BOMAG
FAYAT GROUP

Operating Instruction
Maintenance Instruction

Original Operating Instructions

BW 100 AD-5 / BW 120 AD-5

S/N 101 880 31 1001> / S/N 101 880 32 1001>

Tandem Vibratory Roller

008 200 87 EN

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1 Foreword

BOMAG manufactures machine for earth, asphalt and refuse compaction, stabilizers/ recyclers as well as milling machine and finishers.

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.

For your machine BOMAG offers service kits to make maintenance easier.

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 available 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.

BOMAG GmbH

1.1 Machine type plate and engine type plate

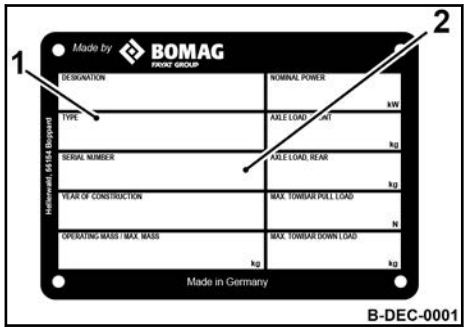


Fig. 1: Machine type plate (example)

Please enter here:	
Machine type (1):	
Serial number (2):	

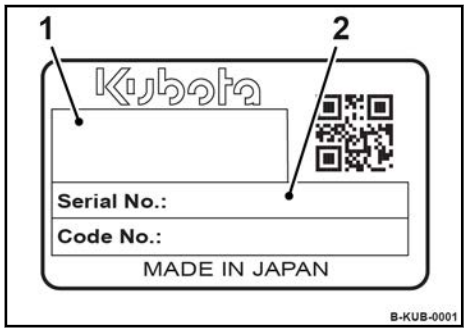


Fig. 2: Engine type plate (example)

Please enter here:	
Engine type (Fig. 1)	
Engine number (2):	

2 Technical data

2.1 Technical data BW 100 AD-5

Dimensions

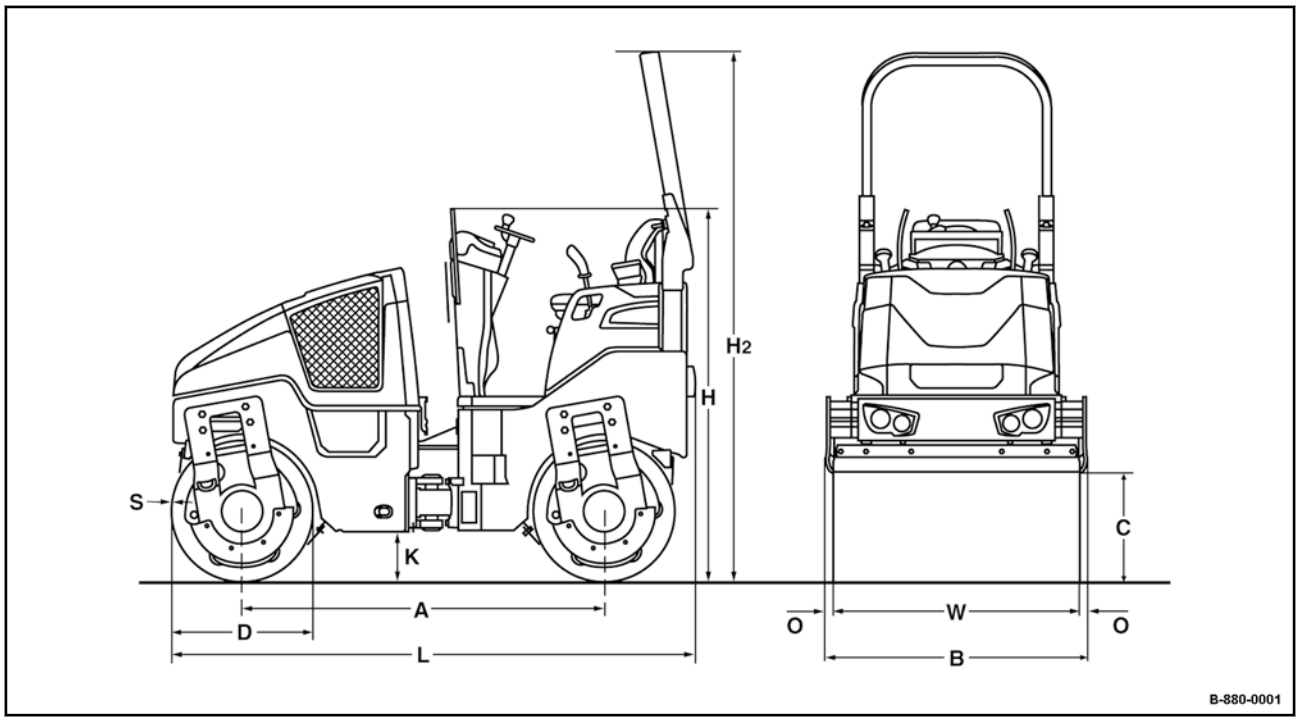


Fig. 3

A	B	C	D	H	H_2	K	L	O	S	W
1752 (69)	1072 (42)	523 (21)	700 (28)	1808 (71)	2568 (101)	254 (10)	2529 (100)	36 (1.4)	13 (0.5)	1000 (39)
Dimensions in millimetre (Dimensions in inch)										

Weights		
Max. operating weight	3300 (7275)	kg (lbs)
Operating weight with ROPS (CECE)	2500 (5512)	kg (lbs)

Weights		
Mean axle load (CECE)	1250 (2756)	kg (lbs)
Mean static linear load (CECE)	12.5 (70)	kg/cm (pli)

Travel characteristics		
Travel speed	0 - 10 (0 - 6.2)	km/h (mph)
Working speed with vibration	0 - 10 (0 - 6.2)	km/h (mph)
Max. gradability without/with vibration (soil dependent)	40/30	%

Drive		
Engine manufacturer	Kubota	
Type	D 1703-M-E3B	
Cooling	Water	
Number of cylinders	3	
Rated power ISO 14396	24.3	kW
Rated power SAE J 1995	32.6	hp
Rated speed	2600	min^{-1}
Fixed engine speed (1)	2500	min^{-1}
Fixed engine speed (2)	2600	min^{-1}
Driven drum	front + rear	

Electric system		
Voltage	12	V

Brakes		
Service brake	hydrostatic	
Parking brake	hydro-mechanical	

Steering		
Type of steering	Oscill.-articul.	
Steering operation	hydrostatic	
Steering angle	+/- 32	°
Oscillation angle	+/- 10	°
Inner track radius	2550 (100.4)	mm (in)
Crabwalk, lateral offsetting of drum right/left	50 (2.0)	mm (in)

Exciter system		
Vibrating drum	front + rear	
Frequency (1/2)	63/67 (3780/4020)	Hz (vpm)
Amplitude	0.46 (0,018)	mm (in)
Centrifugal force (1/2)	30/34 (6744/7644)	kN (lbf)

Water sprinkler system		
Type of sprinkling	Pressure	

Filling capacities		
Fuel (diesel)	35 (9)	l (gal us)
Water	205 (54)	l (gal us)

2.1.1 Noise and vibration data

The following noise and vibration data were determined in accordance with the following guidelines under equipment specific conditions and by using harmonized standards:

- EC Machine Directive edition 2006/42/EC
- Noise Emission Directive 2000/14/EC, Noise Protection Directive 2003/10/EC
- Vibration Protection Directive 2002/44/EC

During operation these values may vary because of the prevailing operating conditions.

2.1.1.1 Noise data

Sound pressure level on the operator's stand

L_{pA} = 84 dB(A), determined acc. to ISO 11204 and EN 500

WARNING!

Loos of hearing caused by too high noise burdens!

– Wear your personal protective outfit (ear defenders).

Guaranteed sound power level

L_{WA} = 103 dB(A), determined acc. to ISO 3744 and EN 500

2.1.1.2 Vibration data

Vibration of the entire body (driver's seat)	The weighted effective acceleration value determined according to ISO 7096 is ≤ 0.5 m/s^2.
Hand-arm vibration	The weighted effective acceleration value determined according to EN 500/ISO 5349 is ≤ 2.5 m/s^2.

2.2 Technical data BW 120 AD-5

Dimensions

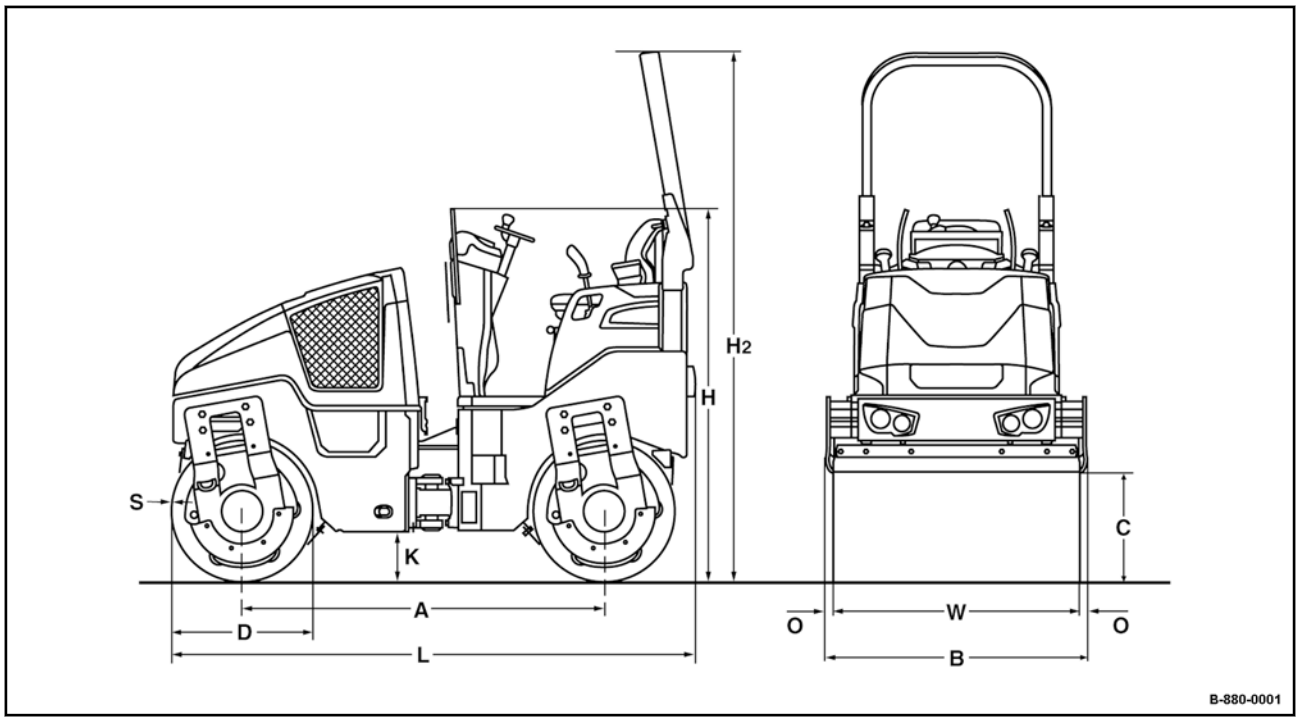


Fig. 4

A	B	C	D	H	H_2	K	L	O	S	W
1752 (69)	1272 (50)	523 (21)	700 (28)	1808 (71)	2568 (101)	254 (10)	2529 (100)	36 (1.4)	13 (0.5)	1200 (47)
Dimensions in millimetre (Dimensions in inch)										

Weights		
Max. operating weight	3500 (7716)	kg (lbs)
Operating weight with ROPS (CECE)	2700 (5953)	kg (lbs)

Weights		
Mean axle load (CECE)	1350 (2976)	kg (lbs)
Mean static linear load (CECE)	11.3 (63)	kg/cm (pli)

Travel characteristics		
Travel speed	0 - 10 (0 - 6.2)	km/h (mph)
Working speed with vibration	0 - 10 (0 - 6.2)	km/h (mph)
Max. gradability without/with vibration (soil dependent)	40/30	%

Drive		
Engine manufacturer	Kubota	
Type	D 1703-M-E3B	
Cooling	Water	
Number of cylinders	3	
Rated power ISO 14396	24.3	kW
Rated power SAE J 1995	32.6	hp
Rated speed	2600	min^{-1}
Fixed engine speed (1)	2500	min^{-1}
Fixed engine speed (2)	2600	min^{-1}
Driven drum	front + rear	

Electric system		
Voltage	12	V

Brakes		
Service brake	hydrostatic	
Parking brake	hydro-mechanical	

Steering		
Type of steering	Oscill.-articul.	
Steering operation	hydrostatic	
Steering angle	+/- 32	°
Oscillation angle	+/- 10	°
Inner track radius	2450 (96.5)	mm (in)
Crabwalk, lateral offsetting of drum right/left	50 (2.0)	mm (in)

Exciter system		
Vibrating drum	front + rear	
Frequency (1/2)	63/67 (3780/4020)	Hz (vpm)
Amplitude	0.49 (0,019)	mm (in)
Centrifugal force (1/2)	36/41 (8093/9217)	kN (lbf)

Water sprinkler system		
Type of sprinkling	Pressure	

Filling capacities		
Fuel (diesel)	35 (9)	l (gal us)
Water	205 (54)	l (gal us)

2.2.1 Noise and vibration data

The following noise and vibration data were determined in accordance with the following guidelines under equipment specific conditions and by using harmonized standards:

- EC Machine Directive edition 2006/42/EC
- Noise Emission Directive 2000/14/EC, Noise Protection Directive 2003/10/EC
- Vibration Protection Directive 2002/44/EC

During operation these values may vary because of the prevailing operating conditions.

2.2.1.1 Noise data

Sound pressure level on the operator's stand

L_{pA} = 83 dB(A), determined acc. to ISO 11204 and EN 500

WARNING!

Loos of hearing caused by too high noise burdens!

– Wear your personal protective outfit (ear defenders).

Guaranteed sound power level

L_{WA} = 105 dB(A), determined acc. to ISO 3744 and EN 500

2.2.1.2 Vibration data

Vibration of the entire body (driver's seat)	The weighted effective acceleration value determined according to ISO 7096 is ≤ 0.5 m/s^2.
Hand-arm vibration	The weighted effective acceleration value determined according to EN 500/ISO 5349 is ≤ 2.5 m/s^2.

3 Safety regulations

General

This BOMAG machine has been built in compliance with the latest technical standard and complies with the applicable regulations and technical rules. However, dangers for persons and property may arise from this machine, if:

- it is used for purposes other than the ones it is intended for,
- it is operated by untrained personnel,
- it is changed or converted in an unprofessional way,
- the safety instructions are not observed.

Each person involved in the operation, maintenance and repair of the machine must therefore read and comply with these safety regulations. If necessary, this must be confirmed by obtaining the signature of the customer.

Furthermore, the following obviously also applies:

- applicable accident prevention instructions,
- generally accepted safety and road traffic regulations,
- country specific safety regulations. It is the duty of the operator to be acquainted with these instructions and to apply these accordingly. This applies also for local regulations concerning different types of handling work. Should the recommendations in these instructions be different from the regulations valid in your country, you must comply with the safety regulations valid in your country.

Intended use

This machine must only be used for:

- Compaction of bituminous material, e.g. road surface layers,
- light to medium compaction work in earth construction or road sub-bases.

Unintended use

Dangers may arise from the machine when it is used for purposes other than the one it is intended for.

Any danger caused by intended use is the sole responsibility of the customer or driver/operator, the manufacturer cannot be made liable.

Examples for unintended use are:

- work with vibration on hard concrete, cured bitumen layers or extremely frozen ground
- cleaning the drums while driving or changing nozzles during travel.
- driving on subsoils with too low load bearing capacity
- driving on slippery subsoils (e.g. ice and snow)
- driving on surfaces of insufficient size (danger of turning over)
- Passing over high borders (e.g. curbstones, embankments, trenches, potholes)
- unauthorized use of public roads
- Using the machine for towing

Transporting persons, except the machine driver, is prohibited.

Starting and operation of the machine in explosive environments and in underground mining is prohibited.

Remaining dangers, remaining risks

Despite careful work and compliance with standards and regulations it cannot be ruled out that further dangers may arise when working with and handling the machine.

Both the machine as well as all other system components comply with the currently valid safety regulations. Nevertheless, remaining risks cannot be ruled out completely, even when using the machine for the purpose it is intended for and following all information given in the operating instructions.

A remaining risk can also not be excluded beyond the actual danger zone of the machine. Persons remaining in this area must pay particular attention to the machine, so that they can react immediately in case of a possible malfunction, an incident or failure etc.

All persons remaining ion the area of the machine must be informed about the dangers that arise from the operation of the machine.

Regular safety inspections

Have the machine inspected by an expert (capable person) as required for the conditiosn the machine is working under, but at least once every year.

Who is allowed to operate the machine?

Only trained, instructed and authorized persons of at least 18 years of age are permitted to drive and operate this machine. For operation of the machine the responsibilities must be clearly specified and complied with.

Persons under the influence of alcohol, medicine or drugs are not allowed to operate, service or repair the machine.

Maintenance and repair work requires specific knowledge and must therefore only be performed by trained specialists.

Changes and conversions to the machine

Unauthorized changes to the machine are prohibited for safety reasons.

Original parts and accessories have been specially designed for this machine.

We wish to make explicitly clear that we have not tested or approved any parts or accessories not supplied by us.

The installation and/or use of such products may have an adverse effect on the active and/or passive safety.

The manufacturer explicitly excludes any liability for damage caused by the use of non-original parts or accessories.

Damage, deficiencies, misuse of safety installations

Machines which are not safe to operate or in traffic must be immediately taken out of service and shall not be used, until these deficiencies have been properly rectified.

Safety installations and switches must neither be removed nor must they be made ineffective.

Notes on safety in the operating and maintenance instructions

WARNING!

Paragraphs marked like this highlight possible dangers for persons.

NOTICE!

Paragraphs marked like this highlight possible dangers for machines or parts of the machine.

Paragraphs marked like this contain technical information for the optimal economical use of the machine.

ENVIRONMENT!

Paragraphs marked like this point out practices for safe and environmental disposal of fuels and lubricants as well as replacement parts.

Observe the regulations for the protection of the environment.

Loading / transporting the machine

Loading with loading ramp

Use only stable loading ramps of sufficient load bearing capacity. The ramp inclination must be less than the gradability of the machine.

The ramp must be free of grease, oil, snow and ice.

Make sure that persons are not endangered by the machine tipping or sliding off.

During demonstration and when loading the machine do not remain in the danger zone of the machine.

Secure the machine with the articulation lock after driving it on the transport vehicle.

Loading by crane

Lifting tackle must only be attached to loads by expert personnel (qualified person).

Engage the articulation lock.

Always use suitable lifting tackle on the lifting points to lift the machine.

Check all lifting points and fastening elements for damage before lifting the machine. Do not use damaged or in any other way impaired lifting points.

Lift the machine only with suitable lifting gear. Use only safe lifting gear of sufficient load bearing capacity Minimum lifting capacity of lifting gear: see operating weight in chapter "Technical Data".

Do not lift or lower the machine jerkily.

The tension must always be effective in vertical direction.

The machine must not swing about when being lifted.

Do not step or stand under suspended loads.

Lashing

Always use suitable lashing gear on the lifting points to lash down the machine.

Check all lashing points for damage before lashing down the machine. Do not use a damaged or in any other way impaired lashing points.

Always apply the articulation lock for transportation.

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

After transport

Operate the machine only with the foldable ROPS properly fastened and the fastening screws tightened with the correct tightening torque.[Optional equipment]

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

Towing the machine

Apply appropriate measures (e.g. with metal wheel chocks, to be provided by the operating company) to secure the machine against rolling away.

Generally use a tow bar (to be provided by the operating company).

Use a towing vehicle with sufficient traction and braking power for the unbraked towed load.

The machine cannot be steered.

Do not touch hot engine parts.

Only tow the machine with the parking brake released and the travel pump short-circuited.

Towing speed 1 km/h, max. towing distance: only out of the immediate danger zone as the travel pump may be destroyed due to inadmissible heat and insufficient lubrication.

After towing the machine and before disconnecting the tow bar apply appropriate measures to secure the machine against rolling (e.g. with metal wheel chocks).

The hydraulic circuit needs to be filled and bled before the machine can be put back into operation (e.g. following repair).

Checking the Roll Over Protective Structure (ROPS)

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

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

The real machine weight must never exceed the testing weight for the ROPS.

The ROPS must not rattle about when driving. This indicates that it is not properly fastened. All bolted connections must comply with the specifications and should be absolutely tight (observe the tightening torques). Screw and nuts must not be damaged, bent or deformed.

No accessories may be welded or bolted on and no additional holes must be drilled without the consent of the manufacturer, since this will impair the strength of the unit.

The ROPS must therefore also not be straightened or repaired if it is damaged.

A defect ROPS must generally be replaced with an original spare part in close coordination with the manufacturer.

Starting the machine

Before starting

Use only machines which are serviced at regular intervals.

Become acquainted with the equipment, the control elements, the working principle of the machine and the working area.

Wear your personal protective outfit (hard hat, safety boots, etc.). Wear ear defenders.

Before mounting the machine check whether:

- persons or obstructions are beside or under the machine.
- the machine is free of oily and combustible material.
- all grips, steps and platforms are free of grease, oils, fuel, dirt, snow and ice.
- the engine hood is closed and locked.

Use steps and grips to mount the machine.

Before starting the machine check whether:

- the machine shows any obvious faults.
- all guards and safety elements are in place.
- steering, brakes, control elements, light system and warning horn work correctly.
- the seat is correctly adjusted
- mirrors (if present) are clean and correctly adjusted.

Do not start the machine with defective gauges, control lights or control elements.

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

On machines with roll over protection system you must always wear your seat belt!

Starting

Start and operate the machine only from the driver’s seat.

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

Do not use any starting aids like start pilot or ether.

After starting check all display instruments.

Starting with jump wires

Connect plus to plus and minus to minus (ground cable) – always connect the ground strap last and disconnect it first! A wrong connection will cause severe damage in the electric system.

Do not start the engine by shorting the electric terminals on the starter motor, because the machine may start to drive immediately.

Starting and operation of the machine is closed rooms and trenches

Exhaust gases are extremely dangerous! Always ensure an adequate supply of fresh air when starting and operating in closed rooms and trenches!

Driving the machine

Persons in the danger area

Before taking up work, also after breaks, you should always convince yourself that the danger zone is free of persons or obstructions, especially when driving in reverse.

Give warning signals, if necessary. Stop work immediately if persons remain in the danger zone, despite the warning.

Do not step or stand in the articulation area of the machine when the engine is running.

Driving

Always wear the seat belt when driving.

Do not drive on bases with insufficient load bearing capacity.

Do not drive on ice and snow.

In events of emergency and in case of danger actuate the emergency stop switch immediately. Do not use the emergency stop switch as service brake.

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

If the machine has contacted high-voltage power lines:

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

Operate the machine only from the driver's seat.

Do not adjust the driver’s seat while driving.

Do not climb onto or off the machine while the machine is driving.

Change the travel direction only at standstill.

Do not use the machine to transport persons.

In case of unusual noises and development of smoke perform trouble shooting and have the fault corrected.

Always keep a sufficient distance to excavation walls and embankments and do not use working methods that could impair the stability of the machine.

Always keep a sufficient distance when passing through subways, under bridges, tunnels, electric power lines etc.

Driving on inclinations and slopes

Do not drive on gradients exceeding the maximum gradability of the machine.

On slopes drive extremely careful and always directly up or down the slope. Change to a lower gear before starting to drive.

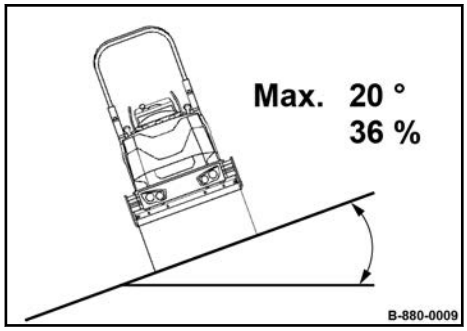


Fig. 5

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

Inclination

The tipping angle was measured in static condition on level, hard ground with the machine stopped, no steering and without vibration.

The max. permissible inclination of the machine may be limited by the max. permissible slanted position of the engine.

The specified angle must not be exceeded.

With loose soil, acceleration/deceleration, running vibration, steering or attached accessories the tipping angle may be considerably lower.

Driving across slopes should therefore be strictly avoided, because of the high risk of tipping over and the related risk of severe or even fatal accidents.

You should therefore always drive straight up or down a slope.

For rollers with a drum width of 1 m (3.3 ft) or less there is a considerable risk of tipping over near edges (e.g. curbstones, embankments, trenches, potholes) when driving over these edges.

Behaviour in traffic

Match the speed to the working conditions. Do not make extreme steering movements when driving with high speed, danger of tipping over!

Always give way to loaded transport vehicles.

Switch the lights on if the visibility is poor.

Keep away from edges and embankments.

Checking the effect of vibration

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

Do not work with vibration on hard concrete, cured bitumen layers or extremely frozen ground. Danger of bearing damage!

Parking the machine

Park the machine on horizontal, level, firm ground.

Before leaving the machine:

- Shift the travel lever to neutral position and lock it in parking brake position. The parking brake is applied.
- Shut down the engine, pull off the ignition key

Mark machines, which could be in the way, with a clearly visible sign.

Parking on slopes and inclinations

Apply appropriate measures (e.g. with metal wheel chocks, to be provided by the operating company) tp secure the machine against rolling away.

Refuelling

Do not inhale any fuel fumes.

Refuel only with the engine shut down.

Always use access steps.

Do not refuel in closed rooms.

No open fire, do not smoke.

Static charges may be generated in the fuel as it passes through the filling system. A discharge of such charges in the presence of combustible vapours may cause fire or an explosion.

Ultra-low sulphur diesel fuel poses a higher risk of ignition caused by static charges than a diesel fuel with a higher sulphur content.

You should therefore always make sure that the filling system is properly earthed and that there is equipotential bonding to the machine. If necessary install a connecting cable between filling system and vehicle ground.

Monitor the entire refuelling process.

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

Wipe off spilled fuel. Keep dirt and water away from the fuel.

A leaking fuel tank can cause an explosion. Ensure tight fit of the fuel tank cover, if necessary replace immediately.

Fire protection measures

Familiarise yourself with the location and the operation of fire fighting equipment. Observe all fire reporting and fire fighting possibilities.

Maintenance work

Comply with the maintenance work described in the operating and maintenance instructions, including the information concerning the replacement of parts.

Maintenance work must only be performed by qualified and authorized persons.

Do not touch hot engine parts.

For overhead maintenance and assembly work use the access steps and working platforms provided or other secure means. Do not use machine parts as access steps.

Keep unauthorized persons away from the machine.

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

Park the machine on horizontal, level, firm ground.

Remove the key from the ignition switch.

Secure the articulated joint with the articulation lock.

Work on hydraulic lines

Relieve hydraulic pressures before working on hydraulic lines. Hydraulic oil escaping under pressure can penetrate the skin and cause severe injury. When being injured by hydraulic oil consult a medical doctor immediately, as otherwise this may cause severe infections.

Do not step in front of or behind the drums/ wheels when performing adjustment work in the hydraulic system.

Do not change the setting of pressure relief valves.

Drain the hydraulic oil at operating temperature – danger of scalding!

Any hydraulic oil must be caught and disposed of in an environmentally friendly manner.

Always catch and dispose of hydraulic oils separately.

Do not start the engine after draining the hydraulic oil.

Once all work is completed (with the system still depressurized!) check all connections and fittings for leaks.

Changing hydraulic hoses

Hydraulic hoses must be visually inspected at regular intervals.

Hydraulic hoses must be immediately replaced if:

- the outer layer is damaged down to the inlay (e.g. chafing, cuts, cracks).
- the outer layer is brittle (formation of cracks in the hose material).
- the hose shows deformations in pressurized and depressurized condition, which do not comply with the genuine shape of the hydraulic hose.
- the hose shows deformations in bends, e.g. squeezing, buckling, layer separation, formation of blisters,
- parts of the hose are leaking.
- hoses are not correctly installed
- the hydraulic hose has separated from the fitting
- the fitting shows corrosion that impairs both function and strength.
- fittings are damaged or deformed, whereby the function and strength of the hose - hose connection is impaired.

hoses are mixed up by mistake.

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

Working on the engine

Shut down the engine before opening the engine 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 oil contaminated materials in a separate, specially marked container and dispose of environmentally.

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

Check and change coolant only when the engine is cold.

Catch coolant and dispose of environmentally.

Working on electric parts of the machine

Before starting to work on electric parts of the machine disconnect the battery and cover it with insulating material.

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

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 hands or clothes! When injured by acid flush off with clear water and seek medical advice.

Metal objects (e.g. tools, rings, watch straps) must not come in contact with the battery poles – danger of short circuit and burning!

When recharging non-serviceable batteries remove all plugs, to avoid the accumulation of explosive gases.

Observe the applicable instructions when starting with an auxiliary battery.

Switch off the charging current before removing the charging clamps.

Ensure sufficient ventilation, especially if the battery is to be charged in a closed room.

Dispose of old batteries according to regulations.

Working on the fuel system

Do not inhale any fuel fumes.

Avoid open fire, do not smoke, do not spill any fuel.

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

Cleaning work

Do not perform cleaning work while the motor is running.

Do not use gasoline or other easily inflammable substances for cleaning.

When cleaning with steam cleaning equipment do not subject electrical parts and insulation material to the direct jet of water, or cover it beforehand.

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

After maintenance work

After all maintenance work is completed reinstall all guards and safety installations.

Repair

Mark a defective machine by attaching a warning tag to the steering wheel.

Repair work must only be performed by qualified and authorized persons. Use our repair instructions for this work.

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

Disconnect the battery before starting welding work on the machine.

Information and safety stickers/decals on the machine

Keep stickers/decals in good and legible condition (see spare parts catalogue) and comply with their meaning.

Replace damaged and illegible stickers/decals.

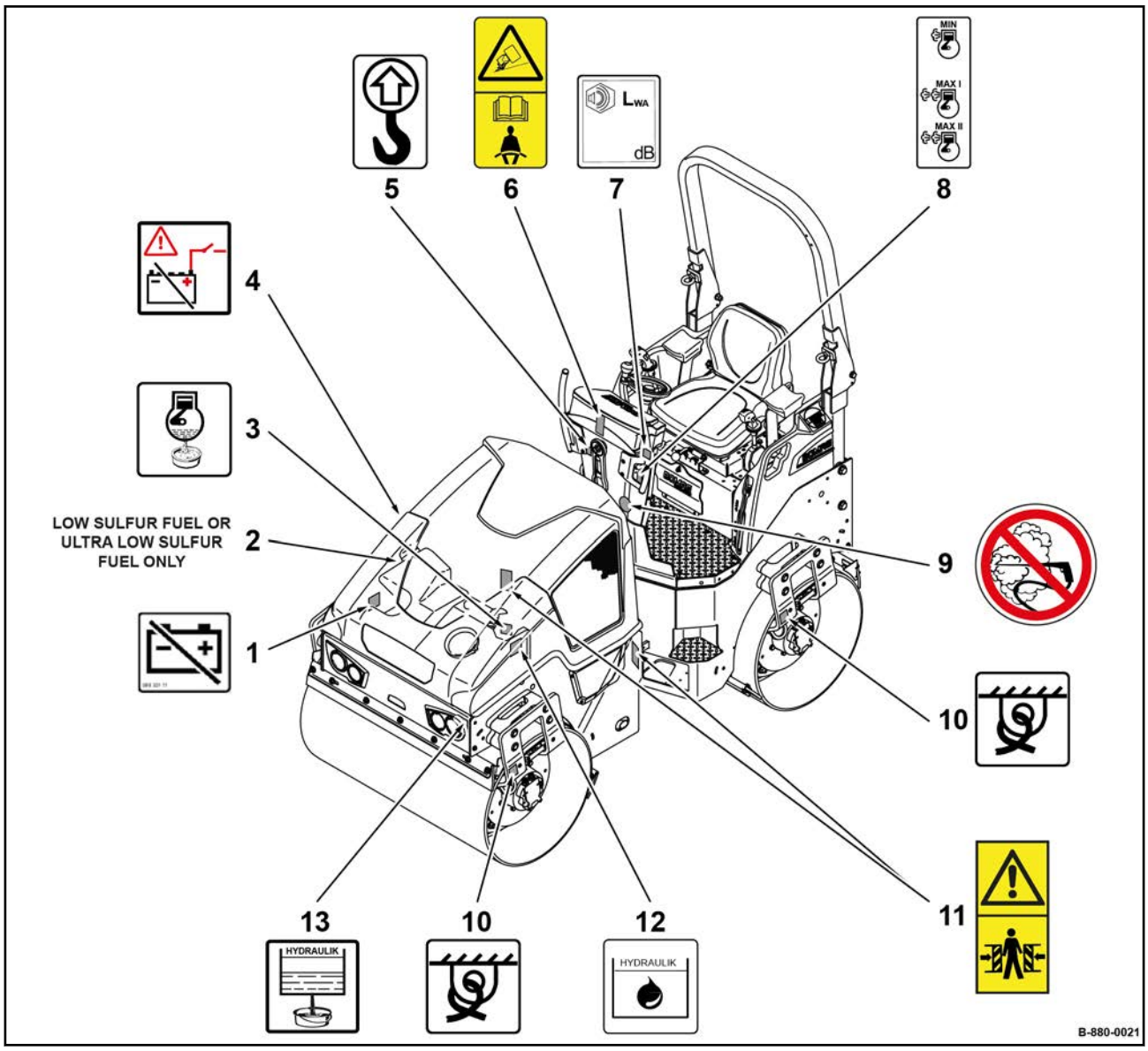


Fig. 6: Stickers and decals BW 100 AD-5 / BW 120 AD-5

1 Information sticker - Battery
2 Information sticker - Low sulphur fuel
3 Information sticker - Engine oil drain
4 Information sticker - Main battery switch plus side *(optional equipment)*
5 Information sticker - Lifting point
6 Warning sticker - Danger of tipping over *(only BW 100 AD-5)*
7 Information sticker - Guaranteed sound capacity level
8 Operation sticker - Throttle lever
9 Prohibition sticker - High pressure cleaner
10 Information sticker - Lashing point
11 Warning sticker - Danger of crushing

12 Information sticker - Hydraulic oil
13 Information sticker - Hydraulic oil drain

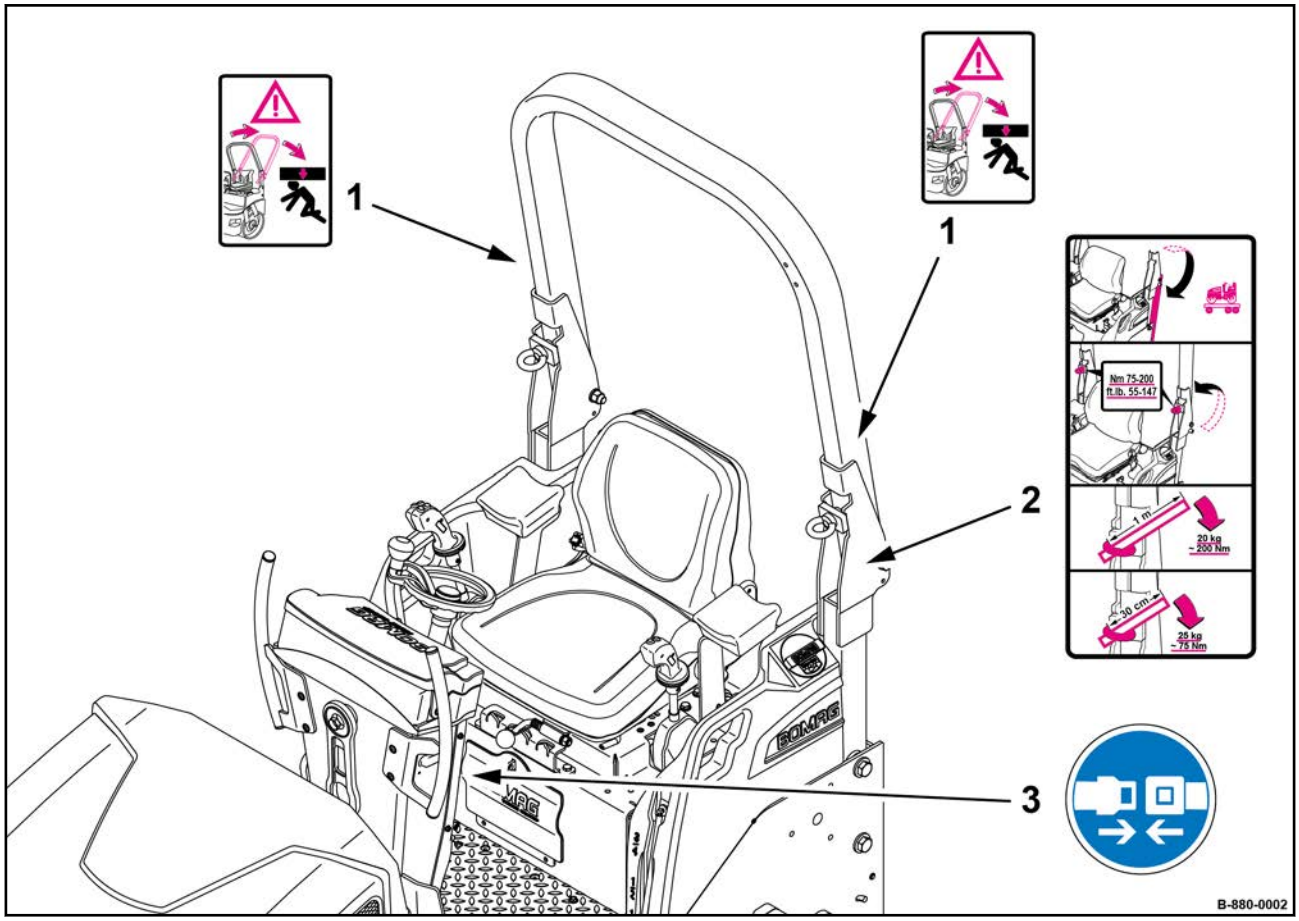


Fig. 7: Stickers on the foldable ROPS

1 Warning sticker - Foldable ROPS
2 Operation sticker - Foldable ROPS
3 Instruction sticker - Always wear your seat belt

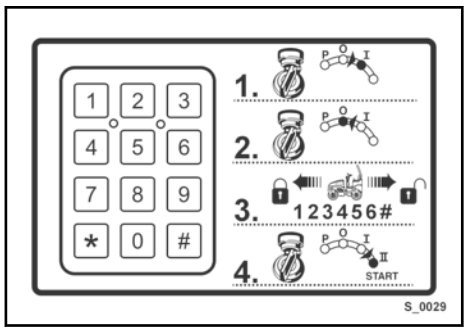


Fig. 8

Information sticker - Electronic immobilizer Optional equipment

4 Display and control elements

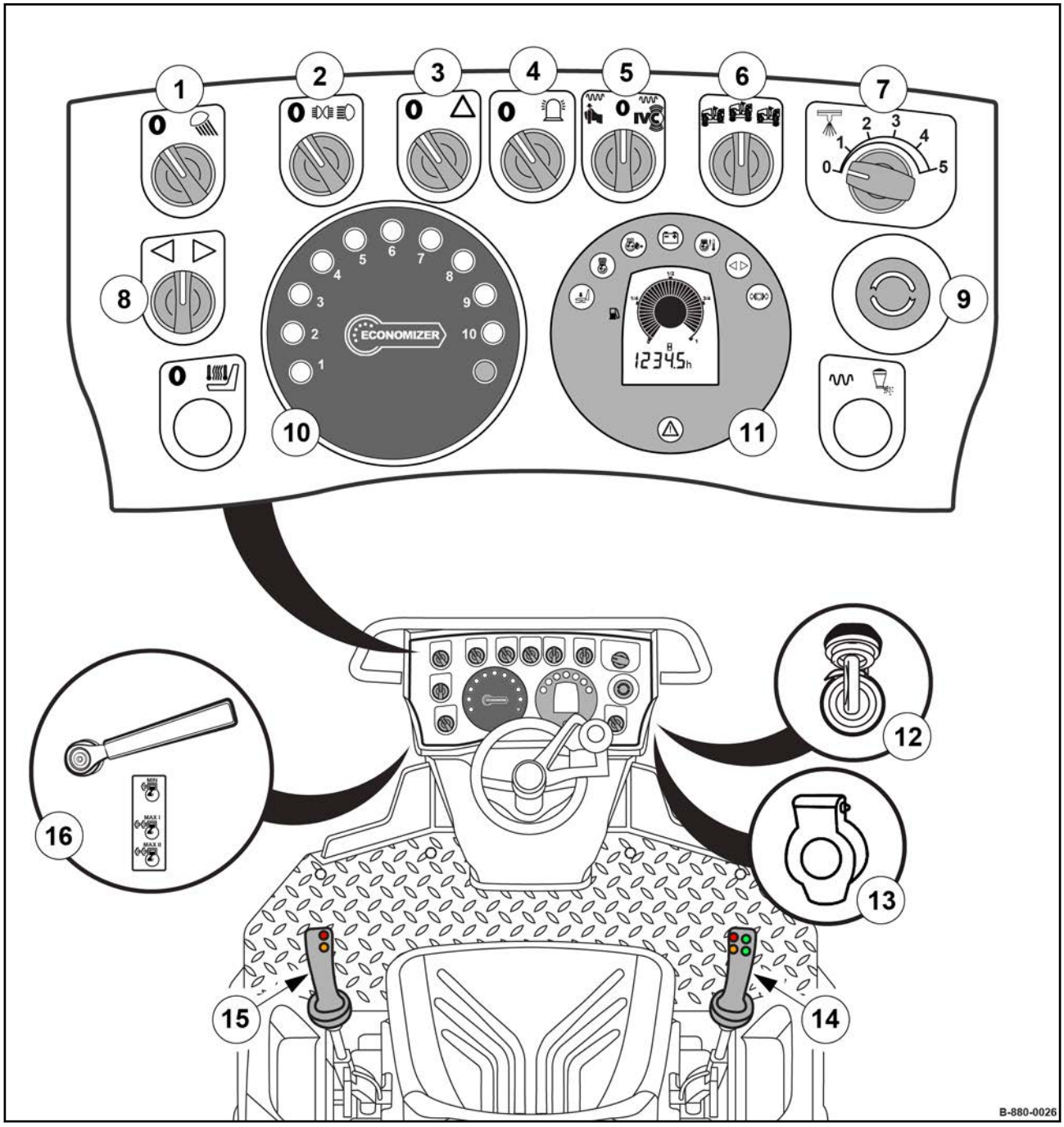


Fig. 9

1 Rotary switch for working lights
2 Rotary switch for lighting *(optional equipment)*
3 Rotary switch for hazard light system *(optional equipment)*
4 Rotary switch for flashing beacon *(optional equipment)*
5 Rotary switch for vibration pre-selection
6 Rotary switch for vibration, drum pre-selection
7 Interval switch for pressure sprinkling system

8 Rotary switch for direction indicators *(optional equipment)*
9 Emergency stop push button
10 Economizer display *(optional equipment)*
11 Instrument cluster
12 Start switch
13 12V socket
14 Travel lever
15 Double travel lever *(optional equipment)*
16 Throttle lever

4.1 General notes

If you are not yet familiar with the control and display elements on this machine you should read this section thoroughly before starting any operation on the machine. Here all functions are described in detail.

The section "Operation" contains only brief descriptions of the individual control steps.

4.2 Description of indicators and control elements

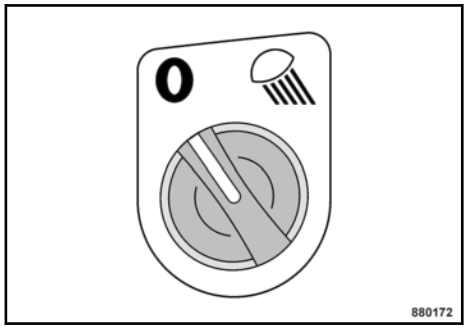


Fig. 10

- Rotary switch for working lights

Position "Left"	Working lights off
Position "Right"	Working light on (with starter switch in position "I")

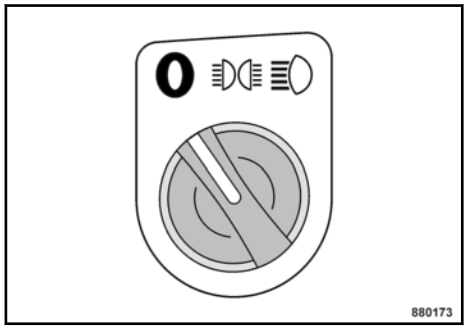


Fig. 11

- Rotary switch for lighting[Optional equipment]

Position "Left"	Light off
Position "middle"	Side light on (with starter switch in position "I")
Position "Right"	Travel light on (with starter switch in position "I")

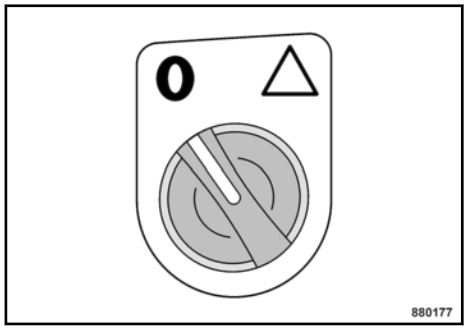


Fig. 12

- Rotary switch for hazard light system[Optional equipment]

Position "Left"	Hazard light system off
Position "Right"	Hazard light system on All direction indicators, warning lights in switch and indicator control light in the instrument cluster start flashing.

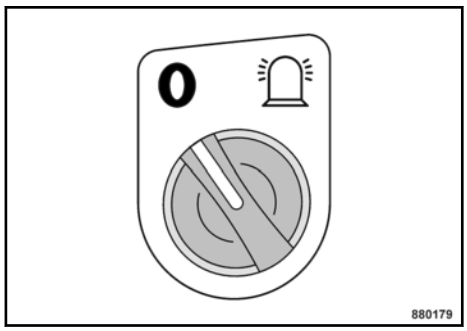


Fig. 13

- Rotary switch for flashing beacon[Optional equipment]

Position "Left"	Flashing beacon off
Position "Right"	Flashing beacon on

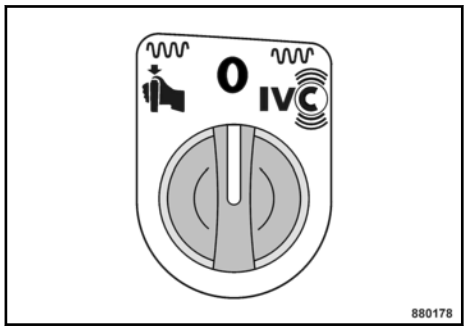


Fig. 14

- Rotary switch for vibration pre-selection

Position "Left"	Pre-selection vibration in manual mode Vibration is switched on or off via the vibration push button in the travel lever.
Position "Middle"	Vibration off
Position "Right"	Pre-selection vibration in automatic mode Vibration is automatically switched on or off when a certain travel speed is exceeded or fallen short of. The vibration push button in the travel lever is not active.

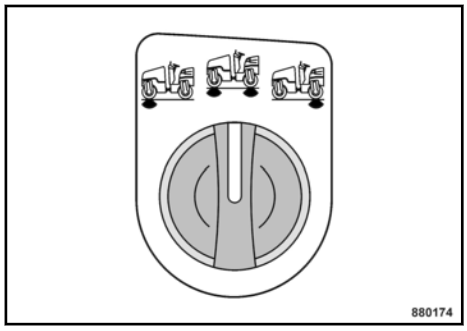


Fig. 15

- Rotary switch for vibration, drum pre-selection

Vibration change-over is only activated if the vibration is switched off beforehand.

Position "Left"	Vibration of front drum
Position "Middle"	Vibration of front and rear drums
Position "Right"	Vibration of rear drum

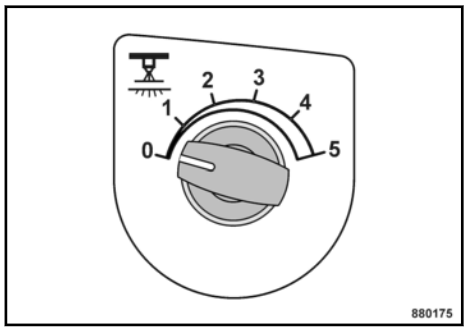


Fig. 16

- Interval switch for pressure sprinkling system

Position "0"	Sprinkling off
Position "1" to "4"	various sprinkling intervals
Position "5"	Permanent sprinkling

With the travel lever in neutral position and interval switch in position "5" (permanent sprinkling) the sprinkling system is already active.

With interval sprinkling the machine needs to drive forward or backward.

With the travel lever in neutral position sprinkling will continue for another 15 seconds.

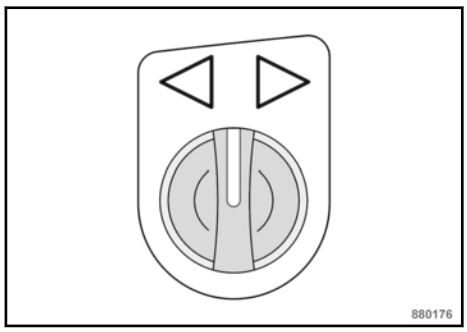


Fig. 17

- Rotary switch for direction indicators[Optional equipment]

Position "Left"	Front and rear left direction indicators are flashing
Position "Middle"	Direction indicators off
Position "Right"	Front and rear right direction indicators are flashing

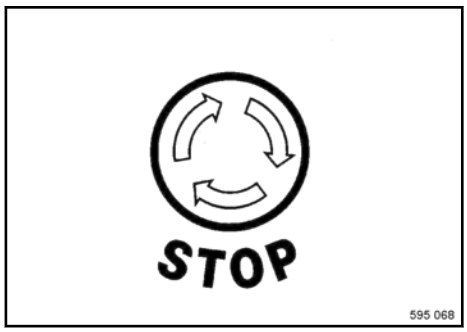


Fig. 18

Emergency stop push button

WARNING!
Danger of accident!
Use only in events of emergency during operation.

Do not use as parking brake.

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

The machine is braked immediately, the engine is shut down.

actuate	press the button completely down, it automatically locks in fully pressed position.
switch off/unlock	Turn button clockwise. Restart the engine.

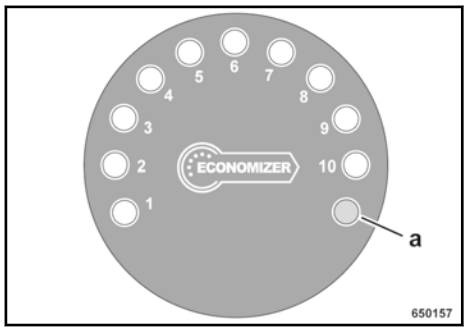


Fig. 19

Economizer display[Optional equipment]

1 - 10 yellow	Measuring value display
a red	Measuring fault warning lamp

Description see section "Operation - operating the Economizer"

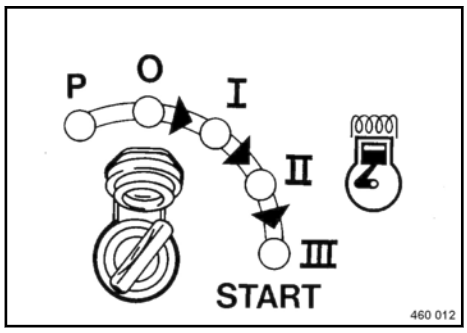


Fig. 20

- Start switch

Position "P"/"0"	Ignition off, key can be pulled out
Position "I"	Ignition on, all warning and control lights in the instrument cluster light up for a moment *test function(, the lighting szstem can be switched on.
Position "II"	Pre-heating position, at temperatures below +10 °C (+50 °F), hold the ignition key in position "II" for up to 10 seconds, the pre-heating control lamp in the instrument cluster lights.

The engine can only be started if the travel lever is in braking position and the emergency stop switch is unlocked.

The starter switch is designed with a re-start lock. The ignition key must first be turned back to position "0" before a new starting attempt can be made.

Position "III"	Turn further against spring pressure, the engine starts, turn the ignition key back to position "I" once the engine has started.

NOTICE!

Run the engine warm for a short while before starting work. Do not rev up a cold engine to high idle speed/full load speed.

Do not shut down the engine all of a sudden from full load speed, but let it idle for about 2 minutes.

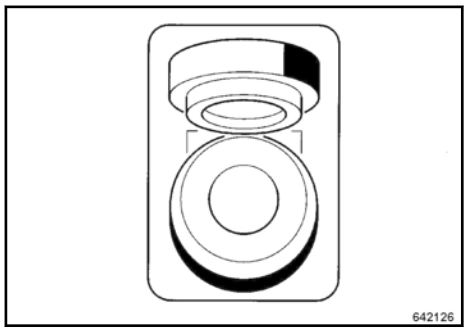


Fig. 21

- 12V-socket

Permanent voltage with ignition switched on

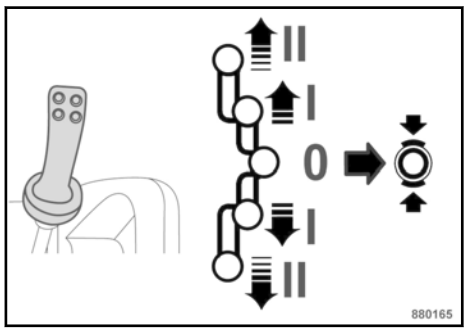


Fig. 22

- Travel lever

Position "Middle"	Neutral position
Position "middle right"	Parking brake position, the parking brake is closed.
Position "I"	Forward/reverse travel up to approx. 5 km/h (3.1 mph)
Position "II"	Forward/reverse travel up to approx. 10 km/h (6.2 mph)

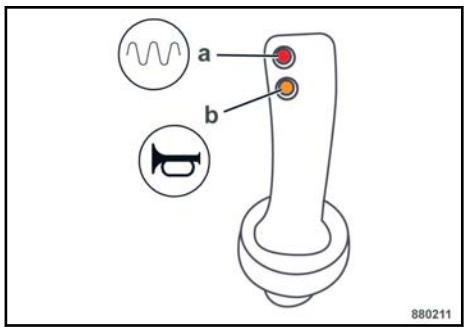


Fig. 23

a	Vibration on/off
b	Warning horn

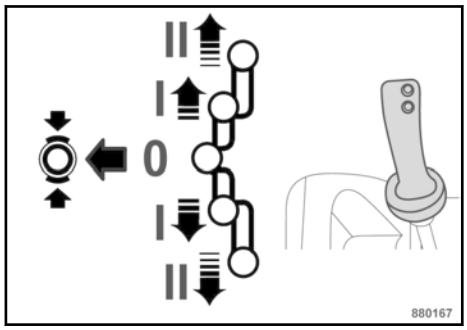


Fig. 24

- Double travel lever

Position "Middle"	Neutral position
Position "middle left"	Parking brake position, the parking brake is closed.
Position "I"	Forward/reverse travel up to approx. 5 km/h (3.1 mph)
Position "II"	Forward/reverse travel up to approx. 10 km/h (6.2 mph)

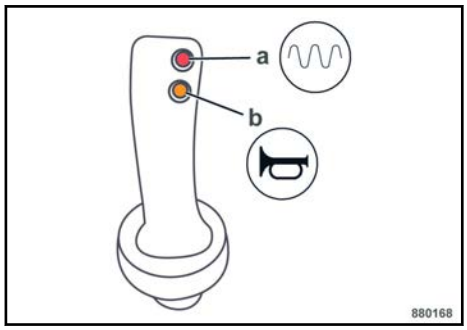


Fig. 25

a	Vibration on/off
b	Warning horn

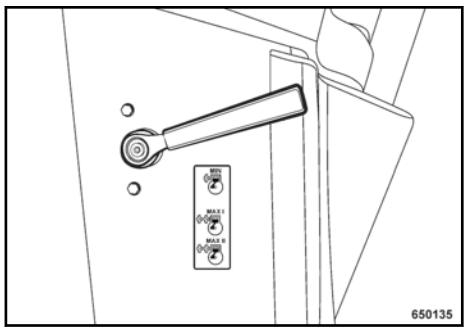


Fig. 26

■ Throttle lever

Position "MIN"	Idle speed position
Position "MAX I"	Full load position I, operating position for driving and vibration
Position "MAX II"	Full load position II, operating position for driving and vibration

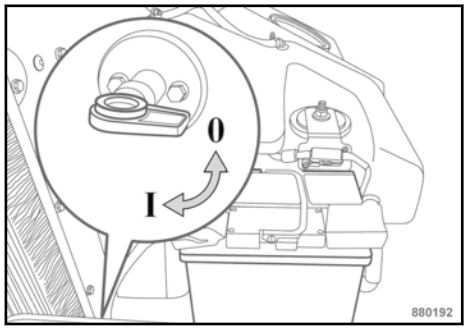


Fig. 27

■ Main battery switch[Optional equipment]

Position "0" (horizontal)	Detachable, separates the battery plus from the on-board electrics in case of cable fire and fire in the engine compartment as well as protection against unauthorized use.
Position "I" (vertical)	Operating position, engine can be started.

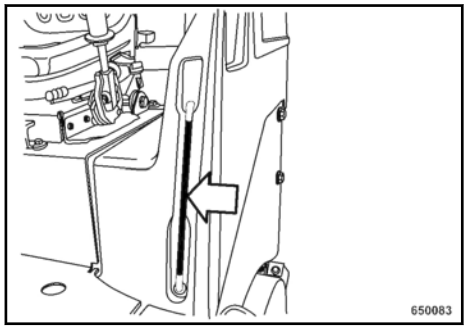


Fig. 28

■ Water level gauge

4.3 Instrument cluster

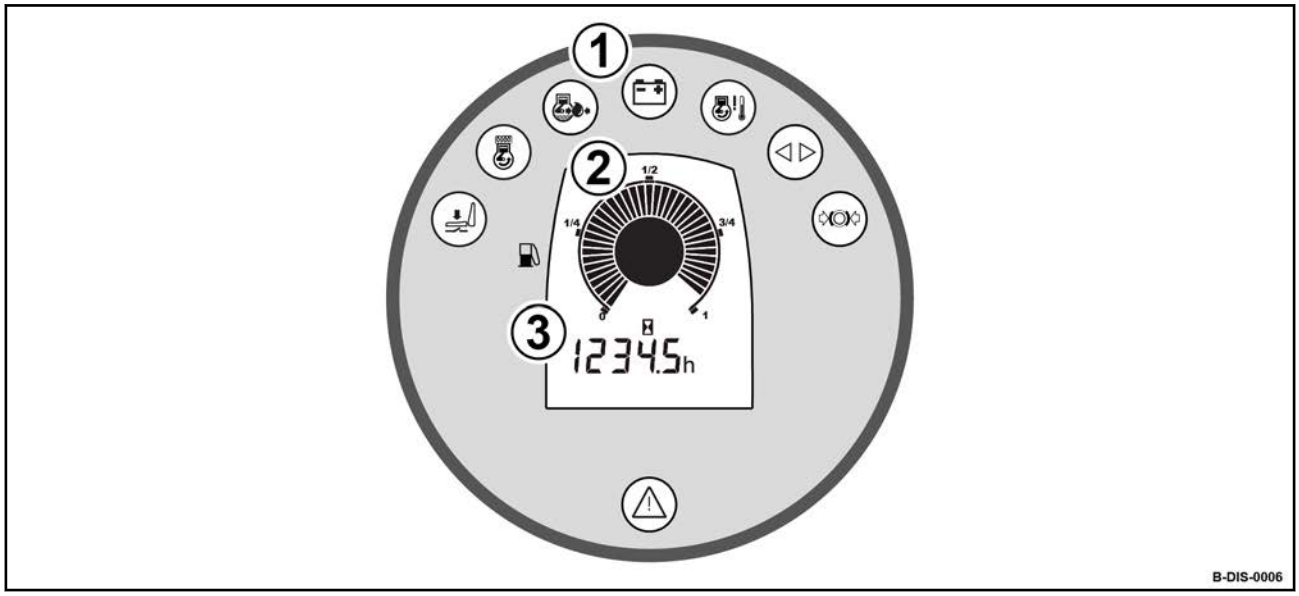
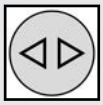


Fig. 29

1 Control and warning lamps
2 Fuel level gauge
3 Operating hour meter

Control and warning lamps

	Designation	Note
	Driver's seat warning lamp	Lights when the driver's seat is not occupied. If the machine is travelling the warning buzzer will sound, the engine is shut down after 2 seconds. If the travel lever is shifted to any travel direction , the engine will be shut down.
	Preheating control lamp	Lights during preheating in starter switch position "II". Goes out after 10 seconds

	Designation	Note
	Engine oil pressure warning lamp	Lights if the engine oil pressure is too low The warning buzzer sounds, the engine is shut down after 10 seconds. Check the engine oil level, if necessary repair the engine.
	Charge control lamp	Lights if the battery is not being charged. Check the V-belt, if necessary repair the generator.
	Warning light engine overheating	Lights when the engine overheats. The warning buzzer sounds, the engine is shut down after 2 minutes. Switch off vibration, run the engine with idle speed or shut it down if necessary, clean the radiator, if necessary repair the engine.
	Indicator control light	
	Parking brake warning lamp	Lights when the travel direction switch is in parking brake position.
	Central warning lamp	Lights when the water content in the fuel filter reaches the sensor contacts. The warning buzzer sounds, the engine is shut down after 2 minutes. Clean the water separator.
		The warning lamp flashes in case of a fault on the rotation angle sensor of the sprinkling system interval switch.

5 Operation

5.1 General

If you are not yet acquainted with the controls and indicating elements on this machine you should thoroughly read chapter "Indicators and control elements" before starting work.

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

5.2 Tests before taking into operation

Before the everyday use or before a longer working period the following tests and inspections must be performed.

WARNING!

Please observe strictly the safety regulations in the corresponding section of this instruction manual!

Park the machine on ground as level as possible.

Check:

Fuel tank and fuel lines for condition and leaks

Hydraulic oil tank and lines for condition and leaks

Screw connections

function of steering

function of emergency stop

function of parking brake

machine for cleanliness, damage

presence of the appropriate operating and maintenance instructions

proper maintenance of the machine

engine hood closed and locked

For a description of the following tasks refer to the chapter "maintenance every 10 operating hours".

Engine oil level, top up if necessary

Fuel level, top up if necessary.

Hydraulic oil level, top up if necessary.

Hydraulic oil filter element, change if necessary

Coolant level, top up if necessary

Water level, top up if necessary.

5.3 Electronic immobilizer

Optional equipment

Before starting the engine the anti-theft protection* must be disarmed by entering a code.

With the electronic immobilizer armed, the light emitting diode (a) flashes slowly.

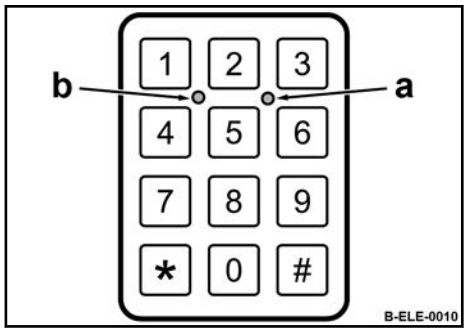


Fig. 30

Slowly enter the six-digit user code.

⇨ When entering the code, the light emitting diode (6) lights up with every digit.

Press the diamond button.

⇨ The electronic immobilizer is now disarmed and the engine can be started within the next 15 minutes.

5.4 Adjusting the driver's seat

WARNING!
Danger of accident!
Do not adjust the driver's seat while driving.

Make sure that all settings are securely locked.

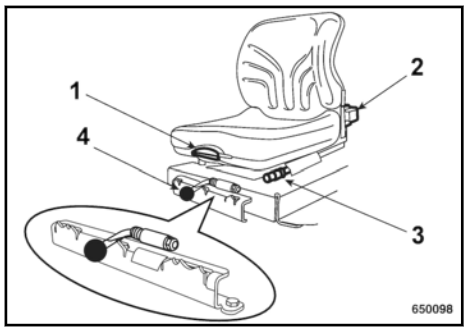


Fig. 31

Pull up lever (1) ↳ Fig. 31 and adjust the backrest.

Use lever (2) to adjust to the weight of the operator.

In its adjustment lever (2) is locked in upwards direction. This lock can be released by pressing the lever completely down against the stop. Then adjust to the weight of the operator by sliding the lever down.

Pull up lever (3) and adjust the seat in longitudinal direction.

Pull up lever (4) and adjust sideways.
Optional equipment

Make sure that the seal is properly locked in a locking position.

5.5 Start the engine

WARNING!
Danger of accident! Danger of injury!
Wear your personal noise protection means (ear defenders) before starting operation.

Start and operate the machine only from the driver's seat.

Prerequisites:

- Main battery switch switched on *(optional equipment)*
- Travel lever in parking brake position
- Unlock the emergency stop switch

When closing the dashboard cover the Emergency Stop switch will lock automatically and must be unlocked before starting again.

Fasten your seat belt.

Set the throttle lever to position "MIN".

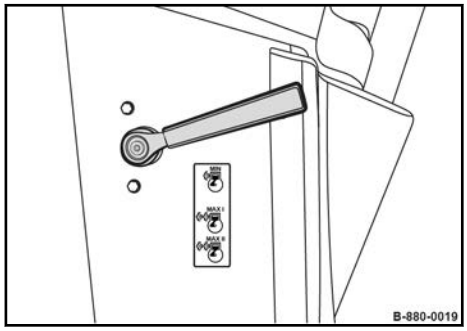


Fig. 32

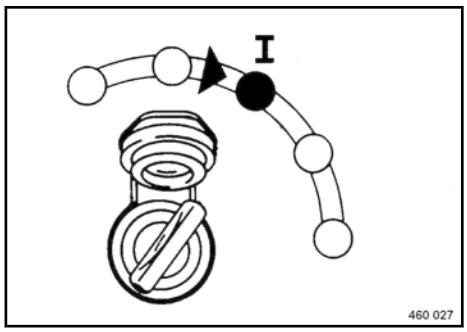


Fig. 33

Turn the ignition key to position "I".

⇨ All control and warning lamps in the instrument cluster light up a moment.

Fig. 34

With cold ambient temperatures hold the ignition key up to 10 seconds in position "II".

⇨ The preheating control lamp lights up.

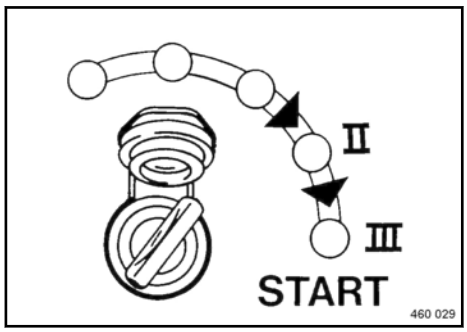


Fig. 35

The starter switch is designed with a re-start lock. The ignition key must first be turned back to position "0" before a new starting attempt can be made.

NOTICE!

Components may get damaged!

– Run 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, determine the cause.

Turn the ignition key through position "II" to position "III".

⇨ The starter cranks the engine.

NOTICE!

Run the engine warm for a short while before starting work. Do not rev up a cold engine to high idle speed/full load speed.

5.6 Driving the machine

WARNING!
Life hazard! 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 climbing ability of the machine.

Do not drive up and down inclinations which exceed the maximum gradability of the machine (see chapter "technical data").

Driving across slopes should therefore be strictly avoided, because of the high risk of tipping over and the related risk of severe or even fatal accidents.

You should therefore always drive straight up or down a slope.

For rollers with a drum width of 1 m (3.3 ft) or less there is a considerable risk of tipping over near edges (e.g. curbstones, embankments, trenches, potholes) when driving over these edges.

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.

Drive and operate the machine only from the driver’s seat.

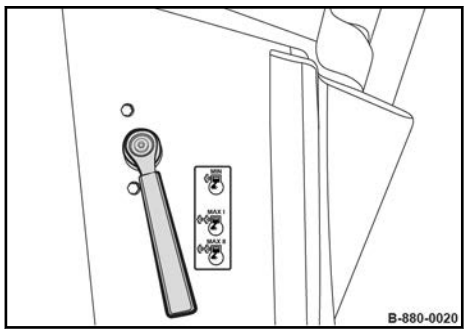


Fig. 36

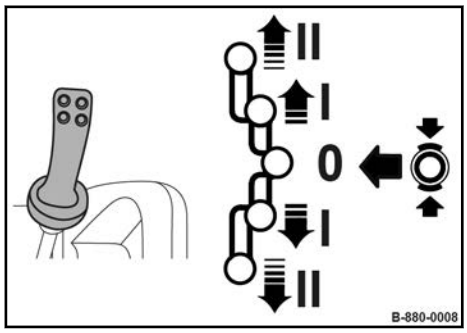


Fig. 37

Set the throttle lever to position "Max I" or "MAX II".

NOTICE!

During operation the throttle lever always remains engaged in full load position "MAX I" or "MAX II". Control the travel speed with the travel lever.

NOTICE!

Do not operate jerkily!

Disengage the travel lever out of braking position and move it slowly to the desired travel direction.

Position "I"	Forward/reverse travel up to approx. 5 km/h (3.1 mph)
Position "II"	Forward/reverse travel up to approx. 10 km/h (6.2 mph)

Important notes on travel operation

NOTICE!

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! Control the travel speed with the travel lever.

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

5.6.1 Seat contact switch

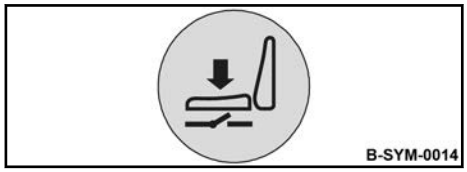


Fig. 38

If the operator leaves his seat while travelling, the driver's seat warning lamp will light up. The warning buzzer sounds and the engine is shut down after two seconds and the parking brake is applied.

If the seat is occupied again within 2 seconds both the warning lamp and the warning buzzer will go out.

If the travel lever is moved out of parking brake position while the engine is stopped and the seat is not occupied, the engine will be shut down immediately.

If the engine stops, occupy the driver's seat and restart the engine ↳ *Chapter 5.5 'Start the engine' on page 65*.

5.7 Stopping the machine, operating the parking brake

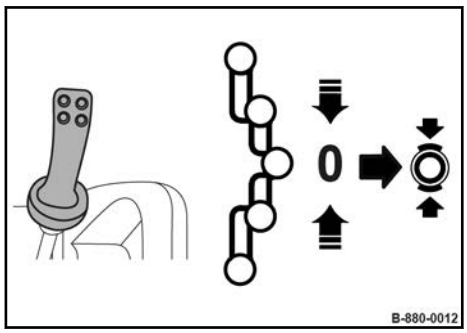


Fig. 39

Shift the travel lever slowly back to neutral position and lock it in parking brake position.

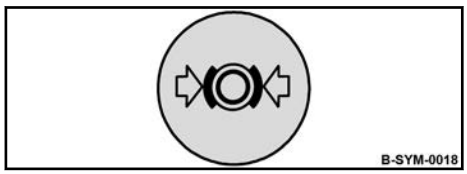


Fig. 40

⇨ The machine is automatically braked by the hydrostatic drive and the parking brake is applied after approx. 2 seconds.

The parking brake warning lamp lights up.

5.8 Shutting down the engine

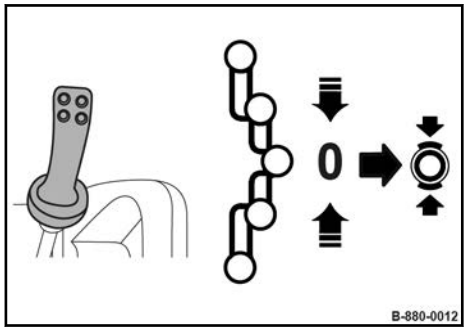


Fig. 41

Shift the travel lever slowly back to neutral position and lock it in parking brake position.

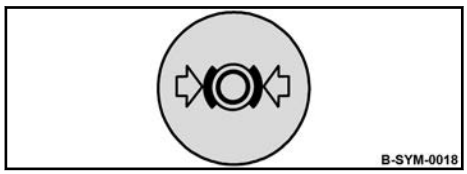


Fig. 42

⇨ The machine is automatically braked by the hydrostatic drive and the parking brake is applied after approx. 2 seconds.

The parking brake warning lamp lights up.

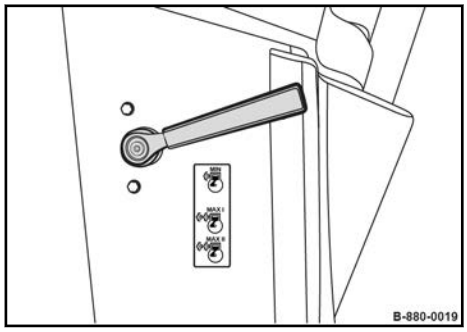


Fig. 43

Set the throttle lever to position "MIN" (idle speed).

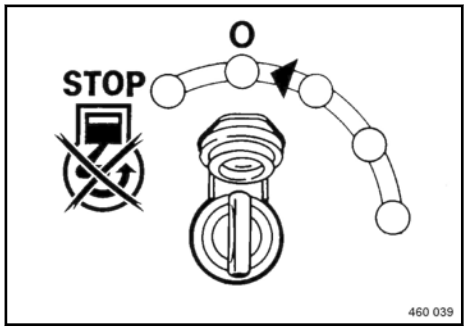


Fig. 44

NOTICE!

Danger of engine damage!

– Do not shut down the engine all of a sudden from full load speed, but let it idle for about 2 minutes.

Turn the ignition key to position "0" and pull it out.

WARNING!

Danger of accident!

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

Mark machines, which could be in the way, with a clearly visible sign.

5.9 Switching the vibration on/off

5.9.1 Preliminary remarks and safety notes

NOTICE!

Possible damage to neighbouring buildings!

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

NOTICE!

Components may get damaged!

– Do not activate the vibration on hard (frozen, concrete) ground.

Vibration at standstill causes transverse marks

- Switch the vibration on only after shifting the travel lever to the desired travel direction.
- Switch the vibration off before stopping the machine.

In automatic operation, vibration is automatically activated when a certain low travel speed is reached. The vibration is automatically switched off when falling below this certain slow travel speed.

This avoids the formation of transverse marks caused by vibration with the machine at standstill.

5.9.2 Vibration in manual mode

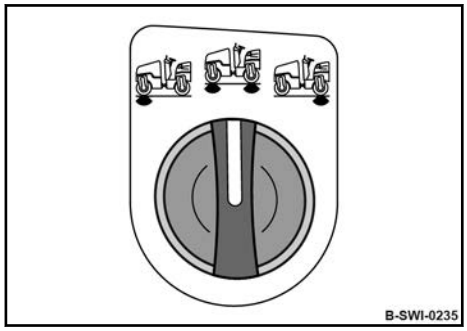


Fig. 45

Use the rotary switch for drum pre-selection to pre-select the desired drum(s).

Drum pre-selection is only activated, if the vibration has been switched off beforehand.

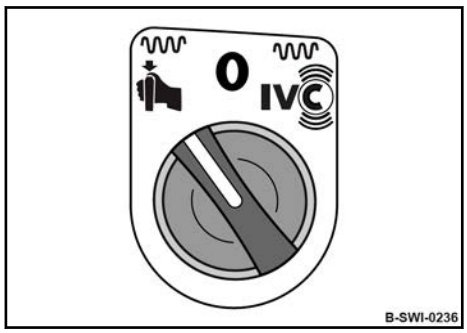


Fig. 46

Turn the rotary switch for vibration preselection to position "left".

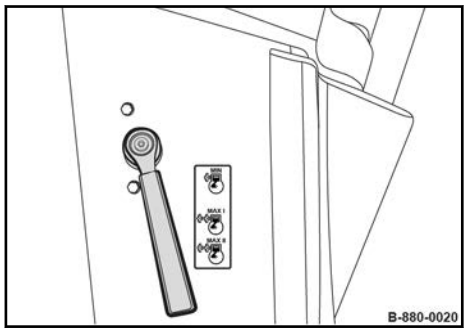


Fig. 47

Set the throttle lever to position "Max I" or "MAX II".

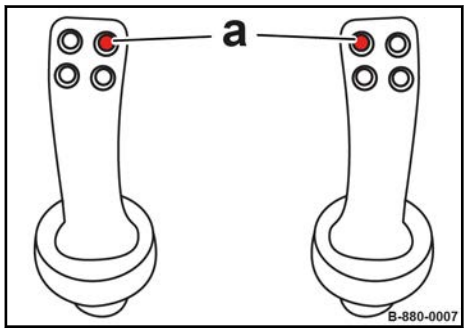


Fig. 48

NOTICE!

Vibration at standstill causes transverse marks!

– Do not switch on vibration with the machine at standstill.

Shift the travel lever slowly to the desired travel direction.

a Push button vibration

Press the vibration push button on the left or right travel lever.

⇨ Vibration is switched on.

Press the vibration push button ↳ Fig. 48 again or turn the rotary switch for vibration pre-selection ↳ Fig. 49 to position "0".

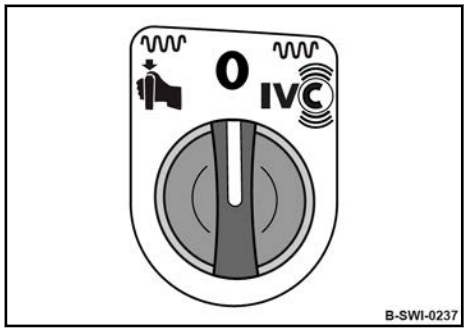


Fig. 49

5.9.3 Vibration in automatic mode

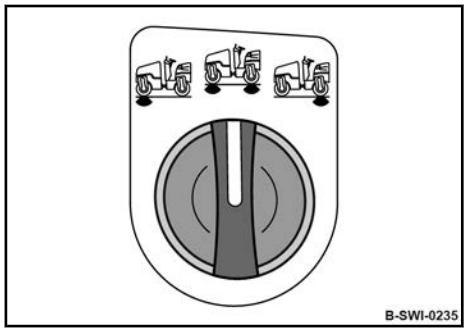


Fig. 50

Use the rotary switch for drum pre-selection to pre-select the desired drum(s).

Drum pre-selection is only activated, if the vibration has been switched off beforehand.

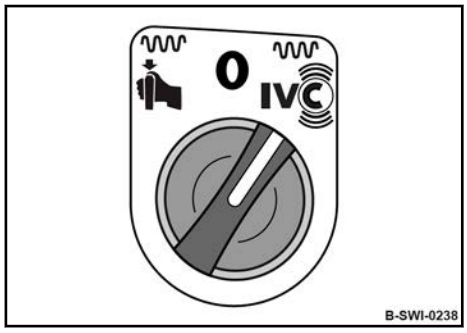


Fig. 51

Turn the rotary switch for vibration pre-selection to position "Right".

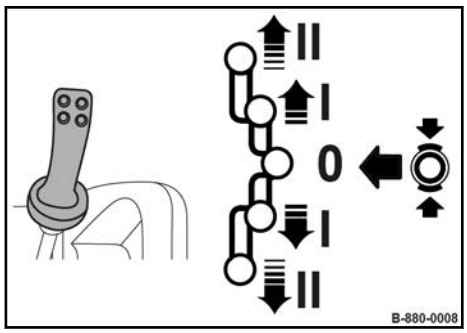


Fig. 52

Shift the travel lever slowly to the desired travel direction.

⇨ The vibration comes on at a low travel speed.

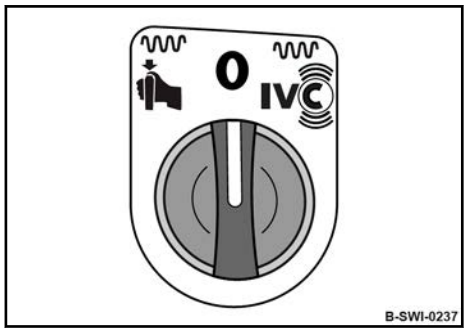


Fig. 53

To switch off vibration return the travel lever ↳ Fig. 52towards "0" or switch the rotary switch for vibration pre-selection ↳ Fig. 53 to position "0".

5.10 Operating the Economizer

The Economizer continuously informs the driver about the compaction status and enables the detection and selected re-compaction of weak spots.

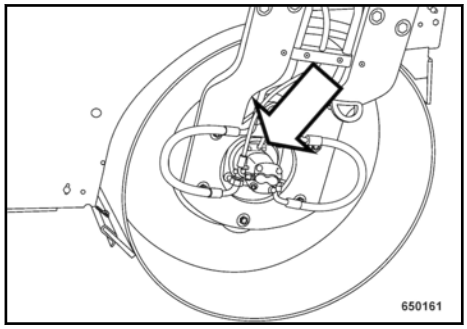


Fig. 54

The acceleration transducer on the front drum ↳ Fig. 54 measures the reaction of the road subbase or the different asphalt layers on the vibrating drum.

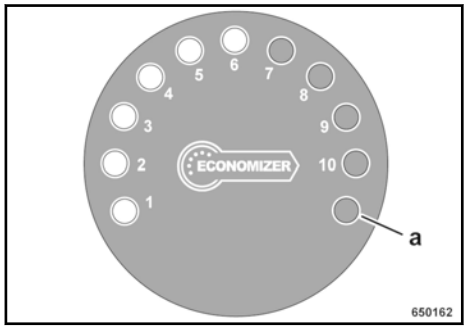


Fig. 55

The increasing number of yellow LEDs (1) - (10) ↳ Fig. 55 lighting up indicates the increase in compaction.

If the number of yellow LEDs does not increase any further, no further compaction can be achieved with this machine.

The red LED (a) flashes when the system is unable to determine an assessable measuring value (e.g. jump operation of the drum caused by a hard subbase, acceleration sensor not connected or cable breakage).

In order to achieve the desired soil stiffness or asphalt density, one must alsways perform a suitable reference measurement before compaction is started.

This is necessary to find out how many LEDs in the Economizer display correspond with the required soil stiffness value or asphalt density on the soil being compacted.

Tandem rollers of the same type show identical measuring values when used on the same soil.

The measuring values achieved with different tandem rollers with Economizer from BOMAG can be made comparable by calibration to a reference value.

The Economizer is maintenance free.

Starting the measuring system

The measuring system is automatically started when switching on the machine.

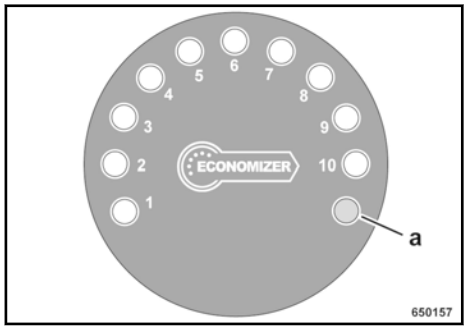


Fig. 56

The system first performs an LED-test. The LEDs light up one after the other, starting with LED (1) ↳ Fig. 56. Once all LEDs are on, the display goes out again in single steps.

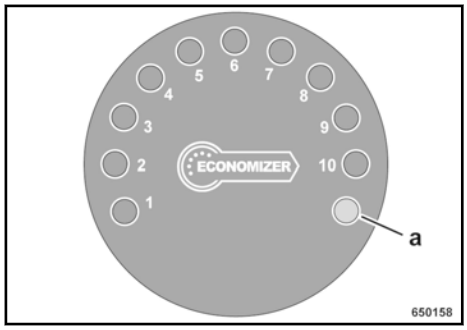


Fig. 57

After switching on the vibration the red LED (a) ↳ Fig. 57 flashes for approx. 1 - 2 seconds, until the vibration motor has reached its nominal frequency. Then the red LED goes out.

The system is now in measuring mode.

If the red LED still flashes or lights up, se chapter "Notes on operation".

Notes on operation

Display	Explanation:
The maximum display value will not be reached, even after many passes.	Due to different soil stiffness values or asphalt densities the maximum value will not be reached in each case.
The display varies during a pass by one LED up/down:	Due to minor fluctuations in the material composition and the filling height of the road subbase or the asphalt paving thickness, the value may fluctuate. The average of the display reading during the last pass is decisive.
The red LED is flashing	The system is unable to determine an assessable measuring value (e.g. jump operation of the drum caused by a hard subbase, acceleration sensor not connected or cable breakage). The last valid measuring value will be displayed, until a new measuring value has been determined.
The red LED lights up.	The system is unable to read a calibration value when starting. Since this value is required for calculation the measuring values, measuring operation is blocked. Restart the measuring system. Turn the ignition key back to position "0" and then again to position "I". If the warning lamp still light, please contact our customer service.

Display	Explanation:
The displayed measuring values are not plausible.	The acceleration sensor is not fastened correctly. Shut down the engine and check the fastening screws for the acceleration transducer. Both screws must be tight.
	Weak spots in the road subbase are also measured when paving asphalt. In unfavourable cases an excessively varying material composition or moisture can influence the measuring results. On considerably dry or excessively moist material lower measuring values will be displayed.

5.11 Switching the pressure sprinkling system on and off

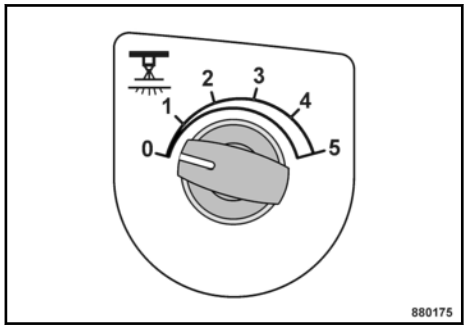


Fig. 58

Switch the interval switch for pressure sprinkling ↳ Fig. 58 to the desired flow interval.

Position "0"	Sprinkling off
Position "1" to "4"	various sprinkling intervals
Position "5"	Permanent sprinkling

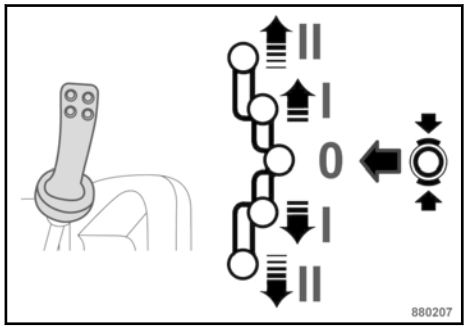


Fig. 59

To switch on the sprinkling system pull the travel lever ↳ Fig. 59 out of braking position.

With the travel lever in neutral position and interval switch in position "5" (permanent sprinkling) the sprinkling system is already active.

With interval sprinkling the machine needs to drive forward or backward.

With the travel lever in neutral position sprinkling will continue for another 15 seconds.

The edge cutter sprinkling system is activated when the edge cutter is lowered. *Optional equipment*

To switch off the pressure sprinkling system switch the interval switch for pressure sprinkling ↳ Fig. 58 to position "0".

Test position

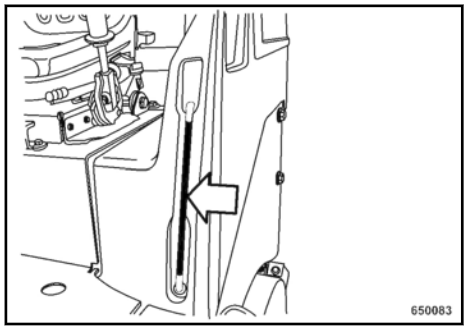


Fig. 60

Check on the water level indicator ↳ Fig. 60 whether the water tank is sufficiently filled.

NOTICE!

In test position the water pump will be running.

Do not remain too long in test position, because the water pump may get damaged when the water tank is empty or the batty will be discharged.

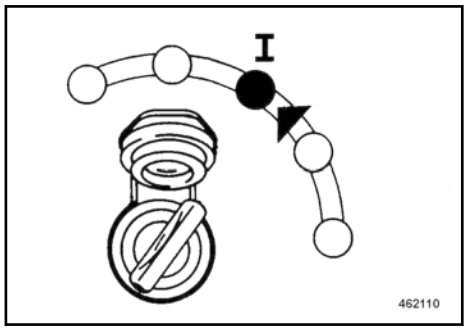


Fig. 61

To test the pressure sprinkling system shut down the engine and set the ignition key ↳ Fig. 61 to position "I".

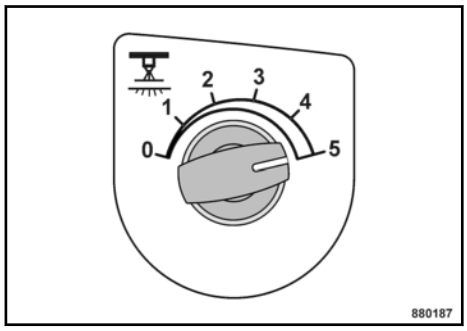


Fig. 62

Set the interval switch for pressure sprinkling ↳ Fig. 62 to position "5" (permanent sprinkling).

The pressure sprinkler system is switched on.

Check water output and spray pattern on all nozzles.

In positions "1" to "4" the corresponding interval is activated once. Then the pump is switched off.

5.12 Setting the crabwalk

WARNING!
Danger of accident! Life hazard!
Safety instructions for lifting loads, see chapter "Loading/Transport"

Retighten the screws after you have set the crabwalk.

Shut down the engine.

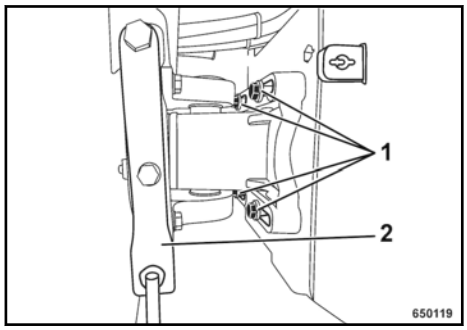


Fig. 63

NOTICE!
Do not back out the screws too far.

Slightly loosen the screws (1) ↳ Fig. 63.

Disengage the articulation lock (2) ↳ Fig. 63 and fasten it in the holder.

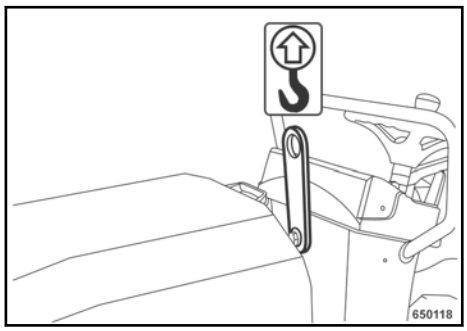


Fig. 64

Lift up the machine by the central lifting device ↳ Fig. 64 so that it is just above the ground.

Displace the rear frame.

Lower the machine to the ground.

Tighten all fastening screws again.

5.13 What to do in events of emergency

Actuating the emergency stop switch

WARNING!
Danger of accident!
In events of emergency and in case of danger actuate the emergency stop switch immediately.

Start travel operation of the machine only after the danger that caused the actuation of the emergency stop switch has been eliminated.

NOTICE!
Do not use as service brake. The deceleration is extremely high. In case of frequent use the wear on the multi-dics brakes will be very high.

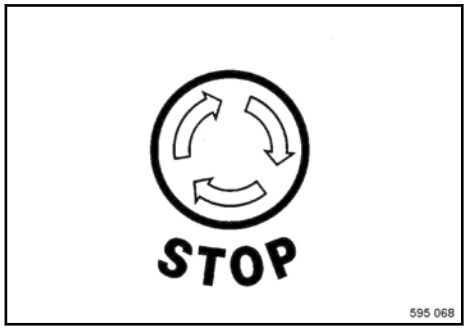


Fig. 65

Press the button of the emergency stop switch ↳ Fig. 65 completely down, it automatically locks in fully pressed position.

Shuts the engine down and closes the brake.

Turn the button clockwise to unlock the emergency stop switch.

Start the engine again, see chapter "Starting the engine".

Disconnecting the battery

WARNING!

In order to be able to disconnect the battery quickly in case of danger (e.g. cable fire or electrical malfunction) the minus terminal has been designed as a quick release pole clamp.

Open the engine hood.

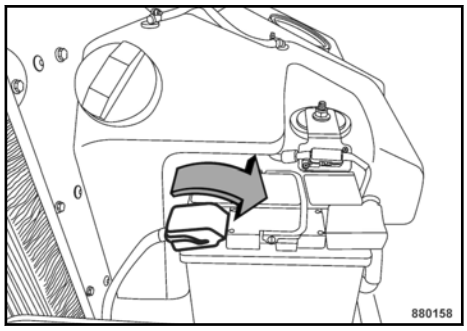


Fig. 66

Pull up the cap from the minus pole ↳ Fig. 66. The pole clamp on the minus pole thereby becomes loose.

Disconnect the pole clamp from the minus pole of the battery and lay it to the side.

5.14 Towing

WARNING!

Danger of accident! Danger of injury!

Apply appropriate measures (e.g. with metal wheel chocks, to be provided by the operating company) to secure the machine against rolling away.

Use a towing vehicle with sufficient traction and braking power for the unbraked towed load.

Use a tow bar (to be provided by the operating company).

The machine cannot be steered.

Do not touch hot engine parts.

The closed hydraulic circuit empties during the towing process. Therefore, the hydraulic circuit needs to be filled and bled after towing.

NOTICE!

Only tow the machine with the parking brake released and the travel pump short-circuited.

Towing speed 1 km/h, max. towing distance: only out of the immediate danger zone as the travel pump may be destroyed due to inadmissible heat and insufficient lubrication.

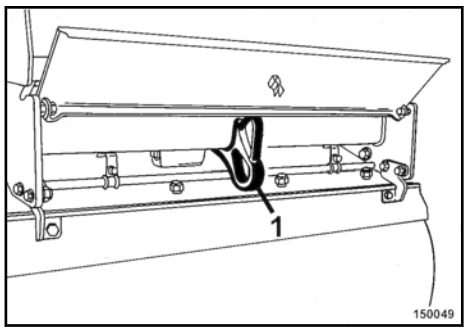


Fig. 67

Shut down the engine.

Fasten the tow bar to the front or rear towing device (1).

Short-circuiting the travel pump

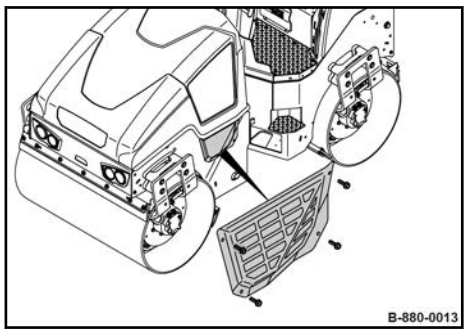


Fig. 68

Open the engine hood and remove the covering from the travel pump.

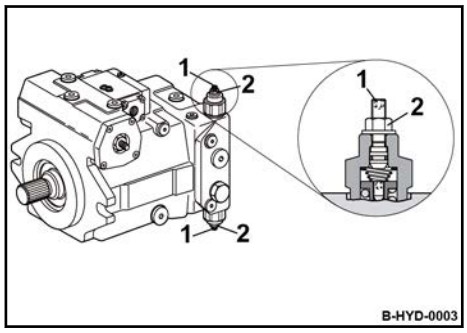


Fig. 69

Unscrew the counter nuts (2) on the high pressure relief valves of the travel pump.

Tighten the hexagon socket screws (1) until they touch the spring cup (increased resistance).

Turn the hexagon socket screws another half turn.

Retighten the counter nut, tightening torque: 22 Nm (16 ft·lbf).

Releasing the brakes on front and rear drums

The brakes on both drums must be released.

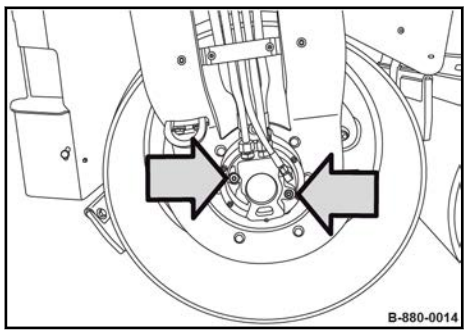


Fig. 70

Remove two plugs.

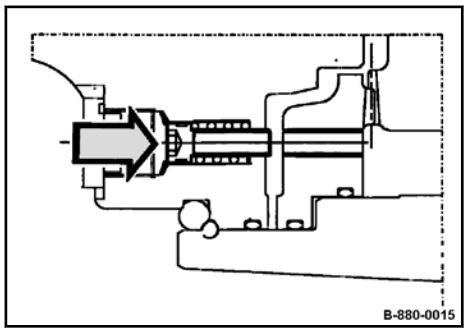


Fig. 71

Press both screws in against the springs.

Tighten both screws alternately and in steps with 35 Nm until they bottom, tightening torque: 35 Nm (25 ft·lbf).

Screw both plugs ↳ Fig. 70 back in, tightening torque: 50 Nm (37 ft·lbf).

After towing

WARNING!

Danger of accident!

Apply appropriate measures to secure the machine against rolling away (e.g. with metal wheel chocks, to be provided by the operating company) before disconnecting the tow bar.

After towing close the brakes on both drums again.

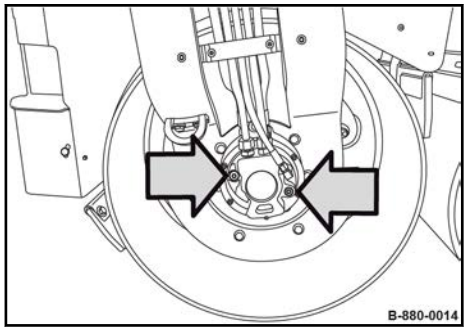


Fig. 72

Remove two plugs.

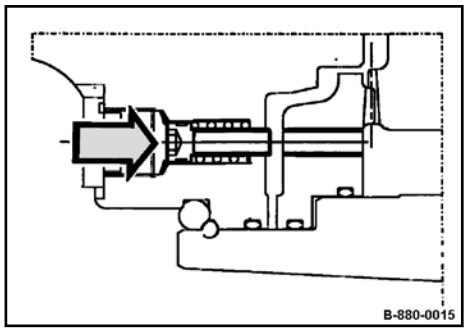


Fig. 73

Completely release both screws to close the brake.

Screw both plugs ↳ Fig. 72 back in, tightening torque: 50 Nm (37 ft·lbf).

Close also the brake on the second drum.

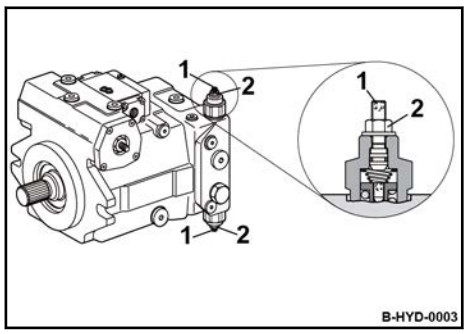


Fig. 74

Unscrew the counter nuts (2) on the high pressure relief valves of the travel pump.

Unscrew the hexagon socket screws (1) as far as they will go.

Retighten the counter nut, tightening torque: 22 Nm (16 ft·lbf).

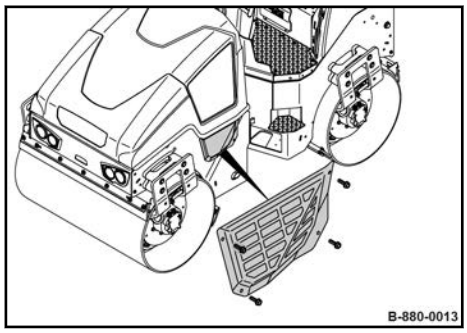


Fig. 75

Reassemble the covering to the travel pump.

WARNING!
Danger of accident!
The hydraulic circuit needs to be filled and bled before the machine can be put back into operation (e.g. following repair).

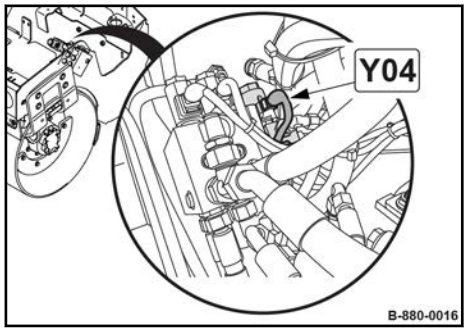


Fig. 76

Before starting the machine pull the plug (**Y04**) off the solenoid valve for the parking brake, to prevent the parking brake from opening.

Close the engine hood.

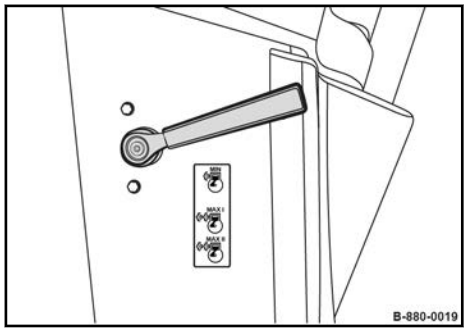


Fig. 77

Set the throttle lever to position "MIN".

Start the engine and shut it down again after approx. 2-3 seconds.

Repeat this process after short break.

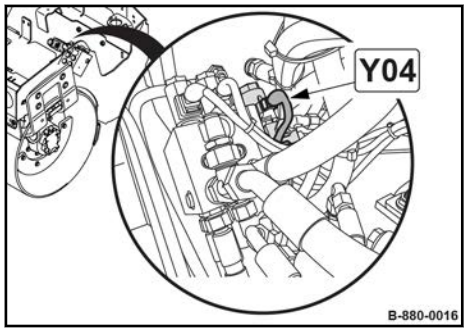


Fig. 78

Open the engine hood and reconnect the plug (**Y04**) to the solenoid valve for the parking brake.

Close the engine hood.

Then start the engine *Chapter 5.5 'Start the engine' on page 65*.

5.15 Loading/transport

Loading with loading ramp

WARNING!
Danger of accident! Life hazard!

Use only stable loading ramps of sufficient load bearing capacity. The ramp inclination must be less than the gradability of the machine.

Loading ramps must be free of grease, oil, snow and ice.

Make sure that persons are not endangered by the machine tipping or sliding off.

During demonstration and when loading the machine do not remain in the danger zone of the machine.

Secure the machine with the articulation lock after driving it on the transport vehicle.

Make sure that no persons are in the danger area.

Drive the machine carefully on the transport vehicle.

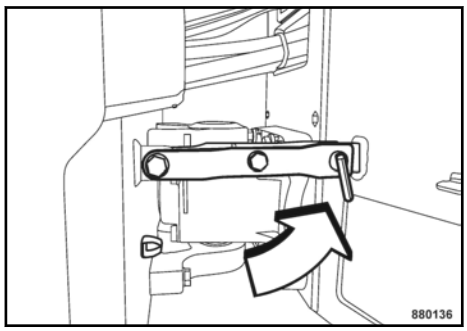


Fig. 79

After driving the machine onto the transport vehicle attach and secure the articulation lock ↳ Fig. 79.

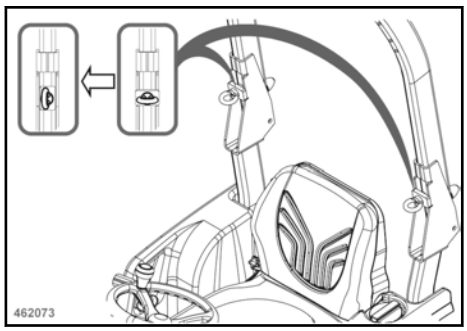


Fig. 80

Fold down the foldable ROPS for transport. Loosen the eye bolts ↳ Fig. 80 and adjust the clamping plates vertically. Optional equipment

Fold the foldable ROPS back.

Loading by crane

WARNING!

Danger of accident! Life hazard!

Lifting tackle must only be attached to loads by expert personnel (qualified person).

Engage the articulation lock.

Always use suitable lifting tackle on the lifting points to lift the machine.

Check all lifting points and fastening elements for damage before lifting the machine. Do not use damaged or in any other way impaired lifting points.

Lift the machine only with suitable lifting gear. Use only safe lifting gear of sufficient load bearing capacity Minimum lifting capacity of lifting gear: see operating weight in chapter "Technical Data".

Do not lift or lower the machine jerkily.

The tension must always be effective in vertical direction.

The machine must not swing about when being lifted.

Do not step or stand under suspended loads.

Engage the articulation lock.

Fold down the foldable ROPS[Optional equipment]

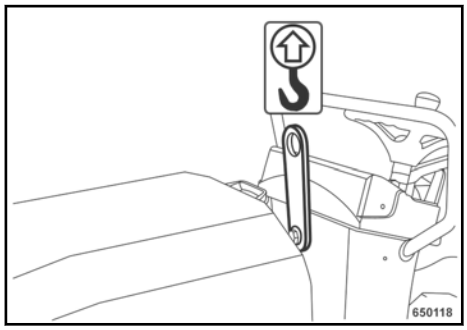


Fig. 81

Use the central lifting facility ↳ Fig. 81 to lift the machine.

Lashing

WARNING!

Danger of accident! Life hazard!

Always use suitable lashing gear on the lifting points to lash down the machine.

Check all lashing points for damage before lashing down the machine. Do not use a damaged or in any other way impaired lashing points.

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

Always apply the articulation lock for transportation.

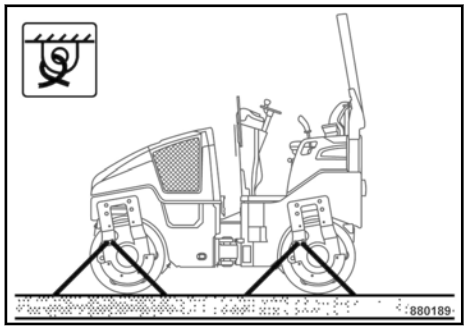


Fig. 82

Lash the machine ↳ Fig. 82 to the transport vehicle, use the lashing eyes on front and rear frame for this purpose.

After transport

WARNING!

Danger of accident! Life hazard!

Operate the machine only with the foldable ROPS properly fastened and the fastening screws tightened with the correct tightening torque.[Optional equipment]

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

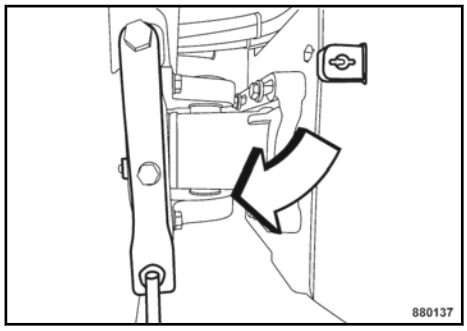


Fig. 83

After transport release the articulation lock ↳ Fig. 83 again and swing it back into the holding bracket.

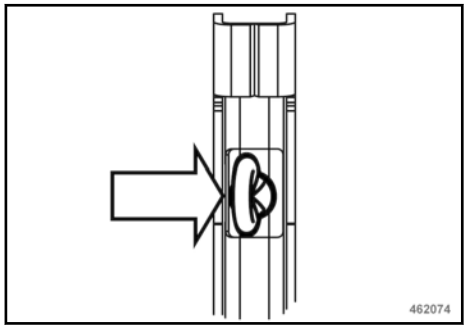


Fig. 84

To fold up the foldable ROPS align the clamping plates on both sides vertically ↳ Fig. 84.

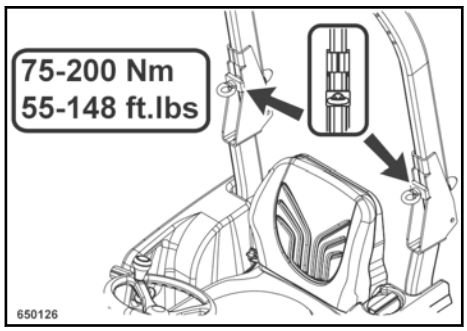


Fig. 85

Fold up the foldable ROPS ↳ Fig. 85.

Turn the clamping plates to horizontal position and tighten the eye bolts with a tightening torque of 75 – 200 Nm (55 – 148 ft.lbf).

6 Maintenance

6.1 General notes on maintenance

Always comply with the appropriate safety regulations when performing maintenance work.

Thorough maintenance of the machine guarantees far longer safe functioning of the machine and prolongs the lifetime of important components. The effort needed for this work is only little compared with the problems that may arise when not observing this rule.

The terms right/left correspond with travel direction forward.

Always clean machine and engine thoroughly before starting maintenance work.

Do not touch hot engine parts.

For maintenance work stand the machine on level ground.

Always remove the main battery switch for all maintenance work.

Perform maintenance work only with the engine shut down.

Relieve hydraulic pressures before working on hydraulic lines.

Before working on electric parts of the machine disconnect the battery and cover it with insulation material.

When working in the area of the articulated joint attach the articulation lock (transport lock).

ENVIRONMENT!

During maintenance work catch all oils and fuels and do not let them seep into the ground or into the sewage system. Dispose of oils and fuels environmentally.

Keep used filters in a separate waste container and dispose of environmentally.

Catch biodegradable oils separately.

Notes on the fuel system

The lifetime of the diesel engine depends to a great extent on the cleanliness of the fuel.

Keep fuel free of contaminants and water, since this will damage the injection elements of the engine.

Drums with inside zinc lining are not suitable to store fuel.

When choosing the storage place for fuel make sure that spilled fuel will not harm the environment.

Do not let the hose stir up the slurry at the bottom of the drum.

The fuel drum must rest for a longer period of time before drawing off fuel.

Fuel residues in the drum are not suitable for the engine.

Notes on the performance of the engine

On diesel engines both combustion air and fuel injection quantities are thoroughly adapted to each other and determine power, temperature level and exhaust gas quality of the engine.

If your engine has to work permanently in "thin air" (at higher altitudes) and under full load, you should consult our customer service or the customer service of the engine manufacturer.

Notes on the cooling system

Prepare and check coolant with highest care, since otherwise the engine may be damaged by corrosion, cavitation and freezing.

The coolant is prepared by mixing a cooling system protection agent (ethylene glycol) into the coolant.

Mixing with cooling system protection agent is necessary in all climatic zones. It prevents corrosion, lowers the freezing point and raises the boiling point of the coolant.

Notes on the hydraulic system

During maintenance work on the hydraulic system cleanliness is of major importance. Make sure that no dirt or other contaminating substances can enter into the system. Small particles can produce flutes in valves, cause pumps to seize, clog nozzles and pilot bores, thereby making expensive repairs inevitable.

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.

Seal external leaks immediately. If necessary inform the responsible customer service.

Do not store drums with hydraulic oil outdoors, or at least under a cover. Water can be drawn in through the bunghole when the weather changes.

We recommend to use our filling and filtering unit with fine filter to fill the system. This ensures finest filtration of the hydraulic oil, prolongs the lifetime of the hydraulic oil filter and protects the hydraulic system.

Clean fittings, filler covers and the area around such parts before disassembly to avoid entering of dirt.

Do not leave the tank opening unnecessarily open, but cover it so that nothing can fall in.

6.2 Fuels and lubricants

6.2.1 Engine oil

6.2.1.1 General

Modern diesel engines put high demands on the lubrication oil used. The engine powers that have continuously increased over the past few years lead to higher thermal loads for the lubrication oil. Apart from that, the lubrication oil is additionally loaded by contamination because of the reduced lubrication oil consumption and the prolonged lubrication oil change intervals.

For this reason it is necessary to follow the requirements and recommendations in these operating instructions in order not to reduce the lifetime of the engine.

Engine oils of the same specification can generally be mixed among each other. However, mixing of engine oil should be avoided, because the poorest characteristics of a mixture will always prevail.

The use of additives for lubrication oils is not permitted.

The lubrication oil quality has a considerable influence on the lifetime, performance and thus the economy of the engine. The following is generally valid: the better the lubrication oil quality, the better its properties.

6.2.1.2 Oil quality

Lubrication oils are classified according to their performance and quality class.

Use only engine oils of API-classification CF, CF-4, CG-4, CH-4 and CI-4 in combination with low-sulphur fuel.

For operation of an engine with high sulphur fuels it is recommended to use an engine oil of classification CF or higher with a total base number of at least 10.

6.2.1.3 Oil viscosity

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 following oil viscosity chart as a reference.

Ambient temperature	Oil viscosity
more than 25 °C (77 °F)	SAE 30 SAE 10W-30 SAE 15W-40
-10 °C to 25 °C (14 °F to 77 °F)	SAE 10W-30 SAE 15W-40
below - 10 °C (14 °F)	SAE 10W-30

6.2.1.4 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 one year, the oil change should be performed at least 1x per year, irrespective of the operating hours reached.

Oil change intervals with API CF, CF-4, CG-4, CH-4, CI-4: 250 operating hours.

NOTICE!
Danger of engine damage!
– When using fuels with a sulphur content of more than 0.5 %, the oil change intervals must be halved.

6.2.2 Fuel

6.2.2.1 Fuel quality

We recommend the use of diesel fuel as per following specifications.

- EN 590
- ASTM D975 Grade-No. 1-D and 2-D.

The recommended Cetan index number os 45. A Cetan index number higher than 50 should preferably be used, especially at ambient temperatures below -20 °C (-4 °F) and when working at altitudes of 1500 m (4921 ft) and more.

With respect to the percentage (ppm) of sulphur the fuel used in the engine must comply with all relevant exhaust emission regulations in the are of use of the engine.

It is highly recommended to use a fuel with a sulphur content of less than 0.1 % (1000 ppm).

When using a diesel fuel with a high sulphur content of 0,5 % (5000 ppm) to 1,0 % (10000 ppm) the oil change intervals must be halved.

Fuels with a sulphur content of more than 1.0 % (10000 ppm) are not permitted.

6.2.2.2 Winter fuel

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.

Diesel fuels suitable for temperatures down to -44 °C (-47 °F) are available for Arctic climates.

NOTICE!

Danger of engine damage!

– The admixture of petroleum and the addition of "flow enhancing additives" (fuel additives) is not permitted.

6.2.2.3 Storage

Even traces of zinc, lead and copper can cause deposits in the injection nozzles, especially in modern Common-Rail injection systems.

Zinc and lead coatings in refuelling systems and fuel lines are not permitted.

Copper containing materials (copper lines, brass items) should be avoided, because they can cause catalytic reactions in the fuel with subsequent depositing in the injection system.

6.2.3 Coolant

Always use a mixture of anti-freeze agent and clean, dehardened water with a mixing ratio of 1:1.

Under particularly extreme temperature conditions you should consult our customer service concerning the anti-freeze agent to be used.

There are various types of anti-freeze agents available. For this engine you should use ethylene glycol.

Before filling in the coolant mixed with anti-freeze agent the radiator must be flushed with clean water. This procedure should be repeated two to three times to clean the inside of radiator and engine block.

NOTICE!

Danger of engine damage!

– Do not mix different coolants and additives of any other kind.

Mixing the coolant:

- Prepare a mixture of 50% anti-freeze agent and 50% low mineral, clean water.
- Stir well before filling it into the radiator.
- The method of mixing water and anti-freeze depends on the brand of the anti-freeze agent (see standard SAE J1034 and also standard SAE J814c).

Add anti-freeze agent:

- If the coolant level drops because of evaporation,only clean water is to be used for topping up.
- In case of leakages you must always fill in anti-freeze agents of the same brand and the same mixing ratio.

Do not use any radiator cleaning agent after the anti-freeze agent has been mixed in. The anti-freeze agent also contains a corrosion protection agent. If this mixes with cleaning agent it may cause the development of sludge, which could damage the cooling system.

Anti-freeze concentration	Freezing point
50 %	-37 °C (-35 °F)

6.2.4 Hydraulic oil

6.2.4.1 Mineral oil based hydraulic oil

The hydraulic system is operated with hydraulic oil HV 46 (ISO) with a kinematic viscosity of 46 mm^2/s at 40 °C (104 °F) and 8 mm^2/s at 100 °C (212 °F).

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).

6.2.4.2 Bio-degradable hydraulic oil

The hydraulic system can also be operated with a synthetic ester based biodegradable hydraulic oil.

The biologically quickly degradable hydraulic oil Panolin HLP Synth.46 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, or our customer service for details.

NOTICE!

Risk of damage!

– Check the filter more frequently after this change.
– Perform regular oil analyses for content of water and mineral oil.
– Replace the hydraulic oil filter element every 500 operating hours.

6.3 Table of fuels and lubricants

Assembly	Fuel or lubricant		Spare parts number	Filling quantity
	Summer	Winter		Observe the level marks!
Engine oil	SAE 10W/-40 Specification: *Chapter 6.2.1 'Engine oil' on page 104*		009 920 06 20 l	6.5 l (1.7 gal us)
	SAE 10W-30			
	SAE 15W-40			
	SAE 30			
Fuel	Diesel	Winter diesel fuel		35 l (9 gal us)
	Specification: *Chapter 6.2.2 'Fuel' on page 106*			
Coolant	Mixture of water and anti-freeze agent Specification: *Chapter 6.2.3 'Coolant' on page 107*		009 940 08 20 l	6 l (1.6 gal us)
Hydraulic system	Hydraulic oil (ISO), HLP 46 Specification: *Chapter 6.2.4.1 'Mineral oil based hydraulic oil' on page 109*		009 930 09 20 l	35 l (9 gal us)
	or ester based biodegradable hydraulic oil Specification: *Chapter 6.2.4.2 'Bio-degradable hydraulic oil' on page 109*			
Sprinkler system	Water	Anti-freeze mixture		205 l (54 gal us)

6.4 Running-in instructions

6.4.1 General

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

NOTICE!

Danger of engine damage!

– 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.

6.4.2 After 50 operating hours

Check the engine for leaks.

Tighten all bolted connections on air intake, exhaust, oil sump and engine mounts

Retighten the bolted connections on the machine.

6.5 Maintenance table

6.6 Every 10 operating hours

6.6.1 Check the engine oil level

NOTICE!

The machine must be in horizontal position.

When the engine is warm, shut it down and check the oil level after five minutes.

With a cold engine the oil level can be checked immediately.

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

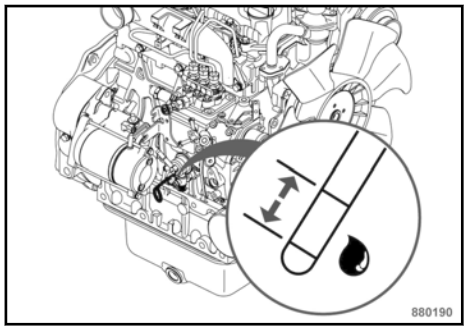


Fig. 86

Pull the dipstick ↳ Fig. 86 out, wipe it off with a lint-free, clean cloth and reinsert it until it bottoms.

Pull the dipstick back out.

The oil level must always be between the "MIN"- and "MAX"-marks.

If the oil level is too low top up oil immediately.

If the oil level is too high, determine the cause and drain the oil off.

6.6.2 Checking the fuel level

NOTICE!

Always top fuel up in due time.

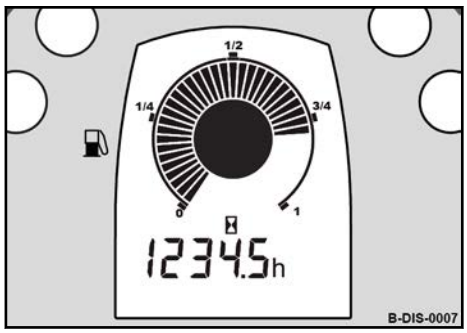


Fig. 87

Check the fuel level on the fuel gauge.

Refuel, shut the engine down to do so.

Refuelling

WARNING!
Fire hazard!
When working on the fuel system do not use open fire, do not smoke, do not spill any fuel.

Do not refuel in closed rooms.

Shut down the engine.

WARNING!
Health hazard!
Do not inhale any fuel fumes.

NOTICE!
Contaminated fuel can cause malfunction or even damage of the engine. If necessary, fill in fuel through a funnel with screen.

Monitor the entire refuelling process.

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

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

Shut down the engine.

Open the engine hood.

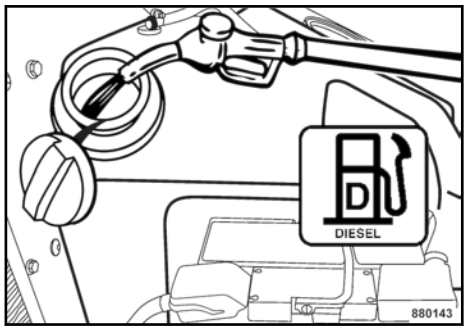


Fig. 88

Clean the area around the filler opening.

Open the fuel tank cover ↳ Fig. 88.

Top up with fuel (diesel or winter diesel).

Screw the fuel tank cover back on.

6.6.3 Checking the hydraulic oil level

NOTICE!

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.

In hydraulic systems filled with Panolin Synth. 46 use only the same oil to top up. With other ester based oils consult the lubrication oil service of the respective oil manufacturer.

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

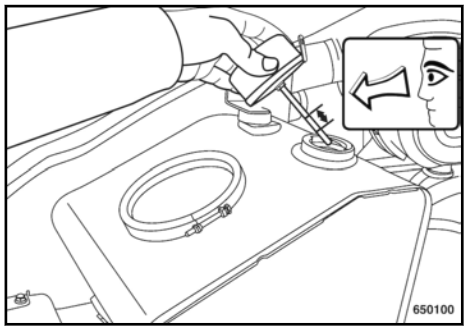


Fig. 89

Check the oil level on the dipstick. The oil level must be between the "MIN" and "MAX" marks ↳ Fig. 89.

If the oil level is too low top up hydraulic oil immediately.

6.6.4 Checking the hydraulic oil filter element

NOTICE!

If the hydraulic oil is very cold the pin may pop up, you should therefore only check the filter and press the pin in at operating temperature.

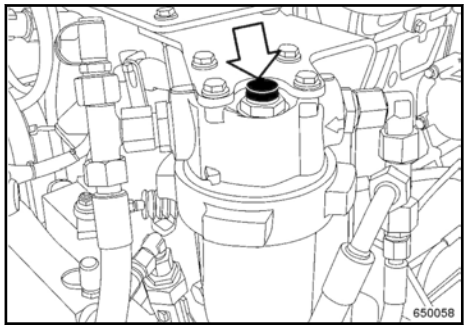


Fig. 90

Check the contamination indicator ↳ Fig. 90 at operating temperature and with the engine running at maximum speed.

If necessary press the pin in.

Pin remains pressed in	Hydraulic oil filter element o.k.
Pin pops out	Replacing the hydraulic oil filter element

6.6.5 Check the coolant level

WARNING!

Danger of scalding!

Open the cap on the coolant compensation tank only when the engine is cold.

NOTICE!

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

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

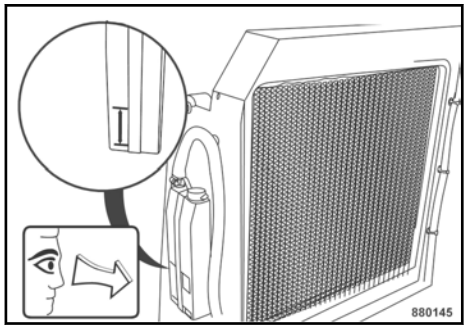


Fig. 91

Check the coolant level in the compensation tank ↳ Fig. 91.

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

6.6.6 Checking the water level

NOTICE!

If there is a risk of frost observe the special service instructions in chapter "water sprinkler system, maintenance in case of frost".

Make sure that the ventilation bore in the filler cap is free.

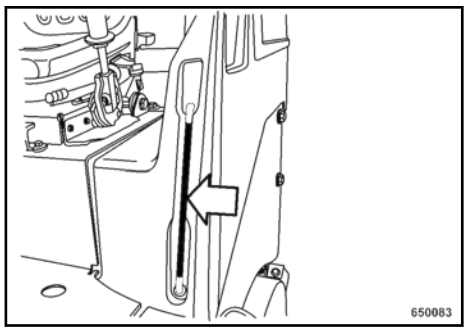


Fig. 92

Check the water tank filling level on the water level gauge ↳ Fig. 92.

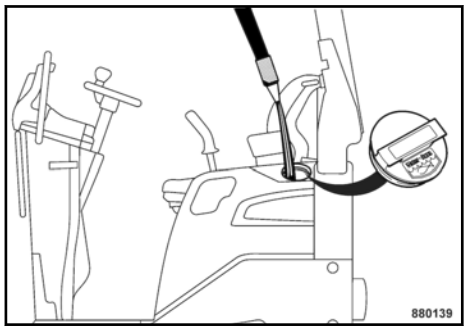


Fig. 93

Remove the water tank cover ↳ Fig. 93.

If necessary fill in water through the filler screen and close the cap again.

6.7 Every 50 operating hours

6.7.1 Check, clean the air filter, replace if necessary

NOTICE!

Do not start the engine after having removed the air filter.

If necessary, the air filter may be cleaned up to six times. After one year at the latest it must be replaced together with the safety element.

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

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

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

Do not continue to use a damaged air filter element. If in doubt use a new air filter.

If the air filter is damaged, the safety element must be replaced as well.

The safety element must not be cleaned.

We generally recommend to renew the air filter. A new filter element is far less expensive than a possible engine damage.

Open the engine hood.

Under very dusty conditions you may have to check the filter service indicator every day.

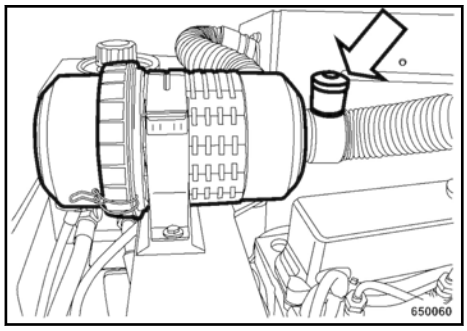


Fig. 94

Service of the dry air filter is due when the red piston of the filter service indicator ↳ Fig. 94 reaches into the transparent window.

NOTICE!

After cleaning the air filter press the reset button for the red piston on the filter service indicator.

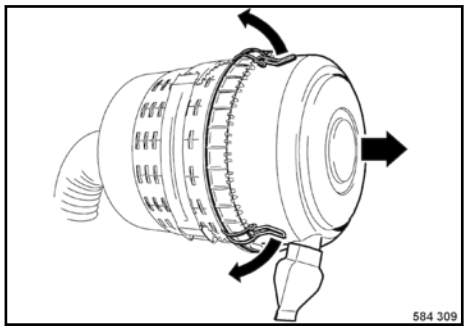


Fig. 95

Loosen both locking hooks ↳ Fig. 95 on the housing cover and take the cover off.

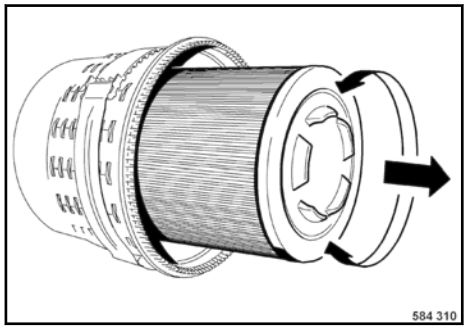


Fig. 96

Pull out the main filter element ↳ Fig. 96 with light turning movements.

Clean housing cover and dust discharge valve.

WARNING!

Danger of injury!

Wear protective clothing (goggles, gloves).

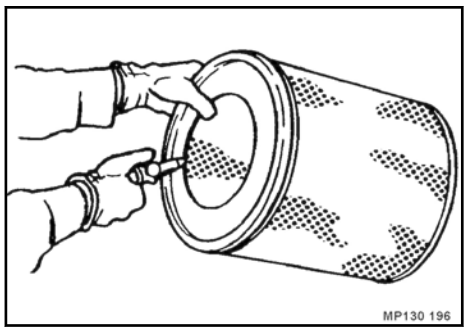


Fig. 97

Blow the air filter ↳ Fig. 97 out with dry compressed air (max. 2.1 bar (30 psi)) from inside to outside by moving the gun up and down inside the element, until it if free of dust.

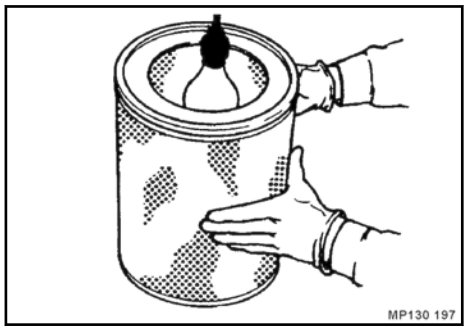


Fig. 98

Examine the air filter with a torch for cracks and holes in the paper bellows ↳ Fig. 98.

In case of damage replace the air filter and the safety element.

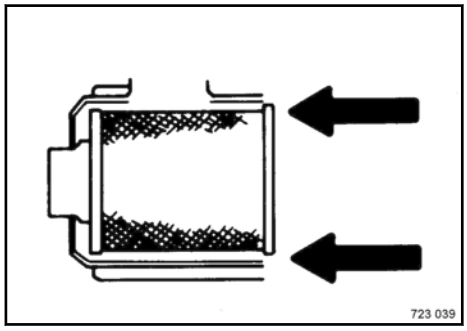


Fig. 99

Slide the air filter carefully into the housing ↳ Fig. 99.

NOTICE!

The dust discharge valve must point vertically downwards.

Make sure that the cover locks engage correctly.

Reassemble the housing cover.

Replacing the safety filter element

NOTICE!

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

The safety element must be replaced:

if the air filter is damaged or has been replaced replaced.

at the latest after 1 year.

if the red piston of the filter service indicator is visible again after the air filter has been cleaned.

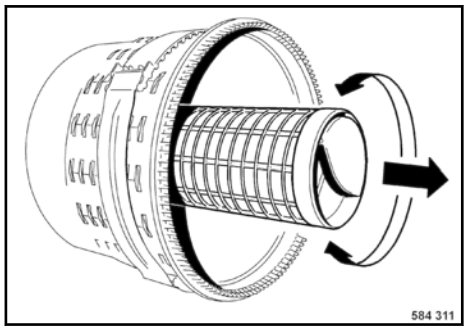


Fig. 100

Remove the housing cover and pull the air filter off.

Pull the safety element ↳ Fig. 100 out by turning it lightly.

Push in a new safety filter element.

Insert the air filter and reassemble the housing cover.

6.7.2 Checking fuel lines and clamps

WARNING!

Danger of burning!

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

NOTICE!

If fuel lines or hose clamps are found to be damaged, the corresponding parts must be immediately repaired or replaced.

Removed or new fuel lines must be closed with clean cloths on both ends, to make sure that no dirt will enter into the fuel system. Dirt particles can destroy the injection pump.

Check the condition and tight fit of all fuel lines and hose clamps.

6.7.3 Check, clean the water separator

WARNING!
Fire hazard!
When working on the fuel system do not use open fire, do not smoke. Do not spill any fuel.

Shut down the engine.

WARNING!
Health hazard!
Do not inhale any fuel fumes.

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.

ENVIRONMENT!

Any fuel must be caught and disposed of in an environmentally friendly manner.

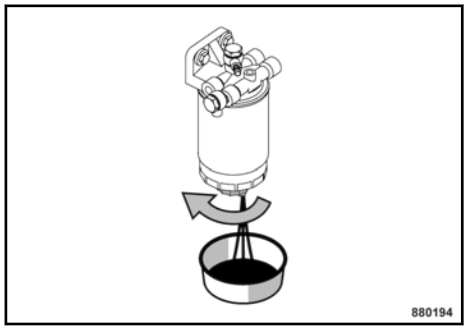


Fig. 101

Slacken the drain plug ↳ Fig. 101 for a few turns and catch running out fuel / water.

Tighten the drain plug again and check for leaks, if necessary replace the seal ring.

6.8 Every 250 operating hours

6.8.1 Changing engine oil and oil filter cartridge

Perform this maintenance work at the latest after one year.

WARNING!
Danger of scalding!
When draining off hot oil.

By hot oil when unscrewing the engine oil filter.

NOTICE!

The oil change at 250 operating hours refers to the use of fuels with a sulphur content of less than 0.5%.When using fuels with a sulphur content of more than 0.5% the oil change intervals must be halved.

Drain the engine oil only when the engine is warm.

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

ENVIRONMENT!

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

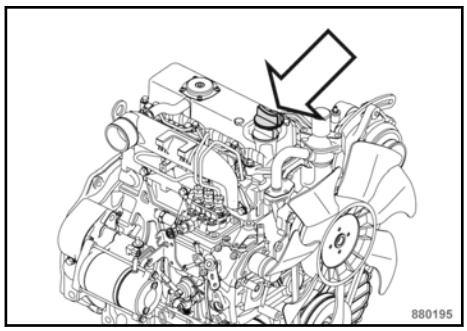


Fig. 102

Unscrew the oil filler plug ↳ Fig. 102.

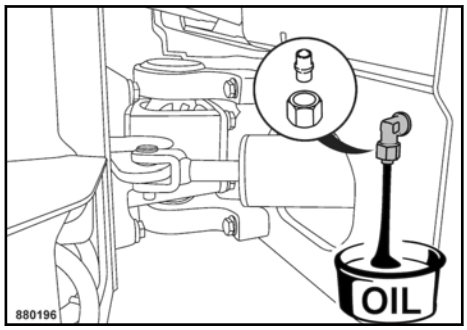


Fig. 103

Unscrew the drain plug ↳ Fig. 103 and catch running out oil.

Turn the plug tightly back in.

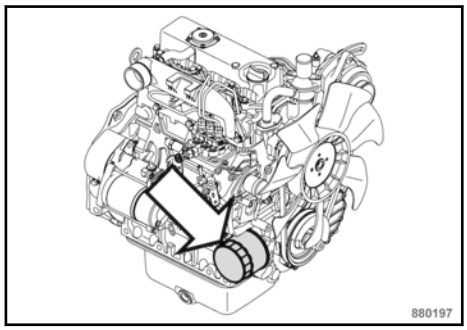


Fig. 104

Unscrew the filter cartridge ↳ Fig. 104 using an appropriate filter wrench.

Clean the sealing face on the filter carrier from any dirt.

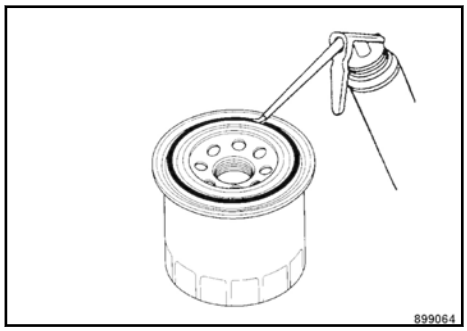


Fig. 105

Slightly oil the rubber seal on the new filter cartridge ↳ Fig. 105.

Turn the new filter cartridge on by hand, until the seal contacts.

Tighten the filter element for another half turn.

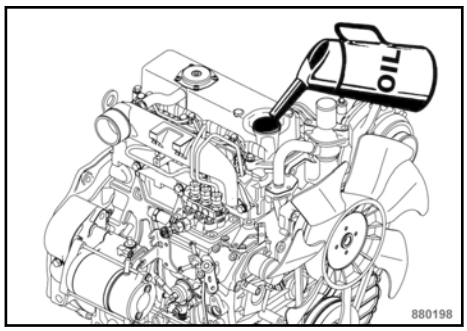


Fig. 106

Fill in new engine oil ↳ Fig. 106.

Tighten the oil filler cap properly.

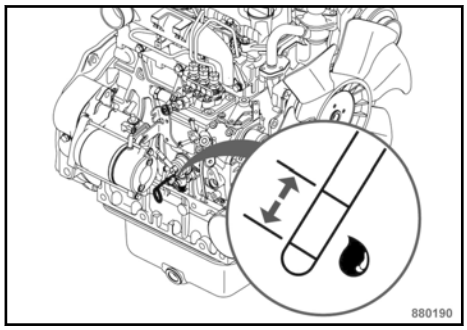


Fig. 107

After a short test run check the oil level once again ↳ Fig. 107, if necessary top up to the top mark (MAX).

6.8.2 Check, tension, replace the V-belt

Checking the V-belt

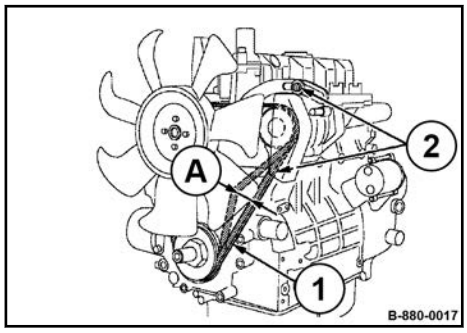


Fig. 108

Inspect the entire circumference of the V-belt (1) visually for damage and cracks.

Replace a damaged or cracked V-belt immediately.

Check with thumb pressure whether the V-belt can be depressed by approx.
7 to 9 mm (0.28 – 0.35 inch) between the V-belt pulleys (A), retighten if necessary.

Tightening the V-belt

Slightly slacken the fastening screws (2) .

Press the generator in direction outward using a lever, until the correct V-belt tension is reached.

Retighten all fastening screws and check the V-belt tension once again.

Replacing the V-belt

Slightly slacken the fastening screws (2) .

Press the generator completely against the engine.

Remove the old V-belt.

Fit the new V-belt to the V-belt pulleys.

Tension the V-belt as previously described.

6.8.3 Check the air intake lines

WARNING!

Danger of burning!

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

NOTICE!

Take care that no contaminants enter into the air intake system, since this could damage the engine!

If an air intake hose is damaged, both hose and hose clamp must be replaced immediately.

Check the condition and tight fit of all air intake lines and hose clamps.

6.8.4 Cleaning radiator and hydraulic oil cooler

WARNING!
Danger of injury!
Perform cleaning work only after the engine has cooled down and with the engine stopped.

NOTICE!
Do not damage any cooling fins on the cooler core when cleaning.

Dirt on fan blades and radiator 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 radiator and clean the cooling surfaces after.

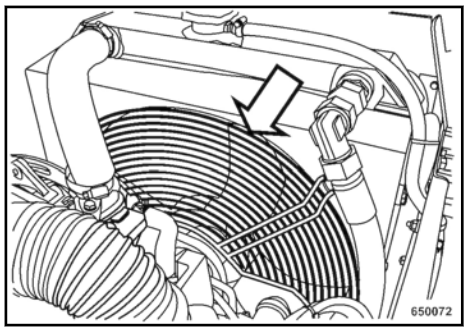


Fig. 109

Open the engine hood.

Remove the fan grille ↳ Fig. 109.

Blow the radiator out with compressed air.

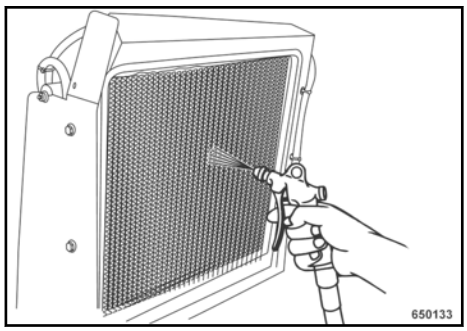


Fig. 110

Blow the cooler ↳ Fig. 110 out with compressed air.

Cleaning with cold cleansing agent

NOTICE!

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

Spray engine and cooler 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.

Reassemble the fan grille.

Run the engine warm for a while to avoid corrosion.

6.8.5 Battery service

WARNING!

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!

For recharging remove the plugs from the battery to avoid the accumulation of highly explosive gases.

ENVIRONMENT!

Dispose of the old batteries environmentally.

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 quick 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.

NOTICE!

Exhausted batteries (batteries with formation of sulphate on the plates) are not covered under warranty!

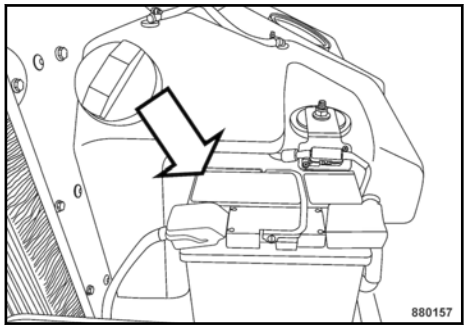


Fig. 111

Open the engine hood.

Clean battery ↳ Fig. 111 and battery compartment.

Clean battery poles and pole clamps and grease them with pole grease (Vaseline).

Retighten the pole clamps.

Check the fastening of the battery.

6.8.6 Checking radiator hoses and hose clamps

WARNING!
Danger of burning!
Perform inspection work only after the engine has cooled down and with the engine stopped.

NOTICE!
If a radiator hose is swollen, hardened or cracked, both hose and hose clamp must be replaced immediately.

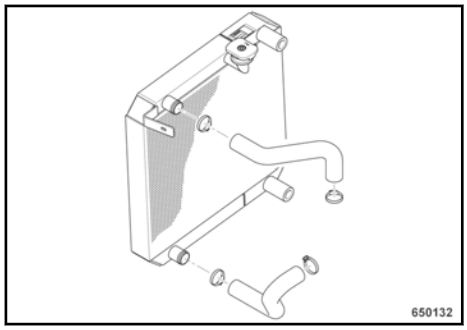


Fig. 112

Check the condition and tight fit of all radiator hoses and hose clamps ↳ Fig. 112.

6.8.7 Check the scrapers, adjust if necessary

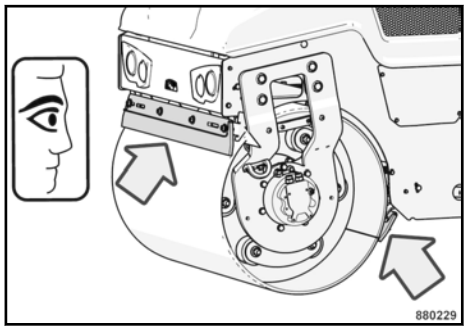


Fig. 113

Open the flap.

Check the scrapers (two each per drum), clean or replace if necessary ↳ Fig. 113.

6.8.8 Check the parking brake

WARNING!
Life hazard!
Before checking the parking brake make sure that there are no persons or obstacles in front or behind the machine.

Park the machine on level ground.

Stop the machine on level ground and shut down the engine.

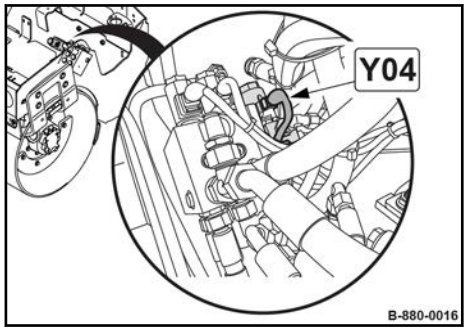


Fig. 114

Open the engine hood and pull the plug (**Y04**) off the solenoid valve for the parking brake, to prevent the parking brake from being opened.

Close the engine hood.

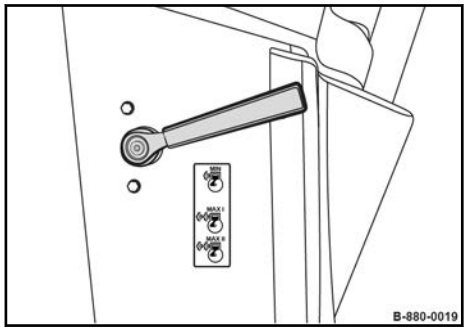


Fig. 115

Set the throttle lever to position "MIN".

Start the engine.

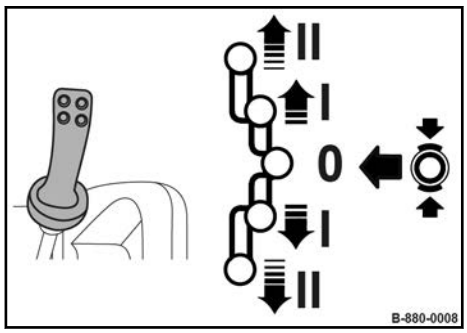


Fig. 116

Shift the travel lever out of parking brake position and move it backwards first.

Then shift the travel lever forward.

WARNING!

Danger of accident!

The machine should not move during this test!

If the machine moves you must examine and possibly repair the brake system.

In this condition the machine is not safe and must immediately be taken out of operation. Only operate the machine after the travel control has been repaired.

Inspections or repairs in the brake system must only be carried out by authorized service personnel.

Shift the travel lever slowly back to neutral position and lock it in parking brake position.

Shut down the engine.

Open the engine hood.

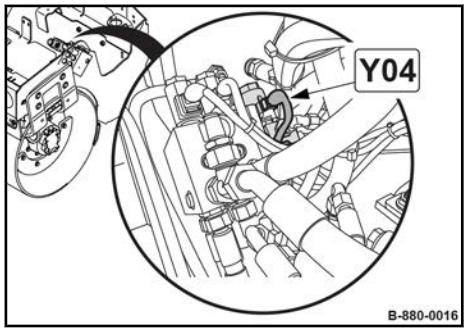


Fig. 117

Reconnect the plug (**Y04**) to the solenoid valve for the parking brake.

Close the engine hood.

6.9 Every 500 operating hours

6.9.1 Drain the fuel tank sludge

WARNING!
Fire hazard!
When working on the fuel system do not use open fire, do not smoke, do not spill any fuel.

WARNING!
Health hazard!
Do not inhale any fuel fumes.

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

When performing this work the fuel tank shall only hold max. 5 l (1.3 gal us) of fuel, pump off if necessary.

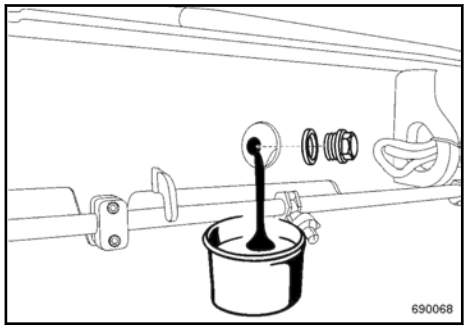


Fig. 118

Place the suitable container under the fuel tank drain plug↳ Fig. 118.

Unscrew the plug and drain off fuel.

Once all fuel has run out screw the drain plug back in with a new seal ring.

Fill the fuel tank with clean fuel.

6.9.2 Replacing the fuel filter

WARNING!
Fire hazard!
When working on the fuel system do not use open fire, do not smoke, do not spill any fuel.

WARNING!
Health hazard!
Do not inhale any fuel fumes.

ENVIRONMENT!
Catch running out fuel and dispose of environmentally together with the fuel filters.

Replacing the fuel pre-filter.

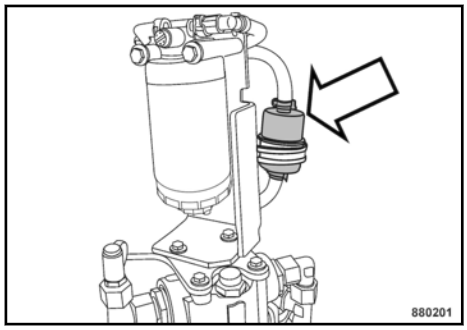


Fig. 119

Unscrew the hose clamps on the fuel pre-cleaner ↳ Fig. 119.

Pull the fuel filter out of the hoses.

Install the new fuel pre-filter and observe the flow direction (arrow).

Fasten the hose clamps.

Replace the fuel filter

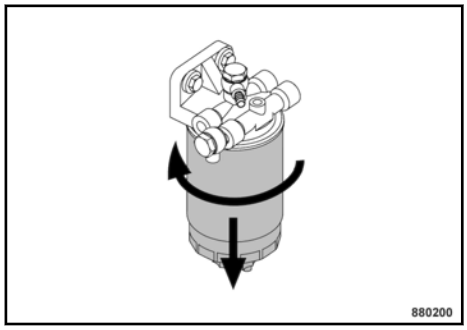


Fig. 120

Slacken and unscrew the fuel filter cartridge ↳ Fig. 120.

Clean the sealing face on the filter carrier from any dirt.

Apply a thin film of fuel to the seals and screw the new filter cartridge on hand-tight.

6.9.3 Check the anti-freeze concentration and the condition of the coolant

WARNING!
Danger of scalding!
Check the anti-freeze concentration only when the engine is cold.

NOTICE!

In order to avoid damage to the engine (e.g. by corrosion, cavitation and freezing), particular attention must be paid to the inspection of the coolant.

For coolant quality refer to the "table of fuels and lubricants".

Do not mix different coolants and additives, see section "Fuelds and Lubricants - Coolant".

If the coolant is contaminated by corrosion residues or other suspended matter, flush the cooling system, see section "Changing the coolant".

ENVIRONMENT!

Catch coolant and dispose of environmentally.

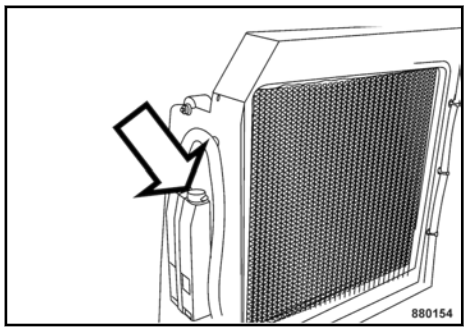


Fig. 121

Remove the cap ↳ Fig. 121 from the coolant compensation tank and check the anti-freeze concentration with a conventional tester.

Check the condition of the coolant.

Screw the cap back on.

6.10 Every 1000 operating hours

6.10.1 Check, adjust the valve clearance

NOTICE!

We recommend to have this work carried out by trained personnel or our after sales service.

Check and adjust only when the engine is cold.

The first cylinder is the one nearest to the cooling fan side.

Adjustment value for intake and exhaust valves: 0.18 - 0.22 mm (0.007 - 0.009 in)

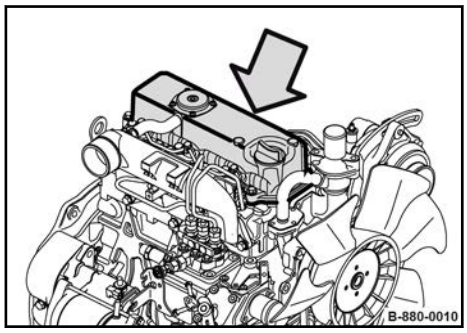


Fig. 122

Shut down the engine.

Remove the valve covers.

Crankshaft position 1

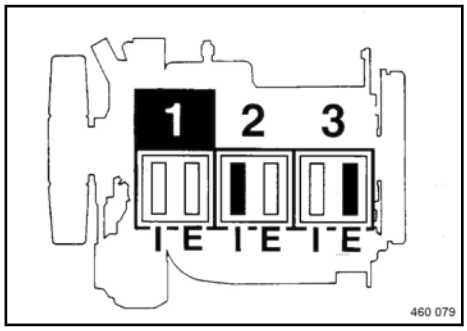


Fig. 123: Crankshaft position 1

I Intake valve

Crank the engine with the starter or a spanner by the V-belt pulley until both valves on cylinder 1 are “overlapping”.

Overlapping means: Exhaust valve not yet closed, intake valve starts to open.

Check the valve clearance on the valves marked black.

E Exhaust valve

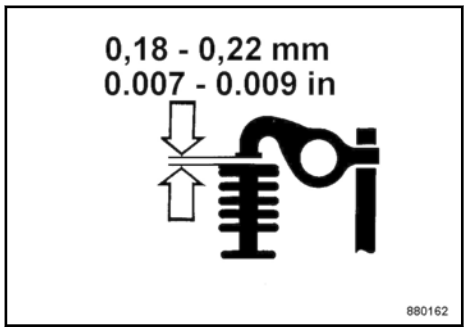


Fig. 124

A feeler gauge of appropriate thickness must fit with little resistance between rocker arm and valve.

If the gap is too narrow or too wide for the feeler gauge, the valve must be adjusted.

Crankshaft position 2

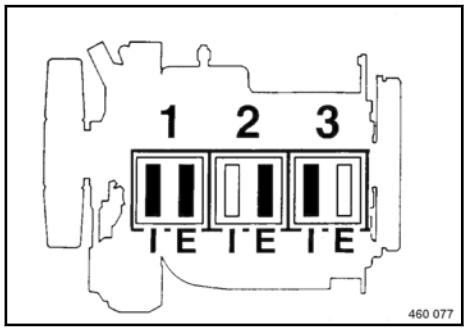


Fig. 125: Crankshaft position 2

I Intake valve
E Exhaust valve

Turn the crankshaft one revolution (360°) further.

Check the valve clearance on the valves marked black, adjust if necessary.

Install the cylinder head cover with a new gasket.

After a short test run check the engine for leaks.

6.10.2 Checking the engine mounts

Check air intake and exhaust manifold fastenings for tight fit.

Check sockets and clamps on the air filter for tight fit and leak tightness.

Check fastening and tightness of the lubrication oil sump.

Check condition and tight fit of engine mounts.

6.10.3 Check the travel control

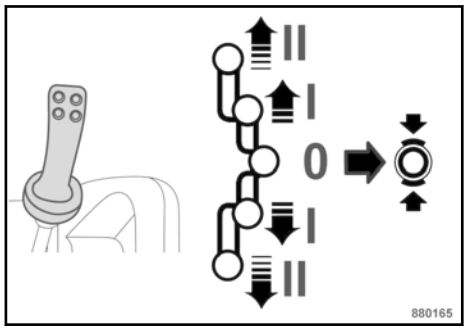


Fig. 126

Move the travel lever ↳ Fig. 126 forward, backwards and to braking position. Thereby check for function, light movement, clearance and damage.

In case of malfunction perform trouble shooting and replace the corresponding parts.

NOTICE!

Only operate the machine after the travel control has been repaired.

6.11 Every 2000 operating hours

6.11.1 Changing hydraulic oil and breather filter

Perform this maintenance work at the latest after two years.

See also the notes on the hydraulic system in the chapter "General notes on maintenance".

WARNING!
Danger of scalding!
When draining off hot hydraulic oil!

NOTICE!

The hydraulic oil must also be changed after major repairs in the hydraulic system.

Perform the oil change when the hydraulic oil is warm.

Replace the hydraulic oil filter elements with every hydraulic oil change.

Change the filter only after the hydraulic oil change and after the test run.

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

Do not start the engine after draining the hydraulic oil.

Do not use any detergents to clean the system.

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

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.

ENVIRONMENT!

Catch running out oil and dispose of environmentally.

Drive the machine, until the hydraulic oil has reached operating temperature.

Shut down the engine.

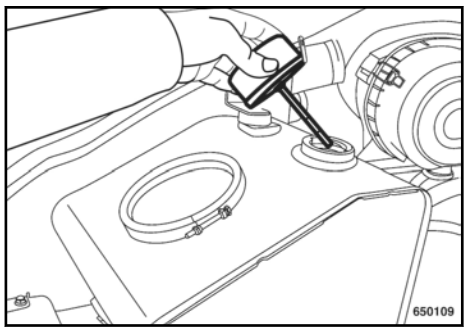


Fig. 127

Remove the cap from the hydraulic oil tank ↳ Fig. 127.

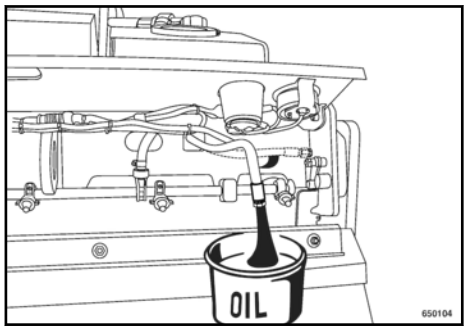


Fig. 128

Fold the front cover ↳ Fig. 128 up and take out the hose.

Unscrew the drain plug from the hydraulic oil tank, drain off and collect all hydraulic oil.

Tighten the drain plug again, fasten the hose.

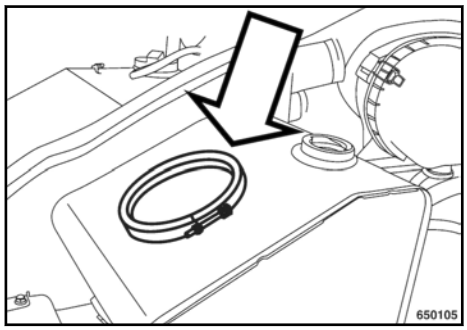


Fig. 129

Loosen the strap ↳ Fig. 129 on the hydraulic oil tank and take it off with the cover.

Wipe the inside of the hydraulic tank clean with the lint-free cloth.

NOTICE!

Do not use any detergents. This will contaminate the hydraulic oil!

Attach the cover and tighten the strap.

We recommend to use our filling and filtering unit with fine filter to fill the system. This ensures finest filtration of the hydraulic oil, prolongs the lifetime of the hydraulic oil filter and protects the hydraulic system.

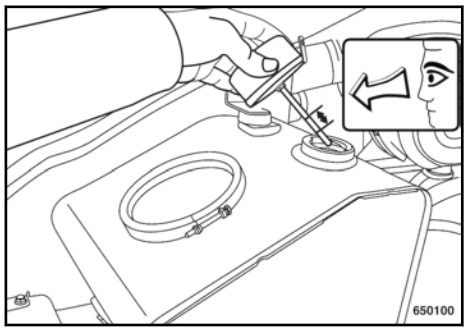


Fig. 130

Fill in new hydraulic oil ↳ Fig. 130.

Check the oil level on the dipstick. The oil level must be between the "MIN" and "MAX" marks ↳ Fig. 130.

Close the tank with a new cover.

Perform a test run and check the system for leaks.

The breather filter for the hydraulic oil tank is integrated in the filler cap, you must therefore replace the complete filler cap.

6.11.2 Replacing the hydraulic oil filter

Perform this maintenance work at the latest after two years.

WARNING!
Danger of scalding!
Danger of scalding by hot oil when unscrewing the oil filter.

NOTICE!

If the filter has to be changed together with the hydraulic oil, the filter must only be changed after the oil change and after the test run.

Do not use the oil in the filter bowl again.

Visible dirt may be an early sign for the failure of system components and indicate the possible failure of components. In this case determine the cause and replace or repair the defective components, if necessary. Negligence may cause destruction to the entire hydraulic system.

Do not clean or reuse the filter element.

Apart from the normal oil change intervals, the filter element must also be changed after major repairs in the hydraulic system.

ENVIRONMENT!

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

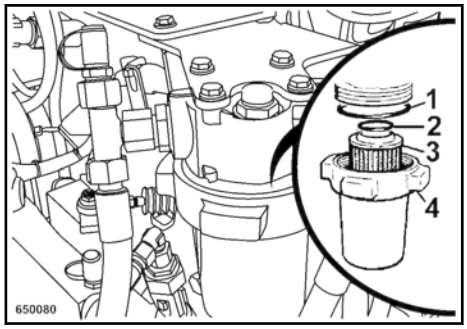


Fig. 131

Clean the area around the hydraulic oil filter.

Remove filter bowl (4) ↳ Fig. 131 with filter element (3).

Examine the surface of the filter element thoroughly for any visible dirt.

Take out the old filter element and clean filter bowl and thread.

Reassemble the filter bowl with a new filter element and new loop rings (1) and (2).

Changing the high pressure filter

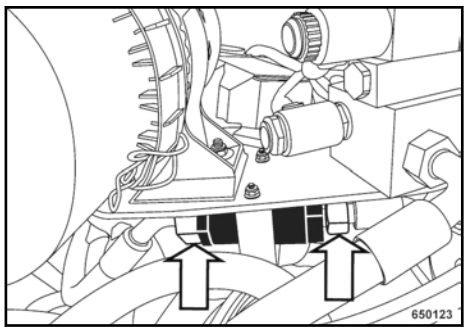


Fig. 132

Clean the area around the high pressure filter ↳ Fig. 132.

Disconnect the high pressure oil lines from the high pressure filter.

Remove the high pressure filter and assemble the new high pressure filter, pay attention to the flow direction (arrow).

Connect and tighten the hydraulic lines.

After a short test run check hydraulic oil filter and high pressure filter leaks.

6.11.3 Changing the coolant

Perform this maintenance work at the latest after two years.

WARNING!

Danger of scalding!

Change the coolant only when the engine is cold.

Do not remove the radiator cap when the engine is still hot.

Always wear gloves when handling anti-freeze agent.

NOTICE!

Always screw the radiator cap tightly back on (second detent).

Always fill the engine cooling system with an anti-freeze mixture (corrosion protection).

Do not use more than 50% anti-freeze.

Do not mix different coolants and additives of any other kind. If necessary flush the cooling system 2-3 times with clear water.

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

ENVIRONMENT!

Catch running out coolant and dispose of environmentally.

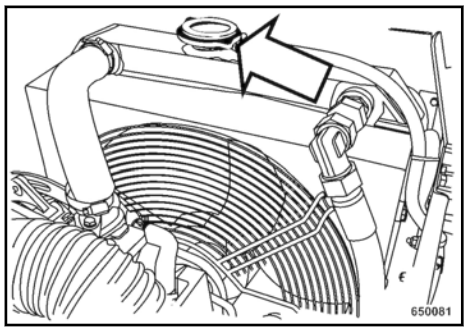


Fig. 133

Remove the radiator cap ↳ Fig. 133.

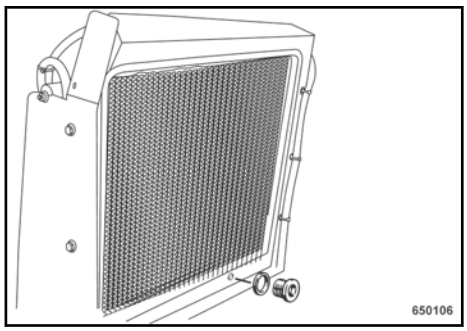


Fig. 134

Unscrew the coolant drain plug
↳ Fig. 134.

Drain the coolant completely off and collect it.

Close the drain plug again.

Check the condition of radiator hoses, if necessary replace all radiator hoses.

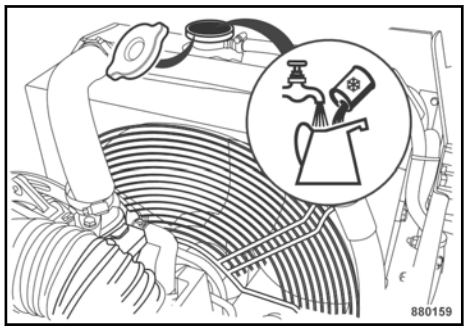


Fig. 135

Fill in coolant until the level reaches the bottom edge of the filler socket
↳ Fig. 135 .

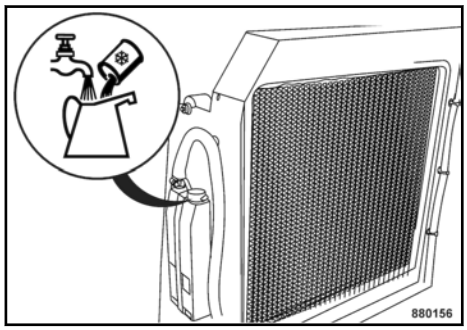


Fig. 136

Fill in coolant up to the MAX mark
↳ Fig. 136.

Reattach the radiator cap and the cap of the compensation tank.

Start the diesel engine and run it warm to operating temperature.

Let the engine cool down and check the coolant level again, if necessary top up in the compensation tank.

6.11.4 Replacing the fuel lines

WARNING!
Fire hazard!
When working on the fuel system do not use open fire, do not smoke, do not spill any fuel.

WARNING!
Health hazard!
Do not inhale any fuel fumes.

NOTICE!
For safety reasons this work should be performed every two years.

Hoses consist of rubber or plastic material and age over the course of time.

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

Replace all fuel hoses, including their hose clips.

6.11.5 Check the injection valves

NOTICE!
This work must only be performed by authorized service personnel.

6.12 Every 3000 operating hours

6.12.1 Check the fuel injection pump

NOTICE!

This work must only be performed by authorized service personnel.

6.13 As required

6.13.1 Water sprinkler system, maintenance in case of frost

NOTICE!

If there is a risk of frost the water sprinkler system must be emptied or filled with an anti-freeze mixture.

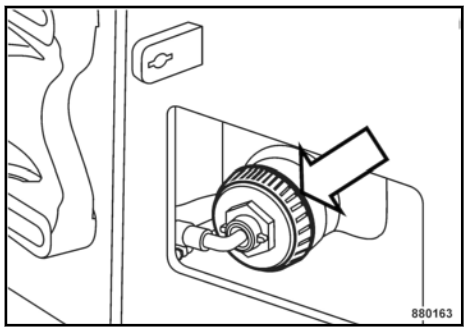


Fig. 137

Unscrew the screw plug for water provision on the rear frame left hand side and allow all water to run out, then screw the screw plug back in again.

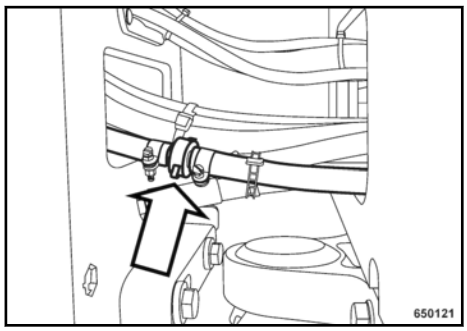


Fig. 138

Open the sprinkling system line connection and let all water run out and close all hose connections again.

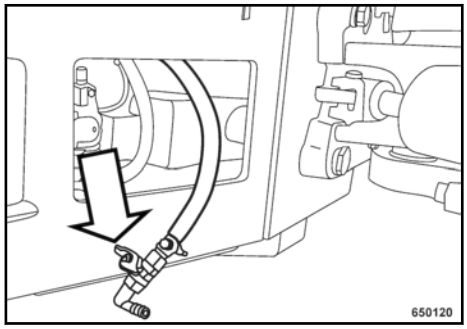


Fig. 139

Route the hose on the rear frame to the outside, open the water drain tap and let all water run out.

Switch on the pressure sprinkling system for a short while and drain the water from the pump.

Close the drain tap again and reroute the hose.

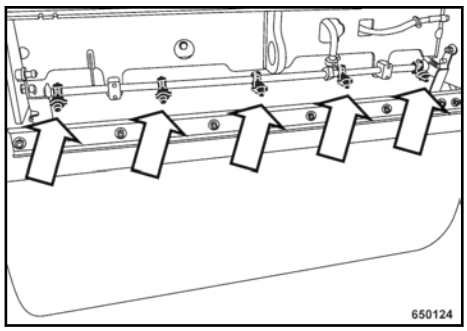


Fig. 140

Unscrew the water sprinkling nozzles at front and rear and let all water run out.

Screw the nozzles back in before using the machine the next time.

6.13.2 Tightening torques for screws with metric unified thread

Bolt dimensions	Tightening torques* ft - lb		
	8.8	10.9	12.9
M4	2	3	4
M5	4	7	7
M6	7	11	13
M8	18	26	33
M10	37	55	61
M12	65	91	108
M14	101	145	173
M16	156	221	264
M18	213	303	361
M20	304	426	513
M22	413	559	695
M24	524	738	885
M27	774	1092	1308
M30	1047	1482	1770

Fig. 141

* Strength classes for screws with untreated, non-lubricated surface. The quality designation of the screws is stamped on the screw heads.

8.8 = 8G

10.9 = 10K

12.9 = 12K

The values result in a 90%ige utilization of the screws yield point, at a coefficient of friction of tot. = 0,14.

The compliance with the specified tightening torques is checked with torque wrenches.

The specified tightening torques do not apply when using a MoS_2 lubricant.

Self locking nuts must always be replaced by new ones after they have been unscrewed.

6.13.3 Engine conservation

NOTICE!

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

Depending on the weather condition these conserving measures will provide protection for approx. 6 - 12 months.

The conserving oil must be replaced by engine oil (refer to the section "Fuels and lubricants") according to the API- (MIL) classification before taking the machine into operation.

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

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

Clean the engine, including the cooling system: With cold cleansing agent and a water jet or, even better, with steam cleaning equipment

Run the engine warm and shut it down.

Drain the still warm engine oil and fill in anti-corrosion engine oil.

Drain the fuel from the fuel tank, mix it well with 10% anti-corrosion oil and fill it in again. Instead of mixing anti-corrosion oil to the fuel the tank may also be filled with injection pump testing oil with anti-corrosive properties (e.g. Calibration Fluid B).

Run the engine for 10 minutes until all lines, filter, pump and nozzles are filled with the conserving mixture and the new engine oil is distributed to all parts.

After this run remove the cylinder head cover and spray the rocker chamber with a mixture of diesel fuel and 10% anti-corrosion oil. Reassemble the hood.

Now crank the engine several times (throttle lever in stop-position) to spray the combustion chamber.

Take the V-belt off and spray the grooves on the V-belt pulleys with anti-corrosion oil. Remove the anti-corrosion oil before restarting the machine.

Close the air intake opening on the air filter and the exhaust opening.

7 Trouble shooting

7.1 General notes

Please observe strictly the safety regulations in the corresponding section of these operating and maintenance instructions.

Malfunctions are frequently caused by incorrect operation of the machine or insufficient maintenance. Whenever a fault occurs you should therefore thoroughly read these instruction on correct operation and maintenance.

If you cannot locate the cause of a fault or rectify it yourself by following the trouble shooting chart, you should contact our customer service department.

7.2 Starting with jump wires

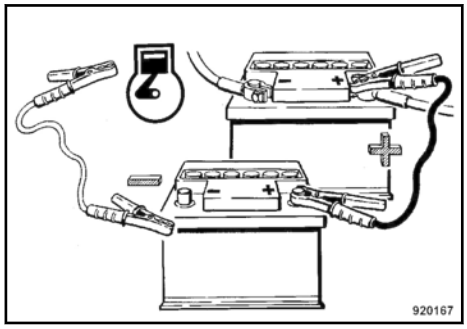


Fig. 142

NOTICE!

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

Only use a 12 Volt battery to bridge the machine.

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 battery and then to engine or chassis ground, as far away from the battery as possible↳ Fig. 142.

Start as described under 'Starting the engine'.

Once the engine is running switch on a powerful consumer (working light, etc.).

NOTICE!

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.

7.3 Engine problems

Fault description	Cause	Remedy
No or poor starting of engine	Fuel tank empty	Fill fuel tank
	Fuel filter clogged, in winter due to paraffin separation	Change the fuel filter, use winter fuel
	Fuel lines leaking	Check all line connections for leaks and tighten the fittings, bleed the fuel system
	Travel lever not in "0"-position	Shift the travel lever to position "0".
	Battery discharged or not connected, battery power too low	Charge the battery, clean the terminal clamps, tighten and cover them with acid-free grease, have battery tested
	Emergency stop push button is locked	Unlock the emergency stop switch
	Especially in winter: use of too viscous engine oil	Use the correct engine oil for the ambient temperatures
Engine runs irregularly with poor power	Fuel supply too low, fuel system clogged by paraffin separation (winter operation)	Change the fuel filter, check line connections for leaks and tighten fittings, us winter fuel under cold conditions
	Injection valve or injection pump defective	Have examined by a specialist
	Air filter cartridge soiled	clean, if necessary use a new one
	Excessive play in throttle cable	Adjust the throttle cable, replace if necessary

Trouble shooting – Engine problems

Fault description	Cause	Remedy
Engine looses power and speed, excessive exhaust smoke	Engine oil level too high	Drain the oil down to the top dipstick mark
	Poor quality fuel	Use specified fuel
	Air filter dirty	clean, if necessary use a new one
	Poor compression because of burned or broken compression rings	Have compression rings and pistons examined by specialist.
	Injection valve defective	Have examined by a specialist
Engine overheating, engine must be shut down immediately!	Radiator heavily soiled	Clean the cooling fins
	Coolant level too low	Fill up coolant
	Injection valve defective	Have examined by a specialist
	Engine oil level too low	Fill up oil down to the top dipstick mark
	Injection pump displacement not correctly adjusted	Have corrected by a specialist
	Insufficient cooling air supply to the cooling fan	Remove any clogging from the cooling air duct
	V-belt loose or broken	Retighten or replace the V-belt
	Air filter cartridge soiled	clean, if necessary use a new one

Fault description	Cause	Remedy
Engine has too low oil pressure, engine must be immediately shut down!	Leaks in the lubrication system, oil level too low	Check fittings on oil lines and lubrication oil filter for leaks, if necessary tighten all fittings Fill up engine oil down to the top mark on the dipstick
	Engine oil with wrong SAE viscosity class	Change the engine oil
Charge control light lights up during operation	The generator does not charge the battery, because of defect on generator or regular	Have examined by a specialist

7.4 Fuse assignment

7.4.1 Notes on safety

WARNING!
Danger of injury by fire in the machine!
– Do not use fuses with higher ampere ratings and do not bridge fuses.

7.4.2 Central electrics

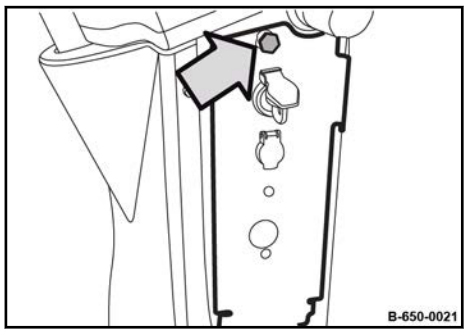


Fig. 143

Unscrew the fastening screws and fold out the central electrics against the end stop.

The printed circuit board is a equipped with a fuse test socket (Fuse Test). When plugging in an intact fuse an LED lights up.

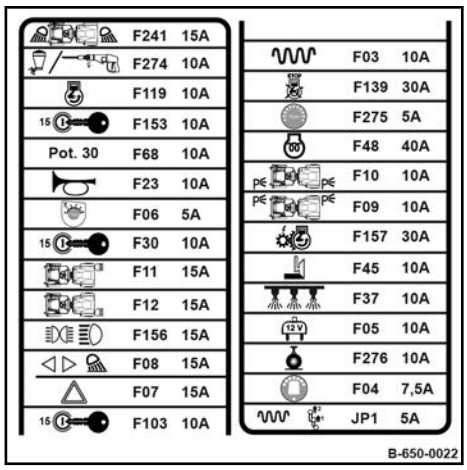


Fig. 144

Fuse	Amperage	Designation
F241	15 A	Optional headlights
F274	10 A	Precision spreader / hydraulic breaker
F119	10 A	Motor
F153	10 A	Potential 15
F68	10 A	Potential 30
F23	10 A	Warning horn
F06	5 A	Interval switch for pressure sprinkling system
F30	10 A	Potential 15
F11	15 A	Headlights, left
F12	15 A	Headlights, right
F156	15 A	Lighting
F08	15 A	Direction indicators and working head lights
F07	15 A	Hazard light system
F103	10 A	Potential 15
F03	10 A	Vibration
F139	30 A	Engine solenoid
F275	5 A	Economizer
F48	40 A	Preheating system

Fuse	Amperage	Designation
F10	10 A	Parking and tail light, right
F09	10 A	Parking and tail light, left
F157	30 A	Starter
F45	10 A	Edge cutter
F37	10 A	Sprinkling pump
F05	10 A	12 V socket
F276	10 A	Pump for emulsion sprinkling system
F04	7.5 A	Instruments
JP1	5 A	Vibration also with travel lever in position"II"

7.4.3 Main battery fuse

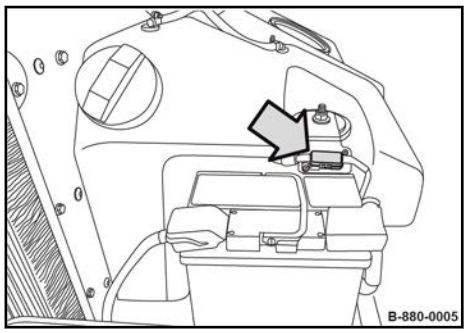


Fig. 145

Fuse	Amperage	Designation
F00	80 A	Main battery fuse

8 Disposal

8.1 Final shut-down of machine

If the machine can no longer be used and needs to be finally shut down you must carry out the following work and have the machine disassembled by an officially recognized specialist workshop.

WARNING!

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!

Remove the batteries and dispose of in compliance with legal regulations.

ENVIRONMENT!

Catch all fuels and lubricants, do not let them seep into the ground and dispose of in compliance with legal regulations.

Empty the fuel tank.

Drain the hydraulic oil tank.

Drain coolant from engine and cooling system.

Drain the lubrication oil from the engine.

WARNING!
Danger of explosion!
Parts that previously contained combustible fluids must not be cut with a cutting torch.

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