



BOMAG

FAYAT GROUP

Operating Instruction Maintenance Instruction

Original Operating Instructions

BPR 35/42 D - BPR 35/60 D



S/N 101 692 54 / S/N 101 692 55 / S/N 101 692 57 / S/N 101 692 71 / S/N 101 692 58
/ S/N 101 692 72

Reversible Vibrating Plate



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

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

This manual comprises:

- Safety regulations
- Operating instructions
- maintenance instructions
- Trouble shooting

Using these instructions will

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

Compliance with the maintenance instructions will

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

BOMAG will not assume liability for the function of the machine

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

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

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

Please note!

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

These operating and maintenance instructions are part of the machine.

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

Strictly observe the safety regulations.

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

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

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

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

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

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

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

The above notes do not constitute an extension of the warranty and liability conditions specified in the general terms of business of BOMAG.

We wish you successful work with your BOMAG machine.

BOMAG GmbH

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Please fill in

.....
Machine type (Fig. 1)

.....
Serial No. (Fig. 1 and 2)

.....
Engine type (Fig. 3)

.....
Engine No. (Fig. 3)



Supplement the above data together with the commissioning protocol.

During commissioning our organisation will instruct you in the operation and maintenance of the machine.

Please observe strictly the safety regulations and all notes on risks and dangers!

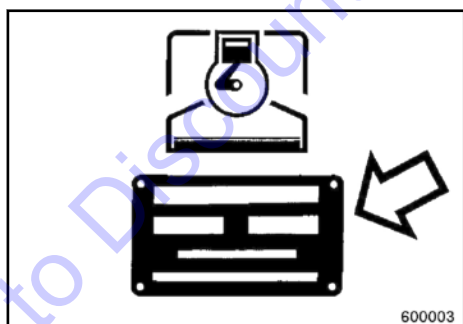


Fig. 1

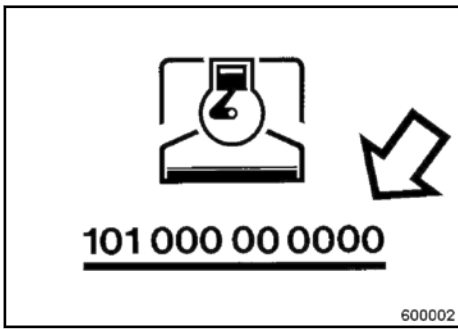


Fig. 2

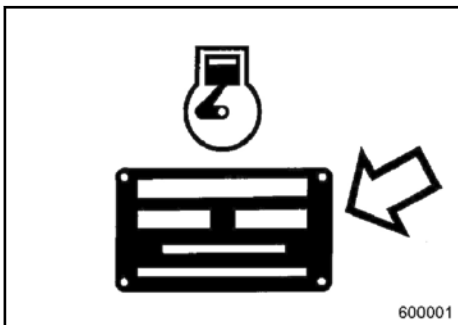
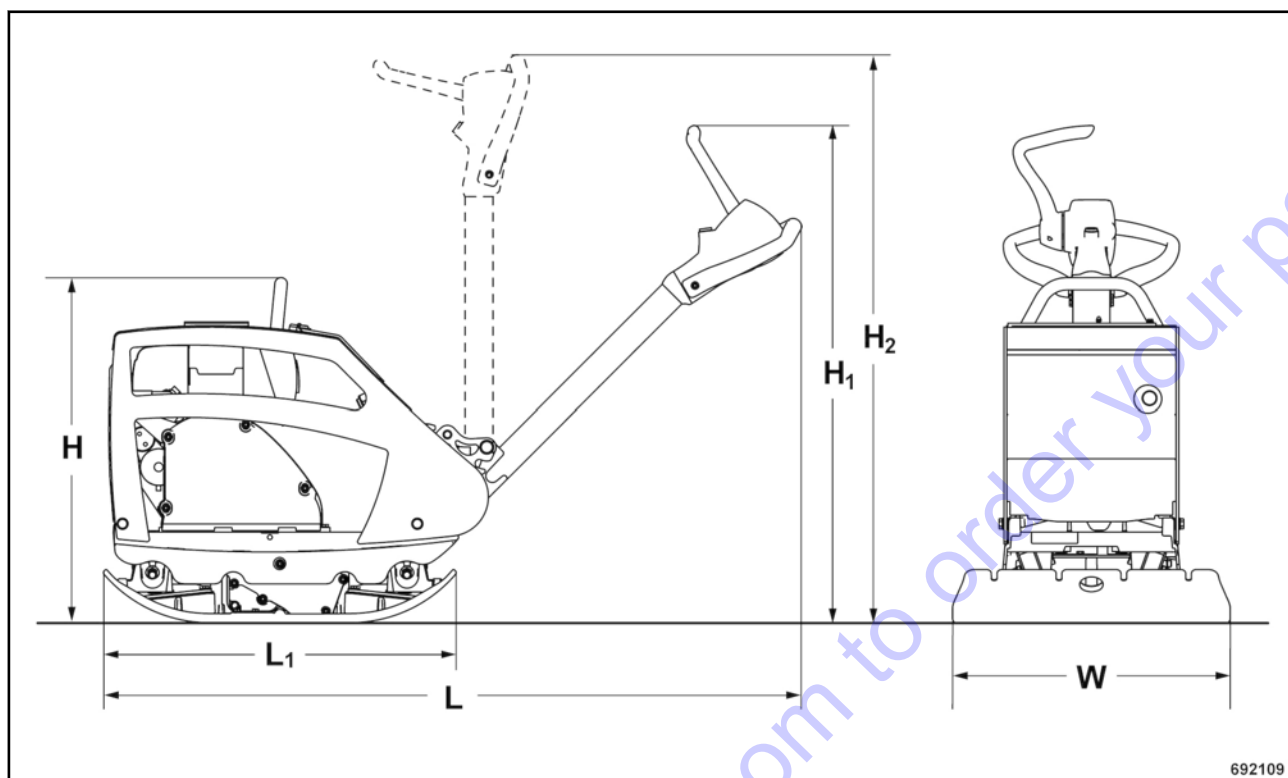


Fig. 3

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Technical data



692109

Fig. 4

BPR 35/42 D	H	H ₁	H ₂	L	L ₁	W
Dimensions in mm	688	820	1220	1510	762	420
Dimensions in inch	27.1	32.3	48.0	59.4	30.0	16.5

BPR 35/42 D		
Weights		
Operating weight (CECE) (manual/electric starter)	205/225 kg	452/496 lbs
Basic weight (manual starter/electric starter)	202/222 kg	445/489 lbs
Full engine protection cover (<i>Optional equipment</i>)	+ 18 kg	+ 40 lbs
Transport wheels (<i>Optional equipment</i>)	+ 5 kg	+ 11 lbs
Travel characteristics		
Working speed max.	27 m/min	89 ft/min
Max. gradability (depending on soil)	32%	32%

Technical data

BPR 35/42 D		
Drive		
Engine manufacturer	Hatz	Hatz
Type	1B20	1B20
Cooling	Air	Air
Number of cylinders	1	1
Rated power ISO 3046 IFN	3.1 KW	4.2 hp
Rated speed	3000 min ⁻¹	3000 rpm
Drive system	mechanical	mechanical
Exciter system		
Frequency	80 Hz	4800 vpm
Centrifugal force	35 kN	7868 lbf
Amplitude	1.5 mm	0.06 in
Filling capacities		
Fuel (diesel)	3.0 l	0.8 gal us



Subject to technical alterations.

Technical data

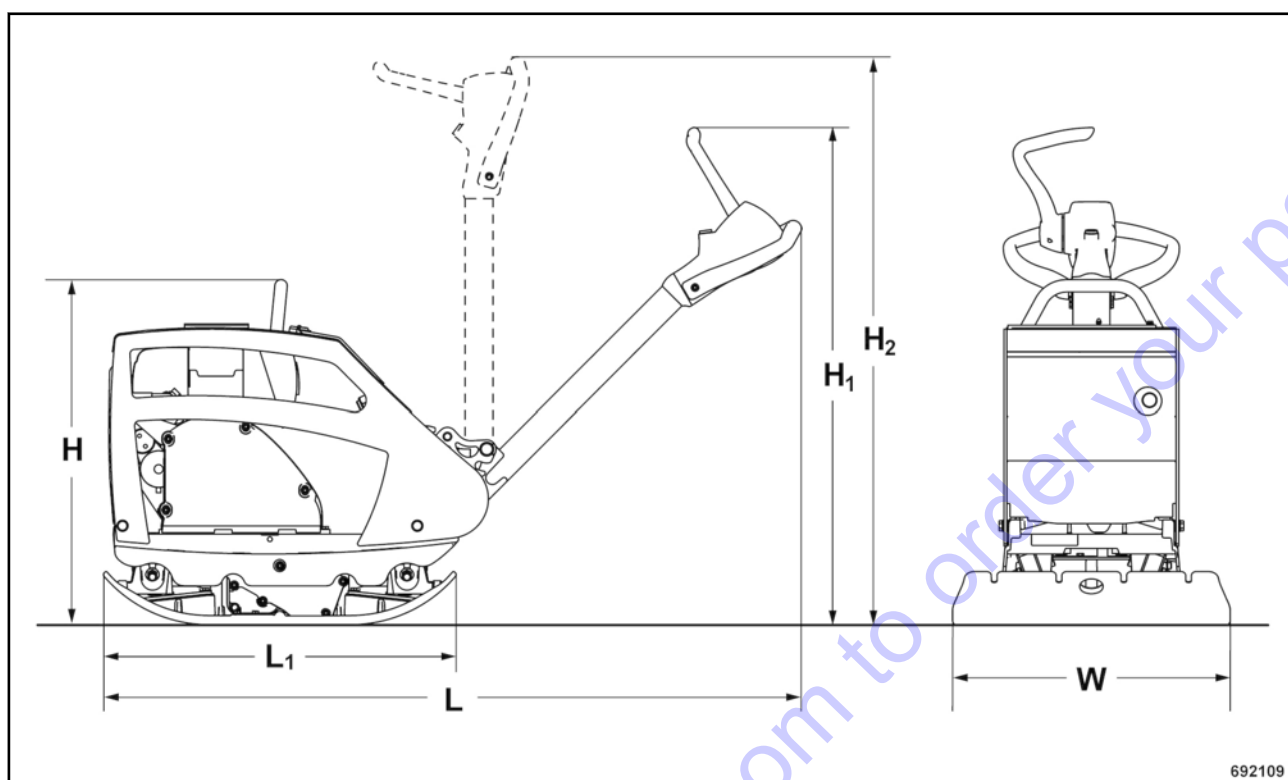


Fig. 5

BPR 35/60 D	H	H ₁	H ₂	L	L ₁	W
Dimensions in mm	688	820	1220	1510	762	600
Dimensions in inch	27.1	32.3	48.0	59.4	30.0	23.6

BPR 35/60 D		
Weights		
Operating weight (CECE) (manual/electric starter)	220/240 kg	485/529 lbs
Basic weight (manual starter/electric starter)	217/237 kg	478/523 lbs
Full engine protection cover (<i>Optional equipment</i>)	+ 18 kg	+ 40 lbs
Paving plate (<i>Optional equipment</i>)	+ 21 kg	+ 46 lbs
Transport wheels (<i>Optional equipment</i>)	+ 5 kg	+ 11 lbs
Travel characteristics		
Working speed max.	27 m/min	89 ft/min
Max. gradability (depending on soil)	32%	32%

Technical data

BPR 35/60 D		
Drive		
Engine manufacturer	Hatz	Hatz
Type	1B20	1B20
Cooling	Air	Air
Number of cylinders	1	1
Rated power ISO 3046 IFN	3.1 KW	4.2 hp
Rated speed	3000 min ⁻¹	3000 rpm
Drive system	mechanical	mechanical
Exciter system		
Frequency	80 Hz	4800 vpm
Centrifugal force	35 kN	7868 lbf
Amplitude	1.3 mm	0.05 in
Filling capacities		
Fuel (diesel)	3.0 l	0.8 gal us



Subject to technical alterations.

The following noise and vibration data acc. to

- EC Machine Regulation edition 2006/42/EG and
- the noise regulation 2000/14/EG, noise protection guideline 2003/10/EC
- Vibration Protection Regulation 2002/44/EC

were determined during conditions typical for this type of equipment and by application of harmonized standards.

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

Noise value

Sound pressure level on the place of the operator:

BPR 35/42 D: $L_{pA} = 94$ dB(A), determined acc. to ISO 11204 and EN 500

Technical data

BPR 35/60 D: $L_{pA} = 94$ dB(A), determined acc. to ISO 11204 and EN 500

Guaranteed sound power level:

BPR 35/42 D: $L_{WA} = 108$ dB(A), determined acc. to ISO 3744 and EN 500

BPR 35/60 D: $L_{WA} = 108$ dB(A), determined acc. to ISO 3744 and EN 500



WARNING!

Loss of hearing!

Wear your personal noise protection means (ear defenders) before starting operation.

Vibration value

Hand-arm vibration:

Vector total of the weighted effective acceleration in three orthogonal directions:

Weighted total vibration value

BPR 35/42 D: $a_{hv} = 7.3$ m/s² on crushed rock determined acc. to ISO 5349 and EN 500

BPR 35/60 D: $a_{hv} = 6.7$ m/s² on crushed rock determined acc. to ISO 5349 and EN 500



NOTICE!

Observe the daily vibration load (Industrial safety acc. to 2002/44/EEC).

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Safety regulations

General

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

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

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

Furthermore, the following obviously also applies:

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

Intended use

This machine must only be used for:

- Compaction of all types of soils
- Repair work on all types of soil
- Paving of walkways
- Work in trenches
- Underfilling and compaction of hard shoulders

Unintended use

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

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

Examples for unintended use are:

- Dragging the machine along as a measure of transportation
- Throwing the machine off the transport vehicle
- Attaching an additional weight to the machine

It is not permitted to stand on the machine while working.

Any transport ropes fastened to the machine must be removed before operation.

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

Remaining dangers, remaining risks

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

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

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

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

Regular safety inspections

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

Who is allowed to operate the machine?

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

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

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

Changes and conversions to the machine

Unauthorized changes to the machine are prohibited for safety reasons.

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

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

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

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

Damage, deficiencies, misuse of safety installations

Machines which are not safe to operate 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.

Safety regulations

Notes on safety in the operating and maintenance instructions



WARNING!

Paragraphs marked like this highlight possible dangers for persons.



NOTICE!

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



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



ENVIRONMENT!

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

Observe the regulations for the protection of the environment.

Loading/transporting the machine

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

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

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

Fasten the lifting gear only at the specified lifting points.

Check lifting eye for damage before use. Do not use a damaged or in any other way impaired lifting eye.

Do not lift or lower the machine jerkily.

The tension must always be effective in vertical direction.

The machine must not swing about when being lifted.

Do not step or stand under suspended loads.

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

When lashing down the machine disassemble the transport wheels from the base plate. Optional equipment

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

Starting the machine

Before starting

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

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

Before starting the machine check whether:

- the machine shows any obvious faults
- all guards and safety elements are in place
- the controls are fully functional
- the machine is free of oily and combustible material
- all grips are free of grease, oils, fuel, dirt, snow and ice.

When starting with recoil starter check the starter rope for chafing before starting, replace if necessary. A damaged rope can break and cause injuries during starting.

Use only machines which are serviced at regular intervals.

Do not use starting aid sprays or other inflammable fluids for starting.

Starting and operation of the machine in closed rooms and trenches

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

Operation

Operate the machine only with the steering rod folded down.

Guide the machine only by the steering rod.

Guide the machine so that your hands do not hit against solid objects, danger of injury.

As a measure to avoid injury the machine must only be guided from the side by the steering handle

Always keep an eye on a running machine.

Watch out for unusual noises and development of smoke. Perform trouble shooting and have the fault corrected.

Operate the machine only with full engine speed, as otherwise the centrifugal clutch will be destroyed.

Parking the machine

Park the machine on level and firm ground.

Before leaving the machine:

- Park the machine so that it cannot tip over,
- shut the engine down and pull the ignition key out.

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

Refuelling

Do not inhale any fuel fumes.

Refuel only with the engine shut down.

Do not refuel in closed rooms.

Safety regulations

No open fire, do not smoke.

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

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.

Maintenance work

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

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

Keep unauthorized persons away from the machine.

Do not touch hot engine parts.

Do not perform maintenance work while the motor is running.

Park the machine on level, firm ground.

Remove the key from the ignition switch.

Working on the engine

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

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

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

Working on electric parts of the machine

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

Do not use fuses with higher ampere ratings and do not bridge fuses - fire hazard!

Working on the battery

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

Do not let acid come in contact with hands or clothes! When injured by acid flush off with clear water and seek medical advice.

Wear gloves and goggles.

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

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

Observe the applicable instructions when starting with an auxiliary battery.

Switch off the charging current before removing the charging clamps.

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

Dispose of old batteries according to regulations.

Working on the fuel system

Do not inhale any fuel fumes.

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

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

Cleaning work

Do not perform cleaning work while the motor is running.

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

When using a steam cleaner for cleaning do not subject electrical parts and insulation material to the direct jet or cover these items beforehand.

Do not guide the water jet directly into air filter and air intake or exhaust muffler.

After maintenance work

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

Repair

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

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

Mark defective machines by attaching a warning note to the steering handle.

Welding

Before starting welding work on the machine disconnect the battery and cover the fuel tank with insulating material.

Safety stickers on the machine

Keep safety stickers in good condition and legible and follow their meaning.

Replace damaged and illegible safety stickers.

Safety regulations

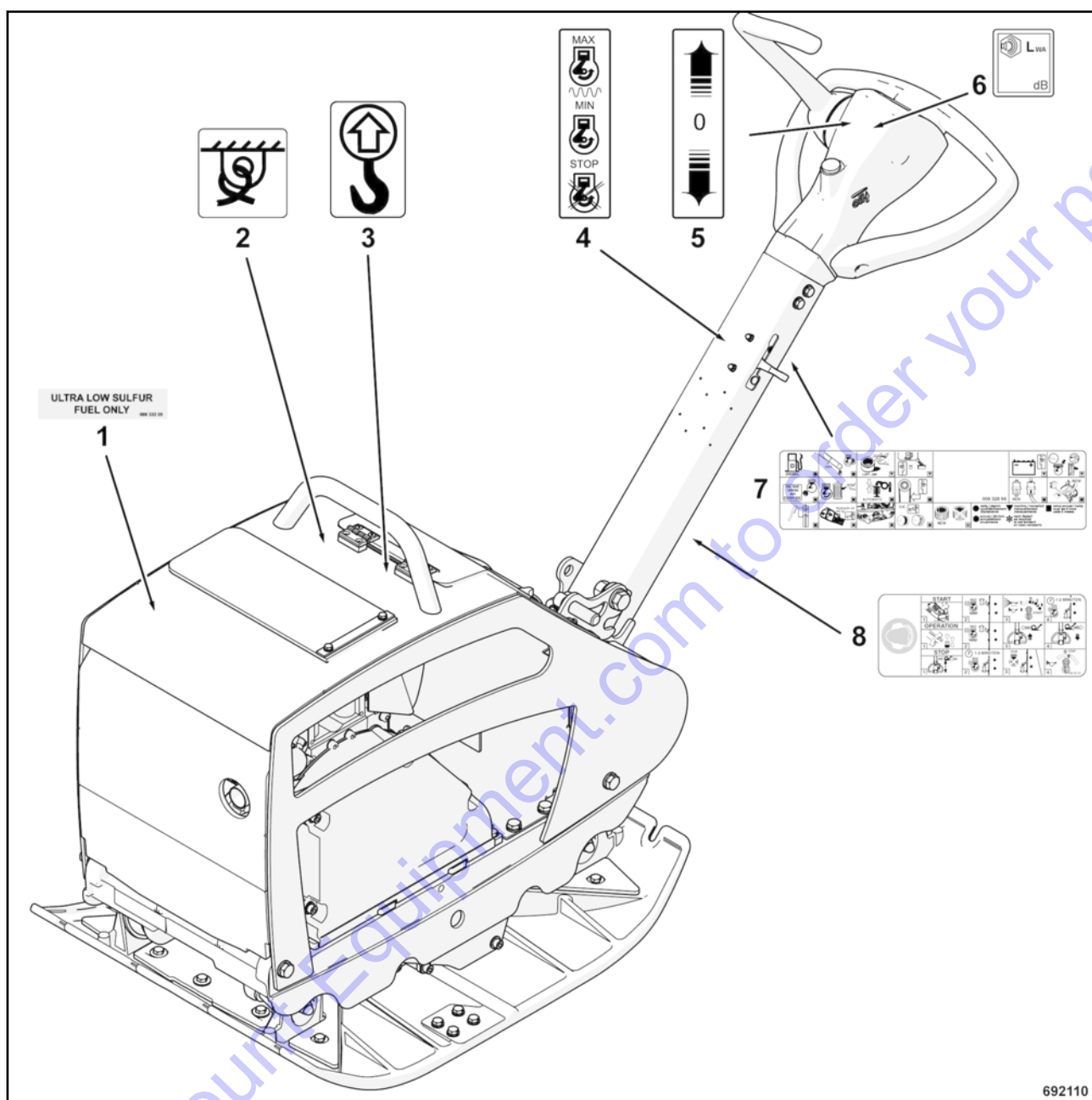
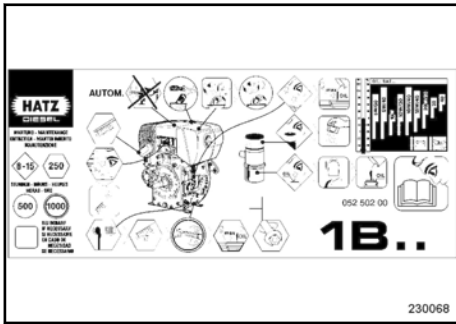


Fig. 6: Stickers and decals

- 1 Information sticker - Ultra-low sulphur fuel
- 2 Information sticker - Lashing point
- 3 Information sticker - Lifting point
- 4 Information sticker - Throttle lever
- 5 Information sticker - Travel lever
- 6 Information sticker - Guaranteed sound capacity level
- 7 Maintenance sticker
- 8 Brief operating instructions



Maintenance sticker "Engine"

Fig. 7

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4.1 General notes

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

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

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4.2 Description of indicators and control elements

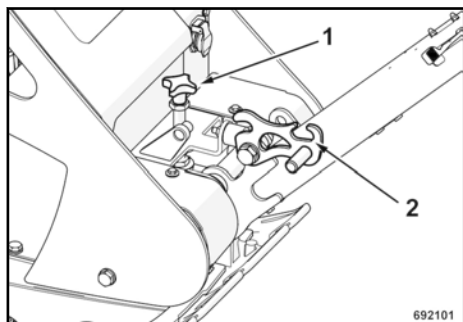


Fig. 8

- 1 - Steering rod height adjustment
- 2 - Locking pawl lever

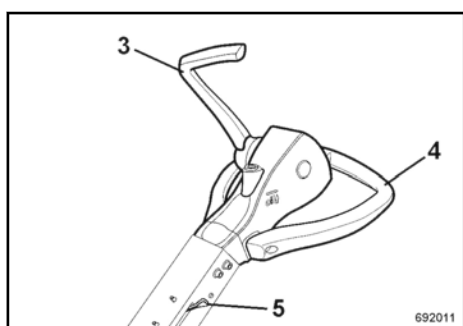


Fig. 9

- 3 - Travel lever
- 4 - Handle
- 5 - Throttle lever

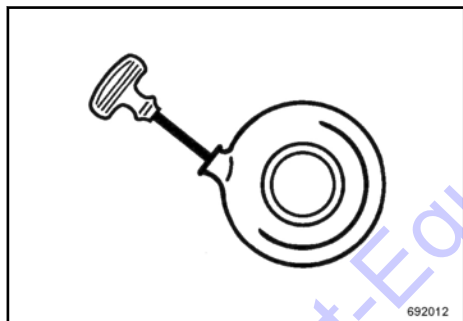


Fig. 10

- Recoil starter

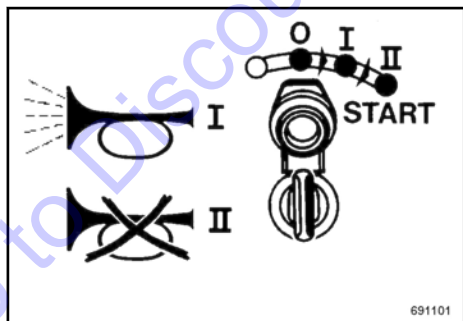


Fig. 11

- Start switch

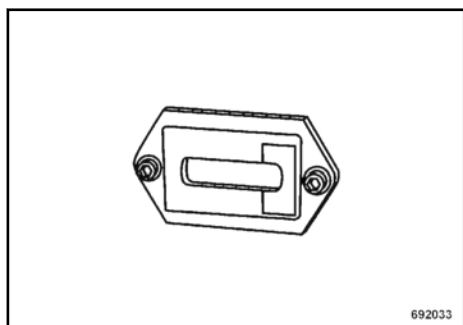


Only machines with electric starter.

Position "0"	Ignition off, warning buzzer off
Position "I"	Ignition on, warning buzzer on

Position "II"	Engine starts, warning buzzer off
---------------	-----------------------------------

Display and control elements



- Operating hour meter

Fig. 12

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5.1 General

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

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

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5.2 Tests before taking into operation

The following inspections must be carried out before each working day or before a longer working period.

**WARNING!****Danger of accident!**

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

Park the machine on ground as level as possible.

Cleaning the machine.

Check:

condition of engine and machine.

fuel tank and fuel lines for leaks.

screw connections for tight fit.



For a description of the following tasks refer to the chapter "Daily maintenance".

Check the engine oil level, top up if necessary.

Check the fuel level, top up if necessary.

5.3 Folding down the steering rod

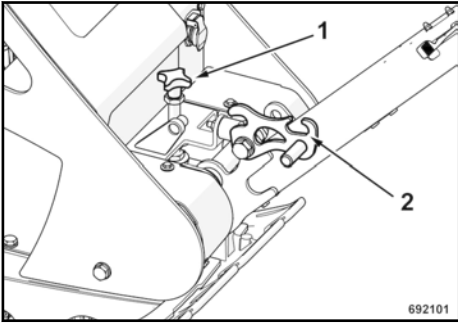



Fig. 13

Pull the locking pawl lever (2)  Fig. 13 and lower the steering rod, so that it can swing freely.

Adjust the steering rod with the height adjustment (1) to the height of your body.

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5.4 Starting with recoil starter



On machines without electric starter the recoil standard is the normal starting facility

On machines with electric starter this starting procedure should only be used in case of a defective, discharged or missing battery.



WARNING!

Exhaust gases are highly dangerous!

Always ensure an adequate supply of fresh air when starting and operating in closed rooms and trenches!



WARNING!

Danger of accident!

Before starting make sure that there are no persons in the danger area of engine or machine and that all safety installations are in place.

Before starting check the starter rope for chafing, replace if necessary. A damaged rope can break and cause injuries during starting.

Do not use starting aid sprays or other inflammable fluids for starting.

Always hold on to the machine.

Always keep an eye on a running machine.



WARNING!

Loss of hearing!

Wear your personal noise protection means (ear defenders) before starting operation.

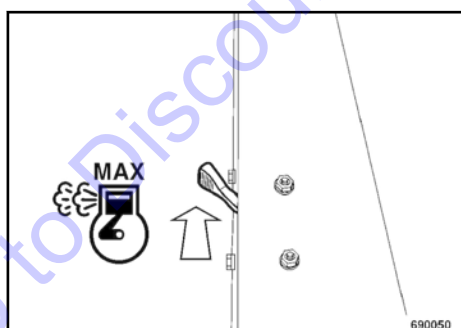


Fig. 14

Set the throttle lever to position "MAX".

Operation

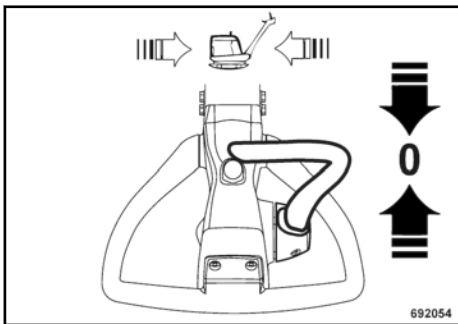


Fig. 15

Shift the travel lever ↩ Fig. 15 to position "0".

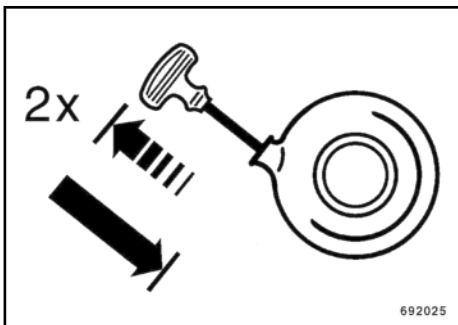


Fig. 16

Slightly pull the starter handle ↩ Fig. 16 two times, until resistance can be felt (compression pressure), and return it to initial position.

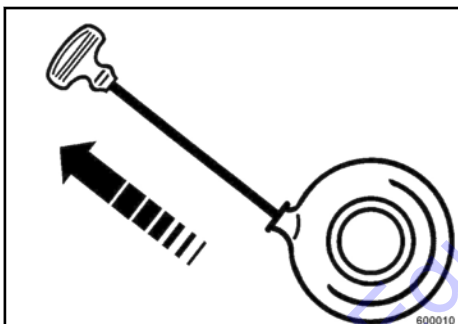


Fig. 17

Pull the starter handle ↩ Fig. 17 quickly and powerful as far out as possible.



NOTICE!

Do not let the starter handle hit back, but guide it back.



Set the throttle lever to position "MIN" ↩ Fig. 18.

Run the engine warm for approx. 1 to 2 minutes in idle speed.



Operation of the vibratory plate can be started as soon as the engine responds to short throttle commands.

Fig. 18

5.5 Starting the engine electrically ^{Optional equipment}



WARNING!

Exhaust gases are highly dangerous!

Always ensure an adequate supply of fresh air when starting and operating in closed rooms and trenches!



WARNING!

Danger of accident!

Before starting make sure that there are no persons in the danger area of engine or machine and that all safety installations are in place.

Do not use starting aid sprays or other inflammable fluids for starting.

Always hold on to the machine.

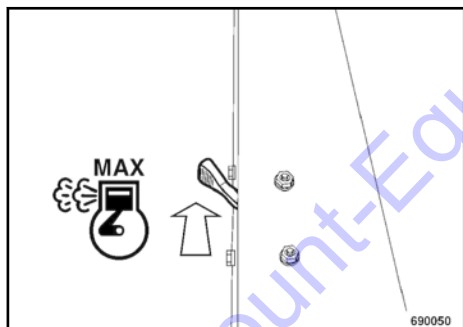
Always keep an eye on a running machine.



WARNING!

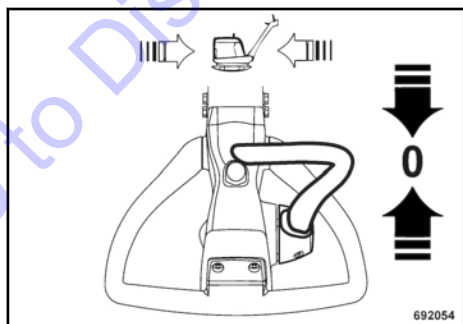
Loss of hearing!

Wear your personal noise protection means (ear defenders) before starting operation.



Set the throttle lever ↗ Fig. 19 to position "MAX".

Fig. 19



Shift the travel lever ↘ Fig. 20 to position "0".

Operation

Fig. 20



NOTICE!

Starting attempts should not exceed 30 seconds uninterrupted or max. 3 times 10 seconds. After this time allow the starter to cool down to ambient temperature.

If the engine has not started after these attempts, determine the cause.



The starter switch is designed with a re-start lock. For a new starting attempt turn the ignition key first back to position "0".

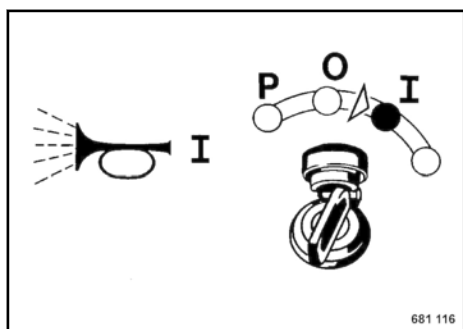


Fig. 21

Turn the ignition key to position "I" ↪ Fig. 21, the warning buzzer sounds.

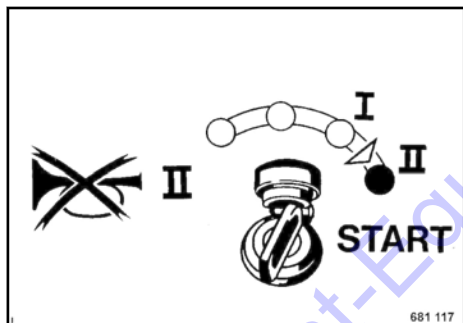


Fig. 22

Turn the ignition key further to position "II" ↪ Fig. 22 to start the engine.

As soon as the engine runs, return the ignition key to position "I". The warning buzzer stops.

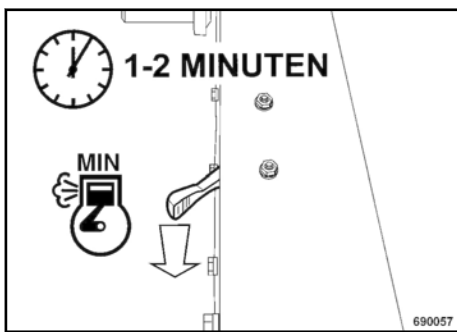


Fig. 23

Set the throttle lever to position "MIN" ↪ Fig. 23.

Run the engine warm for approx. 1 to 2 minutes in idle speed.



Operation of the vibratory plate can be started as soon as the engine responds to short throttle commands.



NOTICE!

When the engine is running leave the ignition key in position "I".

5.6 Work/operation



WARNING!

Danger of accident!

Operate the machine only with the steering rod folded down.

Guide the machine only by the steering rod.

Guide the machine so that your hands do not hit against solid objects.

Always keep an eye on a running machine.



NOTICE!

Operate the vibratory plate only with full engine speed, as otherwise the centrifugal clutch will be destroyed.

For short breaks you should always return the throttle lever to idle speed position, this avoids premature wear of the centrifugal clutch.

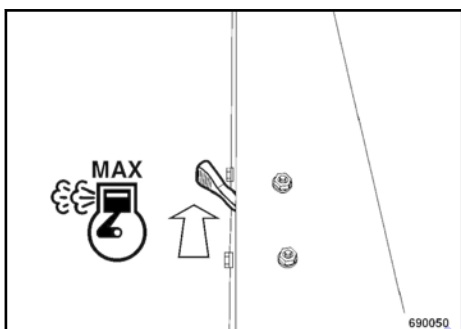


Fig. 24

Set the throttle lever ↪ Fig. 24 to position "MAX".

Drive forward

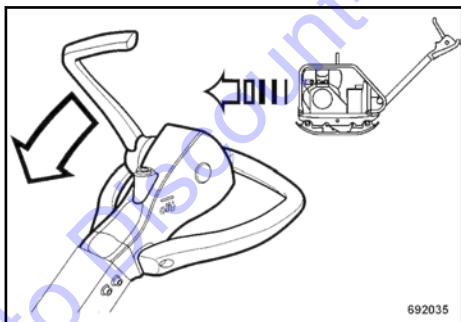


Fig. 25

Push the travel lever ↪ Fig. 25 forward, until the vibratory plate has reached the desired speed.

The machine drives with a speed which corresponds with the travel lever position.



If the machine moves forward with considerably reduced speed, pull the travel lever completely back and shift it forward again.

Drive backwards



WARNING!

Danger of accident!

As a measure to avoid injury the machine must only be guided from the side by the steering handle

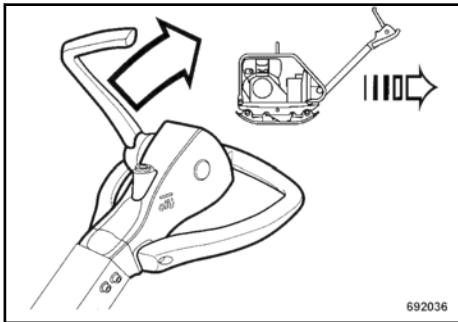


Fig. 26

Pull the travel lever ↩ Fig. 26 back, until the vibratory plate has reached the desired speed in reverse.

The machine vibrates backwards with a speed which corresponds to the travel lever position.

Vibration on the spot

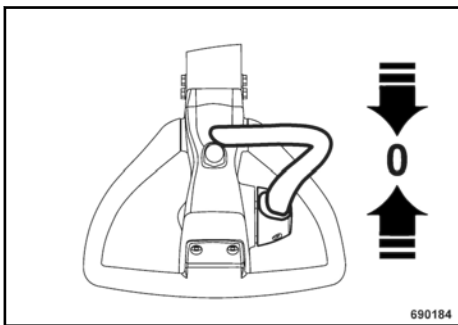


Fig. 27

Move the travel lever ↩ Fig. 27 to middle position, the machine will vibrate on the spot.

If the vibratory plate got stuck

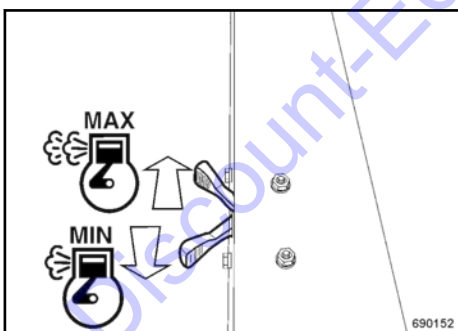


Fig. 28

Keep shifting the throttle lever ↩ Fig. 28 between "MIN" and "MAX" positions.

At the same time pull the vibratory plate by the steering rod to the right and left, until it comes free.

5.7 Shut down the engine



NOTICE!

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

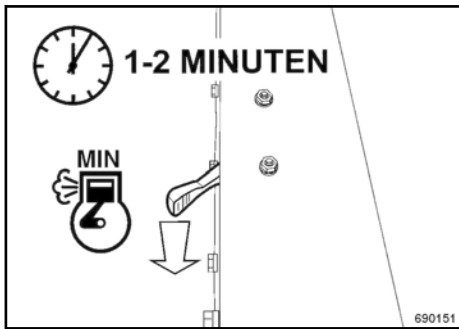


Fig. 29

Shift the throttle lever to position "MIN" ↪ Fig. 29 and let the engine run with idle speed for a short while.

Vibration is shut down.

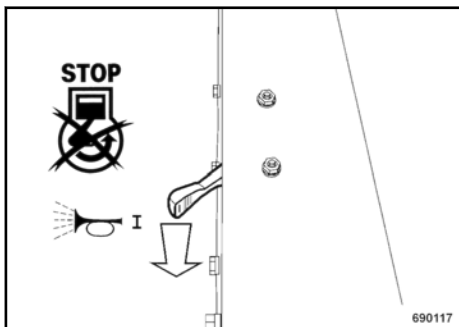


Fig. 30

Set the throttle lever ↪ Fig. 30 to position "STOP".

On machines with electric starter the warning buzzer will sound.

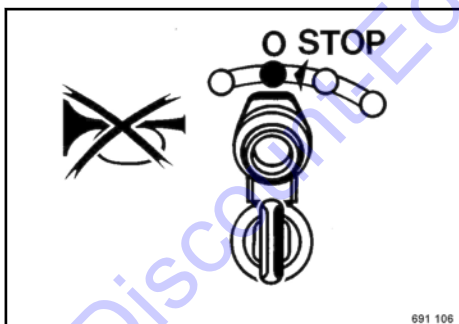


Fig. 31

Turn the ignition key ↪ Fig. 31 to position "0" and pull it out.

The warning buzzer no longer sounds.

5.8 Assembling the transport wheels Optional equipment



WARNING!

Danger of injury!

By the machine tipping over when assembling or dis-assembling the transport wheels



NOTICE!

Shut down the engine.

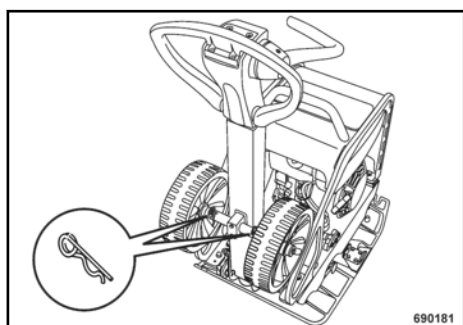


Fig. 32

Adjust the steering rod upright and lock it. Engage the locking pawl lever securely.

Remove the spring cotter ↗ Fig. 32 and pull the transport wheels out of the bracket on the steering rod.

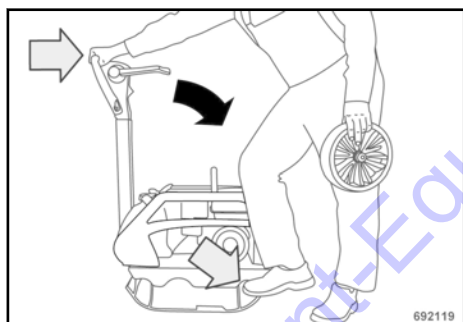


Fig. 33

Stand at the side of the machine.

Tilt the machine forward by the steering rod ↗ Fig. 33.

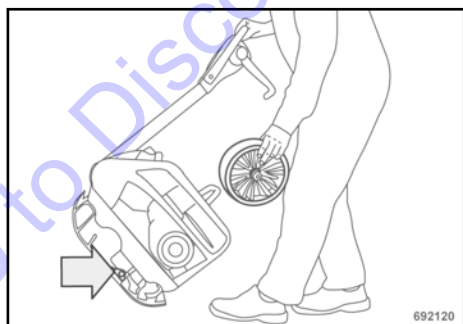


Fig. 34

Insert the transport wheel into the bracket ↗ Fig. 34 on the base plate.

Operation

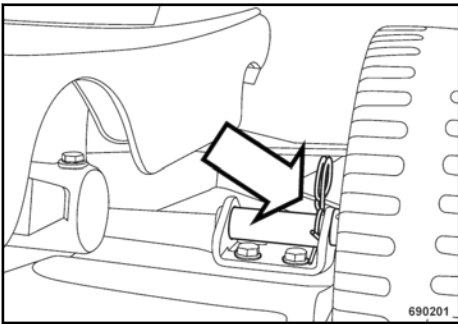


Fig. 35

In the bracket secure the transport wheel with the spring cotter ↪ Fig. 35.

Insert the second wheel into the bracket on the opposite side of the base plate and secure it with the spring cotter.

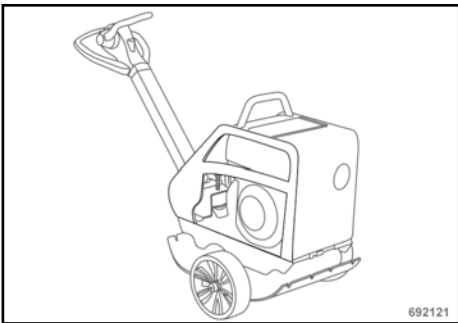


Fig. 36

Unlock the steering rod and fold it down ↪ Fig. 36.

Lock the steering rod in working position. Engage the locking pawl lever securely.

The machine can now be moved.

5.9 Loading/transport



WARNING!

Danger of accident! Life hazard!

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

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

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

For lifting the machine attach the lifting gear only to the lifting eye provided for this purpose.

Check lifting eye for damage before use. Do not use a damaged or in any other way impaired lifting eye.

Do not lift or lower the machine jerkily.

The tension must always be effective in vertical direction.

The machine must not swing about when being lifted.

Do not step or stand under suspended loads.

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

When lashing down the machine disassemble the transport wheels from the base plate. Optional equipment

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

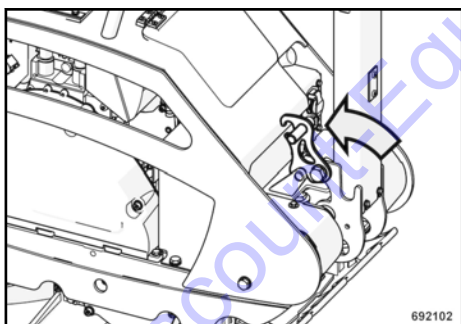


Fig. 37

Adjust the steering rod upright and engage the locking lever
 ↪ Fig. 37.

Operation

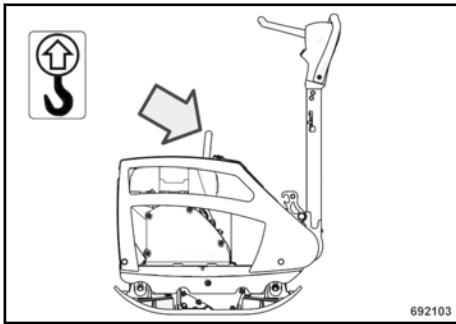


Fig. 38

Always attach the lifting tackle to the lifting eye to load the vibratory plate ↪ Fig. 38 on a transport vehicle.

Lash the vibratory plate down to the transport vehicle, so that it is secured against rolling, sliding and turning over. Fasten the lashing tackle at the marked lashing points.

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Go to Discount-Equipment.com to order your parts

6.1 General notes on maintenance

When performing maintenance work ensure strict compliance with the respective safety instructions and particularly the safety regulations mentioned in the corresponding section of these operating and maintenance instructions.

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

Always clean machine and engine thoroughly before starting maintenance work.

For maintenance work stand the machine on level ground.

Do not touch hot engine parts.

Perform maintenance work only with the engine shut down.



ENVIRONMENT!

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

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

Notes on the fuel system

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

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

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

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

Under no circumstances must the drum be rolled to the tapping point just before drawing out fuel.

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

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

Do not draw off fuel from near the bottom of the drum.

Residues in the fuel drum must not be used.

Notes on the performance of the engine

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

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

Frequent causes of faults

Operating errors

Incorrect, inadequate 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.

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6.2 Fuels and lubricants

Engine oil

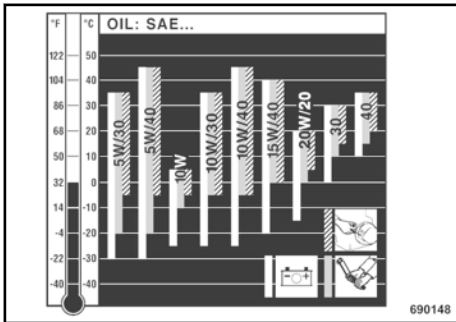


Fig. 39

Oil viscosity

Choose the oil viscosity in dependence on the ambient temperature at the operating location of the engine (see diagram).

Occasional falling short of the temperature limit (e.g. use of SAE 15W/40 down to -15 °C (+5 °F)) may effect the cold starting ability of the engine, but will not cause any engine damage.

Temperature related lubrication oil changes can be avoided by using multi-purpose oils. The following oil change intervals apply also when using multi-purpose oils.

Oil quality

You should preferably use oils of API quality class CD/CE/CF/CF-4/CG-4 or higher, or ACEA B2/E2.

Lubrication oil change intervals

1 months or 250 operating hours



When changing to a higher alloyed oil quality after a longer period of operation, it is recommended to perform the first oil change of the higher quality oil already after 25 operating hours.

Fuels

Quality

You should only use commercially available brand diesel fuel and ensure strict cleanliness when filling in.

The fuel provision should always be topped up in due time, so that the tank will not run dry.

The following fuel specifications are permitted:

- EN 590
- BS 2869: A1 and A2
- ASTM D 975 1-D and 2-D

For engines used in EPA areas, the use of fuels with a ultra-low sulphur content is mandatory. United States Environmental Protection Agency

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.

Mineral oil based hydraulic oil

The hydraulic system is operated with hydraulic oil HV 32 (ISO) with a kinematic viscosity of 32 mm²/s at 40°C (104 °F).

For topping up or for oil changes use only high-quality hydraulic oil, type HVLP according to DIN 51524, part 3, or hydraulic oils type HV according to ISO 6743/3. The viscosity index (VI) should be at least 150 (observe information of manufacturer).

Maintenance

6.3 Table of fuels and lubricants

Assembly	Fuel or lubricant		Quantity approx.
	Summer	Winter	Attention
			Observe the level marks
Motor			
- Engine oil	API CD/CE/CF/CF-4/CG-4		approx. 0.9 l (0.24 gal us)
	SAE 5W/30 (-5 °C to +35 °C) (+23 °F to +95 °F)		
	SAE 5W/40 (-5 °C bis +45 °C) (+23 °F bis +113 °F)		
	SAE 10W/30 (-5 °C to +35 °C) (+23 °F to +95 °F)		
	SAE 10W/40 (-5 °C to +45 °C) (+23 °F to +113 °F)		
	SAE 10W/40 (0 °C to +40 °C) (+32 °F to +104 °F)		
	SAE 30 (+15 °C to +30 °C) (+59 °F to +86 °F)	SAE 10W (-5 °C to +5 °C) (+23 °F to +41 °F)	
	SAE 40 (+20 °C to +35 °C) (+68 °F to +95 °F)		
- Fuel	Diesel	Winter diesel fuel	3.0 l (0.8 USgal)
		(-12 °C) (+10.4 °F)	
Vibrator shaft housing	as engine oil		0.4 l (0.11 USgal)
Steering rod	Hydraulic oil HV 32		approx. 0.4 l (0.11 gal us)

6.4 Running-in instructions

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

**NOTICE!**

During the running-in period, up to approx. 200 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 200 operating hours.

After 25 operating hours

Change the engine oil.

Check engine and machine for leaks.

Retighten the fastening screws on air filter exhaust, fuel tank and other attachments.

Retighten the bolted connections on the machine.

Check the vibration drive V-belts.

Check the oil level in the vibrator housing.

Maintenance

6.5 Maintenance table

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

No.	Maintenance work	Comment	daily	weekly	monthly	half-annually	annually	as required
6.6.1	Clean the machine		X					
6.6.2	Check the engine oil level	Dipstick mark	X					
6.6.3	Check the fuel level		X					
6.7.1	Check, clean the water separator			X				
6.8.1	Battery service	Only machines with electric starter.			X			
6.8.2	Check, clean the air filter, replace if necessary	in case of extreme dust check every day renew min. every 6 months			X			
6.8.3	Clean the cooling fins and the cooling air intake openings				X			
6.9.1	Check the oil level in the exciter housing					X		
6.9.2	Check the V-belt tension, if necessary replace the V-belt					X		
6.9.3	Check, adjust the valve clearance	automatic valve clearance adjustment				X		
6.10.1	Change the engine oil	at least every 250 operating hours					X	
6.10.2	Clean the engine oil filter	at least every 1000 operating hours					X	
6.10.3	Replace the fuel filter						X	
6.10.4	Replace the starter rope						X	
6.10.5	Change the oil in the exciter shaft housing	at least every 500 operating hours					X	

Maintenance

No.	Maintenance work	Comment	daily	weekly	monthly	half-annually	annually	as required
6.10.6	Check the hydraulic oil level						X	
6.10.7	Check the rubber buffers						X	
6.11.1	Tighten all bolted connections							X
6.11.2	Engine conservation							X

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6.6 Maintenance every day

6.6.1 Clean the machine



NOTICE!

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

Dirty operating conditions, particularly lubrication oil and fuel deposits on the cooling fins of the engine and the cooling air intake opening have an adverse effect on the cooling of the engine. You should therefore immediately seal any oil or fuel leaks near fuel tank, cylinder or cooling air intake and subsequently clean the cooling fins.

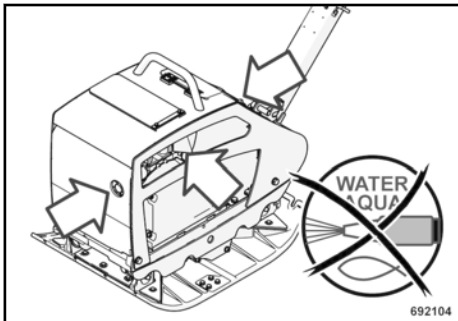


Fig. 40



NOTICE!

Do not guide the water jet directly into the cooling air openings of the recoil starter, into the dry air filter or on electrical equipment ↘ Fig. 40.

After wet cleaning run the engine warm to evaporate all water residues and to avoid corrosion.

6.6.2 Check the engine oil level



NOTICE!

Park the machine on level ground so that the engine is in horizontal position.

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

Shut down the engine.

Screw out the dipstick (1) ↘ Fig. 41, wipe it off with a lint-free, clean cloth and screw it completely back in.

Unscrew the oil dipstick again and read the oil level.

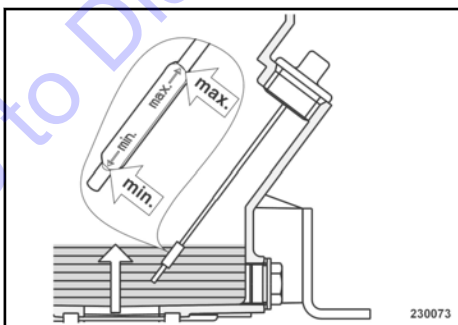


Fig. 41



NOTICE!

Operation with an oil level below the min mark or above the max mark can cause engine damage.

The oil level should reach the upper mark on the dipstick. If the oil level is too low top up oil immediately.

Check the seal on the dipstick, replace if necessary.

Screw the dipstick in again until it bottoms.

6.6.3 Check the fuel level



WARNING!

Fire hazard!

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

Do not refuel in closed rooms.

Shut down the engine.



WARNING!

Health hazard!

Do not inhale any fuel fumes.



NOTICE!

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



ENVIRONMENT!

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

Clean the area around the filler cover, unscrew the filler cover → Fig. 42.



NOTICE!

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

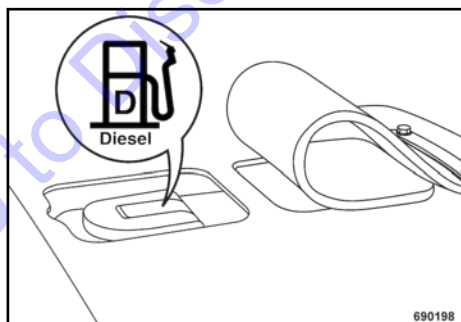


Fig. 42

Fill in fuel through a funnel with screen.

Close the tank again.

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6.7 Weekly maintenance

6.7.1 Check, clean the water separator


WARNING!
Fire hazard!

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

Shut down the engine.


WARNING!
Health hazard!

Do not inhale any fuel fumes.


ENVIRONMENT!

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



The inspection interval for the water separator depends on the water proportion in the fuel and the care that is exercised when refuelling.

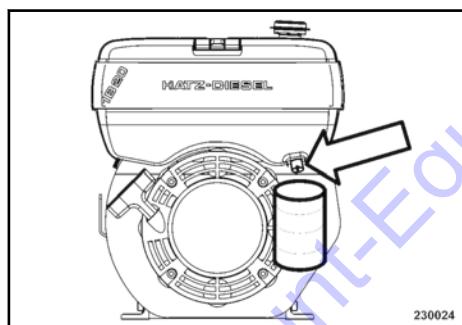


Fig. 43

Place the transparent container ↘ Fig. 43 under the drain plug.

Loosen the screw for approx. 3 to 4 turns and collect running out water/fuel.



Since water is heavier than diesel fuel, water will run out before the fuel. This can be noticed by a clearly visible parting line.

When only fuel comes running out, tighten the drain plug again.

6.8 Maintenance every month

6.8.1 Battery service Only machines with electric starter.



WARNING!

Danger of cauterisation ! Danger of explosion!

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

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

Wear protective clothing!

Wear safety goggles!

Do not lay any tools on the battery!

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



ENVIRONMENT!

Dispose of old batteries in compliance with legal regulations.



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

The following therefore applies for the service life:

Switch off all consumers (e.g. ignition).

Check open-circuit voltage of the battery at regular intervals. At least once per month.

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

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

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

After each charging process allow the battery to rest for one hour before taking it into service.

For resting periods of more than one month you should always disconnect the battery. Do not forget to perform regular open-circuit voltage measurements.



NOTICE!

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

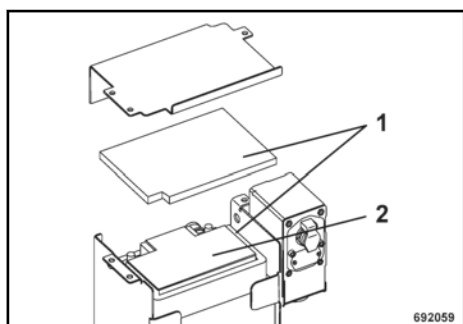


Fig. 44

Unscrew the battery box cover ↗ Fig. 44.

Remove the vibration insulation mats (1).

Remove the battery (2) and clean the battery compartment.

Clean the outside of the battery.

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

Check the condition of the vibration insulation mats, replace if necessary.

On serviceable batteries check the acid level, if necessary top up to the filling mark with distilled water.

Install battery and vibration insulation mats.

Close the battery box cover again.

6.8.2 Check, clean the air filter, replace if necessary



NOTICE!

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

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

Replace the air filter after five times cleaning, but at the latest after half a year.

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

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

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

In case of wet or oily dirt replace the filter element.

Do not run the engine without air filter.

Maintenance

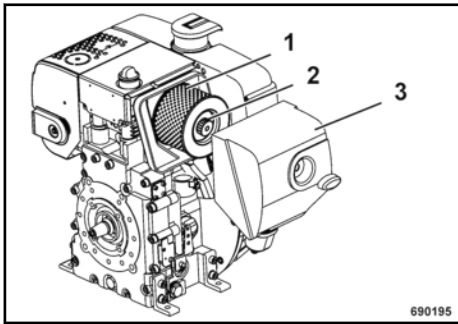


Fig. 45

Remove the filter cover (3) ↗ Fig. 45.

Unscrew the knurled nut (2) and pull out the air filter (1).



NOTICE!

The clean air side must be kept clean of dirt and foreign particles.

Do not blow the inside of the filter housing out with compressed air.

Wipe the inside of the filter housing only with a clean cloth.
Clean the cover thoroughly.



WARNING!

Danger of injury!

Always wear protective clothes (goggles, gloves) when working with compressed air.

Blow the air filter ↗ Fig. 46 out from inside to outside with dry compressed air (max. 5 bar (73 psi)).

Check the air filter for damage, replace if necessary.

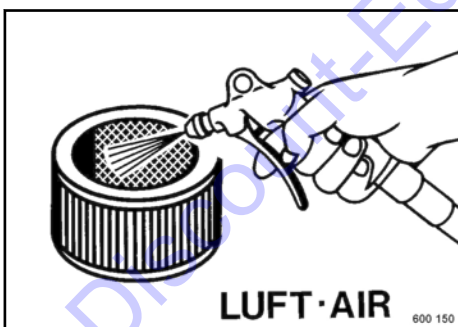


Fig. 46

Insert the air filter (1) ↗ Fig. 45 into the housing and fasten it with the knurled nut (2).

Install the filter cover (3), ensure correct fit of cover and seal.

6.8.3 Clean the cooling fins and the cooling air intake openings


WARNING!
Danger of injury!

Always wear protective clothes (goggles, gloves) when working with compressed air.


NOTICE!

Dirty operating conditions, particularly lubrication oil and fuel deposits on the cooling fins of the engine and the cooling air intake opening have an adverse effect on the cooling of the engine.

You should therefore immediately seal any oil or fuel leaks near fuel tank, cylinder or cooling air intake.

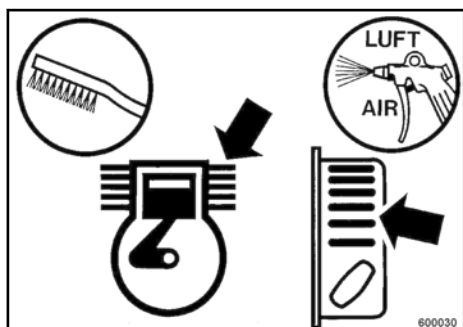


Fig. 47

Loosen dried on dirt with a suitable brush ↵ Fig. 47 from all cooling fins and cooling air intake openings and blow it off with compressed air .


WARNING!
Fire hazard!

Do not use any inflammable solvents.


NOTICE!

Do not guide the water jet directly into the cooling air openings of the recoil starter, into the air filter and on electrical equipment.

On a oil contaminated engine use a cold cleansing agent for cleaning.

After a sufficient soaking time clean off with a water or steam jet and blow out with compressed air.

Run the engine warm for a while to avoid corrosion.


NOTICE!

Look for the cause of oily contamination and have any leaks sealed by our customer service.

6.9 Maintenance every 6 months

6.9.1 Check the oil level in the exciter housing



NOTICE!

Park the machine on level ground.

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

Clean the area around breather and drain plug.

Unscrew the bleeding screw (1) ↪ Fig. 48.

Unscrew the oil drain plug (2) and check the oil level.

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

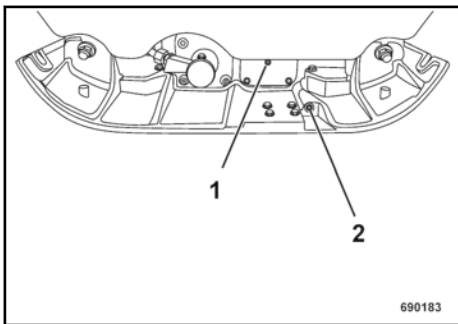


Fig. 48

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

Clean oil drain and bleeding screw and assemble both screws with sealing compound (e.g. BOMAG part-no. 00970016).

6.9.2 Check the V-belt tension, if necessary replace the V-belt

Checking the V-belt

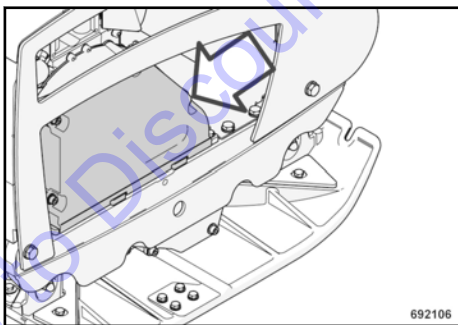


Fig. 49

Remove the V-belt guard ↪ Fig. 49.

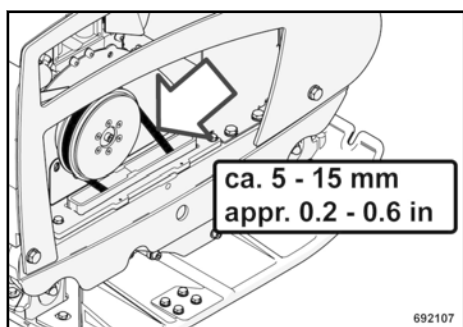


Fig. 50

Check condition and tightness of V-belt ↪ Fig. 50.

i Compression measurement approx. 5 - 15 mm (0.2 - 0.6 in)



NOTICE!

Replace a damaged V-belt.

The V-belt cannot be tightened manually. Always replace the V-belt, if the compression measurement is exceeded.

Replacing the V-belt

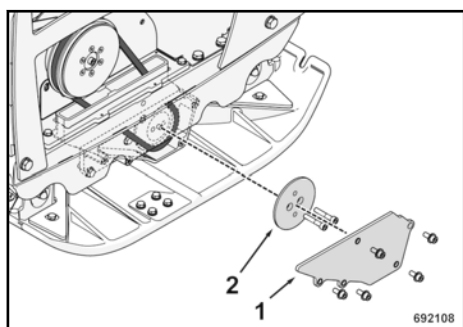


Fig. 51

Remove the safety cover (1) ↪ Fig. 51.

Disassemble the front V-belt pulley (2).

Take off the V-belt and replace it with a new one.

Reassemble the previously removed spacers.

Install and fasten the front V-belt pulley (tightening torque: 35 Nm (26 ft.lbs)).

Install and fasten the guard (tightening torque: 15 Nm (11 ft.lbs)).

Install the top V-belt guard .

6.9.3 Checking, adjusting the valve clearance



NOTICE!

The engines are equipped with an automatic valve clearance adjustment, the valve clearance does therefore not need to be checked and adjusted.

6.10 Maintenance every year

6.10.1 Change the engine oil



WARNING!

Danger of scalding when draining off hot engine oil.



NOTICE!

Park the machine on level ground.

Drain the engine oil only when the engine is warm.

Change the engine oil at the latest after 250 operating hours.

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



ENVIRONMENT!

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

Screw the oil dipstick out of the oil filler opening .

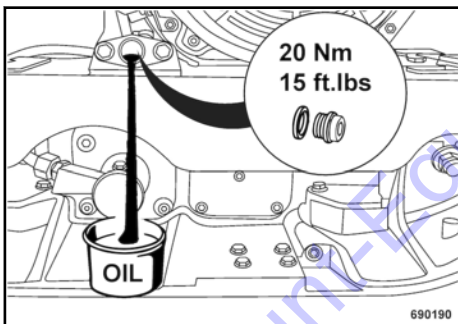


Fig. 52

Unscrew the oil drain plug and catch running out old oil
↳ Fig. 52.

Clean the oil drain plug and screw it back in with a new seal ring (tightening torque: 20 Nm (15 ft.lbs)).

Fill in fresh engine oil through the oil filler opening.

Screw the oil dipstick back in.

Perform a test and check the oil level, correct if necessary.

Check the drain plug for leak tightness.

6.10.2 Clean the engine oil filter

**WARNING!****Danger of scalding!**

When draining off hot oil.

By hot oil when unscrewing the engine oil filter.

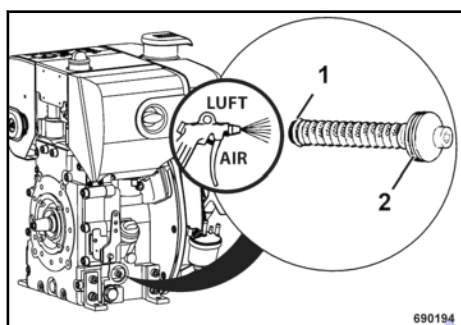
**NOTICE!**

Remove and clean the engine oil filter only after draining off the engine oil.

Park the machine on level ground so that the engine is in horizontal position.

**ENVIRONMENT!**

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



Loosen the fastening screw for approx. 5 turns and pull the engine oil filter out of the housing ↪ Fig. 53.

**WARNING!****Danger of injury!**

Always wear goggles when working with compressed air.

Fig. 53

Blow the engine oil filter out with compressed air from inside to outside.

Check the seal (1) for damage, change if necessary.

Cover seal rings (1) and (2) slightly with oil before assembling.

Push the engine oil filter into the housing.



Before tightening the screw make sure that the tensioning springs touch the oil filter with both ends.

Tighten the fastening screw.

After filling in engine oil perform a short test run and check for leaks, if necessary tighten the fastening screw.

6.10.3 Replace the fuel filter



WARNING!

Fire hazard!

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

Do not refuel in closed rooms.

Shut down the engine.



WARNING!

Health hazard!

Do not inhale any fuel fumes.



NOTICE!

Ensure strict cleanliness to keep dirt out of the fuel lines. Dirt particles can destroy the injection system.

The service interval to change the fuel filter depends on the cleanliness of the fuel. If necessary this service must be performed every six months.



ENVIRONMENT!

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

Dispose of the used fuel filter environmentally.

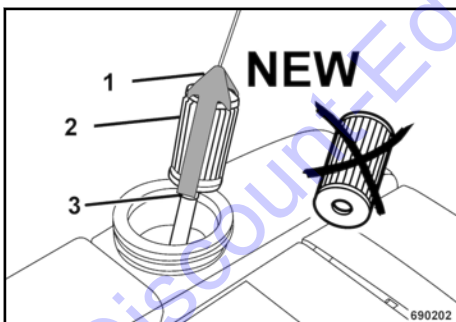


Fig. 54

Open the quick lock on the tank.

Pull the holder (1) ↗ Fig. 54 with the fuel filter (2) by the cord out of the tank.

Pull the fuel hose (3) off the fuel filter

Push the fuel filter out of the holder.

Push the new fuel filter into the holder.
 Push the fuel hose onto the new fuel filter.



NOTICE!

Do not insert the hose into the tank without a filter.
 Danger of contamination!

Insert the holder with the fuel filter into the tank and attach the quick lock.



The fuel system is self bleeding.

6.10.4 Replacing the starter rope

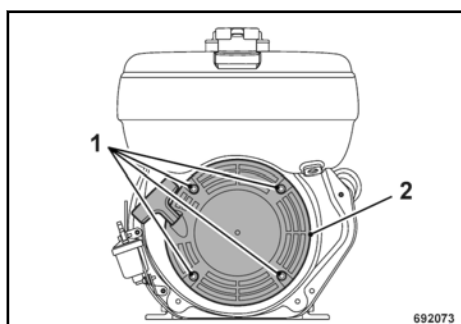


Fig. 55

Unscrew the fastening screws (1) ↗ Fig. 55 and pull the recoil starter (2) from the engine housing.

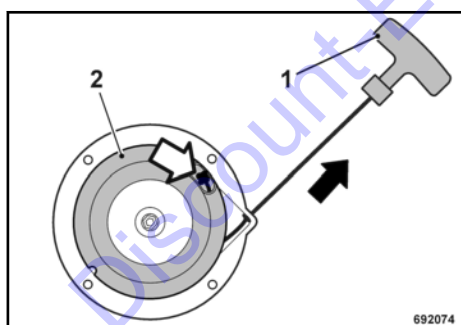


Fig. 56

Pull the starter rope with the starter handle (1) out completely ↗ Fig. 56.

Secure the coil (2) against winding up.

Loosen the knot of the starter rope on the coil and remove the old starter rope.

Carefully turn the coil back, until the recoil spring is relieved.

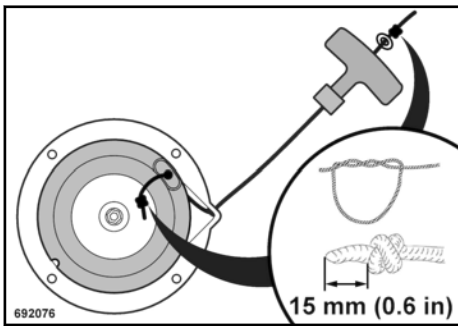


Fig. 57

Thread in the new starter rope and fix it with knots on both ends ↪ Fig. 57.



NOTICE!

Incorrect sense of rotation will damage the spring ends of the recoil spring.

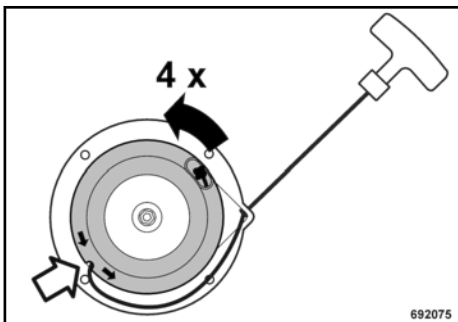


Fig. 58

Pre-tension the coil by approx. 4 rotations in direction of arrow. Thereby place the starter rope into the recess in the coil ↪ Fig. 58.



WARNING!

Danger of injury!

Do not let the starter handle hit back, but guide it back slowly.

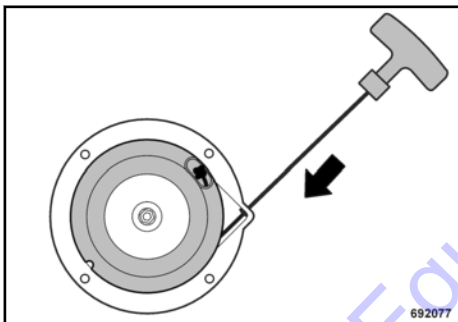


Fig. 59

Slowly guide the starter handle back to initial position ↪ Fig. 59. The rope is thereby wound on the coil.

Test function and light movement of the recoil starter by pulling the starter handle.

Mount the recoil starter to the engine housing.

6.10.5 Change the oil in the exciter shaft housing



NOTICE!

Park the machine on level ground.

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



ENVIRONMENT!

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

Clean the area around breather and drain plug.

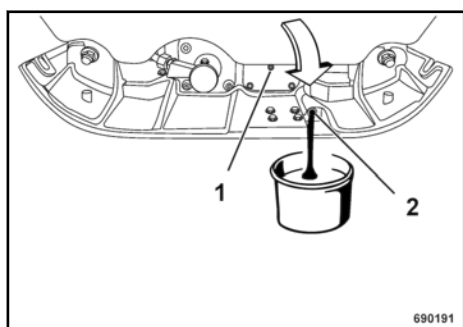


Fig. 60

Tilt the machine to the side with the oil drain plug and support it safely.

Unscrew the bleeding screw (1) ↪ Fig. 60.

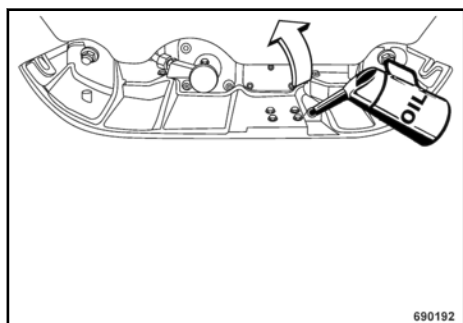


Fig. 61

Unscrew oil drain plug (2), drain and catch running out old oil.

Tilt the machine to the opposite side and secure it properly.

Fill in fresh engine oil through the drain opening ↪ Fig. 61.

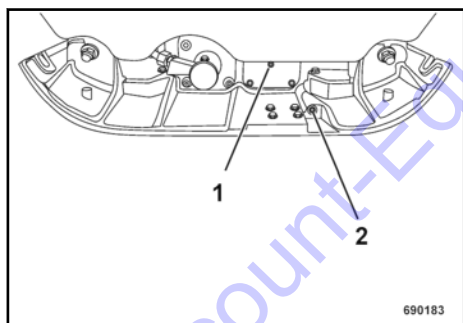


Fig. 62

Park the machine on level ground.

Check the oil level.

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

Clean oil drain (2) ↪ Fig. 62 and bleeding screw (1) and assemble both screws with sealing compound (e.g. BOMAG part-no. 00970016).

6.10.6 Check the hydraulic oil level



NOTICE!

Park the machine horizontally.

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



ENVIRONMENT!

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

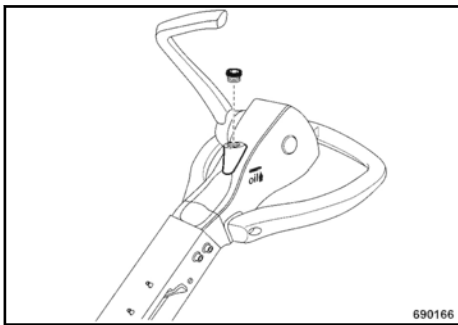


Fig. 63

Adjust the steering rod with height adjustment ↪ Fig. 63 so that the area with the level inspection plugs is horizontal.

Unscrew the plug.

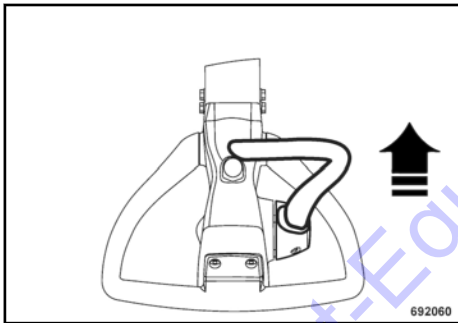


Fig. 64

Hold the travel lever in forward position ↪ Fig. 64.

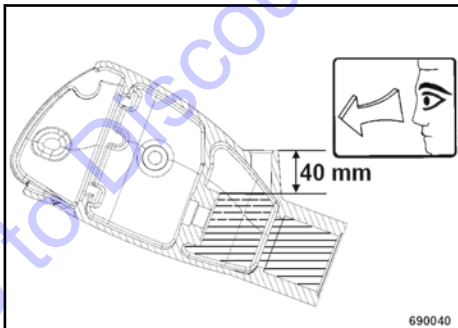


Fig. 65

Check whether the hydraulic oil level is approx. 40 mm (1.6 in) below the filler opening ↪ Fig. 65 (see also mark on steering rod head), top up hydraulic oil if necessary.

Filling up hydraulic oil

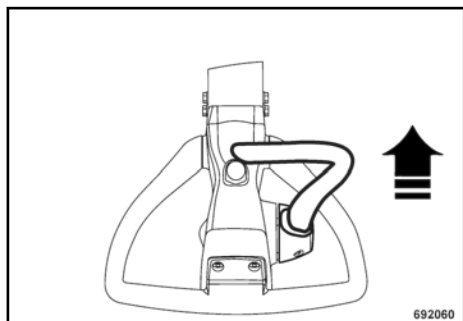


Fig. 66

Shift the travel lever forward against the stop ↗ Fig. 66.

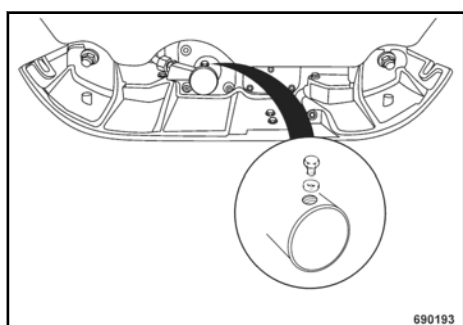


Fig. 67

i Lay a cloth down before loosening the venting screw.

Slacken the bleeding screw ↗ Fig. 67.

Wait until all air has escaped, then tighten the bleeding screw.

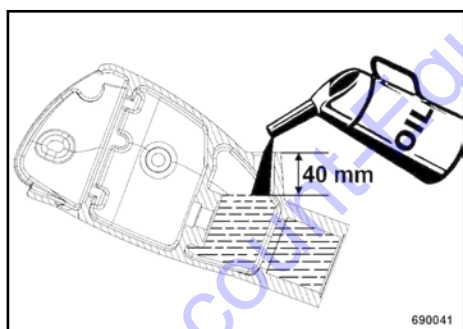
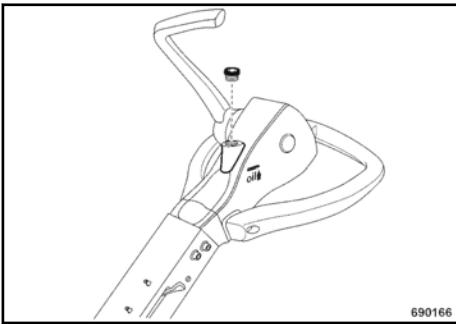


Fig. 68

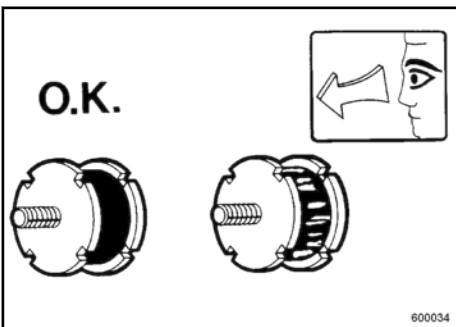
Fill in hydraulic oil to approx. 40 mm (1.6 in) below the edge of the filler opening ↗ Fig. 68.



Screw in and tighten the plug ↗ Fig. 69.

Fig. 69

6.10.7 Check the rubber buffers



Check all rubber buffers ↗ Fig. 70 for tight fit, cracks and damage and replace immediately if damaged.

Fig. 70

Go to Discount-Equipment.com to order your parts

6.11 As required

6.11.1 Tightening the screws

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

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

Fig. 71

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

8.8 = 8 G

10.9 = 10 K

12.9 = 12 K

The values result in a 90% utilization of the screw's yielding point at a coefficient of friction of μ total = 0.14.

The compliance with the tightening torques is to be checked with torque wrenches.

The tightening torques are not applicable when using MoS₂ lubricants.

6.11.2 Engine conservation

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

Clean the engine including the cooling system: with cold cleansing agent or, even better, with a steam cleaner.

Run the engine warm and shut it down.

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

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

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

After running the engine remove the valve cover and spray the rocker chamber with a mixture of diesel fuel and 10% anti-corrosion oil. After this screw the cover back on.

Crank the engine several times by hand (throttle lever in stop position) to spray the combustion chamber.

Take the V-belt off and spray the grooves in the V-belt pulleys with anti-corrosion oil. Remove the anti-corrosion oil before taking the machine back into operation.

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



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

The conserving oil must be replaced by engine oil according to the API- (MIL) classification before taking the machine into service.

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

Mark a machine with a conserved engine by attaching a clearly visible warning tag.

Go to Discount-Equipment.com to order your parts

Go to Discount-Equipment.com to order your parts

7.1 General notes

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

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

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

Go to Discount-Equipment.com to order your parts

7.2 Starting with jump wires

i Use this starting procedure if the starter battery is discharged.

Remove the cover from the battery.

! **NOTICE!**
A wrong connection will cause severe damage in the electric system.
The auxiliary battery must have the same voltage as the starter battery.

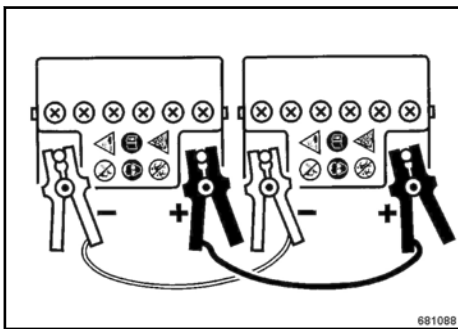


Fig. 72

Join the plus poles on external battery and starter battery with the jump wire ↪ Fig. 72.

Use the second jump start cable to connect the negative poles on external battery and starter battery.

Start the engine as described in the chapter "Starting the engine".

When the engine is running remove the jump start cable from the two negative poles first and from the positive poles after.

i This work sequence is necessary to avoid short circuit caused by contact between positive and negative cables.

Fasten the battery cover again.

7.3 Fuses



Only machines with electric starter.



WARNING!

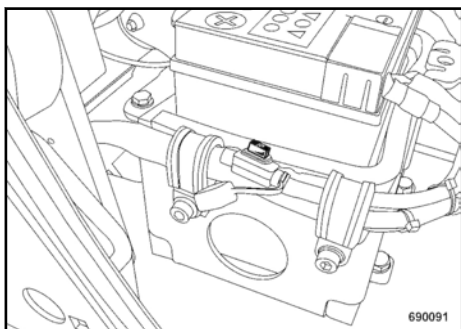
Fire hazard!

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



NOTICE!

Always cover the fuse with the protective cover.



Fuse (25 A) ↗ Fig. 73.

Fig. 73

7.4 Changing the injection pump



WARNING!
Fire hazard!

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



WARNING!
Health hazard!

Do not inhale any fuel fumes.



NOTICE!

Ensure strict cleanliness to keep dirt out of the fuel lines. Dirt particles can destroy the injection system.



ENVIRONMENT!

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

Disassembly

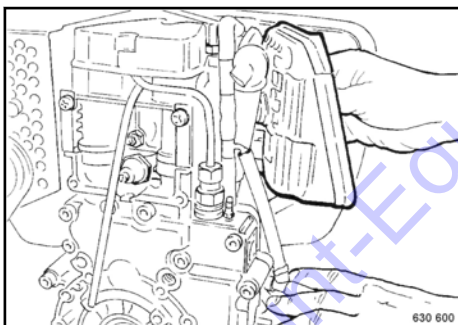
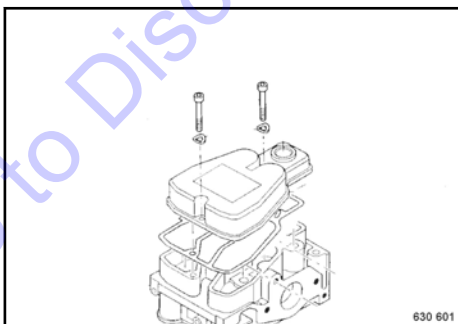


Fig. 74

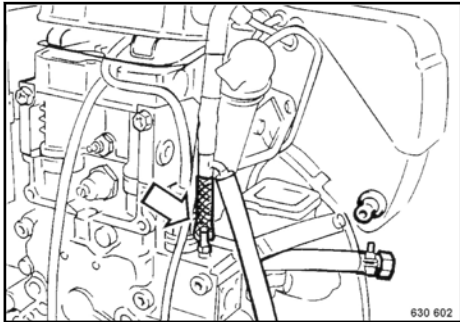
Remove the air filter console ↪ Fig. 74.



Remove the valve cover ↪ Fig. 75.

Trouble shooting

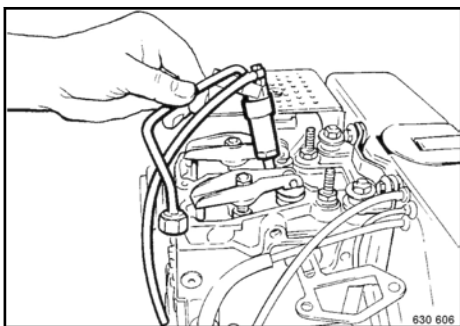
Fig. 75



Pull the fuel hose off the leak oil socket on the pump
↳ Fig. 76.

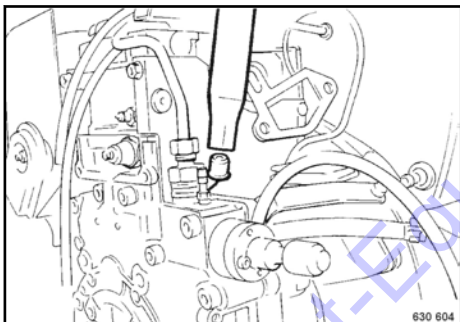
Place a suitable container under the hose socket to catch running out fuel.

Fig. 76



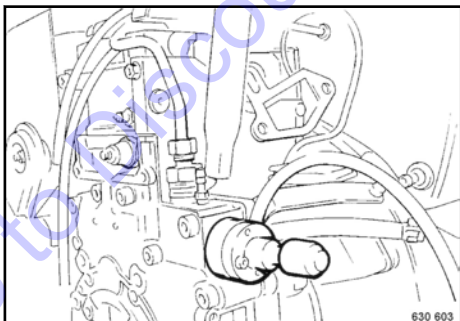
Remove the injection nozzles ↳ Fig. 77 completely with the nozzle base.

Fig. 77



Disassemble the crankcase ventilation grommet ↳ Fig. 78.

Fig. 78



Unscrew the oil shut-off valve ↳ Fig. 79.

Fig. 79

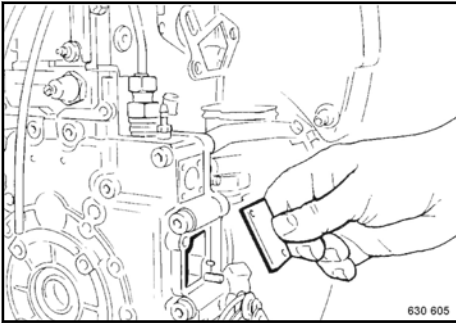


Fig. 80

Remove the cover plate ↪ Fig. 80.

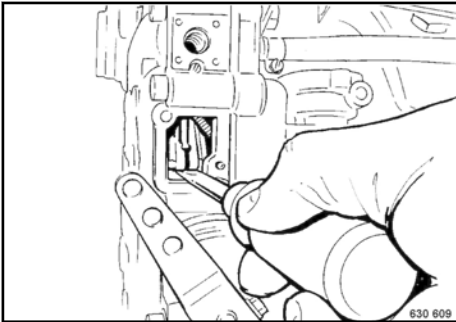


Fig. 81

Unhook pump piston ↪ Fig. 81 from the rocker arm to the injection pump.

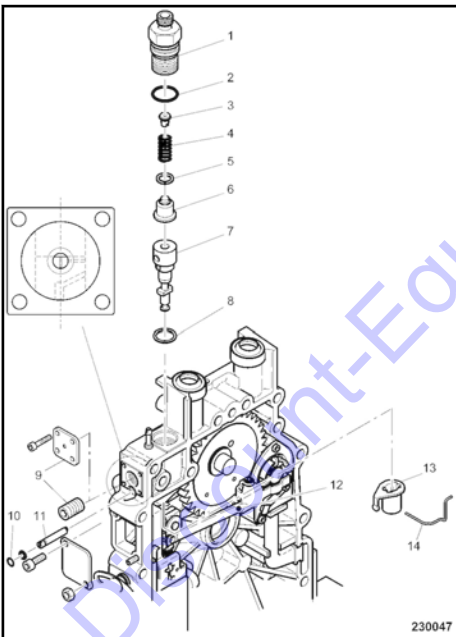


Fig. 82

Unscrew the pressure valve holder (1) ↪ Fig. 82 with O-ring (2).

Remove filling piece (3), spring (4), seal ring (5) and pressure valve (6).

Trouble shooting

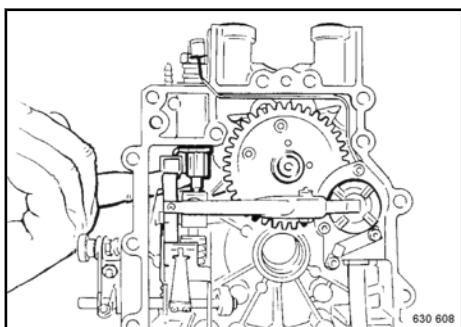


Fig. 83

Press the pump element ↪ Fig. 83 through the lateral opening up with your fingers and lift it out with a magnetic rod.

Remove shim (8) ↪ Fig. 82.

i The control bushing (13) is located by the bracket (14) and does not need to be removed.

Inspection / repair

Check the pump piston for light movement over the entire control range.

Replace damaged or worn parts.

Assembly

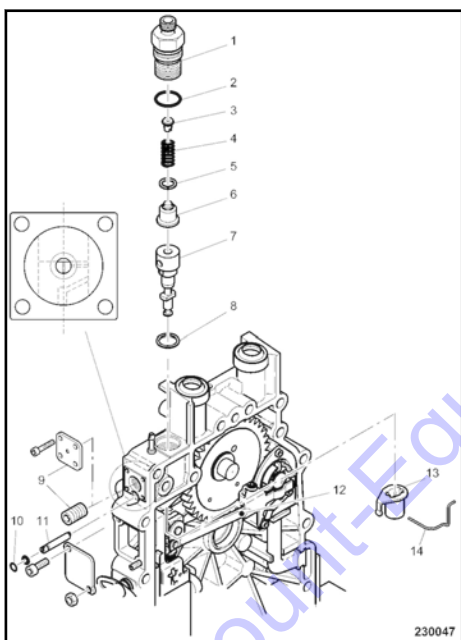
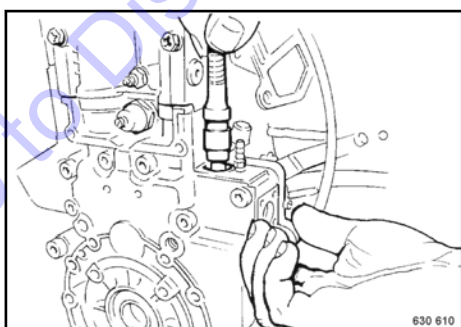


Fig. 84

Assemble shim (8) ↪ Fig. 84.



Insert the pump element ↪ Fig. 85, observe correct positioning of the suction hole (tapered bore) ↪ Fig. 84 and element flag (the number with 400 or 4 belongs to the side that should be opposite the suction hole).

Fig. 85

When inserting the element group make sure that the plunger flag also is inserted through the control sleeve (is achieved by turning the regulating sleeve slightly to and fro) and that the eccentric peg (11) also engages in the groove of the element cylinder ↪ Fig. 84.

Hook the pump piston to the rocker arm to the injection pump.

Assemble parts (6...1), tighten pressure valve holder (1) only slightly (approx. 10 Nm).

Turn the throttle lever completely to the right and lock it.

Lift the pump piston by approx. 2 mm.

Now check the position of the starting slot to the suction bore (visible through the bore the plug is screwed into).

The starting slot must be arranged centrally to the suction bore, or may be maximum one slot width offset to the left. If this is not the case lift flap (10) with a scriber and correct the position by turning the eccentric (11) accordingly.

If this places the suction bore too far out of centre, the deflection lever (12) is damaged and needs to be replaced.

Tighten the pressure valve holder with the following torque: 30 - 0 - 30 - 0 - 35 ± 2 Nm (tighten - loosen - tighten ...).

Complete the engine.

Trouble shooting

7.5 Engine problems

Fault description	Cause	Remedy
No or poor starting of engine	Fuel tank empty	Fill in fuel
	No fuel at the injection pump, supply not correct, fuel filter clogged (can be notice if no fuel runs out when the fuel supply line is pulled off)	Check the fuel supply Check the fuel supply line to the engine Check the fuel filter, replace if necessary
	Injection nozzle out of order	Have examined by a specialist
Engine does not start or starts poorly (at low temperatures)	Paraffin separation in the fuel	Check the fuel, if necessary drain the fuel tank and fill in winter fuel
Engine difficult to crank	Oil with too high viscosity	Drain off oil and fill in oil of correct viscosity
Engine has no compression	Incorrect valve clearance	Have examined by a specialist
	Engine defective	Have examined by a specialist
Engine loses power and speed	Fuel tank empty	Fill in fuel
	Throttle lever does not stay in selected position	Tighten the nuts
	Fuel filter clogged	Change the fuel filter
	Tank ventilation blocked	Check the tank ventilation
Engine loses power and speed, black exhaust smoke	Air filter clogged	Clean the air filter
	Incorrect valve clearance	Have examined by a specialist
	Injection nozzle defective	Have examined by a specialist
	Too much oil in crankcase	Drain the oil down to the MAX-mark on the dipstick

Fault	Possible cause	Remedy
Engine overheating	Lack of cooling air	Clean cooling air inlet and cooling fins
	Function of injection system not correct	Have examined by a specialist
	Too much oil in crankcase	Drain the oil down to the MAX-mark on the dipstick
Engine stops	Fuel tank empty	Fill in fuel
	Fuel filter clogged	Check the fuel filter, replace if necessary
	Tank ventilation blocked	Check the tank ventilation

Trouble shooting

Fault	Possible cause	Remedy
	Air in the fuel system	Check the fuel system for air Check the bleeding valve
Engine runs with high speed, but no vibration	Centrifugal clutch defective	Change the centrifugal clutch
	V-belt	Check tension, replace if necessary

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8.1 Final shut-down of machine

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



WARNING!

Danger of cauterisation ! Danger of explosion!

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

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

Wear protective clothing!

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



ENVIRONMENT!

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

Empty the fuel tank.

Drain lubrication oil from engine and exciter housing.

Drain off hydraulic oil.



WARNING!

Danger of explosion!

Parts that previously contained combustible fluids must not be cut with a cutting torch.

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