Operating instructions

This chapter contains rules which must be followed in order to operate the machine safely. However, these rules are to be followed in conjunction with laws or other national regulations applicable to road safety and labour welfare.

Alertness, judgement and respect for applicable safety regulations are conditions for avoiding risk of accidents.

Running-in instructions

During the first 100 hours, the machine should be operated with a certain care. It is important to check oil and fluid levels often during the running-in period.

NOTE!
In order to meet the optimal travel speed, the sufficient time for running-in is necessary.

Visibility

⚠ WARNING

Risk of serious accidents.
Machine parts, equipment or load could obstruct the operator's view. Operating or driving with obstructed operator's view could cause serious accidents.
Use a signal man if operator's view is obstructed.

It may not be possible to provide direct visibility to all areas around the machine. To achieve acceptable visibility, additional devices such as warning systems, mirrors, and closed-circuit television cameras (CCTV) may be used.

In order to minimize hazards that may be caused by restricted visibility, rules or procedures shall be established by the job site management. For example:

NOTE!
Some parts of the basic machine may restrict visibility, for example, the cab's pillars, frames, exhaust pipe, engine hood, as well as optional equipment such as buckets, pallet forks, grapples, and so on. The load that is handled with these attachments may also restrict visibility.

- Ensure that operators and job site workers have received thorough safety instructions.
- Control the traffic patterns for the machine and other vehicles. Avoid travelling in reverse if possible.
- Restrict the machine's operating area.
- Use a signalman to help the operator. Use signals according to the signal diagram, see page 262.
- Provide two-way communication equipment if necessary.
- Ensure that job site workers communicate with the operator before approaching the machine.
- Use warning signs.

Standard ISO 5006 "Earthmoving machinery- Operator's field of view" deals with the operator's visibility around the machine and is meant to be used for measuring and evaluating the visibility.

The machine is tested by methods and performance criteria according to this standard. The visibility method used may not include all aspects of the operator's visibility, but provides information for determining if additional devices for indirect visibility, such as warning systems, are necessary.

The test was performed on machines with standard equipment and attachment. If the machine is modified or fitted with other equipment or attachment, which results in impaired visibility, it should be re-tested according to ISO 5006.

If other equipment or attachments are used and the visibility has been impaired, the operator should be informed.

Conforming to the standard is a requirement in EU-countries and provides for improved visibility around the machine.

Mirror and camera (if installed) settings

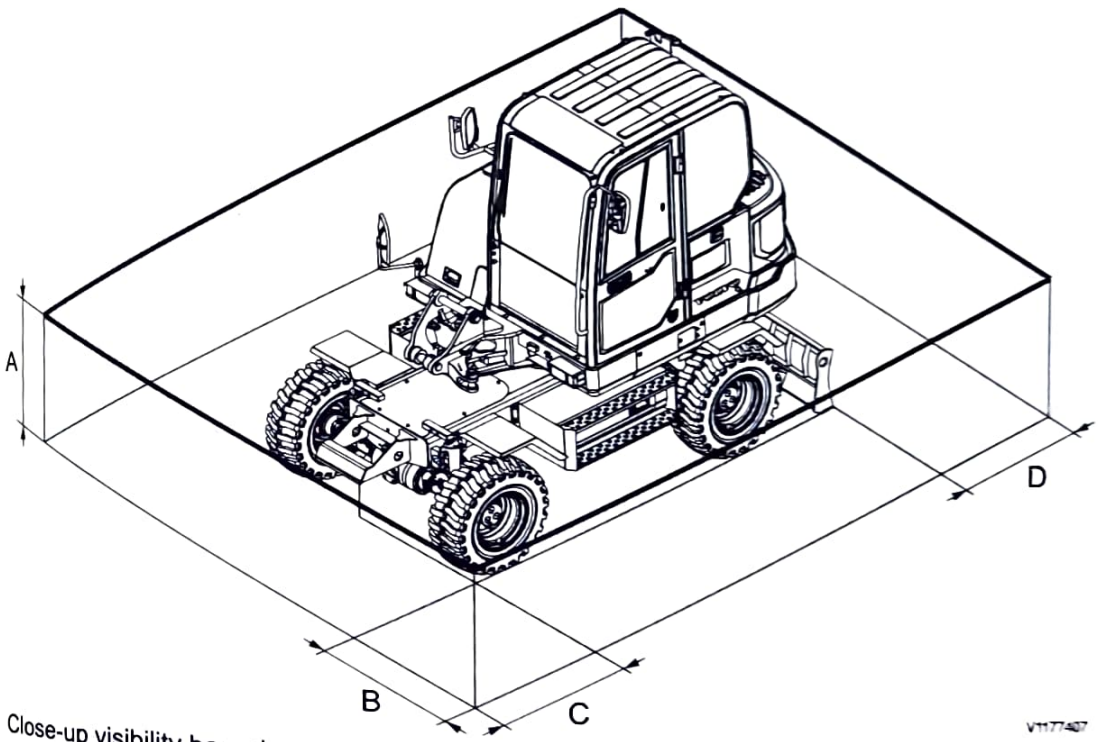
Mirrors, adjusting

ISO 5006 states that an imaginary boundary line around the machine must be visible to the operator.

- Park the machine straight and on level ground.
- Adjust the mirrors until the imaginary boundary line is visible to the operator, see figure below.

NOTE!

Camera may be also used to create visibility on the rectangular boundary. (Camera is not adjustable on the machine.)

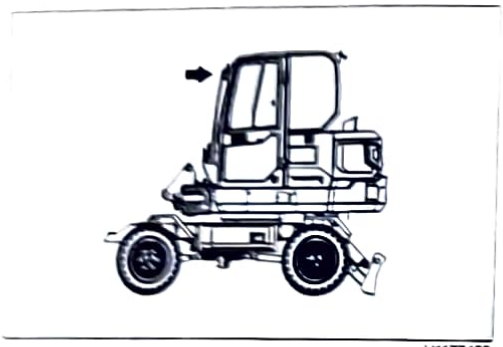


Close-up visibility boundary according to ISO 5006 (thick line)

A 1.2 m (47.2 in)
B 1.0 m (39.4 in)
C 1.0 m (39.4 in)
D 1.0 m (39.4 in)

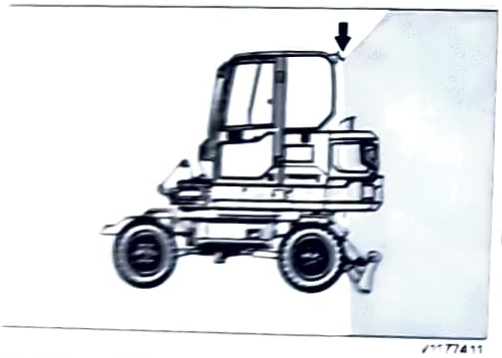
V1177408

Machine's right view



V1177409

Machine's left view

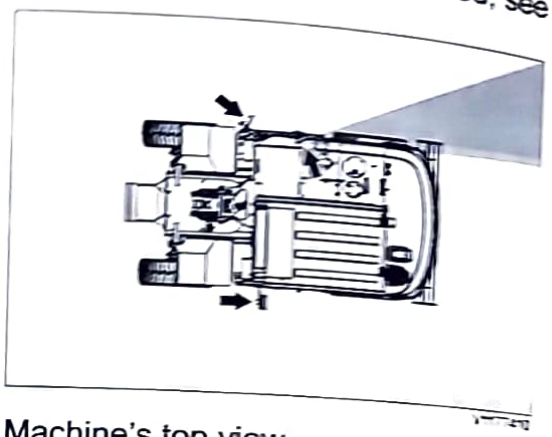


V1177411

Machine's left view

Rear-view mirrors

Using the rear-view mirrors, check that you have as good visibility as possible towards the machine's superstructure and lower frame, and with as wide angle as possible. If not, adjust the rear-view mirrors until good visibility is obtained, see figures.



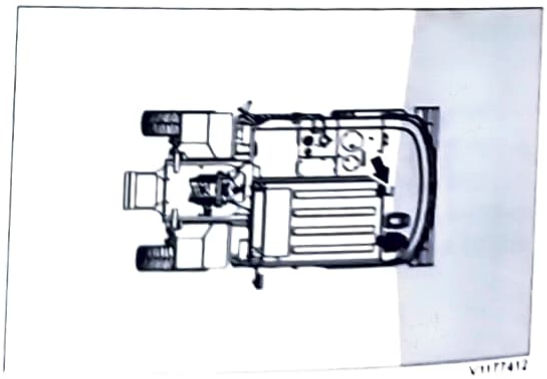
V1177410

Machine's top view

Rear-view camera (if installed)

Check the rear-view camera's display screen, which is focused on the visible area, for good visibility.

NOTE!
Camera is not adjustable on the machine.



V1177412

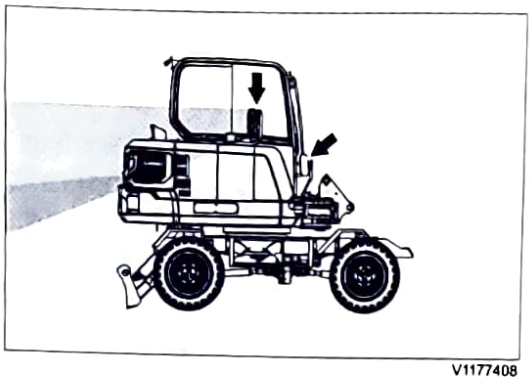
Machine's top view

Measures before and during operation

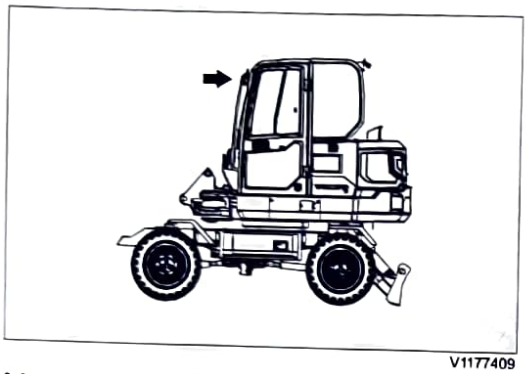
- Walk around the machine and check that there are no obstacles next to the machine.
- Check that mirrors and other visibility-enhancing devices are in good condition, clean, and correctly adjusted.
- Clean the camera, if camera is installed.

NOTE!
When you have direct access to the camera for cleaning, be sure to use an appropriate external ladder or an appropriate platform.

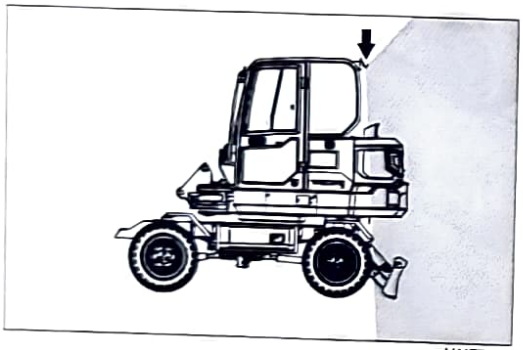
- Check that the horn, back-up/travel alarm and rotating beacon (optional equipment) are working correctly.
- Check if the management has established rules or procedures for the work site.
- Always pay attention around the machine to identify any obstacles.
- Prevent persons from entering or remaining in the work area, i.e., the area around the machine and at least 7 m (23 ft) beyond the maximum reach of the attachment. However, depending on the job site's organization, the operator may allow a person to remain in the work area, but must then observe caution and operate the machine only when the person can be seen or has given clear indications of where he or she is.
  Never allow any person to walk or stand under raised equipment or suspended loads.


V1177408

Machine's right view


V1177409

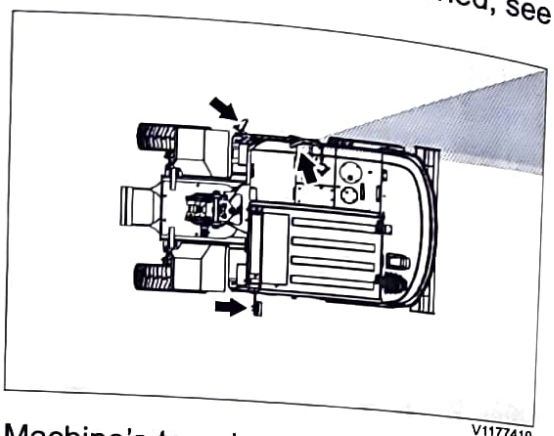
Machine's left view


V1177411

Machine's left view

Rear-view mirrors

Using the rear-view mirrors, check that you have as good visibility as possible towards the machine's superstructure and lower frame, and with as wide angle as possible. If not, adjust the rear-view mirrors until good visibility is obtained, see figures.

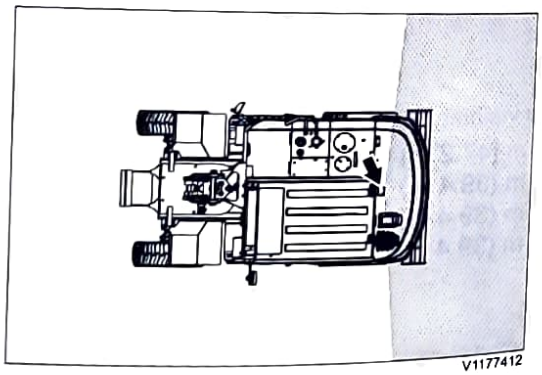

V1177410

Machine's top view

Rear-view camera (if installed)

Check the rear-view camera's display screen, which is focused on the visible area, for good visibility.

NOTE!
Camera is not adjustable on the machine.


V1177412

Machine's top view

Measures before and during operation

- Walk around the machine and check that there are no obstacles next to the machine.
- Check that mirrors and other visibility-enhancing devices are in good condition, clean, and correctly adjusted.
- Clean the camera, if camera is installed.

NOTE!
When you have direct access to the camera for cleaning, be sure to use an appropriate external ladder or an appropriate platform.

- Check that the horn, back-up/travel alarm and rotating beacon (optional equipment) are working correctly.
- Check if the management has established rules or procedures for the work site.
- Always pay attention around the machine to identify any obstacles.
- Prevent persons from entering or remaining in the work area, i.e., the area around the machine and at least 7 m (23 ft) beyond the maximum reach of the attachment. However, depending on the job site's organization, the operator may allow a person to remain in the work area, but must then observe caution and operate the machine only when the person can be seen or has given clear indications of where he or she is.
  Never allow any person to walk or stand under raised equipment or suspended loads.

Safety rules when operating

Operator obligations

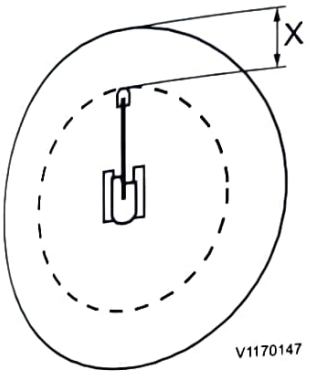
⚠ WARNING

Risk of fatal accidents.
Unauthorised persons within the work area around the machine could lead to serious crushing injury.
• Clear all unauthorised personnel from the working area.
• Keep a lookout in all directions.
• Do not touch control levers or switches during start.
• Sound the horn before beginning operation.

- The operator must operate the machine in such a way that the risk of accidents is minimized for both the operator and persons present on the work site.
- The operator must be thoroughly familiar with how to operate and maintain the machine and should undergo adequate training on the machine.
- The operator must follow the rules and recommendations in the Operator's Manual, but must also pay attention to any legislation and national regulations or specific requirements or risks that apply at the work site.
- The operator must be thoroughly rested and must never operate the machine when under the influence of alcohol, medicine, or other drugs.
- The operator is responsible for any load while working with the machine.
  - There must be no risk of the load falling off while operating.
  - Refuse to take a load which is an obvious safety risk.
  - Respect the stated maximum load for the machine. Pay attention to the effect of different distances to the centre of gravity and the effects of different attachments.

- The operator must check that the mirrors and camera (if installed) are in good condition, clean, and adjusted correctly for good visibility before operating the machine.

NOTE!
Camera (if installed) is not adjustable on the machine. Check that the camera screen is displayed correctly on the I-ECU when pressing the camera button on the keypad.



- The operator must be in control of the machine's work area.
  - Prevent persons from walking or standing under raised excavating equipment or suspended loads, unless it has been made safe or supported.
  - Prevent persons from entering or remaining in the work area, i.e., the area around the machine and at least 7 m (23 ft) beyond the maximum reach of the attachment. However, depending on the job site's organization, the operator may allow a person to remain in the work area, but must then observe caution and operate the machine only when the person can be seen or has given clear indications of where he or she is.
  - Prevent persons from being in the cab of a vehicle that is in a location with a risk that the cab may be hit by other machines or falling objects, for example, stones or logs. This does not apply if the cab is sufficiently strong or is protected to withstand the impact of such external forces.
  - Make sure that you know the weight limitation of the ground on which the machine is working.

The operator may only take an instructor on board, if there is an approved instructor's seat in the machine.

⚠ WARNING

Risk of fatal accidents.
Using attachments for lifting or transporting persons may lead to fatal accidents with serious crushing injury or death.
Never use attachments for lifting or transporting persons.

Accidents

- Accidents and also incidents should be reported to the site management immediately.
- If possible leave the machine in position.
- Only take necessary action so as to reduce the effect of damage, especially personal injuries. Avoid action which may make an investigation more difficult.
- Wait for further instructions from the site management.

Operator safety

- The machine must be operational, that is faults which can cause accidents must be rectified.
- Suitable clothing for safe handling and a hard hat should be worn.
- Mobile phone should not be used when operating the machine. Follow all national regulations for mobile phone use during operation!
- Always sit in the operator seat when starting the engine/machine.
- Keep your hands away from areas where there is a risk of crushing, for example covers, door and window.
- Always use the seat belt.
- Check that the seat belt is not damaged or worn.
- Use steps and handholds when entering or leaving the machine. Use the three-point grip, that is two hands and one foot or two feet and one hand. Always face the machine - do not jump!
- The door must be closed.
- Check that the attachment is properly attached and locked.
- The vibration (shaking) which arises when operating may be harmful to the operator. Reduce this by:
  - adjusting the seat and tightening the seat belt.
  - picking the smoothest operating surface for the machine (levelling the surface when necessary).
  - adapting your speed.
- In case of travelling on uneven ground, do not let the machine lean more than 10° to one side.
- The cab has two emergency exits, the door and the rear window.
- Only walk and step on surfaces which are provided with anti-slip protection.

- During electrical storms, do not attempt to enter or exit the machine.
  - If you are off the machine, stay well away from the machine until the storm passes.
  - If you are in the cab, remain seated with the machine stationary until the storm passes. Do not touch controls or anything metal.
- When DPF regeneration;
  - Make sure that there is no flammable material around the machine, this is important to prevent risk of fire.
  - Move the machine to safety area, if there is a risk that people may get too close and then perform the regeneration.

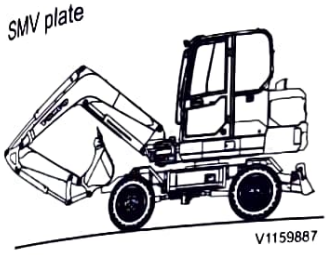
⚠ WARNING

Risk for fire.
Regeneration generates hot exhaust and causes hot exhaust pipe. Do not perform regeneration in a flammable environment.

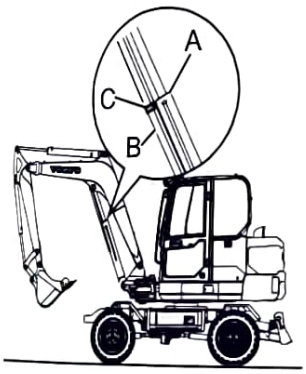
Operating on public roads

- Road signs, traffic restricting arrangements and other safety devices, which may be required when considering traffic speed and intensity or other local conditions, must be used.
- When moving the machine with a suspended load, special attention must be observed. when required, request the help of a signal man.
- Warning beacon may by used:
  - On attached or connected implement, which is wider than the vehicle itself.
  - When the vehicle constitutes a hindrance or danger to other traffic.
  - When working on or by the side of the roadway.

SMV plate



Position of attachment when travelling on public roads (Except EU region)



Position of attachment when travelling on public roads (EU region, mono boom)

A Boom cylinder head
B Protection cover
C Guide decal for boom cylinder head position

NOTE!
To meet EU road regulations when travelling on public roads, adjust boom cylinder head to guide decal. And then position the dipper arm, bucket and dozer blade as shown in the illustration.

Travelling on public roads

As a machine operator you are considered to be a road-user and therefore you are obliged to know and follow local regulations and national traffic regulations.

It is important to bear in mind that the machine, in comparison with the rest of the traffic, is a slow moving and wide vehicle, which may cause obstruction. Bear this in mind and pay attention to the traffic behind you. Facilitate overtaking.

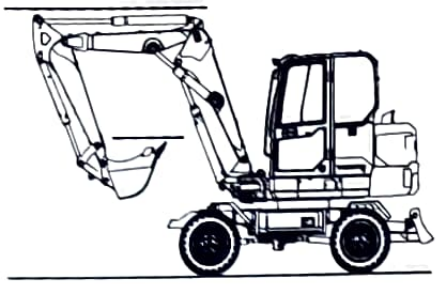
The use of a SMV-plate (Slow Moving Vehicle plate) is regulated in law in some countries. Check your national traffic regulations.

Before the machine may be driven (operated) on public roads, it must be prepared as follows:

- Raise the dozer blade, if installed.
- Align the superstructure with the undercarriage.
- Empty the bucket and lay it in travelling position.
- Close the windscreen(s).
- Put the mode selector in T-mode.

NOTE!
Travelling on public roads is only allowed in T-mode (travel mode).

NOTE!
Make sure that the piston rods of the hydraulic cylinders are not in their end position when travelling. The piston rods or attaching points may be damaged otherwise.



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Position of attachment when travelling on public roads (if 2 PCS boom is equipped)

NOTE!
To meet EU road regulations when travelling on public roads, adjust second boom and bucket to horizontally position.

- Always operate the machine in its natural direction of travel, i.e. the steered wheels at the front.
- Use lights, hazard flashers and rotating warning beacon according to national traffic regulations.
- Keep an eye on persons in the proximity of the machine. Ask someone to indicate to you how to move the machine if you are not sure how to do this without risk.
- Never exceed the maximum permitted load for bridges.
- Keep a tab on the permitted ground pressure. Bear in mind that the ground pressure of the machine may change depending on attachment and load.
- Follow the traffic regulations that apply to the machine.
- Bear the height and length of the attachment in mind.

NOTE!
If the machine is equipped with mesh doors, these have to be removed before travelling on public roads.

Travelling with clamshell bucket

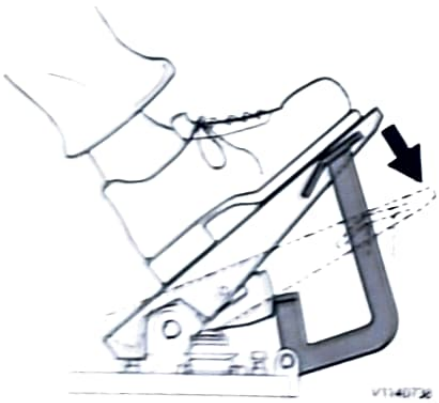
Machine equipped with a clamshell bucket may only be used for travelling when the bucket is secured to the clamshell bucket retainer. Grab hold of the retainer with the clamshell bucket.

Travelling on uneven ground

In case of travelling on uneven ground, retract the attachment and raise it 40–50 cm from the ground.

Check national regulations regarding driving on public roads.

NOTE!
When applying the service brake, both the service brake pedal and the digging brake release lever must be depressed together, otherwise the digging brake may be engaged, locking all the wheels.



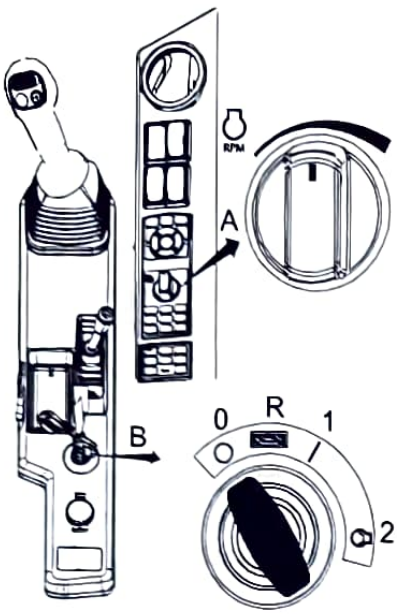
Applying the service brake

Measures before operating

NOTICE

The safety regulations and operating instructions issued by the manufacturer must be strictly observed.

- Read the Operator's manual.
- Carry out daily service, see page *289*. In cold weather, make sure that the freezing point of the coolant is sufficiently low and that the lubricating oil is intended for winter use.
- Clean / scrape ice off the windows.
- Clean the dust around engine, battery and cooler.
- Check the level of hydraulic fluid, refill if required.
- Check that there is sufficient fuel in the fuel tank.
- Check that there are no faulty, loose parts or leaks, which can cause damage.
- Check that the battery disconnected switch is switched on.
- Check for cracks on frame and tires.
- Check that hoods and covers are closed.
- Make sure fire extinguisher if equipped is fully charged.
- Inspect steps and handholds for damage or loose parts. Make necessary repairs if needed.
- Check that there are no persons in the vicinity of the machine.
- Adjust the operator seat and fasten the seat belt.
- Adjust and clean the mirrors.
- Inspect working and other lights for proper operation.
- Travel alarm should be on before operating the machine.
- Inspect the failure of gauges in the instrument panels.
- Check the function of the attachment quick coupler (optional equipment).



A Engine speed control switch
B Ignition switch

Off position **(0)**
Radio position **(R)**
Operating (preheating) position **(1)**
Start position **(2)**

Starting engine

NOTE!
Make sure the control lockout lever is in locked position, PWT mode selector switch is in P mode and Travel control lever is in Neutral position, otherwise the engine can not be started.

⚠ WARNING

Risk of fatal accidents.
Unauthorised persons within the work area around the machine could lead to serious crushing injury.
- **Clear all unauthorised personnel from the working area.**
- **Keep a lookout in all directions.**
- **Do not touch control levers or switches during start.**
- **Sound the horn before beginning operation.**

NOTICE

Do not keep the ignition switch in starting position for more than 20 seconds, as this may seriously damage the starting system. If the engine does not start, turn the switch back to stop position and wait a couple of minutes before the next starting attempt.

NOTICE

If the engine sounds or runs strangely or if strong vibrations arise, the ignition switch must be turned to stop position immediately.

NOTICE

Wait until the electronic system is completely shut down before restarting.

1 Place the travel direction lever in Neutral position and control lockout lever in locked position.
2 Turn the key to operating position. At the same time check that all lights and indicators.
3 Turn the key to the start position. If the engine does not start, turn the key back to the Off position, before making a new start attempt.
4 Release the key when the engine has started.
5 Warm up the machine. See page *167*.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Air preheating indicator

Starting engine in cold weather

1 Turn engine speed control switch (A) to the low speed position.
2 Turn the key to the operating (preheating) position and keep it there while the preheating is working. The preheating indicator will be displayed on the indicator screen of I-ECU.
3 When the preheating is finished, sound the horn and let other workers and bystanders know you are starting the machine. For the startup sequence, see page *43*.
4 Turn the key to the start position.
5 Release the key when the engine has started.
6 Check the travel lights and work lights. If a travel alarm is installed, check this function.
7 Warm up the machine. Run at low speed and with a light load until the oil in the engine and hydraulic system has warmed up.

NOTICE

Run the engine at low idling speed for 10–15 minutes to warm the engine and the hydraulic system at temperatures below –15 °C (+5 °F) before putting the machine to work.

Use recommended lubricating oil for winter use. See page *356*.
During the cold season, fill the fuel tank after work has finished for the day to counteract the formation of condensation water in the tank.

Starting with booster batteries

⚠ WARNING

Risk of explosion.
Batteries could explode due to the current surge if a fully charged battery is connected to a completely discharged or frozen battery.
Do not boost start a machine with a completely discharged or frozen battery.

When starting with booster batteries, check that the booster batteries or other power source have the same voltage as the batteries of the machine. If the batteries in another machine are used the engine of that machine must be turned off.

NOTICE

Do not attempt to start the engine while the battery charger is still connected to the mains. This may cause serious damage to the electronic control units.

1 Turn OFF the battery disconnect switch.
2 Remove the protections from the battery pole studs.
Connect two 12 V batteries as follows :
3 Connect one of the jump leads between (+) terminal on the battery of the machine and the (+) terminal on the booster battery.
4 Connect the other jump lead between the (-) terminal of the booster battery and a grounding point on the machine.

NOTICE

Do not connect ground to the undercarriage on the machine. This may seriously damage the swing bearing.

5 Connect the batteries of the machine by turning on the battery disconnect switch.
6 Start the engine with the ignition switch in a cab.
7 Leave the batteries connected for 5-10 minutes after starting the engine.
8 Disconnect the jump lead from the chassis connection on the machine, and then disconnect the other end of the jump lead from the (-) terminal on the booster battery.
9 Finally disconnect the jump lead between the (+) terminals.
10 Re-install the battery pole stud protections.

Warming up

Machine may respond slowly at low temperatures. Operate carefully until the system has reached normal temperature. Otherwise unexpected movements may occur.

Hydraulic system, warming up

The oil in machine's hydraulic system is used for operating the hydraulic cylinders of the equipment as well as the hydraulic motors for travelling and swinging. When the oil is cold it is viscous.

Therefore the machine's hydraulic functions operate slower than when the oil is warm.

Malfunctions may result if one or more of the machine functions are forced against end-position without first having warmed up the system.

NOTE!
Operate the machine functions (travel, swing, and attachments including boom swing) very slowly and carefully.

⚠ WARNING

Risk of crushing injury.
The hydraulic system could respond slowly at low temperatures and could cause unexpected machine movements.
Operate carefully until the hydraulic system has reached operating temperature.

NOTICE

Do not rush warming of the oil, since forced warming can damage the machine.

⚠ WARNING

Risk of crushing.
Sudden movement of attachments may cause serious injury or death to personnel near the machine.
Quick-acting controls operate the optional attachments. Operate the controls carefully.

1 Start the engine and let it run at low idle for 5 minutes.
2 Then increase engine speed to approx. 1,200 rpm.
3 Run out the bucket cylinder using the control lever and let the bucket move to its end-position.
4 Then carry out a number of boom, dipper arm, swing, and travel movements with the machine to distribute the warmed hydraulic oil to all hydraulic cylinders and motors.
If 2PCS boom or boom swing option is equipped, operate the optional attachment.

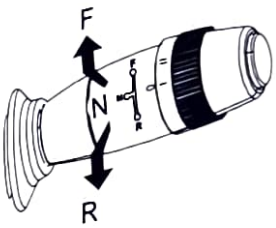
Carry out these movements until the hydraulic system has reached working temperature/rapid working movements.

Travelling a short distance

Moving the machine a short distance (for example, when loading onto or off a trailer) must be done slowly with great care. Under these conditions the engine speed must not exceed 1,200 rpm and the travel speed control should be in low speed position.

Operating

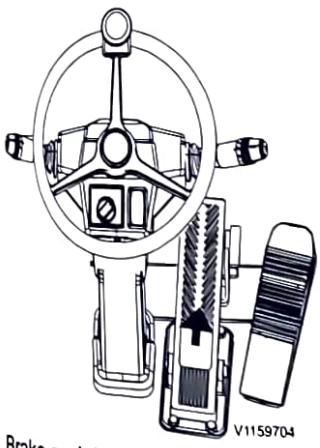
Forward and reverse travel



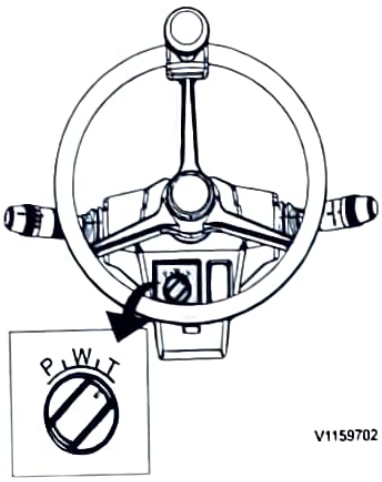
NOTE!
Check the position of the dozer blade before starting to drive the machine. If the cab is turned 180°, forward and reverse travel is opposite!

NOTE!
Check the release condition of parking and working brakes, axle locking, dozer blade before travelling. Check for personnel or obstructions around the machine, start slowly and sound the horn before moving.
Never operate attachment levers while travelling, if necessary, operate them after stopping the machine in a safe place.
If the PWT mode selector switch is in travel position, attachments can't be operated, therefore, set attachments to travel position before starting.

Depress the brake pedal and turn the PWT mode selector switch to travel (T) position, at this time, the parking brake is released.



Brake pedal



V1159702

PWT mode selector switch: travel (T) position

- Use maximum engine speed by using the travel pedal. It is possible to adjust the engine speed by the travel pedal.
- Attachment operation is impossible. (travelling is stabilized)

PWT mode selector switch: work / travel (W) position

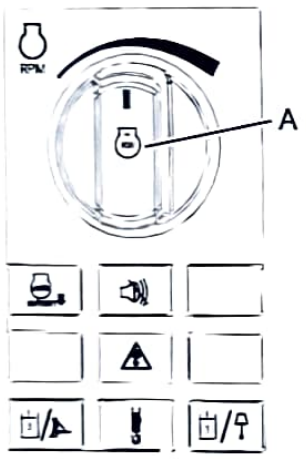
- Maximum engine speed and maximum output are lower than when the PWT mode selector switch is in travel position.

NOTE!

The engine speed depends on a high value between the travel pedal and engine speed control switch.

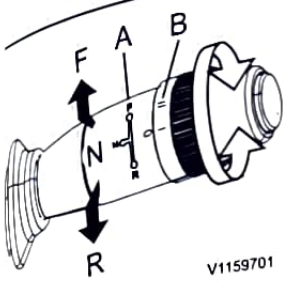
- Possible to perform travel and operation at the same time.

Turn the engine speed control switch to low speed position so that the engine speed is lowered.



V1159657

A Engine speed control switch



Select the required direction and speed with the travel control lever, depress travel pedal and slowly start.

A Travel control lever
- Pull up and then push forward: Forward travel (F)
- Center position: Neutral (N)
- Pull up and then pull backward: Reverse travel (R)

B Speed change
Turn the switch to the required position.
- Position (I): Low speed
- Position (II): High speed

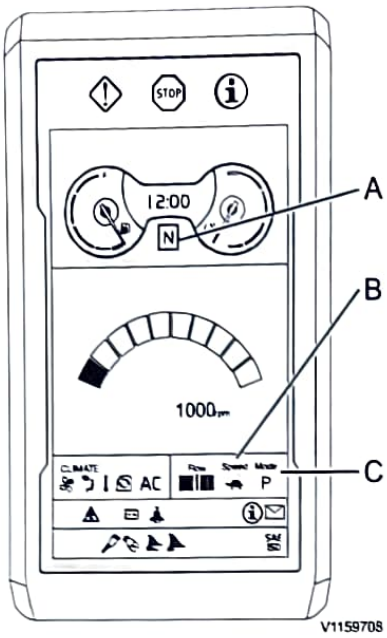
To select the travel speed, set the travel control lever to 1st / 2nd.

NOTICE

Make sure the machine has come to a complete stop before changing travel direction or travel speed.

NOTE!
If the travel speed position is changed while the service brake is not applied, the travel speed is not changed.

NOTE!
If the travel speed changes while the machine is travelling, it is an abnormal condition.
Contact a workshop authorized by Volvo CE to check the machine.

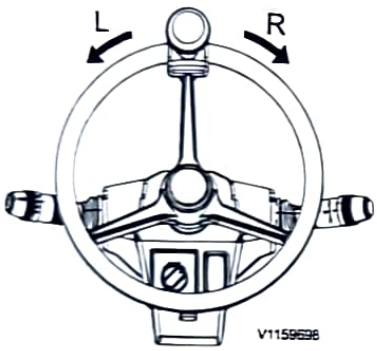


A Travel direction
B Travel speed
C PWT mode

When the travel direction and travel speed are selected, symbols are displayed on the display unit. The rabbit or turtle symbol will blink on the display unit.

- To change the travel speed, press the brake pedal to apply the service brake and then turn the speed control switch to the required position again.

NOTE!
Do not attempt a sudden start after changing travel direction or travel speed to prevent a transfer gearbox damage.



Steering direction

To select the turning direction of machine, turn the steering wheel to the required direction.

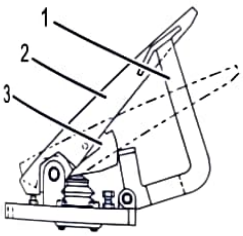
- L direction: Left turn
- R direction: Right turn

NOTE!
It is difficult to steer the machine if the engine is stopped. Give attention that steering is opposite if the superstructure is turned 180°.

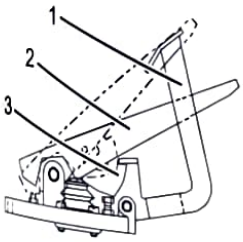
Service brakes

NOTE!
Prior to excavating, depress the brake pedal and engage the latch mechanism to lock the service brakes in the applied position.
Do not use the service brakes to park the machine. The machine could move by the brakes slowly releasing over time. It may cause accidents. Always apply the parking brake.
For safety and protection of brake system, lower the dozer blade to the ground and support the machine before working.
Do not use the service brakes unnecessarily since overheating could occur, causing brake performance to deteriorate.
When finishing work or parking the machine always release the brake pedal.
Before starting work, always check the performance of the service brakes.

The service brakes are used to prevent the machine from being pulled or pushed when excavating, and are locked and released by the latch brake pedal as shown in the illustration.



A



B V1079522

A Service brake released
B Service brake locked

1 Latch pedal
2 Brake pedal
3 Lock plate

Operating method

When working, ensure the brake pedal is completely locked to the latch pedal.

When travelling, press the brake pedal and the latch pedal at the same time to stop the machine.
If this procedure is not followed, the brake can be suddenly applied.

NOTE!
If you use the service brake more than it is required, it can affect on the durability of brake disc. When working, make sure to lower down the dozer blade.

NOTE!
The machine should not travel under any circumstance with the service brake applied. If it does travel, brake pressure is insufficient or the axle brake system is malfunctioning. At this time, stop the machine and contact a Volvo dealer to repair the machine.

NOTE!
If not in emergency situation, do not use sudden service brakes.

Parking brake

Before travelling check the function of the parking brake by setting the mode selector switch to parking (P) position and also check the parking brake warning lamp.

NOTE!
Park the machine on level ground, apply the parking brake, then put a wood block under each tyre.

The main brake system of the machine is a negative actuation type (rearward working method). This system can always be locked and released when the engine is running, but locked automatically when the engine stops.
Attachment cannot be operated when the mode selector switch is at parking (P) position.

Axle locking system

The front axle is pivoted to the undercarriage frame to provide the best possible ground contact when travelling over uneven ground.
The axle can be locked by pressing the switch on the right instrument panel as shown in the illustration. Locked axle is indicated with a lamp on the display unit (I-ECU).

NOTE!
Lock the axle when the machine is transported on a trailer, when travelling with a load or when operating in situations where the dozer blade cannot be used.

NOTE!
The axle is automatically locked when:

- Parking mode in the PWT mode select switch.
- Control lockout lever is locked position.
- Travel speed is low and working brake is pressed.

⚠ WARNING

Risk of serious accidents.
Swaying load could cause accidents with serious injury.
Always lock the pivot axle before travelling with a suspended load.

Checking shaft

NOTE!
To use bent or damaged shaft causes oscillation of the machine and transfer gearbox and axle can be seriously damaged.

Retighten and maintain bolts, nuts and damaged parts of the shaft after checking them before travelling. If necessary, refill grease.

- Tightening torque of bolt and nut: 6.5 ± 0.65 kgf m (46.9 ± 4.7 lbf ft).
- Always align shaft yoke. Misalignment of shaft yokes causes oscillation.
- Check joint, bearing, yoke and welded pipe tube. If necessary, repair or maintain them.
- Repair or replace the tube if it is oscillated over 0.5 mm.

Exhaust aftertreatment system

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 410000

⚠ WARNING

Risk for fire.

Regeneration generates hot exhaust and causes hot exhaust pipe. Do not perform regeneration in a flammable environment.

⚠ WARNING

Risk of severe burns.

Exhaust system components get very hot during regeneration and could cause severe burns to unprotected skin.

Avoid contact with engine compartment covers, interior components and structure during regeneration.

The diesel particulate filter (DPF) is part of the exhaust aftertreatment system. The DPF traps soot and other particles and when it gets full, burns the soot and particles completely in a process called regeneration. When the soot content in the (DPF) has reached a maximum level, the machine will request a DPF regeneration cycle. Regeneration requests will continue until regeneration is completed. Warning levels will increase if regeneration requests are declined. The time between DPF regeneration cycles depends on the machine work duty cycle.

Under normal conditions below, the operator should start regeneration immediately.

- Machine is in an area free of flammable materials, particularly those near or above the exhaust stack or under the machine where they could be drawn up into the engine compartment.
- No plan to turn off the machine during 20 - 45 minutes.

NOTE!
Move the machine to safety area if there is a risk that people may get too close.

NOTE!
If machine is parked, operator should remain in the immediate vicinity of the machine to monitor the regeneration.

It is most fuel-efficient to run the regeneration while operating. To determine if the operator can continue using the machine during regeneration or must park the machine for regeneration, see the detail below.

Machine condition to run regeneration

- Display unit has requested to start regeneration
  or
  the soot load is enough to start regeneration. (over 100%)
- Coolant temperature is over 50°C (122°F).
- Control lockout lever is unlocked position.
- No system fault.

Delay regeneration

Regeneration can be delayed using ESC button if the machine is in an area not free of flammable material.

Regeneration alarm figure display returns in 15 minutes after each regeneration request delay.

NOTE!

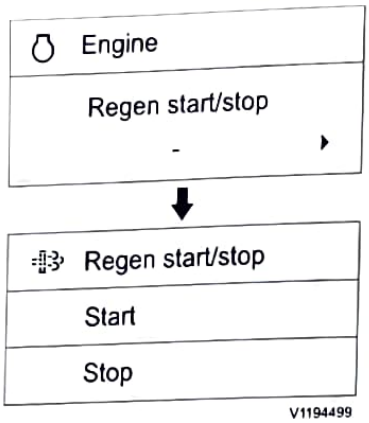
Delaying regeneration several times may lead to a situation where only a parked regeneration is allowed.

Consequences of delaying regeneration

There are 6 levels of regeneration. As regeneration is delayed, the consequences increase, both in lost productivity and increased cost of operation.[1][2][3][4] It should be noted that all levels above level 3 require a parked regeneration.

Regeneration		Type of notice				Regen. type
Level	Mode	Telltale	Message	Buzzer	Central warning lamp	
Level 0 (Normal)	Automatic	**NOTE!** Soot load is below 100%. Regeneration is not required.				
	Parked					
Level 1 (Request)	Automatic	–	–	–	–	Moving or Parked regen.
	Parked	√	–	–	–	Parked regen. only
Level 2 (Warning)	Automatic	√	–	–	–	Moving or Parked regen.
	Parked	√	√	√ (4 times)	–	Parked regen. only
Level 3[2] (Stop)	Automatic	√	√	√ (4 times)	–	Parked regen. only
	Parked	√	√	√ (4 times)	–	Parked regen. only
Level 4[2] (Service)	Automatic	√	√	√	√	Service needed[3]
	Parked	√	√	√	√	
Level 5[4] (Replace DPF)	Automatic	√	√	√	√	Service needed[3]
	Parked	√	√	√	√	

1. The system could go to a "service needed" regeneration status (level 4 and 5).
2. Engine power decreases significantly.
3. Service tool is needed. Contact qualified service technicians.
4. Turn off the engine. Contact qualified service technicians immediately.



Menu —> Engine-> Regen start/stop —> Stop

Cancelling regeneration in progress

NOTE!
A cancelled regeneration must be restarted from the beginning. Cancel a regeneration only in case of an emergency.

- When DPF regeneration stop is pressed, the regeneration cancel screen would show up for 5 seconds.
- When the control lockout lever is set to unlocked position on level 3, the regeneration cancel screen would show up for 5 seconds.

  NOTE!
  It should be noted that all levels above level 3 require a parked regeneration.

The text "Regeneration cancelled" in the information display unit confirms that regeneration has been cancelled.

Regeneration is cancelled automatically:
- when a malfunction occurs.
- if the machine is turned off.

NOTE!
Regen. start shall not be possible again within 15 minutes, after a cancellation. The reason is repetitive start and stop sequences can jeopardize the regeneration function and eventually damage the DPF.

DPF regeneration

DPF regeneration is only possible after the engine has requested(1) the regeneration. Follow the below steps according to regeneration mode and levels.

When the soot content in the diesel particle filter has reached 100%, indicator (A) is shown on the display unit.

Indicator (A), regeneration required

Operator action at automatic regeneration mode: level 1 and 2

- The **machine must be in an area free of flammable.**
- Regeneration will starts automatically if the control lockout lever is in **unlocked** position and no system fault occurs.
- The machine can still be worked during regeneration.

  NOTE!
  Generally regeneration takes 20 to 45 minutes. When operating the machine, regeneration time will be shorter than parked condition. However regeneration time depends on many factors.
- Do not turn off the engine during regeneration.

1. From level 1 status. According to regeneration levels and mode, telltale, buzzer, central warning lamp and different type of messages will be indicated on I-ECU.

Operator action at automatic regeneration mode: level 3 or parked regeneration mode: level 1, 2 and 3

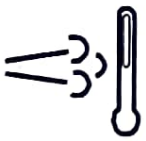
1 Park the machine in an area free of flammable material.
2 Keep the engine speed at low idle.
3 Put the control lockout lever to **locked** position.
4 Start regeneration immediately.

NOTE!
The operator can start or stop the regeneration immediately by pressing SELECT or ESC button.
If pressing ESC button, message will pop up again after 15 minutes.

5 The machine can not be moved during regeneration.
Do not turn off the engine during regeneration.

Operator action at level 4 and 5

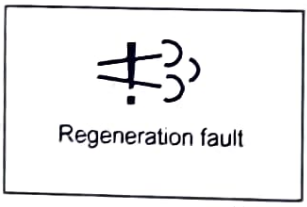
1 Park the machine in an area free of flammable material.
2 Turn off the engine.
3 Contact qualified service technicians immediately.



V1095315

Indicator (B), on regeneration

During regeneration, indicator (B) will be displayed. If DPF regeneration stop is pressed while regeneration is being fulfilled, indicator (B) will be displayed until the exhausted gas temperature is at normal operation temperature.



V1125644

Regeneration fault

When any errors happened during regeneration, the error message will pop up with the message symbol and buzzer sounds 4 times.

Stopping

1 Select as level ground as possible to park the machine.
2 Depress the brake pedal gradually to apply the service brakes.
3 Lower the attachment to the ground.
4 Turn the mode selector to parking mode (P).
5 Reduce the engine speed to a minimum.
6 Make sure the control lockout lever is in locked position.
7 Leave the engine running at low idling speed for approx. 2 minutes before shutting off the engine. Otherwise the lubrication of the turbocharger may be jeopardised, resulting in shorter service life and great risk of bearing seizure.
8 Turn the ignition switch to stop position.
9 If the machine is to be left for any length of time, the battery disconnect switch should be turned off.

NOTE!
Never use the battery disconnect switch to shut down the machine.

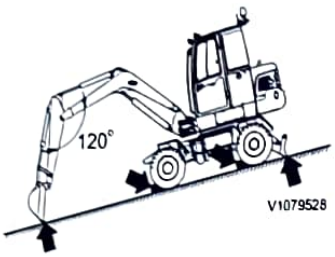
NOTICE

Wait until the electronic system is completely shut down before restarting.

Check after stopping machine

- Check the machine for leakage of oil or water, and defects of the attachments and the tyres.
- Refill the fuel tank.
- Remove papers or dead leaves from the engine compartment to prevent fire.
- Remove soil deposits and debris from the tyres and rollers. In freezing conditions after cleaning the tyres park the machine on wood planks.

Parking



WARNING

Risk of serious injury!
Parking on a slope could lead to unexpected machine movement or cause the machine to slide. This could result in accidents with serious injury.
Park the machine on level ground if possible. Block the drum, wheels, or tracks of the machine with appropriate chocks.

WARNING

Risk of crushing.
Hydraulic or mechanical failure could cause the attachment to fall, resulting in severe personal injury or death.
Never leave the cab with a raised attachment. If a bucket is installed it must be resting against the ground.

1 Park the machine with proper condition that the piston rods of the attachments will be protected against moisture, dust and damage.
2 Follow the paragraphs 2 - 8 above of "Stopping".
3 Close and lock all windows, doors and all covers.
4 Disconnect the battery by turning the battery disconnect switch counter-clockwise and remove the key.

Long-term parking

Follow the instructions as for parking and in addition to that:

1 Wash the machine and touch up the paint finish to avoid rusting.
2 Check the machine for leakage of oil or water, and defects of the attachments and the tyres. Replace or repair all damaged or worn parts.
3 Treat exposed parts with anti-rust agent, lubricate the machine thoroughly and apply grease to unpainted surfaces like cylinders.
4 Fill the fuel tank and the hydraulic oil tank to the maximum marks.
5 Make sure that the freezing point of the coolant is sufficiently low (in cold weather).
6 Place the machine on level, firm ground where there is no risk of freezing, landslide or flooding.
7 When storing machines in extreme cold temperatures, remove batteries and store them at room temperature. Make sure to place the batteries over a wooden/plastic/rubber surface.
8 Cover the exhaust pipe (for parking out-of-doors).

NOTICE

Start the engine once a month and run it at low idling speed for one hour. Operate all function cycles when working temperature has been reached.

Check after long-term parking

- All oil and fluid levels
- Tension of all bolts
- Air cleaner
- Hydraulic hoses
- Seals

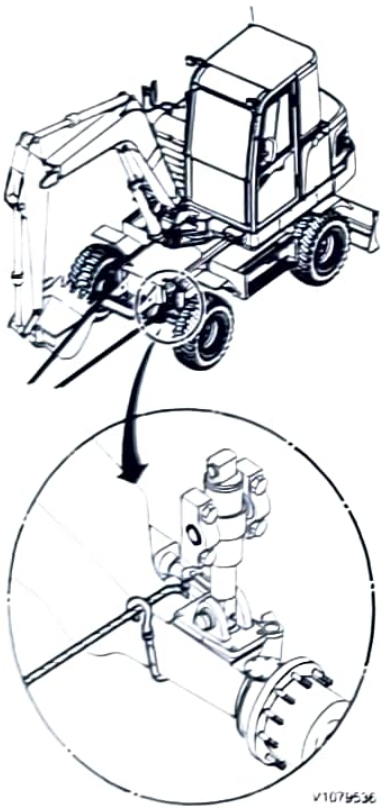
Retrieving and towing

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 314332

⚠ WARNING

Risk of runaway machine.
Improper recovering or towing methods or faulty equipment could cause the machine to break away from the towing vehicle, causing accidents, serious injury or death.
Always apply parking brake and block the wheels to prevent the machine from moving while attaching the towing equipment.

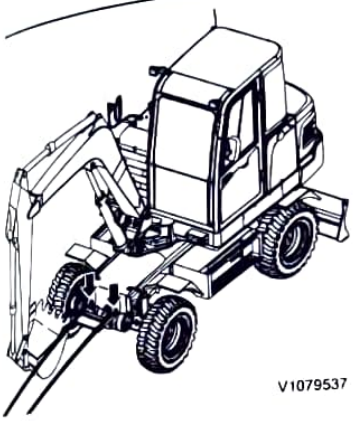
NOTE!
Always use classified cables, lifting straps, shackles and hooks with sufficient lifting capacity.



NOTE!
Incorrect or faulty equipment or improper towing methods may cause accidents. Therefore, carefully follow the instructions given below.

1 In the event of slipping into swampy ground or towing heavy objects, use a wire rope to tow the machine as shown in the illustration. Ensure that the towing linkage is properly connected, and adequate for the purpose.
2 Put wood blocks between the wire rope and the machine to protect the machine and wire rope from damage.

NOTE!
Only use the towing hole for light objects.


V1079537

Usage of towing hole for light objects

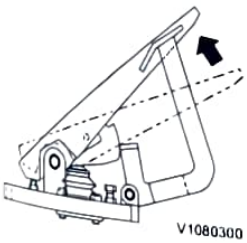
NOTE!
Towing shackle hole for light object is located in the lower frame.

1 Be sure to use shackles. Ensure that the towing linkage is properly connected, and adequate for the purpose.
2 Keep the cable horizontal, straight, and parallel to the tyres.
3 Permissible forces for retrieval and towing is 3,000 kgf (6,614 lbf).
4 Select the slow travel mode. Slowly drive the machine when towing.
5 Towing speed for short distances is maximum 2 km/h and always use other transportation for long distances.

Transfer gearbox and parking brake, mechanical releasing

⚠ WARNING

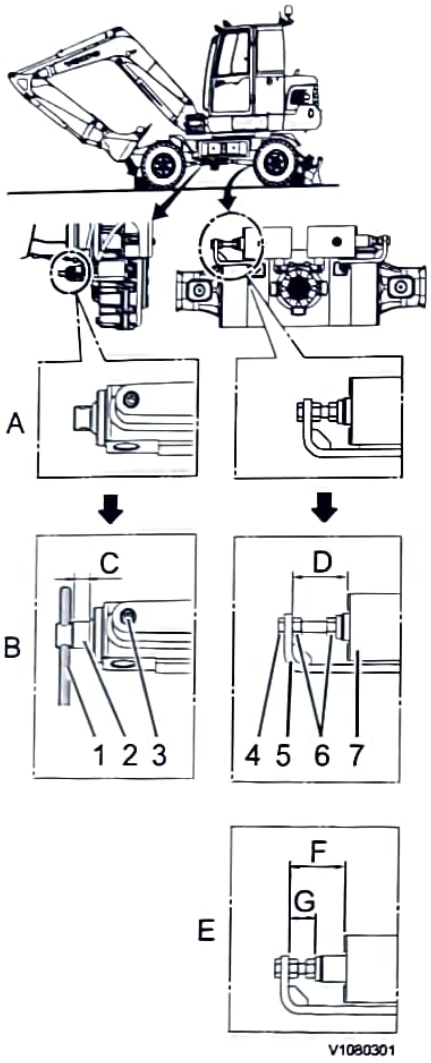
Risk of fatal accidents by runaway machine. Manually releasing the parking brake could cause unexpected machine movement resulting in crushing injury or death.
Block the wheels before manually releasing the parking brake.


V1080300

NOTICE

Always release the transfer gearbox and the parking brake before retrieving or towing the machine.

1 Release the brake pedal of the machine, refer to Service brakes in Operating section, see page *169*.



A Lock position
B Release position

2 **Transfer gearbox, mechanical releasing**
Loosen plug (3) a little, so that spring tension on the release shaft in the transfer gearbox is reduced.

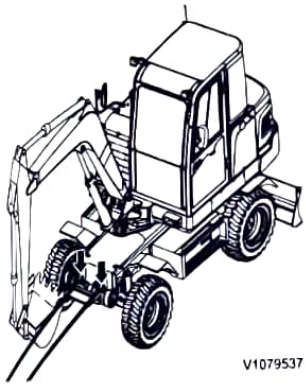
NOTE!
Do not loosen the plug fully. Some parts of the release mechanism in the gearbox would be lost.

3 Insert a steel bar (1) into the hole of shaft (2) and then strike the bar with a hammer carefully, to move the shaft into release position.
4 Measure clearance (C) of the extended shaft.
- Clearance (C): 12 mm (0.47 inch)
5 If the clearance is correct, install plug (3) fully.
6 **Parking brake, mechanical releasing**
Loosen nuts (6) and bolt (4) to release parking brake cylinder (7) installed at the rear axle.
7 Measure clearance (D) between connector (5) and parking brake cylinder (7).
- Clearance (D): 90 mm (3.5 inch)
8 If the clearance is correct, tighten nuts (6) to specified torque, 26.7 ± 2.7 kgf m (193 ± 19.5 lbf ft)
9 Release the parking brake cylinder on the opposite side, same as above procedure.
10 Check the releasing condition of the parking brake cylinder after repairing the machine. See illustration (E) for normal condition.
- Clearance (F): 90 mm (3.5 inch)
- Clearance (G): 36 mm (1.4 inch)

NOTE!
The bolt and nuts must be tightened to the specified torque.

Retrieving and towing

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314333	Changwon 410000



V1079537

Usage of towing hole for light objects

NOTE!

Towing shackle hole for light object is located in the lower frame.

1. Be sure to use shackles. Ensure that the towing linkage is properly connected, and adequate for the purpose.
2. Keep the cable horizontal, straight, and parallel to the tyres.
3. Permissible forces for retrieval and towing is 3,000 kgf (6,614 lbf).
4. Select the slow travel mode. Slowly drive the machine when towing.
5. Towing speed for short distances is maximum 2 km/h and always use other transportation for long distances.

Towing should only be performed to bring the machine out of a risk area and only if the engine is still running.

If the engine cannot be started, the brake and steering functions will be severely limited. In such cases, towing should only be performed in an emergency situation by experienced and trained personnel and only the shortest possible distance of at most 5 km (3 miles) and with a maximum towing speed of 10 km/h (6 mph).

If possible, transport the machine on a trailer.

⚠ WARNING

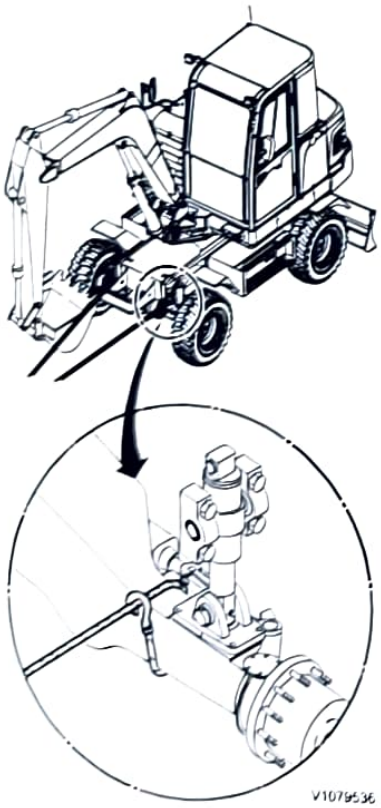
Risk of runaway machine.

Improper recovering or towing methods or faulty equipment could cause the machine to break away from the towing vehicle, causing accidents, serious injury or death.

Always apply parking brake and block the wheels to prevent the machine from moving while attaching the towing equipment.

NOTE!

Always use classified cables, lifting straps, shackles and hooks with sufficient lifting capacity.



NOTE!

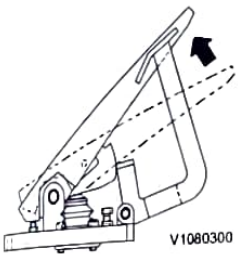
Incorrect or faulty equipment or improper towing methods may cause accidents. Therefore, carefully follow the instructions given below.

1. In the event of slipping into swampy ground or towing heavy objects, use a wire rope to tow the machine as shown in the illustration. Ensure that the towing linkage is properly connected, and adequate for the purpose.
2. Put wood blocks between the wire rope and the machine to protect the machine and wire rope from damage.

NOTICE

Always release the transfer gearbox and the parking brake before retrieving or towing the machine.

Transfer gearbox and parking brake, mechanical releasing

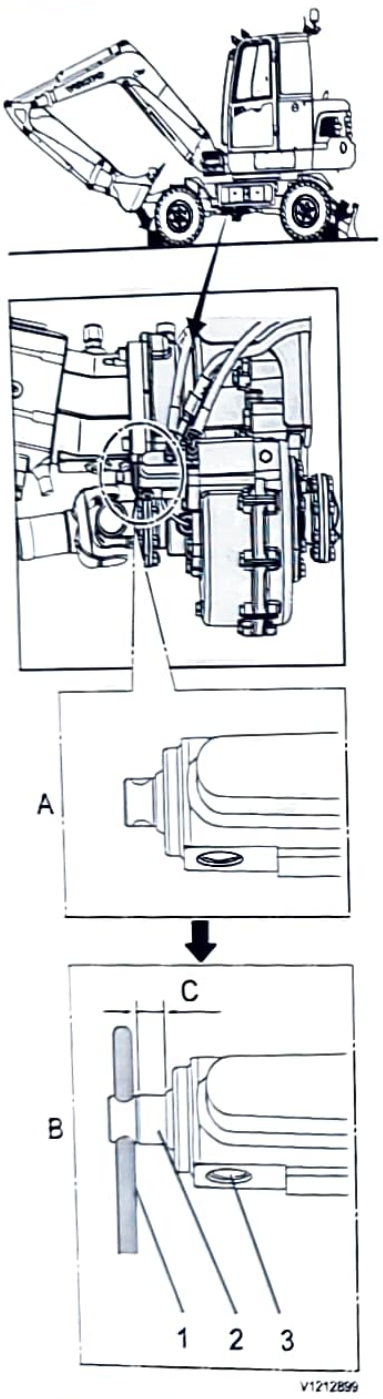


⚠ WARNING

Risk of fatal accidents by runaway machine. Manually releasing the parking brake could cause unexpected machine movement resulting in crushing injury or death.

Block the wheels before manually releasing the parking brake.

1 Put the block under the wheels.
2 Release the brake pedal of the machine, refer to Service brakes in Operating section, see page *169*.
3 Turn off the engine ignition switch.



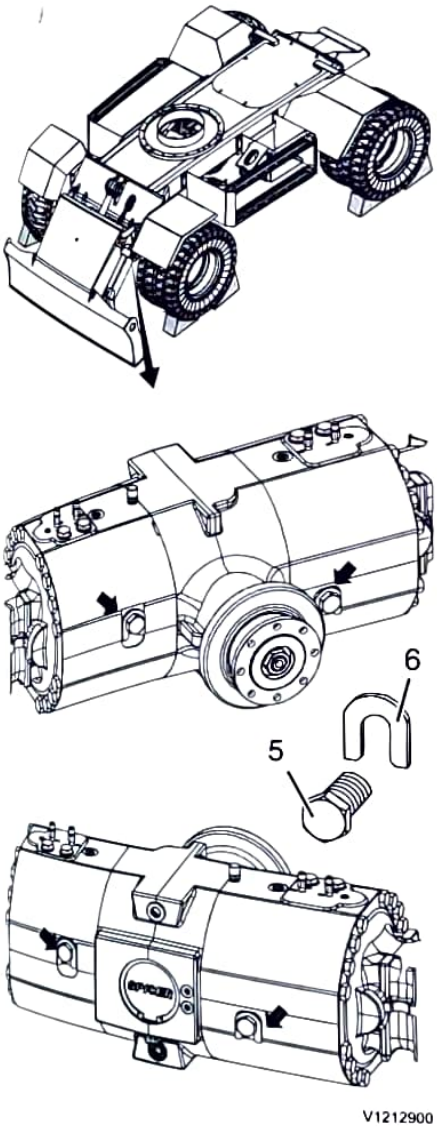
Transfer gearbox
A Lock position
B Release position

4 **Transfer gearbox, mechanical releasing**
Loosen plug (3) a little, so that spring tension on the release shaft in the transfer gearbox is reduced.

NOTE!
Do not loosen the plug fully. Some parts of the release mechanism in the gearbox would be lost.

5 Insert a steel bar (1) into the hole of shaft (2) and then strike the bar with a hammer carefully, to move the shaft into release position.
6 Measure clearance (C) of the extended shaft.
- Clearance (C): 12 mm (0.47 inch)
7 If the clearance is correct, install plug (3) fully.

8 **Rear axle parking brake, mechanical releasing**
Loosen bolt (5) and remove spacer (6) to release parking brake at the rear axle. (Front: 2 points, Rear: 2 points)

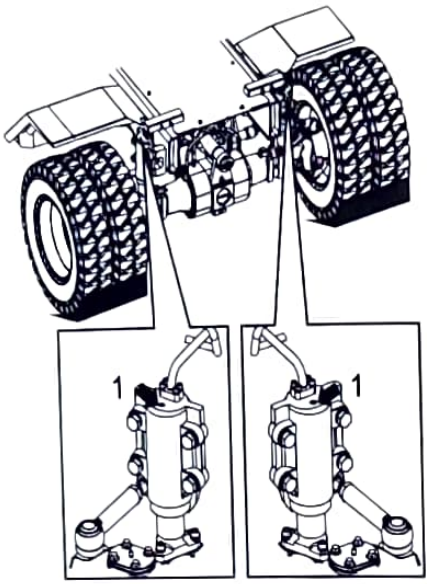


NOTE!
Reinstall spacer (6) and fasten bolts (5) in original position. Tightening torque: 10.7 kgfm (77 lbf ft)

Pivot axle lock cylinder, manual release for towing

In case the engine is not running or if there is no servo pressure the front axle is locked and can only be released manually.

Never tow a machine long distance, max. 5 km with a max. speed of 10 km/h.



Pivot axle lock cylinder, manual release for towing

1 Air vent

Releasing axle lock cylinders manually

A manual release of the axle lock cylinders shall only be done by mechanical personnel.

NOTE!

This procedure shall be done on both cylinders.

1 Turn off the engine.
2 Choose P-mode.
3 Clean the area around the air vent (1).
4 Place a container under the cylinder to collect any oil spills.
5 Loosen the air vent (1) with 2–3 turns to release the encased pressure.
6 Tighten the air vent (1).

NOTE!

After towing, the cylinders have to be restored.

Transporting machine

Measurements before transporting machine

NOTICE

The person in charge of the transport must see to that loading, positioning, lashing and transporting the machine on a trailer or other vehicle is done according to applicable laws and regulations for the country or state in question. For further information, contact your dealer.

Weight and dimension

Weight and dimension are very useful to estimate the method how the machine is supposed to be transported. To comply with the laws and regulations in certain region, use the specifications of total weight and dimension. See page *388* and *394*.

Transporting machine

NOTE!
When transporting the machine, obey the relevant laws governing the weight, height, length and securing of a load.

NOTE!
Make sure that loading ramps and platforms are free from oil, mud, ice and similar so that the machine does not begin to slip.

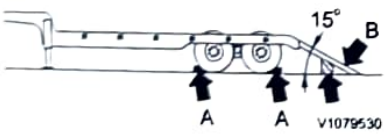
NOTE!
Do not change course on the planks. If it is unavoidable, first descend from the planks and then change course.

NOTICE

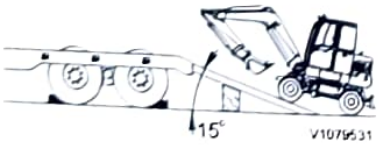
Select low engine speed and low travelling speed for loading and unloading the machine.

- Choose a firm, level place, and keep ample distance from the road shoulder.
- Make sure the strength, width, length and thickness of the planks are safe for loading / unloading. If they bend excessively, support with blocks.
- When swinging on the truck, operate slowly because the base is unstable.
- After loading, block each tyre and secure the machine with tie downs of adequate load rating, that the machine can not move.
- Lock the cab door and lower the antenna.

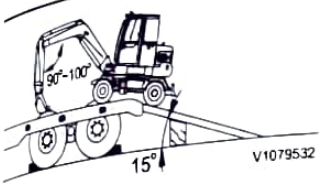
Loading the machine



1 Place the trailer on a firm and level ground.
2 Apply the brake of the trailer.
3 Insert blocks (A) in front of and behind the tyres of trailer.
4 Fix loading ramps (B) securely.
   - Make sure that the strength, width, length and thickness of the planks are safe for loading.
   - Make sure that the angle of loading ramp is 15° or less.



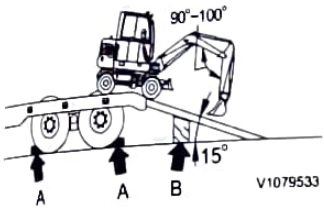
5 Check whether the right and the left loading ramps are of the same height.
6 Set the travel speed at Low speed.
7 Operate the engine at Low speed.



8 Decide the direction and travel slowly onto the loading ramps and trailer bed / platform.
- Load the machine so that the bucket cylinder rod does not contact the trailer.
- Never operate any lever other than the travel pedal while the machine is on the loading ramp.

9 Load the machine on the trailer properly and ensure it is firmly secured.

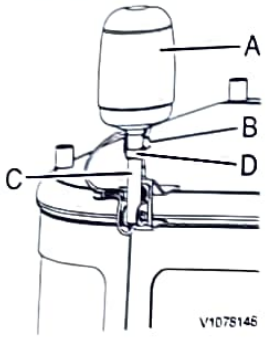
Unloading the machine



1 Place the trailer on a firm and level ground.
2 Apply the brake of the trailer.
3 Insert blocks (A) in front of and behind the tyres of trailer.
4 Fix loading ramps (B) securely.
- Make sure that the strength, width, length and thickness of the planks are safe for loading.
- Make sure that the angle of loading ramp is 15° or less.

5 Check whether the right and the left loading ramps are of the same height.
6 Remove the chains or wire rope holding the machine to the trailer bed.
7 Start the engine and warm the engine up fully.
8 Move the left console box down for travelling, see page *124*.
9 Set the travel speed at Low speed.
10 Operate the engine at Low speed.
11 Decide the direction and travel slowly onto the unloading ramps.
- Raise the attachments, pull in the arm under the boom, then move the machine slowly.
- Never operate any lever other than the travel pedal while the machine is on the unloading ramp.

12 When the machine is horizontal on top of the rear wheels of the trailer, stop the machine.
13 When moving from the rear of the trailer on to the ramps, set the angle of the arm and boom to 90° to 110°, lower the bucket to the ground, then move the machine slowly.
14 When moving down the ramps, operate the boom and arm slowly to lower the machine carefully until it is completely off the ramps.



A Rotating beacon lamp
B Bolt
C Bracket
D Rubber cover

Rotating beacon lamp, disassembling (optional equipment)

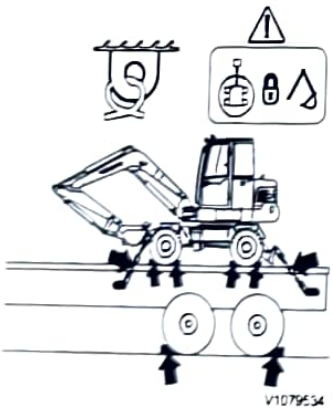
If the machine is too high to fit in the transporting vehicle it is possible to remove the rotating warning beacon (optional equipment). This will reduce the total height of the machine.

When transporting the machine, disassemble the rotating beacon lamp (A) not to be damaged.

1 Loosen the bolt (B) and disassemble the rotating beacon lamp (A) and the wire connector for it.
2 Keep the rotating beacon lamp (A) in the cab during transportation.
3 Put the rubber cover (D) on the bracket (C).

NOTE!
If you remove the rotating warning beacon, be sure to put the rubber protection on the fixing tube. This will avoid rust and other possible damages.

NOTE!
Bolt (B) torque: 0.8 kgf m + 0.1 kgf m



Tying down machine

NOTE!
Make sure that loading ramps and platforms are free from oil, mud, ice and similar so that the machine does not begin to slip.

NOTE!
Load the machine in a level and firm place, and keep ample distance from the side edge of platforms, ramps and road shoulder.

1 After loading the machine on the trailer, tie down the machine firmly and securely.
2 Extend the boom and the arm cylinder up to their stroke end, and lower the boom with care.

NOTE!
Do not allow the bucket cylinder rod to touch any part of the trailer.

3 Put the PWT mode selector switch to P mode.
4 Stop the engine and remove the ignition key.
5 Move the control lockout lever up to lock the hydraulic system securely, see page 124.
6 Turn OFF the battery disconnect switch.
7 Lock the door and the access covers.

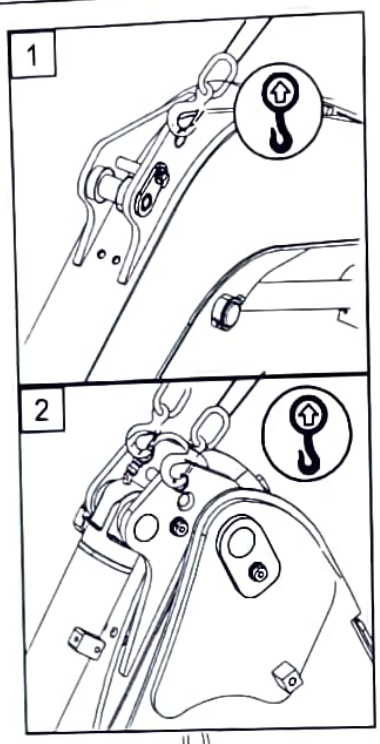
Lifting machine

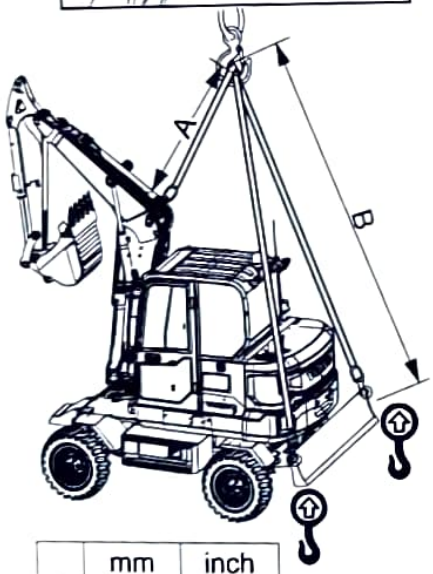
Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 410000

⚠ WARNING

Risk of personal injury.
Faulty or improper lifting equipment could cause the machine to break away from the lifting vehicle, causing accidents, serious injury or death.
Use certified cables, lifting straps, slings, shackles and hooks with adequate load capacity and never lift the machine with a person in or on the machine.

NOTE!
Incorrect or faulty equipment or improper towing methods may cause accidents. Therefore, carefully follow the instructions given below.





	mm	inch
A	2000	79
B	4500	177

V1212902

Lifting point
1 Mono boom
2 Two-piece (2 PCS) boom

1 Park the machine on flat, even and level ground.
2 Position dipper arm, boom and blade as shown in the illustration.
3 Move the control lockout lever up to lock the system securely, see page *124*.
4 Stop the engine, check the safety around the machine.
5 Close and lock the windshield, cab door and engine hood securely.
6 As shown in the illustration for lifting, connect lifting cables or slings with sufficient strength for the machine weight at the lifting points correctly. For machine weight, see page *388*.

NOTE!
Use suitable lifting equipment to lift the machine. Make sure that the lifting chains or slings are strong enough (over 5 tons slings x 3 ea) for the weight of the machine.

7 After installation of all hoisting equipment, lift the machine a little to check its balance, if satisfactory, lift it slowly and evenly.
8 Maintain good visibility of the machine at all times during the lift. And continuously check that the machine is level.

Operating techniques

The excavator is a multi-task machine capable of being fitted with multitude special attachments to perform many types of work. This chapter contains information and instructions regarding the best operating practices to improve efficiency, including examples on how the most common attachments are used. It is important that the correct technique is used to obtain safe and efficient use of the machine.

Whole-body vibrations

Whole-body vibration emission on construction machinery are affected by a number of factors, such as working mode, ground conditions, speed, and so on.

To a large extent the operator can influence the actual vibration levels, because the operator controls the speed of the machine, its working mode, the travel path, and so on.

Therefore, the result can be a range of different vibration levels for the same type of machine. For cab specifications, see page *382*.

Guidelines for reducing vibration levels on earthmoving machines

- Use the proper type and size of machine, with optional equipment and attachments for the application.
- Keep the terrain and haul roads in good condition.
  - Remove any large rocks or obstacles.
  - Fill any ditches and holes.
  - Provide equipment and schedule time to maintain terrain conditions.
- Adjust the speed and travel path to minimize the vibration level.
  - Drive around obstacles and rough terrain conditions.
  - Reduce the speed when it is necessary to go over rough terrain.
- Maintain machines according to the manufacturer's recommendations.
  - Track tensions. (crawler machine only)
  - Tire pressures. (wheel machine only)
  - Brake and steering systems. (wheel machine only)
  - Controls, hydraulic system and linkages.
- Keep the seat maintained and adjusted.
  - Adjust the seat and its suspension according to the weight and size of the operator.
  - Inspect and maintain the seat suspension and adjustment mechanisms.
  - Use the seat belt and adjust it correctly.

- Steer, brake, accelerate, shift gears, and move the attachments smoothly. (wheel machine only)
- Minimize vibrations for long work cycle or long distance travelling.
  - Use suspension systems if available.
  - If no suspension system is available, reduce speed to prevent bouncing.
  - Transport machines when there are long distances between worksites.

Back pain associated with whole-body vibrations may be caused by other risk factors.

The following guidelines can be effective to minimize risks of back pains:

- Adjust the seat and controls to achieve good posture.
- Adjust the mirrors to minimize twisted posture.
- Provide breaks to reduce long periods of sitting.
- Avoid jumping down from the machine.
- Minimize repeated handling and lifting of loads.
- Maintain reasonable weight and physical condition.

Rules for digging

⚠ WARNING

Risk of serious injury.
More than one person in the cab while operating could cause accidents and serious injury.
Only the operator, seated in the operator's seat, may be in the cab when operating. All other persons must keep at a safe distance from the machine.

First read the safety rules for operating, see pages *154*, *155*, *156*, and *158*.

- Always prepare work by carefully studying drawings and regulations that apply to the site. Also study the ground conditions and what the risk areas on the site look like. Turn off gas, electricity and water supplies, if this is necessary. Mark the position of cables and pipes.
- Fence off the area around the machine, if there is a risk that people may get too close. Pay attention to a swinging machine.
- Look after your workmates! Make sure that they take care. No persons, apart from the operator, may be present within the working area of the machine. Teach them to be on their guard against collapsing banks and rolling stones and to be prepared to dash for safety. Changes in stress in a bank immediately prior to a landslip are indicated by small streams of loose material just where the cracks are forming.
- If the machine is provided with optional equipment, which is operated with the pedals, the operator must assure him or her self of that the anticipated movements are obtained when actuating the pedals. An unexpected movement may entail risk of an accident.
- A cab provided with protective grill over the roof window meets the requirements for falling object guard in accordance with stated testing methods (FOPS/ISO 10262). Use the falling object guard when there is risk of heavy, falling objects.

NOTICE

With certain attachment combinations there is a risk that the attachment may strike the cab. Avoid damage by being careful when working close to the machine.

- Never swing the bucket or load above people.
- Never use the bucket for chopping.
- If uncontrolled movements should occur, first release levers and pedals, then shut off the engine immediately by turning the ignition switch to the stop position.
- If red warning lamps light up and/or the buzzer is sounding, the engine must be stopped immediately and the cause investigated.
- The machine must not be equipped with a larger bucket/attachment than permitted.
- When using equipment which generate knocks or vibrations, for example hammer, the hydraulic cylinders must not be operated closer than 10 cm (4 in) from their end-of-stroke positions.
- In case of fire, the battery disconnect switch should be turned off, if possible. See page *271*.

Loading on to a vehicle

⚠ WARNING

Risk of crushing.
Material may fall off when loading a vehicle.
Make sure that no persons are standing near the vehicle while loading.

- If possible, position the machine higher than the vehicle to be loaded.
- Place the vehicle to be loaded so that the machine does not have to swing and lift more than necessary.
- Make sure that the driver of the vehicle to be loaded stays outside the working area of the machine and never swing the bucket over the cab of the vehicle to be loaded.
- Do not load the vehicle unevenly and avoid unnecessary spillage when loading. Do not make the load so high that earth and stones fall over the platform sides.
- Release the load carefully.

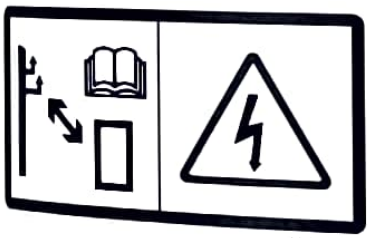
When working, do not:

- use the swing force for raking over the ground, demolition of buildings or thrusting bucket teeth into the ground. It may cause damage to the machine and attachments.
- dig by using the travelling motors or thrusting bucket teeth into the ground. This can overload the rear of the machine and damage the travel drive unit.
- extend the hydraulic cylinder to its end of stroke. This can overload the stop in the cylinder and shorten the life span of the machine. Work with as much clearance as possible.
- work by slamming the bucket into the ground. Do not perform digging by dropping the boom, or using the bucket instead of a pick. Striking digging or continuous striking can overload the rear of the machine or damage the attachment. It is also very dangerous.
- carry out lifting work. Basically, using this machine as a crane is prohibited. However, local or national regulations may allow it on some markets. If permitted, a properly installed rated bucked hook and certified slings / shackles are required. Contact a workshop authorised by Volvo Construction equipment.
- operate by dropping the machine body.

Working within dangerous areas

- Observe great care at marked danger areas.
- Do not operate too close to the edge of a quay, ramp, ditch and so on.
- Move slowly when working in confined spaces and check that there is sufficient room for machine and load.
- When working under ground, special equipment, for example certified engine is required within the EU and in EES countries. Talk to your dealer.
- When working in low light conditions, for example buildings and tunnels, use head light.
- Do not operate the machine when visibility is poor such as a heavy fog, snow or rain.
- When working in an area which is contaminated or dangerous to one's health, the machine must be especially equipped for this purpose. Talk to your dealer. Check also local regulations before entering the area.

High voltage overhead power line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DANGER

Risk of electrocution
Working near or making contact with overhead power lines may lead to electrical flashover and electrocution.
Always keep the minimum clearance from overhead power lines.

DANGER

Risk of electrocution.
Contact with live parts will cause death or serious injury.
Never touch live electrical parts.

High voltage is lethal and the current sufficiently strong to destroy both machine and attachments. Your life is in danger if you come into contact with or close to high voltage power lines. Always contact the power company responsible before beginning any work near high voltage power lines. Go through the special instructions issued by the power company for work/presence near the power lines. Regard all power lines as if they were live even if they are supposed to be without current. Working when the machine or its load at any time is closer than the minimum safety distance to a power line, is taking a very serious risk.

- Remember that the voltage of the power line determines the safety distance. Electrical flash-over may occur and damage machine and operator at fairly great distances from the power line.

Voltage	Minimum distance to power line
0 ~ 50 kV	3 m (10 ft)
50 ~ 69 kV	4.6 m (15 ft)
69 ~ 138 kV	5 m (16.4 ft)
138 ~ 250 kV	6 m (20 ft)
250 ~ 500 kV	8 m (26 ft)
500 ~ 550 kV	11 m (35 ft)
550 ~ 750 kV	13 m (43 ft)
750 kV~	14 m (46 ft)

NOTICE

The operator should have secure visibility when working around the power lines.

NOTICE

When transporting the machine also take overhead power lines into consideration.

NOTICE

Remember that the roof window may distort how distance is perceived.

- Keep the following in mind to ensure safety when operating.
  - Operate the machine slower than normal operation in the vicinity of power lines.
  - Consider the long-span power line, which can sway and reduce the clearance.
  - Pay attention when travelling over uneven ground that could cause the machine to lose balance.
  - Keep all persons away from the machine whenever it is close to power lines.
  - Prohibit persons from touching the machine or its load before it is confirmed to be safe.
- Find out what action to take if a person has been exposed to an electric shock.
- Procedure if a machine touches the power line.
  - The operator should stay inside the cab.
  - All other persons should keep away from the machine, ropes, and load.
  - The operator should try to remove the machine from contact by moving it in the reverse direction from that which caused the contact.
  - If the machine cannot be moved away from contact, the operator should remain inside cab until the lines have been de-energized.

Overhead railway power lines

⚠ DANGER

Risk of electrocution

Working near or making contact with overhead power lines may lead to electrical flashover and electrocution.

Always keep the minimum clearance from overhead power lines.

⚠ DANGER

Risk of electrocution.

Contact with live parts will cause death or serious injury.

Never touch live electrical parts.

Loading and unloading is only permissible between the boundary signs. The signs may be mounted directly on the power line or on special posts.

- Contact authorised railway personnel to obtain permission to load or unload.
- After any breaks in the work, always contact the railway personnel again.

Underground cables and pipes

Make sure that authorities or companies responsible for cables and pipes have been contacted and that their instructions are followed. Also check which rules apply to ground personnel regarding exposing cables and pipes. Normally only the service companies' own personnel may expose and arrange provisional suspension of cables. Make use of a signal man when you cannot see the actual point where you are working or when the position of the pipe or cable is critical, see page *262*. The position of the pipe or cable may deviate from the drawing or distances may be incorrectly determined. Regard all electrical cables as live.

Use safe working procedures

Stop the machine far from the edge of the digging area.

Do not undercut overhead ground because the overhang could without warning collapse onto the machine.

Do not dig too much or undercut the ground supporting the machine. The ground could break away causing the machine to fall.

If necessary, prop up sufficiently so that the ground will not collapse.

Overhead obstructions

- Use special care when operating in places with limited height such as tunnels, under land bridges or power lines.

Low light conditions

- When working in low light conditions, use head lamps.
- In buildings, tunnels, etc., switch on the lights.
- Do not operate the machine when visibility is poor such as a heavy fog, snow or rain.

Snow removal

- An icy road is very slippery, so do not turn sharply or brake suddenly.
- Particularly, when travelling on inclines, travel slowly.
- Take special care during snow removal work because the road condition can not be seen.

Unstable ground

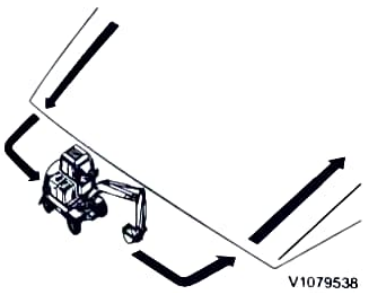
- When operating in dangerous places, take action to ensure safety before proceeding with the work.
- The edges of cliffs or holes, falling rocks or land slides are particularly dangerous.

Working on slopes

NOTICE

In order not to jeopardise the lubrication of the engine, the machine must not be inclined more than 35 degrees in either direction. In addition it may be unsuitable to operate at this inclination as the machine may become unstable and unbalanced, depending on the load.

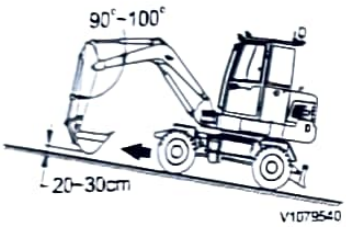
Caution on a slope



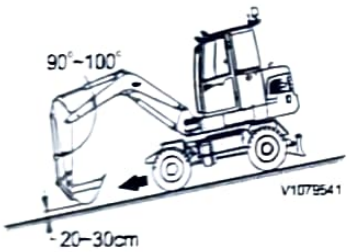
- Be careful when opening or closing the doors on a slope, operational force may be changed rapidly. Make sure to keep the doors closed.
- Do not descend backward on a slope.
- Operate the travel function slowly when approaching or descending a slope.

NOTE!
Before travelling on a slope, set the travel control lever on the right side of the steering wheel to low speed position (|).

- Do not change direction or travel a cross on a slope. Change direction on level ground, if necessary first come down to level ground and make a detour.
- If the machine slides, immediately lower the bucket to the ground. The machine can turn over due to unbalance. Especially, do not swing with loaded bucket. In unavoidable case, pile up earth on the slope, and then make the machine level and stable.



- While travelling on a slope, keep the angle between boom and arm at 90 - 110°, raise the bucket 20 - 30 cm from the ground and travel at low speed (|).



- While travelling down on a slope, keep the angle between boom and arm at 90 - 110°, raise the bucket 20 - 30 cm from the ground and travel at low speed (|).

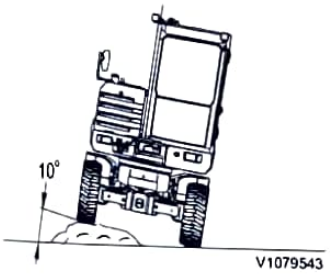
In case of tyres slipping

If the tyres slip when ascending a slope, thrust the bucket into the ground then operate the arm inward and use the power of the attachment to pull the machine.

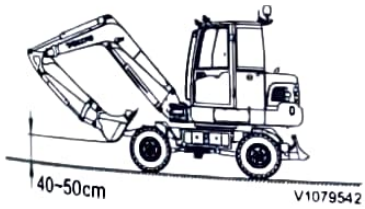
In case of engine failure

In case of engine shut down while travelling on a slope, put the travel lever to neutral position and lower bucket down to the ground, then start the engine.
If the engine shuts down on a slope, do not operate the swing function, since the superstructure may be swung under its own weight and cause tipping or side slipping.

Travelling on uneven ground



- In case of travelling on uneven ground, reduce travel speed and operate the machine so as not to lean to one side more than 10°.

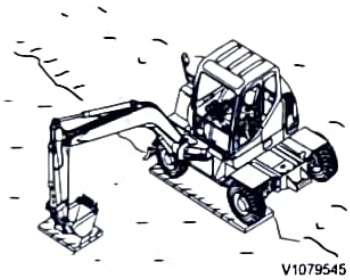


- In case of travelling on flat ground, retract the attachment and raise it 40 - 50 cm from the ground.

Working in water and on boggy ground

Be very careful when working on boggy ground. After working in water or escaping from boggy ground, replenish the grease to the attachment pins or the areas affected by the water. Check the transfer gearbox, drive shafts and axle oil, if contaminated, change the oil.

In case that one tyre gets bogged


V1079545

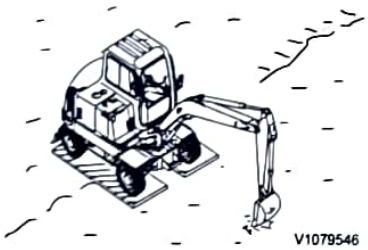
If one tyre gets bogged, raise the bogged tyre using the bucket and put a wood plank under the tyre.

NOTICE

When the machine is lifted with the aid of the boom or the dipper arm, the bottom of the bucket should rest on the ground not the bucket teeth.

Set the angle between boom and arm at 90°~110°.

In case that both tyres get bogged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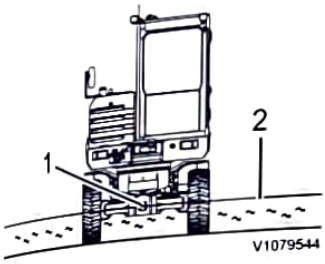
In case that both tyres get bogged, put wood planks under each tyre. Thrust the bucket into the ground, pull arm as with digging work, and put the travel control lever to forward position to escape.

Permissible depth of water



1 Axle center
2 Water level

NOTICE

Never use the machine in water where the surface of the water may reach the bottom of the axle housing. Always check the bottom conditions before taking the machine into water. Risk of machine damage.

NOTICE

Pay attention to the permissible water depth in order to avoid damage to the machine.

Permissible working depth in water is the center of axle (1).
Do not fully submerge the axle.
Upon leaving the water, make sure all the grease is replenished in the areas affected by the water, for example bucket pin and so on, remove the old grease completely regardless of the maintenance period. Also check the oil in the travel drive for contamination, and if necessary, replace it.

Working where there is risk of landslip

Always check ground conditions before beginning to work. If the ground is soft, great care must be taken when positioning the machine. Thawing of frozen ground, rain, traffic, piling and blasting are factors which increase the risk of landslip. The risk also increases on sloping ground. If it is not possible to dig with sufficiently slanting trench sides, the machine must be shored up.

- Do not place excavated material too close to the edge as its weight may cause a landslip. Loose clay should be placed at least 5 m (16 ft) away from the edge.
- Do not dig under the machine.
- Do not operate too close to the edge of a steep slope or road bank. Take care when working in a place where the machine may tip.
- Dig with the excavator unit over the rear axle, with stabiliser blade down. In this way the greatest stability is obtained and the machine will be easy to drive away.
- Take care when working on river banks or in other similar places where the ground is soft. There is a risk that the machine, because of its own weight and own vibrations, may sink and this could lead to accidents.
- Keep in mind that the ground conditions may have changed after heavy rain. Therefore, be careful when restarting work. This is particularly important when working near the edge of ditches, road verges or similar, as the ground may easily give way after it has been raining.

Working in cold weather

DANGER

Risk of electrical shock.
Personal injury results if a body part comes into contact with a machine that conducts electric power.
Disconnect the electrical engine heater before working on the machine.

WARNING

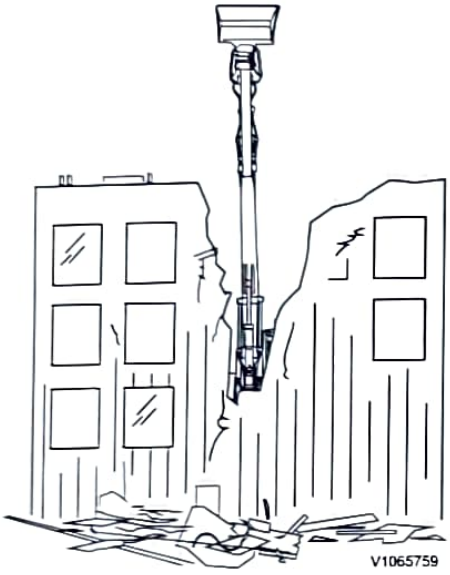
Risk of frostbite.
Bare skin can freeze stuck to cold metal which could cause injury.
Use personal protective equipment when handling cold objects.

WARNING

Risk of crushing injury.
The hydraulic system could respond slowly at low temperatures and could cause unexpected machine movements.
Operate carefully until the hydraulic system has reached operating temperature.

Read the advice for starting, see page *162*.
Use appropriate fluids for the ambient working temperatures. (see recommended fluids in specification section.)
The windows must be free from ice and snow before putting the machine to work.

- Watch out for ice on the machine causing slippery conditions. Step only onto anti-slip surfaces.
- Use an ice scraper on a long handle or a ladder when removing ice from the windows.

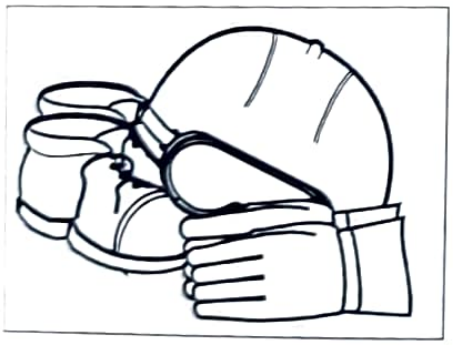

V1065759

Demolition work

The machine is often used for demolition work. Be extremely careful and study the work site thoroughly. Use fall protection over the cab against falling objects.

- Make sure that the material, on which the machine is standing, cannot collapse or slide.
- Operate the machine on firm level ground, if necessary prepare the area with another machine first.
- Do not work close to free-standing walls, which may fall over the machine.
- At all times be aware of where your workmates are. Do not work if anyone is dangerously close to the demolition object.
- Leave sufficient space in front of the machine for debris to fall to the ground and not hit the cab.
- Fence off the dangerous part of the work site.
- Spray water over the demolition site to prevent harmful dust from spreading.

Boots with steel reinforcements in the soles and toe caps, protective goggles and a hard hat are obvious protective items to be worn on a demolition site.


V1067189

If the machine is equipped with special demolition equipment, read the supplied instruction booklet about the safety risks that might occur and how the demolition equipment is used.

Attachments

⚠ WARNING

Risk of fatal accidents.
Using attachments for lifting or transporting persons may lead to fatal accidents with serious crushing injury or death.
Never use attachments for lifting or transporting persons.

Using the correct attachment for a particular job is a deciding factor when it comes to the capacity of the machine. The machine has either direct-mounted attachments or attachments mounted in a hydraulically controlled quick coupler which allows rapid changes of attachments.
Always follow Volvo CE recommendations when choosing attachments. If other attachments are used, follow the operator's manuals from the respective supplier.
EU Machine Safety Directive is stated on the product plate of the machine by the way of a CE marking. Therefore, this marking also covers attachments which are designed and marked by Volvo CE, as they are an integrated part of the machine and adapted to the machine. Volvo CE is not responsible for attachments manufactured by other companies. Such attachments must be CE marked and accompanied by a Declaration of Conformity and user instructions.
It is the responsibility of the machine owner to make sure that the attachments are approved for mounting on the machine. The machine owner is responsible for the safety of the combination machine – attachment.
For more detailed information regarding the choice of attachments, contact a Volvo CE dealer.
The machine is prepared for various different attachments, e.g. hammer and clamshell bucket. In order to be able to connect these hydraulically to the machine, the pressure in the hydraulics must be released by moving the control levers in all directions.

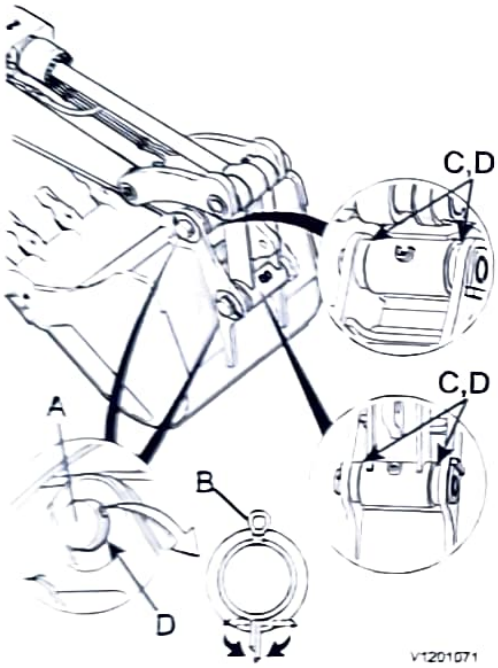
NOTE!
Depending on the attachments the stability of the machine may vary.

Attaching and disconnecting attachments

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 410000

Bucket, changing

Bucket, removal



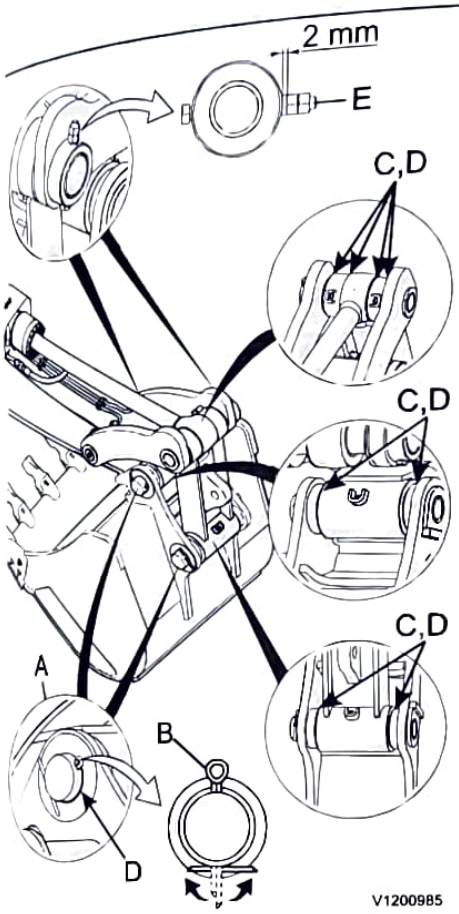
A Bucket pins
B Split pins
C Shim (0.5 t)
D Shim (1.0 t)

⚠ WARNING

Risk of splinter injury.
Striking the bucket pin with a hammer could cause metal chips to fly around and cause serious splinter injury.
Always wear face and eye protection, hard hat and gloves while removing and installing the bucket pins.

1 Lower the bucket lightly on the ground.
2 Bend the end of split pin (B) and then remove it. (2 points)
3 Remove pins (A) and shims (C and D), then remove the bucket from the machine.
4 Check the condition of parts (A,B,C, D) and then reinstall the pins and shims at original position.

Bucket, installation



A Bucket pins
B Split pins
C Shim (0.5 t)
D Shim (1.0 t)
E Lock bolts

⚠ CAUTION

Risk of cutting and crushing.
Loose parts could cause crushing and cutting injury.
Never use your fingers for checking alignment between loose parts. Always use a tool.

1 Align the dipper arm and links to the bucket.
2 Put the shims (C and D) at the each hole for the dipper arm and bucket.
The clearance between shims and hole shall be less than 1.0 mm.

NOTE!
Check the condition of all shims (C and D) before installation.

3 Insert pin (A) and (B).
4 Put shims (C) and (D) at the each hole for the link and bucket.
The clearance between shims and hole shall be less than 1.0 mm.
5 Insert pin (A) and (B).
6 Apply grease to the nipples.

NOTE!
Make sure that there is a clearance of at least 2 mm (0.08 in) between nut and lock bolt (E).

Attachments, connecting and disconnecting

Attachment quick coupler

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 410000

Volvo Quick Coupler (optional equipment)

⚠ WARNING

Risk of crushing.
Falling attachments could result in severe injury or death.
Make sure the attachment bracket is properly locked before starting work.

⚠ WARNING

Risk of crushing.
An unsecured attachment could fall and cause serious injury or death.
Always ensure the attachment is properly secured by pressing the front part of the attachment to the ground until the machine is slightly lifted.

The attachment quick coupler is equipped with a double-acting hydraulic cylinder. The hook for gripping the attachment is fitted to its piston rod. The hydraulic system's pressure acts on the lock cylinder's piston, locking the attachment in place against the rear bucket pin. This means that the hook adjusts itself and provides gap-free locking.

When checking from the cab if the attachment quick coupler is locked or unlocked, slowly curl out the bucket/attachment and dipper arm.

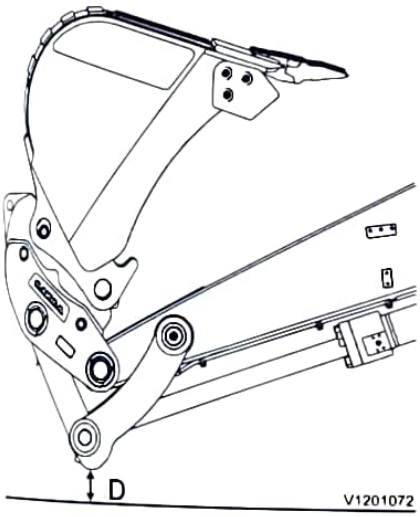
With the lifting eye, the machine can be used for lifting operations. Since the lifting eye is located on the attachment quick coupler, it can be used without bucket. This improves visibility for the operator and increases the maximum permissible load.

Bucket, removing

WARNING

Risk of crushing!
Attachments that move unexpectedly can cause injuries.
Make sure people stay out of the working area when connecting or disconnecting attachments.

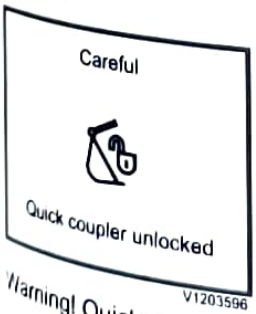
1 Place the machine on firm and level ground.
2 Lower the dozer blade and the boom to the ground.
3 Curl in the bucket completely towards the dipper arm (to release the lock mechanism) as illustrated.



Distance form ground = 200 mm (7.87 inches)

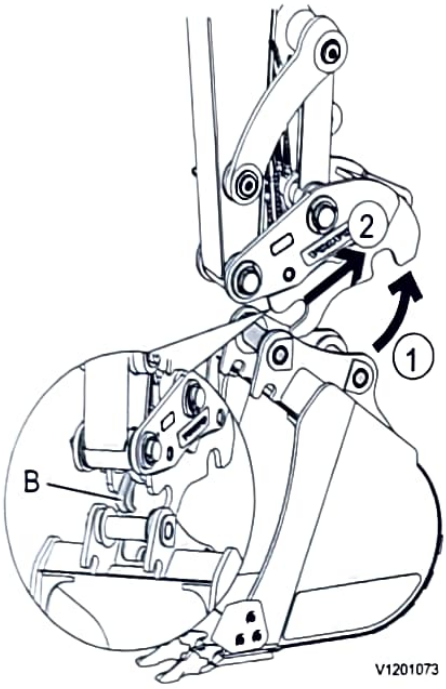
Press down to release the red lock device (A)

4 Press the attachment quick coupler switch to position (1) to open the attachment quick coupler (unlock position). See page *89* for operating of the attachment quick coupler switch.



Warning! Quick coupler unlocked

NOTE!
When the attachment quick coupler is being opened, a warning symbol appears on the display unit, the central warning lamp lights up and the buzzer sounds (unlock position).



Front lock device (B)

5 Lower the bucket to the ground as illustrated. After that lift up the attachment quick coupler from rear bucket pin (1).
Operate the dipper arm to outward (2) to disengage from front bucket pin.
Make sure that the front lock device (B) is fully opened to unhook from the bucket pin. Otherwise, the bucket pin cannot disengage correctly.

Attachment quick coupler switch, right

6 Press the right attachment quick coupler switch to position (0) to close the attachment quick coupler.

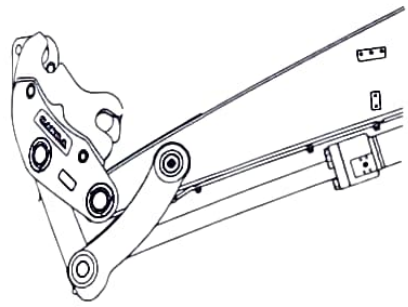
Check! Confirm quick coupler is locked

NOTE!
When the switch is in position (0), the buzzer sounds and the check message for confirming and indicator are displayed on the I-ECU. Press ESC to confirm.

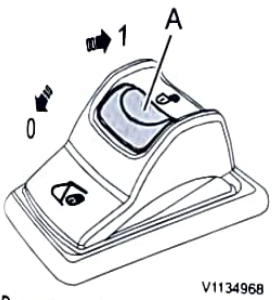
Bucket, installing

WARNING

Risk of crushing!
Attachments that move unexpectedly can cause injuries.
Make sure people stay out of the working area when connecting or disconnecting attachments.


V1201074

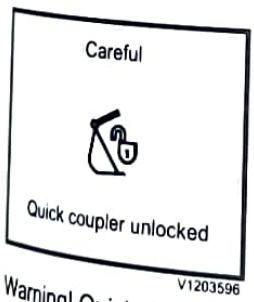
1 Place the machine on firm and level ground.
2 Curl in the attachment quick coupler completely towards the dipper arm (to release the lock mechanism) as illustrated.



V1134968

Press down to release the red lock device (A)

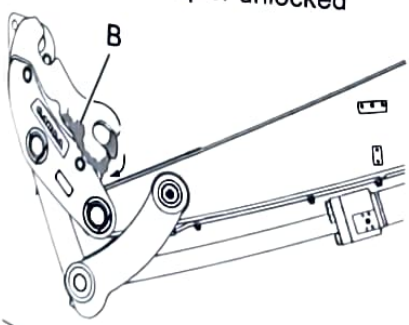
3 Press the attachment quick coupler switch to position (1) to open the attachment quick coupler (unlock position). See page *89* for operating of the attachment quick coupler switch.



V1203596

Warning! Quick coupler unlocked

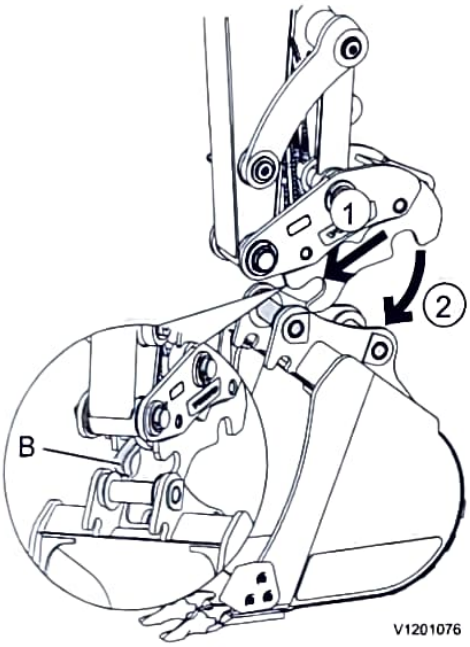
NOTE!
When the attachment quick coupler is being opened, a warning symbol appears on the display unit, the central warning lamp lights up and the buzzer sounds (unlock position).



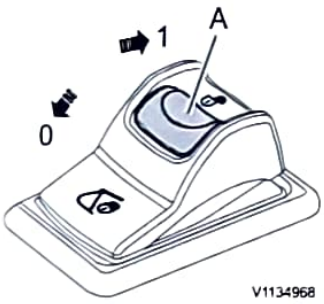
V1201075

Front lock device (B) is opened

4 Make sure that the front lock device (B) is fully opened before hooking it onto the bucket pin. Otherwise, the bucket pin cannot be engaged correctly.

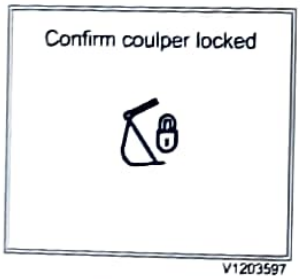


5 Curl out the attachment quick coupler and hook it onto the front bucket pin (1).
6 Slowly curl in the attachment quick coupler fully towards the rear bucket pin (2).



Attachment quick coupler switch, right

7 Press the right attachment quick coupler switch to position (0) to close the attachment quick coupler.



Check! Confirm quick coupler is locked

NOTE!
When the switch is in position (0), the buzzer sounds and the check message for confirming and indicator are displayed on the I-ECU. Press ESC to confirm.

8 Visually check that the front lock device (B) is fully engaged.
9 Lift and curl in the bucket fully towards the dipper arm and hold it there for approximately 5 seconds to ensure that the attachment quick coupler has locked securely to the bucket.

10 Do the following tests to check that the attachment quick coupler is fastened securely.
- Press the bucket against the ground. In this position, curl the bucket in and out to check that it is locked in the correct position.
- If you are uncertain about whether the bucket is securely locked to the attachment quick coupler, get out and check that the front lock device is fully engaged.
- Do not use the machine if the attachment quick coupler is not working.
- Contact a workshop authorized by Volvo if anything is wrong.

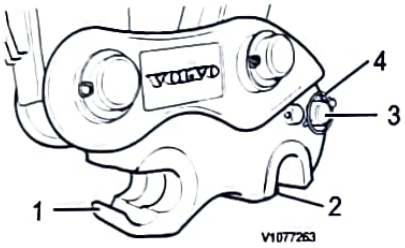
⚠ WARNING

Risk of crushing.
If the red warning lamp for open attachment bracket lights up while working, the attachment could fall off and cause serious crushing injury or death.
Stop working with the machine immediately and make sure the attachment bracket is properly locked before starting to work again.

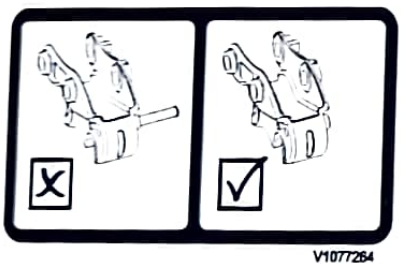
Attachment brackets

Attachment brackets

(Optional equipment)



1 Front hook
2 Rotating hook
3 Locking pin
4 Linch pin



Working with extracted locking pin is hazardous and not allowed. Always make sure that the locking pin is securely fastened.

⚠ WARNING

The attachment quick coupler may be open regardless of what is indicated by the alarm signal or on the instrument panel. Therefore, always check that the attachment quick coupler is locked securely. Also read the instructions in the operator's manual.

⚠ WARNING

Risk of crushing!
Attachments that move unexpectedly can cause injuries.
Make sure people stay out of the working area when connecting or disconnecting attachments.

NOTE!
Do not use the machine, if the attachment bracket is not working correctly.

NOTICE

The attachment bracket increases the total length of the dipper arm. Be careful when moving the bucket and dipper arm towards the machine, there is a risk of damaging the machine.

NOTICE

The attachment bracket is not designed as a lifting device. Do not use the front hook or the rotating hook for lifting. Only specially designed pin-on attachments may be hooked to the attachment bracket.

NOTICE

There is a risk of loss of stability and tip-over when the attachment bracket is in shovel position. The load is moved forward and may exceed the machine's lifting capacity.

Mechanical attachment bracket

Bucket installation with mechanical attachment quick coupler

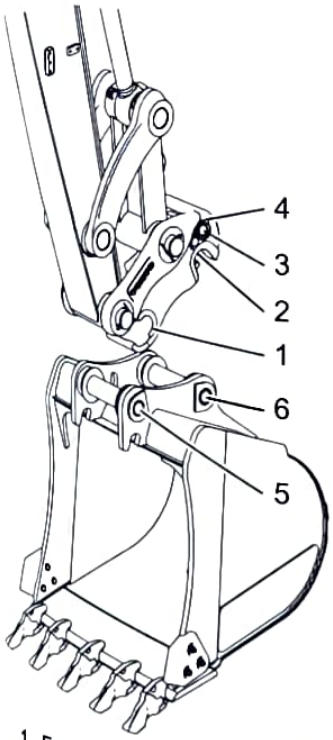
WARNING

The attachment quick coupler may be open regardless of what is indicated by the alarm signal or on the instrument panel. Therefore, always check that the attachment quick coupler is locked securely. Also read the instructions in the operator's manual.

NOTICE

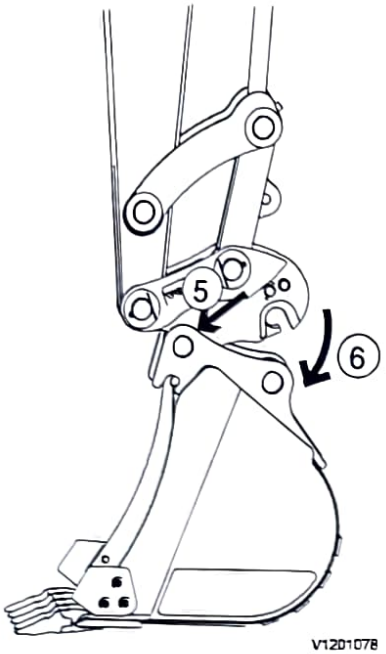
Check that the attachment is locked securely by pressing the front edge of the attachment against the ground so that the machine's front end is raised slightly.

1 Remove linch pin (4) and extract locking pin (3).
2 Rotate the locking pin 90° to lock it in extracted position.



V1201077

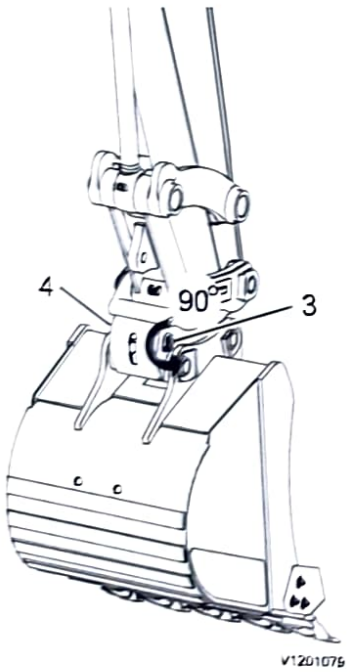
1 Front hook
2 Rotating hook
3 Locking pin
4 Linch pin
5 Front bucket pin
6 Rear bucket pin

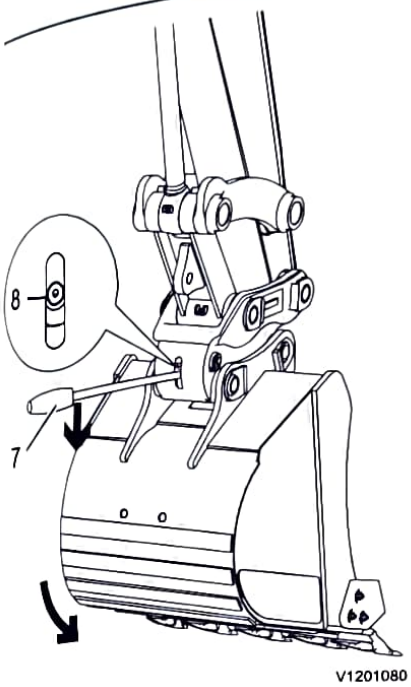


3 Lower the dipper arm into a position where the attachment bracket connects with front bucket pin (5).
4 Lower the attachment bracket towards rear bucket pin (6). Tilt the bucket rearwards (bucket in) until the hook on the attachment bracket is properly connected to the rear bucket pin.
5 Check that the bucket is securely fastened by simultaneously pressing the bucket to the ground and forward.
6 Lower the bucket to the ground.
7 Rotate the locking pin back 90°.
8 Insert the locking pin.
9 Insert the linch pin through the end of the locking pin.

Removing bucket from mechanical attachment bracket

1 Lower the bucket to the ground.
2 Extract the linch pin and the locking pin.
3 Rotate the locking pin 90° to lock it in extracted position.
4 Position the bucket 10 cm (4 in) above the ground.





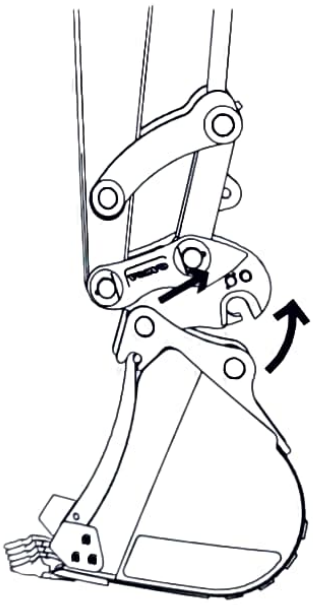
V1201080

5 Insert the release bar (7) into the hole (8) at the back of the attachment bracket.
6 Pull the release bar to release the attachment bracket from the rear bucket pin.

⚠ WARNING

Risk of crushing.
The bucket is only attached in the front bucket pin.
The bucket could fall and cause crushing injury.
Keep a safe distance.

7 Place the bucket on the ground.


V1201130

8 Lift the attachment bracket in direction from the bucket to release the front bucket pin.

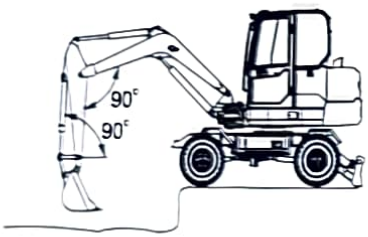
Buckets

Working with buckets

NOTICE

Select a suitable attachment that fits the machine on which it is to be installed. The types of attachments that can be installed vary with the machine type. Contact a workshop authorised by Volvo.

The machine is prepared for several different type of optional equipment to perform many types of work. Only the simplest operations are described below.

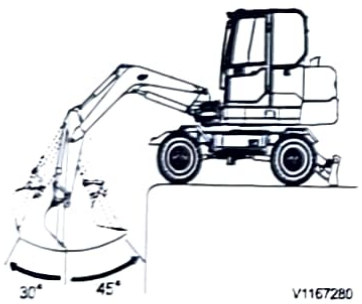


V1167279

Backhoe work

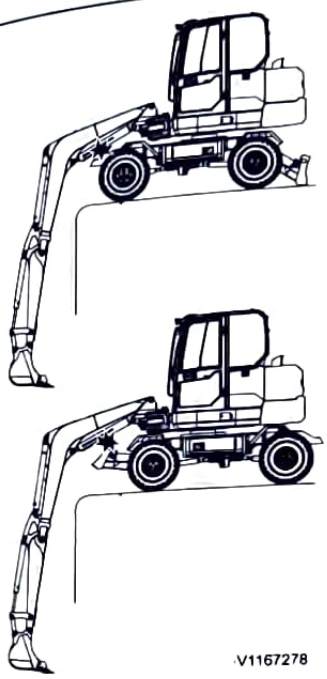
Backhoe work is digging the material at a lower level than the machine is located.

When the angle between bucket cylinder and links, dipper arm cylinder and dipper arm is set to 90° respectively, the working efficiency of each cylinder will be at its maximum.
Take advantage of this angle to improve the work efficiency. The range for effective digging is when the dipper arm is between 30° forward and 45° rearward. There may be a little difference according to digging depth. Do not use the cylinder up to its stroke end, but only within this range.



V1167280

NOTE!
For safety and prevention of machine damage, lower the dozer blade to the ground and support the machine.



NOTE!
Boom cylinder may strike the bucket rest or dozer blade if the boom is lowered too deeply.
Always check the clearance between boom cylinder and boom rest or dozer blade when working with attachment.

Ditching work

Install a proper bucket for ditching. Place the machine where the ditching is performed effectively.

In case of a wide ditch, dig both sides in first, and then dig the center area.

Loading work

Position the hauler or truck so as to achieve a small slewing movement and good visibility for the operator to work effectively.

Also load over the rear side of the dump truck rather than over the side, as this makes the operator work easier and increases efficiency.

Prohibitions during operation

Do not strain the swing mechanism

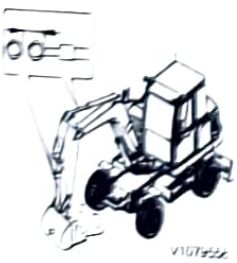
Do not perform raking over the ground, demolition of buildings or thrusting bucket tooth into the ground by using swing force. This operation may cause damage to the machine and attachments.

Do not work with the travelling force

Do not perform digging by travelling force, and thrusting bucket tooth into the ground. This can overload the rear of the machine and damage the tyre drive.

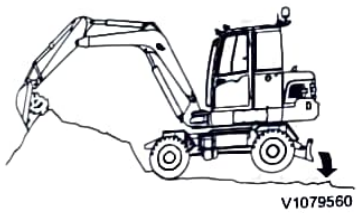
Do not extend the hydraulic cylinder to its end of stroke

Do not operate the cylinder to its stroke end. This can overload the stopper in the cylinder and shorten the life span of the machine.
Work with as much clearance as possible.



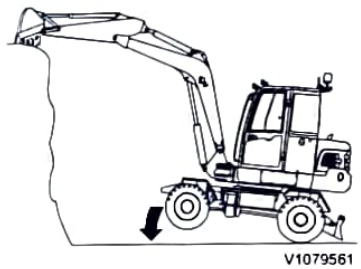
Do not work by slamming the bucket into the ground

Do not perform digging by dropping the boom, or using the bucket instead of a pick. Striking digging or continuous striking can overload the rear of the machine or damage the attachment.
Also it is very dangerous.



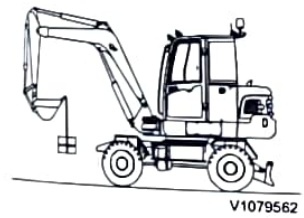
Working by drop force of the machine body

Do not operate by dropping the machine body.



Digging rocks

Break the hard rock area using a hammer, and then perform digging to avoid damaging the machine and to improve work efficiency.



Do not carry out lifting work

Using the excavator as a crane is prohibited. If performing lifting operations ensure the bucket is equipped with a rated bucket hook and is in good condition. Use rated slings and shackles in good condition. For safe load handling use short slings to prevent excessive load swing. Do not lift or swing a load that exceeds machine load rating or in a way that impairs machine stability.

- There may be local, provincial or state regulations governing the use of excavators for lifting work.

See page *256* about handling bucket hook.

Abrupt pedal control

- Do not start up abruptly.
- Do not change direction abruptly from forward to reverse or reverse to forward.
- Do not stop abruptly while high speed travelling.

Hammer

Hammer (hydraulic breaker)

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 410000

Select the proper attachment in accordance with the machine on which the attachment is installed. The type of attachment which is able to be installed varies with the machine type.
Use only hydraulic breaker that is recommended by Volvo. Contact an authorized Volvo dealer workshop.

NOTE!
For complete instructions for the hydraulic breaker, read the separate Operator's Manual for the hydraulic breaker.
Do not operate the hydraulic breaker until you read and understand both machine and hydraulic breaker manuals.

NOTE!
Lubricate the excavator units (such as boom, arm and linkages) twice a day.
If the machine is provided with an attachment quick coupler, this must be checked every day at the same time as rectifying any play.

⚠ WARNING

Risk of severe personal injury.
While working with the hammer flying chips of rock could cause severe injury.
Provide protective nets for the windscreens. Keep windows and door closed and prevent persons from entering the risk zone when operating the hydraulic breaker.

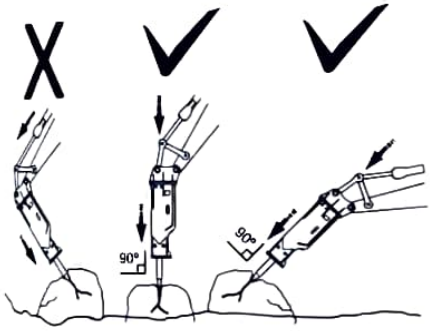
Main works

NOTE!
The machine images in this section are one of excavator's images. However the guideline is valid for all excavators.

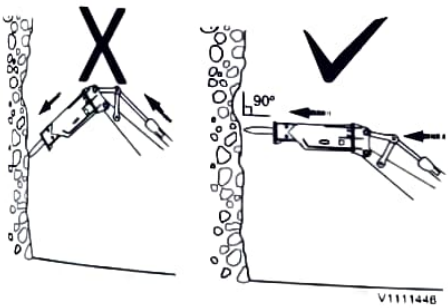
- Breaking stone
- Demolition work
- Road repairing

It is widely used for demolition of buildings, breaking road surfaces, tunneling work, smashing slag, and breaking or cutting stone.

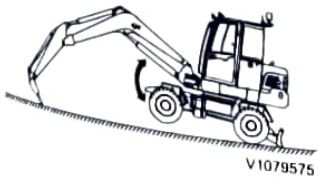
Press the tool (chisel) firmly onto the surface at a right angle as shown.



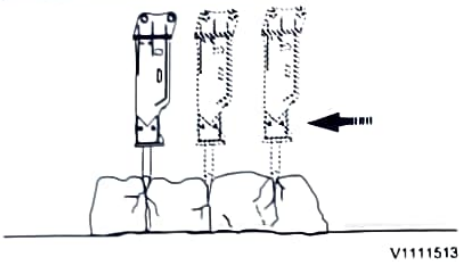
NOTE!
The standard hydraulic breaker must not be used under water. If the water fills the space where the piston strikes the tool, a strong pressure wave is generated and the hydraulic breaker may be damaged.



When striking, press the tool firmly onto the surface and lift the frame about 5cm.
Never raise the machine unnecessarily high.

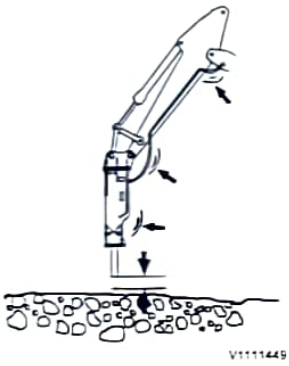


Do not raise the machine by extending the bucket cylinder to maximum.

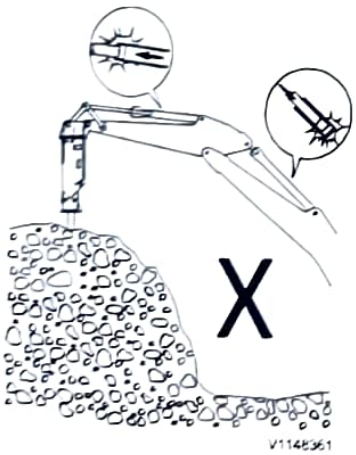


If the surface is repeatedly struck but it is not broken within 30 seconds, move the hydraulic breaker to break from the end portion.
Also If the block has not cracked after a series of approx. ten strokes, change the point of attack.

The striking direction of tool and hydraulic breaker body are slightly deviated. Therefore, adjust the bucket cylinder so that the direction of body and tool is always the same.

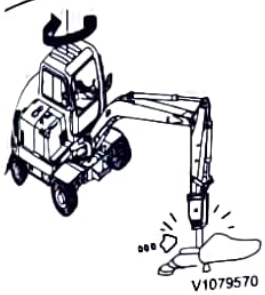


Listen to the sound of the hydraulic breaker when you are using it. If the sound becomes weaker and the impact less efficient, the tool is misaligned with the material and/or there is not enough feed force on the tool. Realign the tool and press the tool firmly against the material.
Stop operation if hydraulic hoses shaking abnormally. Immediately stop the operation. Otherwise this may result in serious failure in the hydraulic system including pumps. Check gas pressure of back head and accumulator and charge the pressure to recommended value. See the breaker manual for detail.



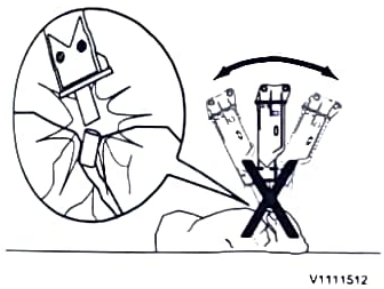
Do not operate the bucket, arm and boom cylinders to their end positions than 10 cm (4 in) to prevent cylinder's damage.

Do not swing the machine while breaking work

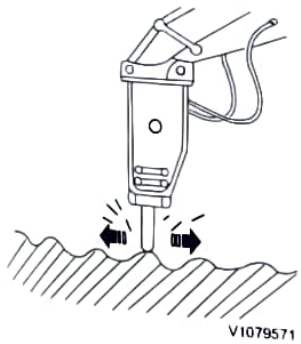


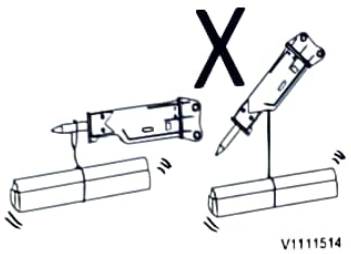
Avoid working with the hydraulic breaker horizontally or in an upward direction. This will cause great wear.

Do not bend with the tool to make a hole in the ground.

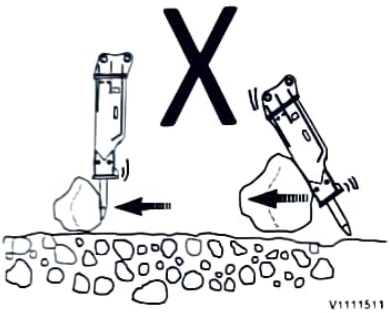


Do not break the materials using drop force of boom. The machine structure can be damaged.
Press the tool firmly against the surface so idle striking is avoided.
Do not move the tool while it is striking a blow.

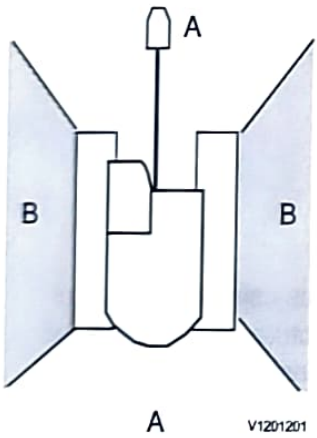




The hydraulic breaker is not designed to lift or transport loads. The hydraulic breaker may easily be damaged and it is very dangerous.

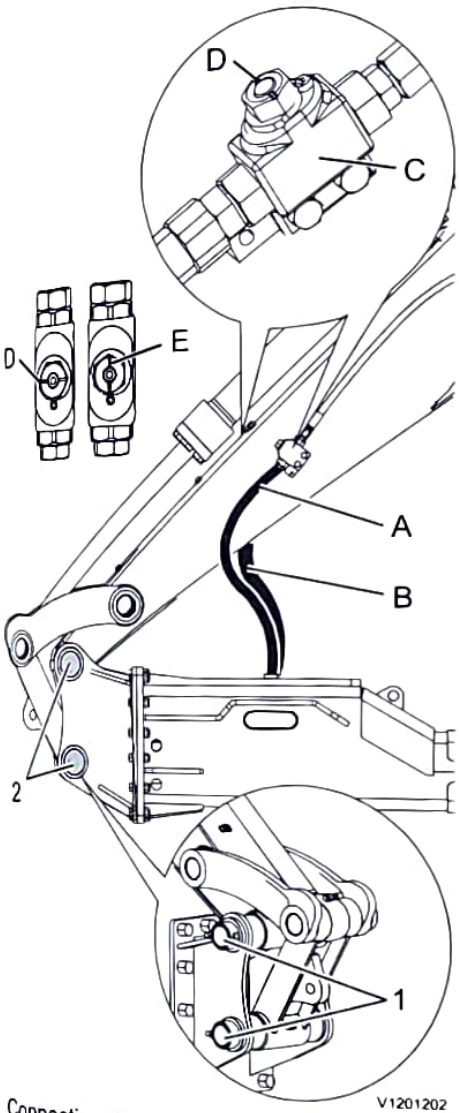


Avoid moving and gathering the objects using hydraulic breaker.



A Longitudinal direction of the undercarriage
B Across undercarriage: not recommended

The best working area is in the longitudinal direction of the undercarriage and within an approximate 45° sector in both directions (A).
Do not operate the hydraulic breaker at (B) area. The machine can be unstable and undercarriage component may be failure as a result from excessive loads on the undercarriage.



Connecting with pivot pins
1 Pivot pins
2 Fastening bores
A Pressure line
B Return line
C Stop valve
D Valve closed
E Valve open

Connecting with pivot pins

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 410000

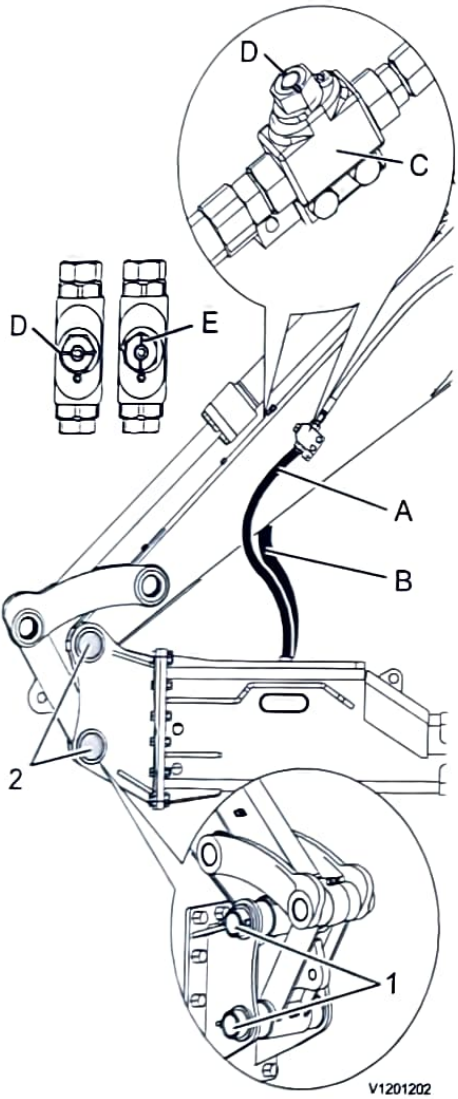
1 Place the machine on firm and level ground.
2 Slowly lower and align the boom, until fastening bores (2) of the hydraulic breaker are flush with the holes in the boom.
3 Insert pivot pins (1) into fastening bores (2).
4 Clean the hydraulic connections on hydraulic breaker and boom.

NOTICE

Protect the hydraulic connections against dirt, because only this will ensure the correct function of hydraulic connections and hydraulic system.

5 Turn off the engine and then turn the Ignition switch to running position. See page *89* for running position.
6 Move the levers in all directions to release the hydraulic pressure.
Move the lever rollers right and left if equipped.
Remove the ignition key and put the safety lever to locked position.
7 Turn the both stop valves (C) to closed position (D).
8 Connect the hydraulic hoses (pressure line (A) and return line (B)) of the hydraulic breaker to the hydraulic connections on the boom.
9 Lock the hydraulic couplings.
10 Turn the both stop valves to open position (E).

NOTE!
The machine hydraulic oil level must be checked after the hydraulic breaker has been operated for 2–3 minutes.



A Pressure line
B Return line
C Stop valve
D Valve closed
E Valve open

1 Pivot pins
2 Fastening bores

Disconnecting with pivot pins

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 410000

1 Place the machine on firm and level ground.
2 Lower the boom and place the hydraulic breaker flat on the ground.
3 Turn off the engine and then turn the Ignition switch to running position. See page *89* for running position.
Move the levers in all directions to release the hydraulic pressure. Move the lever rollers right and left if equipped.
4 Remove the ignition key and put the safety lever to locked position.
5 Turn the both stop valves (C) to closed position (D).
6 Unlock the hydraulic couplings.
7 Disconnect the hydraulic hoses (pressure line (A) and return line (B)) of the hydraulic breaker to the connections on the boom.
8 Cover the hoses with caps to prevent foreign substances from entering it.
9 Remove the pivot pins from fastening bores and then operate the attachment to be disconnected from hydraulic breaker.

Connecting to an attachment quick coupler, hydraulic

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 410000

Install the hydraulic breaker to the hydraulic quick coupler in the same way as a bucket is installed using the hydraulic quick coupler. See page *224* and *231*.

Disconnecting from an attachment quick coupler, hydraulic

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 410000

Disconnect the hydraulic breaker from the hydraulic quick coupler in the same way as a bucket is disconnected using the hydraulic quick coupler.
See page *224* and *231*.

X1 residual pressure release

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 410000

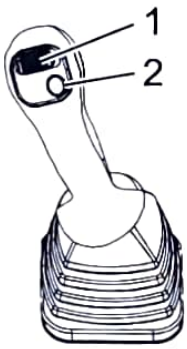
Residual pressure in X1 and/or X3 will make it difficult to disconnect or connect quick coupler when changing attachment or tools. So residual pressure should be release before disconnecting/ connecting attachment.
There are two types of instructions for residual pressure release. One is manual residual pressure release in X1/X3 and another is automatic residual pressure release in X1/X3. Follow one of below instructions.

Manual residual pressure release in X1

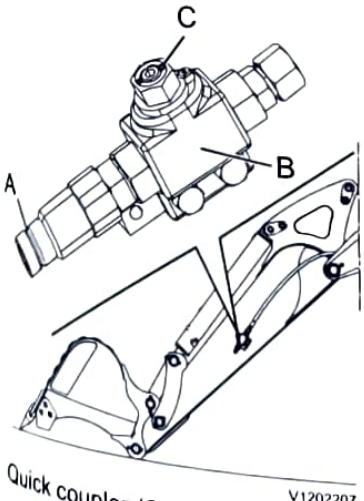
If X1 hose (A) is installed at stop valve (B)

1 Lower the attachment completely to the ground.
2 After turning off the engine, turn the ignition switch to operating (preheating) position.
3 Keep the control lockout lever to be at the unlocked position. See page *124*.
4 Push button (2) on the right control lever to select X1 function if equipped boom-swing option.

NOTE!
Stop valve should be in open position (C).

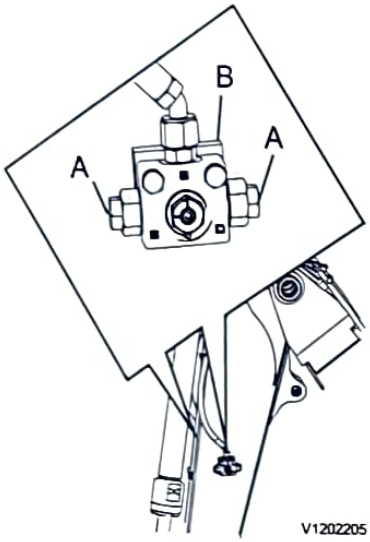


Right control lever



Quick coupler (Stop valve type)
A X1 hose line to/from attachment
B Stop valve
C Open status

5 Move proportional switch (1) from side to side five or six times (during 20 ~ 30 seconds) to release the pressure in X1 lines.
6 Turn the stop valve to closed position.
7 Disconnect the both X1 hose lines (A).



A X1 hose line to/from attachment
B 3 way valve

If X1 hose (A) is installed at 3 way valve (B) such as thumb bucket

1 Lower the attachment completely to the ground.
2 After turning off the engine, turn the ignition switch to operating (preheating) position.
3 Keep the control lockout lever to be at the unlocked position.

Right control lever

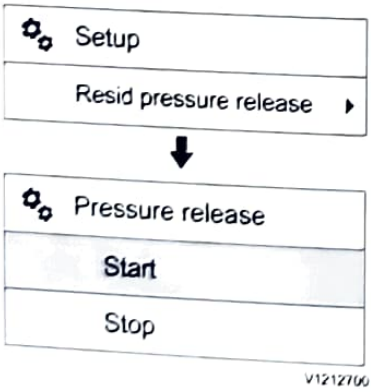
4 Push button (2) on the right control lever to select X1 function if equipped boom-swing option.

NOTE!
3 way valve should be in open position from X1 hose lines to/from disconnecting attachment.

5 Move proportional switch (1) from side to side five or six times (during 20 ~ 30 seconds) to release the pressure in X1 lines.
6 Turn the 3 way valve to closed position.
7 Disconnect the both X1 hose lines (A).

Automatic residual pressure release in X1

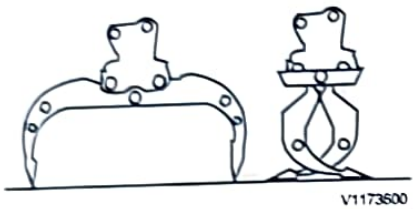
1 Lower the attachment completely to the ground.
2 After turning off the engine, turn the ignition switch to operating position (1). Refer to the page *162* for ignition switch position.
3 Activate X1 function using button on keypad and right control lever. Refer to the page *105* for X1 activation.
4 Select the Start in the I-ECU. (Menu->Setup->Resid pressure release->Start)
5 Follow the pop up message on I-ECU so that X1 return line will be connected to tank line. (Residual pressure release mechanism)



Disconnect/connect the quick coupler from/to the machine.

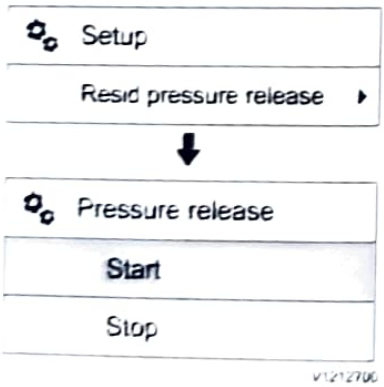
NOTE!

X1 return line is only connected to tank line for about 30 seconds. After 30 seconds the circuit will be closed. If required more time to release the residual pressure in X1, start engine and then repeat above 2 to 5 step.


V1173600

V1202206

Left control lever



V1212706

Manual residual pressure in X3

If X3 attachment is equipped, residual pressure should be released before disconnecting attachment. Follow below instructions.

1 Lower the X3 attachment to the ground as an illustration for easy disconnection of quick coupler.
2 After turning off the engine, turn the ignition switch to running position.
3 Keep the control lockout lever to be at the unlocked position. See page *124*.
4 Allocate X3 function to proportional switch (1).
5 Move proportional switch (1) from side to side five or six times (during 20 ~ 30 seconds) to release the pressure in X3 lines.
6 Disconnect the both X3 hose lines.

NOTE!
Disconnected attachment can occur the residual pressure by external load. Before connecting the attachment to the machine, push the face of female coupler using socket to release residual pressure.

NOTE!
Be careful the oil splash and not to contaminate the ground soil when pushing the female coupler.

Automatic residual pressure release in X3

1 Lower the attachment completely to the ground.
2 After turning off the engine, turn the ignition switch to operating position (1). Refer to the page *162* for ignition switch position.
3 Activate X3 function using button on keypad and left control lever. Refer to the page *105* for X3 activation.
4 Select the Start in the I-ECU. (Menu->Setup->Resid pressure release->Start)
5 Follow the pop up message on I-ECU so that X3 return line will be connected to tank line. (Residual pressure release mechanism) Disconnect/connect the quick coupler from/to the machine.

NOTE!
X3 return line is only connected to tank line for about 30 seconds. After 30 seconds the circuit will be closed. If required more time to release the residual pressure in X3, start engine and then repeat above 2 to 5 step.

Thumb

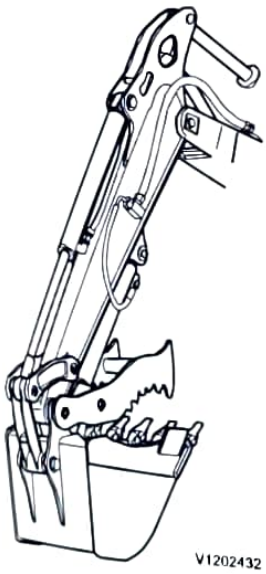
Thumb attachment

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 410000

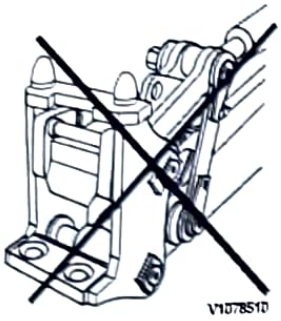
Lubricate the thumb pivot pin every 10 hours.
Check the hydraulic lines wear status every day.

Safety

Do not operate the machine until you know the function and position of the instruments and operating controls. Carefully read through this Operator's Manual, your safety is involved!
See page *105* for operating thumb bucket.

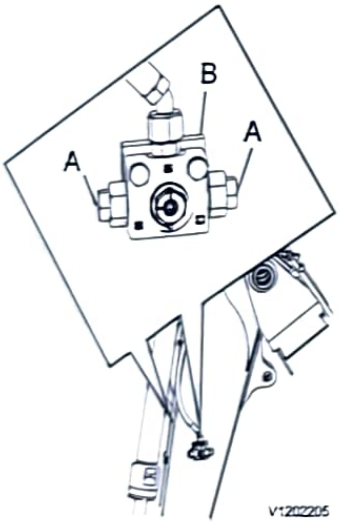

V1202432

- Prevent persons from staying in the risk zone (closer than 7 meters from the machine and its attachments).
- Wear protective equipment. If the machine has a canopy, a front protective guard must be used and operator must use safety glasses and a helmet.
- Never start the engine when the hydraulic couplings are disconnected.
- Never leave the machine with engine running and key inserted.
- Before shutting down the engine or leaving the machine, lower the bucket to the ground and open the thumb. It is dangerous to leave the thumb and bucket in the air with material inside.
- Before disconnecting or connecting hydraulic hoses the engine must be shut down. The ignition key must be switched to running position and the proportional rollers must be shifted right and left. The control levers must be shifted to all directions to relieve trapped pressure.
- To prevent damage on the components and structure, a machine fitted with thumb must also be equipped with a pressure relief valve on the accessory circuit. Check with your Volvo Dealer that your machine is properly equipped.
- The thumb is only approved for use with Volvo designed or approved buckets and attachments. If the thumb is used with other buckets or attachments, it may not work properly.



The thumb is not approved for use with this quick coupler.

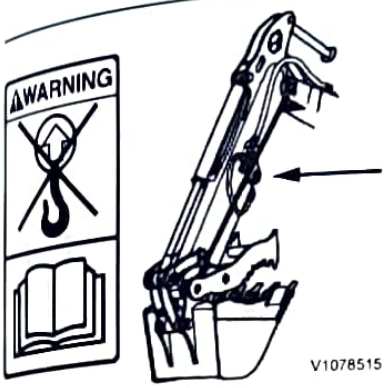
- The thumb attachment is not approved for use with the Volvo compact excavator quick coupler, shown in the image (hydraulic nor mechanical).
- If the thumb is not used for some time, disconnect the hydraulic lines to prevent thumb cylinder drift.



A X1 hose line to/from attachment (left and right side of dipper arm)
B 3-way valve for thumb attachment

Connecting and disconnecting thumb

Connect the hydraulic hose to one of ports (A) at 3-way valve (B). (located on each side of the dipper arm)
If another attachment is used, connect the hydraulic line at another port (A) and turn the 90 degree of valve where located at left and right side of dipper arm to open hydraulic circuit.
Refer to the page *247* for residual pressure releasing when disconnecting attachments.



Operating

⚠ WARNING

Risk of crushing.
A falling load could cause serious crushing. Lifting a load with the dipper arm's welded thumb plate could cause the plate to break and the load to fall. **Never use the welded thumb plate on the dipper arm as a lifting device.**

NOTE!
Refer to lifting capacities chart before using the thumb attachment.

Lower the bucket to the ground before shifting from thumb mode to boom swing (offset) mode. No flow is sent to the thumb to maintain pressure in boom swing mode and the load may fall out from the bucket.

Hose rupture valves

(Optional equipment)

⚠ WARNING

Risk of crushing.
A raised attachment could fall and cause crushing injury.
Before leaving the cab, always lower all attachments to the ground and lock the control functions.

NOTICE

Do not dismantle the hose rupture valve as it is pressurised. Contact a workshop authorised by Volvo if problems arise.

If the machine is equipped with hose rupture valves, it will reduce the falling speed of the boom if a hose bursts.

Attachment lowering after hose rupture

When engine is running

Lower the boom or arm with the operating levers in the usual way. Collect the oil from the ruptured hose in a suitable vessel.

When engine is stopped

The servo hydraulic pressure is maintained by a pressure in accumulator for a few minutes, which permits the operator to lower the boom or arm in the usual way with operating levers. Do not wait too long to lower the boom, the pilot pressure will reduce at a speed depending on your machine's condition and equipment. Collect the oil from the ruptured hose in a suitable vessel.

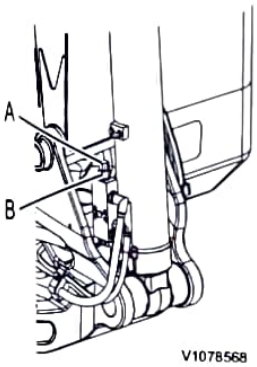
When engine is stopped and with no servo hydraulic pressure

⚠ WARNING

Risk of burns.
Hot oil can cause severe burns to unprotected skin.
Always wear personal protective gloves, goggles and clothing when handling hot oil.

⚠ WARNING

Risk of high pressure injection.
Residual pressure in the hydraulic system could lead to serious injury. Oil under high pressure can jet out, even if the engine has not been running for some time.
Always release the pressure and ensure the ignition switch is in the off position before you perform any service of the hydraulic system.



1 Loosen lock nut (B) a bit and turn adjusting screw (A) counter-clockwise slowly.

   NOTE!
   Before turning the adjusting screw, mark its position to facilitate assembling later (setting pressure : 250 kgf / cm²)

   The boom will then slowly be lowered to the ground.
2 Turn adjusting screw (A) to its original position.
3 Hold adjusting screw (A) securely and tighten lock nut (B).
4 Contact an authorized Volvo CE dealer workshop.

Lifting objects

Valid for serial numbers		
Model version	Serial number start	Serial number stop
EW60E	Changwon 314001	Changwon 410000

If the machine is used to lift objects within an area that is governed by the European Machinery Directive 2006/42/EC and its amendments, the machine must be equipped with following safety working devices.

- A load hooking device.
- A hose rupture valve on the boom or in some countries hose rupture valve on both boom and arm is required depending on risk assessment. See page *254*.
- A overloading warning device. See page *89*.

Safe lifting make great demands on the operator. Read the below recommended steps before starting any lifting.

- Use qualified and properly trained operators who have:
  - Specific machine knowledge and training.
  - Read and understand the operator's manual and its load charts.
  - Specific machine knowledge and training how to properly rig the load.
  - Full responsibility for all aspects of the lift.
- Interrupt the lift if not fully confident of a safe lift.
- Select machine with sufficient capacity for the total expected load, reach and swing. Ideally, load should be less than the load listed on the load chart at maximum reach across the undercarriage.

- Know the mass (weight) of the item to be lifted.
- Know the start and finish positions, load lifting position and setting position.
- Know the machine configuration, especially the dipper arm and boom lengths and counterweight mass.
- Choose the correct lifting chart taking into account all attachments and rigging materials that will be used during the lift. The weight of the rigging materials and attachments, should be deducted from the load capacity.

■ Warm up the machine to normal working temperatures.

■ Position the machine on firm level ground.

■ Properly set outriggers and dozer blade when applicable.

■ Once the load is properly rigged, ensure all ground workers are clear of the load and the machine. If guiding of the load is necessary, use ropes or other type of slings tied to the load to keep ground workers at a safe distance.

■ Use a trained signalman to direct all aspects of the move.

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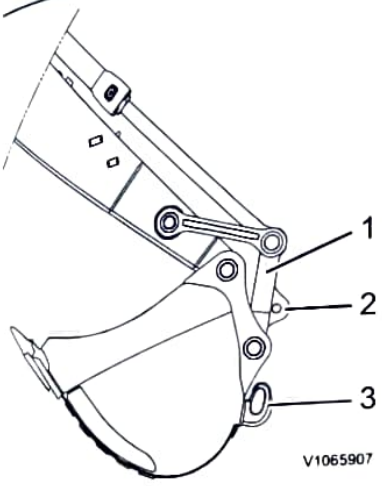
Recommended condition
- Solid and flat ground
- Dozer blade - down position
- Without attachment - for better visibility and maximum lifting capacity

NOTE!

It is the responsibility of the owner or the operator to know and follow the local or national regulations that apply for lifting operations. For further information, contact your dealer.

Keep the following in mind to ensure the highest level of controllability and safety when lifting.

- Operate on solid, flat, level ground.
- If ground conditions are unstable, for example loose gravel, sand or water, do not work with loads close to the rated load maximums given on the machine load chart.
- Do not swing the excavator abruptly with a suspended load, the effects of centrifugal force will impair machine stability.
- Do not use the swing or arm-in operation to drag a load.
- Do not operate the machine while someone is hanging on or in the bucket or attachments

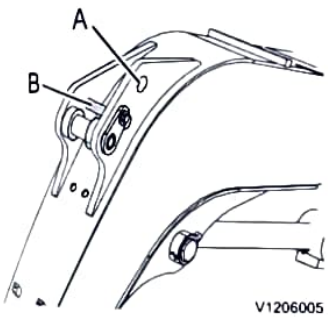


1 Connecting rod
2 Lifting device on connecting rod
3 Lifting device on bucket

1 Load hooking device on bucket or attachment bracket

The lifting device whether mounted on a bucket or other attachment must not be subjected to lateral loads. The load must be applied longitudinally to the hook.
Always ensure that the load lies within the marked permissible lifting load of lifting device when manoeuvring the arm and bucket.
Exceeding these limits can cause serious injury.
Remember that the operator is responsible in case of an accident.

NOTE!
This represents the capacity of the hook and not the rated load capacity of the machine which varies according to ground conditions, reach, track position and so on.



A Hole for machine lifting
B Bar

NOTE!
Only use lifting device recommended by Volvo in order to avoid damage to the machine. Contact your dealer for information regarding other lifting device.

NOTE!
Bar (B) is for structural reinforcement purposes. Do not use other purpose such as machine lifting.
For more detail regarding machine lifting, see page *199*.

2 Load hooking device on connecting rod

Lifting device on connecting rod is designed to lift the maximum load as the one described on catalog.

Overload warning

NOTICE

The overload warning does not give the actual machine limit, but constitutes an indication of a potential risk of tipping over in case of deteriorating stability.

The overload warning is engaged and disengaged using the button on the machine control keypad, see page *89*.

NOTICE

The overload warning must always be engaged when lifting a suspended load.

When an overload is registered, the central warning lamp and the control lamp illuminate on the I-ECU and the buzzer sounds. When digging, the overload warning should be disengaged.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Overload warning (Red)

Overload warning pressure

Default pressure of the overload warning system is 110 bar (1595 psi).

NOTE!
Overload warning pressure must be below the rated lifting capacity in accordance with European Machinery Directive 2006/42/EC, local and/or national government regulations. Contact your local Volvo dealer for more information.
If the default pressure needs to be adjusted in accordance with local and/or national government regulations, contact a qualified service technician.

⚠ WARNING

Risk of accidents.
Overloading could lead to a turnover of the machine or to falling load and attachments.
Do not exceed the machine's maximum lifting capacity and never ignore the overload warning.

Lifting capacities are based on the machines with following conditions:

- Lifting point: At the dipper arm end, without bucket

- Operator and all fluids (e.g., all the lubricants and fuel in the fuel tank are fully topped up.)
- Dozer blade/stabiliser is up (if equipped).

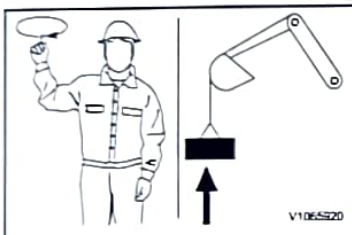
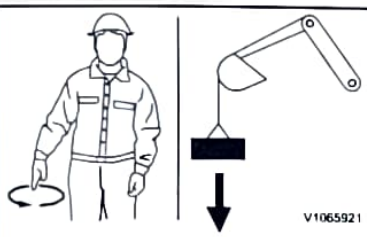
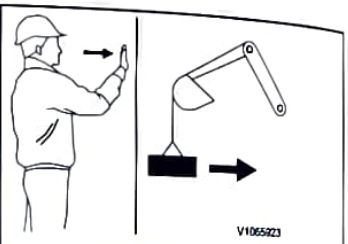
The values in the lifting capacities are in compliance with ISO10567. Rated loads do not exceed 87% of hydraulic lifting capacity or 75% of tipping load. See page *413* for more information.

Overload warning system, checking

NOTE!
A check of the overload warning equipment must be carried out every 1000 hours, see page *325*.

Signalling diagram

Manual signalling to operator of a mobile excavator as per SAE J1307.
The primary use of hand signals is for a signalman to direct the lifting, handling, and placement of loads attached to working equipment. Hand signal usage may also be applicable to earthmoving operations and/or machine travel when the operator's visibility is obstructed.
If a rapid lifting, lowering or moving movement is required, the dipper arm movements should be carried out more lively. If two different machines are used for lifting the same load, there should be an agreement beforehand how the lift should be carried out and what signals should be given to the respective operators.

<table>
<tr>
<td>  </td>
<td>  </td>
<td>  </td>
</tr>
<tr>
<td>RAISE LOAD VERTICALLY
With either forearm vertical, forefinger pointing up, move hand in small horizontal circles.</td>
<td>LOWER LOAD VERTICALLY
With either arm extended downward, forefinger pointing down, move hand in small horizontal circles.</td>
<td>MOVE LOAD IN HORIZONTALLY
With either arm extended, hand raised and open toward direction of movement, move hand in direction of required movement.</td>
</tr>
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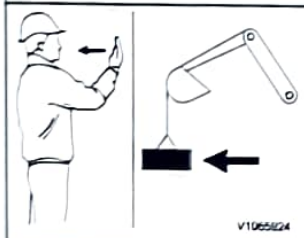
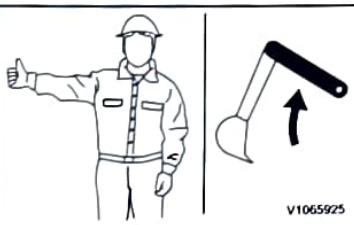
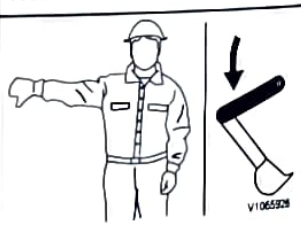
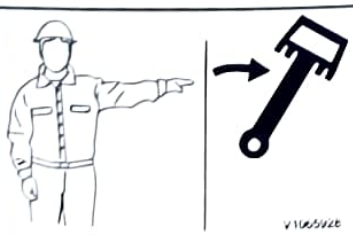
<td>  </td>
<td>  </td>
<td>  </td>
</tr>
<tr>
<td>MOVE LOAD OUT HORIZONTALLY
With either arm extended, hand raised and open toward direction of movement, move hand in direction of required movement.</td>
<td>RAISE BOOM
With either arm extended horizontally, fingers closed, point thumb upward.</td>
<td>LOWER BOOM
With either arm extended horizontally, fingers closed, point thumb downward.</td>
</tr>
<tr>
<td>  </td>
<td>  </td>
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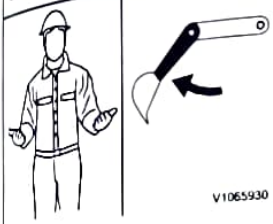
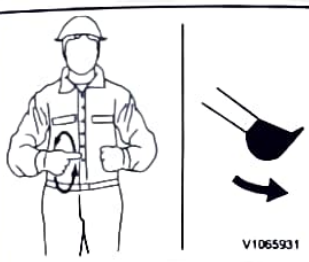
</table>

SWING
With either arm extended horizontally, point with forefinger to direction of swing rotation.

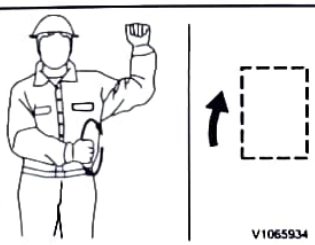




DIPPER ARM INWARD
With both hands clenched, point thumbs inward.

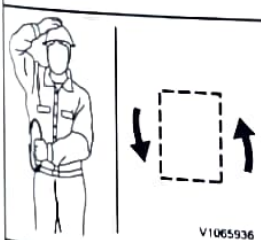
DIPPER ARM OUTWARD
With both hands clenched, point thumbs outward.

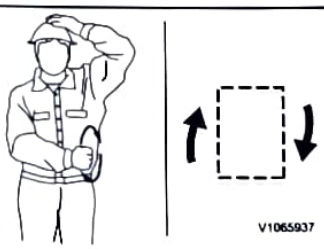
CLOSE BUCKET
Hold one hand closed and stationary. Rotate other hand in small vertical circle with forefinger pointing horizontally at closed hand.



OPEN BUCKET
Hold one hand open and stationary. Rotate other hand in small vertical circle with forefinger pointing horizontally at open hand.

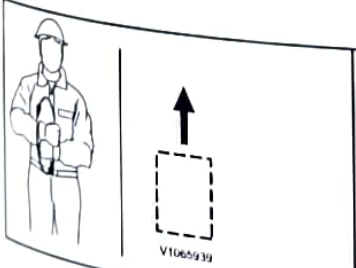
TURNTHIS FAR TO GO
Raise forearm with closed fist indicating inside of turn. Move other fist in vertical circle indicating direction of track or wheel rotation.

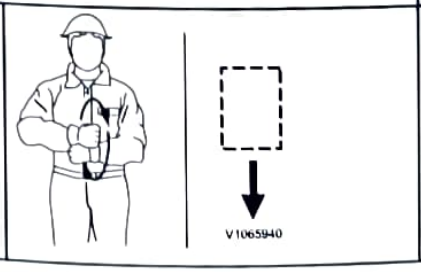




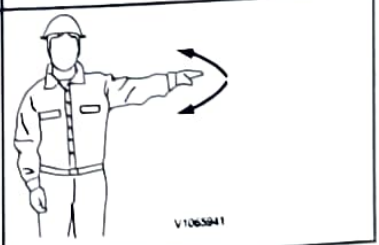
THIS FAR TO GO
With hands raised and open inward, move hands laterally, indicating distance to go.

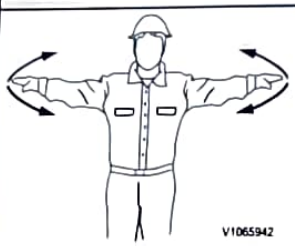
COUNTER ROTATE
Place hand on head indicating side or reverse track or wheel rotation. Move other hand in vertical circle indicating forward rotation of other track or wheel.





MOVE SLOWLY
Place one hand motionless in front of hand giving motion signal. Raise load slowly is shown.



TRAVEL Raise forearm with closed fist indicating inside of turn. Move other fist in vertical circle indicating direction of track or wheel rotation.		**STOP** With either arm extended laterally, hand open downward, move arm back and forth.
		
EMERGENCY STOP With both arms extended laterally, hands open downward, wave arms back and forth.	**STOP ENGINE** Draw thumb or forefinger across throat.	

Safety when servicing

This section deals with the safety rules which should be followed when checking and servicing the machine. It also describes the risks when working with unhealthy material and ways to avoid personal injuries.
Further safety rules and warnings texts are given within the respective sections.

⚠ WARNING

Risk of burns!
Hot machine parts could cause burns.
Allow hot machine parts to cool before performing adjustments or service. Wear personal protective equipment.