bleeding the fuel system

Refer to the Cummins Operation and Maintenance Manual Bulletin 3666417

Adjusting the parking brake

CAUTION: **Have adjustment work on the brake performed by a specialist! Always adjust both sides.**

- Secure the machine with chocks against unintentional rolling.
- Start the diesel engine to release the brake.

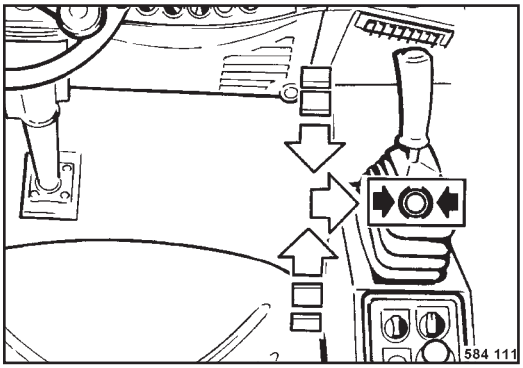

Fig. 167

- Unlock the travel lever (Fig. 167) by pushing it to the left, but do not actuate it to position “I” or “II”.

The parking brake is released

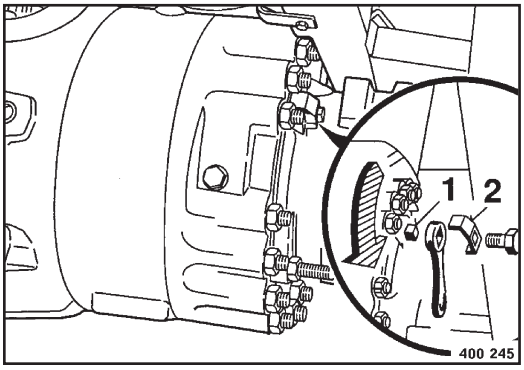

Fig. 168

- Unscrew the locking plate 2 (Fig. 168).
- Turn the square (1) in anti-clockwise direction against the end stop.

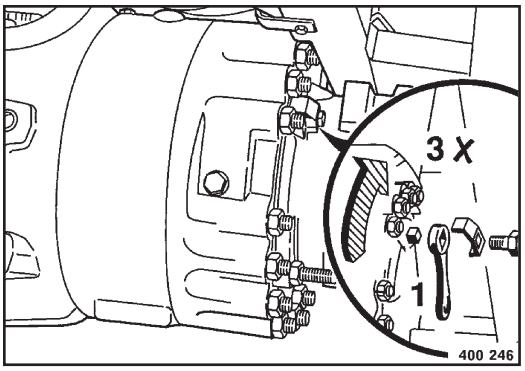

Fig. 169

- To adjust the clearance turn the square 1 (Fig. 169) three revolutions back in clockwise direction.
- Screw the locking plate back on.
- Pull the plug off the brake valve and try to drive.
- The machine must be braked.

Changing the tires

DANGER: **Danger of accident!**

Observe all safety notes for the lifting of loads.

- Place a jack (min. 5 t bearing capacity) under the rear frame and jack the machine up so that the wheel can turn freely.
- Unscrew the wheel nuts and take the wheel off.

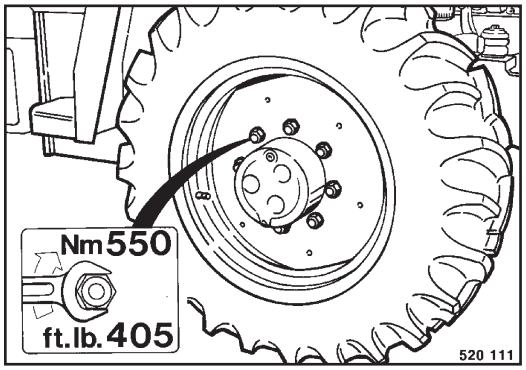

Fig. 170

- Attach the wheel (Fig. 170) and tighten the wheel nuts crosswise with 550 Nm (405 ft. lb.).
- Check the tire pressure, see technical data.

Changing the fresh air filter in the cabin

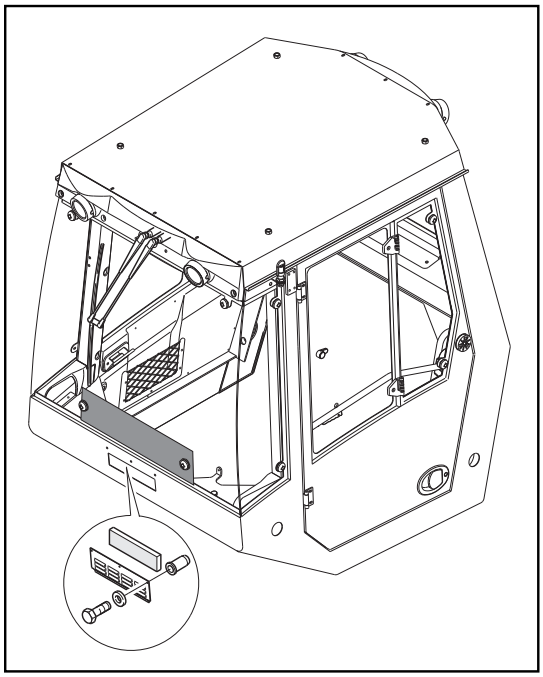

Fig. 171

- Unscrew fastening screws for the ventilation grid (Fig. 171) and remove the filter.
- Insert a new filter and reassemble the ventilation grid.

Tightening torques

BOLT DIMENSIONS	TIGHTENING TORQUE FT. LBS. / N•m		
	8.8	10.9	12.9
M4	2 ft. lbs./3 N•m	3 ft. lbs./5 N•m	4 ft. lbs./5 N•m
M5	4 ft. lbs./6 N•m	7 ft. lbs./10 N•m	7 ft. lbs./10 N•m
M6	7 ft. lbs./10 N•m	11 ft. lbs./15 N•m	13 ft. lbs./18 N•m
M8	18 ft. lbs./25 N•m	26 ft. lbs./35 N•m	33 ft. lbs./45 N•m
M10	37 ft. lbs./50 N•m	55 ft. lbs./75 N•m	61 ft. lbs./83 N•m
M12	65 ft. lbs./88 N•m	91 ft. lbs./123 N•m	108 ft. lbs./147 N•m
M14	101 ft. lbs./137 N•m	145 ft. lbs./196 N•m	173 ft. lbs./235 N•m
M16	156 ft. lbs./211 N•m	221 ft. lbs./300 N•m	264 ft. lbs./358 N•m
M18	213 ft. lbs./290 N•m	303 ft. lbs./412 N•m	361 ft. lbs./490 N•m
M20	304 ft. lbs./412 N•m	426 ft. lbs./578 N•m	513 ft. lbs./696 N•m
M22	413 ft. lbs./560 N•m	559 ft. lbs./785 N•m	695 ft. lbs./942 N•m
M24	524 ft. lbs./711 N•m	738 ft. lbs./1000 N•m	885 ft. lbs./1200 N•m
M27	774 ft. lbs./1050 N•m	1092 ft. lbs./1480 N•m	1308 ft. lbs./1774 N•m
M30	1047 ft. lbs./1420 N•m	1482 ft. lbs./2010 N•m	1770 ft. lbs./2400 N•m

Fig. 167

* Strength classes for screws with untreated, non-lubricated surface. Screw quality designations are stamped on the screw heads.

8.8 = 8G
10.9 = 10K
12.9 = 12K

- **Axle - frame**

M 24 = 710 Nm (649.0 ft.lbs.)

- **Wheel nuts**

M 22x1.5 = 550 Nm (405.7 ft.lbs.)

The values result in a 90% utilization of the screw yield point at a coefficient of friction μ total = 0,14. When using lubricant MOS_2 the specified tightening torques do not apply.

NOTE: **Self-locking nuts must always be replaced once they have been unscrewed.**

Engine conservation

If the engine is to be shut down for a longer period of time (e.g. over winter), we recommend to apply the following conserving measures to avoid corrosion:

- Clean the engine, including the cooling system: With cold cleansing agent and a water jet or, even better, with a steam cleaner.
- Run the engine warm and shut it down.
- Drain off the still hot engine oil and fill in anti-corrosion engine oil.
- Drain off the coolant and fill in system protection agent.
- Drain the fuel from the tank, mix it well with 10% anti-corrosion oil and fill it back in.
- Run the engine for 10 minutes until all lines, filters, pumps and nozzles with this conserving mixture and the new engine oil has been distributed to all parts.
- Now crank the engine several times (without ignition) to spray the combustion chambers.
- Take the V-belts off and spray the grooves of the V-belts with anti-corrosion oil. Remove the anti-corrosion oil before resuming operation.
- Close intake and exhaust openings tightly.

NOTE: **Depending on the weather conditions these con-serving measures will provide protection for approx. 6 to 12 months.**

Before taking the engine back into operation all conserving oil must be drained off and replaced by regular engine oil, see chapter "Fuels and Lubricants" according to the API-(MIL)-classification.

Anti-corrosion oils are those that comply with the specification MIL-L-21260 B or TL 9150-037/2 or Nato Code C 640/642.

A machine with a conserved engine must be marked by attaching a clearly visible warning tag.

NOTES

Section 6
TROUBLE SHOOTING

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Section 6
TROUBLE SHOOTING

General notes

The following work must only be carried out by qualified and trained personnel or by the sales service.

Please observe strictly the safety regulations in chapter 2 of these operating and maintenance instructions.

Faults occur frequently due to the fact, that the machine has not been properly operated or serviced. Therefore, whenever a fault occurs, read through these instructions on correct operation and maintenance. If you cannot locate the cause of the fault or eliminate it yourself by following the trouble shooting charts, you should contact our customer service departments at our branch office or dealers.

DANGER: **Danger of injury!**

Keep away from rotating parts of the engine.

Engine

Faults	Possible cause	Remedy
The engine does not start	Starter defective or pinion not engaging	Have examined by a specialist
	Fuel tank empty	Fill and bleed the tank
	Temperature below starting limit	Use winter fuel and engine oil acc. to the ambient temperature.
	Fuel filter clogged, in winter due to paraffin separation.	Change the filter. use winter fuel
	Fuel lines leaking	Check all line connections for leakages and tighten the fittings.
	Battery discharged or not conected	Tighten the pole clamps, check the cable connections.
	Injection valves or injection pump defective	Have examined by a specialist
The engine starts poorly and works irregularly with poor power	Battery power too low, battery clamps loose or oxidized, causing the starter to turn too slowly	Have the battery checked, clean the terminal clamps, tighten them and cover them with acid free grease
	Especially during winter: the use of too viscous engine oil	Use engine oil suitable for the ambient temperature
	Fuel supply restricted, in winter fuel system clogged due to paraffin separation	Change the fuel filter. Check the line connections for leaks and tighten the fittings. Use winter fuel in the cold season.
	Incorrect valve clearance	Adjust the valve clearance
	Injection valve defective	Have examined by a specialist
	Injection lines leaking	Check the lines for leakages
	Turbo charger defective	Have examined by a specialist
	Dry air filter dirty	clean, replace if necessary
	Excessive play in the throttle cable	Adjust the throttle cable, change it if necessary

Section 6
TROUBLE SHOOTING

Faults	Possible cause	Remedy
Excessive exhaust smoke	Engine oil level too high	Drain the oil to the upper dipstick mark
	Dry air filter dirty	Clean, replace if necessary
	Exhaust gas turbocharger defective	Have examined by a specialist
	Poor compression due to burned or broken compression rings or incorrect valve clearance	Have compression rings and pistons examined by a specialist, adjust the valve clearance
	Incorrect valve clearance	Adjust the valve clearance
Engine over-heats, shut down immediately!	Cooling fins on radiator extremely soiled (the warning light "engine oil temperature" lights)	Clean the cooling fins
	Injection valve defective	Have examined by a specialist
	Engine oil level too low	Top up engine oil to the upper dipstick mark
	Filling capacity of the injection pump not correctly adjusted	Have adjusted by a specialist
	Cooling air flow restricted	Clean the cooling air duct
	V-belt lose or broken	Tension or replace the V-belt
Poor engine power	Engine oil level too high	Drain the engine oil down to the upper dipstick mark
	Dry air filter dirty	Clean, change if necessary
	Exhaust gas turbo-charger defective	Have examined by a specialist
	Charge air hose leaking	Check fastening and connections
	Incorrect valve clearance	Adjust the valve clearance
	Injection valve defective	Have examined by a specialist
Engine oil pressure too low	Engine oil level too low (control light "engine oil pressure" lights, the warning buzzer sounds)	Top up oil
	Leakages in the lubrication system	Shut the engine down immediately, check fittings on oil lines, lubrication oil filter and oil cooler for leaks, if necessary tighten the fittings.
The charge control light lights during operation, the warning buzzer sounds	Generator speed too low	Check the V-belt tension, replace the V-belt if necessary
	The generator does not charge the battery, because generator or regulator is defective	Have examined by a specialist

Optional Pad foot/Smooth Shell Kit Maintenance

CAUTION: **Units equipped with the optional Pad foot or Smooth shell kit requires maintenance. Failure to perform required maintenance will result in a shorten equipment life cycle and the voiding of the warranty.**

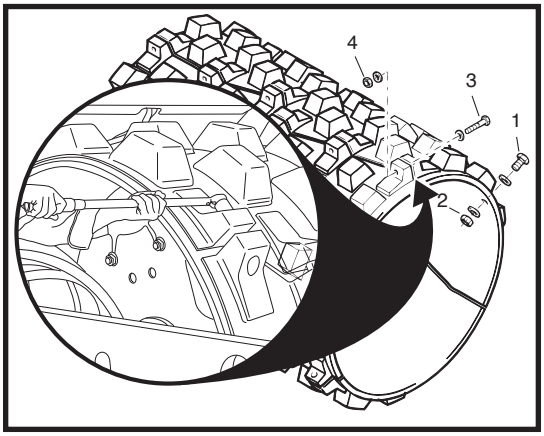
Units covered under this maintenance information are:

Pad foot shell kit:
BOMAG: BW145D/DH, BW177D/DH, BW211D, BW213D/DH
HYPAC: C820, C830 and C850 series of single drum rollers.

Smooth shell Kit:
BOMAG: BW145PDH, BW177PDH, BW211PD, BW213PDH
HYPAC: C822, C832, C842, C852

CAUTION: **Maintenance must be performed every 50 hours or weekly which ever comes first. Failure to comply with the required maintenance with result in the voiding of the warranty.**

Pad foot shell kit

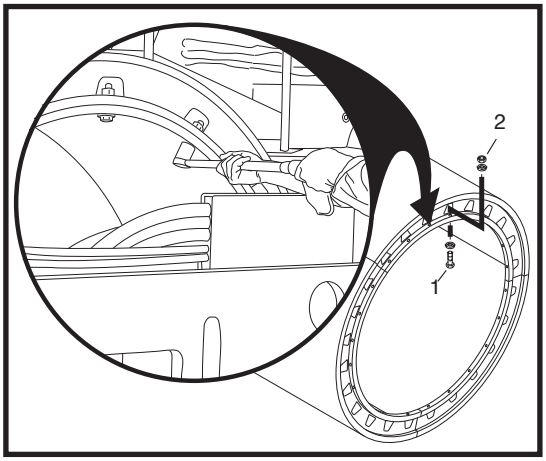


Pad foot Hardware Torque specifications:

Items 1 and 2. Grade 10.9 bolt/nut combination 221 ft. lb. (300 Nm). 2 Bolts.

Items 3 and 4. Grade 8.8 bolt/nut combina-tion 156 ft. lb. (212 Nm). 18 Bolts.

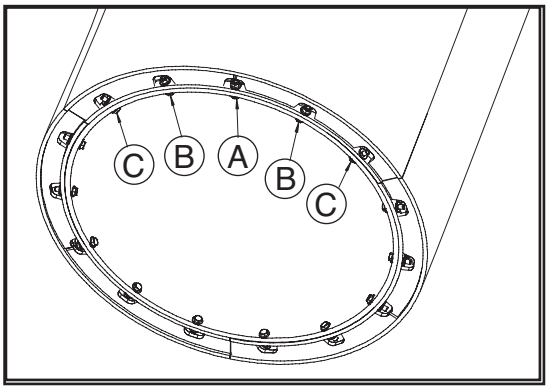
Smooth shell kit



Smooth Hardware Torque specifications: Items 1 and 2.

BW145PDH, BW177PDH, C822 C232:
Grade 10.9 bolt/nut combination 236 ft. lb. (320 Nm). 30 Bolts.

BW211PD, BW213PDH, C842, C852:
Grade 10.9 bolt/nut combination 427 ft. lb. (580 Nm). 30 Bolts.



Smooth shell kit torque sequence.
First torque the bolt at the A postion, then the 2 bolts at the B postion and then the 2 bolts at the C postion on both sides of the drum. Repeat the process for the remaining sections. Recheck the torque values.

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