Introduction

Foreword

This manual is intended to assist with the training of new operators. It is not intended to replace the operators manual supplied with the machine. Any information required should only be taken from the operators manual.

Note before starting the machine!

It is the responsibility of the owner / employer to ensure that the operator can use the machine safely. Before starting the machine, both the supervisor and operator must have read and understood the Brokk manual so that they understand:

The safety instructions which apply to the machine

What the machine is intended for and what it is not equipped to deal with

How to maintain, use and operate the Brokk machine

How to follow the instructions to prevent personal injury and damage to the machine.

Modifications

At the request of the owner, the machine can be modified during manufacture. These modifications are handled as additions to the standard documentation and can be found behind the tab divider in the folder. Always check what modifications have been made to the machine by reading the relevant additions.

Ordering spare parts

When ordering spare parts it is extremely important to know what modifications have been made to the machine. There may be sections in the standard documentation that are similar to the modified machine which may cause the wrong spare part to be ordered. Always read the modified section, which supersedes other sections, before ordering.

Manufacturer's conditions

- Brokk AB reserves the right to change the specifications and instructions of the machines without prior warning.
- The machine must not be modified without written permission from the manufacturer. The owner takes responsibility if the machine is modified after delivery from Brokk, and without written permission from the manufacturer. Modification may cause new risks to the operator, machine and surrounding area. For example these could be a reduction in rigidity or defective protection. It is the responsibility of the owner to specify the modifications to be carried out and to contact the machine supplier for approval before starting any such modification.

Guarantee conditions

The following points must be met before a claim application can be requested:

- In order to be processed, a claim must be made within 14 days of the repair being completed at the latest.
- If a damaged component can cause further damage to the machine, Brokk AB must be informed immediately. If this is not done, the warranty does not cover any subsequent damage.
- Brokk AB is only liable for Brokk original components. The liability does not cover faults that have occurred due to accidental damage, modifications, misuse or incorrect usage.
- Regardless of what warranty conditions may apply locally and providing no other agreements have been made, Brokk AB's warranty period for new standard products is 12 months from delivery to end user, or a maximum of 1000 operating hours, whichever occurs first. If the start date is not reported to Brokk AB, the delivery date from Brokk AB's factory applies.
- Brokk AB's responsibility for claims regarding failures in the design, materials or manufacture is limited to replacement of the faulty component. In the event that specialist knowledge is required to replace a faulty component, Brokk AB will remove the old component and install the new one. Where specialist knowledge is not required, Brokk AB has fulfilled its responsibility when the repaired or replaced component is supplied to the purchaser.
- Brokk AB's responsibility does not cover normal wear or degradation. Brokk AB is not liable for faults or breakdowns caused by incorrect or defective maintenance, incorrect repairs, problems caused by dirt, water or particles in the hydraulic system or insufficient power supply. The equipment must be used and maintained in accordance with the instructions in the Brokk manual.
- Brokk AB's warranty for replacement parts applies for 12 months from installation or a maximum of 18 months after delivery from the factory, whichever comes first.
- Examples of components that are not normally covered by the warranty: Cylinders, hoses, chisels for hydraulic breakers, buckets, rubber feet, caterpillar tracks, bearings etc.
- Warranty conditions in accordance with ORGALIME S 2000.

Warning levels

Warnings concerning safety are given in four different levels shown below.

DANGER!
DANGER indicates that an accident **will** take place if the directions are not followed. An accident may lead to severe or even lethal personal injury and severe damage of property.

Warning!
Warning indicates that an accident **may** take place if the directions are not followed. An accident may lead to severe or even lethal personal injury and severe damage of property.

!

Caution!
Caution indicates that an accident **may** take place if the directions are not followed. An accident will cause personal injury or damage to property.

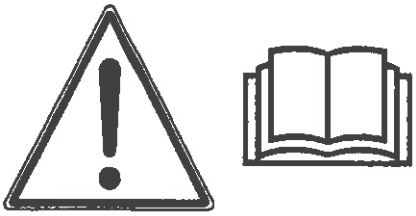
NB! **NB!** indicates risk for breakdown if the directions are not followed.

Always adhere to the warnings given in this manual and on the machine to prevent accidents or incidents arising. The same applies to warnings/instructions at each work place.

Safety regulations

General

- The operator must read and understand the instruction manual and the directions on signs and labels before putting the machine in service.
- The operator must have the relevant training and experience in order to carry out the task safely.
- The employer and operator are responsible for ensuring that national and local legislation, regulations and other directions are followed when the machine is being used.



Range of uses

Brokk machines are designed exclusively for demolishing work with attachments designed for this specific purpose. The manufacturer cannot be held responsible for damage caused by incorrect use, unsuitable attachments or the use of non-original spare parts.

The machine must not be used for purposes for which it was not intended or that are unsuitable, i.e. handling that causes damage to property or persons.

The machine must not be operated in premises classed as an "explosion hazard".

Since Brokk machines can be used for many different applications, it is essential that the operator's protective equipment is adapted to the conditions in question in each case. Examples of fields of work demanding specialist knowledge and special protective measures:

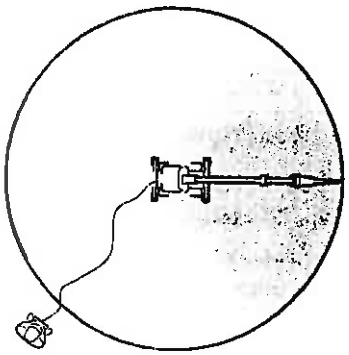
- working on ladles and kilns in extremely hot environments
- demolishing refractory brick linings
- demolishing radioactive installations in nuclear power plants.

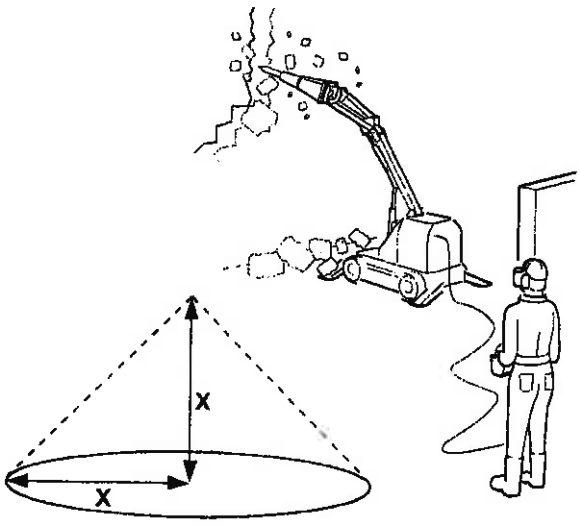
It is essential that working methods be adapted to the actual conditions.

The operator must observe safety precautions at all times while operating the machine and always think ahead.

The most important safety aspects for the operator are to:

- read and understand the instruction manual
- use the necessary personal protective equipment
- stay outside the working range and risk zone of the machine.
- stand in a position that is not affected by the demolishing work (splinters, falling objects, risk of collapsing, etc.)
- make sure nobody comes within the working range and risk zone of the machine or where there is risk of falling or flying objects.





Protective equipment

Because Brokk machines can be used in a variety of environments and for different applications, the protective equipment must be suitable for the working conditions. The operator and supervisor must evaluate what protective equipment is required. The following equipment is only an example.

Personal protective equipment

The following is recommended as basic protection:

- hardhat with eye protection and ear defenders
- thick overalls
- protective gloves
- safety footwear

Attention. Danger. Use personal protective equipment

Other protective equipment

- Safety harnesses and stands for control units must be used when working at height or where there is risk of collapse. The operator and machine must be secured using separate harnesses.
- Breathing masks, gas masks or airstream helmets must be used in environments where the inhaled air is harmful to health.
- Heat shields and appropriate protective clothing must be used when working in hot environments.
- Barriers must be used to mark out the risk zone of the machine.
- Safety equipment must be used to secure machine components during repairs or service.

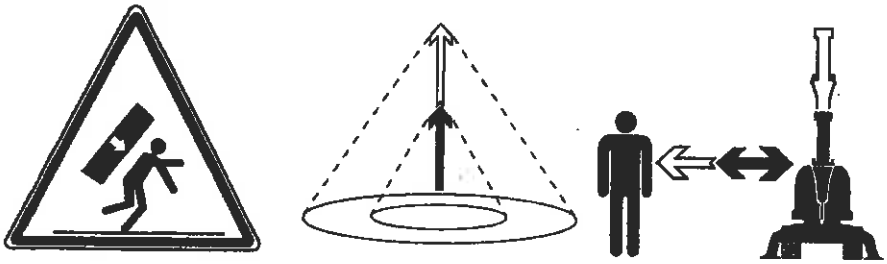
Attention. Danger. Use protective equipment appropriate to the work

Positioning in relation to the machine

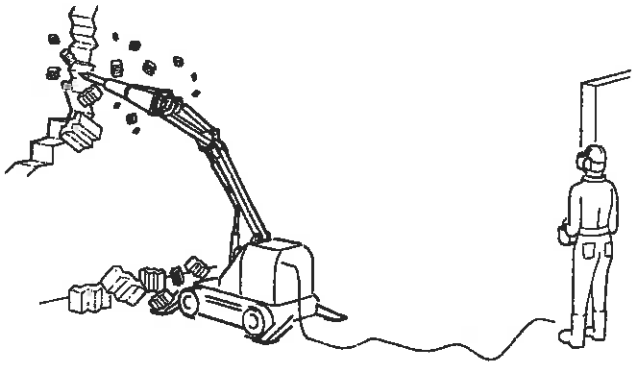
A remote controlled machine does not have a designated driver's position, therefore, the basic rule is never to stand within the risk zone of the machine during operation. Identifying the risk zone can be difficult. The risk zone can vary depending on the object being worked on, the materials, the working method and the tools used. Furthermore, the risk zone can vary during the course of the work.

Think ahead! The operator must decide on a safe control position at every job. Use the safety principle, no job is worth risking your own life, or the lives of others.

Continually define the risk zone during work. Neither the operator, nor surrounding personnel are permitted within the risk zone during work.



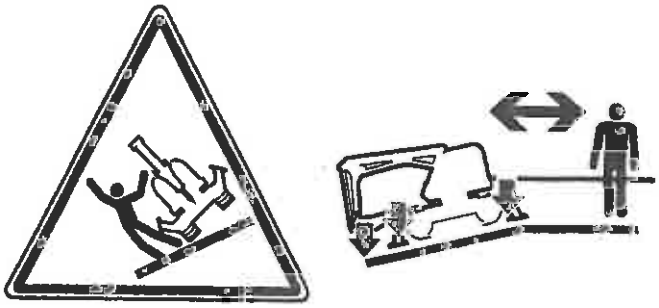
Attention. Danger. Keep your distance from the machinery depending on the size of the risk zone. The size of the risk zone varies



Position yourself outside the risk zone of the machine, preferably protected behind a wall or pillar.

When moving the machine on a flat surface always walk behind or to the side of the machine, if there is sufficient room. When operating or moving the machine on an inclined surface position yourself uphill of the machine.

Do not begin any work before you are sure of your own safety and the safety of your surroundings.



Risk of compression or crushing injury. Outriggers must be slightly deployed when moving. Anchor the machine. Keep your distance

Risks factors when demolishing

It is essential that the operator is familiar with the machine functions and characteristics. The demanding tasks performed by the machine also means that it is essential to always "think safety" while working.

Since the machines are used in many different environments, it is impossible to give general guidelines and warnings for all possible risks. This means that a great responsibility rests on the operator and supervisor and their judgement and ability to identify possible risks before and during the job. Experience of demolishing work, prudence and thinking safety are decisive for working with demolishing equipment without exerting personnel and equipment to unnecessary risks.

The environment the machine is working in often involves various risk factors:

- demolition of structural elements with associated risks.
- placing a heavy machine on floors of doubtful strength or close to shafts, see illustration 1
- placing the machine on rubble where it can tip over, see illustration 2
- moving up or down stairs or ramps, see illustration 2
- demolition where hazardous electrical, gas and fluid lines may be concealed in walls or floors, see illustration 3
- falling objects
- cutting material that splinters and flies around in an uncontrollable manner, see illustration 4, etc.

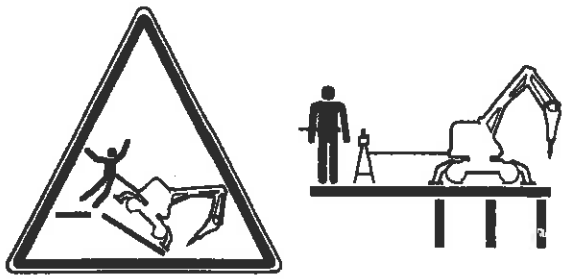


Illustration 1

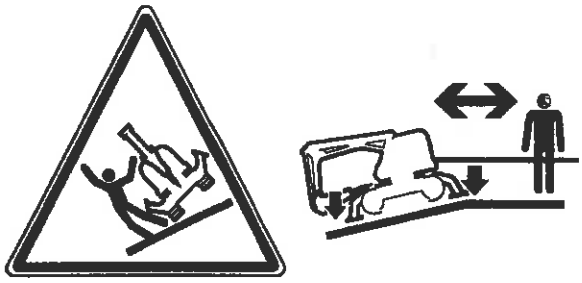


Illustration 2

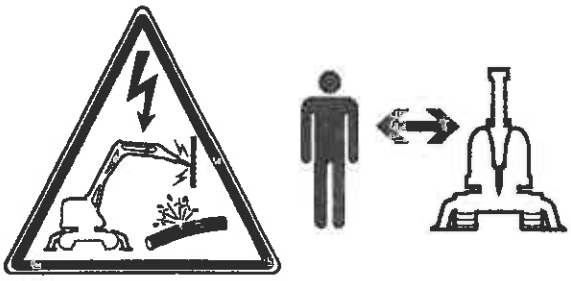


Illustration 3

Illustration 4

Supervisor and operator responsibility

Constructional aspects must be taken into consideration by the supervisor/operator when commencing demolishing work.

- Make sure the surface is able to withstand the weight of the machine and the forces arising from the attachments being used.
- Investigate the consequences of pulling down structural elements.

  Take necessary safety precautions: bracing, trussing and correct order when pulling down structural elements.
- Plan the order in which to perform the various demolishing procedures.
- Check and mark where cables are run and make sure cables in walls/floors being demolished are disconnected, see illustration 1.
- Ensure the mobility of the machine in the workplace.
- When moving/operating the machine on a ramp or staircase, the machine must always be secured. Make also sure that the ramp/staircase is strong enough to support the weight of the machine, see illustration 2.
- The operator must have access to personal protective equipment, including a safety line and stand, if there is the slightest risk of falling, see illustration 3.
- The operator must be informed of any risks (location of structural elements, floor strength, live power cables).

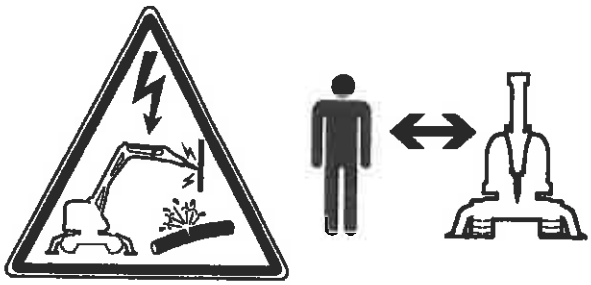


Illustration 1

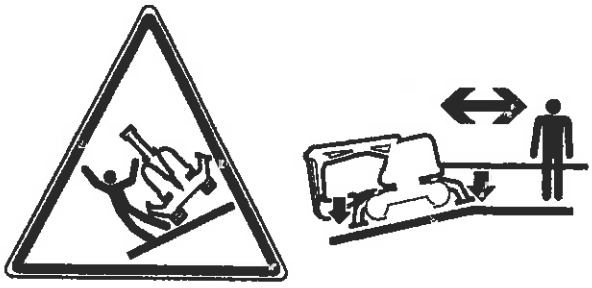


Illustration 2

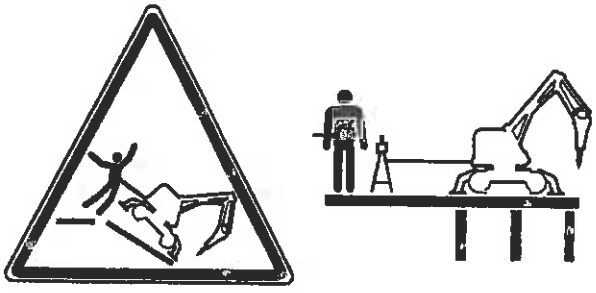


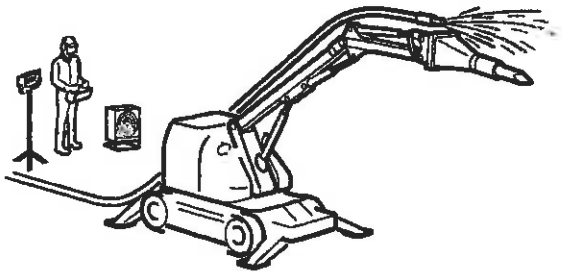
Illustration 3

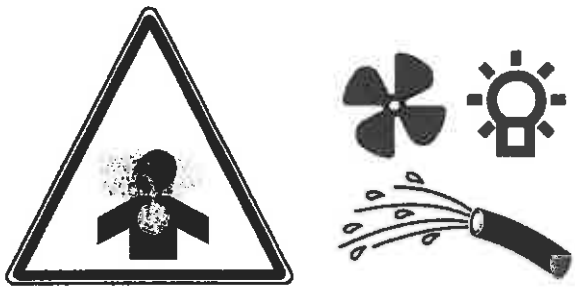
Work environment

National and local regulations must always be followed. This can apply to e.g. demands for special protective equipment, sound and vibration levels, the use of breathing apparatus, cordoning off, etc. Local regulations can be checked with the safety representative.

Other important aspects include observing and attending to the work environment that arises during demolishing in the best way possible. Naturally, personal protective equipment must be used. Remember that the dust that arises may be a health hazard - always use breathing apparatus.

The air in confined areas or in hollows may deteriorate rapidly due to exhaust fumes. Provide good ventilation. A good working light can be a decisive factor with respect to working safely and with good vision.



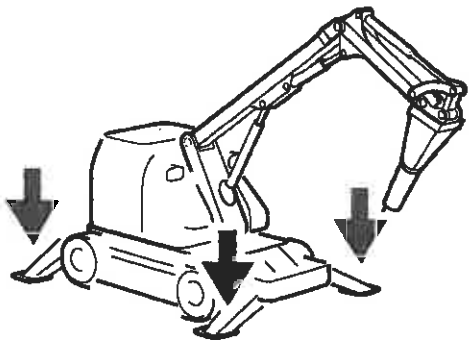


Stability

The machine stability can vary considerably depending on how it is standing and on the weight of the attachment being used.

During operation, the machine must be standing as level as possible and the outriggers must be fully lowered.

However, it may be impossible to work with the outriggers fully lowered on certain occasions. This can apply in confined areas, when moving or when working close to an obstruction. It is essential to be aware of the fact that machine stability deteriorates when the outriggers are not fully lowered. The working range will be limited and procedures must be adapted to these circumstances. The machine can tip over if the arm is slewed outside the range of the outriggers/tracks, i.e. the arm may only work in a forward direction, not to the side.



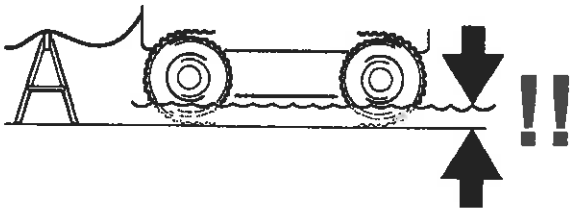
The same problem may occur when machines with track drive are working with narrow track width or with the outriggers folded back. Safety in these circumstances is greatly affected by the operator and his judgement.

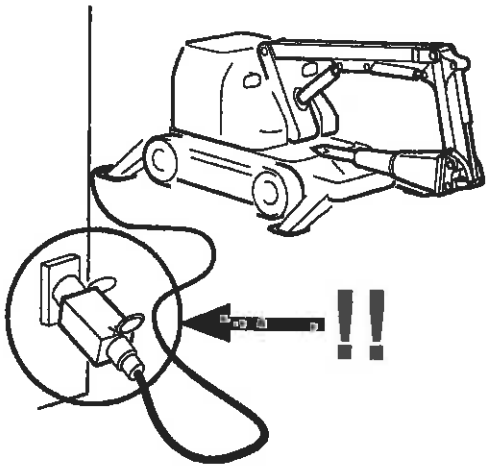
There is a risk of the machine tipping while working with the machine standing on debris and rubble when not all the outriggers are on stable ground.

Always anchor the machine when working on inclines.

Electrical safety

- **Handle electric equipment with great respect. This applies also to cables and connectors.**
- **Always connect the machine through an earth fault relay, 30mA.**
- The machine must never be moved into deep water so that the water reaches up to and enters connectors, power cables, the electric motor or any other electric equipment that may then be damaged.
- Check that the voltage and fuse values are correct before connecting the machine's supply cable.
- Make sure the supply cable is not damaged.
- Damage to electric cables may interfere with the machine function and cause mechanical parts to become live.
- The electric cabinet must not be opened while the machine is connected to the mains. Certain parts of the electric cabinet are always live.



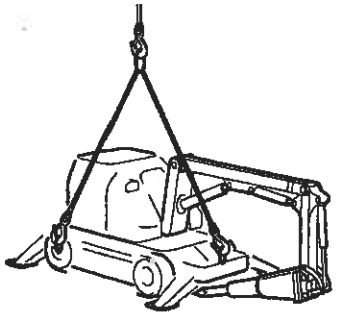


Radio

If several radio-controlled machines are working in close proximity to each other and transmitting on the same frequency, they may block out each other.

Transporting and moving

- Lifting devices may be used only on specified points, see chapter "Handling, Transporting and lifting". The machine may not be lifted by the arm system, see illustration 1.
- Check that the lifting device and the lifting tools that are used are free from faults and are approved for the weight of the machine.
- Make sure nobody is under the machine or in its vicinity when it is suspended.
- Always secure the machine when transporting it on a vehicle as described in the section on handling, see illustration 2.
- Check local regulations concerning the fastening of loads.
- Connecting equipment to the machine, e.g. a diesel generator, and towing it is forbidden (does not apply to MiniCut).
- The arm must be folded when the outriggers are raised.
- When moving the machine, the arm may be used in certain circumstances to lift the driving wheels over uneven surfaces. Due to the risk of tipping, the arm must never be slewed or lifted high, see illustration 3.
- Lower the outriggers so they are positioned just above the surface when moving on uneven surfaces.
- Certain machines have a pair of freewheels. These machines must not be operated with the freewheel pair first down stairs or ramps.
- Use the arm as extra support when moving on inclining surfaces (in the direction of travel), see illustration 4.



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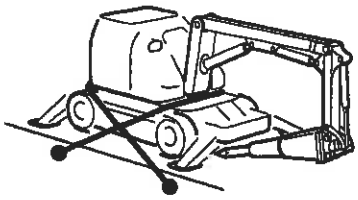

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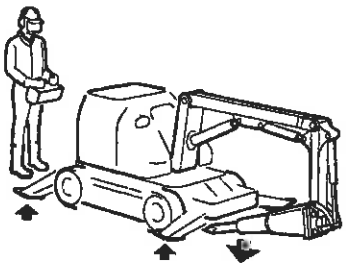

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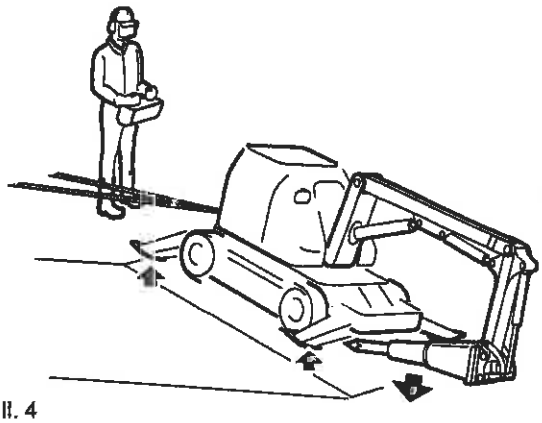
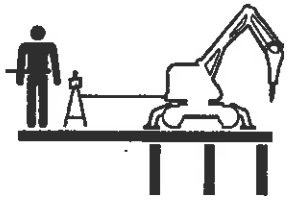


Ill. 4

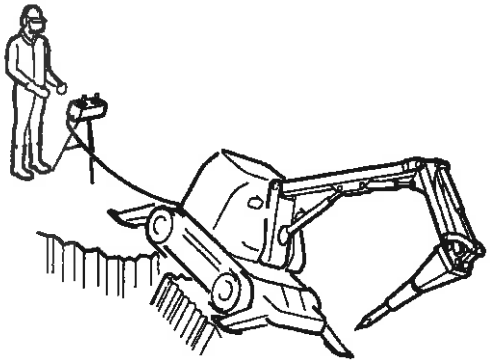
- **Anchor the machine when operating on inclined planes/ramps.**

Always stand above the line of the machine when working on an incline to avoid the risk of being crushed. The machine may slip on the surface.



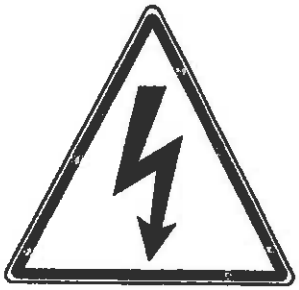
- **Always concentrate on the machine while the control circuit is on. Wait until the control circuit has turned off (indicator H3 goes out) before entering the working range of the machine.**

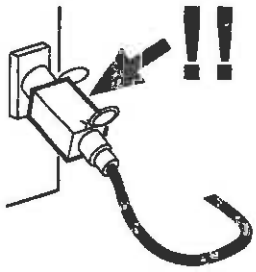
Moving the control cables or any other actions that may inadvertently move the control levers and thereby also the machine while the control circuit is on may cause fatal injury.



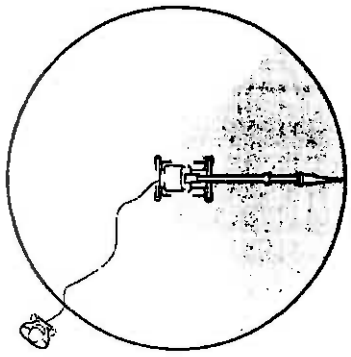
- **The operator must always be separated from the control box when moving the machine where there is risk of the machine falling over.**

Before operation





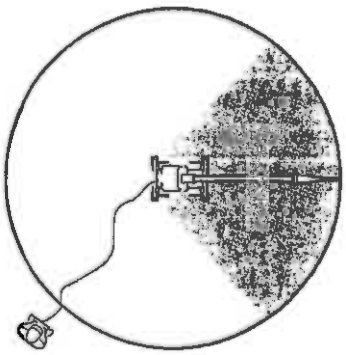
- Always connect the machine through an earth fault relay, 30mA.
- Check that the voltage and fuse values are correct before connecting the machine's supply cable.
- Check that the supply cable is not damaged before connecting it and while work is being carried out.
- Make sure nobody is standing within the working range of the machine.
- Make sure the machine is standing firmly.
- Follow the instructions carefully when changing attachments.



Changing attachments manually while the control circuit is active may cause fatal injury.

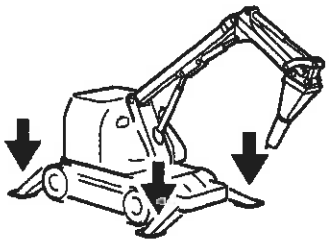
During operation

- Note that the operator is always responsible for ensuring that the correct part of the building is demolished and that vibration from the hydraulic breaker does not cause cracks to form in other places in the building or that loose stone or other material does not come loose and cause damage to property or person.
- Never stand within the working range of the machine, see illustration 1. A burst hydraulic hose or an incorrect manoeuvre can have serious consequences.
- Always concentrate on the machine while the control circuit is on. Wait until the control circuit has turned off (indicator H3 goes out) before entering the working range of the machine.



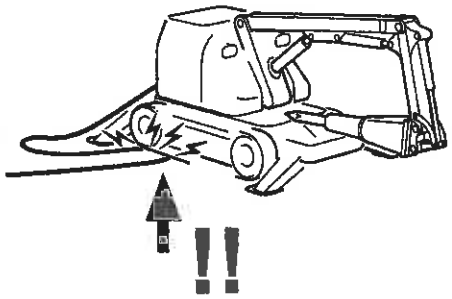
Ill. 1

Moving the control cables or any other actions that may inadvertently move the control levers while the control circuit is on may cause fatal injury.

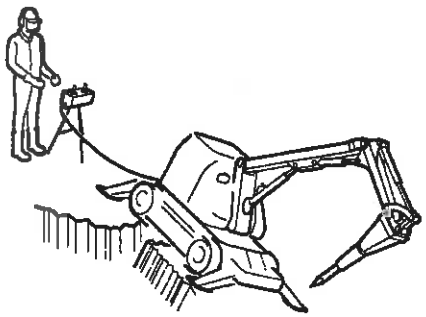


Ill. 2

- Always operate the machine with the outriggers lowered, see illustration 2.
- Do not stand on the control or power supply cables.
- Always keep the power and control cables away from the working zone.
- Make sure the control and power cables are not run over while moving the machine, see illustration 3.
- The operator must always be separated from the control box when working where there is risk of the machine falling over, see illustration 4.
- Never stand under a raised arm.
- Stand in a position that is not affected by the demolishing work (splinters, falling objects, risk of collapsing, etc).

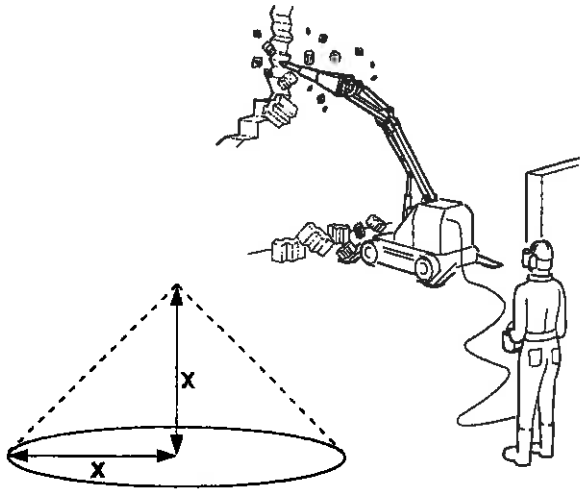


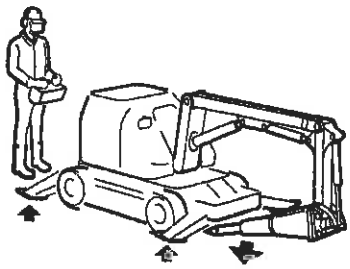
Ill. 3



Ill. 4

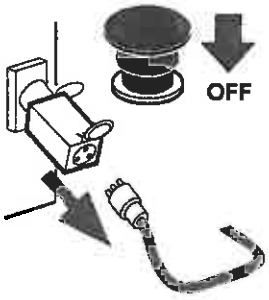
- Observe the risk of flying splinters.
- When cutting at an inclined angle, the demolition waste can be spread over an area roughly as large as the distance up to the spot being cut.
- **Never stand where there is a risk of being jammed between the machine and a wall or pillar, for example. Note that the position of the machine can change rapidly due to unforeseen external forces.**
- Observe the risk of being jammed in the machine's moving parts, under wheels/tracks or under outriggers when the machine is being turned round and when changing attachments.
- On certain models, it is possible to angle in the outriggers slightly or reduce the track width when working in confined areas. On these occasions, the arm must not be slewed outside the outriggers/ tracks.
- Note that machine stability changes depending on the weight of the attachment being used and the overhang of the arm.
- Always stand above the line of the machine when working on an incline. The machine may slip on the surface.
- Press down the safety stops before taking off the control box and when leaving the machine unattended.





After operation

- Always place the attachment on the floor or the ground after finishing work.
- Press down the safety stops before taking off the control box and when leaving the machine unattended.
- Turn off the power supply to the machine.
- Always store the control box safely to prevent operation of the machine by unqualified persons.

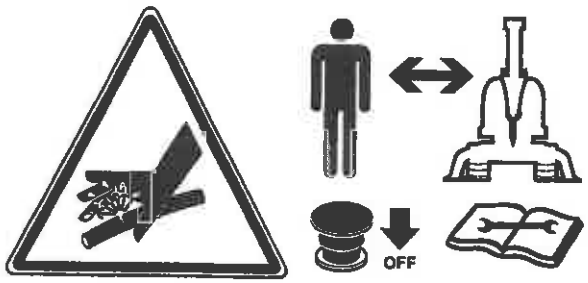


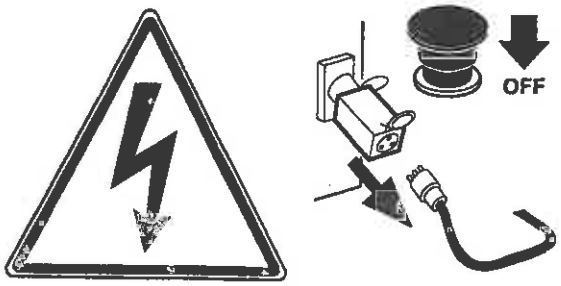
Safety during servicing and maintenance

Most machine-related accidents occur during servicing and maintenance because personnel are located at such times within the working area of the machine. Injury can be avoided by paying particular heed to this risk.

- Set out clear markings so that people in the surrounding area will easily understand that maintenance, servicing, etc. is in progress.
- When the servicing process does not require the machine to be started, the power cable must be disconnected from the mains and placed in such a manner that it may not be inadvertently connected.
- The machine must be checked regularly, daily inspections must be carried out and any defects attended to. The machine must be kept in such a condition that the operator or other people are not exposed to danger or accidents.
- Never carry out repairs on the machine without the necessary knowledge. Only trained service personnel may carry out work on the electric and hydraulic systems.
- Any faults or damage must be rectified immediately. Do not operate the machine until such faults have been rectified.
- Use safety goggles during servicing and maintenance.

- Check the function and condition of the control box regularly. Change malfunctioning control levers and buttons immediately.
- Pipe and hose couplings may be under pressure even though the motor has been turned off. Always be careful when dismantling connections.
- Never disconnect a hydraulic hose before making sure it is not under pressure.
- Always secure moving parts mechanically before disconnecting a hydraulic hose.
- Never attempt to stop a leaking or damaged hydraulic hose with your hand. Atomised fluid can penetrate the skin at high pressure and cause serious injury.
- The electric cabinet must not be opened while the machine is connected to the mains.
- Work on the machine's high-voltage circuitry must only be carried out by a qualified personnel.
- Cut the power to the machine before any cables or other components containing electric current are removed or opened.





Stickers

Brokk machines are equipped with type plates, warning stickers and information stickers. Before using the machine the operator must have read and understood the instructions regarding the plates and stickers on the machine. Any stickers which are missing or illegible must be replaced. The location and part number of a sticker is given in the spare part list.

Type plate

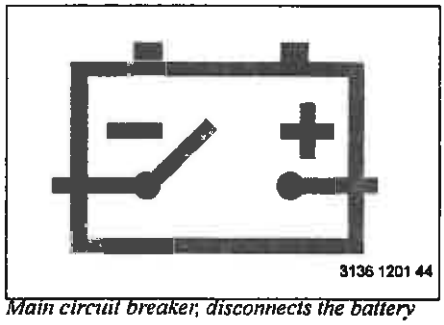
The type plate is located beside the mounting for arm one. It contains the following information:

- CE mark
- Manufacturer
- Year of manufacture
- Type designation, revision
- Serial number
- Motor data
- Machine weight

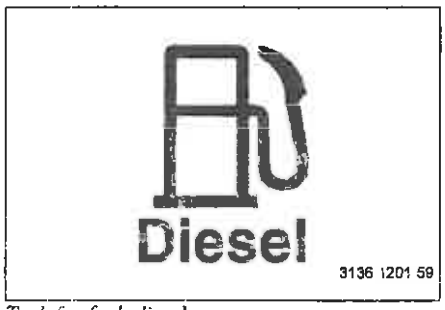
Information stickers

The sticker can indicate direction of movement, lifting points or what hydraulic fluid was in the hydraulic system of the machine on delivery.

The sticker indicates the position of the lifting points. The number of lifting points varies depending on the machine model.



Main circuit breaker, disconnects the battery

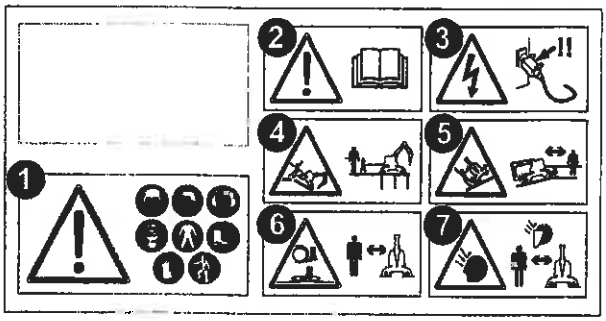


Tank for fuel, diesel

Warning signs

Warning signs are located on the machine. Their locations are described in the instructions in the following chapter. Warning symbols on the signs are grouped in pairs: The symbol on the left, in the warning triangle, indicates the danger that exists. The symbol on the right describes how the danger can be forestalled and avoided.

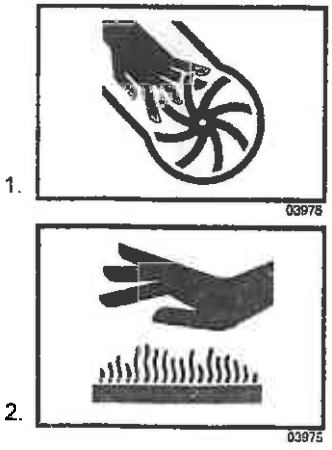
The warning symbols on the signs have the following meanings:



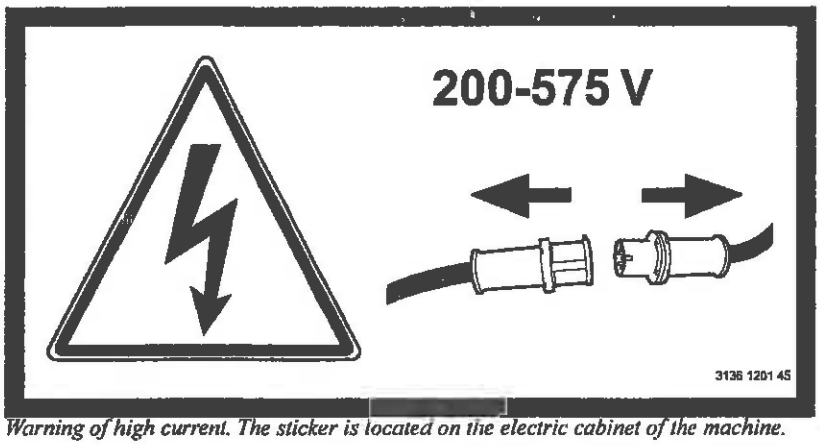
1. General hazard – Use personal protective equipment.
2. General hazard – read the instruction manual.
3. Warning, high voltage – Always connect the machine through an earth fault relay.
4. Risk for collapsing, falling machine, falling operator – Check surface, stabilise surface, anchor the machine and operator, separate the operator from the control box by using a stand.
5. Risk for tipping/sliding machine – Anchor the machine, keep your distance and stand above the level of the machine.
6. Risk for being run over, fastening in cables – Keep your distance.
7. Risk for splintering, falling objects – Keep your distance, use personal protective equipment.

Warning signs for Brokk Diesel

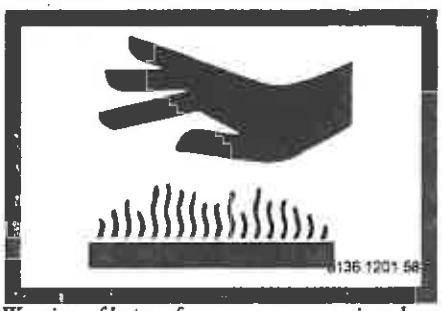
1. Warning for rotating fan blades, can cause serious injury to fingers and hands.
2 Warning for hot surfaces, can cause serious burns if touched.



Specific warning stickers



Warning of high current. The sticker is located on the electric cabinet of the machine.



Warning of hot surfaces, can cause serious burns if touched

Warning of entanglement, never touch rotating parts

Handling

The most important condition for your own safety, your colleagues' safety, and the operational safety of the machine is that the information from this manual and common sense are used.

Areas of use

The machine is intended for:

- Demolition, digging, making openings, materials handling
- Working in hazardous environments. The machine is remote controlled so that the operator can control the machine without being within the risk zone
- Working with hydraulic and mechanical tools
- Work which requires safe positioning with good repetition
- Working indoors and outdoors. Indoor work using machines equipped with diesel engines requires good ventilation
- Work in dangerous environments, where the machine is exposed to risk of collapse, dangerous substances or extreme heat for example
- Work in environments classed as "fire hazards" on the condition that the connection to the electrical network is the correct size and not damaged

The machine is NOT intended for:

- Work in areas that are classed as "explosive hazards"
- Work in water where the water level threatens damage to the electrical equipment or the machine
- Passenger transport
- Use on the public highway
- Use as a towing vehicle or lift
- Work which endangers the lives or health of the operator or nearby personnel. Remove the risks before starting work or use another method

Working in difficult environments

Heat

The operator must make sure the machine does not overheat when operating in warm surroundings. The recommended operating temperature for the hydraulic system is 80°C. The operator must also be aware that if heat radiation occurs, it can cause local heating that will damage machine components.

The temperature of the hydraulic fluid must not exceed 90°C except for short periods. The function of the machine will deteriorate and certain parts can be seriously damaged if the machine is operated with overheated fluid for too long.

Consider the following when working in warm environments:

- The fluid temperature is affected primarily by the nature of the job. Continual use of the hydraulic breaker generates most heat.
- The fluid can also be heated unnecessarily if the attached tool is not correctly adapted to the machine.
- If possible, increase ventilation when working indoors.
- We recommended using compressed air to cool the machine when operating in warm surroundings.
- Check the condition of the machine. Internal leaks in the pump or valves make the machine inefficient and run warm.
- Remember that coolant properties deteriorate at higher altitudes (5 % per 1000 metres).

Extra cooling

At ambient temperatures higher than 40°C, the machine must be equipped with forced draught cooling. Contact the machine supplier for more information.

Driving tracks

Rubber driving tracks must not be exposed to temperatures above 70°C. In difficult environments, steel tracks must be used.

Cold

The minimum temperature limit for the machine depends on the grade of hydraulic fluid being used.

Note that maximum pump flow rate must never be applied as long as the fluid temperature is below +10°C. When starting in temperatures below freezing, the instructions for cold starting must be followed.

Water

The machine can be operated outdoors and in damp surroundings. However, never use the machine in deep water so that water can enter the electrical equipment. The electric motor and other components can be damaged.

If water enters the electrical equipment during a stop, the motor must not be started. Disassemble the motor and oven dry it. Normally, the transformer and the contactors must be replaced. Contact the motor supplier or a qualified electrician.

Fire and explosion hazards

Providing all cables and connectors are of approved quality, the machine may be operated in environments classified as "fire hazards" but **NOT** in those classified as "explosion hazards

Electric cabinet functions

P1  Hours counter, displays the operational time of the machine.

Q1  Main circuit breaker and phase switch.

- **0** Power supply voltage to the machine interrupted.
- **1-2** Power supply voltage connected. Select position 1 or 2 for correct phase sequence.

S02  Stop button and safety stop. Turn clockwise to reset after stopping.

S20  Pressed in to activate the filler pump for hydraulic fluid.

S2  Starts the electric motor during emergency operation

S8  Emergency operation For further information see section: "Troubleshooting".

 Remote control. The machine is controlled via a control unit.

S9  Hydraulic fluid temperature is displayed on the electronic unit display when the switch is pressed in.

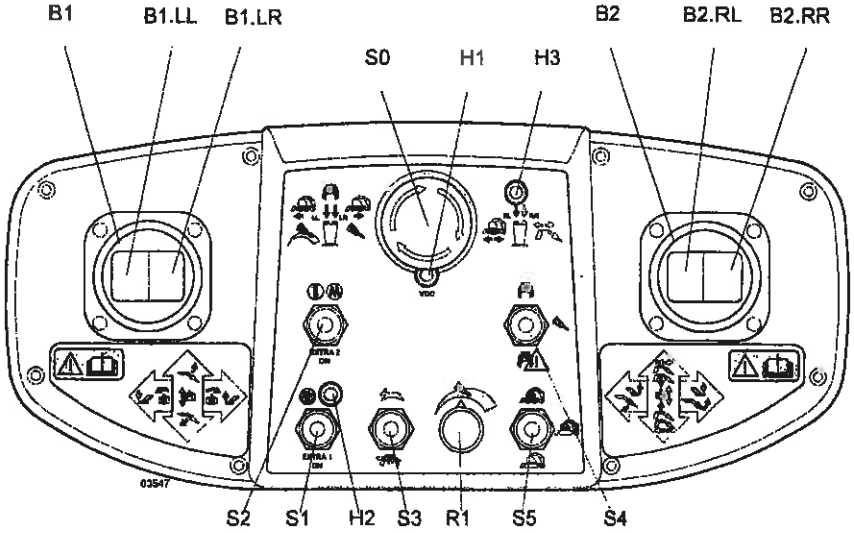
S16  Breaker lubrication shut off.

 Breaker lubrication activated.

S22  Switch for resetting radio inhibitor. Only Brokk 40 and Brokk 50.

Control unit functions

B1	Left control lever	B2	Right control lever
B1.LL B1.LR	Left pushbutton	B2.RL B2.LL	Right pushbutton



Switch

S0 

Stop button and safety stop. Turn the stop button clockwise to reset it after stopping.

S1 

One press: Starting the controlunit.
Second press: Activates the sound signal.
Two quick presses: Changes the radio frequency.

Also used when programming and testing the control unit. Sprung to return to centre position.

EXTRA 1 ON

Engagement of on/off function 1.

S2 

Starts the electric motor. Sprungto return to centre position.

EXTRA 2 ON

Engagement of on/off function 2.

S3 

Resets from reduced speed to normal speed on all functions. The control levers must be in the neutral position. Sprung to return to centre position.

Activation causes reduced speed on all functions in five stages. Sprung to return to centre position.

S4

Switch S4 switches between three different settings for hydraulic tools. The switch is inhibited and must be lifted in order to set other positions.

Double-action position for, for example, hydraulic cutters.

Single-action position for hydraulic breakers.

Double-action position with increased working pressure.

This position must only be used with Brokk hydraulic cutters for Brokk 180 and Brokk 330.

For Brokk 40, Brokk 50 and Brokk 90 this position does not give any increased pressure.

NB!	**Single action hydraulic attachments can be damaged if the operating pressure is fed to the return side. With increased operating pressure the operating pressure is 25.0 Mpa which can damage tools not intended for use at that pressure.**

S5

Position to operate the arm system and caterpillar tracks at the same time.

Operating position, the control levers affect the upper section of the machine.

Transportation position, the control levers affect the lower section of the machine.

R1

Setting the flow to the hydraulic attachment. Functions only when pushbutton B1.LL on the left-hand control lever is depressed.
If the machine is equipped with variable flow B1.LR also applies.

H1

Green LED which lights when the stop button S0 is turned upwards. Displays that there is power supply to the control unit.

H2

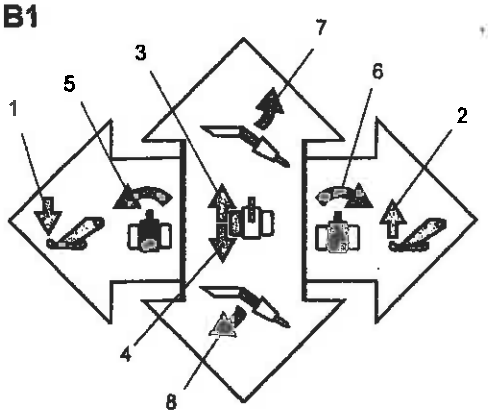
Yellow LED which lights when the control unit is engaged when S1 is pressed once.

H3

Red LED which lights when the control circuit is connected to the control levers.

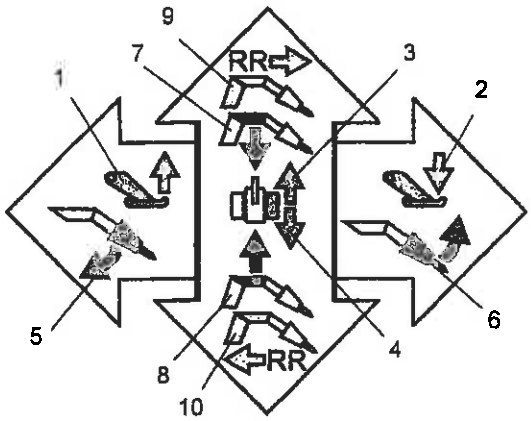
Left control lever	B1	Right control lever	B2
Left pushbutton	B1.LL B1.LR	Right pushbutton	B2.RL B2.LL

B1



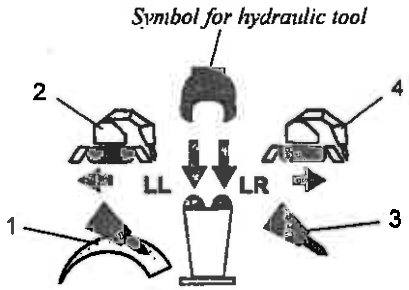
1. Outrigger down, left-hand side/rear
2. Outrigger up, left-hand side/rear
3. Left-hand caterpillar track forwards
4. Left-hand caterpillar track backwards
5. Slew anti-clockwise
6. Slew clockwise
7. Arm 3 up
8. Arm 3 down

B2



1. Outrigger up, right-hand side/front
2. Outrigger down, right-hand side/front
3. Right-hand caterpillar track forwards
4. Right-hand caterpillar track backwards
5. Tilt in
6. Tilt out
7. Arm 2 down
8. Arm 2 up
9. Increase reach
10. Reduce reach

B1.LL, B1.LR



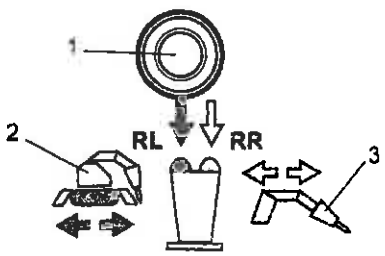
B1.LL 1. Variable flow to hydraulic tool

2. Caterpillar track backwards, when operating the caterpillar track at the same time as the upper section.

B1.LR 3. Maximum flow to hydraulic attachment

4 Caterpillar track forwards, when operating the caterpillar track at the same time as the upper section.

B2.RL, B2.RR



B2.RL 1. Engagement of control circuit/changing reach of the telescopic arm

2. Operating the caterpillar track at the same time as the upper section

B2.RR 3. Changing reach

Breaker lubrication

The hydraulic breaker is exposed to great wear by continuous chipping. Breaker lubrication decreases the wear between the tip and the breaker.

NB!	Check daily. Check that the reservoir contains lubricant. The tool can shatter if there is no lubrication. Dirt is the greatest threat to the lubrication system. Conditions must be as clean as possible when working on the system.

When a tool other than the breaker is being used the lubrication function must be switched off, otherwise the pump will build pressure making it difficult to reconnect the lubrication line to the breaker. If the pressure exceeds the permitted value the lubrication grease is evacuated back to the reservoir via a pressure limiting valve. Increased pressure may be also be due to a blocked lubrication channel. Rectify the fault immediately. Insufficient lubrication can damage the breaker.

If there is an unintentional pressure build up; disconnect the lubrication line from the quick coupling on the machine arm temporarily, the pressure will then fall.

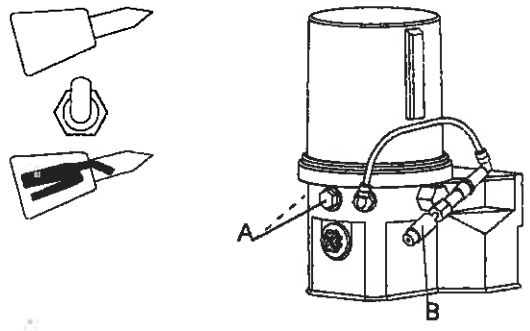
New installation

On new installation the lubrication hose from the lubrication pump to the breaker must be filled and bled. Connect a grease nipple and grease gun to one end. The other end should be open. Pump the grease gun until grease comes out of the other end.

Electrically powered breaker lubrication

Electrically powered breaker lubrication is switched off at the electric cabinet as illustrated below. It is activated using the push buttons in the left lever. B1.LL B1.LR.

Lubricating grease is filled using a grease gun or grease pump at filler nipple on the side of the lubrication pump.



A filler nipple, B pressure limiting valve

NB!	Deactivate the function if any tool other than a hammer is used.

Hydraulically powered breaker lubrication

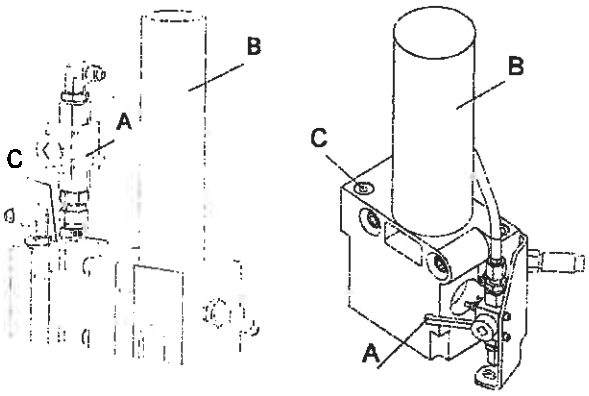
Hydraulically powered breaker lubrication is switched off using a stopcock beside the pump.

Lubrication grease is filled by replacing grease cartridges:

- Close the stopcock as illustrated (A)
- Unscrew the existing grease cartridge (B)
- Remove the sealing plug from the new grease cartridge
- Install a new grease cartridge in the housing.

The grease volume can be adjusted by screwing the choke valve under the plug (C).

- Turn clockwise = Decrease the grease volume
- Turn anti-clockwise = Increase the grease volume



Cable drum

Brokk machines can be equipped with a cable drum for the power cable, operating cable or cable for other equipment. The cable drum can be powered by springs or hydraulically. Take note of the weight and location of the cable drum because the total weight and centre of gravity of the machine are affected. If the cable drum and cable are attached to different areas of the machine the machine must be equipped with swivel limitation to avoid breaking the cable.

If the cable is fully extended there is a risk that the connectors can be pulled apart and damaged. The machine would be stationary and unpowered in the operating zone. Secure the cables using strain relief near the connectors to avoid separated cables from being wound into the cable drum. If a cable drum is used for the machine's power cable the machine must be connected via an earth fault relay.

Avoid running the machine for long periods with the power cable wound up. The wound cable will act as a coil and cause heat which may damage the cable.

Daily check

- Check the cable drum as part of the daily check of the machine. Rectify any faults before using the machine. Check for secure installation and damage to the cable, connector and cable ducts.

Read the supplier's instructions.

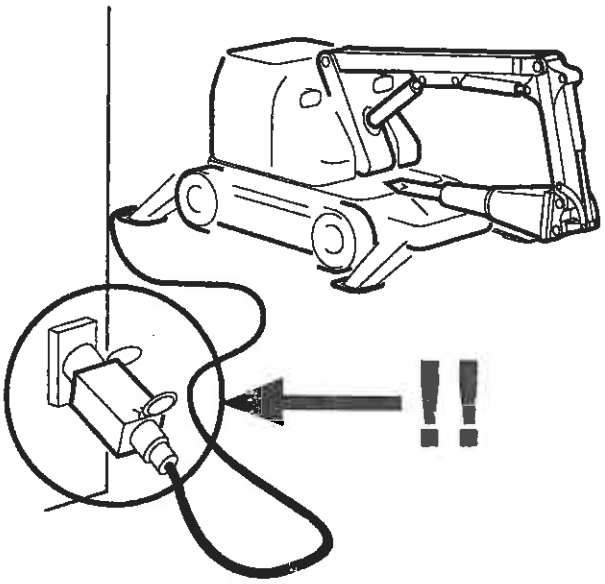
Starting and stopping

Read the safety regulations before using the machine.

Before starting

The following points must have been carried out each morning and before starting work on a new site.

- Carry out the daily inspection described in the *"Service schedule"* in the Service chapter. In addition, make sure the fluid is of the correct viscosity.
- Make sure there is no transit damage on the machine.
- Make sure that all outrigger pads are in place and locked.
- Make sure that the power and control cables are not damaged.
- Check that the power socket has the correct voltage and fuse.
- Always connect the power cable through an earth fault relay with personal protection.



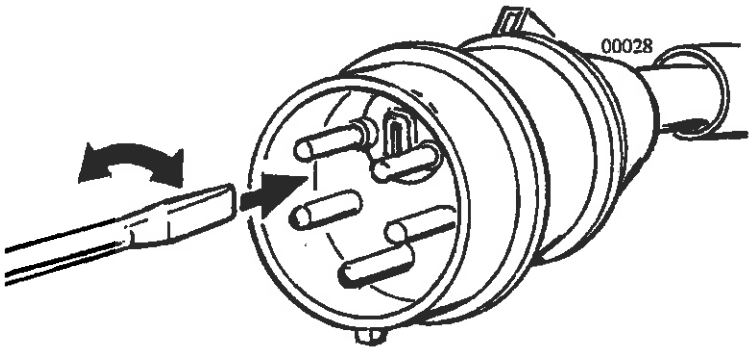
WARNING!
Risk for electric shocks.
The machine may become live if the power cable is damaged.
Always connect the machine through an earth fault relay.
The earth fault relay must always be situated outside steel vessels, etc. when working inside electrically conducting materials.

- Connect the control cable.
- The operator must ensure that the correct control box is being used for the machine in question and carefully observe the reaction of the machine during the starting procedure. This is especially important when there are two or more radio controlled machines on the same work site.

Check that the phase sequence is correct

The electric motor cannot start if the phase sequence is incorrect, the phase sequence is switched by the main switch of the machine. For further information see section "Electric cabinet's functions".

Brokk 40 and Brokk 50 have another function. The electric motor can be started despite an incorrect phase sequence but the hydraulic pump does not provide a flow so the hydraulic functions cannot operate. Switch off the engine and check the direction of rotation of the fan. There is a sticker on the fan housing which indicates the correct direction of rotation. The phase sequence can be changed in the connector for the power supply cable.



Brokk 40 and Brokk 50 have a connector that can change the phase sequence.

Operating the upper section of the machine

Brokk machines are tool carriers; this means that the tool does the work. Do not use the arm system and swivel function to strike, tear or scrape. If the swivel function of the machine fails, the upper section can become loose causing damage to the machine and the surrounding area.

Swivel function

By swivelling the upper section of the machine, work can be carried out in several directions without moving the machine. Note that the stability of the machine varies depending on the direction of the arm in relation to the undercarriage. The machine is most stable when working straight ahead or straight behind. While the machine can work with the tool in the straight ahead position without stability problems, the machine can tip when the arm system is moved to the side. When the upper section of the machine is turned to the side, the outriggers must be deployed and the arm system moved as close to the ground as possible.

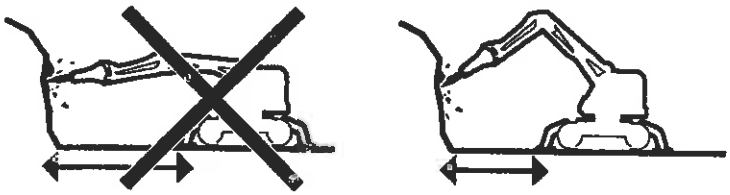
It can be difficult to anticipate the direction of rotation depending on the position of the operator in relation to the machine. In the event of any doubt, carefully operate the swivel motion to the determined direction of travel.

Arm system

Do not use the arm if the machine outriggers are folded up. The outriggers provide stability and reduce the risk of the machine tipping.

Work as close to the work object as possible because:

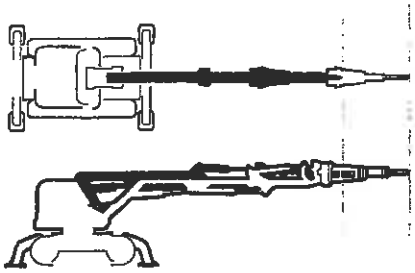
- The power of the arm system and cylinders is utilized best when operating near the machine.
- The load on components of the arm system and the turn table increases the further the arm system is extended. Move the machine closer to the work object instead of extending the arm system.



Move the machine closer to the work object instead of extending the arm system

The risk of tipping is increased when the arm system is extended. The reach of the machine is an advantage in cases where the work object cannot be reached, but the machine must always be positioned as close to the work object as possible.

By operating cylinder 1 and cylinder 2 at the same time the reach of the machine can be adjusted without the machine having to be moved.



Changing the reach of the machine by operating cylinder 1 and 2 together

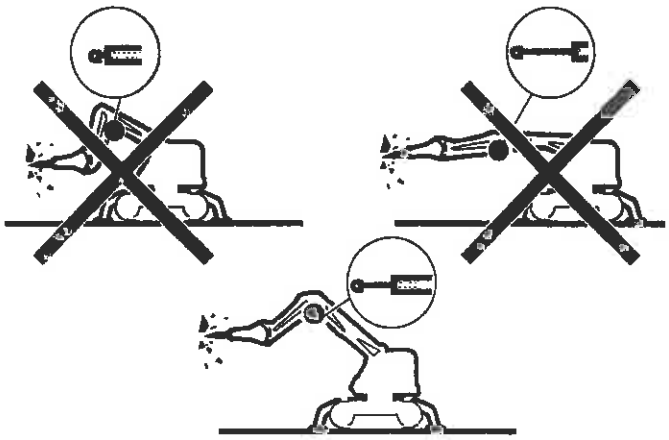
If the machine is equipped with a telescopic arm, cylinder 1 and 2 are initially used to extend the reach. Never use the telescopic arm to press the tool against the work object.

Do not secure the machine to fixed items, such as adjacent walls, to increase the force against the work object. Both the machine and tool can be overloaded.

Do not brace against walls using the outriggers. Keep a distance from the adjacent walls.

The arm system of the machine can be overloaded if incorrectly used. Avoid this by following this advice.

Do not work with the cylinders in the inner or outer limit positions. When a few centimetres of the cylinder maximum movement are left, the hydraulic fluid remaining in the cylinder acts as a shock absorber. The hydraulic fluid alleviates knocks and vibrations which can cause direct mechanical damage and material wear.



Do not work with the cylinders in the inner or outer limit positions

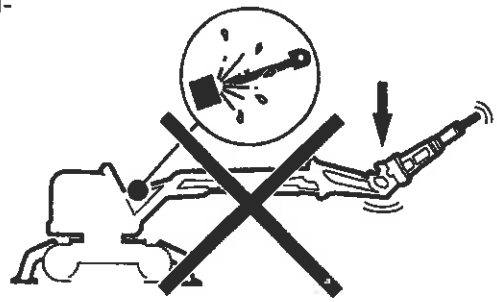
There are two operating positions that put extreme strain on each cylinder.

OPERATING POSITION 1

Condition: Cylinder 1 and 2 are moved to maximum out limit position, the breaker operates upwards.

Result: The arm system is forced downwards, the force acting on cylinder 1 will pull it apart.

Remedy: Never move cylinder 1 to the outer limit position.



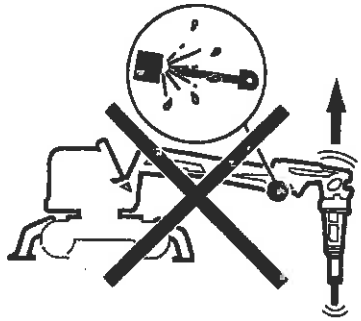
Operating position 1 subjects cylinder 1 to extreme load

OPERATING POSITION 2

Condition: Cylinder 3 moved to maximum out limit position, the breaker operates downwards.

Result: The arm system is forced upwards, the force acting on cylinder 3 will pull it apart.

Remedy: Never move cylinder 3 to the outer limit position.



Operating position 2 subjects cylinder 3 to extreme load

Tools

General

Read, understand and practice the handling instructions in the Operator's Manual for the machine before starting work with tools. Always read the separate safety precautions and handling instructions from the relevant tool manufacturer before using a new tool.

Positioning of tools

When a tool is not being used it must be positioned so that it does not cause a hazard. Ensure that it is stable and cannot tip. If the tool is positioned at height or on an incline it must be secured so that it cannot be set in motion or fall. Position the hydraulic connectors for the tool so that they cannot be damaged or deformed and are protected from dirt.

Hydraulic settings

Depending on the Brokk machine being used the control unit has a number of settings that can be applied to different types of tool. The flow to the tool can be steplessly adjusted, in one direction, and different pressure levels can be selected. For further information see section "Control system". Ensure that the settings are correct for the relevant tool before using it.

Changing tools

Brokk machines have either fixed tool mountings or mechanical quick hitches. Regardless of the type of mounting the operator must always ensure that the mounting and tool are correctly installed and secured. A tool which comes loose unexpectedly can, in the worst case, cause personal injury. Therefore, it is very important to check the tool and mounting. Carry out a daily inspection and regular service.

> **!** Caution!
> Risk of personal injury. Changing the tool can mean that the operator must be within the risk zone of the machine. Pay close attention to the machine. Be prepared to shut the machine down. Take care to keep hands and feet from being crushed.

Ensure that no one accidentally operates the machine during a tool change. Ensure that the machine is on a stable surface with lowered outriggers. Never change tools without first defining the risks and risk zone.

Fixed tool mounting
Brokk 40

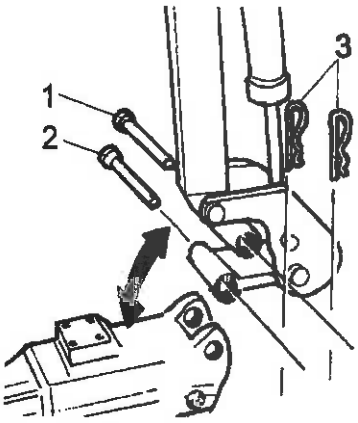
The tool is mounted directly onto the arm using two shafts and lock pins.

Installing

- Position the tool so that it is turned towards the machine, the hydraulic pressure port of the tool on the left hand side seen from the machine.
- Operate the arm of the machine so that the holes in arm 3 align with the tool.
- Knock the upper shaft (1) in.
- Operate cylinder 4 so that the hole in the link aligns with the tool and knock in the lower shaft (2).
- Lock both the shafts using lock pins (3).

Removal

- Operate the arm system. Position the tool on the ground, turned towards the machine. Position the arm as flat and stable as possible.
- Disconnect any hydraulic hoses. See chapter "Connecting tools to the hydraulic system".
- Remove the lock pins.
- Knock the shafts out.



Secure the tool mounting
1 Upper shaft
2 Lower shaft
3 Lock pin

Fixed tool mounting
Brokk 50

Installing

- Position the tool with the mounting turned towards the machine. The hydraulic pressure port of the tool on the left hand side seen from the machine. See illustration 1.
- Manoeuvre the link into the upper hole's guide. Raise the tool slightly and tap in the shaft (1). See illustration 2.
- Lock the shaft using the lock pin (2).
- Raise the tool so that it is freely suspended in the air. Operate the arm of the machine so that the holes in arm 3 align with the tool.
- Tap in the other shaft (3) and lock using the lock pin (2). See illustration **3.**

Removal

- Operate the arm system and position the tool on the ground, turned away from the machine. Position the arm as flat and stable as possible.
- Disconnect any hydraulic hoses. See chapter "Connecting tools to the hydraulic system".
- Remove the lock pins.
- Knock the shafts out.

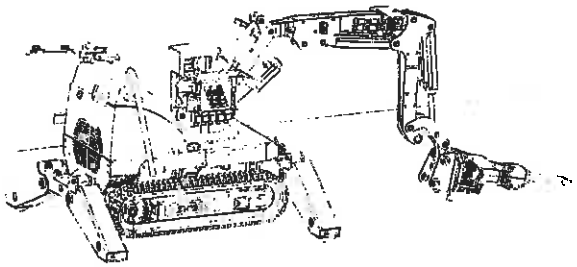


Image 1

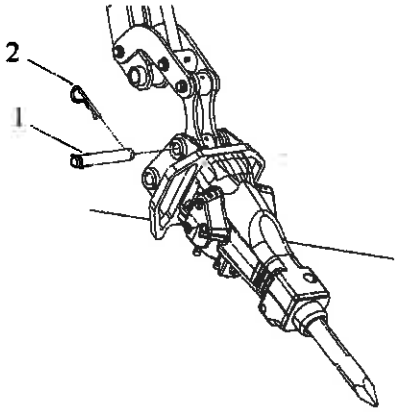


Image 2

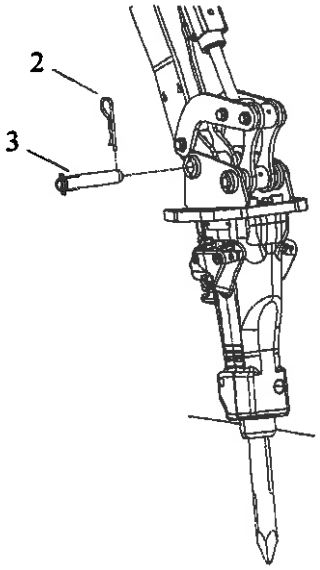
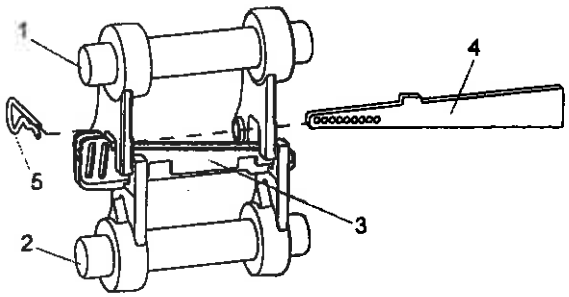


Image 3

Mechanical quick hitch

The tool mounting has two shafts. When the piston rod in cylinder 4 is operated inwards these two shafts fall away from each other and lock the tool. The tool mounting is secured using a two part wedge and a lock pin.

> **Caution!**
> **Risk of injury if the tool comes loose. If the lock pin is not installed or comes loose, the wedges can slide out and the tool can come loose. Check that the wedges and lock pin are securely installed.**



Mechanical quick hitch

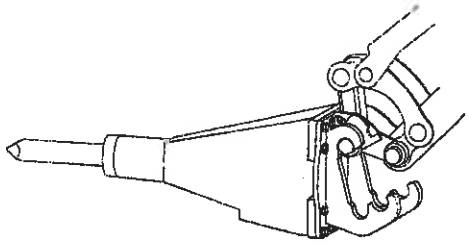
1. Upper shaft
2. Lower shaft
3. Fixed wedge
4. Moving wedge
5. Lock pin

Installing

- Position the tool so that it is turned away from the machine, the hydraulic pressure port of the tool on the left hand side seen from the machine.
- Move the quick hitch shafts together by moving cylinder four out.
- Operate the arm system so that the tool hooks into place against the upper shaft (1).
- Lift the tool carefully so that the shaft (2) moves into the correct position.
- Move the quick hitch shafts apart by moving cylinder four in.
- Insert the wedge (3).
- Insert the wedge (4) so that the shafts are locked against the hooks on the tool without any play. Ensure that the lug on the wedge (4) is turned as illustrated.
- Lock the wedge in the knocked in position. Insert the lock pin (5) through the one of the holes or grooves in the wedges.

Removal

- Operate the arm system. Position the tool on the ground, as flat and stable as possible.
- Disconnect any hydraulic hoses. See chapter "Connecting tools to the hydraulic system".
- Remove the lock pin (5).



The starting point for tool changes is that tools with mounting hooks must be located as illustrated.

- Knock the wedge (4)out.
- Remove the wedge (3).
- Move the quick hitch shafts together by moving cylinder four out. The lower shaft disconnects from the tool. Moving the arm upwards facilitates this.
- Move cylinder three in so that the mounting separates from the tool.

Connecting tools to the hydraulic system

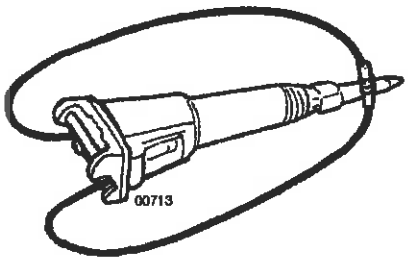
When connecting a tool to the hydraulic system ensure that:

- No dirt penetrates the hydraulic system
- Enclosed hydraulic pressure is released
- Hydraulic fluids of different types are not mixed
- The tool is installed correctly.

Cleanliness

Dirt in the hydraulic system is one of the most common causes of stoppages. The risk of contaminating the hydraulic system is greatest when the otherwise closed hydraulic system is opened, such as for tool changes. Prevent dirt entering the system by:

- Wiping any dirt from the connections, both before the tool is removed and before it is installed.
- Installing dust caps on the hydraulic connectors on the machine when no tool is installed.
- Ensuring that hoses on the tool are always connected to each other when the tool is not attached to a machine.



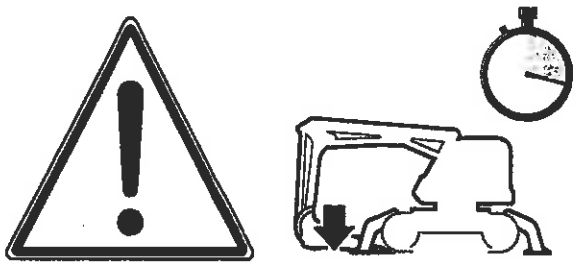
Connecting the hydraulic hoses to each other when the tool is not connected to the machine

Release any trapped pressure

Quick couplings cannot be connected to each other if pressure is trapped in the hoses.

- Relieve the arm system against the ground.
- If the machine is equipped with hand levers on the main valve, release the pressure by moving the levers to their limit positions. NOTE The machine must be switched off.
- If the machine is not equipped with hand levers on the main valve, wait until the pressure has dropped via internal leakage.

When working with double-action tools, high trapped pressures can be avoided by not moving the tool to the limit position just before the tool is to be removed.



Attention. Danger. Trapped pressure can cause injury. Rest the arm system on the ground. Wait for the pressure to fall.

Correct connection of tools

Read the tool supplier's manual and ensure that the tool is correctly attached. Correct connection includes both correct attachment and correct pressure use.

NB!	There is a risk of damage to the machine if operating pressure is fed in on the return side of a single-action machine, or if the settings of the control unit are not correct for the relevant tool. For further information about the control unit settings see "Control system":

Connecting tools

The tool feed connection must be connected to the main valve A port for tools via the feed hose located on the left hand side of the machine. If the machine is equipped with quick couplings the connection is female.

The tool return connection must be connected to the main valve B port via the return hose located on the right hand side of the arm system. If the machine is equipped with quick couplings the connection is male.

Main valve A and B ports can be found in the spare parts list.

Single-action and double-action tools are attached in the same way with the exception of the Brokk 40 and Brokk 50. See the instructions below.

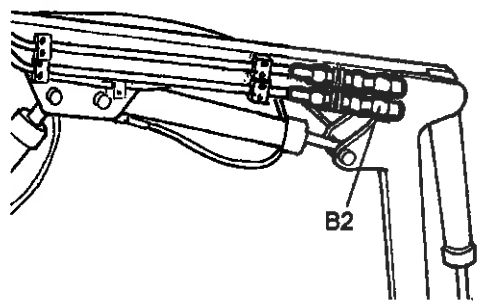
Connecting positioning tools

A side-angling device must be connected to extra hydraulic function 1 and a rotator to extra hydraulic function 2.

For further information; see the machine's hydraulic diagram and spare part list.

BROKK 40, BROKK 50

Double-action tools must be attached to return line B2, which leads to the main valve on the right hand side of the arm.



Connecting the double-action tool to Brokk 40 and Brokk 50.

Service

General

The best way to prevent unplanned stoppages and breakdowns is to carry out daily checks and regular services.

NB!	These are general instructions, certain check items may not be found on your machine.

Most machine accidents occur during fault-tracing, service and maintenance because personnel must be within the risk zone to carry out the work. Personal injury can be avoided by strict awareness of the risk.

Read and understand the safety chapter, section "Risk factors during service and maintenance work" and carry out "Preparations for service and maintenance" before starting service work.

Service schedule

The service schedule is based upon the operation time of the machine. Because the working conditions can vary, it may be necessary to adapt the service interval to the relevant working conditions and environment.

- For further information on how to carry out checks and service, see the instructions that follow the service schedule.
- For information about diesel engine maintenance, also see the engine supplier's instructions and recommendations.
- For information about tool maintenance, see the manufacturer's instructions and recommendations.

Checks

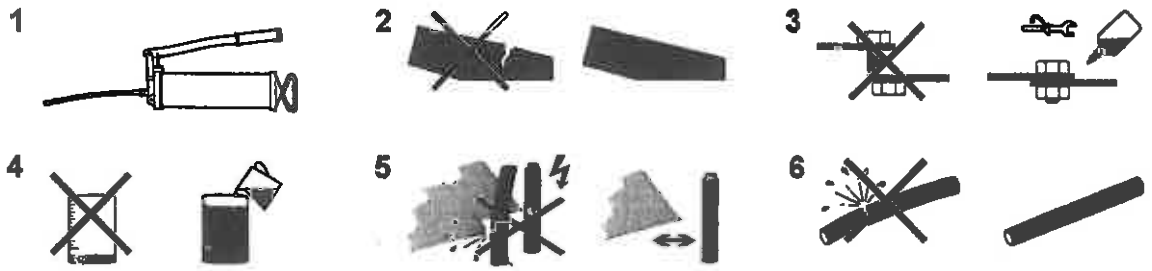
After carrying out checks, failures must be remedied immediately through replacement, adjustment, repair etc.

Service schedule

Daily check

Daily checks must also be carried out after transportation

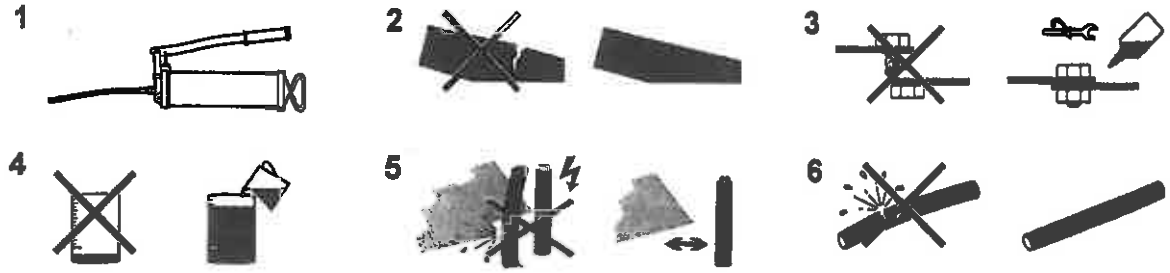
Symbol descriptions



Function		With reference to								
		Lubrication	Cracks	Securing	Level check	Wear/damage	Leakage	Function	Replacement	Other
Symbol		1	2	3	4	5	6			
Undercarriage and Outriggers, containing cylinders and shafts			•	•			•	•		
Arm system and Tool mounting, containing cylinders and shafts		•	•	•		•	•	•		
Hoses, visible hoses, for example, arm system outriggers						•	•			
Power cable, connection socket						•		•		
Hydraulic fluid					•					
Diesel	**Engine oil**				•					
	Coolant				•					
	Pre-filter									**Draining**
	Diesel				•					
	Warning lights							•		
Breaker lubrication					•					
Tools		•	•	•			•	•		

For maintenance of tools, extra equipment etc. also see other manuals

Weekly service



Function		With reference to								
		Lubrication	Cracks	Securing	Level check	Wear/damage	Leakage	Function	Replacement	Other
	Symbol	1	2	3	4	5	6			
Entire machine										**Clean the machine**
Daily check										**Carry out**
Undercarriage, outriggers, containing cylinders and shafts		•	•	•			•	•		
Drive and track frames, including track tensioning		•	•	•		•		•		**Worn track**
Power unit (engine, fan, fan housing)				•						
Radiator								•		**Clean**
Hoses						•	•			
Other hydraulic components							•			
Slew motor, slew gear								•		
Gear ring slew		•								
Diesel	**Air filter, pre-filter, hoses**							•		
	Water separator									**Draining**
	Fuel filter									**Draining**
	Fan belt							•		
Water separator, forced air cooling										**Draining**
Breaker lubrication								•		
Crusher				•			•			**Check jaws**

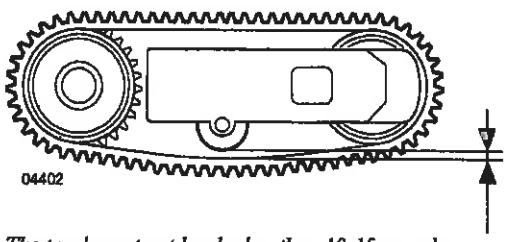
For maintenance of tools, extra equipment etc. also see other manuals

Track tension

Track tension tensions the track so that it does not come loose during operation. Over tightening increases the load and can cause break down.

- Ensure that the track is not slacker than 10-15 mm play and that it only just lies against the carriage wheel.

If demolition material or similar enters the side of the track during operation, a spring function prevents machine damage and breakdown. The spring function consists of either a hydraulic accumulator or a spring. Lighter models of machine are not equipped with the spring function.



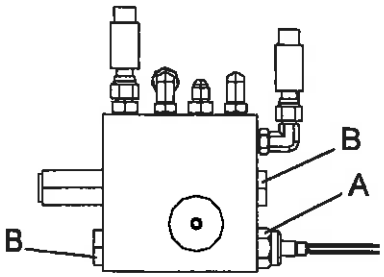
The track must not be slacker than 10-15 mm play

AUTOMATIC HYDRAULIC TRACK TENSIONING

Automatic hydraulic track tensioning means that it is activated when the outriggers of the machine are deployed. Operate the outriggers up so that the pressure in the accumulator increases. Deploy the outriggers down to the end limit position. Wait 15 minutes before checking. If the track is slack this could be due to a restrictor valve (A) or check valve (B) of the track tensioning function being blocked or defective.

By operating the outriggers upwards, with the restrictor valve open, the hydraulic fluid is pumped around the system and the accumulator valve is cleaned.

- Release the pressure in the accumulator and cylinder for track tensioning by opening the restrictor valve anticlockwise. Operate the outriggers upwards. Close the restrictor valve. Do not over tighten, this can damage the restrictor valve. Operate the outriggers up so that the pressure in the accumulator increases.

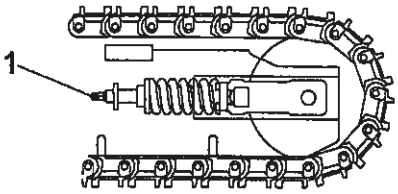


A Restrictor valve, B Check valve

MANUAL TRACK TENSIONING

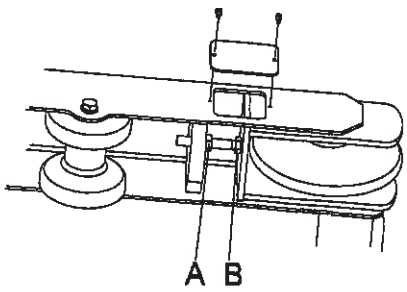
Deploy the outriggers to their limit position and check to see if the track slackens.

Grease filled cylinders and springs can be adjusted to achieve track tensioning by connecting a grease gun to the cylinder nipple (1) and pumping to the required track tension.



Nipple for adjusting track tension

Track tensioning using the adjustment screw is carried out by slackening off the lock nut (A) and turning the adjustment screw (B) until the track is correctly tensioned. Tighten the lock nut.



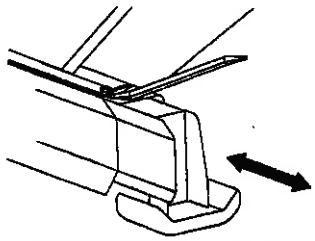
Track tensioning using the adjustment screw (B) and the lock nut (A)

Mechanical settings

These functions are not available on all machine models.

Controlling outrigger width

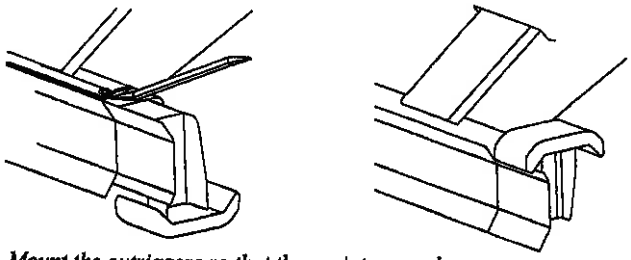
Adjust the distance between the outriggers for the bulldozer blade. Release the outrigger lock and slide the outrigger in the required direction. Lock the outrigger in place.



The spring lock is released using a crowbar

Complete bulldozer blade

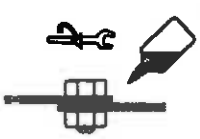
The bulldozer blade can be used without the outriggers touching the ground by changing the position of the outriggers. Pry up the spring above the bulldozer blade and move the outrigger to the other side. Mount the outrigger so that the outrigger pad points upwards.



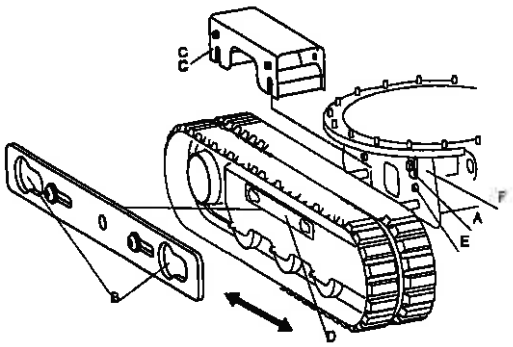
Mount the outriggers so that they point upwards

Controlling track gauge

In confined passages the track extensions on the machine can be removed which reduces the gauge of the machine. Note that the stability of the machine is impaired.



Note the tightening torques and other installation instructions in the spare parts list



The track gauge of the machine can be reduced by removing the track extensions.

Removing track extensions

- Move the outriggers downwards so that the tracks are off the ground.
- Remove the power supply cable and position it so that it cannot be reconnected by mistake.
- Remove the screws (B). Pull the track frame away.
- Remove the retainer (A) and track extension (C).
- Slide the track frame towards the intermediate flange(F).
- Slide the plate (D) on the track frame and install the screws (B).

Installing track extensions

- Move the outriggers downwards so that the tracks are off the ground.
- Remove the power supply cable and position it so that it cannot be reconnected by mistake.
- Remove the screws (B). Pull the track frame away.
- Pull the track frame away and install the track extension (C) on the guides and the retainer (A).
- Slide the track frame towards the track extension.
- Slide the plate (D) on the track frame. Screw the screws (B) and track extension into place.

Trouble shooting

General

This chapter on troubleshooting has been written with emphasis on the causes of the most common faults. It will give an understanding of the function of the machine and thereby guide you through the process of fault diagnosis.

Tools

All measuring instruments must be approved for the range of measurement being used.

- Normal toolkit with flexible assortment of spanners.
- Pressure gauge with connecting hose and nipple.
- Multimeter for measuring voltage and resistance.
- Clip-on ammeter for measuring current
- Spare power cable that you know for certain is free from defects.

Troubleshooting methods

- Always check first that the power supply is satisfactory when the Brokk is malfunctioning. Follow the instructions "Checking the power supply".
- Most faults can be caused by malfunctions in both the electrical and the hydraulic systems. Make sure the control box/control circuit is intact to exclude it as a source of faults.
- Always test radio controlled machines using a cable connection if problems arise.
- The display on the electronic unit in the electric cabinet may show a number of error codes, which can help in diagnosing faults. A list of error codes can be found later in this chapter.

Electricity supply

If Brokk is to function, the electrical supply must be satisfactory. The power supply must be stable even under full load. The power outlet must be fused correctly for the length of the power cable and surface area of the conductors, see *"Typical fuse sizes and extension cable dimensions"* in the Service chapter. Delayed action fuses must be used on direct start and Y/D start machines, automatic fuses must be designed for motor drive. Type K or in certain cases type D can be used, others are triggered too fast and may therefore cause problems. Machines with smooth start can be started with most fuse types.

The machine must always be connected via an earth fault relay with 30 mA fault current designed for personal protection because there is always a risk that long power cables can be pinched or otherwise damaged during operation. A damaged power cable can cause fatal injury if touched and there is also risk that the machine may become live. An earth fault relay is available as an optional accessory.

Safety precautions when troubleshooting

Warning!
During troubleshooting and repair one is exposed to many dangers. Components connected to the power supply are measured, the activated machine is close by when measurements are being taken on the hydraulic system, components can be hot, etc.
Therefore, concentrate on the machine and the procedures during troubleshooting and repair.

The following points are extremely important:

- Always disconnect the machine from the power supply when conducting repairs
- Work on the high-tension sections of the machine may only be carried out by a qualified electrician.
- Always secure machine parts that can be put in motion while working on the hydraulic system.
- Only trained service personnel may perform service on the electric and hydraulic systems.
-

Fault symptom quick-guide

Electric motor will not start

- Start the machine as instructed in *"Starting and stopping"* in the Handling chapter.
- Make sure the stop button S0 on the control box is released.
- Make sure there is contact between the control box and the machine by looking at the display in the electric cabinet. A number in the first character position indicates that there is contact.
  If there is not any contact:
  - Make sure the control cable is plugged in properly at both ends. Refer also to the instructions in *"Checking the control circuit"*.
  - Test with a cable on radio controlled machines. Make sure the first character position on the machine shows a "1". If a "2" is shown in the first character position then the wrong control box is being used. Change to the correct control box or refer to *"Programming the identity code"* in the Handling chapter.

    If the fault is in the radio communication, refer to *"Troubleshooting the radio control system"* later in this chapter.
- Make sure that there is a power supply voltage on all phases to the machine and that the display in the electric cabinet is on.
  - If the display is not on, check the power supply as instructed: *"Checking the power supply and current consumption"*. Check also that fuses F15, F7 (all three) and F5 in the electric cabinet are intact.
- Read the display error codes.
- Follow the instructions in *"Troubleshooting the electrical and control systems"*.

Fuse F7 triggers

- Phase sequence relay or transformer defective.

Electric motor humming

- One phase missing between K1 and electric motor. Check the power supply as instructed: *"Checking the power supply and current consumption"*.

Fuses at the power source are triggered when attempting to start

- Fuses in socket too small or too fast, or automatic fuses of wrong type. See *"Guide-line values for fuses and extension cable dimensions"* and the section on the electricity supply earlier in this chapter.
- Smooth start malfunction. If the motor does not start within 3-5 seconds after pressing the start button then the smooth start is out of order and the motor is direct starting with the contactor.

A power supply from a diesel powered electric generator must be dimensioned with respect to the starting current being about twice the rated current during smooth start, 3 times during YD start and 7 times during direct start.

Burned electric motor. Call for an electrician to check.

Overload relay F2 triggers on start

- Supply voltage to the machine too low. Measure as instructed: *"Checking the power supply and current consumption"*.
- Bad contact in power supply from electrical distribution unit to motor, check for voltage drop at all connecting points.

Overload relay F2 triggers during operation

- Overload relay incorrectly set. See instructions *"Overload relay - changing and setting"*.
- Read the display error codes.
- Bad contact in one phase conductor, which triggers the phase break protector in overload relay F2. Check the power cable for damage and the cable connections in plugs and sockets.

Warning!
Risk for electric shocks.
The power cable may be live if the insulation is at fault.
Unplug the power cable from the wall socket before inspecting it.

- Voltage drop on mains too great due to defective power source or underdimensioned power cable. See *"Typical fuse sizes and extension cable dimensions"*.
- Check that the voltage between the three phases is the same as instructed in: *"Checking the power supply and current consumption"*. Measure also the current consumption at high load, when outriggers down is operated to end-stop position and one wheel motor is fully operated, and compare the phases, see *"Checking the power supply and current consumption"*. If the current between the phases differs, the motor may be damaged.
- Check current consumption while the attachment is under full load. Current consumption must not exceed *"set value for the thermal overload relay" given in the table "Typical fuse sizes and extension cable dimensions"* in the Service chapter.

The machine will work but the rpm will be considerably reduced when a function is operated.

- Mains voltage to the machine too low. This can be caused by a voltage drop in the mains supply or extension cable connectors, or an underdimensioned power cable. Check the power supply as instructed: *"Checking the power supply and current consumption"*.

The motor is running but none of the hydraulic functions work

- Hydraulic fluid level in tank too low. If this is the case then cavitation will be clearly heard from the pump. Stop the motor immediately for topping up and checking for possible leaks.
- Make sure the control circuit is connected (the orange indicator H3 on the control box should be on). Press the left pushbutton on the right-hand control lever.
- Pressure reducing valve VF8 defective or strainer clogged. Measure the servo pressure according to the instructions: *"Measuring servo pressure"*.
- Circulation pressure the system too low. If the circulation pressure is below 10 bar then there is a risk that the system will not "get going" due to the servo pressure being too low. Measure as instructed: *"Measuring the circulation pressure"*.

Machine sluggish on all functions

- Measure the maximum pressure as instructed: *"Measuring maximum pressure"*. The pressure for the main pressure relief valve may be set incorrectly or the valve may be defective.
- Servo pressure too low. Measure the servo pressure according to the instructions: *"Measuring servo pressure"*. The pressure for the pressure relief valve may be set incorrectly or the valve may be defective.
- Worn pump.

All functions working at full power but arm cylinders and breaker working slowly

- See whether micro-drive is engaged on the control box.
- See whether there is an error code shown on the electronic unit display/diodes.
- Capacitor defective. In this case, the idle voltage across the rectifier will drop from the normal value 24-28V to approx. 18V.
- System circulation pressure set too low. See instructions: *"Measuring the circulation pressure"*.

One arm function working slowly

- Defective pilot valve.
- Restriction in the hydraulic hose due to incorrectly crimped hose coupling, etc. Check by operating the function without load at half speed while measuring the pressure at measuring outlet XPL. If the pressure then rises to the pump maximum pressure, such a fault can be suspected.

A single arm or help function "dead".

- Make sure none of the functions are in operating position when starting the control box.
- See whether there is an error code shown on the electronic unit display.
- Bad contact in control box. Check according to *"Checking the control box"* in the Service chapter.
- Pilot valve coil burnt. Measure resistance between pins 1 and 2. Resistance should be approx. 27 Ohm. Also check the insulation by measuring between the pins and goods, min. value 10 Kohm. If the coil is defective, the entire valve must be replaced.
- Impurities in the pilot valve. The valve can be disassembled and cleaned but it is recommended that it be replaced for reasons of safety.

Warning!
Unexpected movement.
If the spool is stuck in open position, it can lead to a dangerous manoeuvre.
Keep your distance from the machine when starting up after service.

The machine sinks on its outriggers

- Leaking overcentre valves for the outrigger cylinder or internal leak in the cylinders.

Jerky arm movement

- Sticking spool due to impurities or rapid heating of the hydraulic fluid in an otherwise cold machine.
- Air in the pilot valve.
- Defective O-rings in the pilot valves.
- Defective servo circuit.

Cylinder 1 or 2 retracts

- The retaining valve to cylinder 1 or 2 is defective or there is an internal leak in the cylinder.

Cylinder 3 or 4 falls abnormally

- Internal leak in cylinder.
- Defective surge damping valve or damaged (fouled) surge damping valve seat. Replace the surge damping valve with a new one.
- Control spool or bore damaged. Remove the top and pull out the spool for inspection.

Hydraulic system overheating

- Ambient temperature too high; above 30°. Cool the machine body with compressed air. If the machine is to be operated in a warm environment for long periods, forced cooling with compressed air must be fitted.
- Pump maximum pressure or circulation pressure set too high. Measure as instructed: *"Measuring maximum pressure"* and *"Measuring the circulation pressure"*.
- Large restriction in hose or quick-coupling. This is especially sensitive in main lines and the lines to the hydraulic breaker.
- Power consumption too high due to defective or faulty hydraulic attachment.
- Worn hydraulic pump.

Noise in hydraulic system

- Fluid level too low. NB! The pump will be seriously damaged if run with too little fluid in the system.
- Air in the hydraulic fluid. Often occurs after filling with fluid. Run with low loads until the air has separated from the oil.
- Defective hydraulic pump.
- Note that it is difficult to deduce and analyse the cause of the noise. It can change with operating conditions, temperature, etc.

Discoloured hydraulic fluid

- Grey and turbid fluid often is an indication of water in the fluid. Change fluid and clean the whole system or fit a water-absorbing filter and run the machine until the fluid is clean. Find the cause of the water penetration and attend to the hydraulic system.
- Black fluid often indicates a build-up of carbon in the oil due to high operating temperatures. Change the oil. See instructions *"Hydraulic fluid - draining"* and *"Hydraulic fluid - refilling"* in the Service chapter. **Find the cause of the overheating and attend to the problem.**

Codes on display

A great deal of information can be obtained by reading the display during starting and operation. This information will help you to understand the control system and, consequently, facilitate troubleshooting. Therefore, always make a practice of reading the display when starting the machine. In case of faults, a code will take the place of the normal display. All error codes start with an "E" in the first character position.

Operational codes

First character position

The first character position indicates whether data transfer from the control box to the machine electronics has succeeded. If contact cannot be made between the control box and the machine, this will be indicated in the first character position with a "-". After starting the control box, either a "1" or a "2" will be displayed in the first character position.

- "-" in the first character position indicates that the power is reaching the electronic unit.
- "-" in the first character position indicates that data transfer from the control box has not been successful.
- "1" in the first character position indicates that data is being transferred from the control box and that the control box has the correct ID-code.
- "2" in the first character position indicates that data is being transferred from the control box but that the control box has the incorrect ID-code. Shown only when the control cable is connected between the control box and the machine.

  Each control box has a unique ID-code that allows only the machine with the same ID-code stored in the electronic unit to be operated by radio control. This limits the risk of operating the wrong machine with radio control. Using cable control will suppress the ID-code so that any control box can be used, provided it has the correct control system version.

Second and third character positions for cable control

A "-" is displayed in the second and third character positions during cable control.

Second character position for radio control

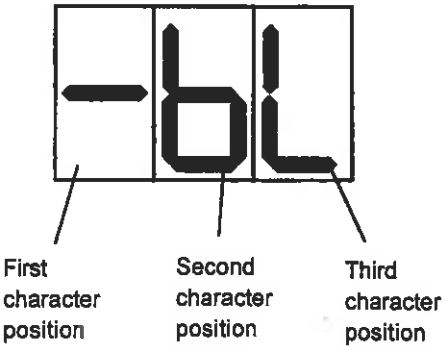
The second character position indicates the frequency range that has been selected for radio control. The value can vary between 1-8. The frequency range is determined by the standard allowed in each country.

Third character position for radio control

The third character position indicates the channel within the frequency range on which radio communication is taking place. There are 12 channels, the value of which can vary from 1-9, A, b or C. When several radio controlled machines are working close to each other and transmitting on the same frequency, they may interfere with each other. This can be avoided by changing the channel. The channel can easily be changed from the control box. See *"Changing radio channel"* in the Handling chapter.

Special codes

"-bL" is shown on the display when the control box has been off for longer than 120 seconds. For safety reasons, restarting is blocked if the control box has been turned off for more than 120 seconds. Voltage to the electronic unit must be disconnected before being able to restart. Applies to radio control only.



Programming

"P" is displayed in the first character position when the ID-code or basic program is transferred from the control box to the electronic unit.

"Pr1" is displayed when the electronic unit is in programming mode 1.

"PPb"is displayed while programming the operating pressure for using hydraulic attachments that require lower pressure than the machine's operating pressure. See "*Adjusting breaker pressure*" in the Handling chapter.

Displaying hydraulic fluid temperature

The hydraulic fluid temperature is displayed in °C by pressing S9 on the front of the electrical cabinet.

"Lo" is displayed if S9 is depressed and the temperature of the hydraulic fluid is below 30°C.

Error codes

The error code takes the place of the normal display and remains visible for 15 seconds, after which the computer will attempt a restart. If the fault persists, the error code will reappear.

Code	Description	Action
E01	Control lever for CY2 (1Y1/2Y1) not in neutral on start or signal outside permitted voltage range during operation. When the control lever is not in neutral when starting the control box, the function is blocked. Other functions are operational. If the signal for a certain function is outside the permitted voltage range, the entire machine stops.	• Press the automatic emergency stop S0 and check that the right-hand control lever, B2, is in neutral backwards/forwards position. • Restart the control box. If the same error code is shown, the right control lever requires service. Checking potentiometer neutral position or cleaning circuit board.
E02	Control lever for CY3 (1Y2/2Y2) not in neutral on start or outside permitted voltage range during operation. When the control lever is not in neutral when starting the control box, the function is blocked. Other functions are operational. If the signal for a certain function is outside the permitted voltage range, the entire machine stops.	• Press the emergency stop button S0 and check that the left-hand control lever, B1, is in neutral backwards/forwards position. • Restart the control box. If the same error code is shown, the left control lever requires service. Checking potentiometer neutral position or cleaning circuit board.
E03	Control lever for CY4 (1Y3/2Y3) not in neutral on start or outside permitted voltage range during operation. When the control lever is not in neutral when starting the control box, the function is blocked. Other functions are operational. If the signal for a certain function is outside the permitted voltage range, the entire machine stops.	• Press the emergency stop button S0 and check that the right-hand control lever, B2, is in neutral left/right position. • Restart the control box. If the same error code is shown, the right control lever requires service. Checking potentiometer neutral position or cleaning circuit board.

Code	Description	Action
E04	Control lever for hydraulic attachment (1Y4/ 2Y4) not in neutral on start or outside permitted voltage range during operation. When the control lever is not in neutral when starting the control box, the function is blocked. Other functions are operational. If the signal for a certain function is outside the permitted voltage range, the entire machine stops.	• Press the automatic emergency stop S0 and check that the pushbutton on the left-hand control lever, B1, is in neutral position. • Restart the control box. If the same error code is shown, the left control lever requires service. Checking push button, damp or dirt.
E05	Control lever for slew function (1Y5/2Y5) not in neutral on start or outside permitted voltage range during operation. When the control lever is not in neutral when starting the control box, the function is blocked. Other functions are operational. If the signal for a certain function is outside the permitted voltage range, the entire machine stops.	• Press the automatic emergency stop S0 and check that the left-hand control lever, B1, is in neutral left/right position. • Restart the control box. If the same error code is shown, the left control lever requires service. Checking potentiometer neutral position or cleaning circuit board.
E08	Supply voltage ripple too great. The machine does not stop and operation of functions can be controlled. Faulty capacitor	• Check the capacitor coupling, if it is OK the capacitor is defective. • Change the capacitor.
E09	24VDC power supply voltage to electronic unit too low. Power supply voltage below 24VDC. Machine does not need to stop but functions can be operated.	• Check machine power supply voltage as instructed. • Make sure the supply to the transformer is on the correct input for the prevailing rated voltage, can be adjusted +/- 3%.

Code	Description	Action
E10	24VDC power supply voltage to electronic unit too high. Power supply voltage above 29VDC. When the voltage is above 33VDC, the machine stops, the display goes out and only the POWER LED is on.	• Check machine power supply voltage as instructed. • Make sure the supply to the transformer is on the correct input for the prevailing rated voltage, can be adjusted +/- 3%.
E11	Overload on power supply to control box.	• Check the control cable as instructed in *"Checking the control box, control cable"*.
E12	Short circuit in an On/Off-function. The machine stops. The output that is short circuited is located by activating one On/Off function at a time.	It is not necessary to start the electric motor for troubleshooting. • Start the control box. • Operate one function at a time and check which of them causes error code E12. Applies to On/Off functions that are connected to outputs OUT1-OUT7 (Refer to wiring diagram, electronic unit). NB. The lever gate also control the dump valve **-Y3**.
E13	Break in cable on output to On/Off-function. Machine does not stop. Break in cable or load on On/Off output. Function does not operate.	Same as above but error code E13 is displayed. Function does not operate.
E14	Shorting of the holding current to contactor K1 for direct start and soft start. K1, K2 and K3 at Y/D start. The machine stops. On machines with intermediate relay K7 for holding current, K7 is malfunctioning or short circuit in cable to the relay.	• Replace the relay. • If the error code returns, unplug the connector with cables marked R5 and SB5, connection X46 on the electronic unit for inspection of the cable.
E15	Interruption of holding current to the contactor or contactors. On machines with intermediate relay K7 for holding current, K7 is malfunctioning or short circuit in cable to the relay.	• Replace the relay. • If the error code returns, unplug the connector with cables marked R5 and SB5, connection X46 on the electronic unit for inspection of the cable.
E16	Proportional function short circuited. The machine stops. The output that is short circuited is located by activating one output at a time.	It is not necessary to start the electric motor for troubleshooting. • Operate one function at a time to max position and check which one causes error code E16.

Code	Description	Action
E17	There is a break in the proportional function cable or magnet in the pilot valve. Machine does not stop but function does not operate.	It is not necessary to start the electric motor for troubleshooting. • Operate one function at a time to max position and check which one causes error code E17.
E30	Incorrect phase sequence on machines equipped with phase sequence relay.	Main switch Q1 is also used as a phase switch. • Turn switch to other position. • On machines without Q1: Change the phases in the connector for supply voltage. Incorrect phase sequence is indicated in positions 1 and 2. • Check that all phases are connected to the machine, both before and after phase switch Q1. Measure as instructed: *"Checking the power supply and current consumption"*. . • Make sure all three F7 fuses are intact.
E31	Triggered overload relay.	Resets automatically when overload relay has cooled. • Locate reason for triggered overload relay. Electric motor overloaded by faulty attachment? • Measure current consumption with a clip-on ammeter while operating the attachment and extending one cylinder to its end-stop. Refer to instruction manual chapter 1 on max current consumption. Phase fault? • Measure as instructed in chapter Inspection instructions: *"Checking the power supply"*.
E33	Undervoltage together with triggered overload relay. If undervoltage is present, the motor will consume more current, which triggers the overload relay. Undervoltage need only affect one phase to cause the overload relay to trigger after operating for a while.	• Check machine power supply voltage as instructed: *"Checking the power supply"*. • On machines with transformer that has several tapping options: Make sure the supply to the transformer is on the correct input for the prevailing rated voltage.

Code	Description	Action
E35	Output for holding voltage to the contactors on at start.	• Replace electronic unit.
E36	Output for proportional function on at start.	• Replace electronic unit.
E40	Transfer of parameters from the control box blocked by the electronic unit. Transfer from the control box when in programming mode is blocked by a time limit.	• Cut the power supply voltage to the electronic unit and try again.
E47	Break in temperature sensor cable or sensor itself.	• Check temp sensor cable or replace temp sensor.
P	Displayed when the ID code or basic program is transferred from the control box to the electronic unit.	
-bL	Control box off for more than 120 seconds. For safety reasons, restarting is blocked if the control box has been turned off for more than 120 seconds. Voltage to the electronic unit must be disconnected before being able to restart. Applies to radio control only.	• Cut the power supply voltage to the electronic unit and restart.
•	Dot in the first character space or anything else flashing. General fault.	• Replace electronic unit.