Contents

Troubleshooting 5
General 5
Troubleshooting method 5
To call service personnel 6
Aids 6
Fault symptoms quick guide 7
The electric motor does not start 7
Diesel engine does not start 7
Fuse F7 blows 8
Fuses at power transformer blow at start attempt 8
Over load relay F2 trips at start up 8
Overload relay F2 trips during operation 8
The machine operates but reduces in speed when a function is affected 9
The engine runs but there is no hydraulic function 9
The functions of the machine have no power 9
All functions have power but the arm and tool functions operate slowly 10
A single function operates slowly in A- or B-direction 10
A single arm or wheel function does not work 10
Jerky arm movements 11
Cylinder sinks 11
Overheating in the hydraulic system 11
Noise from the hydraulic system 12
Discoloured hydraulic fluid 12
Electrical system 13
General 13
Electrical safety 13
Troubleshooting: 15
Electrical and control systems, electrically powered machine 15
Control system, diesel powered machines 17
Radio control 18
The machine does not start 18
Fault in the signal transfer from the control unit to the machine 18
The machine or control module stops 19
Hydraulic system 20
Measurements and remedies 21
General 21
Electrical system 21
Checking the fuses 21
Check, setting of the overload relay 21
Checking the power supply voltage 22
Checking the current consumption 24
Check the power cable and extension cable 25
Checking the start circuit 26
Control system 27
General 27
Troubleshooting radio control 27
Checking the control cable 28
Checking the voltage to the electronic unit 28
Checking the control unit 29

Hydraulic system 31
General 31
Checking the static pressure 31
Checking the maximum pressure 32
Checking the pump pressure 33
Checking the load pressure / signal pressure 33
Checking the servo pressure 34
Checking the filter for servo pressure 34
Checking the hydraulic filter 35
Checking the dump valve 35
Diesel engines start assistance 36
Emergency operation 37
Main valve functions 38
Display codes and indications 39
Electronic unit display 39
Operational codes 39
Other operational codes 40
Programming codes 40
Trouble codes 41
Display and indication, electric cabinet diesel 46
Light indication electronic unit 47
Smooth start light indication 48
Character explanation 48
Operational codes 48
Trouble codes 48
Settings 49
Settings for smooth start 49
Guidelines for connection to the electrical supply 50
Hydraulic system pressure and flow 51
Pump flow 51
Measuring points main valve 51
Troubleshooting

General

Warning!
Risk of personal injury. Most machine accidents occur during troubleshooting, 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.

To increase safety during troubleshooting, read and understand the Brokk manual, section "Risk factors during service and maintenance work" and "Preparations for service and maintenance".

Troubleshooting method

Downtime due to a machine fault often causes great irritation, but it is important to keep calm and to think clearly in order to carry out methodical troubleshooting. All the functions of a Brokk machine are driven by cooperation between the electric system, the control system and the hydraulic system. Troubleshooting becomes faster and more rational with an understanding of the relationship between the different systems.

Tips for the troubleshooting process can be obtained by following the quick guide for fault symptoms. Even if you are not a "fully-fledged mechanic” you can contribute to quick troubleshooting by carrying out some basic checks before contacting service personnel.

- First check that the power supply voltage is satisfactory.
- Ensure that the control unit functions. Eliminate problems with radio transfer by testing the radio controlled machines via cables. Ensure that the control cable is intact and correctly connected.
- Check if the display on the electronic unit of the machine shows a code that assists troubleshooting. Trouble codes are displayed 15 seconds after the fault is indicated and provided that the electric cabinet switch for emergency operation/remote control is in the remote control position.
To call service personnel

Be ready to answer the following questions when calling service personnel for advice:

1. Which machine is it regarding? Note the serial number.
2. How many hours has the machine been used? Read off the timer.
3. What are the environmental conditions of the machine, e.g. ambient temperature and dust?
4. What type of work is the machine carrying out, which tool is being used?
5. When did the fault occur? Was it during transportation, during operation etc.

Aids

The following aids may be required:

- Normal set of tools
- Extra control cable
- Manometer with hose and connection nipple for reading hydraulic pressure. The equipment must be approved for the relevant measurement range.
- Universal instrument for measuring voltage and resistance, approved for the relevant measurement range.
- Buzzer for open-circuit and redirection reading.
- Clip-on ammeter for reading current, approved for the relevant measurement range.
Fault symptoms quick guide

The electric motor does not start

- Start the machine according to the instructions in the Brokk manual, section: "Control system".
- Check that all the safety stop buttons of the machine are turned up.
- Check that the phase sequence relay LED is lit which indicates the correct phase sequence.
- Check, on the electric cabinet display, that there is contact between the control unit and the machine. A number is displayed in the first character window at contact. If there is no contact:
  - Check that the control cable is properly connected at both ends. Also see "Checking the control cable" and "Checking the control unit" instructions.
  - During radio control, test drive using the cable. Check that the first character window on the electronic unit display displays "1". If "2" is displayed in the first character window, the machine and control unit have differing identity codes. Replace the control unit or change the identity code, see "Programming identity code" in the control system section of the Brokk manual.
  - If the machine functions via cable operation, the fault must be traced in the radio transfer, see "Troubleshooting radio control"
- Check that there is power supply voltage on all phases to the machine. Measure voltage according to "Checking power supply voltage". Also check that the electric cabinet fuses are intact.
- Read off the trouble codes from the display.
- Follow the troubleshooting instructions "Electrical and control system, electrically powered machines".
- See "Light indication smooth start".

Diesel engine does not start

- Start the machine according to the instructions in section: "Control system".
- Check that the main switch for the battery is in position 1.
- Check that all the safety stop buttons of the machine are turned up.
- Check that the control cable is properly connected at both ends. Also see "Checking the control cable" and "Checking the control unit" instructions.
- During radio control, test drive using the cable. Check that the first character window on the electronic unit display displays "1". If "2" is displayed in the first character window, the machine and control unit have differing identity codes. Replace the control unit or change the identity code, see "Programming identity code" in the control system section of the Brokk manual.
- If the machine functions via cable operation, the fault must be traced in the radio transfer, see "Troubleshooting radio control"
- Follow the trouble shooting instructions "Control system", diesel powered machines".
- If the starter motor does not turn - check that the battery is fully charged. Charge the battery or jump start.
- See the engine supplier manual.
Fuse F7 blows
• Defective phase sequence relay or power transformer.

Fuses at power transformer blow at start attempt
• Too low voltage, fast fuses in the socket or circuit breakers of the incorrect type. See “Guidelines for connection to the electrical supply” and section “Connection to the electrical supply” in the Brokk manual.
• Burnt out electric motor. Request an electrical engineer to check.
During current consumption from the diesel powered electric plant, the start current must momentarily increase to approximately twice the engine voltage rating at smooth start.

Over load relay F2 trips at start up
• Power supply voltage to the machine too low. Measure according to: ”Checking power supply voltage”.
• Bad contact in power supply from power transformer to the motor. Check voltage drop at all connection points.

Overload relay F2 trips during operation
• Check that the thermal overload relay setting corresponds to the value given in the table ”Guidelines for connection to the electrical supply”
• Read off the trouble codes from the display.
• Defective connection in a phase conductor causing reduced phase connection protection function in overload relay F2. Check the power cable for damage. Check that the cables are securely connected to the control unit.

Warning!
Risk of electric shock. In the event of insulation faults, the power cable can conduct current.
Disconnect the power cable connector from the wall socket before inspecting the cable.

• Too great a voltage drop on the network due to an inadequate power source or under sized power cable. See ”Guidelines for connection to the electrical supply”.
• Check that the voltage between the three phases is the same according to: ”Checking power supply voltage”. Also measure the current consumption at high load and compare between phases. See ”Checking power supply voltage”. To achieve high loads, operate the outriggers to the limit positions at the same time as full deployment of a wheel motor. If the current differs between the phases, there may be a fault in the power source or wiring from the power source, the electric motor may also be defective.
• Check the current consumption when tools are operated at full load. The current consumption must not exceed the set value for thermal overload relay according to the ”Guidelines for connection to the electrical supply” table.
• Power output too high due to dirt or leakage in the hydraulic system. Check the dump valve according to instructions ”Checking the dump valve”.


The machine operates but reduces in speed when a function is affected
- Power supply voltage to the machine too low. This can be caused by a voltage drop in the electrical supply, in the joint connectors or because of a weak power cable. Check the power supply voltage according to instructions: "Checking power supply voltage".

The engine runs but there is no hydraulic function
- Not enough hydraulic fluid in the tank. In this instance, a loud cavitation noise is heard from the pump. Stop the motor immediately. Refill and check for leakage.
- Dump valve open, check according to instructions "Checking the dump valve”.
- Defective pressure reducing valve VF8, or defective filter seal. Measure the servo pressure according to instructions: ”Checking servo pressure”.
- Defective pump regulator. Fault symptoms:
  - The pump produces a reduced pressure so that functions with low pressure requirements can be operated.
  - The pump produces no pressure which can occur if one of the control sliders has jammed in the open position.
- Static pressure setting on the pump too low. If static pressure falls below 14 bar there is a risk of the system not “starting” because of too low servo pressure. Measure according to: ”Checking static pressure”.

The functions of the machine have no power
Measure the load pressure according to ”Checking the load pressure/signal pressure”.
- No or too low signal pressure to the pump.
  - Test drive the machine in emergency driving mode. If the problem remains, connect the pressure reducer UP1 on the signal cable of the pump and test drive. The pressure reducer is defective if the machine then works.
  - Defective pump regulator. Even if the regulator does not show any visible internal damage, its slider and race may still be worn. Wear can cause great internal leakage and the regulator must be replaced.
  - Worn pump.
All functions have power but the arm and tool functions operate slowly
- Check whether micro driving is connected to the control unit.
- Check whether the electronic unit display/LEDs indicate any trouble codes.
- Pump static pressure set too low. See: "Checking static pressure".

A single function operates slowly in A- or B- direction
- Fault in the pilot valve or mechanical stop of the lever.
- Restriction in the hydraulic hose due to incorrect pressed hose connection or similar. Check by operating the function without load at half speed at the same time as reading the maximum pressure. If the pressure then rises to the maximum pressure of the pump, despite low load, a fault can be suspected.

A single arm or wheel function does not work
- Check that no function is being operated at start up of the control unit, safety function "Zero position indication" in the Brokk manual.
- Check whether the electronic unit display/LEDs indicate any trouble codes.
- Poor contact in the control unit. Check according to "Checking the control unit".
- Burnt valve coil in the pilot valve. Measure the resistance between pin 1 and 2. The resistance must be approximately 27 Ohm. Also check insulation by measuring between pins and material. Minimum permitted value is 10 KOhm. If the coil is defective, the entire valve must be replaced.
- Contaminants in the pilot valve. The valve can be removed and cleaned but replacement is recommended due to the safety risk.

The machine sinks on the outriggers
- Leaking load retaining valves for outrigger cylinder or internal leakage in the cylinders.
Jerky arm movements

- A seized valve slide due to contaminants. The cause can also be hydraulic fluid, quickly and locally heating up in a cold machine.
- Air in the pilot valve.
- Defective O-rings in the pilot valves.
- Fault in the servo circuit.

Cylinder sinks

If the machine has run for many operating hours and the cylinder function has gradually deteriorated, this is because of internal leakage in the cylinder, load retaining valve, main valve or pressure reducing valve. Internal leakage is caused by normal wear.

There are contaminants in the hydraulic system or a hydraulic component is defective if the cylinder quickly starts to sink.

- Load retaining valve and pressure reducing valve may be defective, the valve seats can be damaged.
- Internal leakage in the cylinder can be caused by damaged seals, pistons or piston rods.
- Control section in the main valve may be defective. Control slider or race may be damaged or contaminated. Remove the cover and pull out the slider to check.

Overheating in the hydraulic system

- Radiator blocked or clogged by dirt.
- Ambient temperature too high, above 30°. Forced cooling using compressed air must be installed if the machine is operating in hot climates.
- Maximum or static pressure for the pump set too high. Check according to the instructions.
- Restriction in hose or quick coupling caused by damage, component fault or installation fault. Restriction in main pipe or pipe to tool caused by extreme heat increase.
- Power output too high due to defective or unsuitable hydraulic tool being used.
- Main pressure reducer is partially open. Carry out dump valve check.
- Worn hydraulic pump.
Noise from the hydraulic system

- Low hydraulic fluid. NB! The pump will be seriously damaged if it is operated with insufficient hydraulic fluid in the system.
- Air in the hydraulic fluid can occur after top up causing cavitation. Use the machine, but at low load, until the air has separated from the fluid.
- Defective hydraulic pump.

It may be difficult to source and analyse the sound from the machine. Noise can change with operating conditions, temperature etc.

Discoloured hydraulic fluid

- Grey and thick hydraulic fluid often means mixing with water. Trace the source of water penetration into the hydraulic system and remedy the fault. Change hydraulic fluid and hydraulic filter. Clean the entire system or insert a water absorbing filter and run again.
- Black hydraulic fluid often means soot build up due to high operating temperatures. Trace the cause of over heating and remedy the fault. Change the hydraulic fluid and hydraulic filter.
Electrical system

General
The machine is supplied with power by diesel engine or by electricity. If the engine is equipped with a diesel engine the relevant documentation is in a separate section. Carry out a daily inspection and regular service according to the service schedule in the Brokk manual.

Electrical safety
The electrical system in the machine consists of a low current circuit and a high current circuit. Only authorised personnel may work on the high current circuit of the machine.

Warning!
Risk of electric shock.
When the machine is connected to the electrical network there is a danger from high current. Always ensure that the machine is not supplied with voltage before carrying out any work on the electrical system.

The electric cabinet contains high current and may only be opened by authorised personnel. The electric cabinet is not normally opened while work is carried out, but it may be necessary for it to be opened during fault tracing. Power to the machine must be shut off before a cable or other electricity conducting component is disconnected or opened.

Read the safety precautions in Brokk manual and carry out any preparations for service and maintenance before starting any work on the electrical system.

Use the illustration below to see which components are connected to the high current circuit, to ensure that nothing comes into contact with these components while the cover for the electric cabinet is open and the machine is connected to the electrical network.
1. High current is always on.
2. High current is on when the phase selector is in position 1 or 2
Troubleshooting:

Electrical and control systems, electrically powered machine

**Danger!**
Risk of electric shock. It is highly dangerous to touch the components in the electric cabinet that are connected to the high current circuit. See the illustration in the electrical system section. Ensure that nobody comes into contact with these components.

- Turn the safety stops of the machine up. Switch phase switch Q1 to position 1 or 2. Ensure that the switch for emergency operation/remote control is in the remote control position. If the electronic unit display does not light, there is no power supply voltage to the electronic unit:
  - Check the control system fuses F15 and F5.
  - Check the electric cabinet fuse F7.
  - Check if the network fuses or earth fault relay have been switched off. Check that there is power supply voltage to the machine. Measure according to “Checking power supply voltage”.
  - There is current to the power transformer when the electronic unit display lights. ”-” is shown in the first character window in the display if the phase sequence is correct. If the phase sequence is incorrect the display shows “E30”, in this instance, turn Q1 to the second position. NB! It can take up to 20 seconds before the electronics are updated so that the display gives the correct phase sequence.
  - If the display shows the code for incorrect phase sequence “E30” in both positions 1 and 2, a phase for the phase sequence relay is missing.
    - Check the electric cabinet fuse F7.
    - Check that there is power supply voltage to the phase sequence relay by taking readings at phase sequence relay points: (K5.L1 - K5.L2), (K5.L1 - K5.L3) and (K5.L2 - K5.L3).
      - If the electronic unit display shows code “E30” for incorrect phase sequence in both positions 1 and 2, despite there being power supply voltage on all three phases up to the phase sequence relay, the phase sequence relay is defective.
      - If there is no voltage to any of the phases, the power supply to the machine is faulty. Carry out: “Checking power supply voltage”.
  - Move switch S8 to the emergency operation position. All electronics are disabled when S8 is in the emergency operation position. Start the machine using electric cabinet switch S2.
    - If the engine does not start, there is no power supply to switch S2. Carry out: “Checking the start circuit”.

•
•
•
•
•
•
•
• Connect the control unit to the machine via the control cable if the electric motor starts during emergency operation.
  • Set the S8 switch on the electric cabinet to the remote control position. Check that Q1 is in position for the correct phase sequence.
  • Turn the control unit safety stop SO up. Check that the green LED H1 lights and displays that there is supply voltage to the control unit.
    • If the lamp does not light there is no power supply voltage to the control unit. Measure according to “Checking the control unit”.
  • Start the control unit by pressing switch S1 upwards. Check that the orange LED H2, which confirms that the control unit has started, lights. The electronic unit display must show “1” or “2” in the first character window.
    • If LED H2 is not lit the circuit board for the control unit or the LED is defective.
  • Start the electric motor. Push the control unit switch S2 up and hold until the tail lamp on the machine lights. The lamp lights when smooth start and contactor 1 are auto-holding.
    • If the electric motor does not start, check that the electronic unit ON/OFF LED lights. Ensure that there is an output signal on OUT1 by reading off.
        • The electronic unit is defective if there is no output signal on OUT1.
    • If there is an output signal on OUT1 but the electric motor does not start, repeat trouble-shooting of the electric and control systems.
Control system, diesel powered machines

- Turn safety stop S0 on the electric cabinet of the machine up. If the electronic unit display does not light, there is no power supply voltage to the electronic unit:
  - Check that the battery supplies power to the machine, the main switch key must first be pressed in and then turned clockwise.
  - Check main fuse, F9, and electronic unit fuse, F5.
  - Check that the battery is fully charged.
  - Check that the cables are clean and have good contact with the battery poles.
  - If there is no power supply to the electronic unit, check if there is voltage at the start beside the battery. Use a volt meter. Then take readings at every connection point and at each fuse to find the open-circuit.
Radio control

The machine does not start
Follow the start and stop instructions of the machine in section “Control system”.

Fault in the signal transfer from the control unit to the machine
If the machine radio receives interference, the number 1 flashes in the first character window and all or parts of the machine functions stop. The engine stops in the event of too much interference. Several stoppages a day is normal depending on deadspots.

- Run the machine, with the control cable connected, to ensure that it is actually radio transfer that is the problem.
  - Check that the correct control unit is used for the machine.
    - Connect the control cable and start the control unit.
    - Check the electronic unit display, if the number 2 is shown in the first character window, the ID code is incorrect. If the correct control unit is used, the number 1 is shown in the first character window.
  - Check that the battery is fully charged and that there is optimum contact at the battery poles.
  - Check that both the transmitter and the receiver antennas are intact and securely connected. The transmitter antenna is integrated in the control unit.
  - Check that the radio receiver is securely installed.
  - Change the radio frequency. The radio channel can be changed at any time during operation, but the machine will stop and the electric motor must be restarted again.
    - Press switch S1 up twice in quick succession. There are 12 channels to choose from. Two quick presses of S1 scrolls between the channels. The selected channel is shown in the third character window on the display in the electric cabinet.
    - Restart the electric motor using switch S2.

Note. If the safety stop of the machine or control unit is depressed, the radio returns to the pre-programmed channel.
The machine or control module stops
Ascertain which stops first, the machine or the control unit.

1. The machine has switched off if a trouble code is indicated on the electronic unit display despite the green LED H1 and yellow LED H2 lighting on the control unit. Trouble code is displayed for 15 seconds.

2. The control unit has switched off if the yellow LED H2 has gone out.

THE MACHINE STOPS
- Check the battery capacity in the control unit.
- Check if the display on the electric cabinet shows any trouble codes or troubleshoot the electrical, control and hydraulic systems of the machine.
- See the safety functions: "Signal voltage limitation" and "Radio limitation".
- If the machine always stops at a specific function, that function has an electrical fault. Remove the cable connector for the function from the electronic unit and attempt to operate the function again. If the machine does not stop during the attempt, the electronic unit is intact. The fault is somewhere between the cable connector and the relevant function, e.g. cable break, redirection or short-circuit. If no fault can be found, see safety function: “Zero position indication”.

THE CONTROL UNIT STOPS
- Battery and connection problem.
  - Low battery capacity is indicated by the machine beeping and the yellow H2 LED flashing. Replace the battery with a new and fully charged battery.
  - Clean the poles of the battery and battery holder.
  - Check for loose connections between the battery and battery holder poles.
- Fault in the control unit.
  - Carry out the checks: "Checking the control unit” and "Checking the control cable”.
  - In the event of a signal transfer fault between the control unit and the machine, “-“ is shown in the character window on the electronic unit display.
- Check whether any of the safety functions of the machine causes the control unit to stop.
- Check if there are any other radio controlled machines nearby which may be interfering. Observe if the problem persists at any specific work site or if there is anything specific in the area surrounding the machine.
Hydraulic system

Caution!
Risk of serious compression injury.
There is a risk of getting trapped between the machine and surrounding objects when checking the hydraulic pressure of the machine.
Always check the position of the machine in relation to your own position.
Keep one hand on the safety stop of the machine.

- Read the static pressure of the machine according to “Checking static pressure”.
  - Adjust the pressure if it is incorrectly set.
- Read the maximum pressure of the machine according to “Checking maximum pressure”.
  - Adjust the pressure if it is incorrectly set according to “Checking maximum pressure”.

**NB!** The maximum pressure of the pump must not exceed the value in the “Hydraulic system pressure and flow” table. If the maximum pressure of the pump is set too high the function of the machine is jeopardised or the hydraulic system can be seriously damaged.

- Listen to establish if the dump valve of the machine is open, if it is, the motor sounds rough. The machine becomes slow and will not manage any load, it cannot raise itself on the outriggers for example. Contaminants are the most common cause for the dump valve not working. Carry out: “Checking the dump valve”.
- Read off the load and signal pressure of the machine for each function according to “Checking load pressure/signal pressure”.
  - Trace the cause of any fault values amongst the hydraulic valves which belong to the relevant function.
- Read the servo pressure of the machine according to “Checking servo pressure”. If the machine can manage one function at a time, but slows when more than one function is operated at the same time, there is probably a leak in the servo circuit pressure limiter.
- Switch off the machine. Check that the lever can be moved to the limit position, if not, the slider may be stuck or something is preventing the lever from moving.
- Check for hydraulic fluid leakage.

If the hydraulic pressure of the machine is within the recommended values, the fault is electrical. Check the control system.
Measurements and remedies

General
Breakdown can be caused by faults in the electrical system, control system, hydraulic system or in a combination of several of these systems. One method of isolating the fault is to run checks that establish which of the functions are fault free. Run checks by following the start process step by step up to operating the machine.

If the machine is diesel powered contact an authorised service workshop if the diesel engine is suspected as the cause of the breakdown.

Electrical system
The most common causes of breakdowns caused by the electrical system is a defective connection to the electrical supply. See the section “Connection to the electrical supply” in the Brokk manual.

Danger!
Risk of electric shock. Never carry out checks or repairs on the electrical system of the machine without the necessary training.

Checking the fuses
Check the fuses for the electrical supply and the machine. A blown fuse must always be treated as a fault symptom. Investigate what might have caused the fuse to blow and rectify the fault.

Replace the blown fuse with a new slow blow fuse of the same current rating. If the new fuse also blows, there is a fault in the electrical equipment or in the connected machine. The cause of the fault must be rectified before a fuse is replaced.

<table>
<thead>
<tr>
<th>Fuse</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F14</td>
<td>Lighting</td>
</tr>
<tr>
<td>F15</td>
<td>Control system</td>
</tr>
<tr>
<td>F16</td>
<td>Filling pump</td>
</tr>
<tr>
<td>F17</td>
<td>Lighting on cable carrier</td>
</tr>
<tr>
<td>F18</td>
<td>Signal</td>
</tr>
<tr>
<td>F19</td>
<td>Lubrication pump</td>
</tr>
<tr>
<td>F20</td>
<td>Start equipment smooth start</td>
</tr>
</tbody>
</table>

Machine fuses.

Check, setting of the overload relay
Check that the setting value for the thermal overload relay corresponds to the value given in “Guidelines for connection to the electrical supply”.

Set the overload relay by turning the setting knob to the desired position to the arrow point. Check that the reset knob is set to “AUT”, automatic resetting.

A Setting knob
B Setting selection, manual or automatic.
C Red indicator – overload relay tripped
D Manual resetting
Checking the power supply voltage

The aim of the check is to ensure that there is power supply voltage to the machine and that it is sufficiently stable and powerful. The value of the power supply voltage varies from country to country. Even the colour markings can vary. See the examples in the table.

Use a universal instrument to check that there is voltage from the electrical supply to all three of the machine’s phases. Start at contactor K1 and then take a reading at each junction connector to the electrical supply point.

1. Take cross readings in the connector between phases L1 - L2, L1 - L3 and L3 - L2.

2. The readings on the contactor can be taken with the motor switched off but to ensure that the voltage is stable take the reading when the electric motor is under load.

Operate an outrigger downwards at the same time as a drive motor is fully deployed. Check that there is voltage to all the phases in contactor K1, take readings between phases:
K1;1L1 and K1;3L2
K1;3L2 and K1;5L3
K1;1L1 and K1;5L3

<table>
<thead>
<tr>
<th>Extension cable</th>
<th>Machine connector</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Europe</strong></td>
<td><strong>USA</strong></td>
</tr>
<tr>
<td>HD 308</td>
<td>(Previously HD 308)</td>
</tr>
<tr>
<td>G</td>
<td>Y/GN</td>
</tr>
<tr>
<td>L1</td>
<td>BN, SB</td>
</tr>
<tr>
<td>L2</td>
<td>SB, BL</td>
</tr>
<tr>
<td>L3</td>
<td>W</td>
</tr>
<tr>
<td>N</td>
<td>BL</td>
</tr>
</tbody>
</table>

Colour markings can vary in different countries. The standard HD 308 is being introduced during 2004.
Y yellow, GN green, SB black, BN brown, BL blue, W white, R red.
If supply voltage to a phase is missing, remedy by:

- Check the fuses for the electrical supply.
- Take a reading of the supply voltage according to the following points. When taking a reading under full load the voltage must not deviate more than 5% from the nominal value. See table: "Guidelines for connection to the electrical supply”. If the supply voltage deviates after a specific component then that component is defective and must be replaced. The direction of testing must be from the electrical supply point to the machine.
  - Carry out “Check the power cable and extension cable”. Check that the supply voltage is stable under full load by taking a reading of the voltage when an outrigger function is operated downwards at the same time that as a drive motor is operated to the limit.
  - Take reading on the overload relay F2.1 (2T1), F2.2 (4T2), F3.3 (6T3) between phases F2.T1-F2.T2, F2.T1-F2.T3, F2.T2-F2.T3.
  - If the voltage is uneven or low, continue to take readings between the phases on both sides of contactor K1, phase switch Q1 and connector X3 on the machine. Take readings of the power supply before the electric cabinet phase switch Q1, pull the extension cable out of the connector for the machine. Take readings between the phases. If the value is incorrect take a reading of the power supply voltage before the extension cable. If the correct value can be read before the extension cable, then the extension cable is probably faulty.
  - If the fault remains the power supply voltage to the machine must be improved. The fault may be before the electrical supply socket that the machine is connected to.
Checking the current consumption

It is normal for the current consumption to occasionally and briefly exceed the set value; but the value must not be exceeded continually. See the table "Guidelines for connection to the electrical supply".

Current consumption is measured using a clip-on ammeter.

Warning!
Risk of electric shock. The voltage supply to the machine must be interrupted when the clip-on ammeter is secured to the phase conductor.

- Secure the clip-on ammeter to one of the power cable phase conductors.
- Activate the tool, for example, breaker and read off the current consumption during operation.

If the value is exceeded the overload relay will deploy after a period of operation. The cause may be one of the following:

1. Voltage drop. Check the power supply under load by taking a reading at contactor K1. See “Checking the power supply voltage”.
2. Overload caused by the tool being used. Check that current consumption is within the permitted range when tools are used. Also see the tool manual.
Check the power cable and extension cable

- Disconnect the cable from the electrical supply socket.
- Check that the cable has the correct rating. See the table "Guidelines for connection to the electrical supply".
- Check that there are no external, visible signs of damage.
- Check if any part of the cable or any of the connectors is hot. Heat develops in cables that are too narrow and low rated and in connectors with bad connections.
- Open the connector and pull on the cables so that you can feel that they are tightened. There must not be any bad connections.
- Check that the conductors are not under load. The earth lead must be connected to earth and must be longer than the phase conductor so that it disconnects last if the power cable is pulled loose.
- Check if there is a break between the connector and the joint socket. Measure colour to colour using a buzzer.
- Check for redirection between cables. Cross measure using a buzzer.
- Check that the yellow and green earth lead is connected to the chassis of the machine. Connect a buzzer between the earth pin in the connector and the chassis.
- Remove the protective sleeve for the connector so that the ends of the cables are visible. Open the electric cabinet of the machine. Check the cables between the power supply cable connector and phase switch Q1 in the electric cabinet. Check for open-circuits or redirection. Check using an ohmmeter or buzzer.
Checking the start circuit

- Hold switch S2 pressed in and check that 24 VDC voltage is available for smooth start connection point UK1.4.
  - If voltage to smooth start is missing, check that 24VDC voltage is available to phase sequence relay terminals, K5.21 and K5.24.
  - If supply voltage is missing check the phase sequence and that all phases are available to the machine.
  - Check the overload relay function. Carry out: Checking the power supply voltage.
- When switch S8 is in the emergency operation position there should be 24 VDC power supply at the following points.
  - At electronic unit D1, connection point: -X46.+DV
  - At phase sequence relay K5, connection point: -K5.11 and K5.14
  - At phase sequence relay K5, connection point: -K5.21 and K5.24
  - At overload relay F1, connection point: -F1.95 and F1.96
  - At fuse F20
  - At smooth start UK1, connection point: -UK1.2
  - At switch S2: -S2.2
- Press switch S2, there must be 24 VDC power supply at the following points.
  - At switch S2, connection point: -S2.1
  - At smooth start UK1, connection point: UK1.4
  - At start, switch S2 must be held pressed down until smooth start engages the by-pass contactor K1 that gives auto holding to smooth start and contactor K1 over the switch K1.13-14.
Control system

General
If radio control is used the most common causes of breakdown are:

• Discharged battery or dirty battery poles.
• The control unit from another machine is used and so the ID code is incorrect.
• Another radio-controlled machine using the same frequency interferes with the transfer. The Brokk machine stops.

The most common cause of the breakdown when using a control cable is when the control cable is damaged. The simplest check is to connect a control cable that is known to be intact.

Troubleshooting radio control
Always test-drive the system using cable control to limit the troubleshooting. When cable control is used for troubleshooting, the ID code is suppressed and the same control unit can be used for different machines provided that they have the same type of control system.

If there are other radio controlled machines in the area there is a risk of interference. Check this by observing if the first symbol in the electronic unit displays flashes.

Check if the electric cabinet display displays a fault code.
Checking the control cable
- Check that there are no external, visible signs of damage.
- Remove the control cable. Check if there is break in any of the cables or if there is redirection between any of the cables. Measure using a buzzer.
- Check that a connection exists, pin for pin between the control unit chassis switch and the terminal for the transmitter logic card: Check using an ohmmeter or buzzer.
- Check that a connection exists, pin for pin, between the control unit chassis switch and the terminal for the electronic unit. Check using an ohmmeter or buzzer.
- Connect the control cable. Check that a connection exists, pin for pin between the transmitter logic card and the electronic unit. Check using an ohmmeter or buzzer.

Checking the voltage to the electronic unit
Check that the electronic unit display lights. If the display does not light check that:
- The phase switch in the electric cabinet is in position 1 or 2.
- The safety stops for the machine are pulled up.
- Electronic unit fuse F15 is intact.
Checking the control unit

Ensure that the control unit battery is intact and fully charged or use a control cable during the test.

Observe the electronic unit display during the course of the troubleshooting. If any code deviates from the normal start procedure check the meaning of the code.

- Turn the control unit safety stop up. Start the control unit, S1. Check that the green LED H1 lights and displays that there is supply voltage to the control unit. Check that the yellow LED H2 lights and displays that the control unit is in operating mode. Orange LED H3 must be out and the horn must be silent.

- Connect the control circuit by pressing push-button B2.RL. Orange LED H3 must light and display that the lever gate is open. Operate one proportional function at a time to the end limit. If anything is wrong with the control unit is shuts down and yellow LED H2 goes out. A fault in the control unit has deployed the safety function to limit signal voltage.

- If the control unit is defective the horn sounds when S1 is pressed upwards. Count the number of signals to check what function is wrong. Look for the fault code on the electronic unit display in the electric cabinet for more information.

<table>
<thead>
<tr>
<th>Number of signals</th>
<th>Function</th>
<th>Trouble code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CY2</td>
<td>E01</td>
</tr>
<tr>
<td>2</td>
<td>CY3</td>
<td>E02</td>
</tr>
<tr>
<td>3</td>
<td>CY4</td>
<td>E03</td>
</tr>
<tr>
<td>4</td>
<td>Tools</td>
<td>E04</td>
</tr>
<tr>
<td>5</td>
<td>Slew</td>
<td>E05</td>
</tr>
</tbody>
</table>
CONTROL UNIT TEST MODE

The on/off functions and the proportional functions can be checked by moving the control unit to the test position. The control unit is fault-traced by interpreting sound or light signals. The control unit H3 LED indicates that the lever gate is open and flashes at the same pace as the audible signal is sounded.

- Activate test mode by pressing the control unit stop button S0.
- Twist the stop button up again and then press switch S1 upwards eleven times in quick succession. The H2 LED, which indicates that the control unit is in operating mode, will flash and the signal horn will sound once to confirm that the control unit is in test mode.

Note that a time limit is integrated in the system. This means that the control unit will not enter test mode if switch S1 is pressed upwards with too slow a tempo.

- Correct on/off function is confirmed by 2 short signals when the switch is switched on.
- Correct proportional functions are confirmed by short signals increasing in frequency with deployment of the control lever. At maximum deployment long signals are heard.
- Tool functions with variable flow are checked by pressing pushbutton B1.LL and turning potentiometer R3. Short signals increasing in frequency must be heard when the potentiometer is turned to maximum position.
- Tool functions with constant flow are checked by pressing pushbutton B1.LR. Frequent short signals must be heard.
Hydraulic system

General

Dirt is the most common cause of breakdown in the hydraulic system. Take great care with cleanliness when checking the hydraulic system to prevent any dirt penetrating the system. When checking the pressure settings; see "Hydraulic system pressure and flow" in the settings section for recommended pressures and measuring point locations.

Checking the static pressure

MEASURING

- Remove the cover from measuring point XPX. Connect a pressure gauge.
- Move switch S8 in the electric cabinet to the emergency operation position. Start the machine using electric cabinet switch S2.
- Read off the static pressure. Adjust the pressure if it deviates from the recommended value.

ADJUSTING

- The pressure is adjusted on the hydraulic pump regulator.
- Remove the cap nut from the setting screw. Slacken off the lock nut for the setting screw.
- Turn the setting screw using an Allen key until the correct pressure is reached. Turn clockwise to increase the pressure.
- Lock the setting screw by tightening the lock nut to light contact. There is a risk of the setting screw shearing.
- Check that the pressure is correct and that it did not change when the lock nut was pulled out.
- Install the sealing washer and cap nut.
Checking the maximum pressure

**MEASURING**
- Disconnect the hydraulic connection to the hydraulic attachment so that the quick coupling is closed before measuring.
- Remove the cover from measuring point XPX. Connect a pressure gauge.
- Move switch S8 to the emergency operation position. Start the machine using switch S2 in the electric cabinet.
- Move the hand lever for the tool to the outer limit position. See “Emergency operation of the main valve”
- Read off the maximum pressure. Adjust the pressure if it deviates from the recommended value.

**ADJUSTING**
- The pressure is adjusted on the hydraulic pump regulator.
- Remove the cap nut from the setting screw.
- Slacken off the lock nut for the setting screw.
- Turn the setting screw using an Allen key until the correct pressure is reached. Turn clockwise to increase the pressure.
- Lock the setting screw by tightening the lock nut to light contact. There is a risk of the setting screw shearing.
- Check that the pressure is correct and that it did not change when the lock nut was tightened.
- Install the sealing washer and cap nut.

---

*Hydraulic pump regulator, maximum pressure*

- A cap nut
- B setting screw
- C lock nut
Checking the pump pressure
See definition and setting in the table: “Hydraulic system pressure and flow”.

**MEASURING**
- Remove the cover from measuring point XPX. Connect a pressure gauge.

<table>
<thead>
<tr>
<th>Warning!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of serious compression injury.</td>
</tr>
<tr>
<td>When the operator is sufficiently close to the machine to read off the pressure gauge there is a risk of becoming trapped between the machine and the ground, walls, pillars and so on. Use small lever movements and always check the position of the machine in relation to your own position. Be prepared to press the safety stop.</td>
</tr>
</tbody>
</table>

- Check the recommended pressure in the table “Hydraulic system pressure and flow”. Operate the function to the outer limit position. Read off the pressure gauge. NB. When checking the slew function the arm must be fixed against a static object or against the machine outriggers.
- Read off the pump pressure.

Checking the load pressure / signal pressure

**MEASURING**
- Connect the pressure gauge to test connection XPL.
- Move switch S8 in the electric cabinet to the remote control position. Start the machine.
- Operate the functions from the control unit, one at a time. Read off the pressure and compare it to the recommended value.

**ADJUSTING**
See the section “Adjusting hydraulic pressure to the tool” in the Brokk manual.
Checking the servo pressure

MEASURING

- Connect a test nipple to test connection XPS.
- Move switch S8 in the electric cabinet to the remote control position. Start the machine.
- Operate a function to the outer limit position. Read off the pressure. Operate a second and a third function to the outer limit position at the same time. Check that the pressure does not change.
- If the pressure falls it means that reduction valve VF8 is not sealing.

Checking the filter for servo pressure

Relieve the machine from load and clean the area surrounding the main valve.

- Remove the air filter and drain the hydraulic fluid of the machine into a container.
- Brokk 330: To access the servo filter, the main valve must be removed as follows:
  - Remove the mounting screws.
  - Remove the upper return hose from the valve.
  - Pry out the upper section of the valve as much as possible.
  - Also see the image of the main valve in the Spare parts list for the Main valve.
- Brokk 180: The servo filter is easy to access on the P70. See the image of the main valve in the Spare parts list for the Main valve.
- Remove the filter plug, sealing washer, spring, spacer and filter as illustrated.
- Clean and blow clean the components. If necessary, replace the filter.
- Install the components in reverse order. Torque tighten the plug.
Checking the hydraulic filter

If there are large amounts of large particles of metal or sealing material in the filter holder the hydraulic system of the machine must be overhauled immediately. The particles indicate that one or more components is faulty. The particles if trapped in the “wrong place” can cause breakdown and severe damage to the machine. Follow the instructions for replacing the return filter. Check the contents.

Checking the dump valve

Check that the valve receives a signal from the control system. Check that the LED in the dump valve electrical switch lights up when the control circuit is connected. If the LED does not light:

1. Check that the ON/OFF diode in the electronic unit lights.
2. Measure the voltage between +OUT5 and -OUT5 on the electronic unit, and then the switch by the valve. If there is voltage at the switch the LED is faulty and the fault is not electrical.

THE VALVE DOES NOT CLOSE

When the machine is in neutral and the lever gate is closed, the dump valve must open and the hydraulic flow be led back to the tank. The pump gives full flow under low pressure.

When the control circuit is engaged the dump valve must close. The pressure must rise to static pressure and the noise level will fall. If the pressure does not rise when the control circuit is engaged it may be caused by the dump valve not closing.

• Detach the air filter to release the overpressure in the tank. Plug the pipe between the dump valve and the main pressure limiter valve VF1.

If the pressure rises when the pipe is plugged it means that the dump valve is not sealing. Clean or replace the dump valve.

• If the pressure does not rise there is probably dirt in the main pressure limiter valve VF1.

THE VALVE DOES NOT OPEN

If the pressure does not fall when the control circuit is disengaged it may be caused by the dump valve not opening.

• Remove the electrical switch for the dump valve. If the valve still does not open the fault is hydraulic. Check and clean or replace the dump valve.
Diesel engines start assistance
The batteries must be treated with respect. Read the section about Diesel in the Brokk manual and the engine supplier’s instructions.

Warning!
Risk of personal injury, such as electrical shock, abrasion or burning. Risk of damage to the machine, such as damage to electronic equipment. Use personal protective equipment and carefully follow the instructions for starting using jump leads.

The diesel powered Brokk machine has a 24 volt electrical system. Check that the equipment used for start assistance has the same voltage.

Connect the jump leads in the following order.
- From the machine positive pole (1) to the auxiliary start equipment positive pole (2)
- From the auxiliary start equipment negative pole (3) to the earth strip screw on the turntable of the machine (4).

When the machine has started disconnect the start cables in the following order:
- From the earth strip screw on the turntable of the machine (4) and then from the auxiliary start equipment negative pole (3).
- From the auxiliary start equipment positive pole (2) and then from the machine positive pole (1).
Emergency operation

**Warning!**
Risk of unexpected movement. Ensure that the correct hand lever is moved in the correct direction.

- Move switch S8 in the electric cabinet to the emergency operation position.
- Start the motor by pressing electric cabinet switch S2.
- Operate the machine using the levers on the relevant valve section. Move the levers very carefully so that unexpected movements are avoided.
- Stop the motor by pressing electric cabinet safety stop S0.

**NB!** Emergency operation must only be carried out if the machine is equipped with hand levers.

The function is used in the event of a fault in the control circuit, if the control cable is damaged for example. Emergency operation of the machine must only be used in extreme cases when the position of the machine may be a danger.

For safety there is an additional safety stop beside the main valve. Always keep one hand on the safety stop when using emergency operation.

**Warning!**
Risk of serious compression injury.
When the operator is sufficiently close to the machine that the valves can be manually affected, there is a risk of becoming trapped between the machine and the ground, walls, pillars and so on. Use small movements and always check the position of the machine in relation to your own position. Keep one hand on the safety stop.

- Pull the hand lever away from the directional valve for hydraulic pressure in port A.
- Push the hand lever away towards the directional valve for hydraulic pressure in port B.
Warning!
Risk of unexpected movement. If procedures have been carried out on the electrical or hydraulic systems of the machine there is a risk that cables or hoses may be incorrectly installed. Take great care when operating.

Main valve functions

<table>
<thead>
<tr>
<th>Description</th>
<th>Designation</th>
<th>A direction</th>
<th>B direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1VY3</td>
<td>Tool angling Cylinder 4</td>
<td>Out</td>
<td>In</td>
</tr>
<tr>
<td>1VY2</td>
<td>Arm 3 Cylinder 3</td>
<td>Out</td>
<td>In</td>
</tr>
<tr>
<td>1VY1</td>
<td>Arm 2 Cylinder 2</td>
<td>Out</td>
<td>In</td>
</tr>
<tr>
<td>1VY6</td>
<td>Arm 1 Cylinder 1</td>
<td>Out</td>
<td>In</td>
</tr>
<tr>
<td>1VY5</td>
<td>Slew function</td>
<td>Clockwise</td>
<td>Anti-clockwise</td>
</tr>
<tr>
<td>2VY7</td>
<td>Track drive left side</td>
<td>Forwards</td>
<td>Backwards</td>
</tr>
<tr>
<td>2VY6</td>
<td>Track drive right side</td>
<td>Forwards</td>
<td>Backwards</td>
</tr>
<tr>
<td>2VY5</td>
<td>Outrigger right side</td>
<td>Down</td>
<td>Up</td>
</tr>
<tr>
<td>2VY3</td>
<td>Outrigger left side</td>
<td>Down</td>
<td>Up</td>
</tr>
<tr>
<td>1VY4</td>
<td>Hydraulic tool</td>
<td>Close*</td>
<td>Open*</td>
</tr>
</tbody>
</table>

*The function is dependent on what tool is attached.
Display codes and indications

Electronic unit display

During start up and operation, the electronic unit display shows operational data. Always read the display at start up, it aids in the understanding of the control system that facilitates troubleshooting. Trouble codes are displayed instead of operational data in the event of a fault. All trouble codes display “E” in the first character window.

Operational codes

FIRST CHARACTER WINDOW

The first character window indicates the status of data transfer from the control unit to the electronic unit.

<table>
<thead>
<tr>
<th>Code</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>A dash in the first character window and a character in the third character window shows that power supply voltage is being supplied to the electronic unit but that no data is being transferred from the control unit.</td>
</tr>
<tr>
<td>1</td>
<td>The code shows that the data transfer from the control unit functions and that the control unit has the correct ID code. Radio control can be used.</td>
</tr>
<tr>
<td>2</td>
<td>The code shows that the data transfer from the control unit functions but that the control unit has the incorrect ID code. Radio control cannot be used. Indication is only shown when the control cable is connected between the control unit and the machine.</td>
</tr>
</tbody>
</table>

OPERATIONAL CODE DURING CABLE CONTROL

<table>
<thead>
<tr>
<th>Code</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2--</td>
<td>A dash in the second and third character window indicates that the machine is cable controlled.</td>
</tr>
</tbody>
</table>

OPERATIONAL CODE DURING RADIO CONTROL

<table>
<thead>
<tr>
<th>Code</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>13A</td>
<td>A value between 1-8 in the second character window and a value between 1-8 or A,B,C in the third character window indicates that the machine is radio controlled. The second character window value indicates what frequency has been chosen for radio control. The frequency is determined according to relevant national regulations. The third character window value indicates which channel radio transfer occurs within the frequency range. To change the radio channel, see section “Control system”.</td>
</tr>
</tbody>
</table>
Other operational codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Explanation</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>-bl</td>
<td>The code indicates that the radio limitation safety function, for radio controlled machines, is active. The function blocks the electronic unit from radio signals if the control unit has been switched off for 120 seconds.</td>
<td>Cut and reset the power supply voltage to the electronic unit.</td>
</tr>
<tr>
<td>Lo-</td>
<td>Hydraulic fluid temperature is below 40°C. Temperature information is displayed when the electrical cabinet’s switch for temperature display is depressed.</td>
<td></td>
</tr>
</tbody>
</table>

Programming codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>P--</td>
<td>The code shows that the ID code or program has been transferred from the control unit to the electronic unit.</td>
</tr>
<tr>
<td>Pri</td>
<td>The code shows that the electronic unit is in programming mode 1.</td>
</tr>
<tr>
<td>PPb</td>
<td>The code is shown during programming of working pressure for hydraulic tools.</td>
</tr>
</tbody>
</table>
**Trouble codes**

During operation the electronic unit display continuously shows operational status. In the event of a fault, a trouble code is shown for 15 seconds, which causes the electronic unit to attempt to restart. If the fault remains after a start attempt the trouble code is shown again.

<table>
<thead>
<tr>
<th>Code</th>
<th>Explanation</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| E01  | The code shows that a safety function has been activated. The cause is a function fault in the control lever for controlling cylinder 2.  
1. Zero position indication safety function is active. Control lever is not in the neutral position during start up.  
2. Safety function, limiting of voltage intervals, is active. The machine stops. | • Depress the control unit safety stop. Check that the control lever for the function is in the neutral position at restart.  
If the trouble code recurs the control lever must be inspected. Check the neutral position of the potentiometer. Clean the circuit board. Check for any cable breaks. |
| E02  | See code E01 but with regard to the function of cylinder three, CY3. | Same remedy as for trouble code E01. |
| E03  | See code E01 but with regard to the function of cylinder four, CY4. | Same remedy as for trouble code E01. |
| E04  | See code E01 but with regard to the tool function. | • Depress the machine safety stop. Check that the left-hand control lever is in the neutral position at restart.  
If the trouble code recurs the control lever pushbutton must be inspected. Check for dirt, moisture or cable break. |
<p>| E05  | See code E01 but with regard to the slew function. | Same remedy as for trouble code E01. |
| E06  | See code E01 but with regard to the appropriate function. | Same remedy as for trouble code E01. |</p>
<table>
<thead>
<tr>
<th>Code</th>
<th>Explanation</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>E08</td>
<td>The code shows that the power supply voltage to the electronic unit is irregular.</td>
<td></td>
</tr>
</tbody>
</table>
| E09  | The code shows that the power supply voltage to the electronic unit is too low, below 24VDC. The fault can cause problems when operating several functions at the same time. | - Check the power supply voltage to the machine.  
- Check that the supply to the power transformer is sufficient |
| E10  | The code shows that the power supply voltage, 24VDC to the electronic unit is too high, above 29VDC.  
If the power supply voltage is above 33VDC the machine stops, the display goes out and only the POWER LED lights. | Check the power supply voltage to the machine. |
<p>| E11  | The code shows that the current consumption for the control unit is too high. | Short-circuit in the control cable. Check the control cable. |
| E12  | The code shows that one of the On/Off functions of the machine are short-circuited. The machine stops. | Depress and turn the machine safety stop up. It is not necessary to start the electric motor. Troubleshoot by activating an On/Off function one at a time. When the defective function is activated, the trouble code recurs and the machine stops. The trouble code shows the functions connected to the electronic unit outputs OUT1 – OUT7, i.e. also the dump valve. |</p>
<table>
<thead>
<tr>
<th>Code</th>
<th>Explanation</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>E13</td>
<td>The code shows that there is a cable break in one of the On/Off functions outputs. The machine does not stop but the function does.</td>
<td>The function with the cable break can be traced by activating the On/Off function switch, one at a time. It is not necessary to start the electric motor when troubleshooting. When the defective function is activated, the trouble code recurs and the function stops.</td>
</tr>
<tr>
<td>E14</td>
<td>The code shows that there is a short-circuit in the holding current to the machine’s smooth start. The machine stops or cannot be started.</td>
<td>Check the holding circuit for the machine’s smooth start. Check for a short-circuit.</td>
</tr>
<tr>
<td>E15</td>
<td>The code shows that the holding current to the machine’s soft start is broken.</td>
<td>Check the holding circuit for the machine’s smooth start. Check for a cable break.</td>
</tr>
<tr>
<td>E16</td>
<td>The code shows a short-circuit to a proportional function. The machine stops.</td>
<td>Troubleshoot by activating the proportional functions via the control levers one by one. Check which function generates the trouble code. It is not necessary to start the electric motor when troubleshooting.</td>
</tr>
<tr>
<td>E17</td>
<td>The code shows that a proportional function had a cable break or that a magnet in the pilot valve is defective. The machine does not stop but the function does.</td>
<td>Troubleshoot by activating the proportional functions via the control levers one by one. Check which function generates the trouble code. It is not necessary to start the electric motor when troubleshooting.</td>
</tr>
<tr>
<td>Code</td>
<td>Explanation</td>
<td>Remedy</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>--------</td>
</tr>
<tr>
<td>E30</td>
<td>The code shows that the phase sequence is incorrect or that a phase is missing.</td>
<td>Change the phase sequence using the main switch on the machine. Brokk 40 and 50: the phase sequence can be changed in the connector. If the trouble code recurs, check that all phases are in the machine, before and after the phase switch. Check that all three fuses F7 are intact.</td>
</tr>
</tbody>
</table>
| E31  | The code shows that the overload relay has tripped. | The overload relay automatically resets when it cools. If the trouble code recurs, determine why the overload relay tripped. Normal cause is engine overload, that there is a phase fault or loose cables on the overload relay.  
- Read the current consumption using a clip-on ammeter when the tool is operating at the same time as a cylinder is operated to the limit position. See table “Guidelines for connection to the electrical supply” in the machine data section.  
- Check for a phase fault by reading the power supply voltage and current consumption.  
- Check the power supply voltage of the machine. See table “Guidelines for connection to the electrical supply” in the machine data section. |
<p>| E33  | Under voltage together with blown overload relay. If under voltage occurs, the motor will draw more current, which causes the overload relay to trip. Under voltage only needs to affect one phase for the overload relay to trip after a period of operation. | Reset the machine program by downloading a program intended for the machine. |
| E34  | The trouble code can occur during programming. | |</p>
<table>
<thead>
<tr>
<th>Code</th>
<th>Explanation</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>E35</td>
<td>The output for holding voltage for the contactors on at start up.</td>
<td>Replace the electronic unit.</td>
</tr>
<tr>
<td>E36</td>
<td>Output for proportional function on at start up.</td>
<td>Replace the electronic unit</td>
</tr>
<tr>
<td>E37</td>
<td>The code shows that the temperature sensor had a cable break or that the power supply to the machine is too low.</td>
<td>Check the power supply voltage of the machine. See table “Guidelines for connection to the electrical supply” in the machine data section. Check the cable to the temperature sensor.</td>
</tr>
<tr>
<td>E40</td>
<td>The code shows that the signals from the control unit are blocked by the electronic unit. Transfer of program from the control unit to the electronic unit has been blocked by a time limit.</td>
<td>Cut the power supply voltage to the electronic unit and try a new attempt.</td>
</tr>
<tr>
<td>E47</td>
<td>Open-circuit in the cable to temperature sensor or fault in the temperature sensor.</td>
<td>Check the cable to the temperature sensor, or replace the temperature sensor.</td>
</tr>
<tr>
<td></td>
<td>Decimal point in the first character window, flashing character or other code not previously described.</td>
<td>Replace the electronic unit.</td>
</tr>
</tbody>
</table>
Display and indication, electric cabinet diesel

During start and operation the electric cabinet instrument panel displays operational data. Read from the panel when starting the engine and regularly check during operation. The instrument panel consists of a display, six indicator lamps and pushbuttons.

The display shows the present fuel level in the diesel tank and present operation time.

<table>
<thead>
<tr>
<th>Pos</th>
<th>Colour</th>
<th>Function</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Red</td>
<td>Battery status. Red light warns of low battery voltage. The generator is not charging.</td>
<td>Check the fan belt. See the engine supplier manual.</td>
</tr>
<tr>
<td>2</td>
<td>Orange</td>
<td>Indicates that glow plug heating is in progress.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Red</td>
<td>Indicates that the fuel level is low</td>
<td>Stop and top up with fuel.</td>
</tr>
<tr>
<td>4</td>
<td>Red</td>
<td>Indicates that the coolant temperature is too high.</td>
<td>Check the coolant level according to the instructions. Check that the radiator is not blocked or clogged by dirt. High ambient temperatures must be compensated with additional cooling.</td>
</tr>
<tr>
<td>5</td>
<td>Orange</td>
<td>Indicates that the air filter is sealed.</td>
<td>Replace with a new air filter.</td>
</tr>
<tr>
<td>6</td>
<td>Red</td>
<td>Indicates that the engine’s oil pressure is low</td>
<td>Switch off the engine immediately. Check and remedy low oil level and any leakage.</td>
</tr>
</tbody>
</table>

Instrument panel with display and indicator lamps
Light indication electronic unit

The operational status of the machine can be read off from the electronic unit LEDs.

<table>
<thead>
<tr>
<th>Pos</th>
<th>Designation</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.BLK</td>
<td>Yellow LED</td>
<td>Only used on diesel powered Brokk machines. It detects when the engine is running, the start function is inhibited to protect the starter motor.</td>
</tr>
<tr>
<td>2Y1-2Y7 &amp; Y8A</td>
<td>Orange LED</td>
<td>Shows that outputs 2Y1-2Y7, undercarriage can be operated.</td>
</tr>
<tr>
<td>1Y1-1Y7 &amp; Y8A</td>
<td>Green LED</td>
<td>Shows that outputs 1Y1-1Y7, upper section can be operated.</td>
</tr>
<tr>
<td>DIR.B</td>
<td>Orange LED</td>
<td>Lights when a function is operated in direction B.</td>
</tr>
<tr>
<td>DIR.A</td>
<td>Green LED</td>
<td>Lights when a function is operated in direction A.</td>
</tr>
<tr>
<td>ON/OFF</td>
<td>Yellow LED</td>
<td>Lights if an On/Off function is activated. When B2;RL is activated the dump valve, which is an On/Off function, closes. When checking other On/Off functions, the dump valve must be open and the lever gate closed. The control levers must be in the neutral position for 5 seconds before checking.</td>
</tr>
<tr>
<td>DV</td>
<td>Green LED</td>
<td>Lights if the data transfer from the control unit works. It shows that there is holding current to the start equipment for the engine.</td>
</tr>
<tr>
<td>POWER</td>
<td>Green LED</td>
<td>Displays that there is power supply voltage to the electronic unit.</td>
</tr>
</tbody>
</table>
Smooth start light indication

Character explanation

- Off
- Green
- Red
- Flashing green
- Flashing red

Operational codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Motor</th>
<th>Probable cause</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current con-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sumption Line</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Load</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Stopped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No electrical supply or unit not correctly connected</td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Stopped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical supply and phases OK, motor detected, no control</td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Starts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical supply and phases OK, motor detected, control detected and start of smooth start ramp</td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Working with rated speed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical supply and phases OK, motor detected, control detected and end of smooth start ramp</td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Retarding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical supply and phases OK, motor detected, no control and start of smooth start ramp</td>
</tr>
</tbody>
</table>

Trouble codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Motor</th>
<th>Possible cause</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current con-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sumption Line</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Load</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Stopped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical supply voltage too low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check phases 3L2 and 5L3</td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Stopped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Phase/phases missing, network frequency outside range, too much interference</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check the phases</td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Works</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Phase/phases missing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check the phases</td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Stopped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Load missing, thyristor short-circuit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check motor connections and semiconductor relays</td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Stopped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bridging missing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check the bridging connections</td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Stopped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The semiconductor relays cannot close</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check that the connection between 5 and 6 in the control connection block is cor-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ekt. Also check that the load current is sufficient</td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Stopped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Function fault in the micro control unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disconnect the smooth start switch from the network for a short time.</td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Stopped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problem with the electrical supply (voltage drop or a phase missing ...) occurred and disappeared, but control voltage came on.</td>
</tr>
<tr>
<td></td>
<td>o o o</td>
<td>Stopped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problem with the load (temporary disconnection ...) occurred and disappeared, but control voltage came on.</td>
</tr>
</tbody>
</table>
Settings

Settings for smooth start

The settings required for smooth start are Time(s) and Initial torque.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (s)</td>
<td>0.5</td>
</tr>
<tr>
<td>Initial Torque</td>
<td>0.9</td>
</tr>
</tbody>
</table>

These values are also given on the wiring diagram.
**Guidelines for connection to the electrical supply**

The power cable must be rated by an authorised person according to national and local regulations. The electrical supply socket used must have the same current rating as the output connector and extension cable for the machine. For example, output connector 63 A must be preceded by fuse 63 A and the fuse must be suitable for motor starting.

<table>
<thead>
<tr>
<th>Nominal voltage</th>
<th>Minimum voltage</th>
<th>Cable section</th>
<th>Start current</th>
<th>Motor output</th>
<th>Thermal overload relay setting</th>
<th>Maximum cable length during operation</th>
<th>Motor output</th>
<th>Thermal overload relay setting</th>
<th>Maximum cable length during operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>50Hz</td>
<td>60Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>380 V</td>
<td>361,0 V</td>
<td>6 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>41,7 A</td>
<td>169,0 m</td>
<td>281,7 A</td>
<td>450,7 m</td>
<td></td>
</tr>
<tr>
<td>380 V</td>
<td>361,0 V</td>
<td>10 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>41,7 A</td>
<td>281,7 m</td>
<td>450,7 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>380 V</td>
<td>361,0 V</td>
<td>16 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>41,7 A</td>
<td>450,7 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400 V</td>
<td>380,0 V</td>
<td>6 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>39,6 A</td>
<td>187,3 m</td>
<td>312,1 m</td>
<td>499,4 m</td>
<td></td>
</tr>
<tr>
<td>400 V</td>
<td>380,0 V</td>
<td>10 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>39,6 A</td>
<td>312,1 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400 V</td>
<td>380,0 V</td>
<td>16 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>39,6 A</td>
<td>499,4 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>415 V</td>
<td>394,3 V</td>
<td>6 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>38,2 A</td>
<td>201,6 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>415 V</td>
<td>394,3 V</td>
<td>10 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>38,2 A</td>
<td>336,0 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>440 V</td>
<td>418,0 V</td>
<td>6 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>36,0 A</td>
<td>226,6 m</td>
<td>20,4 kW</td>
<td>39,6 A</td>
<td>187,3 m</td>
</tr>
<tr>
<td>440 V</td>
<td>418,0 V</td>
<td>10 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>36,0 A</td>
<td>377,7 m</td>
<td>20,4 kW</td>
<td>39,6 A</td>
<td>312,1 m</td>
</tr>
<tr>
<td>460 V</td>
<td>437,0 V</td>
<td>6 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>34,4 A</td>
<td>247,7 m</td>
<td>21,3 kW</td>
<td>39,6 A</td>
<td>195,8 m</td>
</tr>
<tr>
<td>460 V</td>
<td>437,0 V</td>
<td>10 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>34,4 A</td>
<td>412,8 m</td>
<td>21,3 kW</td>
<td>39,6 A</td>
<td>326,3 m</td>
</tr>
<tr>
<td>480 V</td>
<td>456,0 V</td>
<td>6 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>33,0 A</td>
<td>269,7 m</td>
<td>22,2 kW</td>
<td>39,6 A</td>
<td>204,3 m</td>
</tr>
<tr>
<td>480 V</td>
<td>456,0 V</td>
<td>10 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>33,0 A</td>
<td>449,4 m</td>
<td>22,2 kW</td>
<td>39,6 A</td>
<td>340,5 m</td>
</tr>
<tr>
<td>500 V</td>
<td>475,0 V</td>
<td>4 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>31,7 A</td>
<td>195,1 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 V</td>
<td>475,0 V</td>
<td>6 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>31,7 A</td>
<td>292,6 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>550 V</td>
<td>522,5 V</td>
<td>4 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>28,8 A</td>
<td>236,0 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>550 V</td>
<td>522,5 V</td>
<td>6 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>28,8 A</td>
<td>354,0 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>575 V</td>
<td>546,3 V</td>
<td>4 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>27,5 A</td>
<td>258,0 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>575 V</td>
<td>546,3 V</td>
<td>6 mm²</td>
<td>90 A</td>
<td>18,5 kW</td>
<td>27,5 A</td>
<td>387,0 m</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hydraulic system pressure and flow

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Definition</th>
<th>Measuring point</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump pressure</td>
<td>Pump pressure is the pressure in the pipes between the pump and the main valve. The pressure varies between static pressure and maximum pressure depending on which hydraulic functions are used.</td>
<td>XPX</td>
<td>-</td>
</tr>
<tr>
<td>Tools, max*</td>
<td></td>
<td>XPX</td>
<td>260 Bar +0</td>
</tr>
<tr>
<td>Slew function</td>
<td></td>
<td>XPX</td>
<td>140 Bar ±2</td>
</tr>
<tr>
<td>Outriggers</td>
<td></td>
<td>XPX</td>
<td>260 Bar ±2</td>
</tr>
<tr>
<td>Reach function, Cyl 1 &amp; Cyl 2</td>
<td></td>
<td>XPX</td>
<td>260 Bar ±2</td>
</tr>
<tr>
<td>Other arm functions</td>
<td></td>
<td>XPX</td>
<td>165 Bar ±2</td>
</tr>
<tr>
<td>Static pressure</td>
<td>Static pressure is the pressure from the pump when no functions are activated and the dump valve is closed.</td>
<td>XPX</td>
<td>20 Bar ±1</td>
</tr>
<tr>
<td>Load pressure</td>
<td>Load pressure is the pressure required to lift a load. The machine has a load sensing system, this means that the load pressure controls what pressure and flow the hydraulic pump gives.</td>
<td>XPL</td>
<td>-</td>
</tr>
<tr>
<td>Signal pressure</td>
<td>Signal pressure is the same as the temporarily highest pressure. There is a signal pipe between the main valve and the pump regulator. The regulator is affected by the temporarily highest pressure via the signal pipe. The pressure level in the signal pipe controls what pressure the pump gives.</td>
<td>XPL</td>
<td>-</td>
</tr>
<tr>
<td>Servo pressure</td>
<td>The pump pressure of the machine is reduced to servo pressure by a pressure reduction valve. The servo pressure is used to convert the electrical control signals from the control unit for hydraulic pressure.</td>
<td>XPS</td>
<td>35 Bar ±2,5</td>
</tr>
</tbody>
</table>

Pump flow
62 l/min for 50 Hz electric motors
74 l/min for 60 Hz electric motors

Measuring points main valve

Main valve measuring points