BOMAG
FAYAT GROUP

Operating Instruction
Maintenance Instruction

Original Operating Instructions

BW 100 AD-5

S/N 861 880 41 1180>

Tandem vibratory roller

008 202 52 EN

© 05/2018

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1 Introduction

1.1 Foreword

BOMAG manufactures machines for earth, asphalt and refuse compaction, stabilizers/ recyclers as well as planers and pavers.

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.

These operating and maintenance instructions are part of your machine.

They provide necessary information to operate your machine safely and properly.

They also contain information on required operating, maintenance and repair measures.

Carefully read the operating and maintenance instructions before taking your machine into operation.

Please observe the safety regulations strictly and follow all instructions to ensure safe operation.

If you are not yet acquainted with the controls and indicating elements on this machine, you should thoroughly read the corresponding chapter ↳ *Chapter 4 „Indicators and control elements“ on page 65*.

The description of the individual operating steps including the notes on safety to be followed can be found in chapter “Operation” ↳ *Chapter 6 „Operation“ on page 97*.

Before every start up, carry out all required visual inspections and function tests ↳ *Chapter 5 „Checks prior to start up“ on page 81*.

Ensure the compliance with the specified operating, maintenance and repair measures to maintain the functional safety of your machine.

A description of all necessary maintenance work, maintenance intervals as well as information on fuels and lubricants can be found in the chapter “Maintenance” *Chapter 8 „Maintenance“ on page 135*.

Do not service or repair your machine by yourself to avoid harming persons or damaging material or environment.

The machine must only be serviced and repaired by qualified and authorized personnel.

Contact our Customer Service to carry out the required maintenance work or necessary repairs.

In case of operating errors, inadequate maintenance or the use of unapproved fuels and lubricants all warranty claims will become null and void.

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

For your machine we offer 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, you can also order the spare parts catalogue against the serial number of your machine.

The above notes do not constitute an extension of the warranty and liability conditions specified in the general sales and delivery conditions of BOMAG GmbH.

We wish you successful work with your BOMAG machine.

1.2 Machine type plate and engine type plate

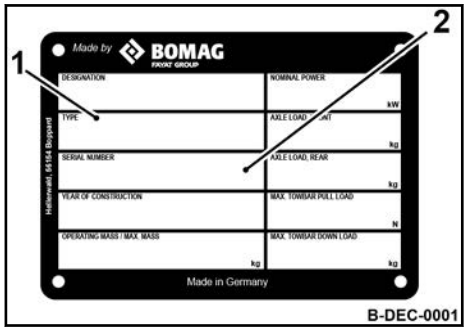

Fig. 1: Machine type plate (example)

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

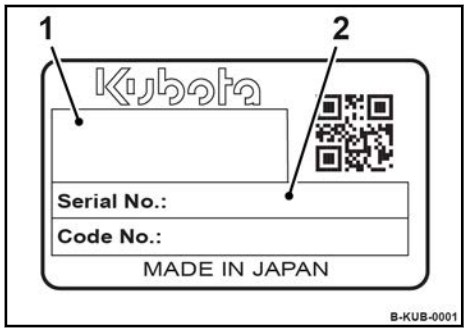

Fig. 2: Engine type plate (example)

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

2 Technical data

Dimensions

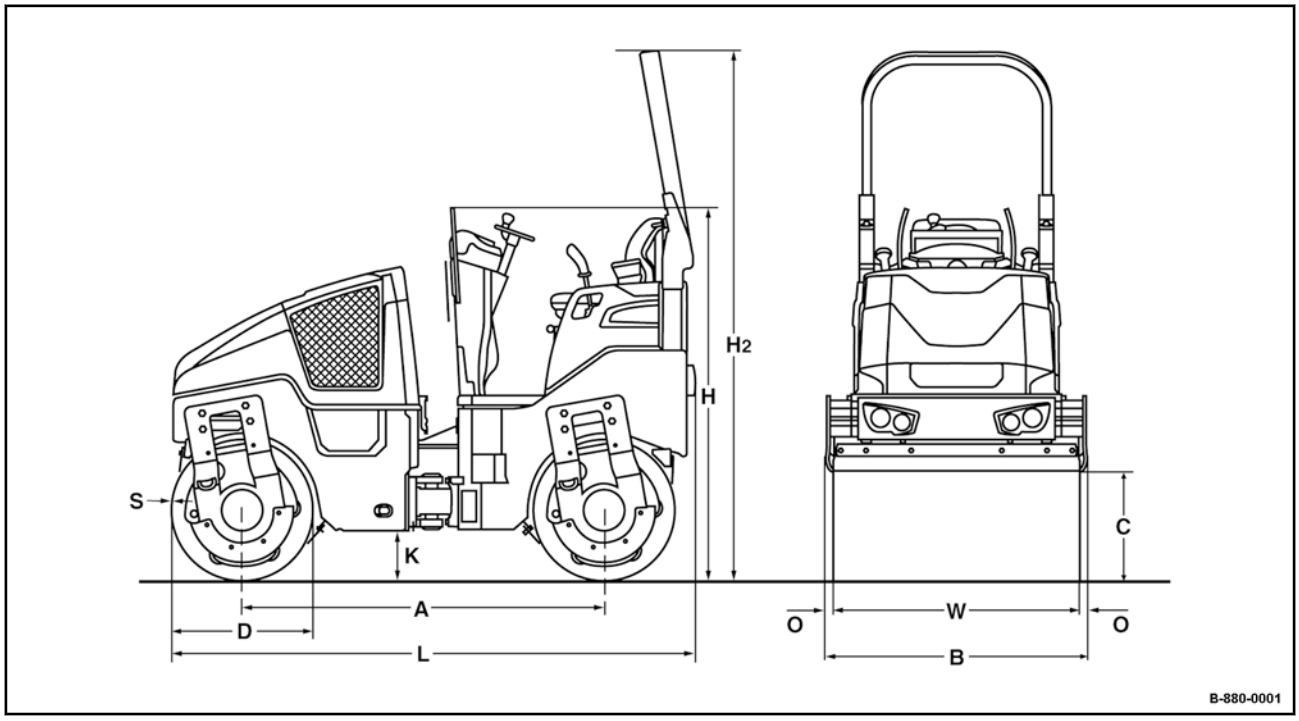

Fig. 3

A	B	C	D	H	H_2
1752 (69)	1072 (42)	523 (20.6)	700 (27.6)	1808 (71)	2568 (101)
Dimensions in millimetres (Dimensions in inch)					

K	L	O	S	W
254 (10.0)	2529 (100)	36 (1.4)	13 (0.5)	1000 (39)
Dimensions in millimetres (Dimensions in inch)				

Height with protective roof and flashing beacon *(optional equipment)*		2890 (114)	mm (in)

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

Technical data

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)	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	0.5 (0.02)	mm (in)
Centrifugal force (1/2)	30/34 (6744/7644)	kN (lbf)

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

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:

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

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

2.1.1 Noise data

Sound pressure level at the operator's stand

L_{pA} = 84 dB(A), determined acc. to ISO 11201 and EN 500.

WARNING!
Loss of hearing caused by too high noise burdens!
– Wear your personal protective equipment (ear protection).

Guaranteed sound power level

L_{WA} = 106 dB(A), determined acc. to ISO 3744 and EN 500

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 Concerning your safety

3.1 Basic prerequisites

3.1.1 General

This 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, the operating company must obtain the relevant signatures as confirmation.

Furthermore, the following obviously also applies:

- applicable accident prevention instructions,
- generally accepted safety and road traffic regulations,
- country/state specific safety regulations.

It is the duty of the operator to be acquainted with the safety regulations and to apply these accordingly. This also applies for local regulations and regulations concerning different types of handling activities. 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.

3.1.2 Explanation of signal words used:

DANGER!
Danger to life if failing to comply!
Sections marked accordingly indicate an extremely dangerous situation that could lead to fatal or severe injuries, if this warning is disregarded.

WARNING!
Danger to life or danger of severe injuries if failing to comply!
Sections marked accordingly indicate a dangerous situation that could lead to fatal or severe injuries, if this warning is disregarded.

CAUTION!
Danger of injury if failing to comply!
Sections marked accordingly indicate a dangerous situation that could lead to fatal or severe injuries, if this warning is disregarded.

NOTICE!
Danger of material damage if failing to comply!
Sections marked accordingly indicate possible dangers for machines or components.

Sections marked accordingly indicate technical information or notes on using the machine or its components.

ENVIRONMENT!

Environmental damage if failing to comply!

Paragraphs marked accordingly indicate practices for safe and environment-friendly disposal of fuels and lubricants as well as replacement parts.

3.1.3 Personal protective equipment

Depending on the work to be carried out, personal protective equipment is required (to be provided by the operating company):

	Working clothes	Tight fitting working clothes with low tear resistance, tight sleeves and without any projecting parts protect against being caught by moving components.
	Safety shoes	To protect against heavy falling parts and slipping on slippery ground.
	Protective gloves	To protect the hands against excoriation, punctures or deep injuries, against irritating and caustic substances as well as against burns.
	Safety goggles	To protect the eyes against airborne particles and squirting fluids.

	Face protection	To protect the face against airborne particles and squirting fluids.
	Hard hat	To protect the head against falling parts and to protect against injuries.
	Hearing protection	To protect hearing against excessive noise.
	Respiratory protection	To protect respiratory tracts against substances or particles.

3.1.4 Intended use

This machine must only be used for:

- Compaction of bituminous material, e.g. road surface layers,
- Compaction work in earth construction and road bases.

Intended use also includes compliance with the specified operating, maintenance and repair measures.

3.1.5 Improper 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 improper use is the sole responsibility of the operating company or driver/operator, the manufacturer cannot be made liable.

Examples for improper 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 too high borders (e.g. curb-stones, 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.

3.2 Definition of responsible persons

3.2.1 Operating company

The operating company is the natural or juridical person who uses the machine or in who's name the machine is used.

The operating company must make sure that the machine is only used for the purpose it is intended for and in strict compliance with the safety regulations mentioned in these operating and maintenance instructions.

The operating company must determine and assess the danger in its company. It must then take appropriate action to ensure health and safety at work for its employees and point out any remaining dangers.

The operating company must determine whether there are special operational hazards such as a toxic atmosphere or limiting soil conditions. Such conditions require special, additional measures to remove or reduce the hazard.

The operating company must make sure that all users read and understand the information concerning safety.

The operating company is responsible for the planning and professional execution of regular safety inspections.

3.2.2 Expert / qualified person

An expert / qualified person is a person who, based on his/her professional education and experience, has profound knowledge in the field of construction equipment and the machine in question in particular.

This person is acquainted with the applicable governmental industrial safety regulations, accident prevention instructions, guidelines and generally acknowledged technical rules and regulations (standards, directives, technical rules of other member states of the European Union or other contractual states concerning the agreement about the European Economic Area) in as far as is necessary to be able to judge the safe condition of this machine.

3.2.3 Driver / operator

This machine must only be operated by trained, instructed persons entrusted by the operating company aged 18 or more.

Observe your local laws and regulations.

Rights, obligations and rules of conduct for driver or operator:

The driver or operator must:

- be instructed about his rights and obligations,
- wear protective equipment as appropriate for the application,
- have read and understood the operating instructions,
- have made himself familiar with the operation of the machine,
- be physically and psychologically able to drive and operate the machine.

Persons under the influence of alcohol, medication 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.

3.3 Fundamentals for safe operation

3.3.1 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 in the area of the machine must be informed about the dangers that arise from the operation of the machine.

3.3.2 Regular safety inspections

Have the machine inspected by an expert / qualified person as required for the conditions the machine is working under, but at least once every year.

3.3.3 Modifications and alterations 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.

3.3.4 Damage, defects, misuse of safety devices

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.

3.3.5 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.

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.

3.4 Handling fuels and lubricants

3.4.1 Preliminary remarks

The operating company must ensure that all professional users have read and follow the corresponding safety data sheets for the individual fuels and lubricants.

Safety data sheets provide valuable information about the following characteristics:

- name of substance
- possible dangers
- composition / information on constituents
- first-aid measures
- fire fighting measures
- measures in case of accidental release
- handling and storage
- limitation and monitoring of exposure / personal protective equipment
- physical and chemical properties
- stability and reactivity
- toxicological data
- environmental data
- notes on waste disposal
- information on transport
- legislation
- other data

3.4.2 Safety regulations and environmental protection regulations for handling diesel fuel

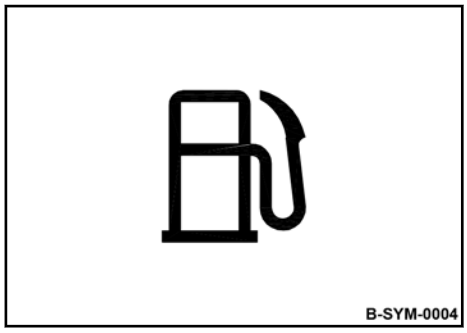

Fig. 4

WARNING!

Danger of burning by ignited diesel fuel!

– Do not allow diesel fuel to come into contact with hot components.
– Smoking and open fire is prohibited!
– Wear your personal protective equipment (protective gloves, protective clothing).

CAUTION!

Health hazard caused by contact with diesel fuel!

– Wear your personal protective equipment (protective gloves, protective clothing).
– Do not inhale any fuel fumes.
– Avoid contact.

CAUTION!

Danger of slipping on spilled diesel fuel!

– Immediately bind spilled diesel fuel with an oil-binding agent.

ENVIRONMENT!

Diesel fuel is an environmentally hazardous substance!

– Always keep diesel fuel in proper containers.
– Immediately bind spilled diesel fuel with an oil-binding agent and dispose of properly.
– Dispose of diesel fuel and fuel filters according to regulations.

3.4.3 Safety regulations and environmental protection regulations for handling oil

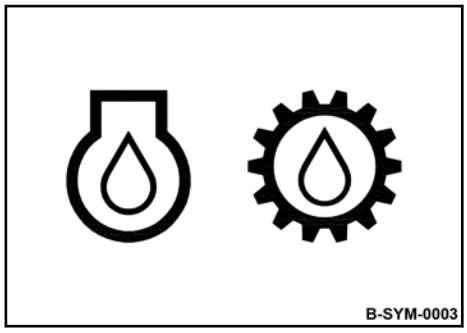

Fig. 5

WARNING!
Danger of burning by ignited oil!
– Do not allow oil to come into contact with hot components.
– Smoking and open fire is prohibited!
– Wear your personal protective equipment (protective gloves, protective clothing).

CAUTION!
Health hazard caused by contact with oil!
– Wear your personal protective equipment (protective gloves, protective clothing).
– Do not inhale any oil vapours.
– Avoid contact.

CAUTION!
Danger of slipping on spilled oil!
– Immediately bind spilled oil with an oil-binding agent.

ENVIRONMENT!
Oil is an environmentally hazardous substance!
– Always keep oil in proper containers.

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– Immediately bind spilled oil with an oil-binding agent.
– Dispose of oil and oil filter according to regulations.

3.4.4 Safety regulations and environmental protection regulations for handling hydraulic oil

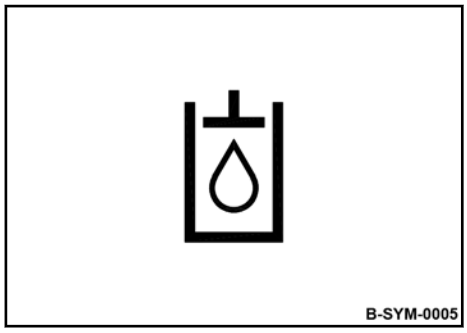

Fig. 6

WARNING!

Danger of injury caused by escaping pressure fluid!

– Always depressurize the hydraulic system before starting work in the hydraulic system.
– Wear your personal protective equipment (protective gloves, protective clothing, goggles).

Should pressure fluid penetrate the skin, immediate medical help is required.

WARNING!

Danger of burning by ignited hydraulic oil!

– Do not allow hydraulic oil to come into contact with hot components.
– Smoking and open fire is prohibited!
– Wear your personal protective equipment (protective gloves, protective clothing).

CAUTION!

Health hazard caused by contact with hydraulic oil!

– Wear your personal protective equipment (protective gloves, protective clothing).
– Do not inhale any oil vapours.
– Avoid contact.

CAUTION!

Danger of slipping on spilled oil!

– Immediately bind spilled oil with an oil-binding agent.

ENVIRONMENT!

Oil is an environmentally hazardous substance!

– Always keep oil in proper containers.
– Immediately bind spilled oil with an oil-binding agent.
– Dispose of oil and oil filter according to regulations.

3.4.5 Safety regulations and environmental protection regulations for handling coolants

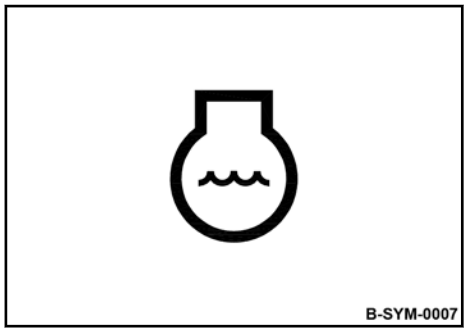

Fig. 7

WARNING!

Danger of scalding by hot fluid!

– Open the compensation tank only when the engine is cold.
– Wear your personal protective equipment (protective gloves, protective clothing, goggles).

CAUTION!

Health hazard caused by contact with coolant and coolant additives!

– Wear your personal protective equipment (protective gloves, protective clothing).
– Do not inhale any fumes.
– Avoid contact.

CAUTION!

Danger of slipping on spilled coolant!

– Immediately bind spilled coolant with an oil-binding agent.

ENVIRONMENT!

Coolant is an environmentally hazardous substance!

– Always keep coolant and coolant additives in proper containers.

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– Immediately bind spilled coolant with an oil-binding agent and dispose of it according to regulations.
– Dispose of coolant according to regulations.

3.4.6 Safety regulations and environmental protection regulations for handling battery acid

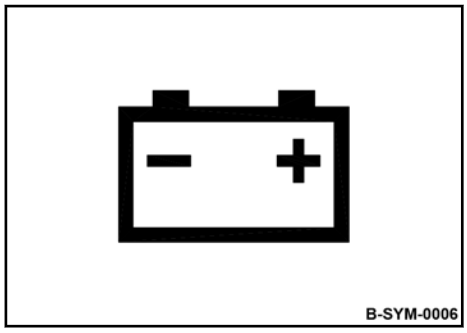


Fig. 8:

WARNING!
Danger of cauterization with acid!
- Wear your personal protective equipment (protective gloves, protective clothing, goggles).
- Do not allow clothes, skin or eyes to come into contact with acid.
- Rinse off spilled battery acid immediately with lots of water.

Rinse acid off clothes, skin or eyes immediately with lots of clean water.

Immediately call for medical advice in case of cauterization.

WARNING!
Danger of injury caused by exploding gas mixture!
- Remove the plugs before starting to recharge the battery.
- Ensure adequate ventilation.
- Smoking and open fire is prohibited!
- Do not lay any tools or other metal objects on the battery.
- Do not wear jewellery (watch, bracelets, etc.) when working on the battery.
- Wear your personal protective equipment (protective gloves, protective clothing, goggles).

ENVIRONMENT!

Battery acid is an environmentally hazardous substance!

– Dispose of battery and battery acid according to regulations.

3.5 Loading / transporting the machine

Use only stable loading ramps of sufficient load bearing capacity.

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

The ramp inclination must be less than the gradability of the machine.

Make sure that persons are not endangered by the machine tipping or sliding off. The instructing person must stand within the view of the operator, but outside the danger area.

Secure the machine with the articulation lock after driving it on the transport vehicle or before loading it with a crane.

Do not use damaged or in any other way impaired lashing points.

Always use appropriate lifting and lashing means on the lifting and lashing points.

Use lifting and lashing gear only in the prescribed direction of load application.

Lifting and lashing gear must not be damaged by machine components.

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

Loads must only be attached and hoisted by an expert / capable person.

Use only lifting gear and lifting tackle with sufficient load bearing capacity for the weight to be loaded.

Fasten the lifting gear only at the specified lifting points.

Danger to the life of persons if they step or stand under a suspended load.

When lifting the machine, avoid uncontrolled movements of the load. If necessary, hold the load with guide ropes.

After the transport loosen the articulation lock again, as otherwise the machine would not be steerable.

Operate the machine only with the ROPS folded up and the fastening screws tightened with the correct tightening torque.

3.6 Start-up procedure

3.6.1 Prior to starting up

Use only machines which are serviced at regular intervals.

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

Use your personal protective equipment (hard hat, safety boots, if necessary also goggles and ear protection).

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

Before mounting the machine check whether:

- persons or obstructions are beside or under the machine,
- the machine is free of oily and combustible materials,
- all access steps, grips and platforms are free of obstacles, grease, oils, fuel, dirt, snow and ice,
- all safety elements are in place,
- all maintenance flaps and doors are closed and locked.

Use only the intended access steps and grips to mount the machine.

Before start up, carry out all required visual inspections and function tests.

If the following tests reveal damages or other faults, the machine must not be operated, until these deficiencies have been corrected.

Do not operate the machine with defective indicators and control elements.

3.6.2 Starting the engine

The machine must only be started and operated from the driver’s seat.

Before starting and moving the machine, make sure that there is nobody in the danger zone.

To start, set all control levers to “neutral position”.

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

The machine must not be operated with damaged, missing or non-functional safety installations.

After starting check all display instruments.

Do not inhale exhaust fumes, because they contain toxic substances, which could cause damage to health, unconsciousness or even death.

For operation in closed or partly closed rooms ensure adequate ventilation.

3.6.3 Starting the engine with jump leads

Connect positive with positive and negative with negative (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.

3.7 Driving the machine; working operation

3.7.1 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.

3.7.2 Driving the machine

Always wear the seat belt when driving.

Do not drive on bases with insufficient load bearing capacity.

Do not drive on ice and snow.

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 operator’s platform.

Do not adjust the driver’s seat while driving.

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

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.

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.

Always keep a safe distance to excavation pit borders, embankments and edges.

Refrain from any work that could adversely affect the stability of the machine.

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

3.7.3 Driving up and down slopes

Do not drive on gradients or slopes exceeding the maximum gradeability of the machine ↳ *Chapter 2 „Technical data“ on page 13*.

Drive extremely carefully on gradients and always directly up or down the slope.

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

Wet and loose soil considerably reduces traction of the machine on inclinations and slopes. Increased danger of accident!

3.7.4 Cross slope

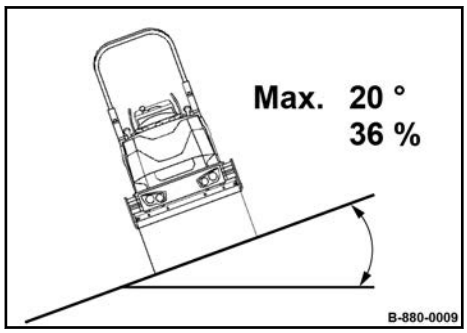


Fig. 9

The tipping angle was measured statically on level, hard ground with the machine stopped and without steering.

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.

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

3.7.5 Working with vibration

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.

Do not activate the vibration on hard (frozen, concrete) ground. Components may get damaged.

3.7.6 Parking the machine

Park the machine on horizontal, level, firm ground.

Before leaving the machine:

- shift all control levers to “Neutral position”, “Off” or “0”,
- apply the parking brake,
- shut down the engine, pull off the ignition key,
- pull off the main battery switch,
- secure the machine against unauthorized use.

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

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

When parking on ascents or descents use appropriate means to secure the machine against rolling.

3.8 Refuelling

Do not inhale any fuel fumes.

Refuel only with the engine shut down.

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. The discharge of these charges in the presence of combustible vapours can cause fire or an explosion.

Ultra-low sulphur diesel fuel poses a higher risk of combustion caused by the static charging than diesel fuel with a higher sulphur content.

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

Monitor the entire refuelling process.

Do not spill any fuel. Collect leaking 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.

3.9 Emergency procedures

3.9.1 Actuating the emergency stop switch

In events of emergency and in case of danger actuate the emergency stop switch immediately.

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

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

In case of frequent use the wear on the multi-discs brakes will be very high, you should therefore never use the emergency stop switch as a service brake.

3.9.2 Disconnecting the battery

In events of emergency, e.g. in case of a cable fire, disconnect the battery from the vehicle network.

Pull out the main battery switch or lift off the battery pole to do so.

3.9.3 Towing the machine

Tow the machine only in case of emergency or to avoid an accident.

Before releasing the parking brake apply suitable measures to secure the machine against unintended rolling.

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

You should generally use a tow bar.

Before starting towing operations make sure that the fastening means are able to withstand the load and are fastened at the points provided for this purpose.

Before removing the towing facility apply appropriate measures to secure the machine against unintended rolling.

3.10 Maintenance work

3.10.1 Preliminary remarks

Adhere to the specified operating, maintenance and repair measures.

The machine must only be serviced by qualified personnel authorised by the operating company.

Keep unauthorised persons away from the machine.

Perform maintenance work only with the engine shut down.

Make sure that the engine cannot be accidentally started during maintenance work.

3.10.2 Working on hydraulic lines

Relieve hydraulic pressures before working on hydraulic lines. Hydraulic oil escaping under pressure can penetrate the skin and cause severe injury. Immediately call for medical assistance if injured by hydraulic oil.

Do not step in front of or behind the machine 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 collected and disposed of in an environmentally friendly way.

Always collect and dispose of hydraulic oils separately.

Do not start the engine after draining off the hydraulic oil. Once all work is completed (with the system still depressurized!) check all connections and fittings for leaks.

Hydraulic hoses must be visually inspected at regular intervals.

Do not mix up hoses by mistake.

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

3.10.3 Working on the engine

Do not work on the fuel system while the engine is running - danger to life due to high pressures!

Wait until the engine has stopped, then wait approx. another 15 minutes.

Keep out of the danger zone during the initial test run.

In case of leaks return to the workshop immediately.

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

Wipe off spilled oil, collect leaking oil and dispose of it in an environmentally friendly way.

Store used filters and other oil contaminated materials in a separate, specially marked container and dispose of them in an environmentally friendly way.

The settings for idle speed and highest speed must not be changed, since this would affect the exhaust gas values and cause damage to engine and power train.

Engine and exhaust system work at high temperatures. Keep combustible materials away and do not touch any hot surfaces.

Check and change coolant only when the engine is cold. Collect coolant and dispose of it in an environmentally friendly way.

3.10.4 Maintenance work on electric components and battery

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.

When working on the battery, smoking or open fire is prohibited!

Do not lay any tools or other metal objects on the battery.

Do not wear jewellery (watch, bracelets, etc.) when working on the battery.

The connection cables of the battery must not touch or rub against machine parts.

3.10.5 Cleaning work

Do not perform cleaning work while the motor is running.

Allow the engine to cool down before starting cleaning work on engine and exhaust system.

Never use gasoline or other easily inflammable substances for cleaning.

When cleaning with a high pressure cleaner, do not subject electrical parts and insulation material to the direct jet of water, or cover them beforehand.

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

3.10.6 After maintenance work

Reassemble all guards and protective devices.

Close all maintenance flaps and maintenance doors again.

3.11 Repair

Identify a defective machine with a warning sign.

Only operate the machine after it has been repaired.

Repairs must only be performed by an expert/ qualified person.

When replacing safety relevant components, only original spare parts must be used.

3.12 Signage

Keep stickers and signage in good and legible condition and comply with their meaning.

Replace damaged and illegible stickers or signage immediately.

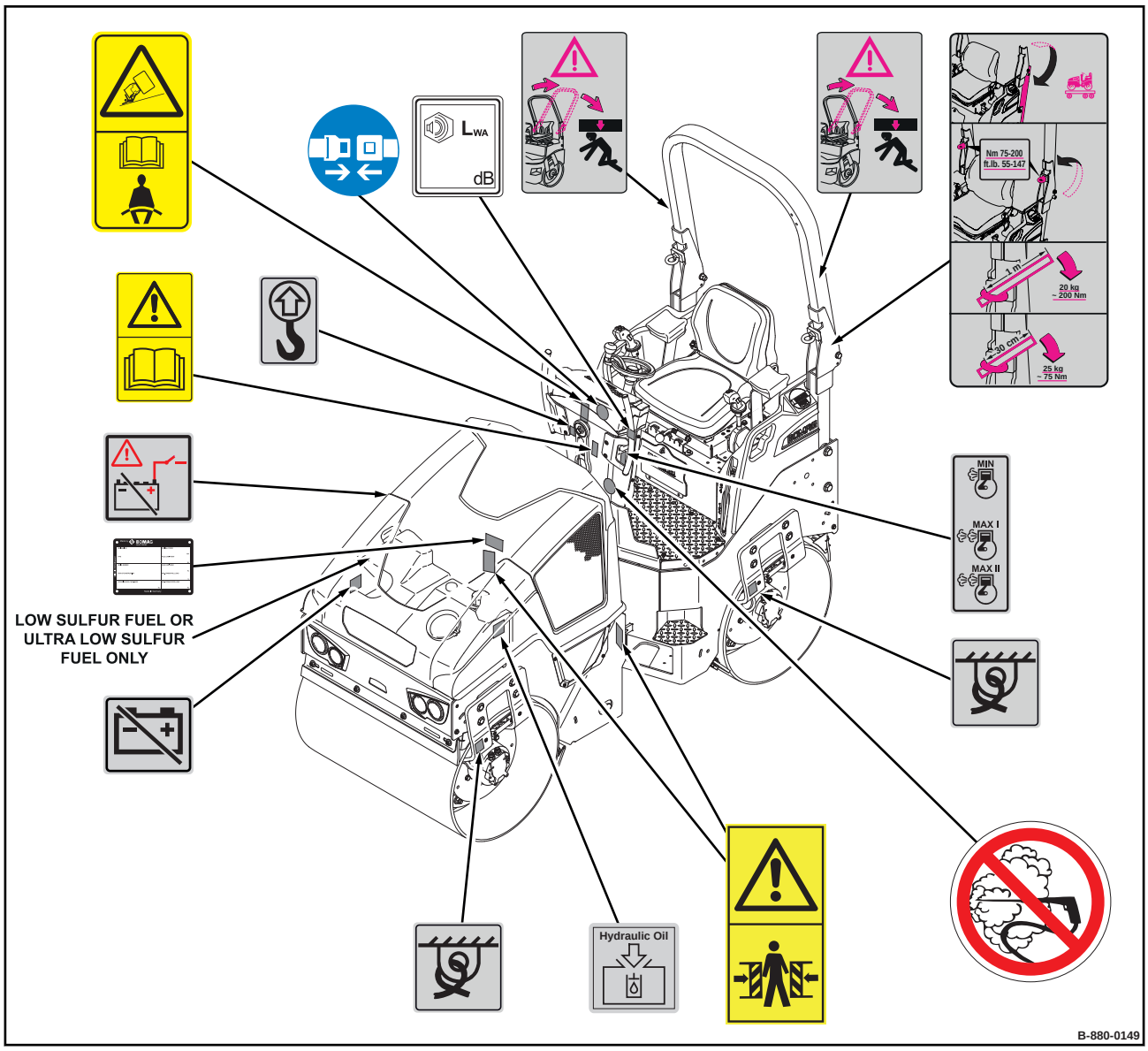

LWA
dB
Nm 75-200
ft.lb. 55-147
20 kg
~ 200 Nm
25 kg
~ 75 Nm
MIN
MAX I
MAX II
LOW SULFUR FUEL OR
ULTRA LOW SULFUR
FUEL ONLY
Hydraulic Oil
B-880-0149

Fig. 10

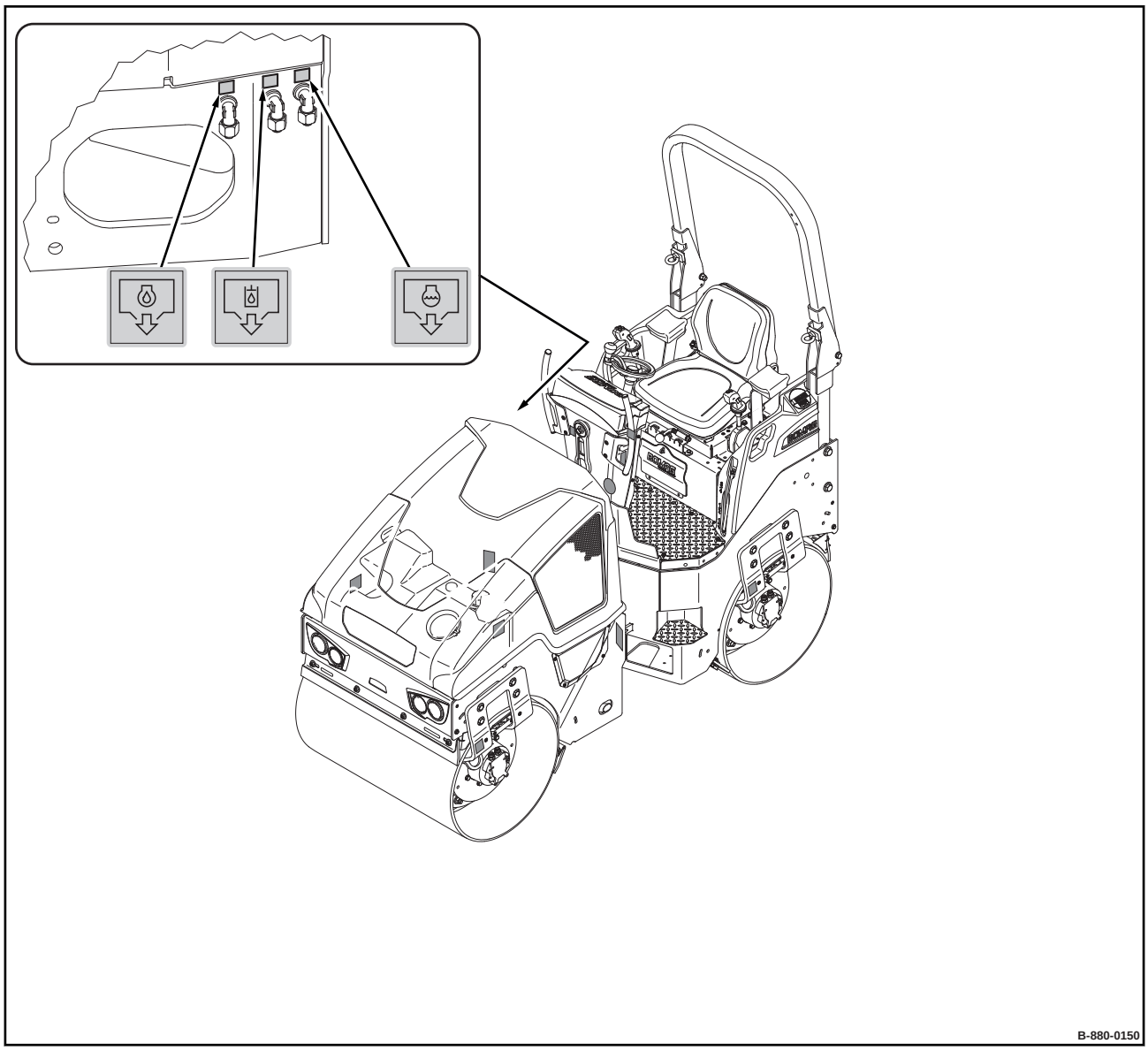
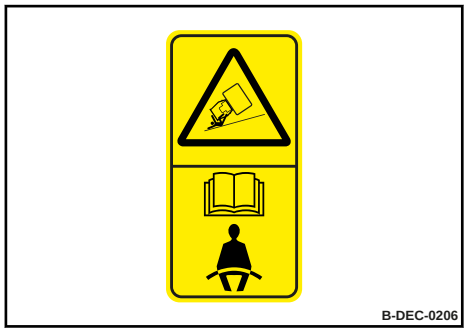


Fig. 11



Warning sticker - Danger of tipping over

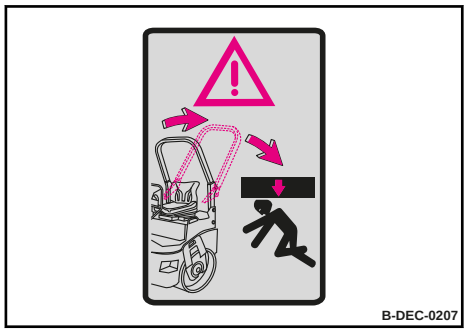
Fig. 12

Warning sticker - Follow operating instructions

Fig. 13

Warning sticker - Danger of crushing

Fig. 14

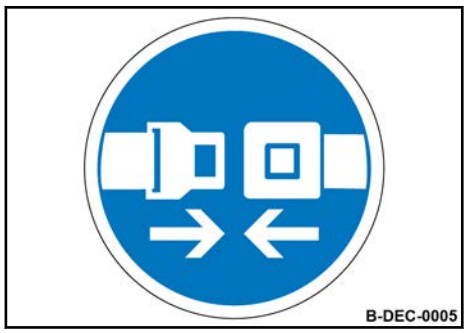


Warning sticker - Foldable ROPS

Fig. 15

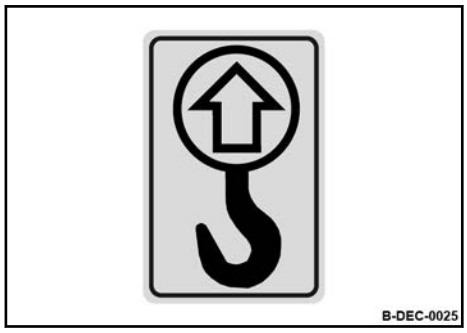
Prohibition sticker - High pressure cleaning

Fig. 16



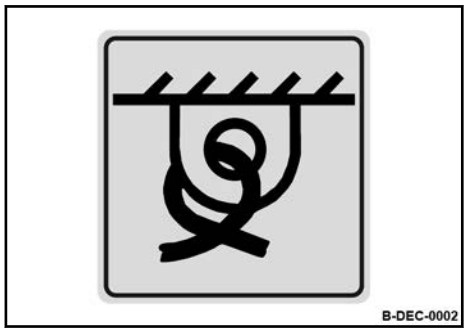
Instruction sticker - Always wear your seat belt

Fig. 17



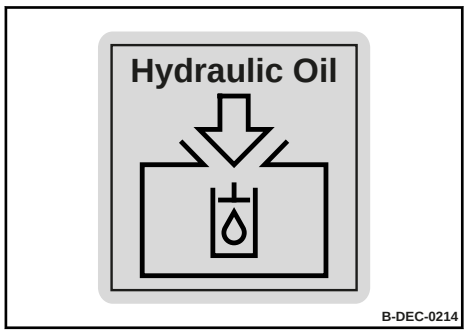
Information sticker - Lifting point

Fig. 18



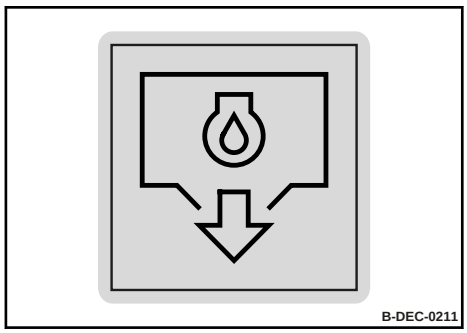
Information sticker - Lashing point

Fig. 19



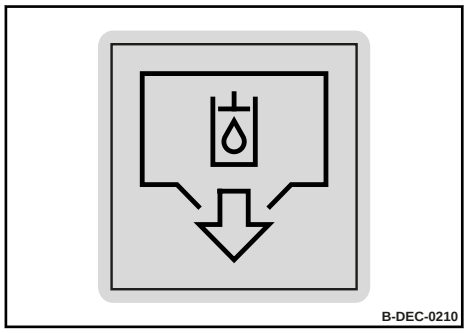
Information sticker - Filler opening for hydraulic oil

Fig. 20



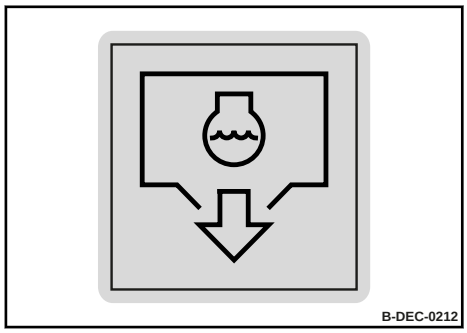
Information sticker - Engine oil drain

Fig. 21



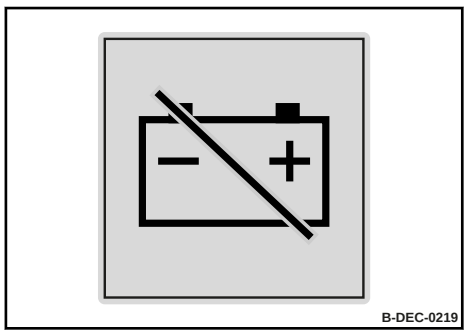
Information sticker - Hydraulic oil drain

Fig. 22



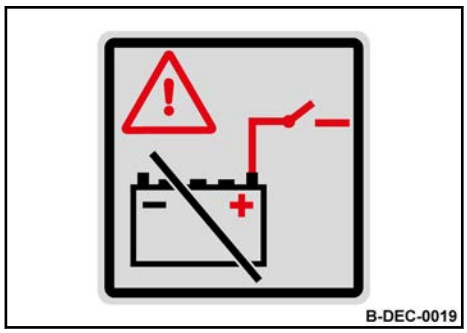
Information sticker - Coolant drain

Fig. 23



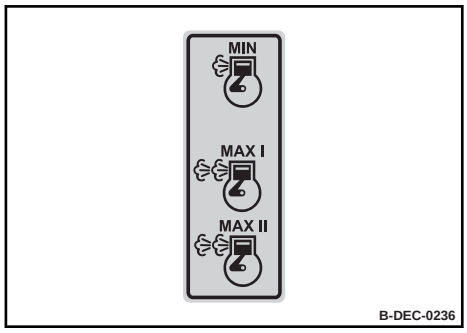
Information sticker - Disconnecting the battery

Fig. 24



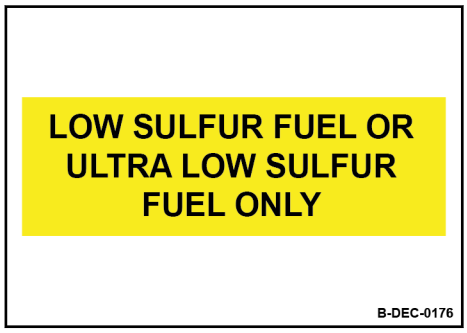
Information sticker - Main battery switch plus side

Fig. 25



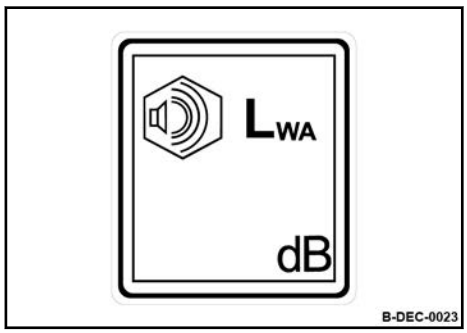
Operation sticker - Throttle lever

Fig. 26



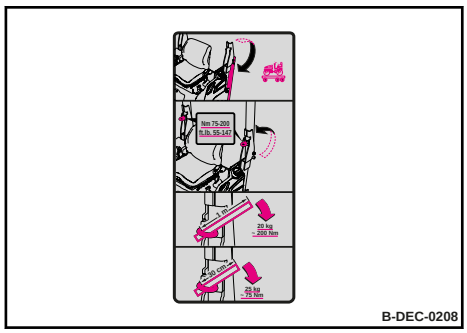
Information sticker - Low sulphur fuel

Fig. 27



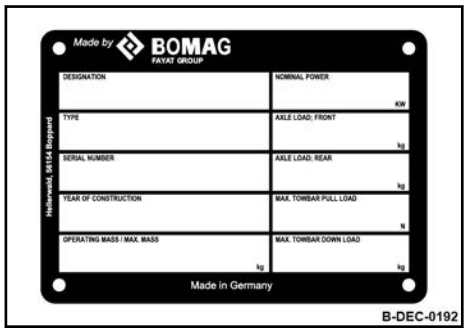
Information sticker - Guaranteed sound capacity level

Fig. 28



Information sticker - Foldable ROPS operation

Fig. 29



Machine type plate (example)

Fig. 30

4 Indicators and control elements

4.1 Driver’s stand

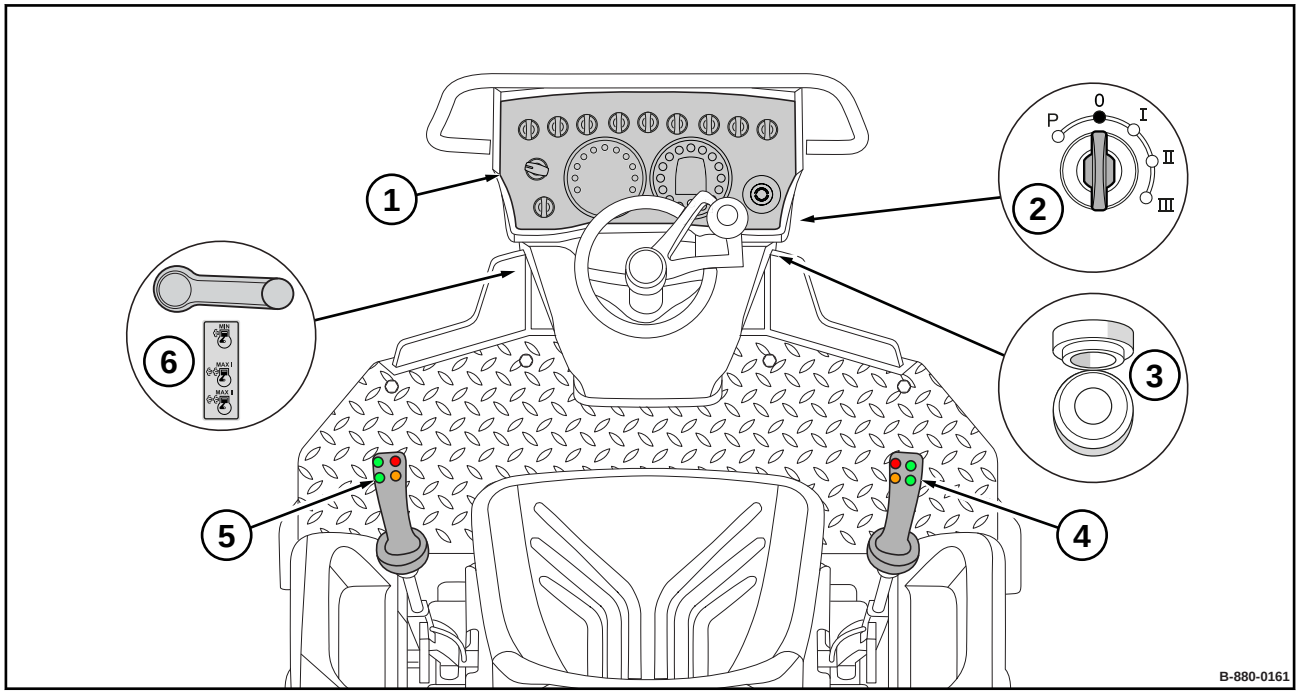


Fig. 31: Overview of driver’s stand

1 Operating console
2 Starter switch
3 12 V DIN socket
4 Travel lever, right
5 Travel lever, left *(optional equipment)*
6 Throttle lever

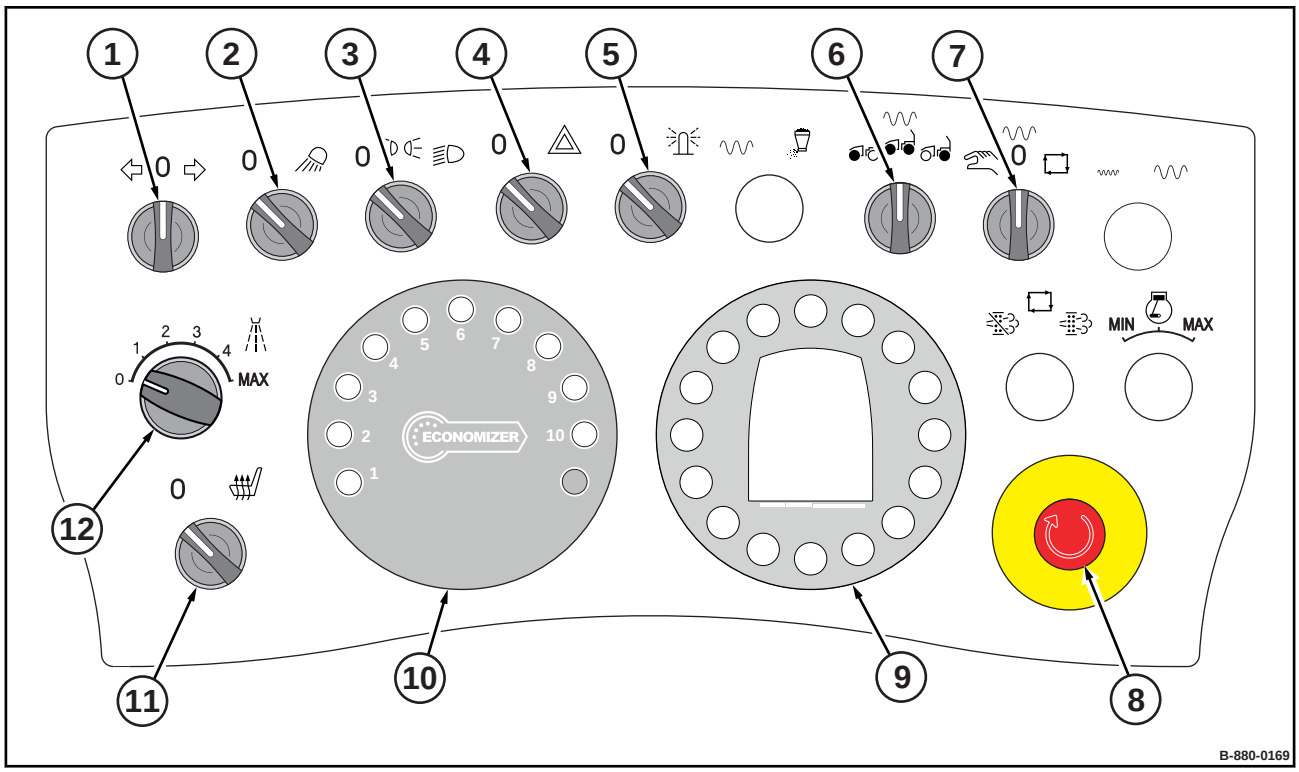


Fig. 32: Overview of operating console

1 Rotary switch for direction indicators *(optional equipment)*
2 Rotary switch for working lights
3 Rotary switch for lighting *(optional equipment)*
4 Rotary switch for hazard light system *(optional equipment)*
5 Rotary switch for flashing beacon *(optional equipment)*
6 Rotary switch for drum pre-selection
7 Rotary switch for vibration pre-selection
8 Emergency stop switch
9 Instrument cluster
10 ECONOMIZER display *(optional equipment)*
11 Rotary switch for seat heating *(optional equipment)*
12 Rotary switch for water spraying system

4.1.1 Operating console

4.1.1.1 Rotary switch for direction indicators

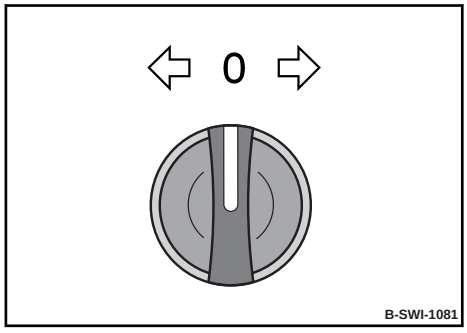


Fig. 33

Position "middle"	Direction indicators off
Position "Left" or "Right"	Front and rear direction indicators on the corresponding side are flashing

Optional equipment

4.1.1.2 Rotary switch for working lights

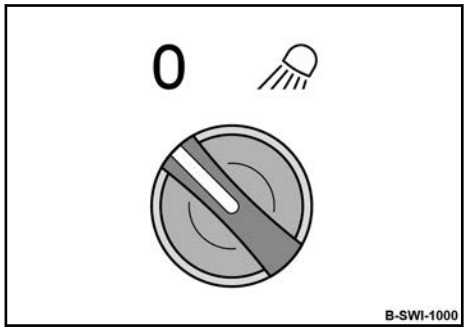


Fig. 34

Position "Left"	Working lights off
Position "Right"	Working light on

4.1.1.3 Rotary switch for lighting

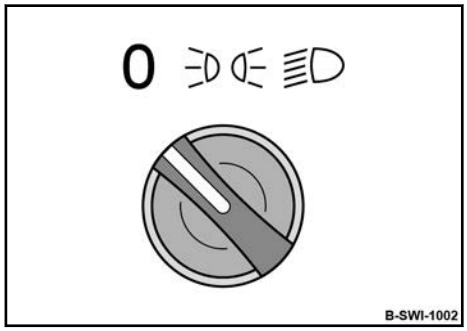
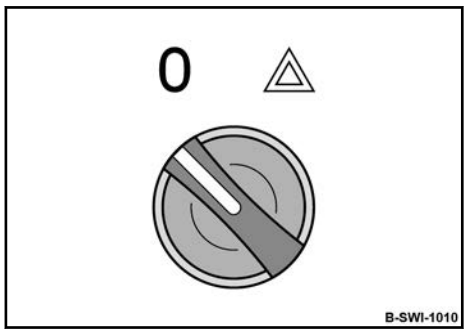


Fig. 35

Position "Left"	Light off
Position "Middle"	Side light on
Position "Right"	Travel light on

Optional equipment

4.1.1.4 Rotary switch for hazard light system

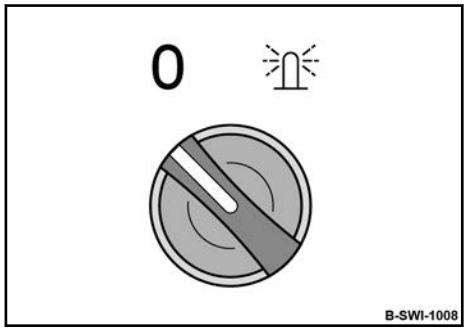


Position "Left"	Hazard light system off
Position "Right"	Hazard light system on

Optional equipment

Fig. 36

4.1.1.5 Rotary switch for flashing beacon

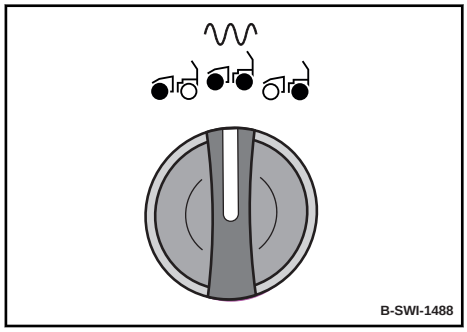


Position “Left”	Flashing beacon off
Position “Right”	Flashing beacon on

Optional equipment

Fig. 37

4.1.1.6 Rotary switch for drum pre-selection



Position “left”	Vibration of front drum
Position “middle”	Vibration of front and rear drums
Position “right”	Vibration of rear drum

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

Fig. 38

4.1.1.7 Rotary switch for vibration pre-selection

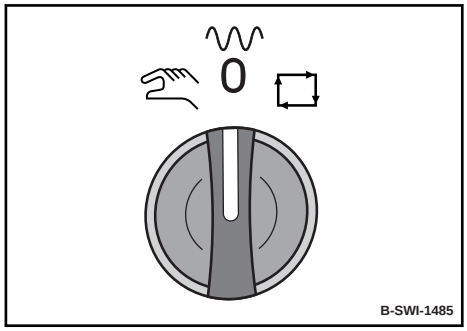


Fig. 39

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 the travel speed exceeds or falls below a certain value.

4.1.1.8 Emergency stop switch

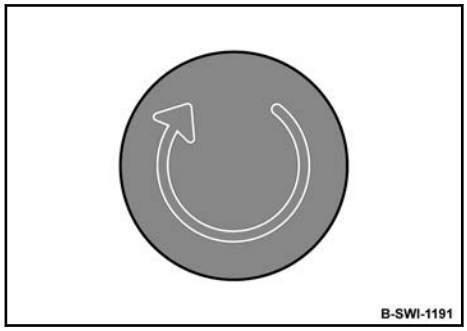


Fig. 40

press	In events of emergency and in case of danger actuate the emergency stop switch immediately by pressing it fully down. It automatically locks in end position. The machine will be braked immediately. The engine is shut down.
switch off/ unlock	Turn the Emergency Stop switch clockwise and let it go.

NOTICE!

In case of frequent use the wear on the multi-discs brakes will be very high.

– Do not use the emergency stop switch as service brake!

4.1.1.9 Instrument cluster

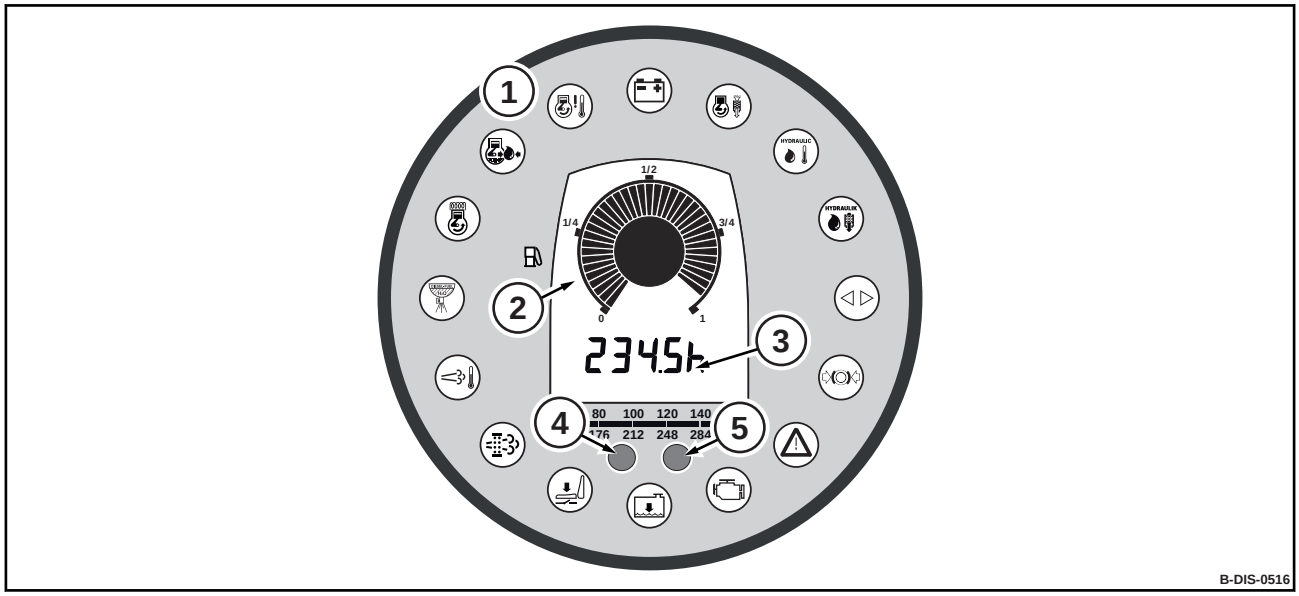


Fig. 41

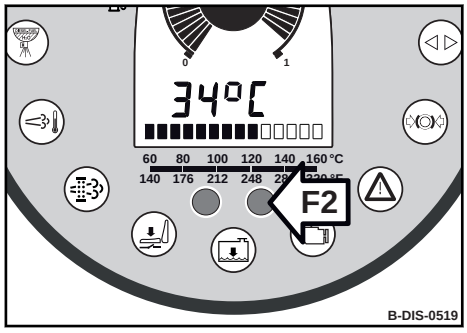
1 Control and warning lights
2 Fuel level gauge
3 Display field
4 Function key *[F1] (not assigned)*
5 Function key *[F2]*

Control and warning lights

	Designation	Note
	Driver's seat warning light	Lights up when the driver's seat is not occupied. If the machine is travelling, the warning buzzer will sound and the engine is shut down after 2 seconds. If the travel lever is shifted to any travel direction, the engine is shut down. If the engine stops, occupy the driver's seat and restart the engine.
	Pre-heating control light	Lights up during pre-heating.

	Designation	Note
	Engine oil pressure warning light	Lights up if the engine oil pressure is too low. Warning buzzer sounds. The engine is shut down after a short while. Check the engine oil level, if necessary, repair the engine.
	Warning light for overheating of engine	Lights up when the engine overheats. Warning buzzer sounds. The engine is shut down after 2 seconds. Run the engine with idle speed or, if necessary, shut it down and clean the radiator, if necessary, repair the engine.
	Charge control light	Lights up if the battery is not being charged. Check V-belt, if necessary repair the generator.
	Indicator control light	
	Parking brake warning light	Lights up when the parking brake is applied.
	Central warning light	Flashes in case of a fault of the rotation angle sensor or rotary switch for the water spraying system

Display field

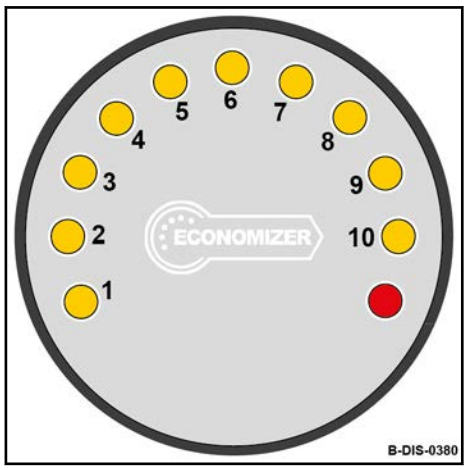


Each actuation of the function key *[F2]* switches between:

- Operating hours
- Asphalt temperature in °C *(optional equipment)*
- Asphalt temperature in °F *(optional equipment)*

Fig. 42

4.1.1.10 ECONOMIZER display



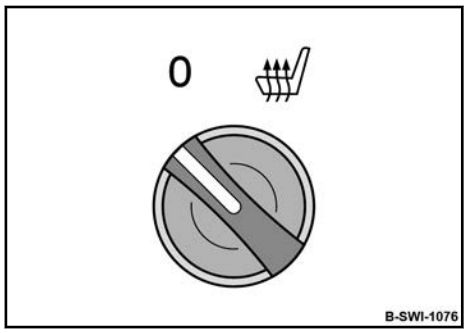
The ECONOMIZER shows the compaction status of the road substructure or the asphalt layer.

Description of display possibilities ↪ Chapter 6.5.6 „ECONOMIZER“ on page 109.

Optional equipment

Fig. 43

4.1.1.11 Rotary switch for seat heating

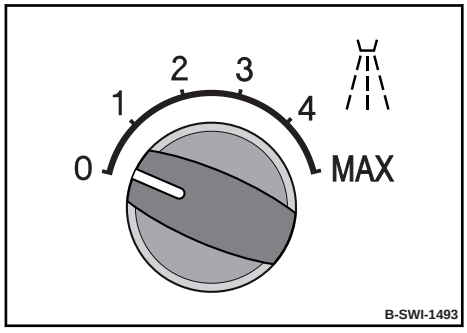


Position “left”	Seat heating off
Position “right”	Seat heating on The control light in the switch lights up.

Optional equipment

Fig. 44

4.1.1.12 Rotary switch for water spraying system



Position “0”	Spraying off
Position “1” to “4”	Interval spraying
Position “MAX”	Permanent spraying

Fig. 45

4.1.2 Starter switch

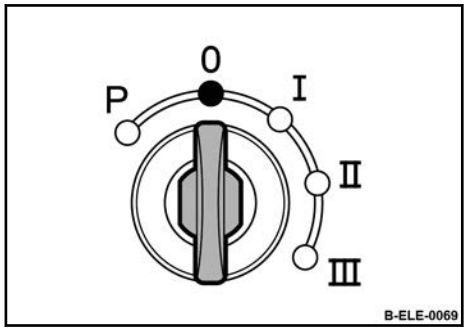


Fig. 46

Position "P"/"0"	Switch the ignition off Ignition key can be removed
Position "I"/"II"	Ignition on All control and warning lights light up for a moment (test function). At low temperatures the pre-heating control light lights up.
Position "III"	Turn further against spring pressure, the engine starts Turn the ignition key back to position "I" when the engine starts.

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.

4.1.3 12 V DIN socket

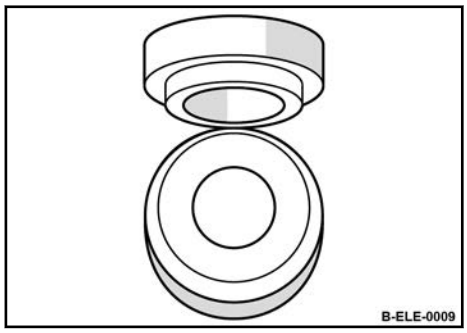


Fig. 47

Permanent current, loadable up to 10 A.

4.1.4 Travel lever

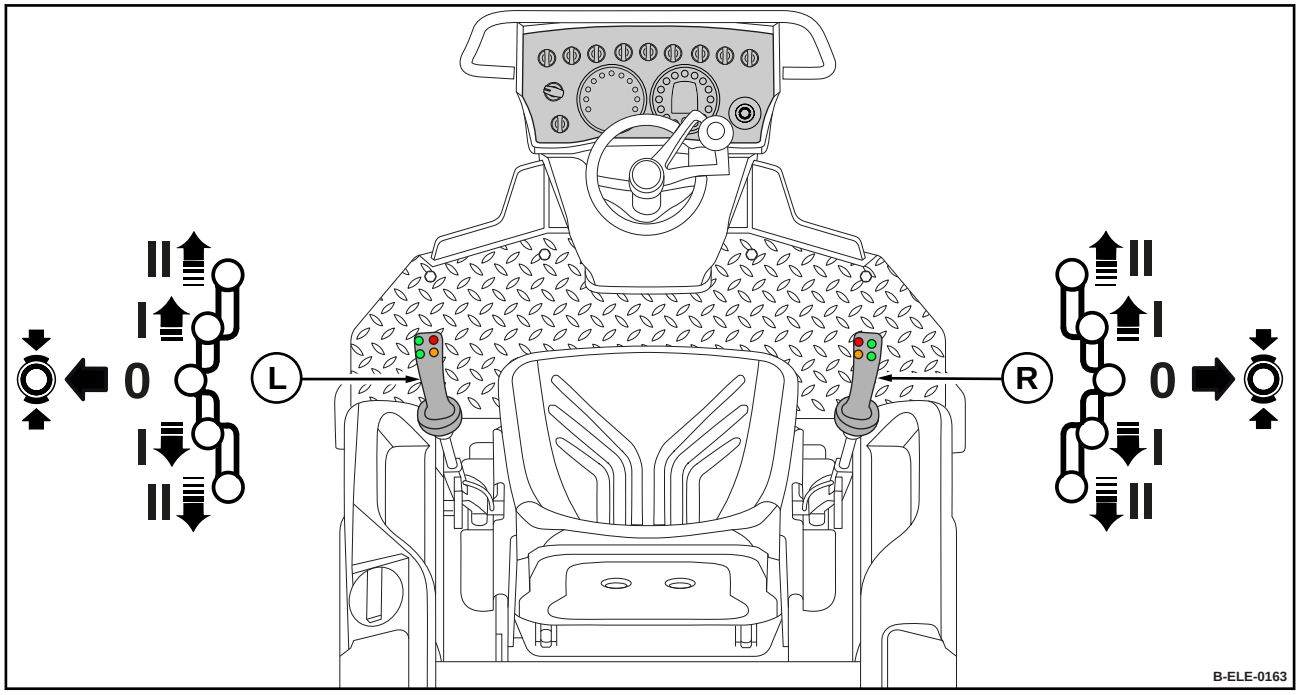


Fig. 48

R Travel lever, right
L Travel lever, left *(optional equipment)*

On machines with double travel lever, the two travel levers are mechanically connected to each other.

Function	Note
Shift forward	Forward travel ■ Position I: up to approx. 5 km/h (3 mph) ■ Position II: up to approx. 10 km/h (6 mph)
Pull back	Backward travel ■ Position I: up to approx. 5 km/h (3 mph) ■ Position II: up to approx. 10 km/h (6 mph)
Position “middle”	Service brake position
Position “middle right” (travel lever right)	Parking brake position
Position “middle left” (travel lever left)	

4.1.4.1 Push button assignment on travel lever

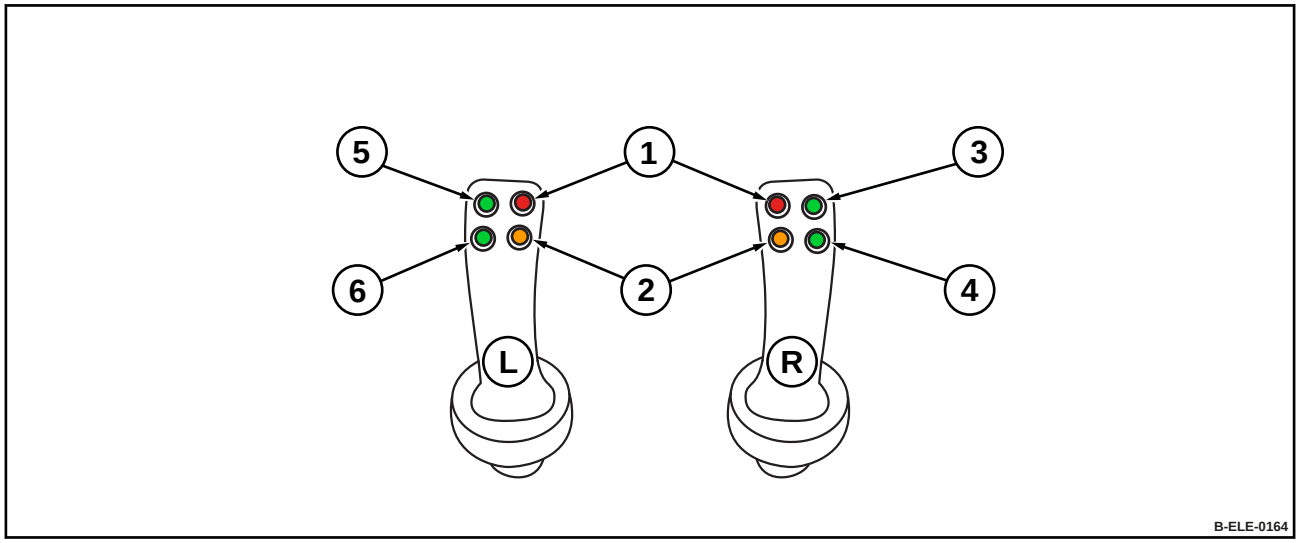
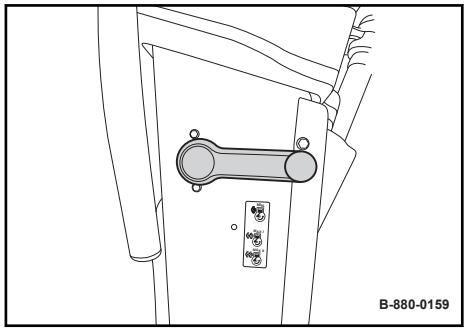


Fig. 49

R Travel lever, right
L Travel lever, left *(optional equipment)*

Pos.	Function	Note
1	Vibration on/off	
2	Warning horn	
3	Lift edge cutter on right hand side	Optional equipment
4	Lower edge cutter on right hand side	Optional equipment
5	Lift edge cutter on left hand side	Optional equipment
	Extend crabwalk	The front drum is extended to the right Optional equipment
6	Lower edge cutter on left hand side	Optional equipment
	Retract crabwalk	The front drum is retracted Optional equipment

4.1.5 Throttle lever



Position “MIN”	Idle speed position
Position “MAX I”	Full load position I
Position “MAX II”	Full load position II

Fig. 50

4.2 Engine compartment

4.2.1 Main battery switch

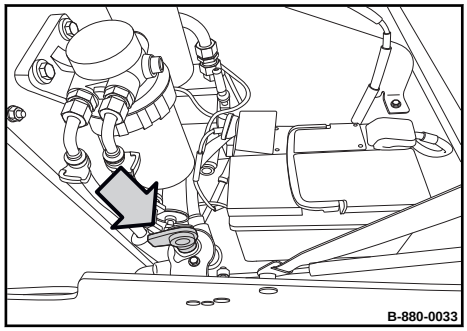


Fig. 51

Position “on”	Main battery switch locked Normal position, operation
Turn anticlock-wise	Main battery switch can be pulled out Isolates the batteries from the on-board electrics in case of cable fire and fire in the engine compartment as well as protection against unauthorized use. Individual control units may still be connected to the board electrics despite the main battery switch being pulled out.

Optional equipment

5 Checks prior to start up

5.1 Notes on safety

If the following tests reveal damages or other defects, the machine must not be operated, until these deficiencies have been corrected.

Do not operate the machine with defective indicators and control elements.

Safety installations must not be removed or made ineffective.

Do not change any fixed settings.

WARNING!

Health hazard caused by fuels and lubricants!

– Safety regulations and environmental protection regulations must be followed when handling fuels and lubricants *Chapter 3.4 „Handling fuels and lubricants“ on page 29*.

WARNING!

Danger of injury caused by rotating parts!

– Before starting work on the machine make sure that the engine can not be started.

CAUTION!

Danger of being injured by the engine hood dropping down!

– Always secure an opened engine hood.

Park the machine safely *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.

Open and secure the engine hood ↬ *Chapter 8.2.2.1 „Open and secure the engine hood“ on page 140*.

Close the engine hood again after work is completed.

5.2 Visual inspections and function tests

1. Check hydraulic oil tank and lines for condition and leaks.
2. Check fuel tank and lines for condition and leaks.
3. Check cooling system for contamination, damage and leaks.
4. Check bolted connections for tight fit.
5. Check engine and exhaust system for leaks.
6. Check belt drive for damage.
7. Check machine for contamination and damage.
8. Check function of steering.
9. Check function of brake.
10. Check emergency stop function.
11. Check function of backup alarm system.
12. Check function of seat contact switch.

5.3 Checking the engine oil level

NOTICE!
Danger of engine damage!
- If 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.
- Use only oil of the permitted specification *Chapter 8.3.1 „Engine oil“ on page 141*.

Protective equipment:
- Working clothes
- Safety shoes
- Protective gloves

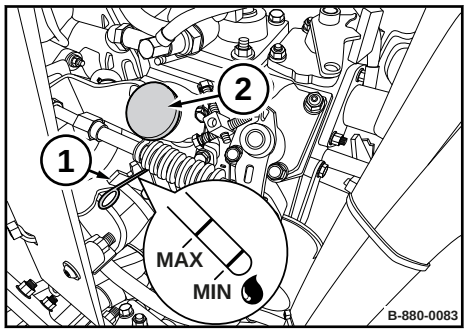


Fig. 52

1 Oil dipstick
2 Oil filler opening

1. Pull the dipstick out, wipe it off with a lint-free, clean cloth and reinsert it to the end stop.
2. Pull the dipstick out again.
   ⇨ The oil level must be between the “MIN” and “MAX” marks.
3. For topping up, clean the area around the filling port.
4. Unscrew the cap and fill with engine oil up to the “MAX” mark.
5. Push the dipstick in.
6. Close the cap.

5.4 Checking the fuel level; topping up fuel

5.4.1 Checking the fuel level

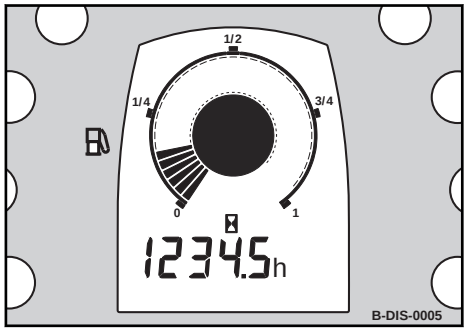


Fig. 53

1. Check the filling level on the fuel gauge.
2. Refuel if required, after first shutting down the engine.

5.4.2 Refuelling

NOTICE!

Danger of engine damage!

- Never run the fuel tank empty, as otherwise the fuel system needs to be bled.
- Monitor the entire refuelling process.
- Contaminated fuel can cause malfunction or even damage of the engine. If necessary, fill in fuel through a screen filter.
- Use only fuel of the permitted specification ↬ *Chapter 8.3.2 „Fuel“ on page 142*.

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

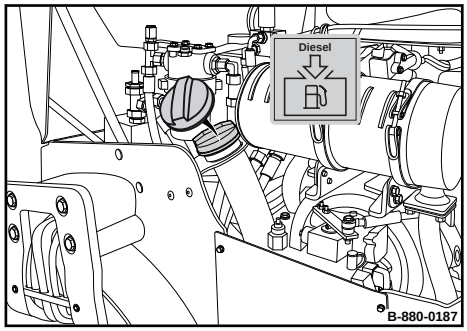


Fig. 54

1. Clean the area around the filling port.
2. Unscrew the cap and fill with fuel.
3. Close the cap.

5.5 Checking the hydraulic oil level

NOTICE!

Components may get damaged!

- Check the hydraulic oil level at room temperature (approx. 20 °C (68 °F)).
- 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.
- Use only oil of the permitted specification *Chapter 8.3.4 „Hydraulic oil“ on page 145*.

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

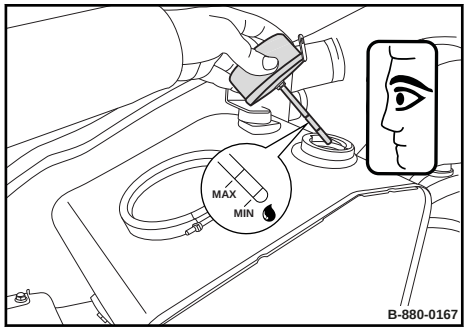


Fig. 55

1. For checking and topping up, clean the area around the filling port.
2. Remove the cap and check the hydraulic oil level on the dipstick.
3. The hydraulic oil level must always be between the “MIN” and “MAX” marks.

   ⇨ Top up hydraulic oil.
4. Close the cap.

5.6 Checking the coolant level

NOTICE!

Danger of engine damage!

- If, during the daily inspection the coolant level is found to have dropped, check all lines, hoses and engine for leaks.
- Do not use radiator sealant to seal leaks.
- Use only coolant of the permitted specification *Chapter 8.3.3 „Coolant“ on page 144*.

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves
- Safety goggles

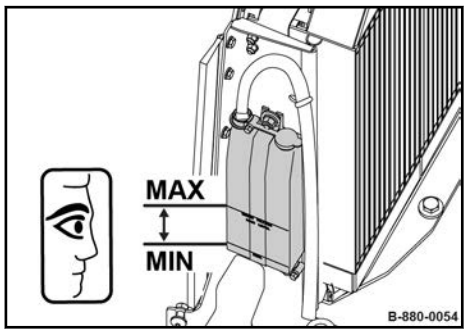


Fig. 56

1. **WARNING!**

   Danger of scalding by hot fluid!

   - Open the compensation tank only when the engine is cold.
   - Wear your personal protective equipment (protective gloves, protective clothing, goggles).

   Check the coolant level in the compensation tank.
2. To refill remove the cover and fill up to the "MAX" mark with coolant.
3. Close the cap.

5.7 Checking the air filter

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

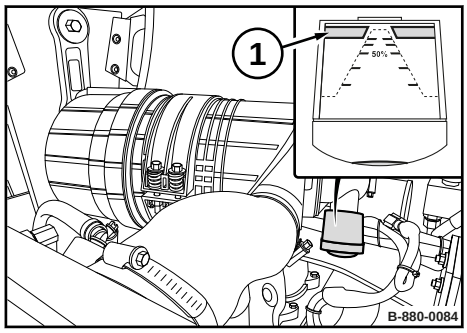


Fig. 57

1. Check the air filter on the maintenance indicator.
2. If the yellow pin has reached the red area (1) conduct maintenance of the air filter ↬ *Chapter 8.13.1 „Air filter maintenance“ on page 178*.

5.8 Checking the water level, topping up

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

NOTICE!

Components may get damaged by frost!

– Follow the special maintenance instructions in case of frost
Chapter 8.13.4 „Measures if there is a risk of frost“ on page 186.

NOTICE!

Dirty or contaminated water can block the water spraying system!

– Fill only with clean water.

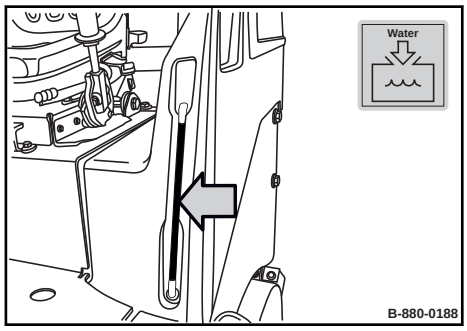


Fig. 58

1. Check the filling level on the water level gauge, fill up if necessary.

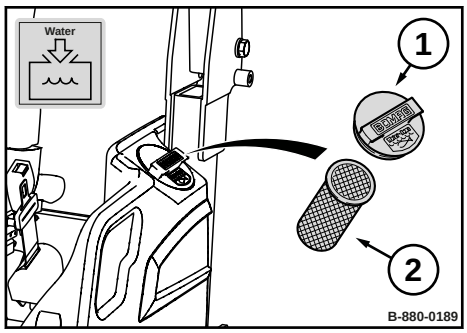


Fig. 59

2. Unscrew the cap (1) and fill in clean water through the strainer (2).
3. Make sure that the ventilation bore in the filler cap is free.
4. Close the cap.

5.9 Checking, adjusting the scrapers

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

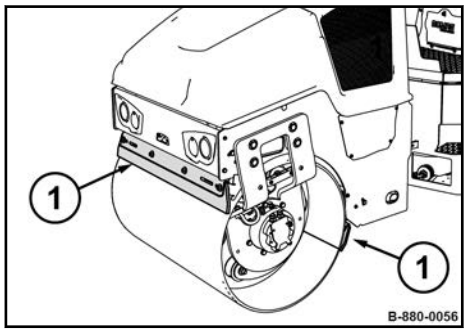


Fig. 60

1. Check the condition of the scrapers (1) and clean them.
2. Replace worn scrapers.

5.10 Checking the hydraulic oil filter

WARNING!
Danger of burning on hot components!
– Wear your personal protective equipment (protective gloves, protective clothing).
– Avoid touching hot components.

Protective equipment:
- Working clothes
- Safety shoes
- Protective gloves

The maintenance indicator is a mechanical indicator which must be checked at operating temperature.

1. Make sure that no persons are in the danger zone during maintenance work.
2. Drive the machine onto level, firm ground.
3. Shift the travel lever to “Middle” position and engage it in parking brake position.
   ⇨ The machine will decelerate down to a standstill and the parking brake will be applied after approx. 2 seconds.
   The parking brake warning light lights up.

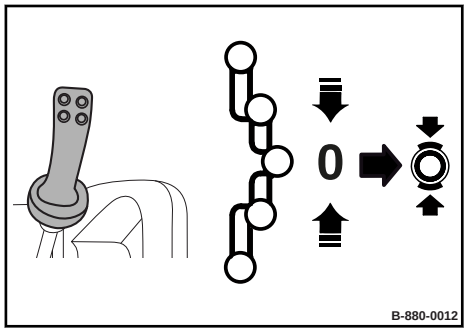


Fig. 61

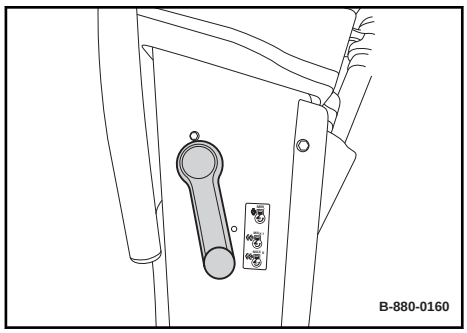


Fig. 62

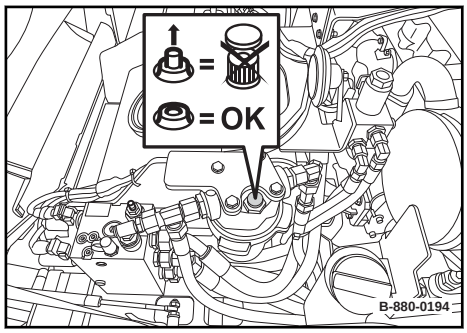


Fig. 63

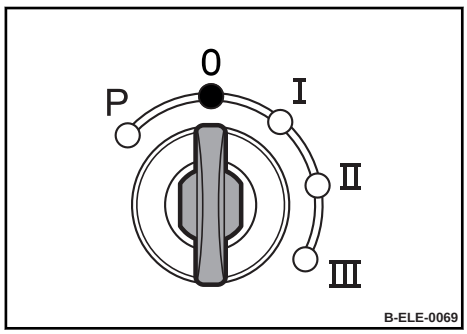


Fig. 64

4. Set the throttle lever to position “MAX II”.
5. Before leaving the machine, make sure that nobody enters the driver’s stand.
6. Open the engine hood. ↳ *Chapter 8.2.2.1 „Open and secure the engine hood“ on page 140*
7. Check on the left hand side of the machine if the pin of the maintenance indicator has popped out.
8. Check the maintenance indicator at maximum engine speed.
9. If the pin is visible, press it in.
   ⇨ Should the pin remain pressed in, the hydraulic oil filter is in good condition.
10. If the pin pops out, replace the hydraulic oil filter ↳ *Chapter 8.10.5 „Replacing the hydraulic oil filter“ on page 166*.
11. Close the engine hood. ↳ *Chapter 8.2.2.2 „Closing the engine hood“ on page 140*
12. Shift the throttle lever to position “MIN” (idle speed).
13. **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 two minutes.

    Turn the ignition key to position “0”.

6 Operation

6.1 Setting-up the work place

1. Park the machine in secured condition ↳ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.

6.1.1 Adjust the driver’s seat

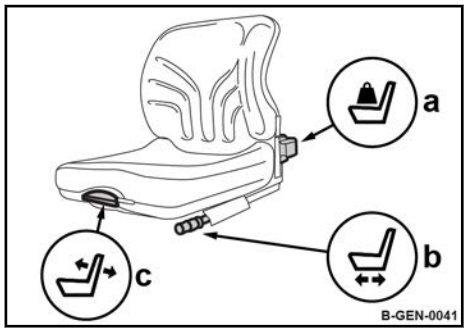


Fig. 65

a Weight adjustment
b Longitudinal adjustment
c Backrest adjustment

1. To adjust the inclination of the backrest operate lever (c) and tilt the backrest forward or back.
2. Adjust the seat in longitudinal direction, disengage lever (b) and push the seat forward or back to do so.
3. Adjust to the weight of the operator using lever (a).

The adjustment lever (a) is locked in upwards direction.

To release the lock press the lever down against the end stop.

Then adjust to the weight of the operator by sliding the lever down.

6.1.2 Sliding the driver’s seat sideways

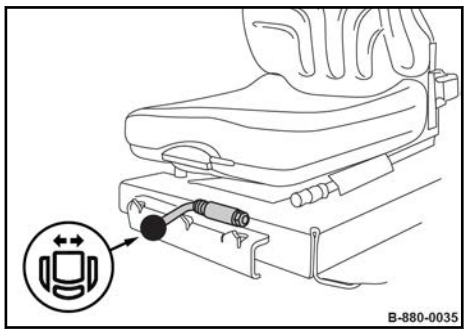


Fig. 66

1. Pull the lever up and slide the driver's seat sideways
2. Always lock the driver's seat safely in one of the locking positions.

6.2 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.

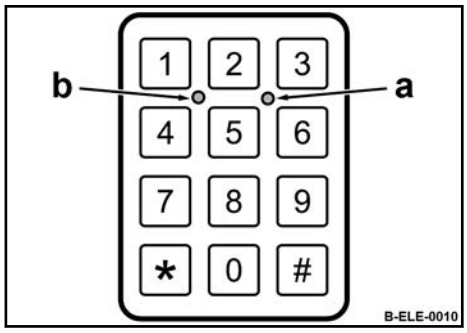


Fig. 67

1. Slowly enter the six-digit user code.
   ⇨ When entering the code, the light emitting diode (6) lights up with every digit.
2. Press the diamond button.
   ⇨ The electronic immobilizer is now disarmed and the engine can be started within the next 15 minutes.

6.3 Starting the engine

WARNING!
Loss of hearing caused by too high noise burdens!
– Wear your personal protective equipment (ear protection).

Protective equipment:
- Hearing protection

Prerequisites:
- Main battery switch (if present) switched on
- Emergency stop switch is unlocked
- Travel lever in parking brake position

When closing the dashboard cover, the emergency stop switch will lock automatically and must be unlocked before starting again.

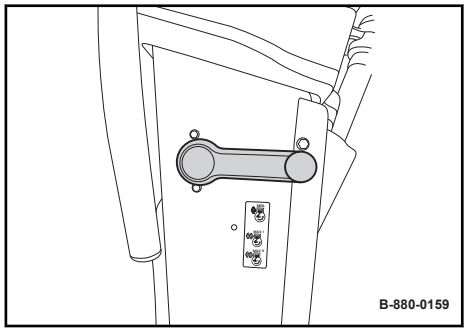


Fig. 68

1. Set the throttle lever to position “MIN”.

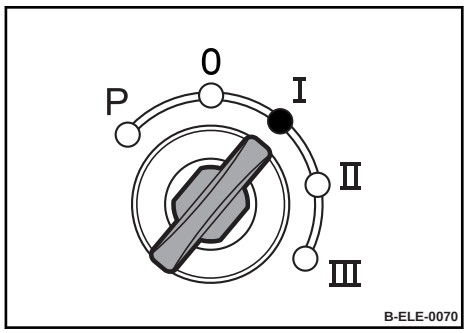


Fig. 69

2. Turn the ignition key to position “I”.

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

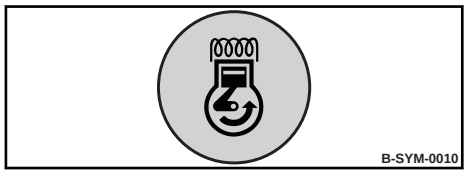


Fig. 70

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

⇨ The preheating control light lights up.

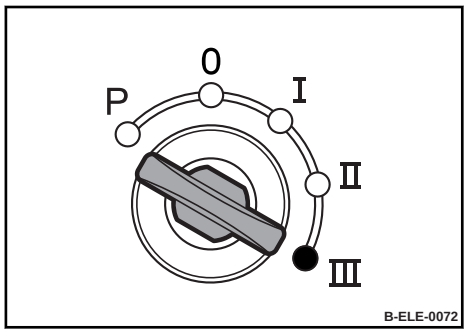


Fig. 71

4.

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!

Danger of engine damage!

– Warm up engine for a short while before starting work. Do not operate the engine immediately under full load.

6.4 Travel operation

6.4.1 Preliminary remarks and safety notes

Before starting to drive make sure that the driving area is absolutely safe.

DANGER!
Danger to life caused by the machine turning over!
– Never drive across a slope.
– Always drive straight up or down a slope.

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

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

Wet and loose soil considerably reduces traction of the machine on inclinations and slopes. Greater danger of accident!

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

Leaving the seat while travelling

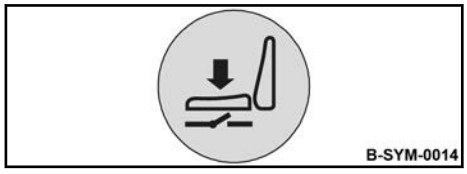


Fig. 72

If the operator leaves his seat while travelling, the driver's seat warning light lights up.

The warning buzzer sounds.

After approx. 3 seconds, the machine brakes to a standstill.

Before being able to drive again, the travel lever must first be shifted to the right into the parking brake position.

6.4.2 Driving the machine

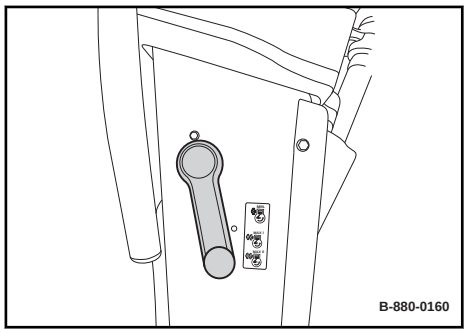


Fig. 73

1. Fasten your seat belt.
2. Set the throttle lever to position “MAX I” or “MAX II”.

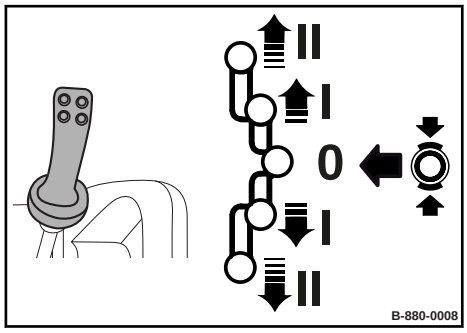


Fig. 74

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

6.4.3 Stopping the machine, applying the parking brake

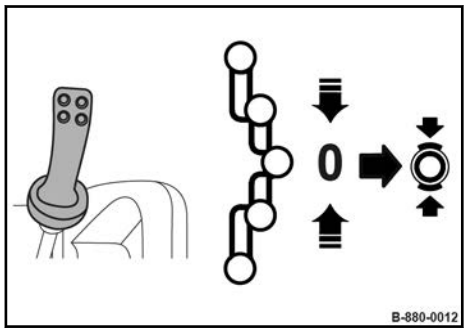


Fig. 75

1. Shift the travel lever to “Middle” position and engage it in parking brake position.

   ⇨ The machine will decelerate down to standstill and the parking brake will be applied after approx. 2 seconds.

   The parking brake warning lamp lights up.

6.5 Working with vibration

6.5.1 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.

6.5.2 Preparing to work with vibration

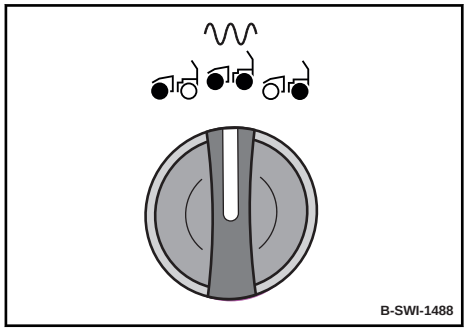


Fig. 76

1. 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.

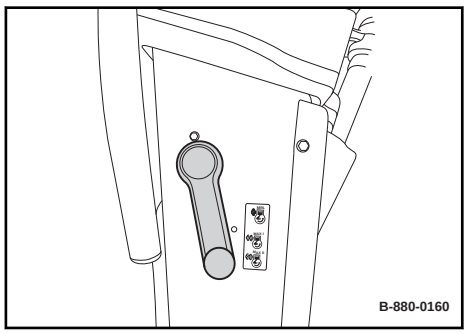


Fig. 77

2. Set the throttle lever to position “MAX I” or “MAX II”.

6.5.3 Manual vibration

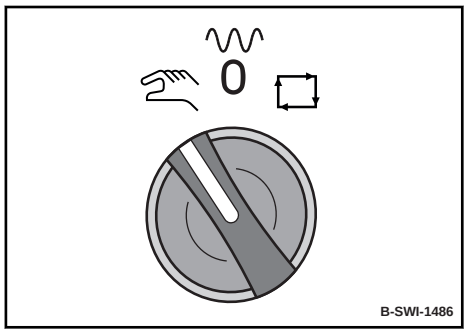


Fig. 78

1. Turn the rotary switch for vibration pre-selection to position “Left”.

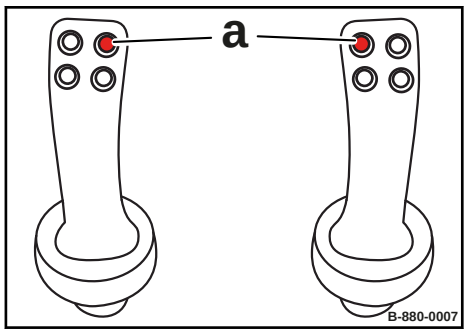


Fig. 79

2.

NOTICE!

Vibration at standstill causes transverse marks!

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

Shift the travel lever slowly in the desired travel direction.

3. Press the push button (a) on the left or right travel lever.

⇨ Vibration is switched on.

4. Press the push button (a) once again to switch off vibration.

6.5.4 Vibration in automatic mode

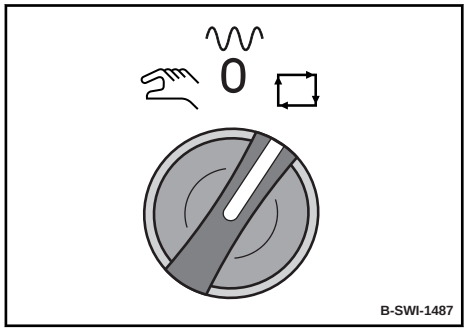


Fig. 80

1. Turn the rotary switch for vibration preselection to position “Right”.

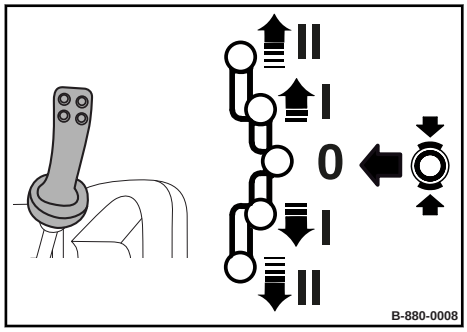


Fig. 81

2. Shift the travel lever slowly in the desired travel direction.

⇨ The vibration comes on at a low travel speed.

3. To switch off vibration, return the travel lever towards “Middle” position.

⇨ The vibration switches off when falling below a low travel speed.

6.5.5 Stop working with vibration

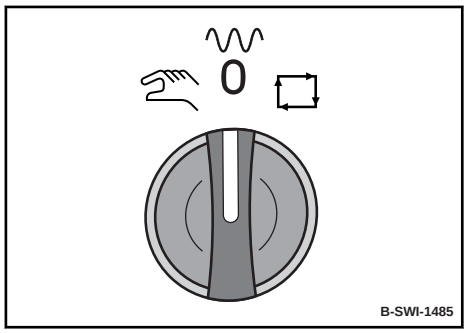


Fig. 82

1. Switch the vibration off.
2. Turn the rotary switch for vibration pre-selection to position “Middle”.

6.5.6 ECONOMIZER

The ECONOMIZER continuously informs the driver about the compaction status of the road subbase or the asphalt layer and enables the detection and selected re-compaction of weak spots.

The acceleration transducer on the front drum measures the reaction of the road subbase on the vibrating drum.

Start process

The ECONOMIZER is automatically started by switching the ignition on.

The ECONOMIZER first of all runs an LED-test. The LEDs light up one after the other, starting with LED (1). Once all LEDs are on, the display goes out again in single steps.

Measuring operation

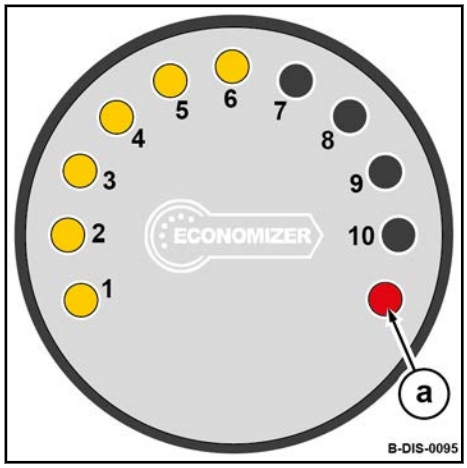


Fig. 83

With the vibration switched on, the measuring value is displayed by the LED display (1-10).

If the display value does not increase any further, no further compaction can be achieved with this machine.

The maximum display value (10) is not always reached.

Due to fluctuations in the measuring value, the display value can vary by one digit up/down during a pass.

The average display value during the last pass is decisive.

The warning display (a):

- Flashes for 1 - 2 seconds after the vibration has been switched on. The display goes out as soon as the vibration motor has reached its nominal frequency.
- flashes if the drum is in jump operation.
- lights in case of faults *Chapter 10.5 „Trouble shooting ECONOMIZER“ on page 206*.

Comparability of measuring values

In order to achieve the desired compaction condition of the road substructure or asphalt layer, one must always perform a suitable reference measurement before compaction is started.

The reference measurement is used to determine which display value of the ECONOMIZER corresponds with the measuring value for soil stiffness or asphalt density.

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

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

6.6 Water spraying system

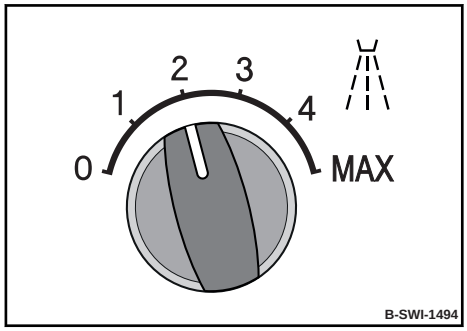


Fig. 84

1. Set the rotary switch for the water spraying system to the desired spraying interval.
2. Disengage the travel lever from parking brake position.

   ⇨ Spraying will only become active after the travel lever is actuated in travel direction, or after the rotary switch for the water spraying system has been set to permanent spraying (position “MAX”).

   With the travel lever in neutral, spraying will continue for a short while.

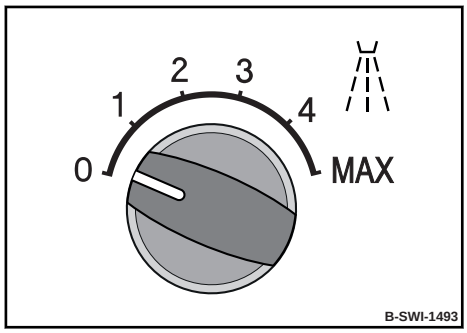


Fig. 85

3. After the end of work, turn the rotary switch for the water spraying system back to position “0”.

6.7 Parking the machine in secured condition

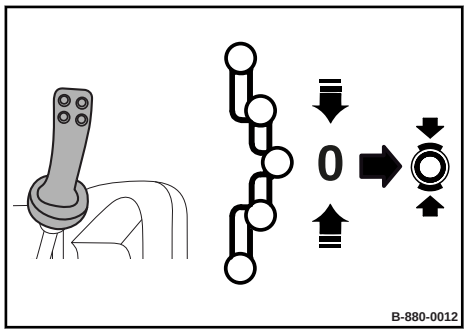


Fig. 86

1. Drive the machine onto level, firm ground.
2. Shift the travel lever to “Middle” position and engage it in parking brake position.
   ⇨ The machine will decelerate down to a standstill and the parking brake will be applied after approx. 2 seconds.

   The parking brake warning light lights up.

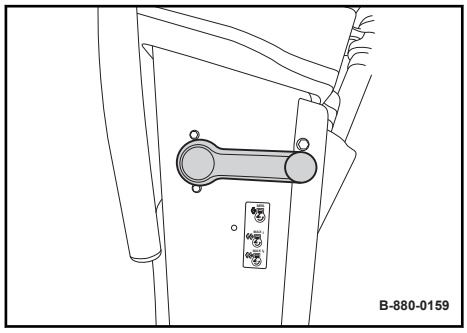


Fig. 87

3. Shift the throttle lever to position “MIN” (idle speed).

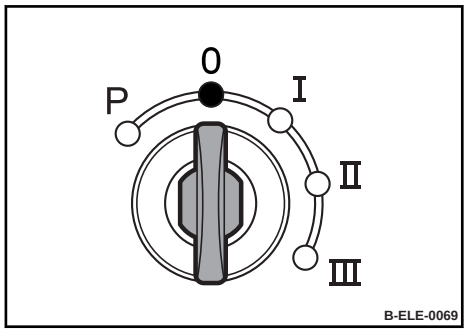


Fig. 88

4. **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 two minutes.

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

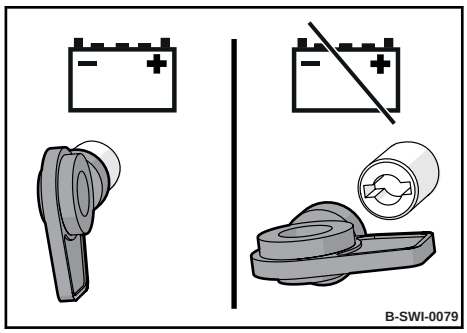


Fig. 89

5. Turn the main battery switch (if present) anticlockwise and pull it out.

6.8 Emergency procedures

6.8.1 Actuating the emergency stop switch

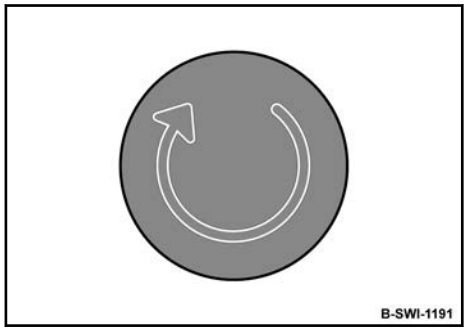


Fig. 90

1. In events of emergency and in case of danger actuate the emergency stop switch immediately.
   ⇨ The engine is shut down and the parking brake is closed.

6.8.2 Disconnecting the battery

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

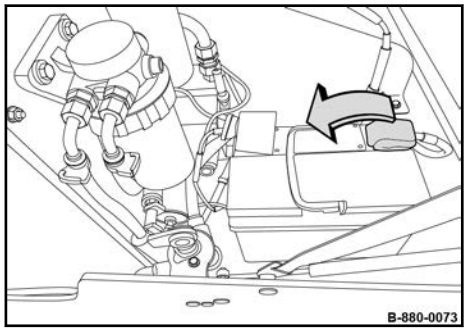


Fig. 91

1. Pull up the cap from the minus pole.
   ⇨ The pole clamp comes off the minus pole.
2. Disconnect the pole clamp from the minus pole of the battery and lay it to the side.

6.8.3 Towing the machine

6.8.3.1 Preliminary remarks and safety notes

Tow the machine only in case of emergency or to prevent an accident.

Always use a tow bar.

Towing distance: only out of the direct danger zone, towing speed: 1 km/h (0.6 mph).

Before towing make sure that:

- the tractor vehicle has sufficient traction and braking power for the non-braking towed load;
- tow bar and fastening means are able to withstand the load and are fastened at the points provided for this purpose.

The machine cannot be steered.

6.8.3.2 Towing the machine

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

Fastening the tow bar

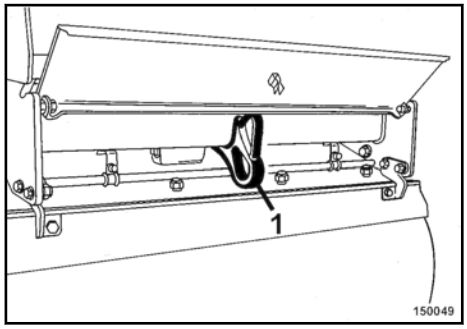


Fig. 92

1. Shut down the engine.
2. Fold the front or rear cover up.
3. Fasten the tow bar to the towing eye (1).

Short-circuiting the travel pump

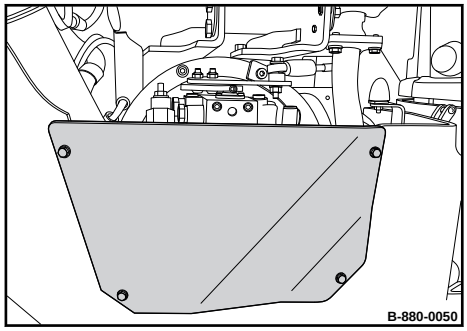


Fig. 93

4. **WARNING!**
   Danger of burning on hot components!
   – Wear your personal protective equipment (protective gloves, protective clothing).
   – Avoid touching hot components.

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

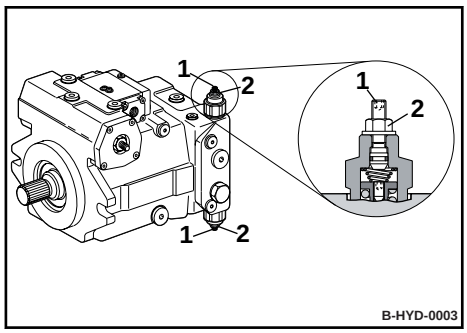


Fig. 94

5. Loosen the counter nuts (2) on the high pressure limiting valves of the travel pump.
6. Tighten the socket head cap screws (1) until the screw touches the spring cup (increased resistance).
7. Tighten the socket head cap screws another half turn.
8. Tighten the counter nuts, tightening torque: 22 Nm (16 ft·lbf).

Releasing the brake

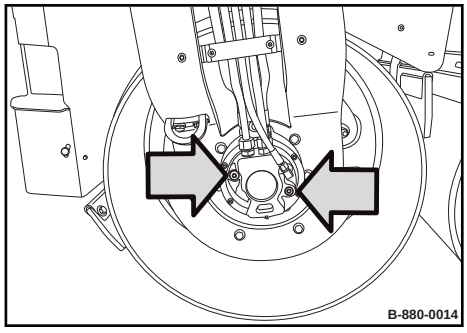


Fig. 95

9. **WARNING!**
   Danger of injury caused by uncontrolled machine movement!
   – Always secure the machine against unintended rolling.

   Remove two plugs.

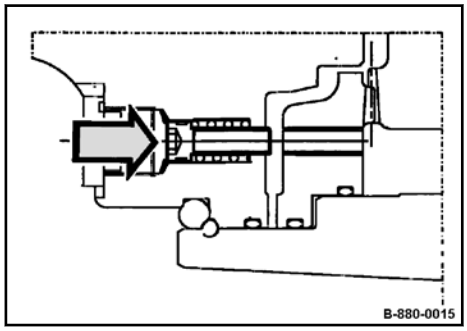


Fig. 96

10. Press both screws in against the springs.
11. Tighten both screws alternately and step by step against the end stop, tightening torque: 35 Nm (25 ft·lbf).

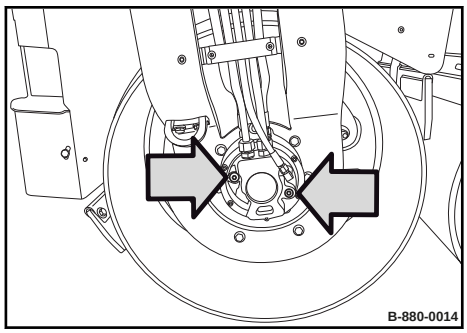


Fig. 97

12. Screw both plugs back in, tightening torque: 50 Nm (37 ft·lbf).
13. Also release the brake on the second drum.

    ⇨ The machine can now be towed.

6.8.3.3 After towing

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

WARNING!
Danger of injury caused by uncontrolled machine movement!
– Always secure the machine against unintended rolling.

1. After towing, park the machine in a safe place and secure it against accidentally rolling away.
2. Remove two plugs.

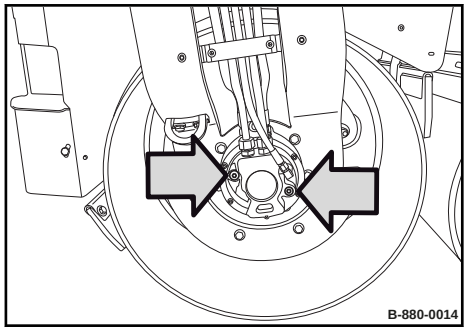


Fig. 98

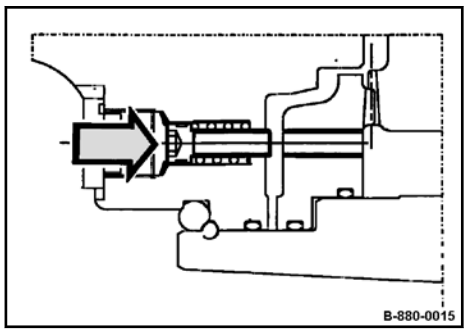


Fig. 99

3. Completely release both screws to close the brake.

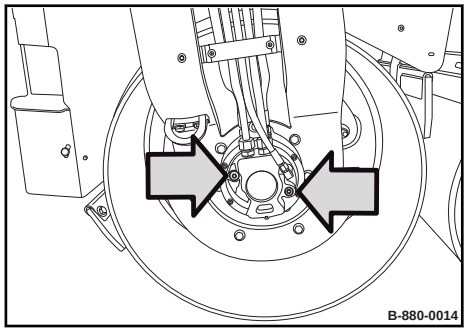


Fig. 100

4. Screw both plugs back in, tightening torque: 50 Nm (37 ft·lbf).
5. Close also the brake on the second drum.

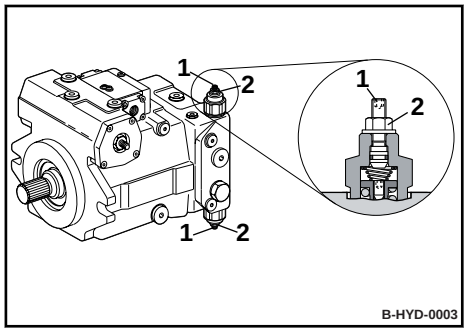


Fig. 101

6. Loosen the counter nuts (2) on the high pressure limiting valves of the travel pump.
7. Unscrew the socket head cap screws (1) against the end stop.
8. Tighten the counter nuts, tightening torque: 22 Nm (16 ft·lbf).

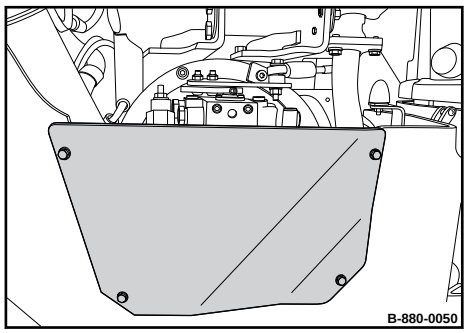


Fig. 102

9. Open the engine hood and assemble the covering on the travel pump.

6.8.3.4 Bleeding the hydraulic circuit

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

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

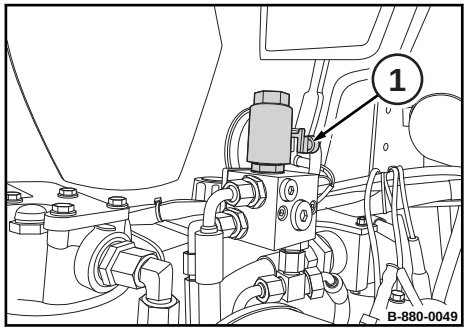


Fig. 103

1 Plug (Y04)

1. Pull plug (Y04) off the solenoid valve for the parking brake, to prevent the parking brake from opening.
2. Close the engine hood.

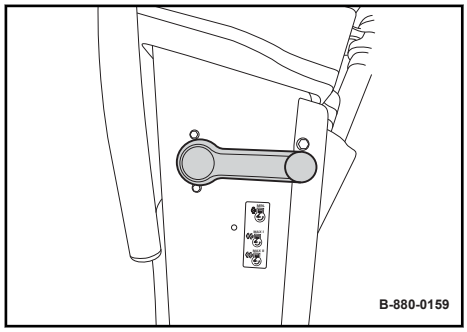


Fig. 104

3. Set the throttle lever to position “MIN”.
4. Start the engine and shut it down again after approx. 2-3 seconds.
5. Repeat this process after a short break.
6. Pull off the ignition key.

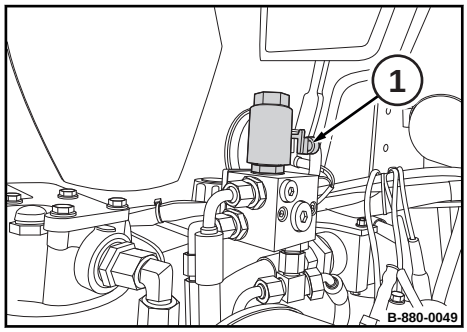


Fig. 105

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

1 Plug (Y04)

7 Loading / transporting the machine

7.1 Prepare for transport

1. Close all flaps.
2. Remove all loose objects from the machine or from the operator's stand or fasten them reliably.

7.2 Loading the machine

Use only stable loading ramps of sufficient load bearing capacity.

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

The ramp inclination must be less than the gradeability of the machine.

Make sure that any persons keep a safety distance of at least 2 metres while the machine is driven onto or down from the transport vehicle. The instructing person should not be inside the travel range of the machine.

1. **DANGER!**
   Danger to life caused by the machine slipping or turning over!
   – Make sure that no persons are in the danger zone.

   Drive the machine carefully onto the transport vehicle.
2. Move the steering to middle position.
3. Shut down the engine, pull off the ignition key.
4. **WARNING!**
   Danger of crushing by the articulating machine!
   – Do not step into the articulation area of the machine while the engine is running.

   Attach and secure the articulation lock.

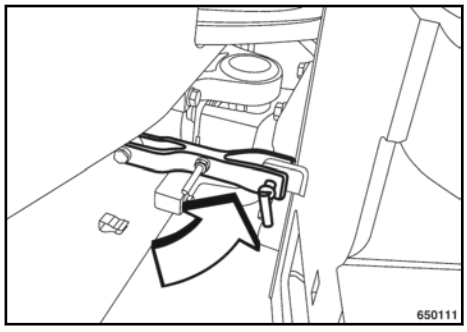


Fig. 106

The foldable ROPS can be folded down to reduce the transport height.

5. Fold down the foldable ROPS, if necessary *Chapter 7.2.1 „Folding down the foldable ROPS“ on page 126*.

7.2.1 Folding down the foldable ROPS

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

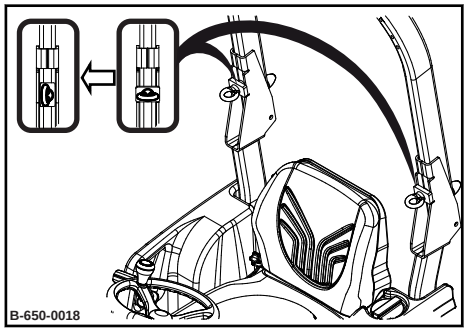


Fig. 107

1. Loosen the eye bolts and adjust the clamping plates vertically.
2. **CAUTION!**
   Head injuries caused by folding the foldable ROPS!
   – Do not step into the slewing area of the foldable ROPS.

   Fold the foldable ROPS back.

7.3 Lashing the machine to the transport vehicle

Do not use lifting points that are damaged or impaired in any other way.

Always use appropriate lifting and lashing tackle at the lifting and lifting points.

Use lifting tackle only in the specified loading direction.

Lifting tackle must not be damaged by machine parts.

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

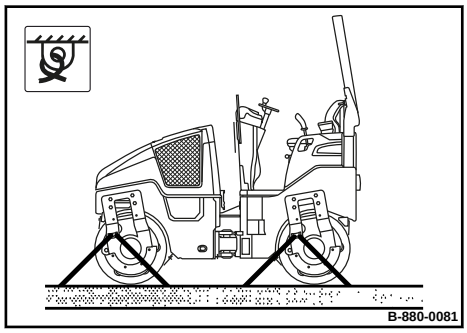


Fig. 108

1. Fasten the lifting and lashing tackle on the marked lashing points on front or rear frame.
2. Lash the machine securely to the transport vehicle.

7.4 Loading by crane

Loads must only be attached and hoisted by an expert / capable person.

Do not use damaged or in any other way impaired lashing points.

Use only lifting gear and lifting tackle with sufficient load bearing capacity for the weight to be loaded. Minimum load bearing capacity of lifting gear: see max. operating weight
↳ *Chapter 2 „Technical data“ on page 13*.

Always use appropriate lifting and lashing means on the lifting and lashing points.

Use lifting and lashing gear only in the prescribed direction of load application.

Lifting tackle must not be damaged by machine components.

When lifting the machine avoid uncontrolled movements of the load. If necessary hold the load with guide ropes.

1. Shut down the engine.

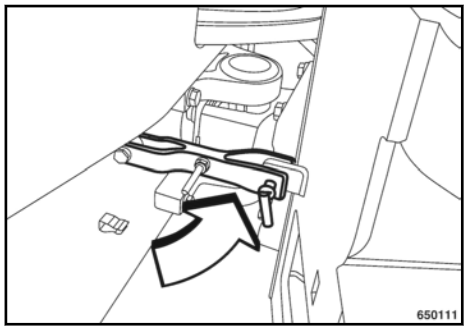


Fig. 109

2. **WARNING!**
   Danger of crushing by the articulating machine!
   – Do not step into the articulation area of the machine while the engine is running.

   Attach and secure the articulation lock.

   The foldable ROPS can be folded down to reduce the transport height.

3. Fold down the foldable ROPS, if necessary
↳ *Chapter 7.2.1 „Folding down the foldable ROPS“ on page 126*.

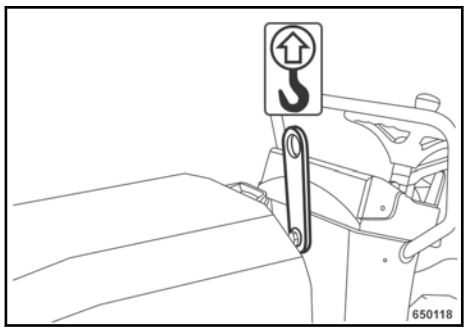


Fig. 110

4. Attach the lifting tackle to the central lifting point.

5. **DANGER!**
   Danger to life caused by suspended loads!
   – Do not step or stand under suspended loads.

   Lift the machine carefully and lower it again at the intended location.

7.5 Loading by crane

Loads must only be attached and hoisted by an expert / capable person.

Do not use damaged or in any other way impaired lashing points.

Use only lifting gear and lifting tackle with sufficient load bearing capacity for the weight to be loaded. Minimum load bearing capacity of lifting gear: see max. operating weight *Chapter 2 „Technical data“ on page 13*.

Always use appropriate lifting and lashing means on the lifting and lashing points.

Use lifting and lashing gear only in the prescribed direction of load application.

Lifting tackle must not be damaged by machine components.

When lifting the machine avoid uncontrolled movements of the load. If necessary hold the load with guide ropes.

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

1. Shut down the engine.

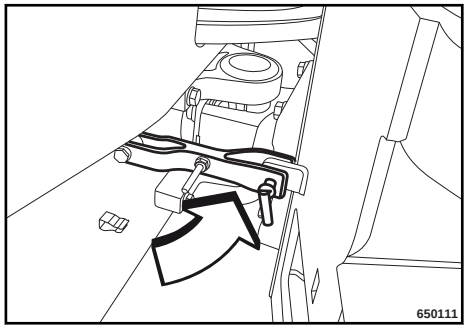


Fig. 111

2. **WARNING!**
   Danger of crushing by the articulating machine!
   – Do not step into the articulation area of the machine while the engine is running.

   Attach and secure the articulation lock.

The foldable ROPS can be folded down to reduce the transport height.

3. Fold down the foldable ROPS, if necessary *Chapter 7.2.1 „Folding down the foldable ROPS“ on page 126*.

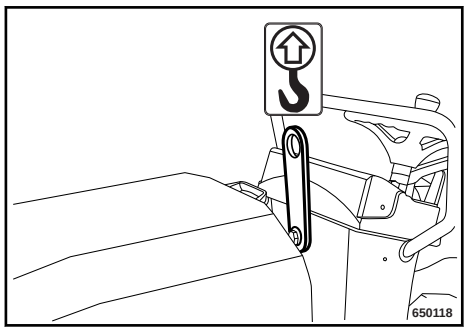


Fig. 112

4. **NOTICE!**
   The protective roof may get damaged when lifting!
   – Always fold the protective roof in.

   Attach the lifting tackle to the central lifting point.

5. **DANGER!**
   Danger to life caused by suspended loads!
   – Do not step or stand under suspended loads.

   Lift the machine carefully and set down again at the intended location.

7.6 After transport

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

1. Erect the foldable ROPS and fasten it with the specified tightening torques *Chapter 7.6.1 „Erecting the foldable ROPS“ on page 132*.
2. **WARNING!**
   Danger of crushing by the articulating machine!
   – Do not step into the articulation area of the machine while the engine is running.

   Loosen the articulation lock again and fasten it in the holding fixture. *Chapter 8.2.1.2 „Disengaging the articulation lock“ on page 139*

7.6.1 Erecting the foldable ROPS

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

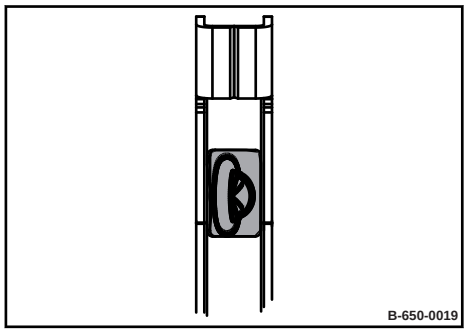


Fig. 113

1. Erect the clamping plates on both sides vertically.

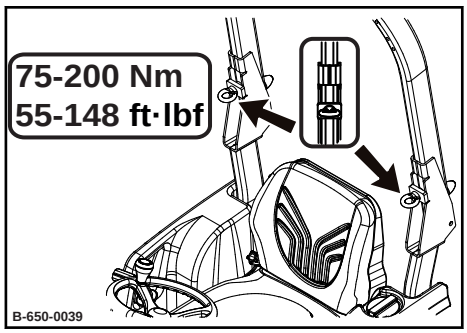


Fig. 114

2.

CAUTION!

Danger of crushing when erecting the foldable ROPS!

– Do not reach with your hands into the slewing area of the foldable ROPS.

Fold up the foldable ROPS.

3. Turn the clamping plates horizontally and tighten the eye bolts, tightening torque: 75 – 200 Nm (55 – 148 ft·lbf).

8 Maintenance

8.1 Preliminary remarks and safety notes

DANGER!
Danger to life caused by an operationally unsafe machine!
- The machine must only be serviced by qualified and authorized personnel.
- Follow the safety regulations for maintenance work *Chapter 3.10 „Maintenance work“ on page 51*.

WARNING!
Health hazard caused by fuels and lubricants!
- Safety regulations and environmental protection regulations must be followed when handling fuels and lubricants *Chapter 3.4 „Handling fuels and lubricants“ on page 29*.

Wear your personal protective equipment.

Do not touch hot components.

Park the machine on horizontal, level, firm ground.

Perform maintenance work only with the engine shut down.

Make sure that the engine cannot be accidentally started during maintenance work.

Thoroughly clean machine and engine before starting maintenance work.

Before mounting the machine, check whether all access steps, grips and platforms are free of obstacles, grease, oils, fuel, dirt, snow and ice.

Use only the intended access steps and grips to mount the machine.

For overhead maintenance work use the access steps and working platforms provided or other secure means.

Do not step on machine parts which are not intended for this purpose.

Always attach the articulation lock when working in the area of the articulated joint.

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

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

Close all maintenance flaps and doors after maintenance work has been completed.

The terms right/left are always in relation to the travel direction.

8.2 Preparations/concluding work

Certain maintenance tasks require preparations and concluding activities.

This includes e.g. opening and closing maintenance flaps and maintenance doors as well as securing certain components.

After this work close all maintenance flaps and doors again and return all components to their operating condition.

8.2.1 Articulation lock

8.2.1.1 Engaging the articulation lock

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

WARNING!

Danger of crushing by the articulating machine!

– Do not step into the articulation area of the machine while the engine is running.

1. Move the steering to middle position and stop the machine.
2. Switch off the engine and remove the ignition key.

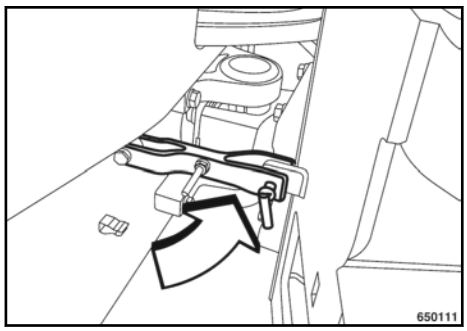


Fig. 115

3. **WARNING!**
   Danger of crushing by the articulating machine!
   – Do not step into the articulation area of the machine while the engine is running.

   Attach and secure the articulation lock.

   The foldable ROPS can be folded down to reduce the transport height.

4. Fold down the foldable ROPS, if necessary ↬ *Chapter 7.2.1 „Folding down the foldable ROPS“ on page 126*.

8.2.1.2 Disengaging the articulation lock

Protective equipment:
- Working clothes
- Safety shoes
- Protective gloves

1. Erect the foldable ROPS and fasten it with the specified tightening torques ↬ *Chapter 7.6.1 „Erecting the foldable ROPS“ on page 132*.

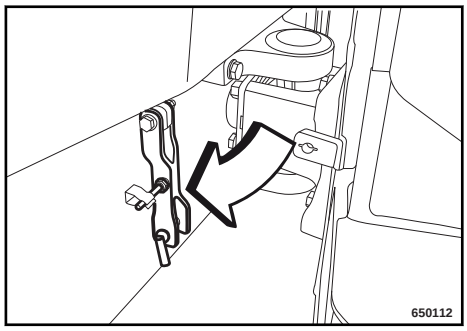


Fig. 116

2. **WARNING!**
   Danger of crushing by the articulating machine!
   – Do not step into the articulation area of the machine while the engine is running.

   Loosen the articulation lock again and fasten it in the holding fixture.

8.2.2 Engine hood

8.2.2.1 Open and secure the engine hood

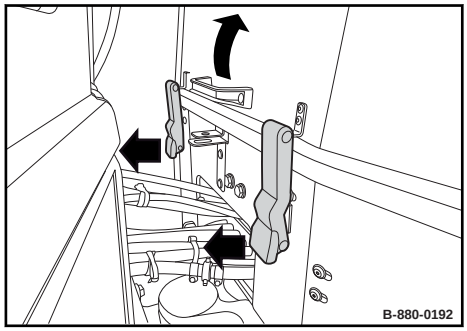


Fig. 117

1. Open the locking.
2. Push the hood to top position.
   ⇨ The hood is raised supported by the gas springs.

8.2.2.2 Closing the engine hood

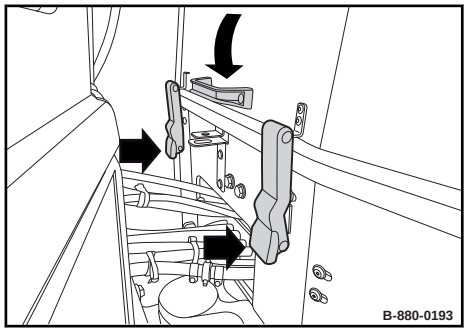


Fig. 118

1. Push the hood at the handle into initial position.
2. Lock the hood.

8.3 Fuels and lubricants

8.3.1 Engine oil

8.3.1.1 Oil quality

The following engine oil specifications are permitted:

- Engine oils as per API-classification CF, CF-4, CG-4, CH-4 and CI-4

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

Avoid mixing engine oils.

8.3.1.2 Oil viscosity

Since engine 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).

The temperature data of the SAE-class always refer to fresh oils. In travel operation engine oil ages because of soot and fuel residues. This adversely affects the properties of the engine oil, especially under low ambient temperatures.

Optimal operating conditions can be achieved by using the following oil viscosity chart as a reference:

Ambient temperature	Oil viscosity
higher 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

8.3.1.3 Oil change intervals

If the oil change intervals are not reached over a period of one year, the oil change should be performed at least 1 x per year, irrespective of the operating hours reached.

If the sulphur content in the fuel is higher than 0.5 %, the oil change intervals must be halved.

8.3.2 Fuel

8.3.2.1 Fuel quality

We recommend using a diesel fuel with a sulphur content of less than 0.1 %.

When using a diesel fuel with a high sulphur content of 0.5 % to 1.0 % the oil change intervals must be halved.

Fuels with a sulphur content of more than 1.0 % are not permitted.

In order to fulfil national emission regulations one must strictly use the legally required fuels (e.g. sulphur content).

The recommended Cetan index number is 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 more than 1500 m (4921 ft).

The following fuel specifications are recommended:

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

8.3.2.2 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.

8.3.2.3 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.

8.3.3 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)

8.3.4 Hydraulic oil

8.3.4.1 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).

When refilling or changing oil, use only hydraulic oil type HVLP according to DIN 51524, part 3, or hydraulic oil type HV according to ISO 6743/4.

The viscosity index must be at least 150 (observe information of manufacturer).

8.4 List of fuels and lubricants

<table>
<tr><th rowspan="2">Assembly group</th><th colspan="2">Fuel or lubricant</th><th rowspan="2">Spare parts number</th><th>Filling quantity</th></tr>
<tr><th>Summer</th><th>Winter</th><th>Observe the level mark!</th></tr>
<tr><td rowspan="4">Engine oil</td><td colspan="2">SAE 10W-40
Specification: ↳ Chapter 8.3.1 „Engine oil“ on page 141</td><td>009 920 06
20 l</td><td rowspan="4">6.5 l
(1.7 gal us)</td></tr>
<tr><td colspan="2">SAE 10W-30</td><td></td></tr>
<tr><td colspan="2">SAE 15W-40</td><td></td></tr>
<tr><td>SAE 30</td><td></td><td></td></tr>
<tr><td rowspan="2">Fuel</td><td>Diesel</td><td>Winter diesel fuel</td><td rowspan="2"></td><td rowspan="2">35 l
(9.2 gal us)</td></tr>
<tr><td colspan="2">Specification: ↳ Chapter 8.3.2 „Fuel“ on page 142</td></tr>
<tr><td>Coolant</td><td colspan="2">Mixture of water and anti-freeze agent
Specification: ↳ Chapter 8.3.3 „Coolant“ on page 144</td><td>009 940 08
20 l</td><td>6 l
(1.6 gal us)</td></tr>
<tr><td>Hydraulic system</td><td colspan="2">Hydraulic oil (ISO), HVLP 46
Specification: ↳ Chapter 8.3.4.1 „Mineral oil based hydraulic oil“ on page 145</td><td>009 930 09
20 l</td><td>35 l
(9.2 gal us)</td></tr>
<tr><td>Water spraying system</td><td>Water</td><td>Anti-freeze mixture</td><td></td><td>160 l
(42 gal us)</td></tr>
</table>

8.5 Running-in instructions

8.5.1 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.

8.5.2 After 50 operating hours

1. Check the engine for leaks.
2. Tighten all bolted connections on air intake, exhaust, oil sump and engine mounts
3. Retighten the bolted connections on the machine.

8.6 Maintenance Table

No.	Maintenance works	Page
	Every 3000 operating hours	
8.12.1	*Checking the fuel injection pump*	*177*
	As required	
8.13.1	*Air filter maintenance*	*178*
8.13.2	*Checking the water spraying system*	*182*
8.13.3	*Cleaning the water spraying system*	*184*
8.13.4	*Measures if there is a risk of frost*	*186*

8.7 Every 50 operating hours

8.7.1 Checking radiator hoses and hose clamps

Protective equipment:
- Working clothes
- Protective gloves

1. Park the machine in secured condition ↳ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Allow the engine to cool down.
3. Check the condition and tight fit of all fuel lines and hose clamps.
4. If fuel lines or hose clamps are found to be damaged, the corresponding parts must be immediately repaired or replaced by authorized service personnel.

NOTICE!

Danger of engine damage!

– After work on the fuel system bleed the system, perform a test run and check for leaks.

8.7.2 Checking, cleaning the water separator

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 check for signs of water and dirt initially every day.

If a too high quantity is drained off, the filter needs to be bled.

Protective equipment:

- Working clothes
- Protective gloves

1. Park the machine in secured condition ↳ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Place the transparent container under the drain plug.
3. Slacken the drain plug for a few turns and collect leaking fluid.
4. Drain the fuel off until there is no water left.
5. Turn the plug tightly back in. Check for leaks, if necessary use a new seal ring.
6. Dispose of collected fluid in an environmentally friendly way.

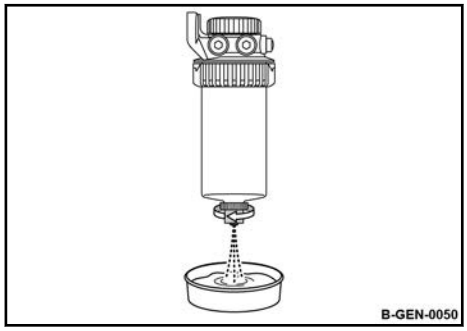


Fig. 119

8.8 Every 250 operating hours

8.8.1 Change engine oil and oil filter cartridge

Perform this maintenance work at the latest after one year.

NOTICE!

Danger of engine damage!

- Change the oil only with the engine at operating temperature.
- Use only oil of the permitted specification *Chapter 8.3.1 „Engine oil“ on page 141*.
- Filling quantity: *Chapter 8.4 „List of fuels and lubricants“ on page 146*

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

1. Park the machine safely *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.

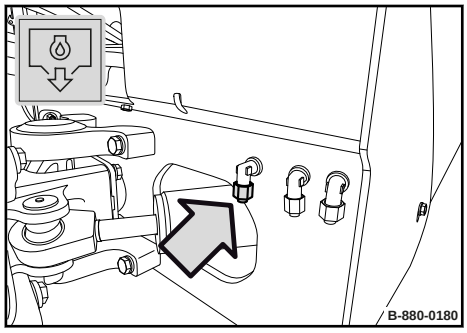


Fig. 120

2. **WARNING!**

   Danger of burning on hot components!

   - Wear your personal protective equipment (protective gloves, protective clothing).
   - Avoid touching hot components.

   Unscrew the drain plug and collect any oil running out.

3. Screw the drain plug back in tightly.

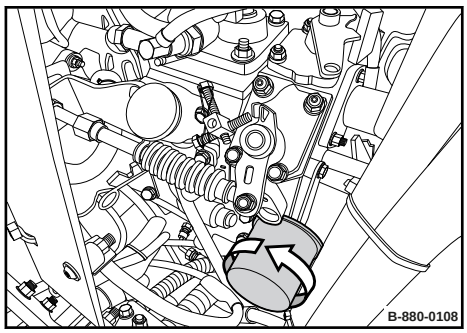


Fig. 121

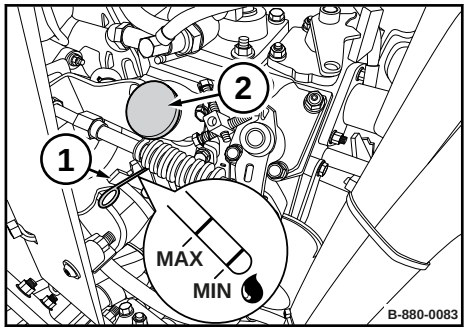


Fig. 122

4. Thoroughly clean the outside of the oil filter cartridge.
5. Unscrew the oil filter cartridge using an appropriate strap wrench.
6. Remove any dirt from the sealing face of the filter carrier.
7. Thinly apply oil to the rubber seal of the new oil filter cartridge.
8. Screw on the oil filter cartridge and tighten by hand.
9. Fill in fresh engine oil through the filler opening (2).
10. After a short test run check the oil level on the oil dipstick (1), if necessary top up to the “MAX” mark.
11. Check oil filter cartridge and drain plug for leaks.
12. Dispose of the oil and filters in line with environmental regulations.

8.8.2 Checking, tensioning the V-belt

8.8.2.1 Checking the V-belt

Protective equipment:
- Working clothes
- Protective gloves

1. Park the machine in secured condition ↬ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Allow the engine to cool down.

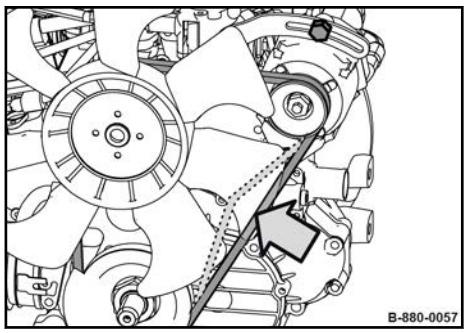


Fig. 123

3. Check the entire circumference of the V-belt for damage and cracks.
4. Replace a damaged or cracked V-belt ↳ *Chapter 8.9.2 „Replacing the V-belt“ on page 160*.
5. Check with thumb pressure whether the V-belt can be depressed more than 7 to 9 mm (0.28 – 0.35 inch) between the V-belt pulleys, retighten if necessary.

8.8.2.2 Tightening the V-belt

Protective equipment:
- Working clothes
- Protective gloves

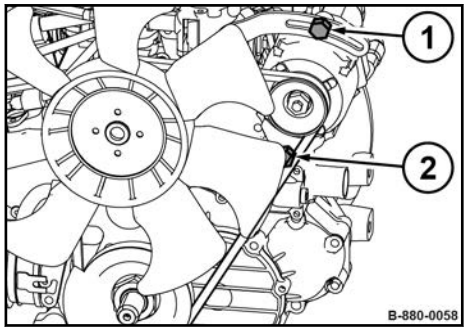


Fig. 124

1. Loosen the tensioning screw (1) and the screw (2) on the generator.
2. Press the generator towards the outside using a lever, until the correct V-belt tension is reached.
3. Retighten clamping screw (1) and screw (2).

8.8.3 Check the air intake lines

Protective equipment:
- Working clothes
- Protective gloves

1. Park the machine in secured condition ↳ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Allow the engine to cool down.
3. Check the condition and tight fit of all air intake lines and hose clamps.
4. If fuel lines or hose clamps are found to be damaged, the corresponding parts must be immediately replaced.

8.8.4 Checking radiator hoses and hose clamps

Protective equipment:
- Working clothes
- Protective gloves

1. Park the machine in secured condition ↳ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Allow the engine to cool down.
3. Check the condition and tight fit of all radiator hoses and hose clamps.
4. If a radiator hose is swollen, hardened or cracked, both hose and hose clamp must be replaced immediately.

8.8.5 Cleaning the radiator module

NOTICE!
Components may get damaged!
- Do not bend or damage cooling fins.
- Do not clean with high pressure.

1. Park the machine in secured condition ↳ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Allow the engine to cool down.

Cleaning with compressed air

Protective equipment:

- Working clothes
- Protective gloves
- Safety goggles

CAUTION!
Danger of eye injuries caused by particles flying around!
– Wear your personal protective equipment (safety gloves, protective working clothes, goggles).

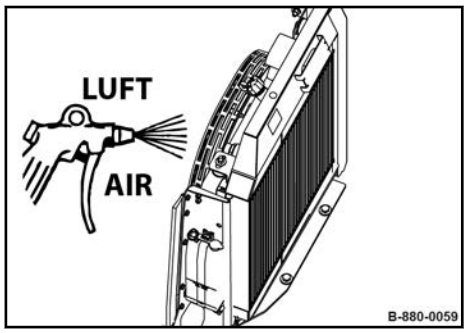


Fig. 125

1. Blow the cooler out with compressed air from inside the engine compartment.

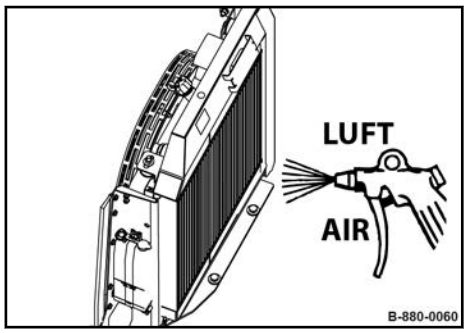


Fig. 126

2. Blow the cooler out with compressed air from the outside.

Cleaning with cold cleansing agent

Protective equipment:

- Working clothes
- Protective gloves

NOTICE!

Electric components can be damaged by water entering into the system!

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

1. Spray engine and cooler with a suitable cleansing agent, let it soak in for a while and spray it off with a strong water jet.
2. Run the engine warm for a while to avoid corrosion.

8.8.6 Battery service

Maintenance free batteries also need care. Maintenance free only means that the fluid level does not need to be checked.

Every battery has a self-discharge, which may, if not checked occasionally, even cause damage to the battery as a result of exhaustive discharge.

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

Protective equipment:

- Working clothes
- Protective gloves
- Safety goggles

1. Park the machine in secured condition ↬ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.

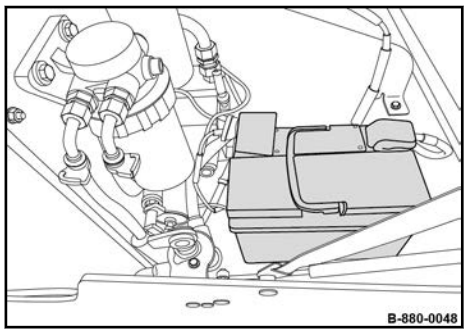


Fig. 127

2. Remove the battery and clean the battery compartment.
3. Clean the outside of the battery.
4. Clean battery poles and pole clamps and grease them with pole grease (Vaseline).
5. Install the battery and check the battery fastening.
6. On serviceable batteries check the acid level, if necessary top up to the filling mark with distilled water.

8.8.7 Check the parking brake

This work must only be performed by authorized service personnel.

8.9 Every 500 operating hours

8.9.1 Replacing the fuel filter

NOTICE!
Danger of engine damage!
- Ensure strict cleanliness! Thoroughly clean the area around the fuel filters.
- Air in the fuel system causes irregular running of the engine, a drop in engine power, stalls the engine and makes starting impossible.

Protective equipment:
- Working clothes
- Protective gloves

1. Park the machine in secured condition ↬ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Loosen the hose clamps (1) on the fuel pre-filter.
3. Pull the hoses off the fuel pre-filter.
4. Install the new fuel pre-filter and observe the flow direction (arrow).

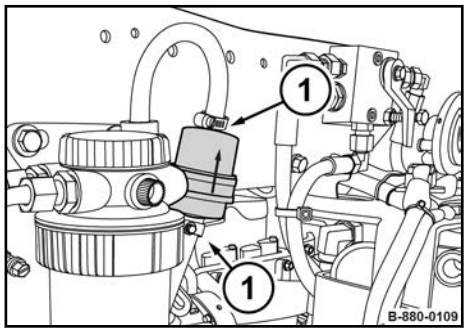


Fig. 128

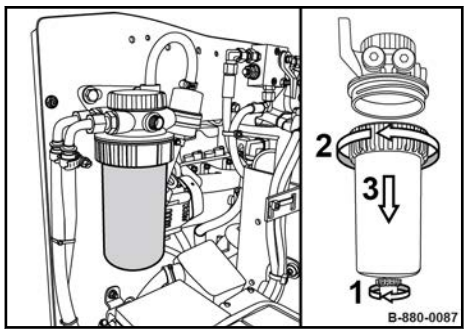


Fig. 129

5. Unscrew the drain plug (1) and catch running out fuel.
6. Open the quick lock (2) and take off the fuel filter (3).
7. Clean the sealing face on the filter carrier from any dirt.

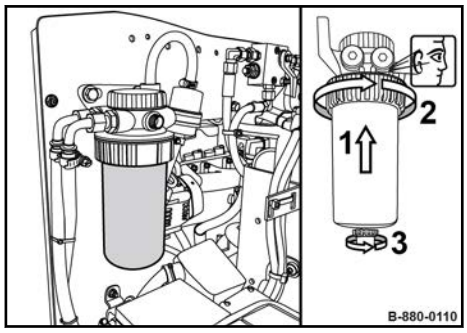


Fig. 130

8. **NOTICE!**
   Danger of engine damage!
   – Never fill filters beforehand, to avoid the entry of dirt into the clean side.

   Slightly oil the rubber seal on the new fuel filter.
9. Attach the fuel filter (1) with the quick lock and ensure correct coding.
10. Close the quick lock (2) so that is engages noticeably.
11. Screw in drain plug (3).
12. Dispose of fuel and fuel filter in an environmentally friendly manner.

8.9.2 Replacing the V-belt

Perform this maintenance work at the latest after two years.

Protective equipment:
- Working clothes
- Protective gloves

1. Park the machine in secured condition ↳ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Allow the engine to cool down.
3. Loosen the tensioning screw (1) and the screw (2) on the generator.
4. Relieve and remove the V-belt.
5. Assemble a new V-belt at the generator.
6. Tension the V-belt to the specified value ↳ *Chapter 8.8.2 „Checking, tensioning the V-belt“ on page 153*.
7. Retighten clamping screw (1) and screw (2).

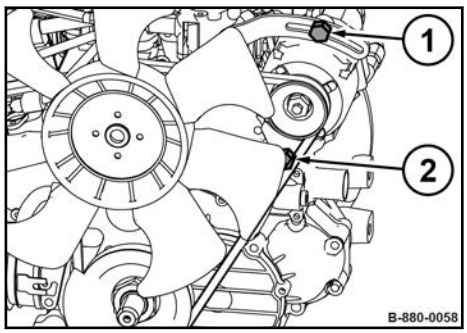


Fig. 131

8.9.3 Checking the anti-freeze concentration and the condition of the coolant

Protective equipment:
- Protective gloves
- Safety goggles

1. Park the machine in secured condition ↳ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Allow the engine to cool down.
3. Remove the cover (1) from the compensation tank and check the anti-freeze concentration with a conventional tester.
4. Check the condition of the coolant.
5. Thoroughly flush the cooling system if the coolant is contaminated by corrosion residues or other suspended matter ↳ *Chapter 8.11.2 „Changing the coolant“ on page 173*.
6. Close the cover again.

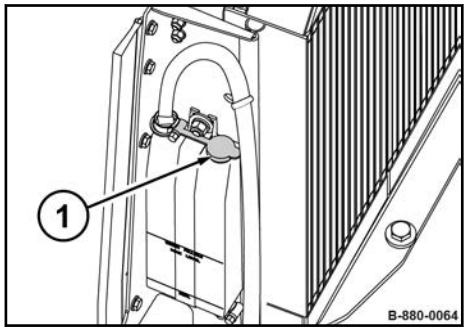


Fig. 132

8.9.4 Checking the hydraulic lines

This work must only be performed by an expert / qualified person!

1. Park the machine in secured condition ↳ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Check all hydraulic lines.

   Hydraulic hoses must be immediately replaced if:

   - the outer layer is damaged down to the inlay (e.g. chafing, cuts, cracks),
   - embrittlement of the outer layer or formation of cracks in the hose material,
   - the hose shows deformation in pressurized and depressurized condition, which do not comply with the genuine shape of the hydraulic hose (e.g. layer separation, formation of blisters, crushed spots, buckling),
   - leaks on hose, socket or fitting,
   - the hydraulic hose has separated from the fitting,
   - fittings are damaged or deformed, whereby the function and strength of the hose - fitting connection is impaired,
   - the fitting shows corrosion that impairs both function and strength,
   - incorrect installation (squeezing, shearing or chafing points),
   - paint covered hydraulic hoses (no detection of identifications or cracks),
   - shelf life and service life exceeded.
3. Replace damaged hydraulic hoses immediately, fasten these properly and avoid chafing.
4. Only operate the machine after it has been repaired.

8.10 Every 1000 operating hours

8.10.1 Checking, adjusting the valve clearance

NOTICE!
Danger of engine damage!
We recommend to have this work carried out by trained personnel or our after sales service.

– Before checking the valve clearance let the engine cool down for at least 30 minutes. The engine oil temperature must be below 80 °C (176 °F).

Valve clearance	
Intake / exhaust valve	0.18 mm to 0.22 mm (0.007 in to 0.009 in)

Protective equipment:
- Working clothes
- Safety shoes
- Protective gloves

1. Park the machine safely *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Allow the engine to cool down.
3. Remove the valve cover.

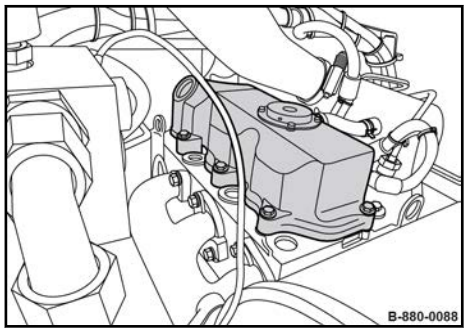


Fig. 133

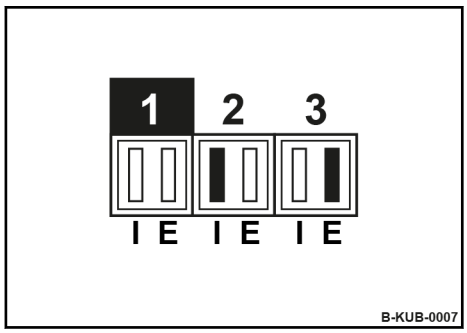


Fig. 134

I Intake valve
E Exhaust valve

4. Set cylinder 1 to overlapping and check the valve clearance on the valves marked black, adjust if necessary.

   Cylinder 1 is on the cooling fan side.

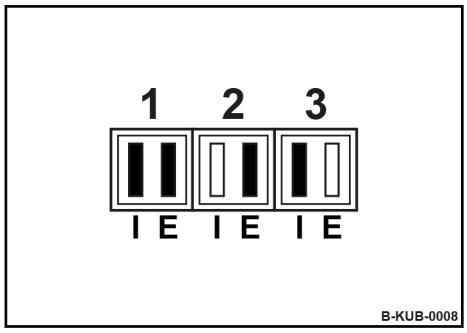


Fig. 135

5. Turn the crankshaft one full turn (360 °) further.
6. Check the valve clearance on the valves marked black, adjust if necessary.

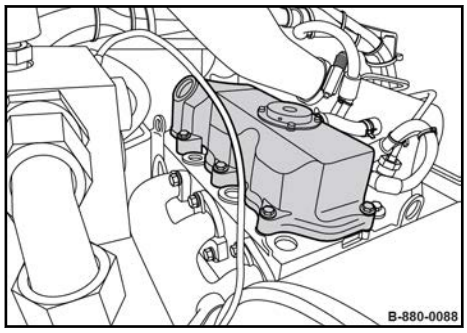


Fig. 136

7. Install the cylinder head cover with a new seal.
8. After a short test run, check the engine for leaks.

Checking the valve clearance

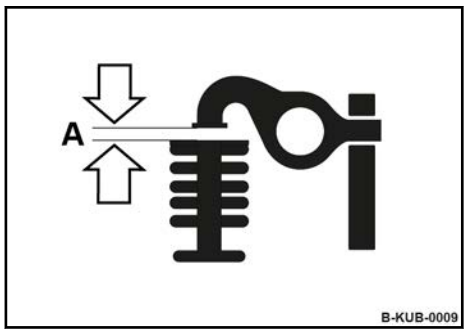


Fig. 137

1. Check valve clearance (A) between rocker arm and valve with a feeler gauge. The feeler gauge must fit through the gap with little resistance.
2. If the gap is too narrow or too wide for the feeler gauge, adjust the valve clearance.

8.10.2 Checking the engine mounts

Protective equipment:
- Working clothes
- Protective gloves

1. Park the machine in secured condition *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Allow the engine to cool down.
3. Check air intake and exhaust manifold fastenings for tight fit.
4. Check sockets and clamps between air filter, exhaust turbocharger and charge air line as well as the engine oil lines for tight fit and leaks.
5. Check fastening screws on the engine oil sump and engine mounts for tight fit.
6. Check condition and tight fit of engine pillow blocks.

8.10.3 Checking the ROPS

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.

Unusual movements and noises (vibrations) during operation are signs for damage or loosened fastening elements.

1. Inspect the ROPS structure for cracks, corrosion, damage and missing fastening parts.
2. Check the fastening screws for the ROPS to the operator's stand for tight fit.
3. Check the rubber buffers of the operator's platform suspension for condition and tight fit.
4. Check the condition and fastening of the seat belts.

8.10.4 Checking the travel control

1. Park the machine in secured condition ↬ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Move the travel lever forward, backwards and to braking position. Thereby check for function, light movement, clearance and damage.
3. In case of malfunction perform trouble shooting and replace the corresponding parts.
4. Only operate the machine after it has been repaired.

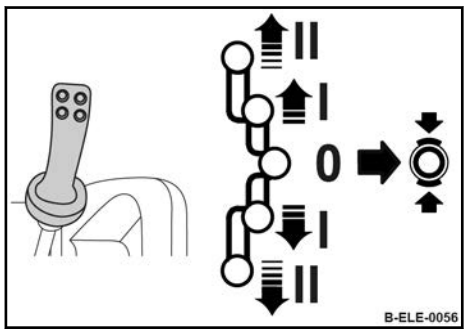


Fig. 138

8.10.5 Replacing the hydraulic oil filter

Perform this maintenance work at the latest after two years.

NOTICE!
Components may get damaged!
- 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.
- Apart from the normal oil change intervals, the filter element must also be changed after major repairs in the hydraulic system.

Preparations

1. Park the machine in secured condition ↬ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Allow the engine to cool down.

Hydraulic oil filter

Protective equipment:
- Working clothes
- Safety shoes
- Protective gloves

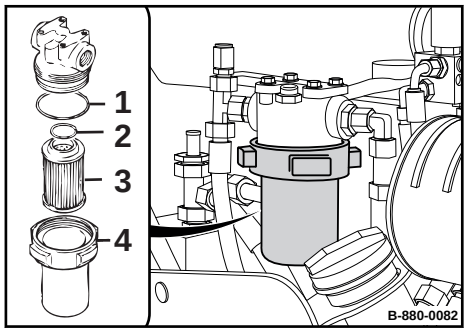


Fig. 139

1. Clean the area around the hydraulic oil filter.
2. Unscrew filter bowl (4) and take it off with filter element (3).

NOTICE!

Negligence may cause destruction to the entire hydraulic system!

- 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.
- Do not clean or reuse the filter element.

3. Take out the old filter element and clean the filter bowl.
4. Clean the thread on the filter bowl.
5. Reassemble the filter bowl with a new filter element and new O-rings (1, 2).

High pressure filter

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

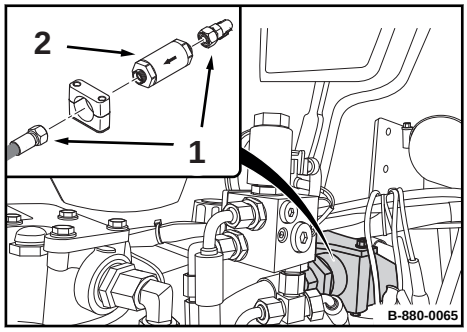


Fig. 140

1. Clean the area around the high pressure filter.
2. Disconnect the hydraulic oil lines (1) from the high pressure filter (2).
3. Remove the high pressure filter and install the new high pressure filter while paying attention to the flow direction (arrow).
4. Connect and tighten the hydraulic lines.

Concluding work

1. After the test run, check the filters for leaks.
2. Check the hydraulic oil level, top up if necessary. ↳ *Chapter 8.11.1 „Changing the hydraulic oil“ on page 170*
3. Dispose of the hydraulic oil and filter in line with environmental regulations.

8.11 Every 2000 operating hours

8.11.1 Changing the hydraulic oil

Perform this maintenance work at the latest after two years.

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

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

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

Do not use any detergents to clean the system.

Use only lint-free cleaning cloths for cleaning.

When changing from mineral oil based hydraulic oil to an ester based biologically degradable hydraulic oil, you should consult the lubrication oil service of the oil manufacturer, or our customer service for details.

NOTICE!

Risk of damage!

- Perform the oil change when the hydraulic oil is warm.
- Use only hydraulic oil of the permitted specification ↳ *Chapter 8.3.4 „Hydraulic oil“ on page 145*.
- Filling quantity: ↳ *Chapter 8.4 „List of fuels and lubricants“ on page 146*.

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

1. Park the machine safely *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.

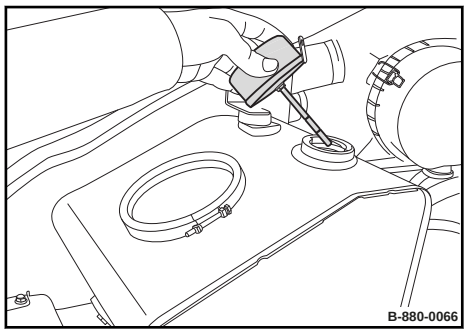


Fig. 141

2. Clean the area around hydraulic oil tank, filler opening and filler cap.
3. Remove the cap from the hydraulic oil tank.

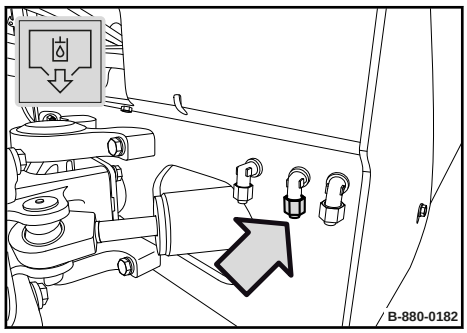


Fig. 142

4. **WARNING!**
   Danger of burning on hot components!
   – Wear your personal protective equipment (protective gloves, protective clothing).
   – Avoid touching hot components.

   Unscrew the drain plug and collect any hydraulic oil running out.
5. Screw the drain plug back in tightly.

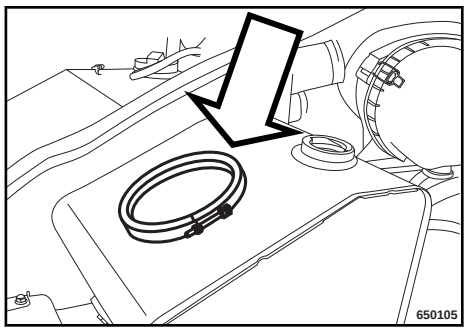


Fig. 143

6. Loosen tightening strap and take off the cover to clean the hydraulic oil tank from inside.
7. **NOTICE!**
   This will contaminate the hydraulic oil!
   – Never use detergents.

   Wipe the inside of the hydraulic oil tank clean with a lint-free cloth.
8. Attach the cap and tighten the strap.

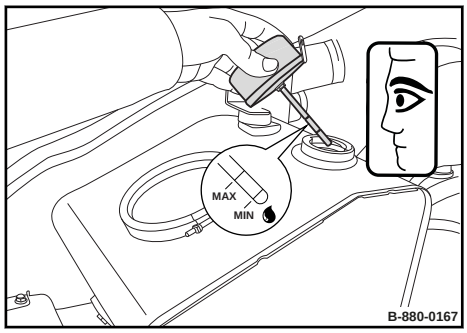


Fig. 144

9. *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 life-time of the hydraulic oil filter and protects the hydraulic system.*

   Fill in new hydraulic oil.
10. Check the hydraulic oil level on the dip-stick.
11. The hydraulic oil level must always be between the “MIN” and “MAX” marks.
12. *The breather filter for the hydraulic oil tank is integrated in the cap, you must therefore replace the complete cap.*

    Close the tank with a new cap.
13. Dispose of hydraulic oil in line with environmental regulations.

8.11.2 Changing the coolant

Perform this maintenance work at the latest after two years.

Do not start the engine after draining off the coolant.

In case of lubrication oil entering into the cooling system or a suspicious turbidity caused by corrosion residues or other suspended matter, the coolant must be drained off and the complete cooling system needs to be cleaned.

Oil can damage the sealing materials used in the cooling system.

If oil has entered, you must add a cleansing agent in order to remove any residues from the system. Follow the instructions of the manufacturer! If in doubt, consult your Customer Service or the engine manufacturer.

When changing the coolant without any signs of contamination, cleaning of the cooling system is not necessary.

NOTICE!

Danger of engine damage!

- Use only coolant of the permitted specification *Chapter 8.3.3 „Coolant“ on page 144*.
- Do not mix different coolants and additives of any other kind.
- Filling quantity: *Chapter 8.4 „List of fuels and lubricants“ on page 146*

Protective equipment:

- Working clothes
- Protective gloves
- Safety goggles

1. Park the machine safely *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Allow the engine to cool down.
3. Unscrew the cover.

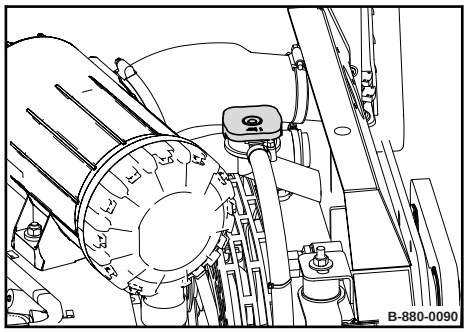


Fig. 145

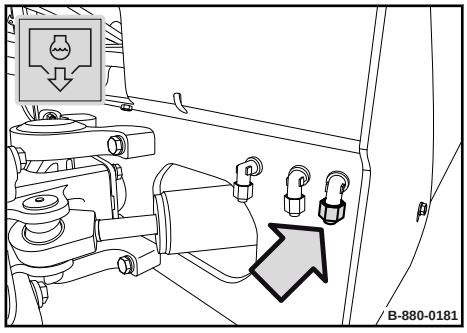


Fig. 146

4. Unscrew the drain plug.
5. Drain off the coolant completely and collect it.
6. Screw the drain plug back in tightly.
7. Check the condition of the coolant.
8. Thoroughly flush the cooling system if the coolant is contaminated by corrosion residues or other suspended matter.
9. Remove the thermostat.
10. Fill with clean water.
11. Start the engine and flush the cooling system out for a short while.
12. Allow the engine to cool down to approx. 50 °C (122 °F).
13. Drain off all water.
14. If using a cleaning agent repeat the flushing process twice with clear water.
15. Reinstall the thermostat.

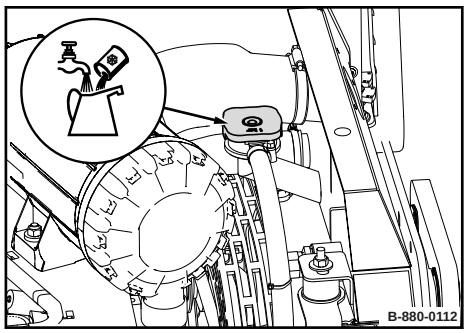


Fig. 147

16. Fill in coolant until the level reaches the bottom edge of the filler socket.
17. Screw the lid back on again.
18. Remove the cap from the compensation tank.

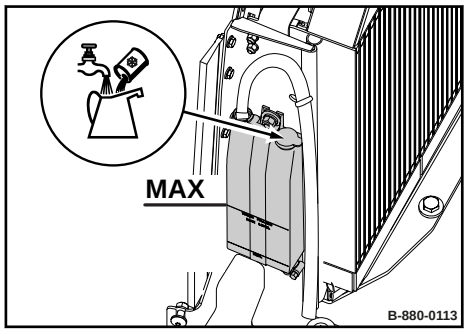


Fig. 148

19. Fill in coolant up to the “MAX” mark on the compensation tank.
20. Close the cap.
21. Start the engine and run to operating temperature.
22. Let the engine cool down and check the coolant level again, if necessary top up in the compensation tank.
23. Dispose of coolant in line with environmental regulations.

8.11.3 Replacing hoses

This work must only be performed by authorized service personnel.

Perform this maintenance work at the latest after two years.

The following hoses need to be renewed:

- fuel hoses,
- air intake hoses.

8.11.4 Check the injection valves

This work must only be performed by authorized service personnel.

8.12 Every 3000 operating hours

8.12.1 Checking the fuel injection pump

This work must only be performed by authorized service personnel.

8.13 As required

8.13.1 Air filter maintenance

NOTICE!
Danger of engine damage!

- 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.

Protective equipment:

- Working clothes
- Protective gloves
- Safety goggles

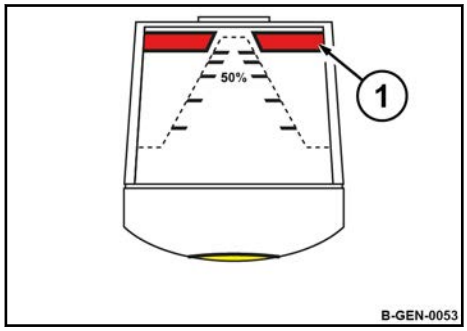


Fig. 149

Air filter maintenance is due when the yellow piston in the maintenance indicator has reached the red sector (1), but at the latest after one year.

1. Park the machine in secured condition ↬ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Allow the engine to cool down.

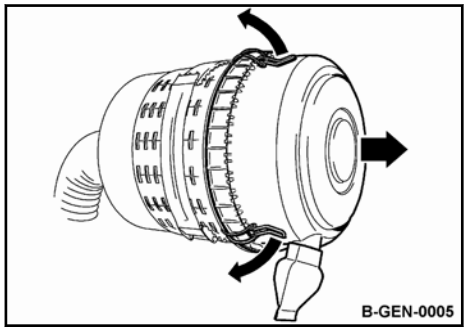


Fig. 150

3. Loosen both locking hooks on the housing cover and take the cover off.
4. Clean housing cover and dust discharge valve.

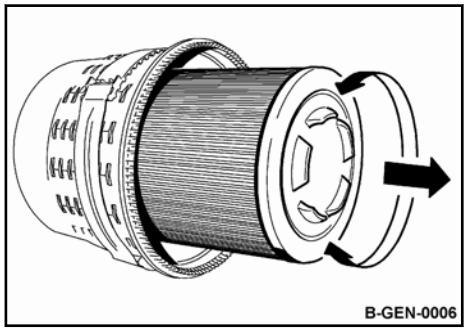


Fig. 151

5. Pull out the main filter element with light turning movements.

CAUTION!
Danger of eye injuries caused by particles flying around!
– Wear your personal protective equipment (safety gloves, protective working clothes, goggles).

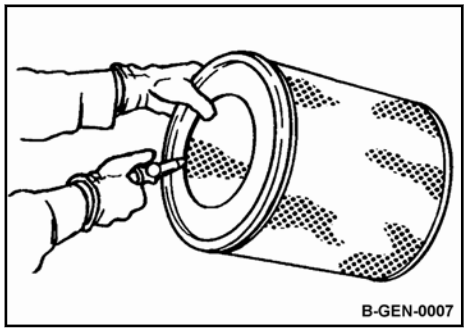


Fig. 152

6. Blow the air filter 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.

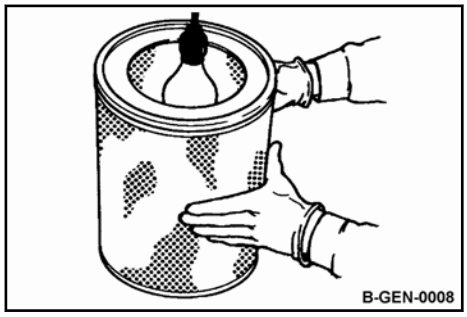


Fig. 153

7. Examine the air filter element with a torch for cracks and holes in the paper bellows.
8. In case of damage replace the air filter and the safety element.

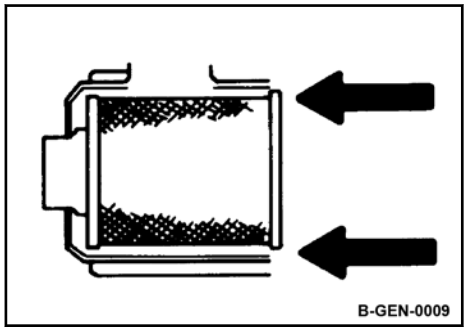


Fig. 154

9. Slide the air filter carefully into the housing.

NOTICE!
Danger of engine damage!
– The dust discharge valve must point vertically downwards.
– Make sure that the cover locks engage correctly.

10. Reassemble the housing cover.

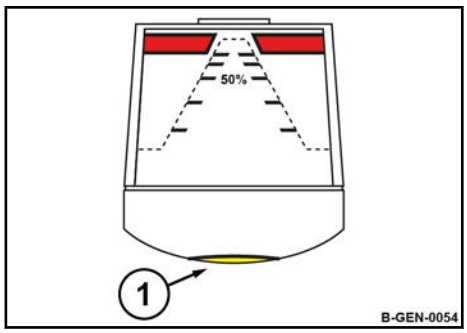


Fig. 155

11. Press the reset button (1) for the yellow piston on the maintenance indicator.

8.13.1.1 Replacing the safety element

NOTICE!

Danger of engine damage!

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.
- at the latest after one year.
- if the air filter warning light comes on again after the air filter has been cleaned.

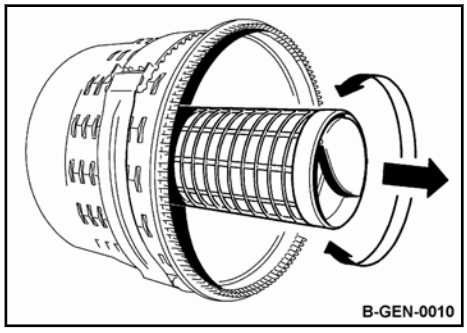


Fig. 156

1. Remove the housing cover and pull the air filter element off.
2. Pull the safety element out by turning it lightly.
3. Push in a new safety element.
4. Insert the air filter and reassemble the housing cover.

8.13.2 Checking the water spraying system

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

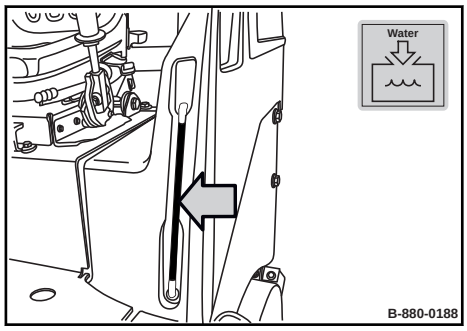
1. Park the machine on level and firm ground.
2. Shut down the engine.
3. 

Fig. 157

NOTICE!

The spraying pump may get damaged if the tank is empty!

– Always keep the water tank filled with a sufficient amount of water.

Check the filling level on the water level gauge, fill up if necessary.

4. Turn the ignition key to position “I”.

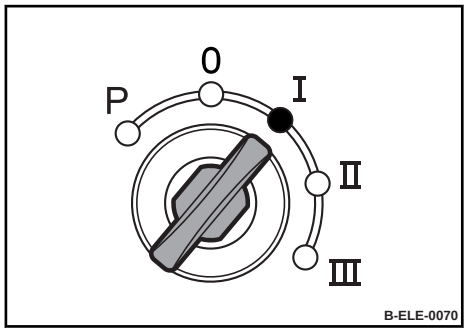


Fig. 158

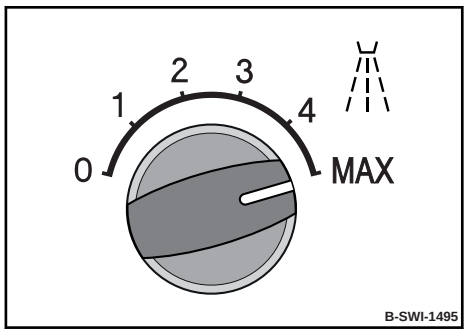


Fig. 159

5.

NOTICE!

The battery is being discharged!

– Do not remain too long in testing position.

Turn the rotary switch for the water spraying system to permanent spraying (position “MAX”).

In positions “1” to “4” the corresponding spraying interval is activated only once.

Then the water pump is switched off again.

⇨ The water spraying system is switched on.

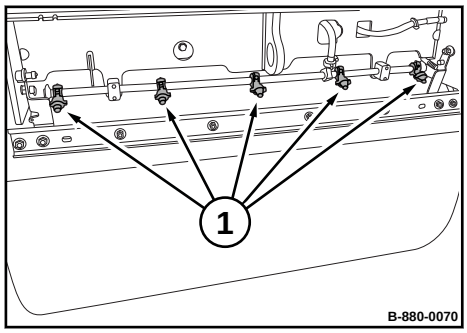


Fig. 160

6. Check water output and spray pattern on all nozzles (1) for both drums.

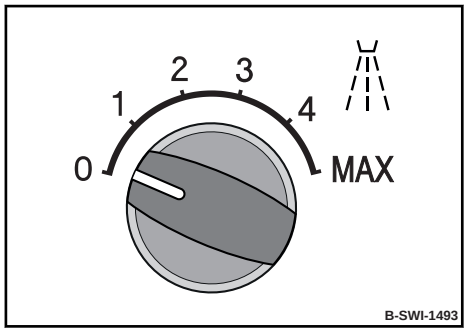


Fig. 161

7. Turn the rotary switch for pressure spraying to “0” to switch the water spraying system off.

8. Turn the ignition key back to position “0” and pull it out.

8.13.3 Cleaning the water spraying system

Perform this maintenance work at the latest after one year.

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

1. Park the machine safely *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
2. Remove the cap (1).
3. Take the filling screen (2) out and clean it.
4. Check the filling screen for damage, replace if necessary.
5. Close the cap.

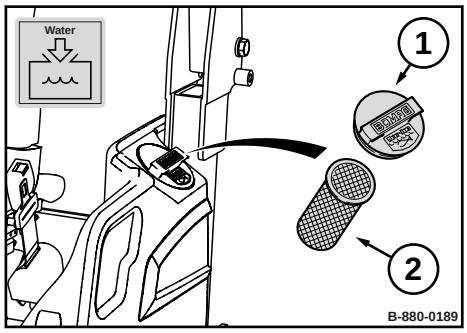


Fig. 162

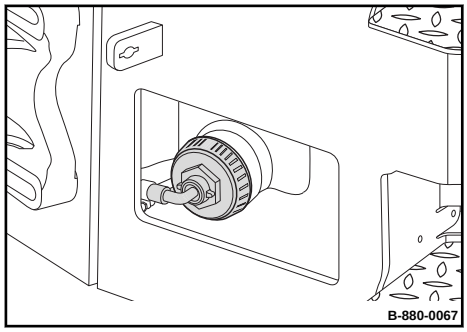


Fig. 163

6. Open the drain cover on the water tank and let all water run out.
7. Flush the water tank out with a strong water jet.
8. Drain off all water and dirt.

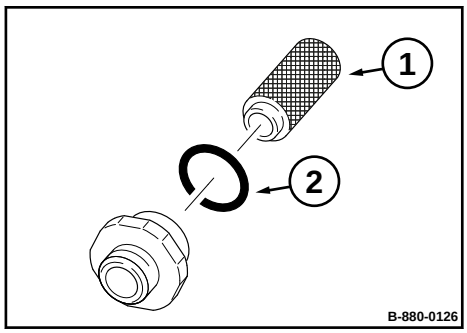


Fig. 164

9. Clean the water filter (1) and check for damage, replace if necessary.
10. Screw the drain cover back on with the water filter and a new seal (2).

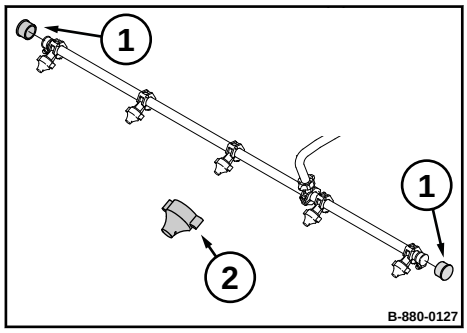


Fig. 165

11. Unscrew the caps (1) and all nozzles (2) from the spray tube and let the water run out.
12. Switch the water spraying system on for a short while to flush contaminants out of the lines.
13. Switch off the water spraying system.
14. Turn the ignition key back to position “0” and pull it out.
15. Reassemble the caps and nozzles on the spray tube.

8.13.4 Measures if there is a risk of frost

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

1. Park the machine safely *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.

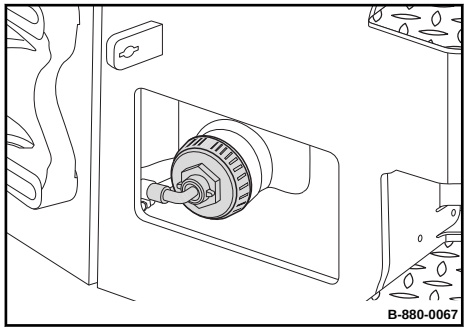


Fig. 166

2. Open the drain cover on the water tank and let all water run out.
3. Screw the drain cover back on.

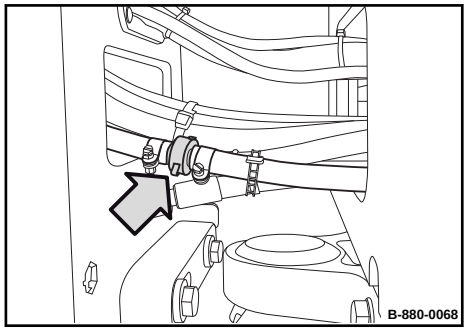


Fig. 167

4. Open the line connection in the articulation area and let all water run out.
5. Close the line connection again.

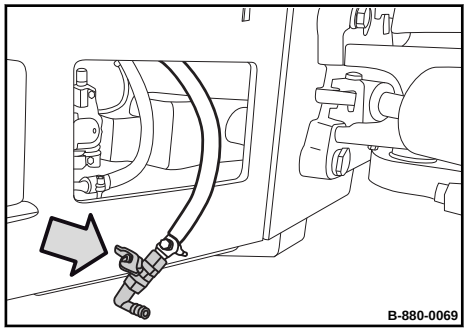


Fig. 168

6. Route the water line on the spraying pump to the outside.
7. Open the drain valve and drain off all water.
8. Switch on the water spraying system for a short while to drain the water from the pump.
9. Switch off the water spraying system.
10. Turn the ignition key back to position “0” and pull it out.

11. Close the drain valve on the water pump and route the water line back into the machine.

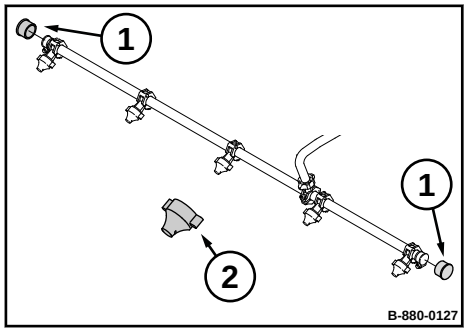


Fig. 169

12. Unscrew the caps (1) and all nozzles (2) from the spray tube and let the water run out.

Before the next use

1. Reassemble the caps and nozzles on the spray tube.

Maintenance – As required

9 Setting up / refitting

9.1 Manually adjusting the crabwalk

Loads may only be attached and hoisted by an expert/qualified person.

Do not use lifting points that are damaged or impaired in any other way.

Use only lifting gear and lifting tackle with sufficient load bearing capacity for the loads to be lifted.

Always use appropriate lifting and lashing tackle at the lifting and lifting points.

Use lifting tackle only in the specified loading direction.

Lifting tackle must not be damaged by machine parts.

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

1. Park the machine safely *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.

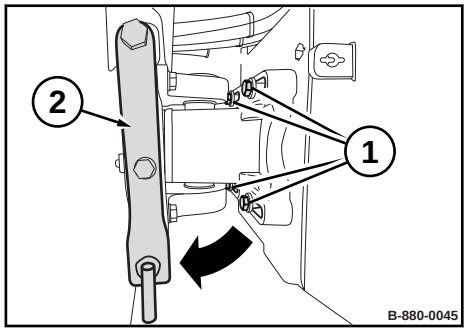


Fig. 170

2. Slightly loosen the screws (1).

Do not back out the screws too far.

3. Disengage the articulation lock (2) and fasten it in the holding fixture.

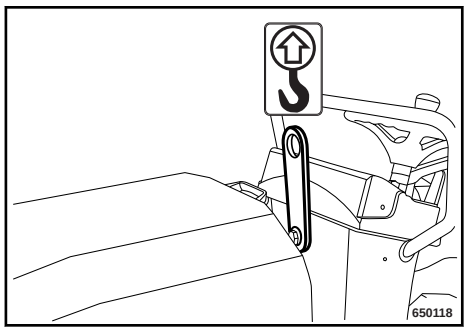


Fig. 171

4. Attach the lifting tackle to the central lifting point.
5. Lift up the machine just above the ground.
6. Shift the rear frame to the desired position left or right.
7. Lower the machine to the ground.

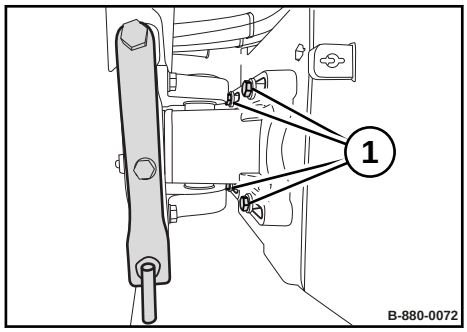


Fig. 172

8. Retighten screws (1).

9.2 Edge cutter – installing tool

1. Park the machine in secured condition ↳ *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.

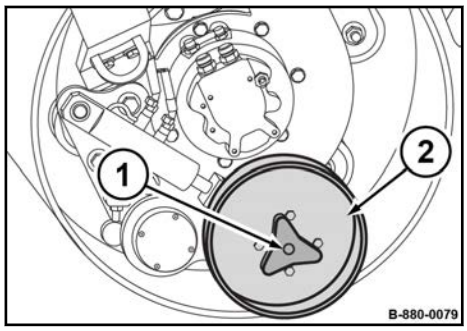


Fig. 173

2. Mount the tool (2) using the star handle screw (1) on the edge cutter.

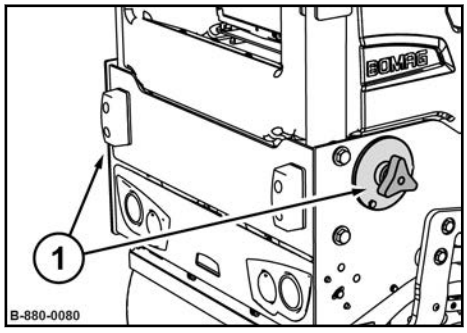


Fig. 174

3. Mount the unused tool to the brackets (1).

9.3 Mounting / removing the chip spreader

9.3.1 Preliminary remarks and safety notes

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

Do not use damaged or in any other way impaired lashing points.

Use only lifting gear and lifting tackle with sufficient load bearing capacity for the weight to be loaded.

Always use appropriate lifting and lashing means on the lifting and lashing points.

Use lifting and lashing gear only in the prescribed direction of load application.

Lifting tackle must not be damaged by components of the chip spreader.

When lifting the machine, avoid uncontrolled movements of the load. If necessary, hold the load with guide ropes.

9.3.2 Mounting the chip spreader

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

1. Park the machine safely *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.

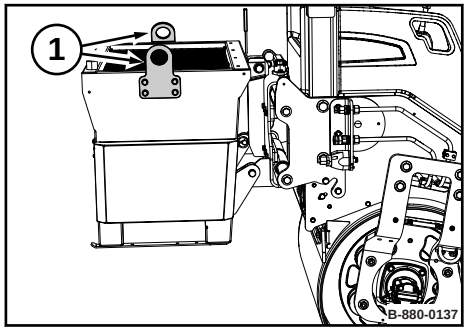


Fig. 175

2. Fasten the lifting tackle at the lifting points (1).

3. **DANGER!**
Danger to life caused by suspended loads!
– Do not step or stand under suspended loads.

Lift the chip spreader and hook it carefully into the fixing points on the machine.

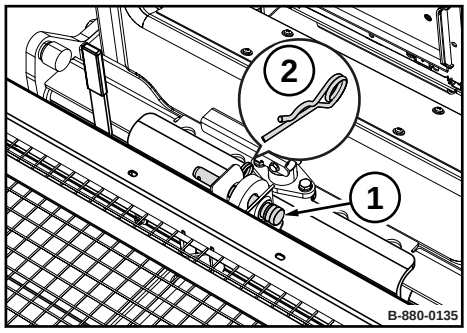


Fig. 176

4. Assemble the bolt (1) and secure it with the split pin (2).

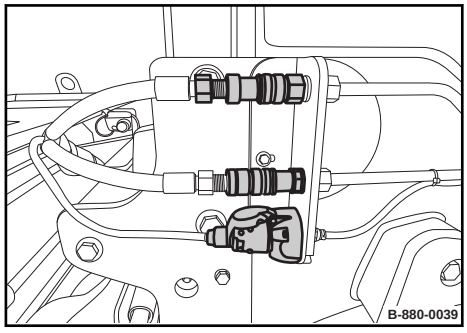


Fig. 177

5. Connect the chip spreader hydraulically and electrically with the machine.

9.3.3 Removing the chip spreader

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves

1. Switch off the chip spreader.
2. Park the machine safely *Chapter 6.7 „Parking the machine in secured condition“ on page 113*.
3. Empty the chip spreader.
4. Disconnect the chip spreader hydraulically and electrically from the machine.

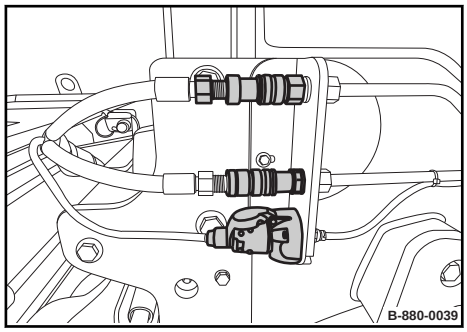


Fig. 178

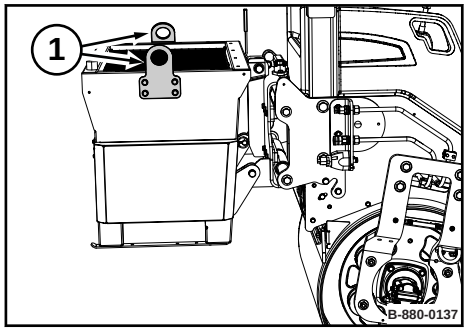


Fig. 179

5. Fasten the lifting tackle at the lifting points (1).
6. Attach the chip spreader to the lifting tackle.

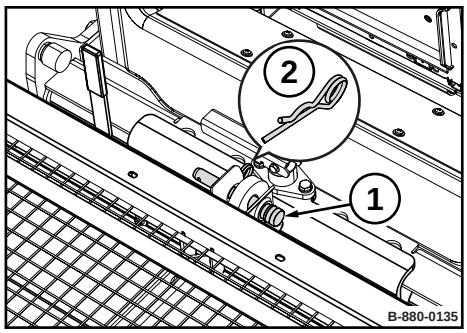


Fig. 180

7. Disassemble split pin (2) and bolt (1).

8.

DANGER!

Danger to life caused by suspended loads!

– Do not step or stand under suspended loads.

Lift the chip spreader and lift it carefully out of the fixing points on the machine.

9. Set the chip spreader safely down on level and firm ground.

10 Troubleshooting

10.1 Preliminary remarks

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

10.2 Starting the engine with jump leads

NOTICE!

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

– Bridge the machine only with a 12 Volt auxiliary battery.

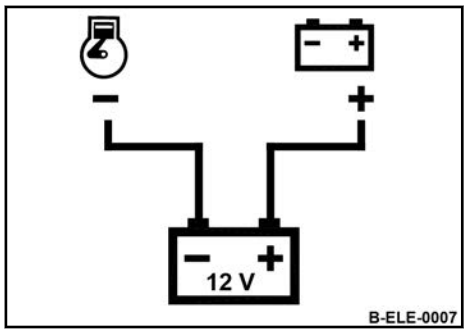


Fig. 181

1. Connect the plus pole of the external battery first with the plus pole of the vehicle battery using the first jump lead.
2. Then connect the second battery cable first to the minus pole of the current supplying auxiliary battery and then to engine or chassis ground, as far away from the battery as possible.
3. Start the engine *Chapter 6.3 „Starting the engine“ on page 101*.

NOTICE!

Danger of damage to the electronic system!

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

4. Once the engine is running switch on a powerful consumer (working light, etc.).
5. After starting disconnect the negative poles first and the positive poles after.
6. Switch off the consumer.

10.3 Fuse assignment

10.3.1 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.

10.3.2 Fuses in engine compartment

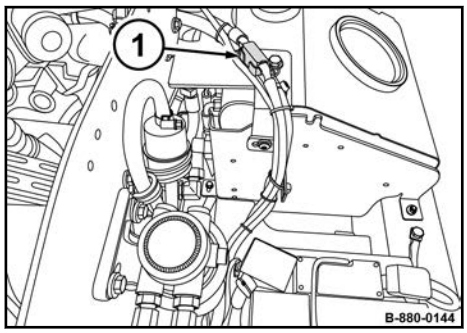


Fig. 182

Pos.	Fuse	Amperage	Designation
1	F00	80 A	Main battery fuse

10.3.3 Central electrics

The central electrics are located in the operating console.

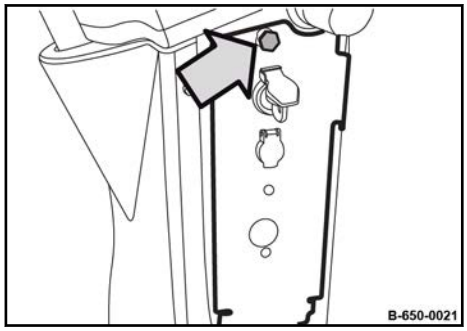


Fig. 183

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

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

Fuse	Amperage	Designation
F03	10 A	Vibration
F04	7.5 A	Instruments
F05	10 A	12 V socket
F06	5 A	Rotary switch for water spraying system
F07	15 A	Hazard light system
F08	15 A	Direction indicators and working head lights
F09	10 A	Parking and tail light, left
F10	10 A	Parking and tail light, right
F11	15 A	Head lights, left
F12	15 A	Head lights, right
F23	10 A	Warning horn
F30	10 A	Potential 15
F37	10 A	Water pump
F45	10 A	Edge cutter
F48	40 A	Preheating system
F68	10 A	Potential 30
F103	10 A	Potential 15
F119	10 A	Engine

Fuse	Amperage	Designation
F139	30 A	Engine solenoid
F153	10 A	Potential 15
F156	15 A	Lighting
F157	30 A	Starter
F241	15 A	Optional headlights
F274	10 A	Chip spreader / hydraulic cutting tool
F275	5 A	Economizer
F276	10 A	Emulsion pump
JP1	5 A	Vibration also with travel lever in position “II”

10.4 Engine faults

Fault	Possible cause	Remedy
Engine does not start	Fuel tank empty	Refuel, bleed the fuel system
	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
	Battery not charged or not connected	Tighten the terminal clamps on the battery, check all cable connections
	Starter defective	Have examined by a specialist
	Emergency stop push button is locked	Unlock the emergency stop switch
	Moving parts overheating because of a lack of lubrication	Check the engine oil level, correct if necessary Check the engine oil filter, replace if necessary Have the lubrication system examined by a specialist
Poor starting of engine or engine works irregularly with poor power	Battery power too low, terminal clamps loose or oxidized causing the starter to turn too slowly	Check the battery charge condition, clean the terminal clamps, tighten and cover them with acid-free grease
	Fuel supply too low, fuel system clogged by paraffin separation during winter	Replacing the fuel filter Check all line connections for leaks and tighten the fittings, bleed the fuel system Use winter fuel in winter
	Engine oil with wrong SAE viscosity class	Change the engine oil
	Air filter dirty	Clean, replace if necessary

Fault	Possible cause	Remedy
	Moving parts overheating because of a lack of lubrication	Check the engine oil level, correct if necessary Check the engine oil filter, replace if necessary Check the lubrication system
Excessive exhaust smoke	Engine oil level too high	Check, drain off if necessary
	Insufficient fuel quality	Use specified fuel
	Air filter dirty	Clean, replace if necessary
	Injection valve defective	Have examined by a specialist
Engine overheating, engine must be shut down immediately!	Cooling fins on radiator are extremely dirty (the warning lamp for engine oil temperature lights)	Clean the cooling fins
	Engine oil level too low	Check, fill up if necessary
	Lack of coolant	Check all pipes and hoses for good condition and leak tightness Check the coolant level, top up if necessary Do not use radiator sealant to seal leaks
	Anti-freeze concentration too high	Use coolant with the specified mixing ratio
	Air filter dirty	Clean, replace if necessary
	Thermostat defective	Check the thermostat, replace if necessary
	Interior parts of radiator corroded	Clean or replace the radiator
	Insufficient cooling air supply to the cooling fan	Remove any clogging from the cooling air duct
	Fan, radiator or radiator cap defective	Have examined by a specialist

Fault	Possible cause	Remedy
Engine has insufficient engine oil pressure (engine oil pressure warning lamp lights)	Engine oil level too low	Check, fill up if necessary
	Lubrication system leaking	Have the lubrication system examined by a specialist
The charge control light lights during operation, the warning buzzer sounds	Generator speed too low	Check the generator belt for tension, replace the belt if necessary
	Generator or regulator defective	Have examined by a specialist

10.5 Trouble shooting ECONOMIZER

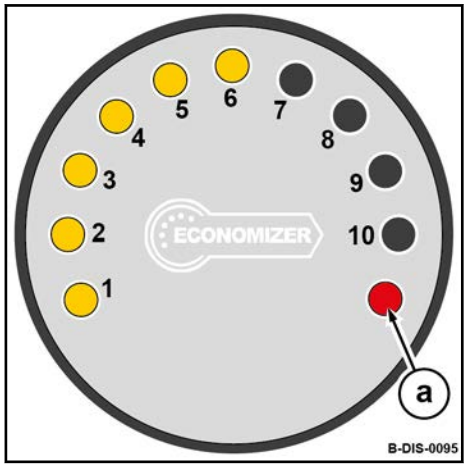


Fig. 184: Economizer display

Fault	Possible cause	Remedy
LED (a) flashes	Switching on: The LED (a) flashes for approx 1 - 2 seconds after the vibration has been switched on.	
	Jump operation of the drum on hard ground	
	Acceleration sensor is not connected	Check the connection of the acceleration sensor
	Cable breakage	Inform our Customer Service Department
LED (a) lights up	The Economizer 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 Economizer. Turn the ignition key back to position “0” and then again to position “I”. If the LED (a) remains on, inform our Customer Service Department.

Fault	Possible cause	Remedy
The displayed measuring values are not plausible.	The acceleration sensor is not fastened correctly.	Shut down the engine and check the fastening screws of the acceleration sensor.
	Weak spots in the road subbase are also measured when paving asphalt.	In unfavourable cases, an excessively varying material composition or moisture in the road subbase can influence the measuring results. On material which is too dry or moist, lower measuring values will be displayed.

11 Disposal

11.1 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!

Health hazard caused by fuels and lubricants!

– Safety regulations and environmental protection regulations must be followed when handling fuels and lubricants *Chapter 3.4 „Handling fuels and lubricants“ on page 29*.

Protective equipment:

- Working clothes
- Safety shoes
- Protective gloves
- Safety goggles

1. Remove the batteries and dispose of in compliance with legal regulations.
2. Empty the fuel tank.
3. Drain the hydraulic oil tank.
4. Drain coolant from cooling system and engine.
5. Drain off engine oil.

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