en

Operating instructions

Hydraulic excavator / Material handler
R 984 C - Litronic

from serial number 15116

Document identification

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Valid for: R 984 C - Litronic from serial number 15116

Author: LFR - Technical documentation department

Product identification

Manufacturer: LIEBHERR France SAS.

Type: R 984 C - Litronic

Type no.: 528 / 1013

Conformity: CE

Address

Liebherr France SAS.

2 avenue Joseph Rey

B.P 90287 F - 68005 Colmar Cedex

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Machine data

Please fill in the following data when you receive your machine.

This will also be of use to you when ordering replacement parts.

Vehicle ident. number:

WLHZ . . . . . ZK . . . . . .

Construction year:

. . . .

First start-up date:

. . / . . / . .

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Preface

These operating instructions have been written for the **machine operator** and for the **maintenance personnel** of the machine.

They contain:

– the technical data.
– the safety requirements.
– the operating instructions.
– the maintenance instructions.

The operating instructions are to be read and used carefully by all persons who carry out work with or on the machine before putting the machine into service for the first time and later, at regular intervals.

Work with or on the machine includes, for example:

– **Operation** including setting up and equipping, rectifying malfunctions during the course of work, resolving production dropouts, care, disposal of operating and process materials.
– **Maintenance**, including maintenance, inspection and repair work.
– **Transportation** or loading the machine.

The operating instructions allow the machine operator to familiarize himself with the machine more easily and prevent malfunctions occurring due to improper operation.

The observance of the operating and maintenance instructions by maintenance personnel:

– increases reliability in use.
– extends the service life of your machine.
– reduces repair costs and downtime.

The operating instructions belong with the machine. Place a copy in an easily reached position on the cab storage shelf.

The operating and maintenance instructions should also incorporate information on current national regulations for accident prevention and protection. In addition to the operating instructions and legally binding regulations on accident prevention which apply in the user country and at point of use, authorized specialist rules for safe and correct working procedures are also to be observed.

These operating and maintenance instructions contain all the information required for operating and maintaining your machine.

– Some illustrations in these operating instructions may depict details and working devices which differ to your machine.
– In some illustrations, protective devices and covers have been removed in the interests of better presentation.
– Improvements, which are always being incorporated into our machines, may result in changes to your machine which are not yet indicated in these operating instructions.

However, should you require any further explanations or information, LIEBHERR's technical documentation, sales school and customer service departments are

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available for your convenience.

You will appreciate that LIEBHERR warranty claims made on the basis of improper operation, unsatisfactory maintenance, use of unauthorized operating materials or non-adherence to safety regulations cannot be recognized.

LIEBHERR will annul any and all obligations incurred by LIEBHERR and / or its dealerships, such as guarantee commitments, service contracts etc. without prior notice in the event that replacement parts other than original LIEBHERR parts or parts purchased from LIEBHERR are used for maintenance or repair work.

Modifications, conditions, copyright

We reserve the right to make modifications without prior notice in the course of technical developments.

The information and illustrations contained in these operating instructions may neither be copied and distributed, nor used for the purposes of competition. All rights are expressly reserved in accordance with copyright laws.

The warranty and liability conditions of LIEBHERR's general business conditions will not be enlarged upon through the above information.

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1 Product description

1.1 Assembly - overview

This section comprises an overview of the machine and descriptions of the components shown.

1.1.1 Machine and construction equipment

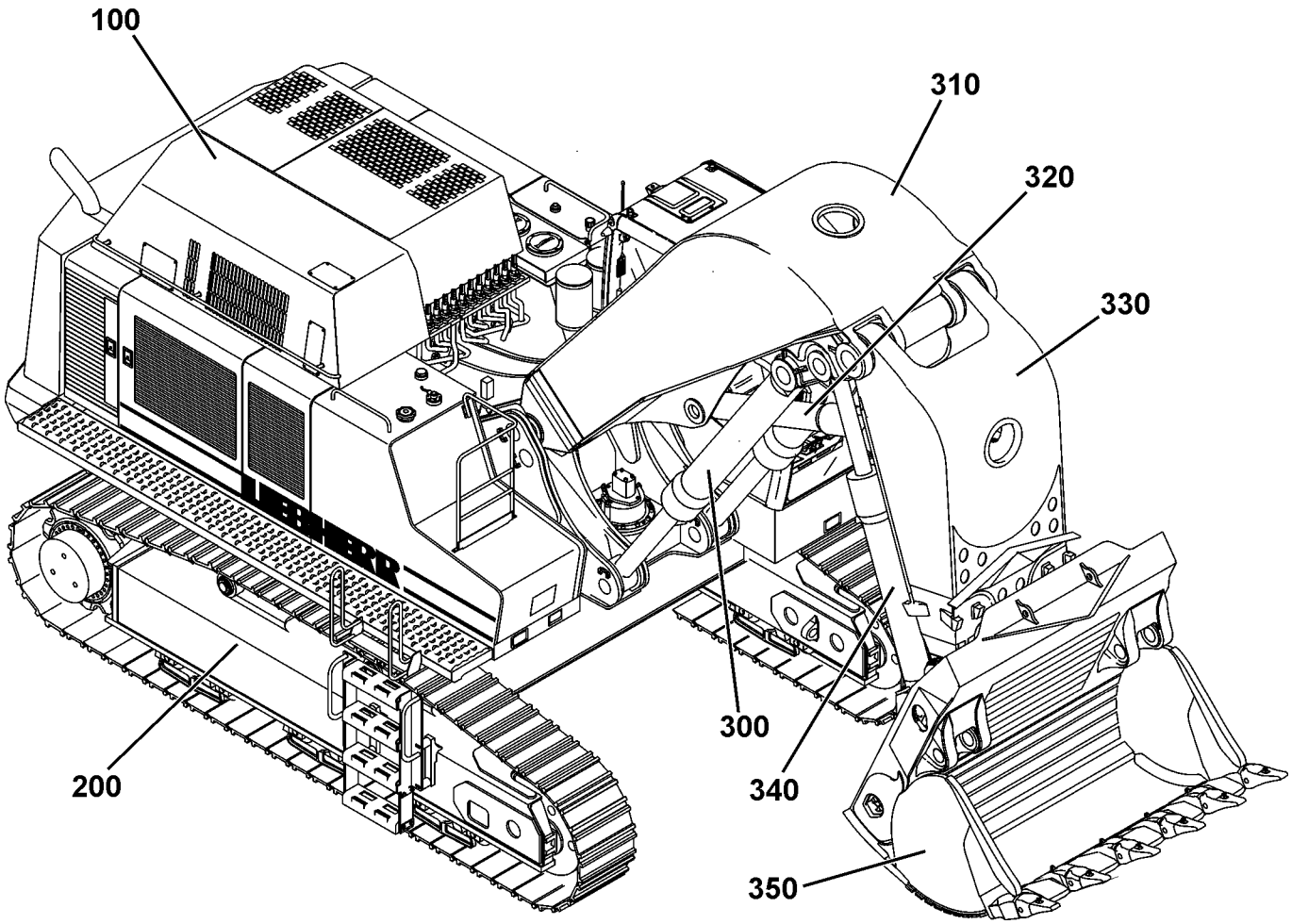

Fig. 1-1 *Machine and construction equipment*

100	Uppercarriage	**320**	Hydraulic cylinder
200	Undercarriage	**330**	Stick
300	Hydraulic jack	**340**	Hydraulic cylinder
310	Boom	**350**	Bucket

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1.1.2 Uppercarriage

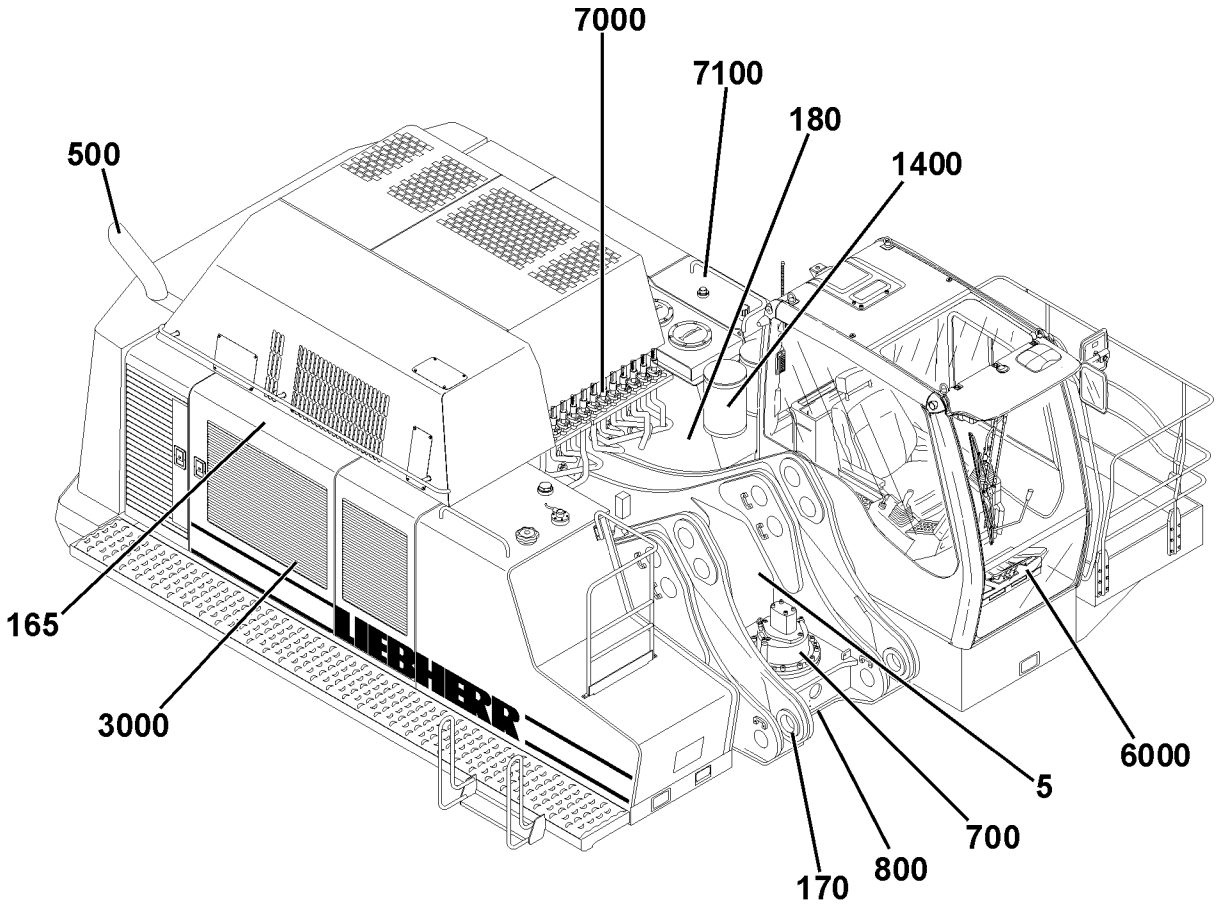

Fig. 1-2 Upper carriage

5	Installation carrier	**800**	Swing ring installation
165	Pumps box parts	**1400**	Centralized lubriacation
170	Attachments mounting parts	**3000**	Air system
180	Heating hoses installation	**6000**	Control cab
500	Engine installation	**7000**	Hydraulic installation
700	Swing gear installation	**7100**	Hydraulic tank installation

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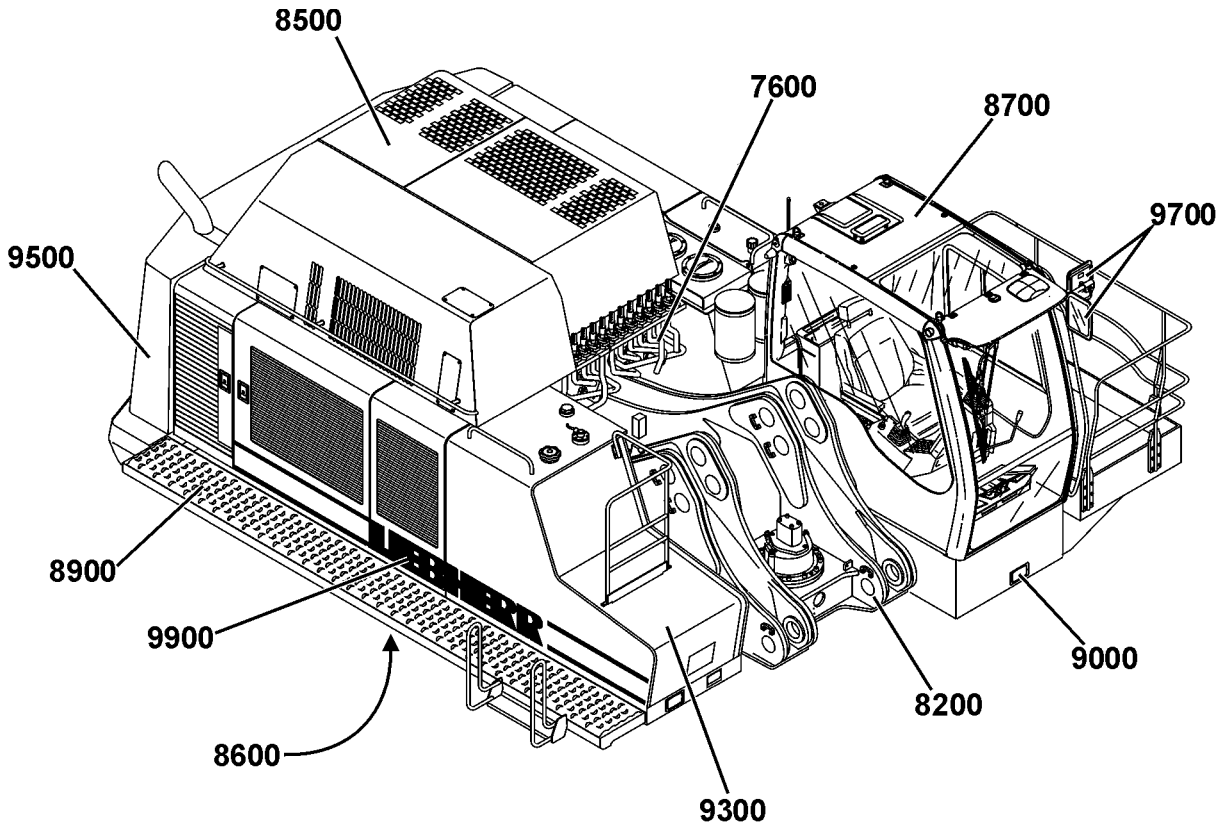

Fig. 1-3 *Upper carriage*

7600 Control valve installation
8200 Rotating deck
8500 Coachbuilding
8600 Lower covering
8700 Cab
8900 Catwalk
9000 Electrical system
9300 Fuel system
9500 Counterweight installation
9700 Arrangement outside mirror

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1.1.3 Undercarriage

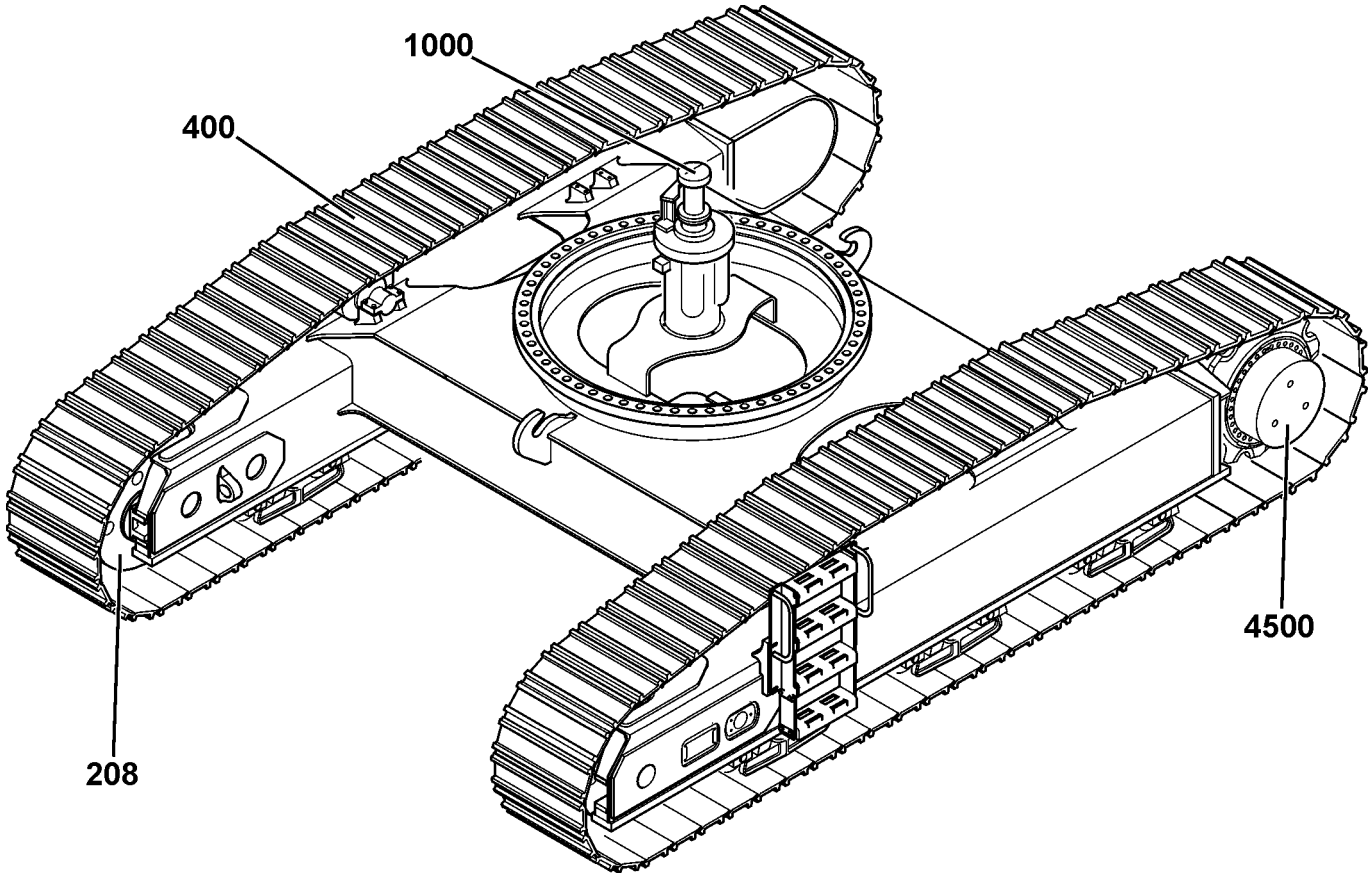

Fig. 1-4 *Undercarriage*

208 Leading wheel
400 Crawlers
1000 Rotary connection
4500 Travelling mechanism with tumbler wheel

1.2 Technical data

This should be taken from the accompanying technical description.

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2 Safety information, signs

Working with the machine holds dangers to which you as the owner, machine operator or maintenance expert could be exposed. If you regularly read and note the safety information, however, you can prevent danger and accidents. This is particularly true for those who are only occasionally in contact with the machine, eg. for maintenance work. The following information comprises safety regulations which, if followed conscientiously, will guarantee your safety and that of other persons, as well as avoiding damage to the machine.

Following these precautions does not release you from the responsibility to take note of safety regulations which apply on site or of guidelines given by legal bodies or professional associations.

For EU countries, guideline 89 / 655 / EEC contains the minimum safety information applicable to the owner.

2.1 Symbols in the operating instructions

Work processes and actions that could cause danger are accompanied by safety information in these operating instructions. This safety information describes various dangers which are emphasized by the terms **Danger**, **Caution** and **Note**.

These terms are identified by symbols in the operating instructions and have the following significance:

Danger!
Warning relating to a danger that carries with it a high risk of death or serious injury if the appropriate preventative measures are not taken.

Caution!
Warning relating to dangers that could result in physical injury and/or damage to the machine if the appropriate preventative measures are not taken.

Note!
This symbol identifies user tips and operating and maintenance procedures whose use will guarantee a high degree of user-friendliness and longevity to the machine or which will considerably simplify working procedures.

– This symbol identifies a listing.

  • This symbol identifies a sub-listing.

❑ This symbol signifies the following: “The precondition must be fulfilled”.

The machine operator or the maintenance personnel must first fulfil the precondition described, i e. the machine must be brought into a particular work position in order to be able to carry out the actions subsequently described.

▶ This symbol identifies an action.

The machine operator or the maintenance personnel should be active at this lo-

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cation and carry out the action described.

↳ This symbol means “Carry out an activity".

If the machine operator or maintenance personnel have carried out the activities described in an action, the result of this action will be described here.

Following these notes does not relieve you of responsibility for following additional rules and guidelines!

Additional points that should be noted are:

– the safety regulations which apply on site,
– statutory road traffic regulations,
– the guidelines provided by professional associations.

2.2 Use in accordance with the regulations

– The hydraulic excavator is a machine with work equipment (eg. hoe type bucket, grab, bucket attachment) designed to detach, lift, transport and shake off earth, stones and other materials, while the transportation of the load itself usually takes place without moving the machine. Moving the machine when it is carrying a load must be carried out while observing the appropriate safety measures (see section "Notes for safe working").
– Machines used for hoisting are subject to specific conditions and must be fitted with the stipulated safety devices (see section “Hoisting work”).
– Other or additional usage, eg. for demolition work or transfer work, requires special equipment and may also require special safety devices. These devices (eg. tree grab, demolition hammer, concrete cutter etc.) may only be attached and used with approval and in accordance with the original manufacturer of the device.
– Transporting persons is not deemed to be in accordance with regulations. The manufacturer is not liable for damage resulting from this action. The user is solely responsible for the risk incurred.
– Observing the operating instructions and the inspection / maintenance instructions is also deemed to be appropriate use in accordance with regulations.

2.3 Safety instructions

2.3.1 General safety instructions

– Please familiarize yourself with the operating instructions before starting up the machine.
– Ensure that you have obtained, read and understood any additional instructions relating to special accessories for the machine.
– Only specifically authorized persons may operate, maintain or repair the machine. The legal minimum age is to be adhered to.
– Only employ trained or appropriately instructed personnel. Clearly establish which personnel are responsible for operating, setting up, maintaining and repairing the machine. Give personnel the power to refuse to carry out unsafe instructions by third parties. This also applies in relation to traffic regulations.

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- Only permit apprentices and personnel who are in training or who have only general training to operate on the machine under the constant supervision of an experienced member of staff.
- As far as possible, monitor personnel to ensure that they are adhering to safe working practices, are aware of risks and are observing the operating instructions.
- Wear safe work clothes when you are working on or with the machine. Avoid wearing rings, watches, ties, scarves, open jackets and loose clothing. There is a risk of injury from, for example, becoming stuck or being drawn in.
- Protective goggles, safety helmets, safety shoes and gloves, reflective vests and ear protection etc. are required for specific jobs.
- Ensure that you obtain information on any special safety regulations for the job site from the site foreman.
- Always tilt up the safety lever before leaving the operator's seat.
- When getting in and out, do not hold on to the steering column, control panel or joystick. Doing this could cause unintentional movement, which could result in an accident.
- Never jump from the machine; use the steps, ladders, gangplanks and supporting straps provided for this purpose.
- Face the machine when getting in or out and always use three-point support, i.e. two hands and one foot or two feet and one hand must always be in contact with the access system at the same time.
- Familiarize yourself with the location of the emergency exit through the front window.
- In the absence of any other instructions, proceed as follows for all maintenance and repair work:
  - switch off the machine on firm, level ground and anchor the grab in the ground.
  - place all operating levers into neutral and tilt the safety lever up.
  - switch off the engine and remove the start key.
- Before touching any parts of the hydraulic circuits, you must also operate all pilot control devices (joystick and pedals) in all directions with the start key in contact position in order to reduce the actuating and dynamic pressures in the work circuits. You must then reduce the internal tank pressure as described in these operating instructions.
- Secure all loose parts on the machine.
- Never operate a machine before carrying out a careful inspection tour and checking whether any warning signs are missing or illegible.
- Respect all danger and safety instructions.
- For special applications the machine must be equiped with specific safety equipments. Work only if they are mounted and functional.
- Do not carry out any modifications, alterations or conversions to the machine which may affect safety without the express permission of the manufacturer. This also applies for the installation of safety devices and valves and for welding work on load-bearing parts.
- It is forbiden to repair the cab.
- Not original equipment and component parts or such kind, wich has generaly not been validated by LIEBHERR for installation or extension, has not to be installed or added onto the excavator without previous written agreement of LIEBHERR. Wherefore the necessary technical documentations has to be at LIEBHERR's disposal.

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2.3.2 Avoidance of crushing and burns

- Do not work beneath the equipment if it is not safely positioned on the ground or supported.
- Do not use any damaged or insufficient load-bearing take-up materials, such as ropes or chains.
- Wear work gloves when working with wire cables.
- When working on the equipment, never use your fingers to locate bores; use the correct punch for the procedure.
- Ensure that no objects enter the fan when the engine is on. The fan will eject or destroy these objects and will itself be damaged.
- The engine cooling system is hot and pressurized when near operating temperature. Avoid coming into contact with coolant carrying parts. There is a risk of sustaining burns.
- Only check the coolant when the sealing cap of the expansion container has cooled to a point where it is possible to touch it. Then turn the cap carefully to let off the overpressure.
- Engine and hydraulic oil are hot when near operating temperature. Avoid coming into contact with hot oil or oil-bearing parts.
- Wear protective goggles and gloves when working on the battery. Avoid sparks and naked flames.
- Never permit the grab to be guided by hand by auxiliary personnel.
- When reaching into the engine compartment, always secure the side doors against unintentional closing by positioning the supports provided for this purpose.
- Never lay under the machine if it is raised with work equipment and has not been correctly and securely supported with hardwood beams.

2.3.3 Avoidance of fire and explosions

- Switch off the engine when refuelling.
- Do not smoke or use a naked flame when refuelling and charging the batteries.
- Always start the engine in accordance with the operating instructions.
- Check the electrical system regularly.
- Have all faults, such as loose connections, blown fuses and lamps and clogged or abraded cables rectified by personnel.
- Do not transport any combustible liquids anywhere on the machine other than in the tanks provided for this purpose.
- Check all lines, hoses and screwed joints regularly for leakage and damage.
- Rectify leakages immediately and replace damaged components.
- Oil spraying out of leaking areas can easily cause a fire.
- Ensure that all holds and shields are correctly installed to guard against vibration, abrasion and heat accumulation.
- Do not use cold start materials (ether) in the vicinity of heat sources, naked flames or in inadequately ventilated areas.
- Do not use any starting aids containing ether to start diesel engines with preheating or flame glow systems. There is a risk of EXPLOSION.
- Familiarize yourself with the location and operation of fire extinguishers on the machine and with local fire warning and fire abatement options.
- The possibility exists to install an extinguisher into the driver's cab.
- Covers and boxes locks have to be unlocked, to facilitate the fight against fire in

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case of.

2.4 Signs on the machine

2.4.1 Introduction

The machine displays several types of signs:

– **Safety plates** provide warnings relating to dangers of accidents which could result in serious injury or death.
– **Information plates** indicate specific points relating to the operation, maintenance and characteristics of the machine.
– **Nameplates** are attached to components for which the machine number must be provided when ordering spare parts.

Danger!
Non-observance of **safety plates** can result in serious injury or death.

▶ Check warning plates regularly to ensure that they are complete and clearly legible.

▶ Replace missing or illegible safety plates immediately.

2.4.2 Arrangement of signs

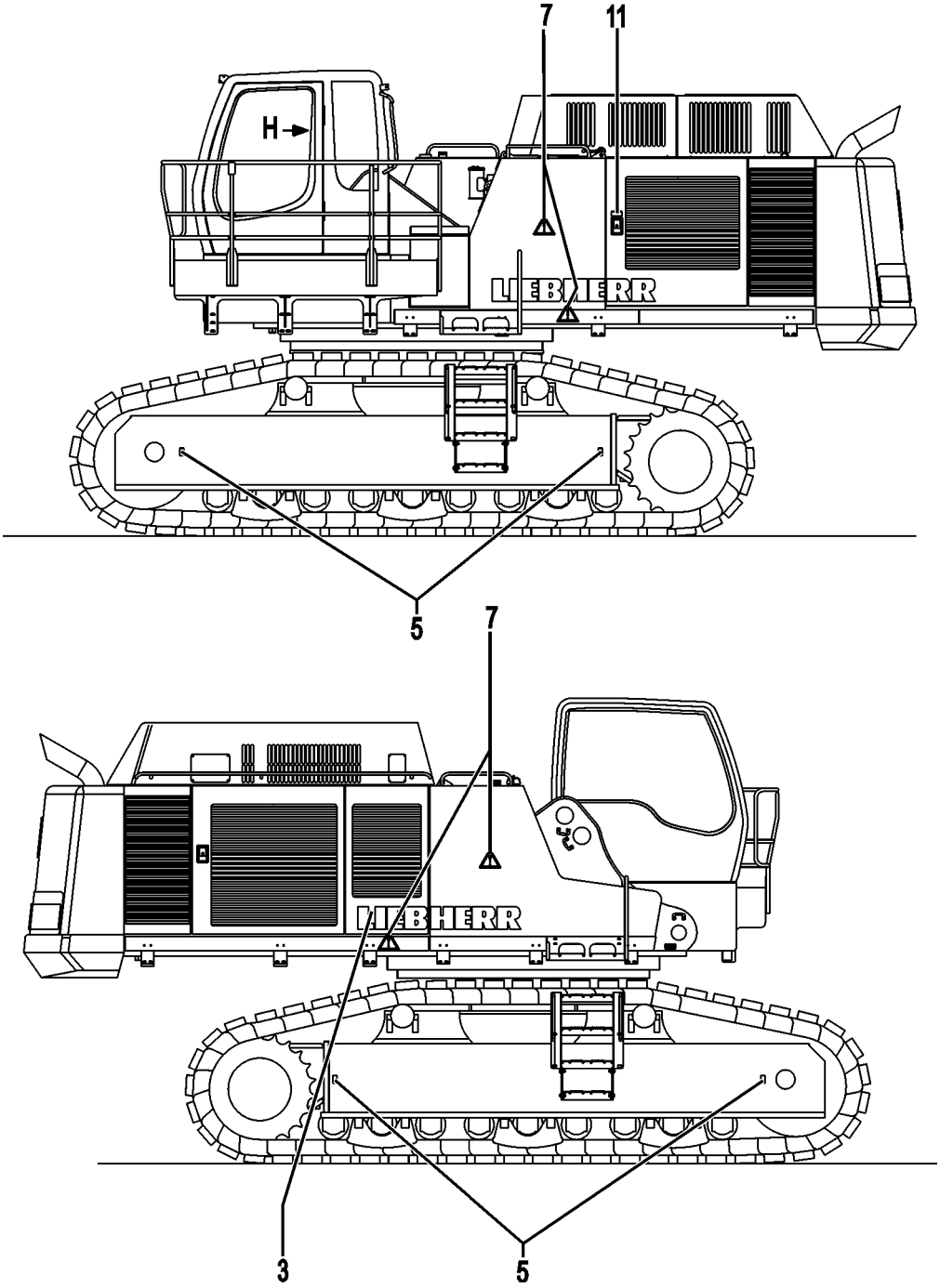

Fig. 2-1 *Arrangement of signage on the machine*

3	Notice external start	**7**	Warning sign danger zone
5	Notice Latch points	**11**	Prohibition Sign

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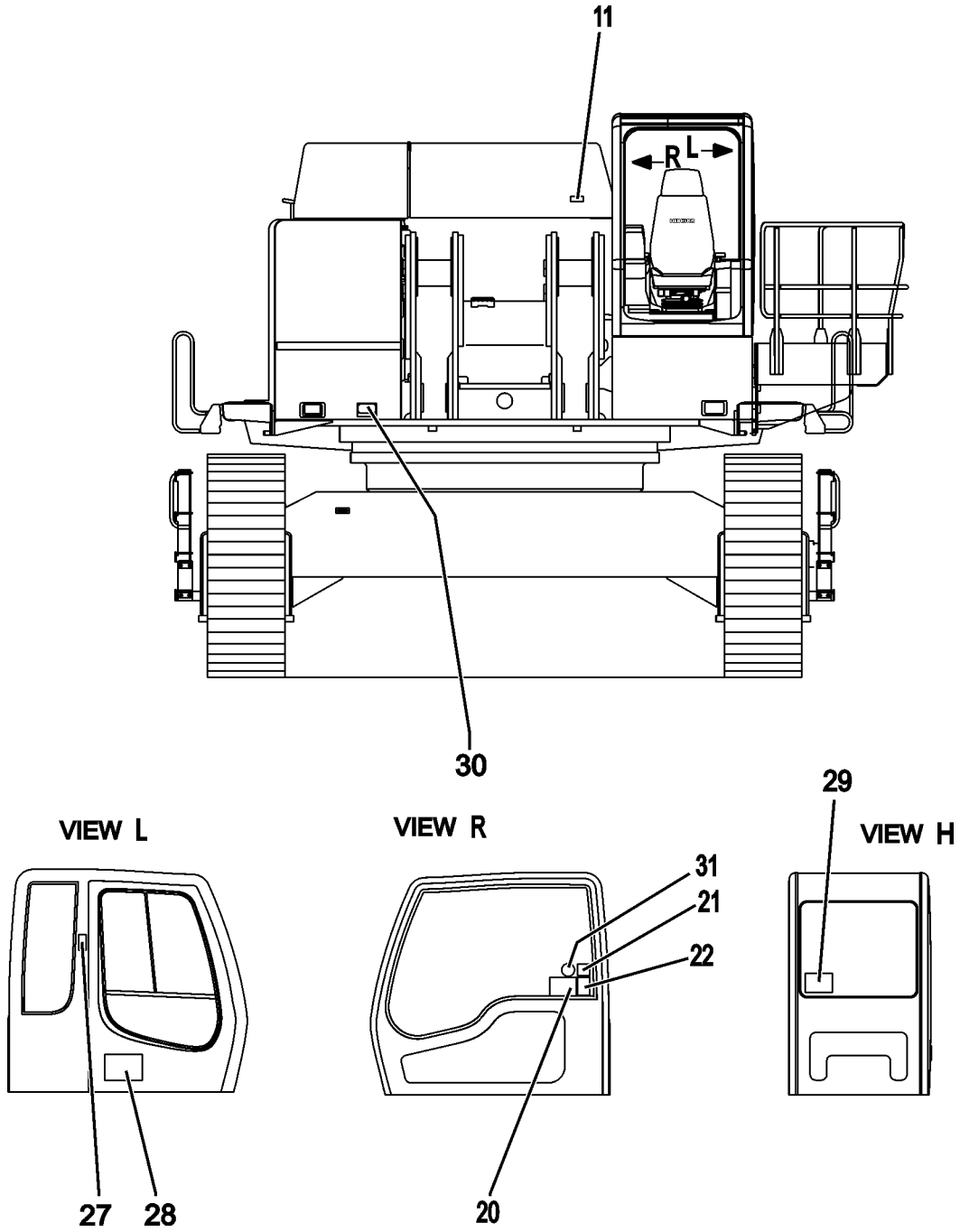

Fig. 2-2 *Arrangement of signs on the machine*

11	Warning sign engine shut down	**28**	Lubrication chart
20	Sign control symbols	**29**	Notice latching and lifting points
21	Warning sign attachment	**30**	ID tag hydraulic excavator
22	Notice accident prevention	**31**	Notice safety belt
27	Notice safety lever		

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2.4.3 Explanation of signs

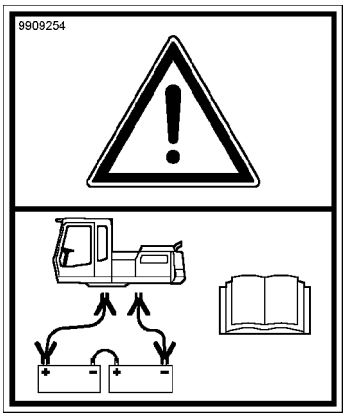

Plate 3: External start

The information in the operating instructions must be carefully noted when starting externally.

Plate 5: Lashing point

– Indicates the machine's lashing points.

Plate 7: Obstruction

– It is forbidden to stand in the danger zone.

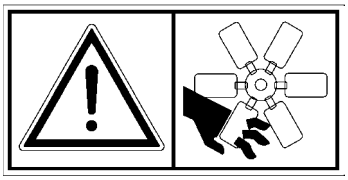

Plate 11: Engine shut down

The engine bonnet may only be opened when the engine is switched off.

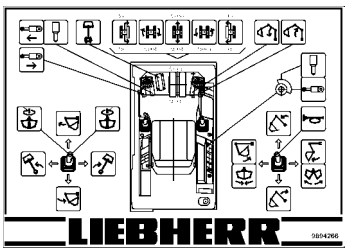

Plate 20: Information about control symbols

Schematic representation of the correlation between the main controls in the cab and the induced actions for the operation of the excavator.

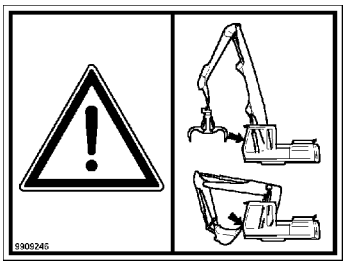

Plate 21: Equipment

Work equipment reaches as far as the cab! Caution – work equipment retracted.

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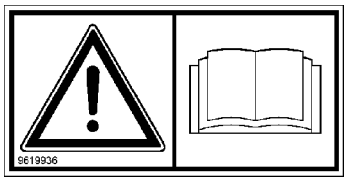

Plate 22: Accident prevention

The accident prevention regulations given in the operating instructions must be carefully noted when operating the machine.

Plate 27: Safety lever

Pull safety lever up fully before leaving the operator's seat.

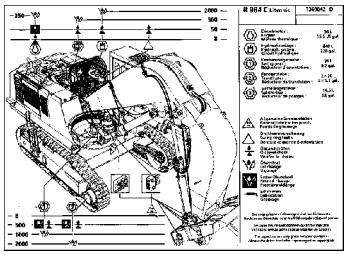

Plate 28: Lubrication chart

Displays the relevant capacities and the change intervals, grease quality, fill and lubrication positions.

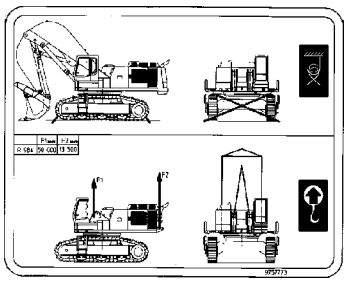

Plate 29: Latch points and lifting points

Indicates the latch points and the stopping points for the lifting on the hydraulic excavator.

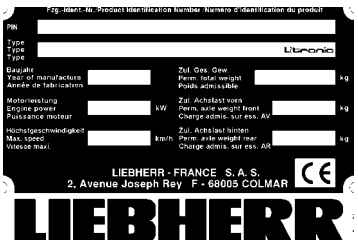

Plate 30: Machine nameplate (ID TAGS)

The nameplate displays the following information:

– Vehicle identification number
– Type
– Construction year
– Engine output
– Top speed
– Permissible overall weight
– Permissible axle load, front

Permissible axle load, rear

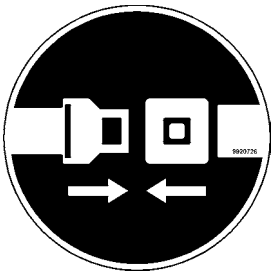

Plate 31: Safety belt

The safety belt must be fastened before starting the machine..

3 Control and operation

3.1 Operating and control elements

3.1.1 Overview of the operator's standing position

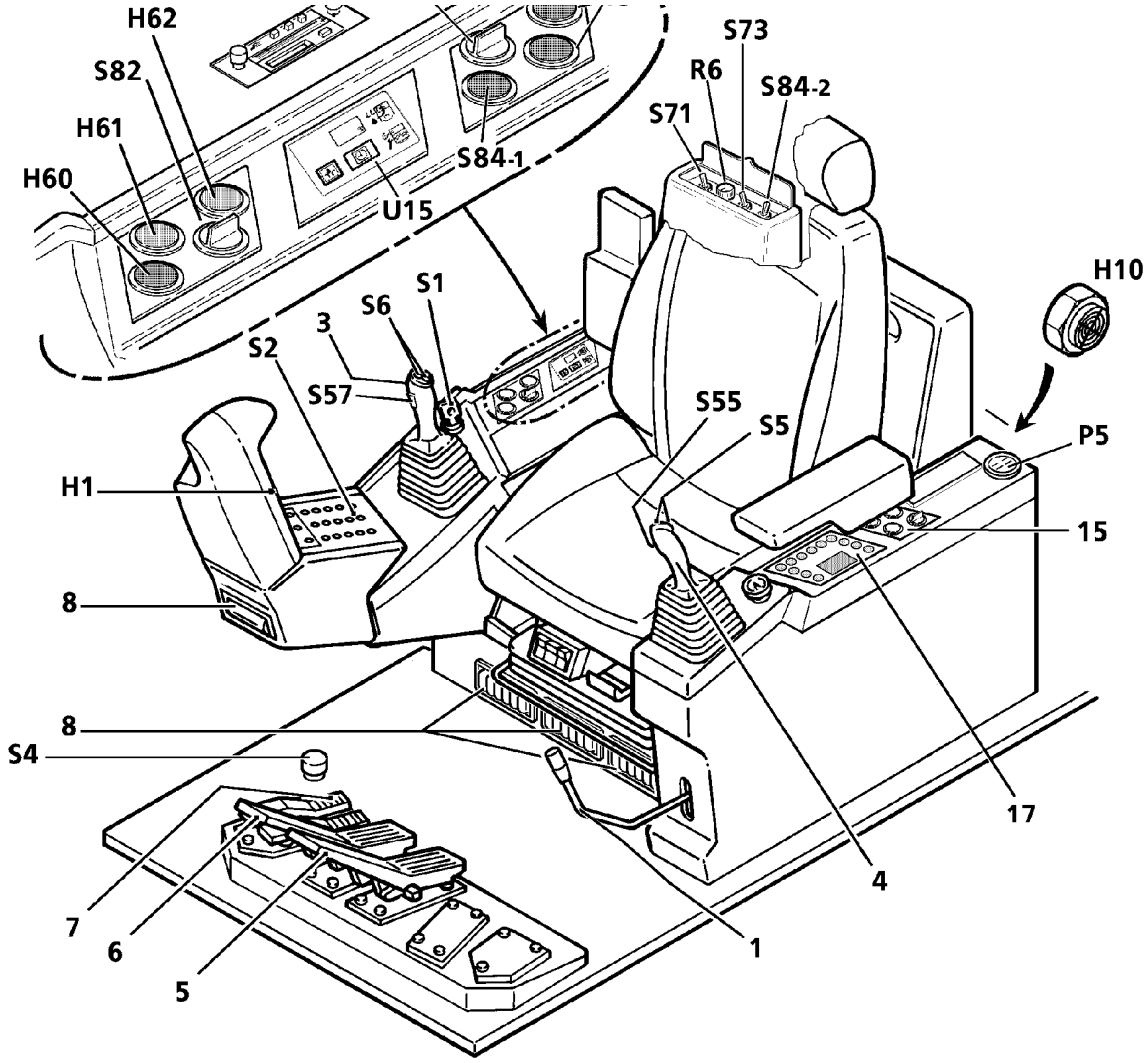

Fig. 3-1 *Operator's standing position*

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1 Safety lever - servo control
3 Right joystick
4 Left joystick
5 Pedal for left travel gear
6 Pedal for right travel gear
7 Attach. or special attach. control*
8 Air conditioner vent
9 Uppercarriage lock
15 Control units - add. attachments*
17 Control unit - air conditioner
A3 Radio*
H1 Monitoring display
H10 Buzzer
H60 Engine monitoring system / indicator light "STOP"
H61 Monitoring system / indicator light "WARNING"
H62 Monitoring system / indicator light "PROTECTION"
P5 Hourmeter
R6 Engine RPM adjust. +/- Manu
S1 Ignition key
S2 Switching unit
S4 Horn (NA+a)
S5 Push but. for rot. device*, or horn, or float posit. boom (NA)
S6 Push but. for float posit. boom or rotating device (NA)
S55 Switch for lift. magnet*, cont. commut. between add. mov.*
S57 Switch for swing brake control
S71 Swit. / eng. RPM cont. in manu
S73 Swit. / saf. mode of servo circ.
S82 Rot. swit. /fault cod. INC - DEC
S84-1 Push button / swing ring teeth lubrication
S84-2 Safety swit. / central lubricat.
S136 Diagnostic switch
S218 Cab roof window wiper and washer
U15 Control unit / central lubricat.

* Optional equipment
(a) Only if rotating device installed
(NA) Location only for North America

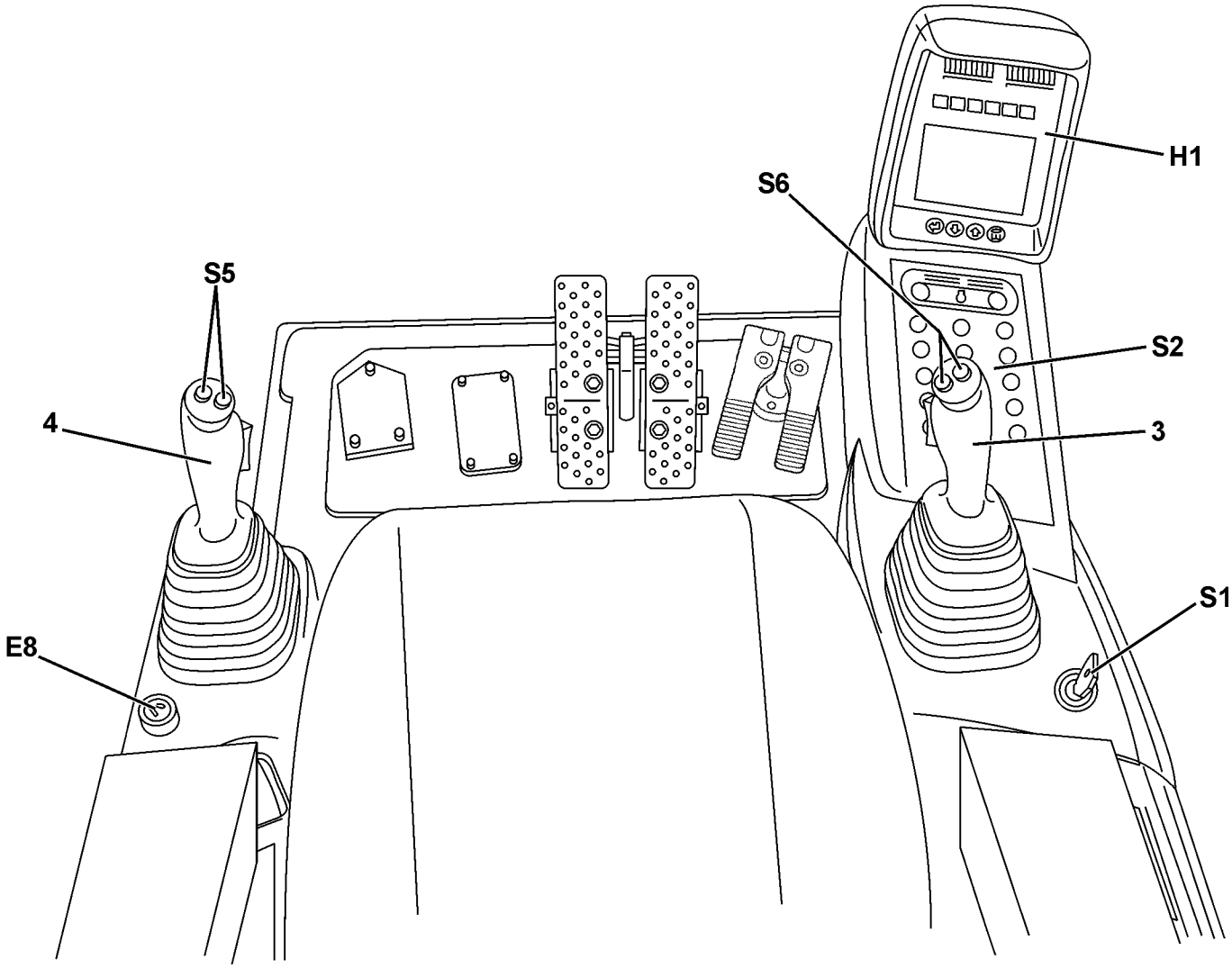

Fig. 3-2 *Operator's standing position, seen from the operator's point of view*

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3	Right joystick	**S1**	Ignition switch
4	Left joystick	**S2**	Keyboard
E8	Cigarette lighter	**S5**	Push button for rotating device*, or horn, or float position boom (NA)
H1	Monitoring screen	**S6**	Push button for float position boom or rotating device (NA)

* Optional equipment
(NA) Location only for North America

3.1.2 Arrangement of joystick

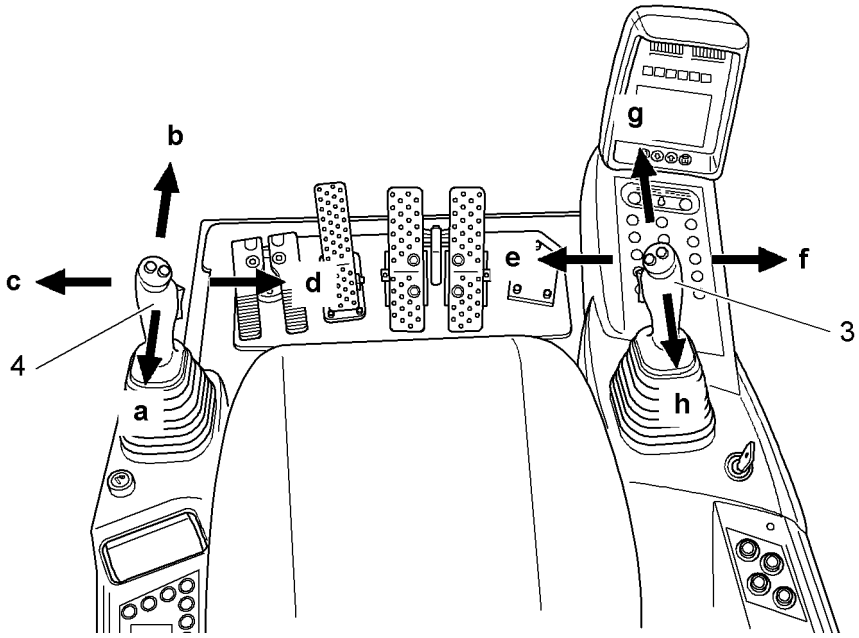

Fig. 3-3 *Joystick, right (**3**) and left (**4**)*

Standard control

The left joystick (**4**) controls the stick and slewing movements.

– Direction of movement **a** and **b**: Stick is drawn in or out.
– Direction of movement **c** and **d**: Upper carriage is rotated to the left or to the right.

The right joystick (**3**) controls the boom or bucket and grab movements.

– Direction of movement **e** and **f**: Bucket will be tilted up or down, grab will close or open.
– Direction of movement **g** and **h**: Boom will be raised or lowered.

Note !
From delivery, the machine is equipped with the standard control system corresponding to the norm ISO. Nevertheless, the machine can be equipped with a commutation circuit allowing the use of a special control system (for example LIEBHERR control system).

3.1.3 Keyboard

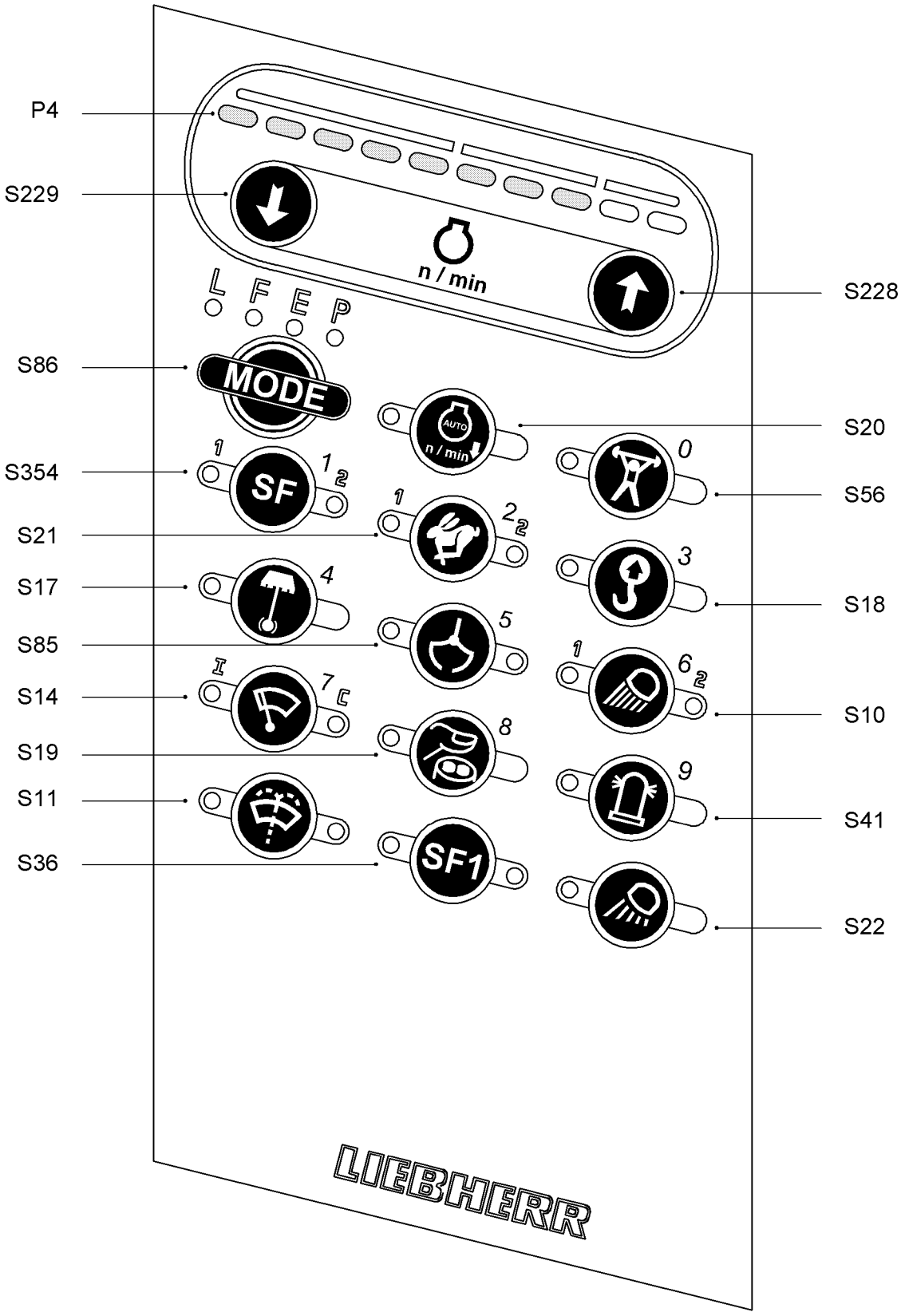

Fig. 3-4 *Excavator keyboard*

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S10 - Floodlight / Equipment headlight

- ▶ Press the switch.
  - ↳ Driving light is activated.
  - ↳ LED 1 in the switch illuminates.
- ▶ Press switch again.
  - ↳ Driving light is deactivated.
  - ↳ LED 1 in the switch goes out.
  - ↳ Equipment headlight is activated.
  - ↳ LED 2 in the switch illuminates.
- ▶ Press switch again.
  - ↳ Driving light and equipment headlight are switched on.
  - ↳ LEDs 1 and 2 in the switch illuminate.
- ▶ Press switch again.
  - ↳ Driving light and equipment headlight are switched off.
  - ↳ LEDs 1 and 2 in the switch go out.

S11 – Windshield washer installation

- ▶ Press and hold button.
  - ↳ Washing water will be sprayed onto the windscreen through the outlet nozzles.
  - ↳ The windscreen washer runs continuously.
- ▶ Release the button.
  - ↳ Washing water will be stopped.
  - ↳ Windscreen washer will run continuously for approx. another 3 seconds.

S14 – Windscreen washer

- ▶ Press switch.
  - ↳ Intermittent setting is activated.
  - ↳ LED I in the switch illuminates.
- ▶ Press switch again.
  - ↳ Continuous operation is activated.
  - ↳ LED C in the switch illuminates.
  - ↳ LED I in the switch goes out.
- ▶ Press switch again.
  - ↳ Windscreen washer is switched off.
  - ↳ LED C in the switch goes out.

S17 – Swing gear brake

- ▶ Press switch.
  - ↳ Swing gear brake is engaged.
  - ↳ Uppercarriage is locked.
  - ↳ LED in the switch illuminates.
- ▶ Press switch again.
  - ↳ Swing gear brake is released.
  - ↳ LED in the switch goes out.

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S18 – Overload warning device (optional extra)

▶ Press switch.
  ↳ Overload warning device is activated.
  ↳ LED in the switch illuminates.

▶ Press switch again.
  ↳ Overload warning device is deactivated.
  ↳ LED in the switch goes out.

❑ No overload warning device is built in.

▶ Press switch.
  ↳ The symbol for "No overload warning device is present" appears on the monitoring screen.

  ↳ LED in the switch illuminates.

▶ Press switch again.
  ↳ The symbol for "No overload warning device is present" goes out.
  ↳ LED in the button goes out.

S19 – Rotating device (grapple, ...)

An additional hydraulic circuit for rotating device operation is necessary to drive some specific equipments (such as rotating grapple, rotating bucket, rotating stick, quick change coupling, ...).

The push button S19 turns on and off the control circuit of these specific equipments.

▶ If S19 turned on,
  ↳ the specific equipments can be actuated using the push buttons S5 on top of the left joystick handle.

▶ When no rotating device is operated, the button S19 must be turned off.
  ↳ The button S19 is operative only if the safety lever is pushed down.

S20 – Low idle automatic

The push button S20 also serves to adjust the time lag between the return to neutral of all joysticks and pedals and the automatic reduction to low idle of the engine RPM. The adjustment is performed similar to the one described above for the windshield wiper pause time via button S14.

▶ Press switch.
  ↳ The function "low idle automatic" is turned on.
  ↳ LED in the switch illuminates.

▶ Press switch again.
  ↳ The function "low idle automatic" is turned off.
  ↳ LED in the switch goes out.

S21 - Travel speed increase (not used)

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S22 - Auxiliary floodlights (optional installation)

▶ Press the switch.
  ↳ Additional headlight is switched on.
  ↳ LED in switch illuminates.

▶ Press switch again.
  ↳ Additional headlight is switched off.
  ↳ LED in the switch goes out.

S36 – Cold starting aid (Startpilot)

The push button S36 controls the cold start system.

▶ Press the switch.
  ↳ An ether based starting fluid is sprayed into the air inlet manifold of the Diesel engine.
  ↳ At the same time, the control light inside the push button will light up.

The cold start system cannot be actuated if the engine is running or at operating temperature

S41 – Rotating beacon (optional installation)

▶ Press switch.
  ↳ Rotating beacon is switched on.
  ↳ LED in the switch illuminates.

▶ Press switch again.
  ↳ Rotating beacon is switched off.
  ↳ LED in the switch goes out.

S56– Pressure increase

▶ Press switch.
  ↳ The light diode in the button is on.
  ↳ The forces on the working attachment are increased,
  ↳ and the movements of the machine become slow at the same time (load lifting operation, ...).

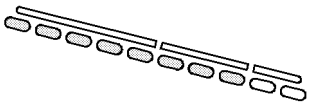
S85 – Grapple operation

This button must be turned on each time when a grapple is operated.

S86– Mode selection, speed adjustment

Four different modes can be selected by pressing the switch. The currently active mode will be displayed under the letter on the LED.

– **L**: LIFT mode (speed level 5)
– **F**: FINE mode (speed level 10)
– **E**: ECO mode (speed level 8)
– **P**: POWER mode (speed level 10)



P4– Engine speed display

The speed range of the diesel engine is displayed in 10 levels.

S228 – Increase speed

▶ Press switch.
  ↳ Speed will be increased by one level.
  ↳ A second LED to the right illuminates in display P4.

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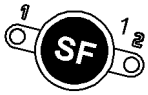
S229 – Decrease speed

▶ Press switch.
  ↳ Speed will be decreased by one level.
  ↳ A second LED from the right goes out in display P4.



S354– Parking brakes

Depressing this button will successively apply and release the mechanical parking brakes in the travel gear.

When the light diode 1 of the button is on, the brakes are applied.

3.1.4 Monitoring display

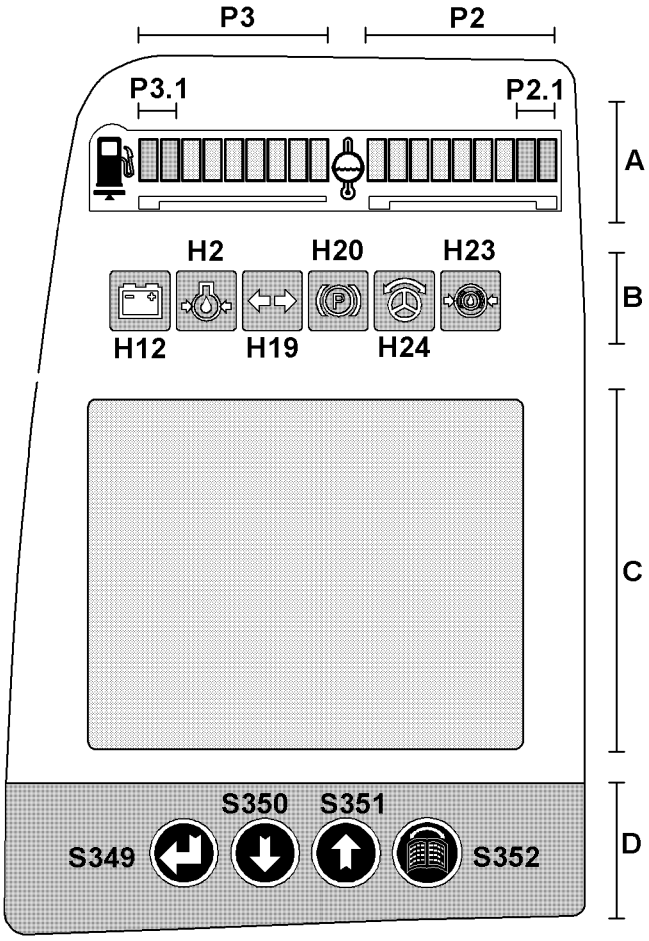


Fig. 3-5 *Monitoring display*

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A	Analog indicator	**H24**	No function
B	Check display	**P2**	Coolant temperature display
C	Main screen	**P2.1**	Coolant temperature display red area
D	Menu control, screen	**P3**	Fuel level display
H2	Indicator light, engine oil pressure	**P3.1**	Fuel level display red area
H12	Indicator light, battery	**S349**	Back button
H19	No function	**S350**	Down button
H20	No function	**S351**	Up button
H23	No function	**S352**	Menu button

Area A: Diesel engine monitoring

P2 –Diesel engine coolant temperature display

The display must be in the green area when operating the machine.

In the event of overheating (over 98 ºC = 204°F), the red LEDs **P2.1** at the end of indicator **P2** will flash.

The buzzer in the cab also sounds.

When this Indicator light illuminates, the error will be saved as error code **E 503**.

▶ The red indicator protection H62 on the control board will light up.

▶ The Quantum system will cause an engine shutdown.

▶ Find and rectify the cause of the problem.

P3 – Fuel level display

The LED indicator lights show the fuel level. When the both red light P3.1 light up, about 10% to 20% fuel are left in the tank as reserves.

H2 –Indicator light, low engine oil pressure

The Indicator light illuminates if the engine oil pressure drops below a given value when the machine is operating.

The buzzer in the cab also sounds.

When this Indicator light illuminates, the error will be saved as error code **E 501**.

▶ The red indicator protection H62 on the control board will light up.

▶ The Quantum system will cause an engine shutdown.

▶ Find and rectify the cause of the problem.

H12 –Indicator light, battery charge

The Indicator light illuminates if the ignition key is placed in the contact position.

The Indicator light goes out as soon as the engine is started.

When the machine is operating, this Indicator light illuminates if the V-belt alternators or the electrical charging system are defective.

▶ Bring the engine to a low idle immediately.

▶ Allow the engine to idle for approximately 5 seconds.

▶ Switch off the engine.

▶ Rectify the error.

H19 – No function

H20 –No function

H23 – No function

H24 – No function

Area B: Menu control for screen

Fig. 3-6 *Screen menu control*

The screen can be operated using the following 4 buttons:

– **S349**: **Back** button
– **S350**: **Down** button
– **S351**: **Up** button
– **S352**: **Menu*** button

* = Change from main to submenus

These buttons can be used to jump from the operator's menu to the submenus or to move from page to page.

Area C: Screen

To change the screen contrast:

▶ Press button **Menu** and arrow button **Up** (higher contrast) or **Down** (lower contrast) simultaneously.
↳ The value set will be saved.

To alter the brightness of the main screen:

▶ Press button **Back** and arrow button **Up** (brighter) or **Down** (darker) simultaneously.
↳ The value set will be saved.

Note!
A light sensor built in to the top left of the monitoring screen controls the illumination on the main screen, dependent on the brightness of the environment. Tracking is carried out using the buttons and originating from the basic setting. Illumination will be automatically reduced in conditions of low environmental brightness.

To change the brightness and the contrast setting to the works setting:

▶ Turn off the ignition.

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- ▶ Press and hold the **Up** and **Down** buttons simultaneously.
- ▶ Turn on the ignition again.
- ▶ Release the buttons once the automatic check is completed.

3.1.5 Main screen

The main screen appears when the machine has been switched on and remains on display until the screen is changed over to the menu selection screen using the **Menu** button.

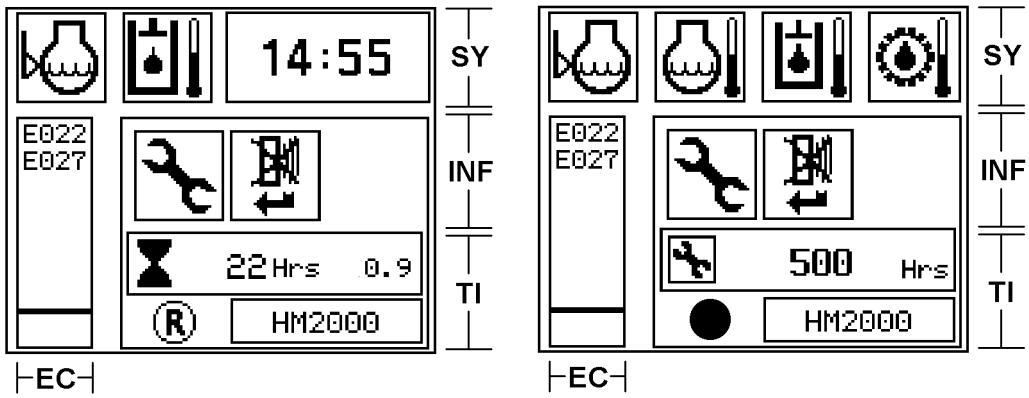

Fig. 3-7 *Main screen*

EC	Cable error display	**SY**	Symbol, clock
INF	Information	**TI**	Hourmeter, current tool (Tool Control)

Main screen design

SY field

The upper field of the monitor shows on the one hand warning and indicator symbols, on the other hand a clock. Should more than two symbols be shown, so the clock is not displayed any more and up to four symbols can be shown at the same time in the field SY.

If more than 4 symbols must be shown, then every 10 seconds, the symbols move to the left by one symbol. (siehe Kap. , "Warning symbols in the SY field" auf Seite 12).

EC field

The EC window displays the error codes for electrical faults which occur in the excavator's electronics system (line errors, sensor errors etc.). A maximum of 7 error codes are displayed simultaneously. If there are more than these 7 errors present, an arrow which points to where the other error codes are located will be displayed next to the error code window.

- ▶ Press the **Up** or **Down** button.
  - ↳ The error code window will be shifted in the direction selected in the error code list.

INF field

The INF field displays information temporarily, in both text and graphic form.

If more than 3 symbols are to be displayed, the symbols will shift one symbol to the left approx. every 10 seconds.

The information is displayed in graphic or text form and indicates specific operating states on the machine. (siehe Kap. , "Information symbols in the INF field" auf Seite 13).

TI field

The machine operating hours and the daily operating hours counter are displayed bottom right in this field. During the start-up phase, the operator will be alerted about a possible up-coming service interval, by a graphic symbol displayed instead of the machine hour-meter.

The symbol ® is displayed when an external flow limitation (function "set option") is activated (siehe "Status of hydraulic pumps and electrical inputs and outputs menu" auf Seite 20).

The symbol "●" appears when no external flow limitation is activated. But an internal flow limitation (travel, swing,...) may be actived.

After having selected a tool (siehe Kap. , "Menu "Set option"" auf Seite 17), the name of the tool is displayed (for example HM200).

Menu navigation in the event of an error display

If an error is recognized as “new” in the SY field, the user is returned to the main screen. The relevant error display is activated.

Depending on the error (level of urgency), the buzzer will sound either continuously or in short consecutive bursts. This symbol will be displayed in the INF field.

Danger!
If the error displayed is not rectified immediately, this could lead to persons sustaining injury or the machine being damaged.

- ▶ Rectify / have the error rectified immediately.
- ▶ To switch off the buzzer, press the **Back** button.
  ↳ The error will be acknowledged and stored.

Warning symbols in the SY field

Each of the symbols which follow will be assigned an error code in the form “E 5xx”. Each error which occurs will be stored via the relevant error code.

E 502–Coolant low

This symbol appears if the coolant level drops below the water sensor level.

The buzzer sounds simultaneously.

- ▶ Bring the engine to a low idle immediately.
- ▶ Switch the engine off as quickly as possible.
- ▶ Localise the leak and carry out repairs.

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Caution!

This monitoring device acts as an increased level of security in case of larger amounts of water loss (e.g. hose rupture). It does not relieve the operator or maintenance personnel from the responsibility of regularly checking the coolant level in the equalizing reservoir.

E 503 –Coolant overheat - Warning stage

This symbol appears simultaneously with the **P2** coolant temperature display if the coolant temperature exceeds 100°C during at least 3 seconds. The buzzer sounds simultaneously and the engine power is reduced.

E 504–Hydraulic oil level low

This symbol appears if the oil level in the hydraulic tank drops below the minimum level.

The buzzer sounds simultaneously.

- ▶ Bring the engine to a low idle immediately.
- ▶ Switch the engine off as quickly as possible.
- ▶ Find the leak and carry out repairs.
- ▶ Depressurize the hydraulic tank.
- ▶ Only refill the hydraulic oil using the return-line filter.

E 505 –Hydraulic oil overheat

This symbol appears if the hydraulic oil temperature in the tank exceeds 99 °C.

- ▶ Bring the engine to a low idle immediately.
- ▶ Switch the engine off as quickly as possible.
- ▶ Localise and rectify the error (radiator dirty etc.).

E 506 – Splitterbox oil overheat

This symbol appears if the oil temperature in the splitterbox exceeds 100 °C.

- ▶ Bring the engine to a low idle immediately.
- ▶ Switch the engine off as quickly as possible.
- ▶ Localise and rectify the error.

E 511 – Over voltage for the BBT

This symbol appears if the operating voltage for the BBT exceeds 30 volts for at least 0.5 seconds.

Information symbols in the INF field

Preheating on

This symbol appears while preheating is taking place.

Preheating off

Preheating will stop automatically after about 20 seconds and the symbol **Preheat off** appears for approx. 2 seconds on the main screen.

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Manual diesel speed adjustment

This symbol appears if toggle switch **S71** for manual speed adjustment is switched to the **Manu** position.

Service due

This symbol appears if a service interval is due.

▶ Switch on the ignition.
  ↳ The service interval to be carried out will be displayed for approx. 10 seconds in place of the overall operating hours.

Acknowledge error

This symbol appears if a machine error (**E5xx**) has occurred and the buzzer sounds simultaneously.

Parking brake and swing gear brake operation changed.

This symbol appears if switch **S73** is in the emergency position.

“Increased care required” note: Operation changed

This symbol appears if switch **S73** is in the emergency position.

Servo control operation changed

This symbol appears if switch **S73** is in the emergency position.

Overload warning device (optional extra)

This symbol appears if the maximum permitted load capacity of the machine has been reached.

No overload warning device present

This symbol appears if switch **S18** (overload warning device) is operated, but either no overload warning device is present on the machine or the switch is not cleared.

Getting information from the operator’s menu on the main screen

Main screen menu selection

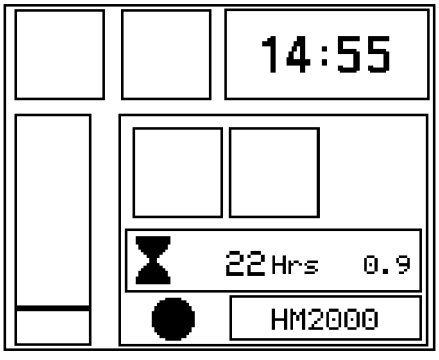

Fig. 3-8 *Main screen*

❑ To change to the operator’s menu, the main screen must be visible.

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▶ Press the **Menu** button on the main screen.
↳ The list of accessible menus is displayed.

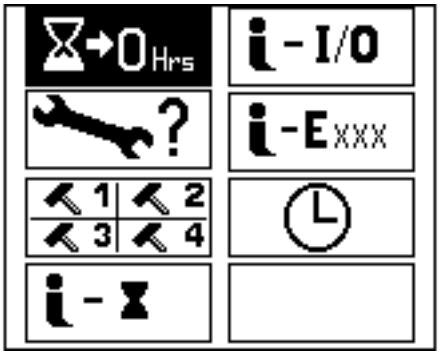


Fig. 3-9 *Menu selection in the operator's menu.*

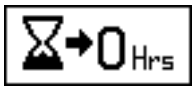
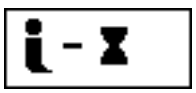
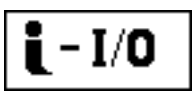
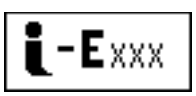
To select the operator's menu:

▶ Press arrow key **Down** or **Up**.
↳ The following or previous operator's menu will be displayed on screen with a black background.

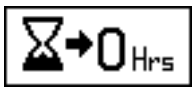
❑ The selected menu is displayed with a black background, the **Reset daily operating hours** menu is used here as an example.

▶ Press the **Menu** button again.
↳ The sub-menu for the function selected is displayed.

▶ Press the **Back** button again.
↳ The sub-menu will be aborted.

Symbol	Description
	Reset daily operating hours counter
	Confirm service interval
	Select flow and pressure limitation relating to mounted tool (e.g. hammer)
	Operating hours and device data
	Status of hydraulic pumps and electrical inputs and outputs
	Recorded and stored errors
	**Clock**

Tab. 3-1 *Overview of menu options*



Reset daily operating hours counter menu

The daily operating hours counter can be reset to 0 using this menu.

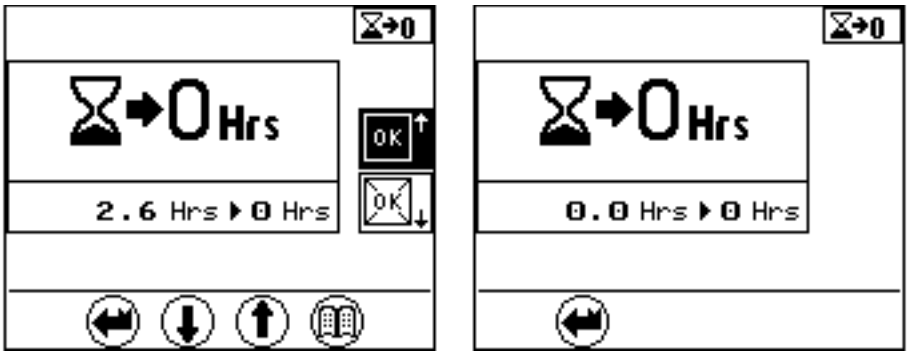


Fig. 3-10 *Resetting the daily operating hours counter*

- ▶ Press the **Up** arrow key.
  - ↳ The OK which is not crossed out will be displayed with a black background.
- ▶ Press the **Menu*** button.
  - ↳ The operating hours will be reset to 0.
  - ↳ The arrow key symbols **Up** and **Down** and the **Menu** symbol will no longer be displayed.

To exit the menu:

- ▶ Press the **Back** button.
  - ↳ The sub-menu will be aborted.

Confirm service interval menu

This menu is used for information on service intervals and to confirm service work which has been carried out.

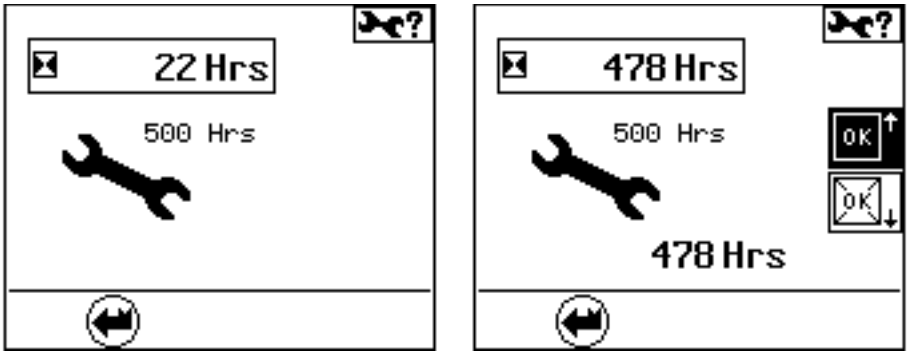


Fig. 3-11 *Service intervals menu*

The operating hours of the next service interval (in this example, “500 Hrs”) and the current operating hours (“478 Hrs”) are displayed in the menu.

A pending service interval can be confirmed a maximum of 50 operating hours before the service interval is due.

When this time period has been reached a query will appear to ask whether the service work has been carried out.

- ❑ Service work carried out.
- ▶ Press the **Up** arrow key.
  - ↳ The OK which is not crossed out will be displayed with a black background.

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▶ Press the **Menu** button.
↳ The current operating hour will be confirmed as the last service interval carried out.

❑ Service work not carried out.

▶ Press the **Back** button.

The sub-menu will be aborted.

Menu "Set option"

Allocation of flow and pressure limitation options to external input I1

In this menu, the user can choose between predefined options. For each option a pressure limitation and a flow limitation is assigned. When an option is chosen, the limitation values assigned to this option are effective as soon as the command of the optional tool is actuated (actuation of the foot pedal for hammer or grapple for example).

Danger!
A wrong option can cause damage to the tool (for example: hydraulic hammer) or restrict its capacity (for example: milling tool)

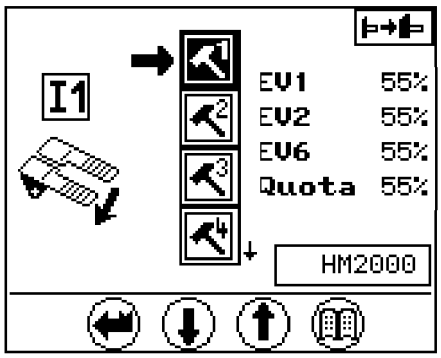

Fig. 3-12 *Menu "Set option"*

EV1 = Oil flow limitation valve 1
EV2 = Oil flow limitation valve 2
EV6 = Pressure limitation valve
Quota = not used

The black field represents the active option.

▶ Press the **Up** or **Down** arrow key.
↳ A different, predefined option displayed with the arrow (1-10) can be assigned (e g. when work equipment is changed).

▶ Press the **Menu** button.
↳ The selection is confirmed. The active option field is black (in this example Option 1 "HM2000").

To exit the menu:

▶ Press the **Back** button.
↳ The sub-menu will be aborted.
↳ In the main screen the name of the chosen option(HM200) is displayed.
↳ The tool will be supplied with the reduced pressure and the reduced flow predefined for the option 1.

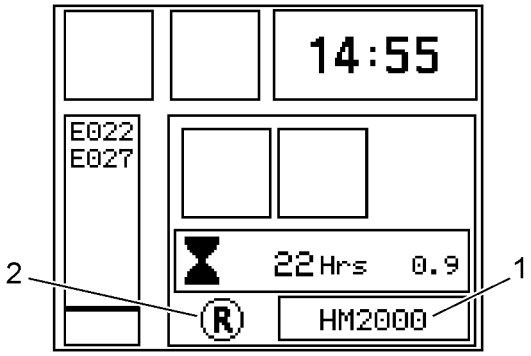

Fig. 3-13 *Main screen, The chosen option is displayed*

1 Chosen option (tool)

2 The symbol "R" is displayed when the option tool is used

Note!
The standard name of the option is "Option 1", "Option 2"...
Liebherr or its customer department can assigned a concrete name to the each option, for example "HM2000" or "Grapple".

Operating hours menu

Pages 1 to 3 provide an overview of the operating hours of individual units, processes and operating types.

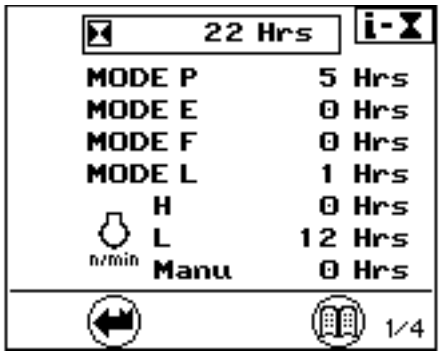

Fig. 3-14 *Engine service life menu (example)*

Page 1 provides the service life in hours for:
– Diesel engine in P mode
– Diesel engine in E mode
– Diesel engine in F mode
– Diesel engine in L mode
– Diesel engine at maximum RPM H
– Diesel engine in low idle L
– Diesel engine operating in manual, Manu speed adjustment

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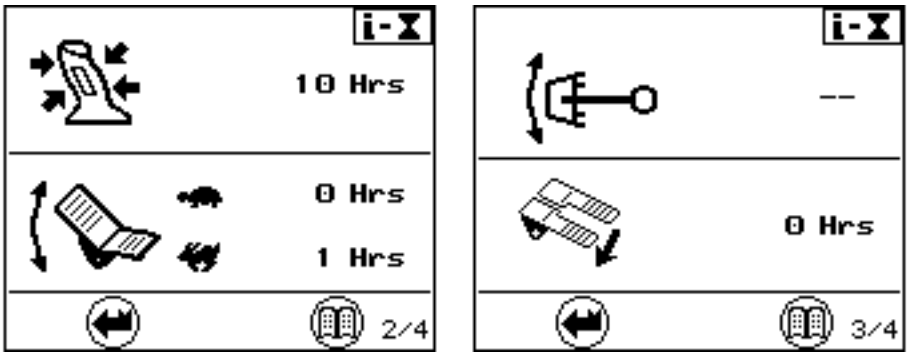

Fig. 3-15 *Service life for travelling motion menu*

▶ Press the **Menu** button.
↳ Page 2 is displayed.

Page 2 provides the service life in hours for:

– Equipment movements using the joystick
– Travelling motion using the accelerator pedal in crawling and fast modes

▶ Press the **Menu** button again.
↳ Page 3 is displayed.

Page 3 provides the service life in hours for:

– Swing movements of the swing gear.
– Additional attached equipment operated via the foot pedals

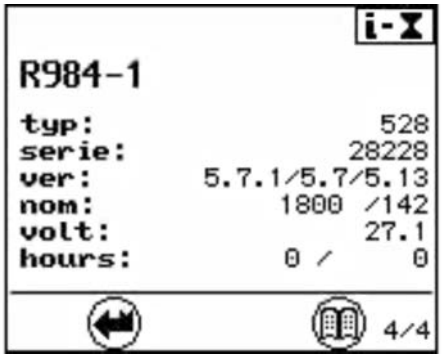

Fig. 3-16 *Technical data*

▶ Press the **Menu** button again.
↳ Page 4 is displayed.

The technical data menu, page 4, provides information on:

– The model of the excavator
– "typ" : the type of the excavator
– "serie" : the serial number of the excavator
– "ver" : the installed Software-Versions for, respectively, the monitoring display, the control unit BBT, the pump regulator BSt, and, on the second line, the installed version of the Diesel engine control circuit „PLD“ and also the SPF nb. (specification number) of this circuit.
– "nom" : not used
– "volt" : indication for the momentary operating voltage.
- "hours" : operating hours for operation with the input X2.8 activated (not used), operation with the input X2.14 activated (not used) and operation of the Diesel engine with standard power curve (maximum power).

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▶ Press the **Menu** button again.
↳ Page 1 is displayed.

To exit the menu:

▶ Press the **Back** button.
↳ The sub-menu will be aborted.

i-I/O

Status of hydraulic pumps and electrical inputs and outputs menu

Pages 1 to 3 provide information on the operating position of the hydraulic pumps.

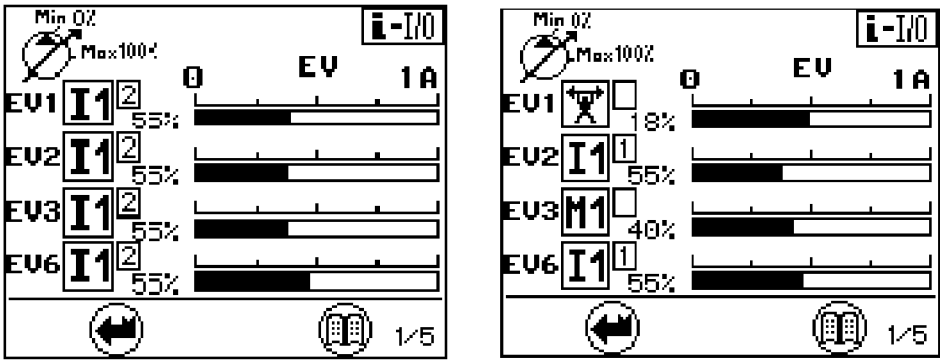

Fig. 3-17 *Flow and pressure limitation menu*

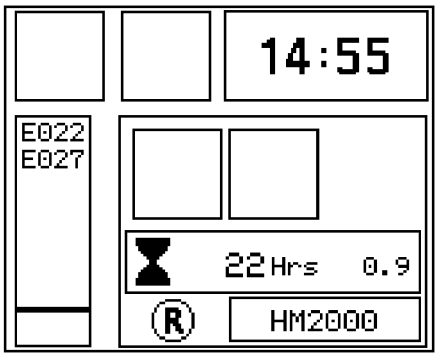

Fig. 3-18 *Main screen when an external limitation is active*

The page 1/5 displays the active option and the percentage of the pressure and flow limitation due to the activation of this option. The bar chart contains the current value, which supplies the regulation valves. The flow of each pump can be independently regulated with the solenoid valves EV1, EV2 and EV3. The valve EV6 regulates the work pressure.

– On the left picture, an external limitation (Hardware input I1, option1) is activated (siehe Fig. 3-17 auf Seite 20). The current supplying the solenoid valves is limited at 55% of its maximal value. When an external limitation is activated, the symbol "R" is displayed in the TI field of the main screen, (siehe Fig. 3-18 auf Seite 20).

– On the right picture, an internal limitation (Pressure increase) and an external limitation (Hardware input I1, option1) are simultaneously activated. When several flow limitations are activated at the same time, the one with the smallest value is decisive for the hydraulic pump. In this case, the symbol "R" is displayed in TI field of the main screen. If just internal limitation are activated, the symbol

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"R" will be changed in "ò".

Note!
An external limitation is activated as soon as the option pedal is actuated.
There are three types of internal limitations:

– The internal limitation M1 is activated when travelling.
– The internal limitation M2 is activated when the pressure increase is actuated (button S56 on the control unit).
– The internal limitation M3 is activated when using the trapp.

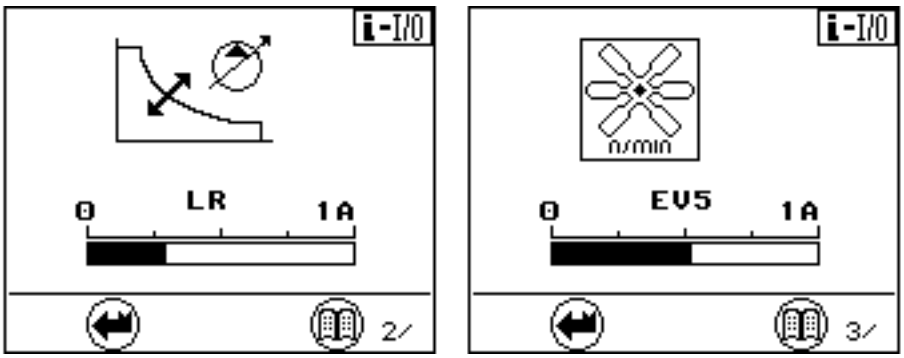


Fig. 3-19 *LR magnet and fan speed current values menu*

▶ Press the **Menu** button again.
↳ Page 2 is displayed.

The current power of the LR magnet (current value for power setting) is displayed on page 2.

▶ Press the **Menu** button again.
↳ Page 3 is displayed.

The current power of proportional valve EV5 for fan speed control at the hydrostatic fan drive is displayed on page 3.

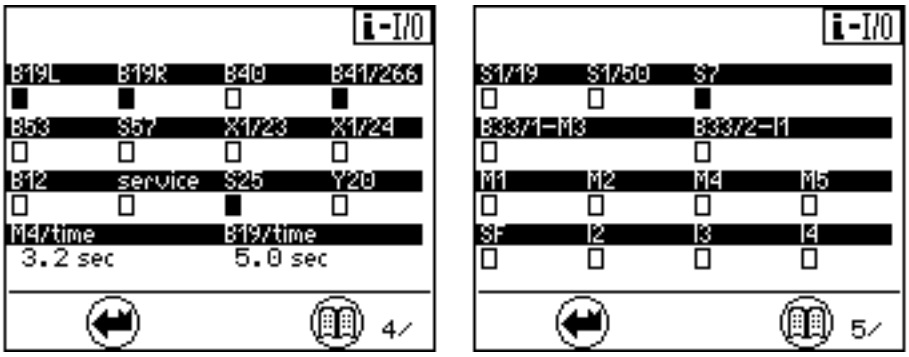


Fig. 3-20 *Electrical inputs*

▶ Press the **Menu** button again.
↳ Page 4 is displayed.

▶ Press the **Menu** button again.
↳ Page 5 is displayed.

Pages 4 and 5 provide an overview of the status of different electrical inputs.

A "□" means "Input not active".

A “■”means "Input active".

An “NC” beneath the terminal designation means that the software for the relevant input has been deactivated.

M4 / Time (and B19 / Time) on the last line of pages 4 / 5 refers to the delay times set for the windscreen’s intermittent switching and to automatic idling.

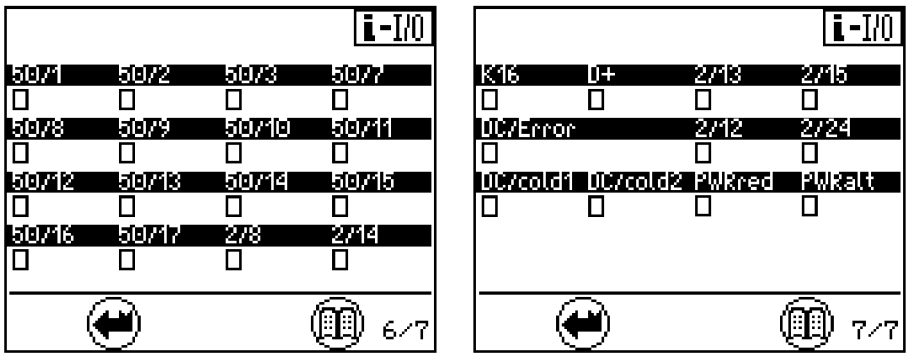


Fig. 3-21 *Electrical inputs*

▶ Press the **Menu** button again.
↳ Page 6 is displayed.

▶ Press the **Menu** button again.
↳ Page 7 is displayed.

The screen 7/7 gives information about the components of the PLD control system of the Diesel engine :

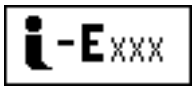
Input X2/13 refers to operation of the Diesel engine with standard power curve.

Input X2/15 refers to external commutation of hydraulic power.

PWRred refers to power reduction of the Diesel engine.

To exit the menu:

▶ Press the **Back** button.
↳ The sub-menu will be aborted.



Error menu (operating errors and electrical system errors)

Fig. 3-22 *Recorded errors menu*

There are 3 selection options in this menu:

– By selecting **list Exxx**, machine errors recorded by the sensors are listed.
– By selecting **list E-elec**, all main screen cable errors stored when operating are

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listed.

– By selecting **list S-Exxx**, all errors which appeared when the service connector was connected are listed.

To select the desired error type:

▶ Press the **Down** or **Up** arrow key.
  ↳ The following or preceding error type will be displayed with a black background.

▶ Press the **Menu** button.
  ↳ The sub-menu on a black background will be displayed.
  ↳ If more than 6 error codes are present, arrow key **Down** or **Up** can be used to scroll to the next page.

Machine error list Exxx:

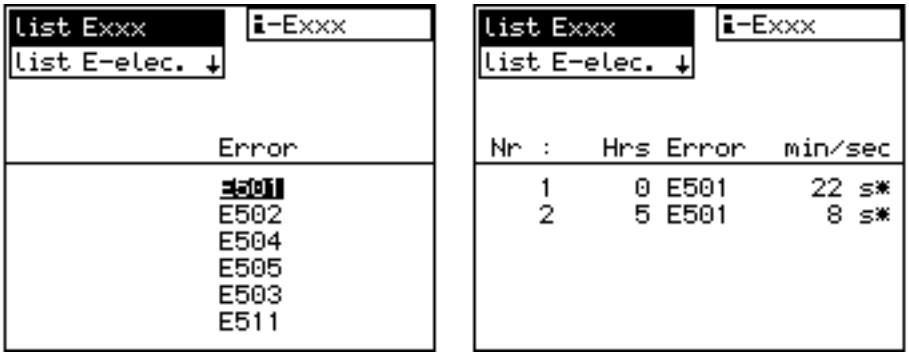

Fig. 3-23 *Error list (Fig. left) and Error occurrence (Fig. right) menu*

▶ Select **list Exxx**.

▶ Press the **Menu** button.
  ↳ The first page of the sub-menu appears.

All errors and their error codes are listed on the first page.

▶ Use the **Down** or **Up** arrow key to select the error code desired.

▶ Press the **Menu** button again.
  ↳ The second page of the sub-menu appears.

Operating hours and the duration of the first and last ten occurrences of the error selected will be listed on the second page.

▶ Press the **Back** button.
  ↳ The first page of the sub-menu appears.

▶ Press the **Back** button again to select another error type or press the **Down** or **Up** arrow key to select a new error code.

s*: Error was indicated by a buzzer and was acknowledged using the **Back** button. The duration is given in seconds.

m*: Error was indicated by a buzzer and was acknowledged using the **Back** button. The duration is given in minutes.

Note!
Only operating errors with an error code **E 5xx** will be displayed in the **list Exxx** menu.

Cable error list E-elec.:

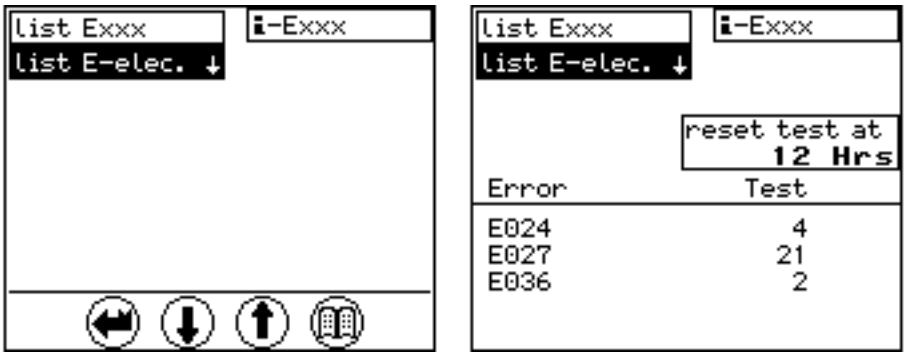

Fig. 3-24 *Occurrence of electrical error (Fig. left) and Error statistics (Fig. right)*

▶ Select **Cable error list E-elec.**:

▶ Press the **Menu** button.
↳ The sub-menu appears.

All electrical errors and their error code are listed.

The “Test” column displays the number of errors which have occurred since the last deletion.

The hour information "reset test at x Hrs" (e g. 12 Hrs) indicates the operating hour in which the "Test" column was deleted.

▶ Press the **Back** button.
↳ A different error type may be selected.

Other errors list S-Exxx:

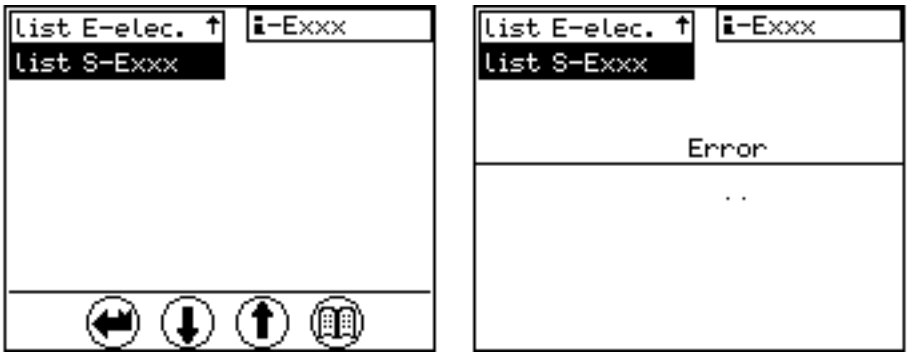

Fig. 3-25 *Call up service operation error list menu*

No information will be displayed in this menu if the service connector is not connected.

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Set time menu

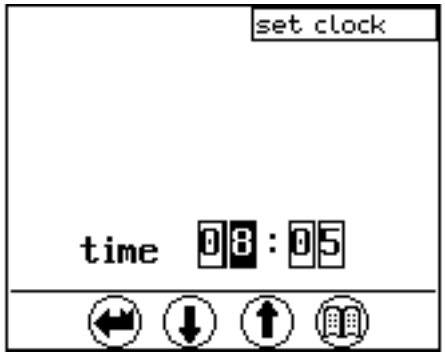

Fig. 3-26 *Clock setting*

- ▶ After selection of the function the digit completely right is inversely displayed.
- ▶ Press key **UP** or **DOWN** to adjust the selected digit.
- ▶ Press **MENU key to select the next digit.**
- ▶ Press the **Enter** key to store the set number.
  ↳ on screen appears shortly to confirm "update xx: xx".

3.2 Operation

3.2.1 Entering or leaving the cab

Climbing up

Caution!
Entering or leaving the cab incorrectly could lead to injury.

- ▶ Ensure that the safety lever is always in its highest position when entering or leaving the cab.
- ▶ Always use the handholds provided for the purpose when entering or leaving the machine.
- ▶ Do not hold onto the controls to steady yourself.
- ▶ Never jump from the machine.

Cab:

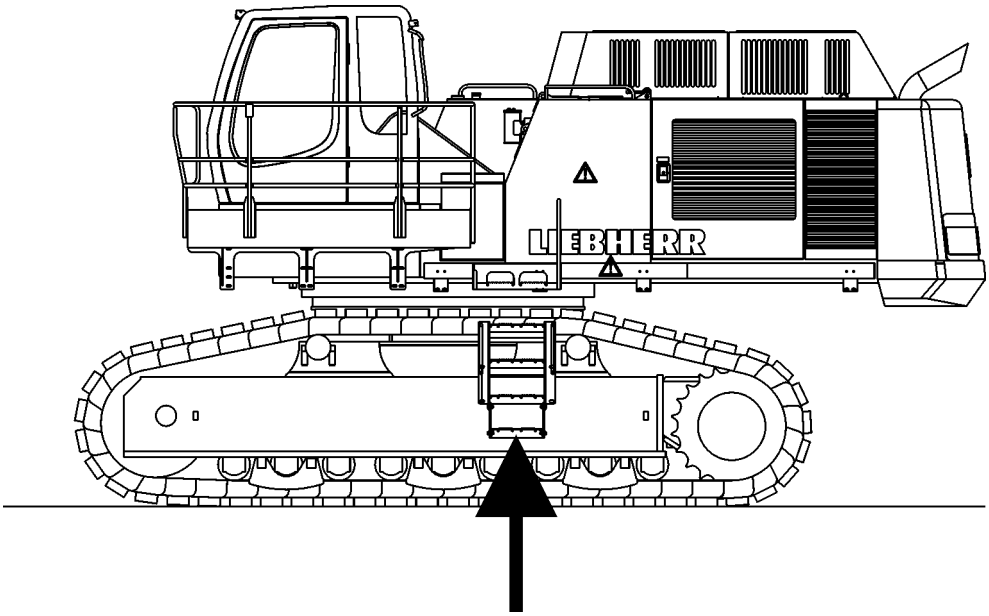

Fig. 3-27 *Climb up using the handholds*

Getting in

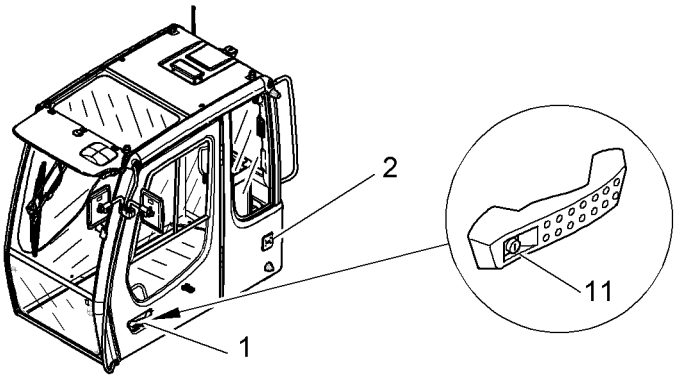

Fig. 3-28 *Door - exterior*

1 Door handle **2** Latch **11** Door lock

- ▶ Press the door lock **11** on the door handle **1** and open the door.
- ▶ If the door is to remain open during operations, swing the door back 180° and secure in the latch **2**.
- ▶ Climb in with your face towards the machine and sit in the operator's seat.
- ▶ Adjust the seat and steering column if necessary.

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Getting out

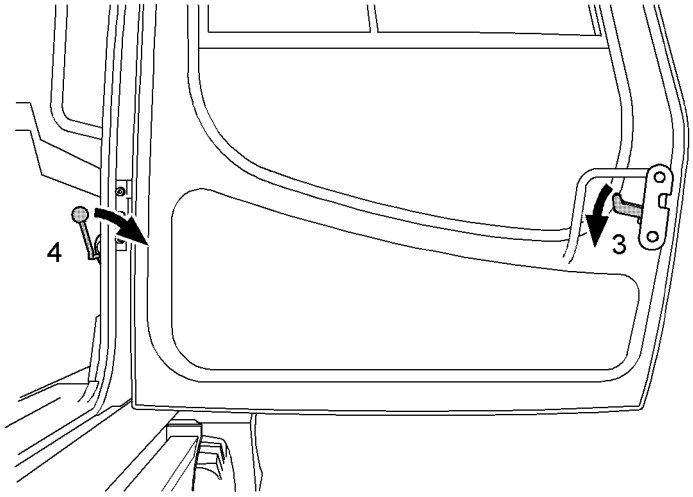

Fig. 3-29 *Door - interior*

3 Door handle on door lock **4** Lever for the latch

- ▶ Switch off the machine and push the safety lever up.
- ▶ Push the door handle **3** on the lock down.
- ▶ Open the door fully and secure it in the latch **2**.
- ▶ Climb out with your face towards the machine.

To release the door latch:

- ❑ The door is secured in latch 2.
- ▶ Move the lever **4** next to the cab frame outwards.
  ↳ The door is now unlocked.
- ▶ Close the door.

3.2.2 Height and inclination adjustable cab (optional extra)

A hydraulically adjustable cab is an auxiliary device enabling the cab to be variably height and/or inclination adjusted.

Danger!
When the cab is raised, the route the machine will be travelling must be even, free of all obstructions and must not have a gradient that could affect the stability of the machine.

- ▶ Only adjust the cab when the machine is stationary.
- ▶ Ensure that no persons are within the machine's danger area when carrying out the cab adjustment.

Danger!
The safety belt is designed to protect the operator.

- ▶ Before starting the machine, always put on the safety belt.
- ▶ Ensure that the safety belt is not twisted when it is secured.
- ▶ To ensure your safety, check the condition, function and fastening of the belt regularly and replace any damaged parts without delay.

Adjusting the height of the cab

The height of the cab is controlled using the switches **S200**, **S201** and **S78** in the left control panel.

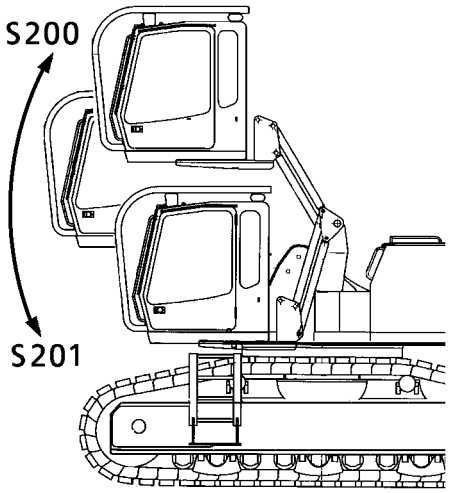

Fig. 3-30 *Adjusting the height of the cab*

- ❑ The machine is ready to operate.
  - ↳ The safety lever is pushed up.
  - ↳ The engine is running.

To raise the cab:

- ▶ Press and hold switch **S200**.
  - ↳ The cab travels upwards as long as switch **S200** is being pressed.

To lower the cab:

- ▶ Press and hold switch **S201**.
  - ↳ The cab travels downwards as long as switch **S201** is being pressed.

Emergency operations

If control of the height adjustable cab should be lost due to a fault in the diesel engine or another defect, there is an emergency cab lowering function.

There are two ways to lower the cab in an emergency:

Emergency cab lowering inside the cab:

- ▶ Press and hold switch **S78**.
  - ↳ The cab travels downwards as long as switch **S78** is being pressed.

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Emergency cab lowering from outside the cab:

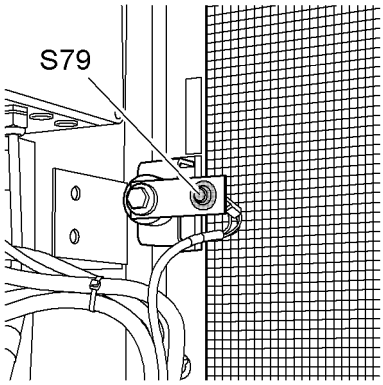

Fig. 3-31 *Emergency cab lowering button in the battery room.*

It is possible to lower the cab using an emergency lowering button on the outside of the machine.

Danger!
Danger of crushing.

- ▶ Ensure that no one is standing in the vicinity of the lifting frame when lowering the cab from the outside in an emergency.

Ensure that you do not place any part of the body in the area of the moving parts when lowering the cab in an emergency.

- ▶ Open the rear left side door (battery room).
- ▶ Press and hold emergency lowering button **S79**.
  ↳ The cab travels downwards as long as switch **S79** is being pressed.

Adjusting the inclination of the cab

With a cab tiltable to 30° for demolition machines **(3)**, the buttons S200, S201, S78 and S79 allow to tilt the cab to the rear or to the front.

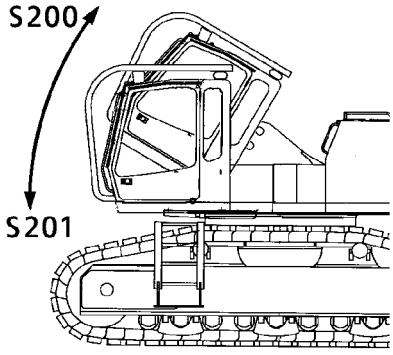

Fig. 3-32 *Adjusting the inclination of the cab*

Repair and maintenance

Danger!
Repair and maintenance work on the cab, lifting frame or on the related hydraulics system should be carried out – as far as possible – with the cab lowered.

▶ For repair and maintenance work which can only be carried out when the cab is raised, the cab should be supported by equipment which is suitable for this purpose.

3.2.3 Safety lever

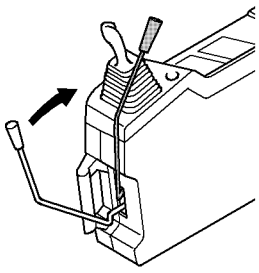

Fig. 3-33 *Safety lever*

For safety purposes, the left control panel is provided with a safety lever.

Caution!
The safety lever must always be pushed up into its highest position (see arrow) when entering or exiting the cab.

When the safety lever is pushed up, the pilot control circuit is disconnected. This means that:

– No work movements can be carried out when pilot control devices, e g. the joystick or foot pedals, are operated.
– The slewing gear brake is locked (LED in switch **S17** illuminates).
– It is not possible to release the slewing gear brake using switch **S17**.

When the safety lever is pushed (push up / push down) to its lowest position, the slewing gear brake and the LED in switch **S17** will return to their original states and the pilot control devices will be active.

▶ Before the operator starts working, he must push the safety lever down into its lowest position while seated in the operator's seat.

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3.2.4 Operator's seat

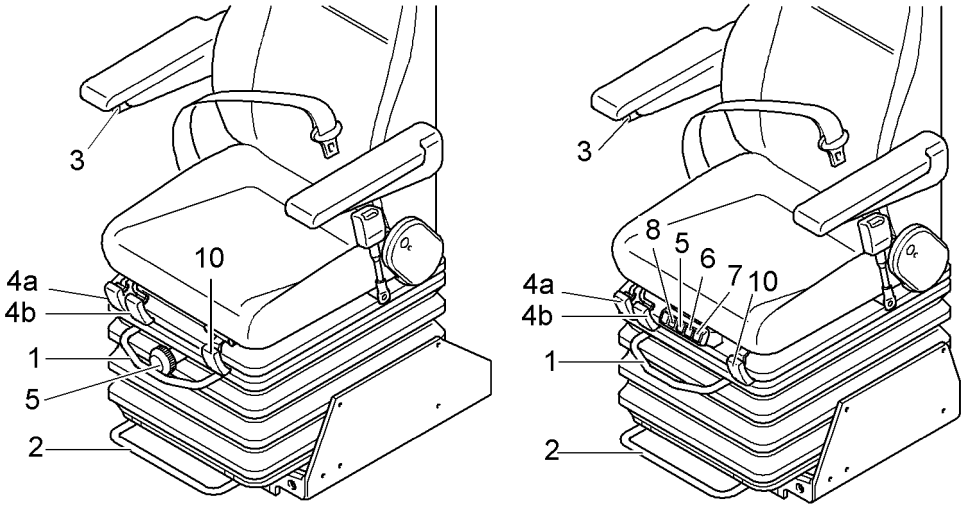

Fig. 3-34 *Standard operator' seat (Fig. left) and air-cushioned (Fig. right, optional extra)*

1	Set horizontal, upper	**4b**	Set seat inclination, rear	**7**	Set lumbar support
2	Set horizontal, lower	**5**	Set seat springs	**8**	Seat heating
3	Adjust armrests	**6**	Set lumbar support	**10**	Set backrest
4a	Set seat inclination, front				

The operator's seat should be set up before starting the machine; this means that:

– The diesel engine may not be started.

– The safety lever must be pushed up.

This will avoid unexpected movement of the machine.

Setting the armrests

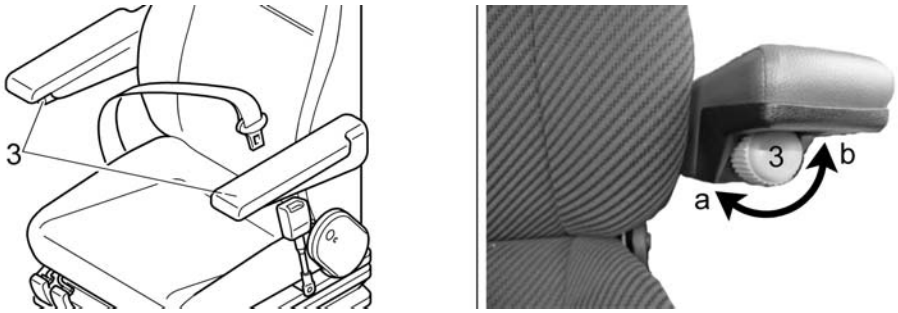

Fig. 3-35 *Setting the armrests*

▶ Turn the knurled head screw **3** on the armrest in direction **a**.
  ↳ The armrests incline upwards.

▶ Turn the knurled head screw **3** on the armrest in direction **b**.
  ↳ The armrests incline downwards.

Setting the seat and backrest

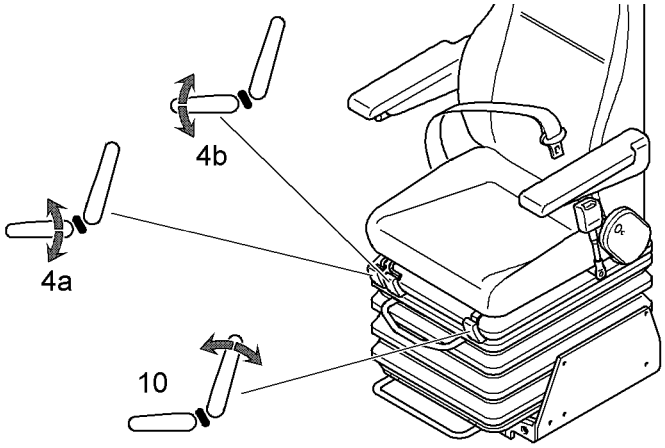

Fig. 3-36 *Setting the seat and backrest*

- ▶ Rear seat inclination: Pull lever **4a** up, set the inclination and release the lever.
- ▶ Front seat inclination: Pull lever **4b** up, set the inclination and release the lever.
- ▶ Backrest: Pull lever **10** up, set the inclination and release the lever.

Setting the horizontal seat position

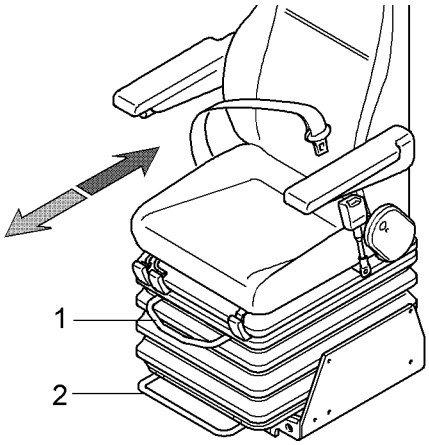

Fig. 3-37 *Setting the horizontal*

- ▶ Pull up the lever **1** to push the operator's seat in the horizontal direction.
- ▶ Pull up the lever **2** to push the operator's seat and control panels in the horizontal direction.

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Setting the seat springs

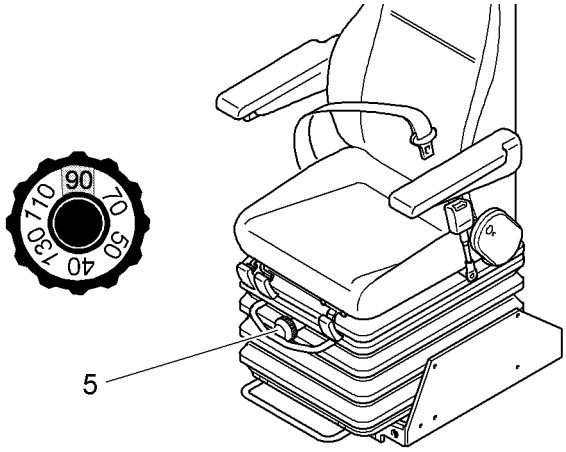

Fig. 3-38 *Setting the seat springs*

▶ Use the rotary knob **5** to set the seat springs to match the body weight.

Options setting (optional extras)

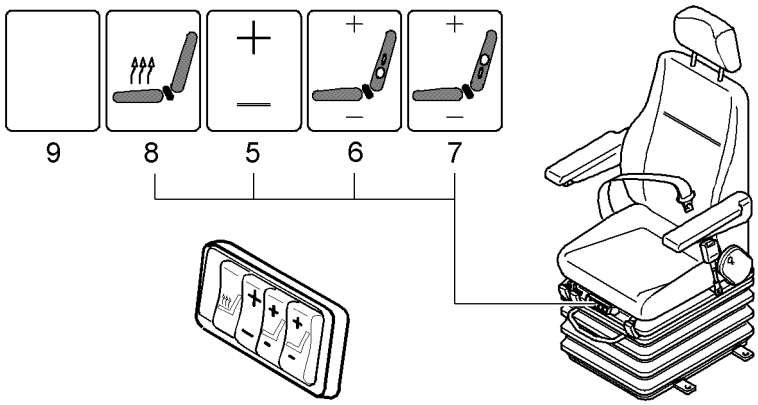

Fig. 3-39 *Switch bar on the air-cushioned operator's seat*

To set the vibration damping:

▶ Press button **5** (**+** or **-**) and set the vibration system according to body weight.

To set the lumbar support:

▶ Press button **6** (**+** or **-**) to inflate or deflate the lower lumbar chamber.

▶ Press button **7** (**+** or **-**) to inflate or deflate the upper lumbar chamber.

To set the seat heating:

▶ Use switch **8** to switch the seat heating on or off.

The seat heating switches off automatically when the temperature set is reached.

Putting on / releasing the safety belt

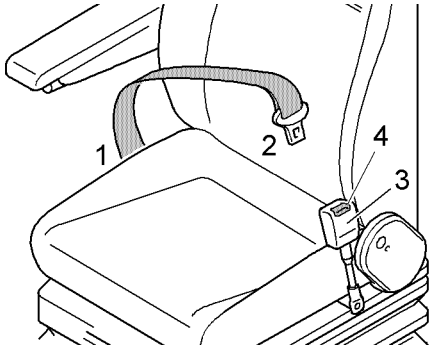

Fig. 3-40 *Safety belt*

The safety belt is automatic. It is not necessary to adjust the length of the belt.

- ▶ Pull the belt and buckle **2** out of the roller mount **1**.
  - ⇘ If pulled out of the roller mount sharply, the belt may lock.
- ▶ Push the buckle into the belt lock **3** until it fastens.

Danger!
The safety belt is designed to protect the operator.

- ▶ Before starting the machine, always fasten the safety belt.
- ▶ Ensure that the safety belt is not twisted when it is fastened.
- ▶ To ensure your safety, check the condition, function and fastening of the belt regularly and replace any damaged parts without delay.

- ▶ To open lock **4**, push down on the belt lock using your thumbs.
  - ⇘ The safety belt will slide automatically back into the roller mount **1**.

Vibration damping

The seat complies with ISO 7096.

If the machine is used in accordance with regulations, the values of the vibration damping transferred by the operator's seat are less than or equal to the tested excitation vibration for the relevant machine class in accordance with ISO 7096.

The values for vibration accelerations a_{zw}, measured in accordance with ISO 2631-1, therefore comply with the requirements for protection against whole body vibration set out in EN 474-1 («acceleration» a_{zw} between 0,5 and 2,5 ms^{-2}).

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3.2.5 Windscreen

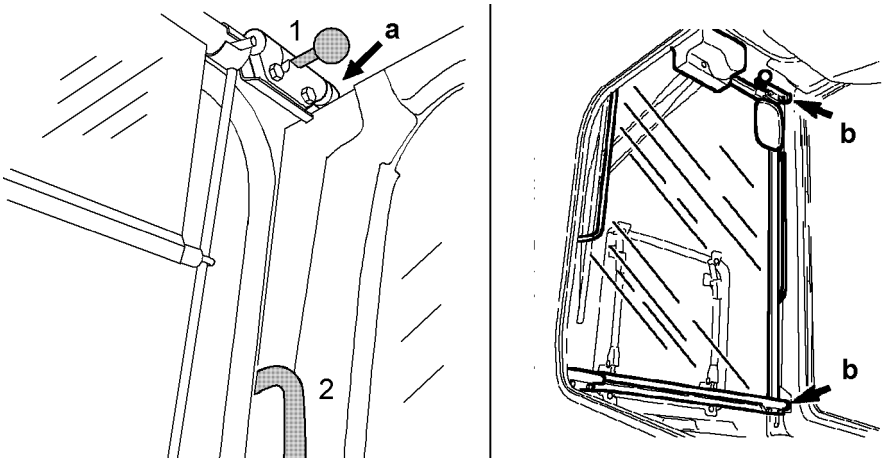

Fig. 3-41 *Windscreen*

The windscreen can be positioned in two ways.

– Position **a**: Window closed.
– Position **b**: Window fully opened (locked in place on the roof of the cab).

▶ Pull bar **1** in and down.
  ↳ The window is unlocked.

▶ Move the windscreen with the bracket **2**, secure in one of the two window positions (**a** or **b**) and relock using bar **1**.

3.2.6 Sunshade

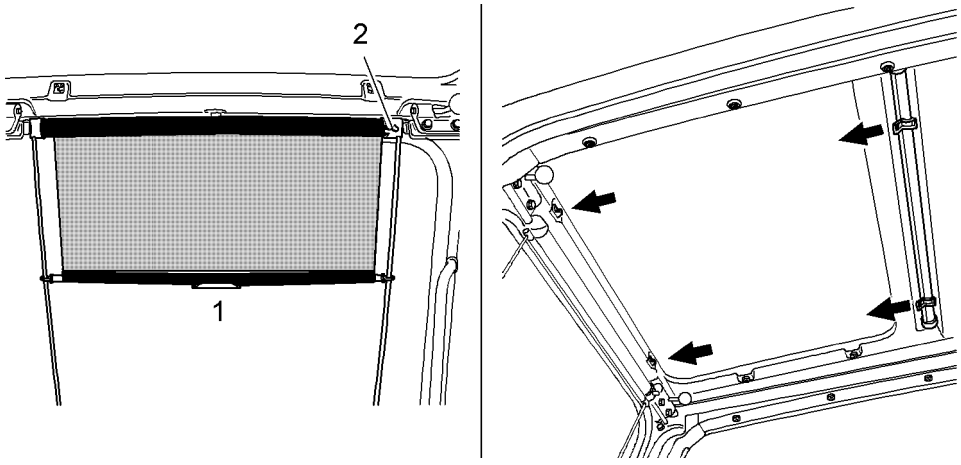

Fig. 3-42 *Windscreen and cab roof sunshade*

The cab is provided with two sunshades, located on the windscreen and on the glass window in the cab roof.

Windscreen

▶ Pull the sunshade down using the cross strut **1**.
  ↳ The sunshade can be set for individual use.

▶ Press button **2** (red).
  ↳ The sunshade rolls itself up.

Cab roof

- ▶ Pull out the sunshade and secure it in the holders designed for the purpose.
- ▶ To retract the sunshade, take it out of the holders and let it roll up slowly.

3.2.7 Emergency exit – rear window

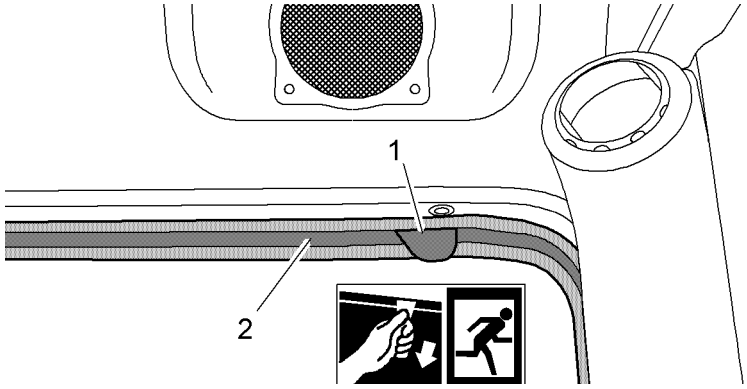

Fig. 3-43 *Emergency exit – rear window*

By pulling the clip **1** on the interior of the rear window, the rubber weatherstrip **2** can be released and removed.

- ▶ In case of emergency, pull the rubber weatherstrip **2** out of the entire area of the window and push out the window.

3.2.8 Interior lighting

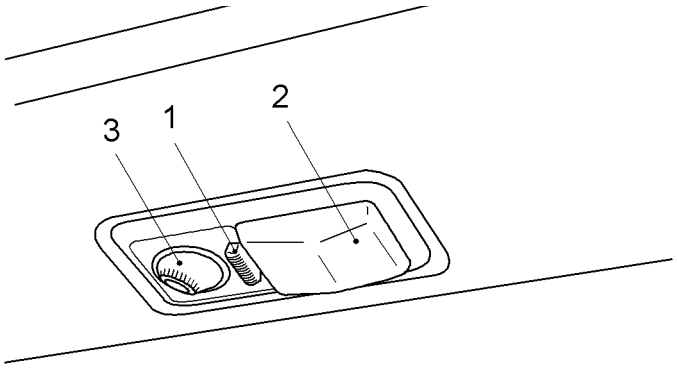

Fig. 3-44 *Interior lighting*

The interior lighting is switched on using the slide regulator **1**.

- ▶ Push the slide regulator to the right.
  ↳ The light **2** is switched on.
- ▶ Push the slide regulator to the left.
  ↳ The spot **3** is switched on.
- ▶ Push the sliding regulator into the central position.
  ↳ Interior lighting is switched off.

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3.2.9 Fire extinguisher*

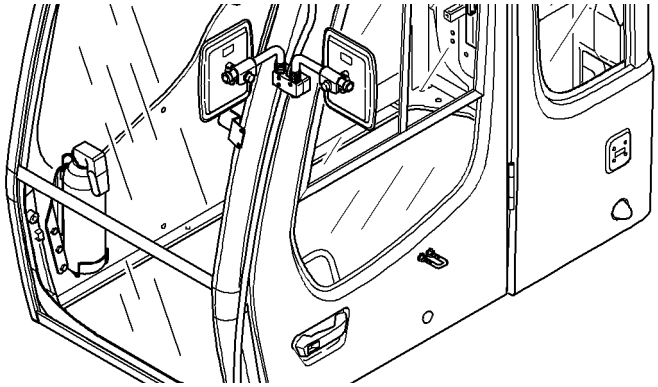


Fig. 3-45 *Fire extinguisher / First-aid box*

The stowing compartment for the fire extinguisher is located on the lower right in the cab.

*Owner regulations

3.2.10 Windscreen wiper

Windscreen wiper

When the ignition is switched on, pressing switch **S14** will activate the windscreen wiper.

- ▶ Press switch.
  - ↳ Intermittent switching
  - ↳ LED I in the switch illuminates.
- ▶ Press switch again.
  - ↳ Continuous operation.
  - ↳ LED C in the switch illuminates.
  - ↳ LED I in the switch goes out.
- ▶ Press switch again.
  - ↳ Windscreen wiper is switched off.
  - ↳ LED C in the switch goes out.

Setting the interval time for the intermittent switching

The interval time can be set when the ignition is on by pressing switch **S14**.

- ❑ Press the switch until the windscreen wiper is switched off (LED I in switch goes out)
- ▶ Press and hold switch.
  - ↳ LED I in the switch flashes.
- ▶ Release the switch when the desired interval time has been reached.
  - ↳ The interval time can be set to between 2 and 10 seconds.

Windscreen washing system

When the ignition is switched on, pressing button **S11** will activate the electric windscreen washing system.

- ▶ Press and hold button.
  - ↳ Washing water will be sprayed onto the windscreen through the outlet nozzles.

↳ The windscreen washer runs continuously.

▶ Release the button.
↳ Washing water will be stopped.
↳ Windscreen washer will run continuously for approx. another 3 seconds.

Windscreen washing fluid container

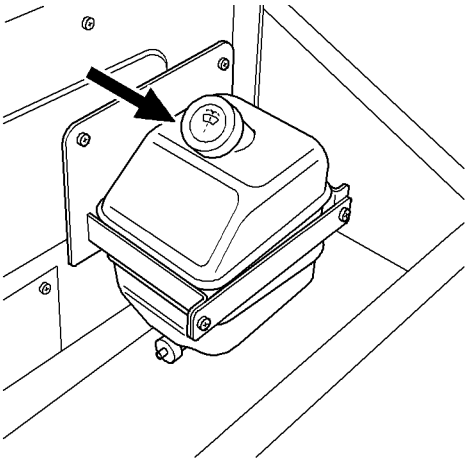


Fig. 3-46 *Windscreen washing fluid container*

The container for the windscreen washing fluid is located at the rear of the cab.

Once the cover (see arrow) has been opened, the container can be refilled with ordinary windscreen washing fluid.

Volume: see lubricant chart

Window washer on the cab roof (optional extra)

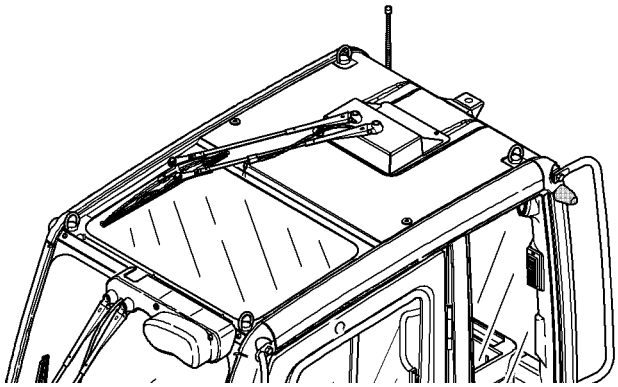
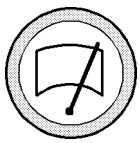


Fig. 3-47 *Window washer on cab roof*

Pressing switch **S218** on the right control panel when the ignition is switched on activates the cab roof window washer.

▶ Press switch **S218**.
↳ Cab roof window washer runs continuously.



▶ Press switch **S218**.
↳ Cab roof window washer is switched off.

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3.2.11 Lighting

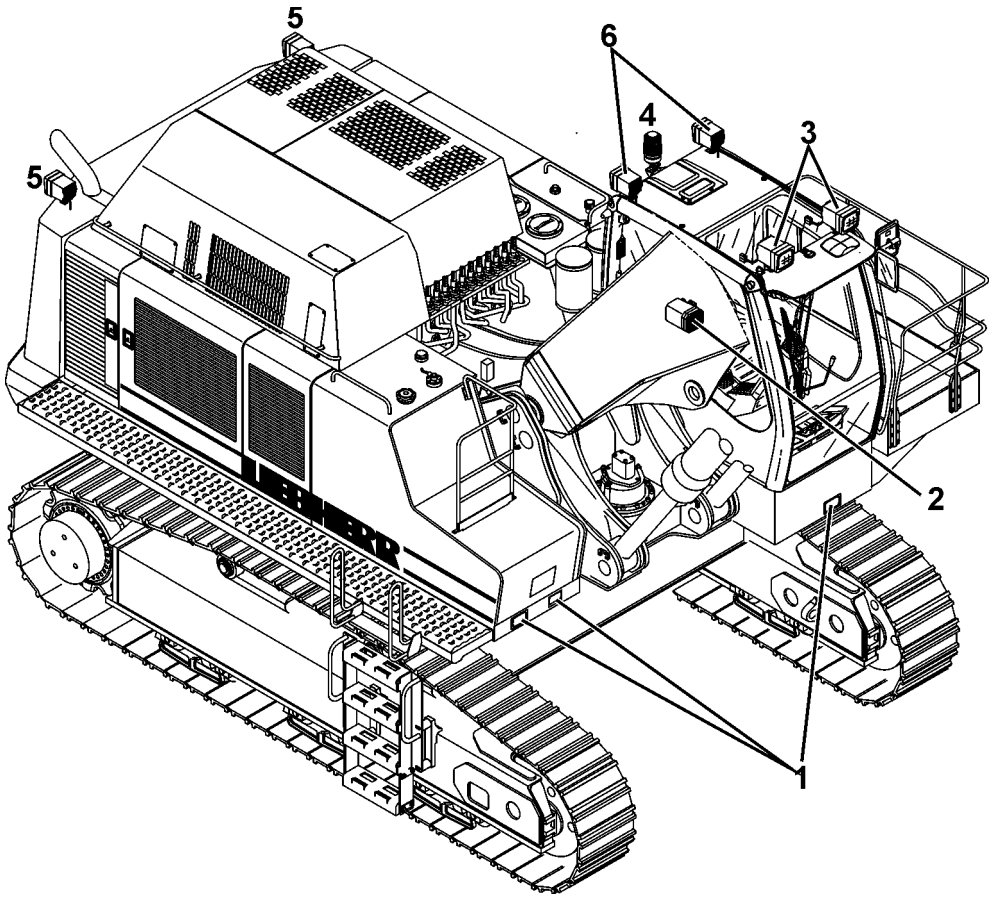

Fig. 3-48 *Arrangement of lighting*

1 Rotating deck floodlights
2 Attachment floodlights
3 Front roof floodlights (optional extra)
4 Rotating beacon (optional extra)
5 Floodlights on Counterweight (optional extras)
6 Roof floodlights, rear (optional extra)

Rotating deck and attachment floodlights

The rotating deck and attachment floodlights (1 & 2) are switched on by pressing switch **S10**.

▶ Press the switch.
  ↳ Rotating deck floodlights are activated.
  ↳ LED 1 in the switch illuminates.

▶ Press switch again.
  ↳ Rotating deck floodlights are deactivated.
  ↳ LED 1 in the switch goes out.
  ↳ Attachment floodlights are activated.
  ↳ LED 2 in the switch illuminates.

▶ Press switch again.
  ↳ Rotating deck and attachment floodlights are switched on.
  ↳ LEDs 1 and 2 in the switch illuminate.

▶ Press switch again.
  ↳ Rotating deck and attachment floodlights are switched off.

↳ LEDs 1 and 2 in the switch go out.

Additional headlight (optional extra)

Pressing switch **S22** when the ignition is on switches on the additional floodlights (3 & 5).

▶ Press the switch.
↳ Additional floodlights are switched on.
↳ LED in switch illuminates.

▶ Press switch again.
↳ Additional floodlights are switched off.
↳ LED in the switch goes out.

Rotating beacon (optional extras)

Pressing switch **S41** switches on the rotating beacon (4) when the ignition is on.

▶ Press switch.
↳ Rotating beacon flashes.
↳ LED in switch illuminates.

▶ Press switch again.
↳ Rotating beacon is switched off.
↳ LED in the switch goes out.

Roof floodlights, rear (optional extras)

Pressing switch **S275** on the right control panel switches on the roof floodlights (6) at the rear on the cab.

▶ Press switch.
↳ Rear floodlights on roof cab are switched on.
↳ LED in switch illuminates.

▶ Press switch again.
↳ Rear floodlights on roof cab are switched off.
↳ LED in the switch goes out.

3.2.12 Heating/air-conditioning system

Overview

The cab has a heating / air-conditioning system as standard. The heating / air-conditioning system is used to heat, cool and ventilate the cab.

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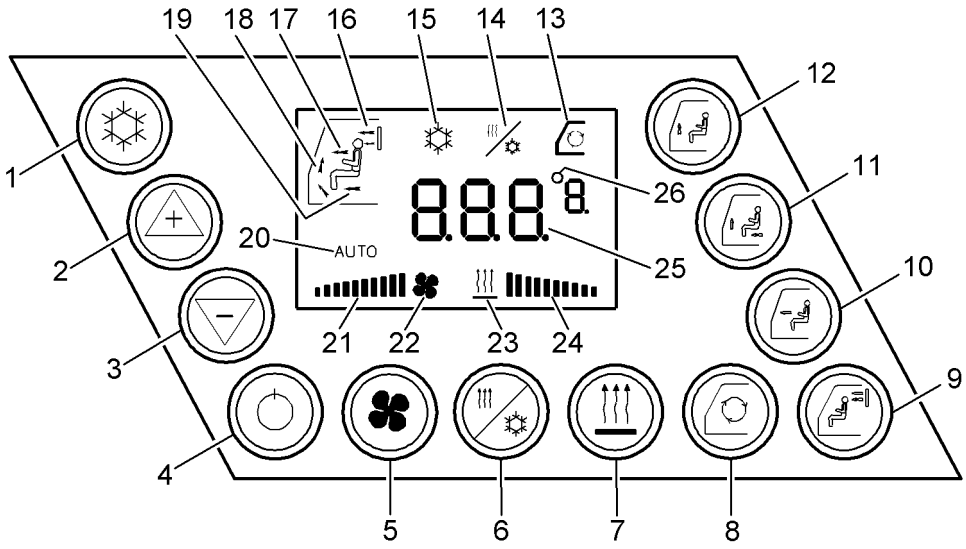

Fig. 3-49 *Air-conditioning system control device*

Control buttons

1 – Air conditioning (cooling)
2 - Increase cab temperature
3 – Reduce cab temperature
4 – Control ON / OFF
5 – Evaporator fan speed – manual / automatic
6 – REHEAT function
7 – Heating – manual / automatic
8 – Fresh air / recirculated air
9 – Rear wall ventilation flap OPEN / SHUT
10 – Right control panel ventilation flap (2 (17)) OPEN / SHUT
11 – Windscreen footwell ventilation flap CENTRE / SHUT
12 – Windscreen footwell ventilation flap CENTRE / OPEN

Main screen displays

13 – Recirculated air
14 – REHEAT function
15 – Air conditioning (cooling)
16 – Rear wall ventilation flap OPEN
17 – Right control panel ventilation flap (2 (17)) OPEN
18 – Windscreen footwell ventilation flap CENTRE
19 – Windscreen footwell ventilation flap OPEN
20 – Automatic function
21 – Fan speed in manual operation bar
22 – Fan speed in manual operation symbol
23 – Heating in manual operation symbol
24 – Heating in manual operation bar
25 – Nominal value / error code
26 – Temperature (°)

If the control unit identifies an error, a flashing error number **F1 – F5** will be displayed.

Note!

▶ In the event of an error occurring, please consult with the LIEBHERR customer service.

Switching on the control unit

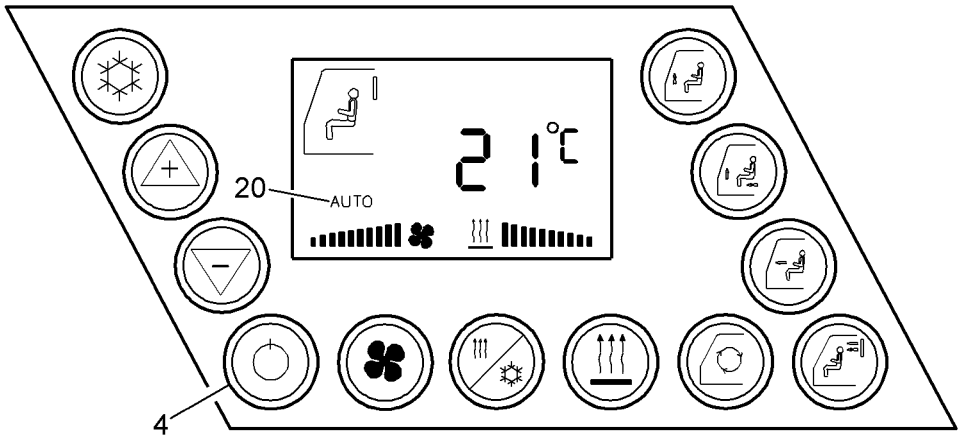

Fig. 3-50 *Switching on the control unit*

▶ Switch on the unit using button **4**.
  ⇩ The software version will be displayed for approximately 12 seconds while the control unit carries out an automatic check.

The heating and air-conditioning in the cab is operating. Heating performance and fan speed will be controlled automatically if the **AUTO (20)** symbol is activated.

Setting the desired cab temperature

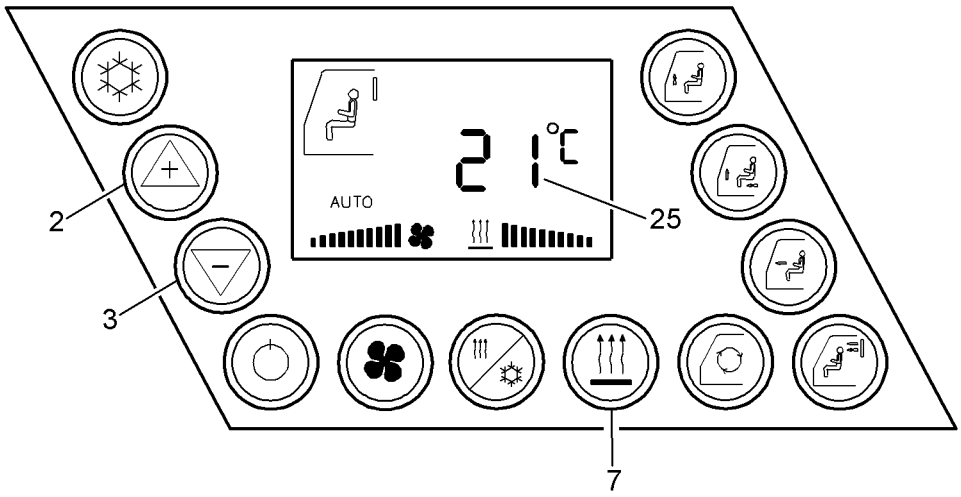

Fig. 3-51 *Setting the desired cab temperature*

The four figure segment display **25** displays the desired cab temperature.

▶ Use the button **2** to increase the temperature.

▶ Use the button **3** to reduce the temperature.

The temperature set will remain stored until the next change is made.

Switch on Air conditioning to cool the cab.

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- ▶ Press button **7** to set the heating manually.
  - ↳ The heating symbol will flash for 5 seconds.
- ▶ While the heating symbol is flashing, use button **2** or **3** to increase or reduce the heating manually.
- ▶ Press button **7** to switch to automatic again.

Air-conditioning

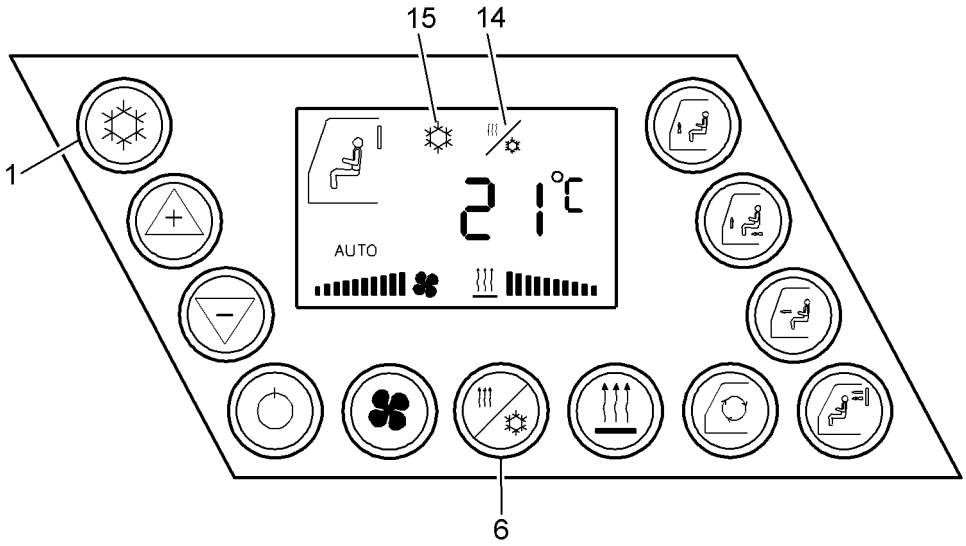

Fig. 3-52 *Air-conditioning*

- ▶ Switch on the air-conditioning using button **1**.
  - ↳ The symbol **15** will be activated.
  - ↳ The compressor will now be switched on by the control unit if required and controls the heating and cooling unit's speed automatically.
- ▶ To dehumidify the cab, switch on the air-conditioning system when heating the cab.
- ▶ Press the REHEAT button **6**.
  - ↳ Symbol **14** is activated.
- ▶ In this case, switch on the air-conditioning unit until the windows are no longer fogged.

After 10 minutes, the REHEAT function switches off automatically.

Recirculated air and fresh air

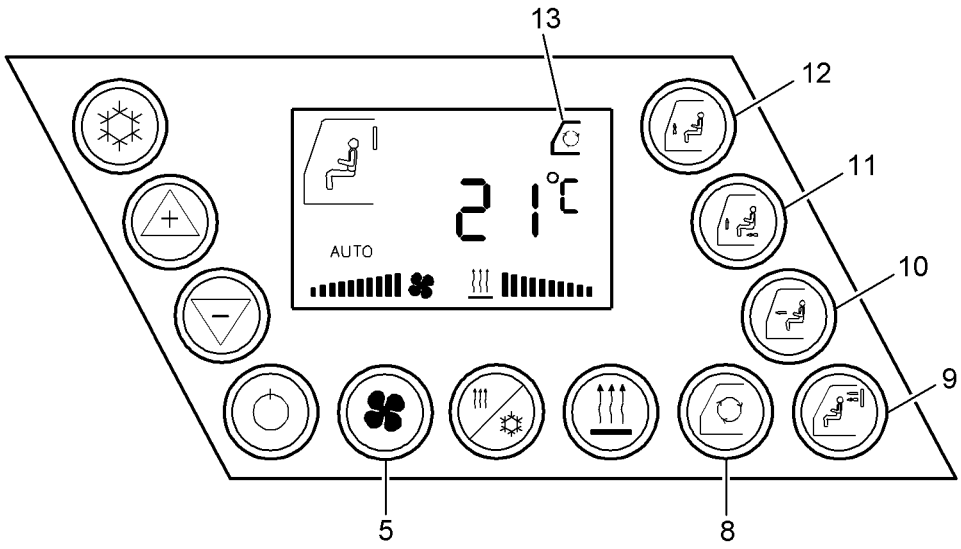

Fig. 3-53 *Recirculated air and fresh air*

The heating and air-conditioning unit can be switched to recirculated or fresh air.

- ▶ Press button **8** to open / close the fresh air flap.
  - ⮷ Symbol **13** indicates that the fresh air flap is closed.
- ▶ Press button **5** to set the fan speed manually.
  - ⮷ The fan symbol will flash for 5 seconds.
- ▶ While the fan symbol is flashing, use button **2** or **3** (siehe Fig. 3-51) to increase or reduce the fan speed manually.
- ▶ Press button **5** to reset the automatic function.

Adjustment of the air flow

Regulation of the air flow is carried out using buttons **9** - **12** (siehe Fig. 3-53) and using rotating and lockable air vents.

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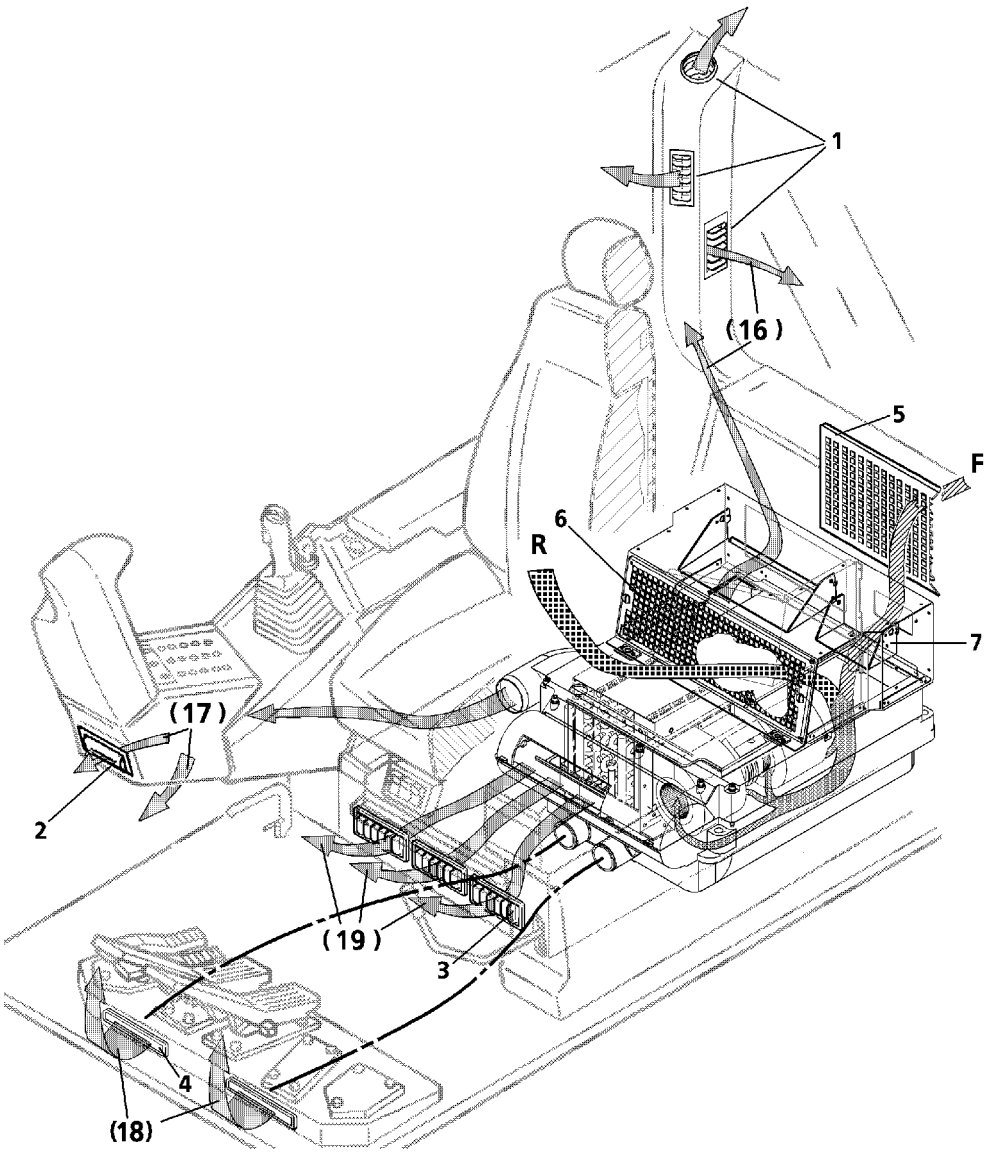

Fig. 3-54 *Position of front air vents and vents on the rear cab wall*

The air vents are located on the seat console **3 (19)**, on the right control panel **2 (17)**, on the front window **4 (18)** and on the cab rear wall **1 (16)**. The area that is open on each ventilation flap is indicated with an arrow in the display.

To obtain optimal comfort:

- When **heating**, open the air vents in the footwell **3**, the right control panel **2** and possibly in the windscreen **4**.
- When **air-conditioning**, open the air vents in the cab rear wall **1** and the right control panel **2**.

The best heating or cooling effect is achieved when using the recirculated air function.

Note!
To prevent the starter motor and the battery from overloading, only switch on the air-conditioning after starting the diesel engine.

▶ If the machine is used for a longer period of time without using the air-conditioning unit, operate the compressor every 2 weeks by pressing the REHEAT button **6** (siehe Fig. 3-52) .

Operating with independent heating (optional extra)

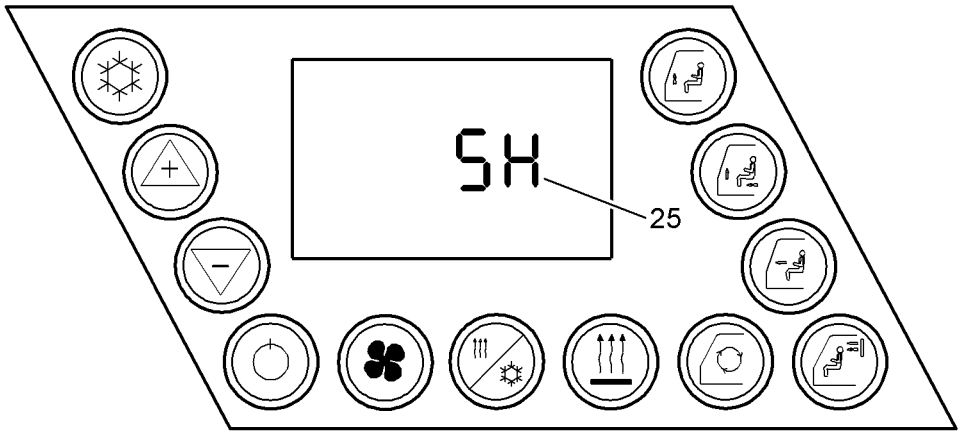

Fig. 3-55 *Operating with independent heating*

Note!
Independent heating can only be operated when the ignition is switched off.
It is not possible to carry out any manual settings in independent heating operation.

▶ Switch on the independent heating.

The independent heating will switch off automatically when the diesel engine is started.

3.3 Operation

3.3.1 Safety instructions

Bringing the machine safely into service

– Carry out a careful inspection tour around the machine each time before starting it.
– Check the machine for loose bolts, cracks, wear, leakage and damage.
– Never attempt to operate a damaged machine.
– Ensure that any damage is immediately rectified.

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- Ensure that all hoods and covers are closed, but that locks are unlocked.
- Ensure that all warning signs are present.
- Keep windows and interior and exterior mirrors clean. Secure doors and windows against unintended movement.
- Ensure that no one is working on or under the machine and warn personnel in the vicinity of the machine that it is about to start by sounding the horn.
- Before starting the machine, adjust the seat, mirrors, armrests and operator's controls in such a way that you are able to work comfortably and safely.
- Acoustic insulation devices on the machine must be set to the insulation position throughout operation.
- Only operate combustion engines and fuel-operated heaters in adequately ventilated spaces. Before starting in closed areas, ensure adequate ventilation. Follow the regulations which apply for the particular area of use.

Starting the machine safely

- Before starting, check all control lamps and instruments for correct function, place all operator's controls in Neutral and tilt the safety lever up.
- Before starting, sound the horn briefly to alert people in the vicinity of the machine.
- Only start the machine from the driver's seat.
- In the absence of any other instructions, start the engine in accordance with the regulations given in the operating instructions.
- Tilt the safety lever down and then test all display and checking devices.
- In enclosed spaces, only allow the engine to run when there is adequate ventilation. If necessary, open doors and windows to ensure sufficient fresh air supplies.
- Bring the engine and hydraulic oil to operating temperature. Low oil temperatures make the control unit react sluggishly.
- Check that the equipment is operating correctly.
- Move the machine carefully to an open area and then check the function of the running and slewing gear brakes, the steering and the signaling and lighting devices.

3.3.2 Stopping the machine safely

- Only stop the machine on level, firm ground.
- If the machine has to be stopped on an incline, chocks should be used to secure it from rolling away.
- Use the stop bolts to secure the upper structure facing the chassis.
- Lower the equipment and anchor the grab lightly in the ground.
- Depress the parking and slewing brakes.
- Stop the engine in accordance with the operating instructions and tilt the safety lever up before leaving the cab.
- Lock the machine, remove all keys and secure it against unauthorized use.

Towing the machine safely

- Always follow the correct procedure: see chapter "Towing the machine" in these operating instructions.
- The machine may only be towed in exceptional circumstances, e.g. in order to move the machine away from an area where it is at risk.
- Before towing, check all attachments and towing devices for safety and stability.

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– Towing devices such as bars must have adequate tensile strength and should be secured on the towing hook provided on the undercarriage chassis.
  Any damage or accidents which occur while towing the machine are not covered by the manufacturer's guarantee.
– Ensure that there is no one in the vicinity of the towing devices when towing.
– When towing, maintain the correct transport position, permitted speed and route.
– After towing, return the machine to correct operational status.
– When restarting the machine, be sure only to proceed in accordance with the operating instructions.

3.3.3 Starting / stopping the machine

General information

Note!
When using the machine at a specific height above sea level and in connection with certain outside temperatures, the performance and service life of the diesel engine with turbocharging is decisively affected.
Under these conditions, there is also an increased risk of the coolant circuit and the hydraulic oil overheating.

To avoid damaging LIEBHERR diesel engines, the engine's power must be reduced when operating in the following environmental conditions (sea level and exterior temperature):

– 3,000 m generally
– 2,700 m and exterior temperature up to 30 °C
– 2,000 m and exterior temperature up to 40 °C
– 1,200 m and exterior temperature up to 50 °C

Pay attention to both the coolant circuit and the hydraulic oil cooling simultaneously.

Activities before starting

Caution!
It is only possible to extinguish a source of fire if it is accessible.

▶ Before starting, unlock all locks on the panelling of the hydraulic excavator.
  ↳ In the event of fire, the doors can be opened immediately and the fire extinguished.

Arrangement of locks: see Maintenance chapter

Caution!
With the activities referred to below, a machine that is already warm from operating, there is a risk of scalding or burning from hot coolant or oil.

▶ Please ensure that you read the information provided in the Maintenance chapter on carrying out these activities.

Before starting the machine, the following activities should be carried out on a daily basis:

– Check air filter for contamination.*

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– Check the oil level in the engine*.
– Check the coolant level in the diesel engine*.
– Check the oil level in the hydraulic tank*.
– Drain the fuel system, if required*.
– If required, remove any ice and snow from the engine hood in the area of the cooling and combustion air intake.

* For how to carry out the activities, see the Maintenance chapter.

Starting the diesel engine

Ignition key switching positions

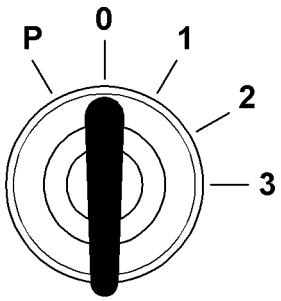
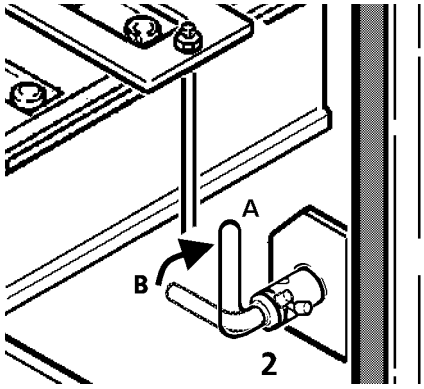


Fig. 3-56 *Ignition switch*

0 Neutral
1 Contact position
2 Preheating
3 Start position
P Park position

Switching on the electrical system



❑ The main battery switch must be in position **A**.

▶ Turn the ignition key to contact position **1**.
↳ As soon as the ignition is switched on, an automatic check of the keypad and the monitoring screen takes place.

Note!
If no automatic check of the keypad and monitoring screen is carried out when the ignition key is in the contact position, check that the main battery switch is set to “one”.

▶ Satisfy yourself that the display instruments are functioning perfectly when you switch on the ignition.
↳ All control lamps must illuminate for a brief period with the exception of the LED of switch **S22** (auxiliary light).

↳ The LIEBHERR logo appears on the monitoring screen.

Service interval display

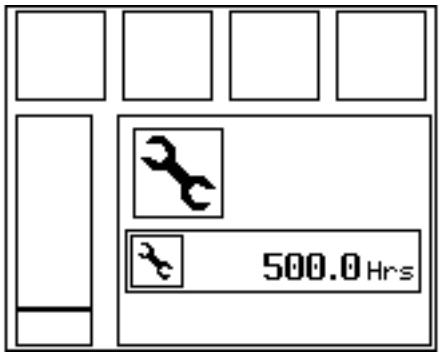


Fig. 3-57 *Service interval request*

After the automatic check, any service interval that may be due will be indicated by a graphic symbol.

In place of the operating hours information, the number of hours relating to the service interval required will now be displayed.

The service interval request will go out after approx. 8 seconds.

Electronic anti-theft device(optional extra)

The machine can be equipped with an electronic anti-theft device.

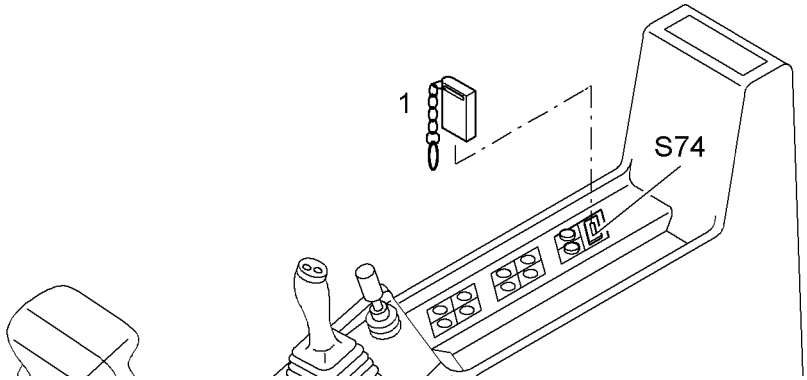


Fig. 3-58 *Electronic anti-theft device*

▶ Insert the code key **1** in the code lock **S74** and then remove.
↳ The LED goes out.
↳ A signal tone sounds.

▶ The anti-theft device is activated.

▶ You have 9 seconds to start the electrical system with the ignition key.

If the ignition is not switched on within 9 seconds, the code key will have to be reinserted in the code lock.

When the ignition is switched off, the anti-theft device activates itself automatically after 30 seconds.

▶ To reorder the code key, give the code number entered on the accompanying code card (credit card format).

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Starting the engine

Note!
Only operate the starter motor when the diesel engine is off.

- ▶ Operate the starter motor continuously for no longer than 10 seconds.
- ▶ If the engine does not start, turn the ignition key back to contact position **0**, before restarting the engine.
- ▶ Wait at least 1 minute before trying to start the engine again.

Starting procedure when the exterior temperature is above 0 °C.

If the engine and batteries are in good condition, the engine can be started without preheating.

- ▶ Turn the ignition key to start position **3**.
- ▶ Release the ignition key as soon as the engine starts.
  - ↳ Control lamps H2, H12 and H24 must go out (H23 goes out after a short delay).
  - ↳ The buzzer will sound briefly when the engine starts until the engine oil pressure builds up.

Starting procedure when the exterior temperature is below 0 °C.

Preheating improves the starting procedure of the diesel engine at low temperatures.

- ▶ Turn the ignition key to position **2**.
  - ↳ The symbol Preheating ON appears on screen.
  - ↳ The symbol is displayed on the main screen for approx. 20 seconds.

- ▶ When the symbol Preheating END (2 seconds) appears, turn the ignition key to start position **3**.
- ▶ Release the ignition key as soon as the engine is running.

Engine afterignition

- ▶ Turn the ignition key to position **2** as soon as the engine is running after the starting procedure.
  - ↳ Symbol appears on the main screen.
- ▶ Release the ignition key.

Note!
Do not preheat an engine which is at operating temperature.

Starting procedure when the exterior temperature is below -18 °C.

For starting at temperatures below -18 °C, it is recommended to equip the machine with the original LIEBHERR cold start aid (see Starting aids)

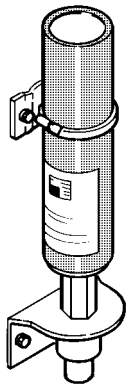

Fig. 3-59 *Cold start aid*

The cold start aid can be operated from the cab and replaces preheating.

External starting procedure

Caution!
Connecting old batteries or batteries which have been recharged several times to charged batteries may result in increased gas formation in the discharged batteries. Always wear safety glasses and protective gloves and avoid open flame and formation of sparks in the area close to the discharged batteries.
Use only battery cables with suitable diameter and proceed as follows to reduce to a minimum the formation sparks.

- ▶ First connect one cable to the + terminal of the discharged battery and then to the + terminal of the charged (external) battery,
- ▶ next connect the second cable to the - terminal of the discharged battery and then to the - terminal of the charged battery.
- ▶ Start the engine as described on previous page.
- ▶ Before removing the external starting cables, always bring to low idle the Diesel engine of the excavator and, if applying, also the Diesel of the external machine.
- ▶ Then first disconnect the cable from the - terminal of the charged (external) battery and then from - terminal of the discharged battery,
- ▶ next disconnect the cable from the + terminal of the charged battery and then from the + terminal of the discharged battery.

Engine shut down procedure

To shut down the engine, do not suddenly turn the engine off when the engine are running at high idle.

- ▶ Reduce first the engine RPM to low idle via the arrow **S229**,
- ▶ and continue to run the engine for 3 - 5 minutes to lower temperature.
- ▶ Then turn the ignition key to "0" position to turn the engine off,
- ▶ remove the key.

Do not turn the starter while the engine is running, this could damage the starter and the starter gear.

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Engine shut down procedure with stop idle 5 min (option)

To shut down the engine, do not suddenly turn the engine off when the engine are running at high idle.

- ▶ Reduce first the engine RPM to low idle via the arrow **S229**,
- ▶ Then turn the ignition key to "0" position to turn the engine off,
- ▶ remove the key.
- ▶ The engine does not stop immediately, it will first run at low idle for about 5 minutes (after running),
- ▶ and then be stopped automatically.

Do not turn the starter while the engine is running, this could damage the starter and the starter gear.

Engine emergency shut down

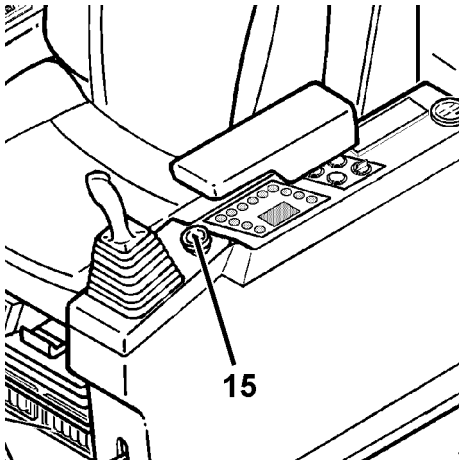

Fig. 3-60 *Emergency off switch*

In case of an emergency, the engine can be shut down, during normal operation as well during "after running",

- ▶ by pushing in either the emergency off switch 15 situated on the control desk, or the one mounted below the counterweight.

Caution!
The engine should be stopped this way only in emergencies. If the engine was turned off in an emergency shut down, it is important to let the engine run at low idle for a short time after restarting.

Speed adjustment and mode functions

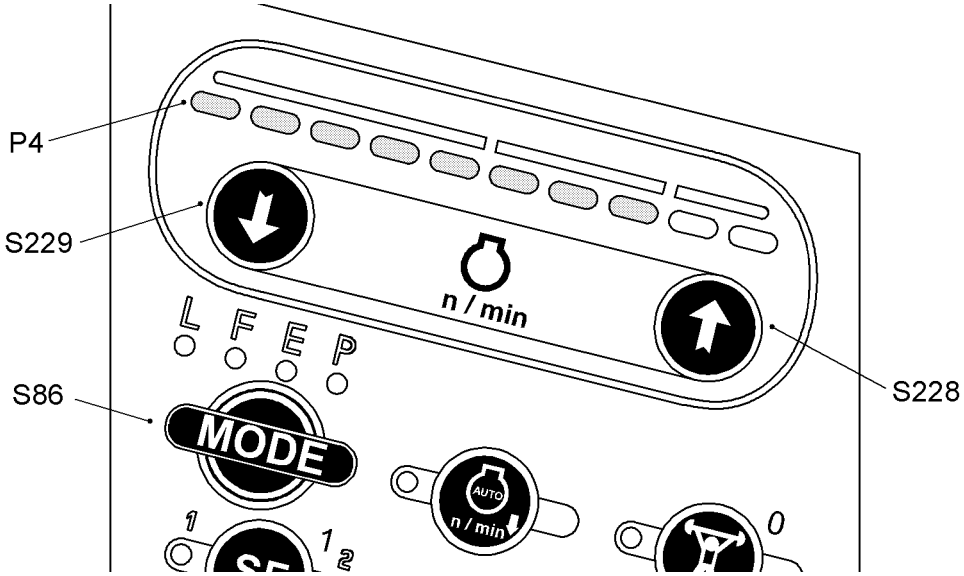

Fig. 3-61 *Speed adjustment and mode functions*

The previously selected engine speed will be displayed on the LED chain **P4**. It is divided into 10 speed levels.

▶ To adjust the engine speed, press arrow keys **S228** or **S229**.
- or -
Press the mode switch **S86**.

Performance selection (adjustment) using the mode button

Four different modes can be selected by pressing switch **S86**.

– **L**: LIFT mode (speed level 5 – sensitive lifting of loads)
– **F**: FINE mode (speed level 10 – skimming work)
– **E**: ECO mode (speed level 8 – economical work)
– **P**: POWER mode (speed level 10)

Using the arrow keys to adjust speed

To increase the speed:

▶ Press switch **S228**.
↳ Speed will be increased by one level.
↳ A second LED to the right illuminates in the **P4** display.

To reduce the speed:

▶ Press switch **S229**.
↳ Speed will be decreased by one level.
↳ A second LED from the right goes out in display **P4**.

A flashing LED above switch **S86** identifies an intermediate stage of the mode selected.

The currently active mode will be displayed under the letter on the LED. The mode selected will be saved when the engine is switched off and will be displayed by a flashing LED above switch **S86** the next time the engine is started.

The speed preselected after the diesel engine has been started will either be at level 1 (low idle on the diesel engine) or at level 3, if a warm-up phase is required for the

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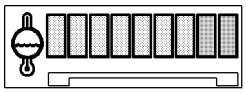
diesel engine.

▶ Press the mode switch **S86**.
  ↳ The mode selected will be used, with the corresponding speed and power.
  ↳ The appropriate LED will illuminate permanently.

In mode **E** (maximum torque) and **P**, the diesel engine works at maximum power. In mode **L** and **F**, the hydraulic power is reduced.

Warm-up phase for diesel engine and hydraulic circuit

Diesel engine



With cold engine coolant (temperature below 20 °C), the speed is automatically set at level 3.

This procedure lasts until the coolant has reached 20 °C, but for a maximum of 3 minutes.

▶ Increase the engine strain slowly until the second green LED (from left) illuminates on display unit **P2**.

Note!
Idling for an extended period of time damages the engine.

▶ Switch off the diesel engine if the machine is not being used.

Hydraulic oil

The pump power is automatically limited when the hydraulic oil is cold (temperature below 8 °C).

As soon the hydraulic oil temperature rises above 8 °C, the machine can attain full power.

Notes after starting the engine

Danger!
Danger of suffocation.

▶ When operating in enclosed spaces, only run the engine in areas with sufficient ventilation.

▶ Open doors and windows to ensure sufficient supplies of fresh air.

Caution!

▶ Bring the engine and hydraulic oil up to operating temperature. The controls operate sluggishly at low oil temperatures.

▶ Move the machine carefully in an open space to test the function of the chassis and slewing gear brakes.

▶ Check that the equipment is operating perfectly.

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Switching off the diesel engine

Caution!
The engine could be damaged.

- ▶ Do not switch off the engine suddenly from full throttle.

- ▶ First use arrow key **S229** to set the engine speed to low idle.
  ↳ Only the LED on the furthest left is now lit on display **P4** (engine speed).
- ▶ Allow the diesel engine to run continuously in low idle for another 2-3 minutes.
- ▶ Now turn the ignition key to position **0** in order to switch off the engine.
- ▶ Remove the ignition key.

3.3.4 Jump start procedure

Danger!
When connecting to exterior batteries, old batteries can be subject to increased gas formation.

- ▶ Wear protective goggles and gloves whenever jump starting, avoid naked flame and creating any sparks in the vicinity of the flat vehicle battery. RISK OF EXPLOSION!
- ▶ Only use jump starting cables with a sufficient cross section. Always follow the established jump starting procedure.

Connecting the batteries

- ▶ First connect the cable to the positive terminal (+) of the flat battery and then to the positive terminal (+) of the exterior battery.
- ▶ Connect the second cable to the negative terminal (-) of the flat battery and then to the negative terminal (-) of the exterior battery.
- ▶ Start the engine as described above.

Caution!

- ▶ Before removing the jump start cable, be sure to place the diesel engine of the jump started machine into low idle.
- ▶ For safety reasons, switch on large consumers such as work headlights, upper carriage lighting etc. to avoid overvoltage. The electronics could otherwise be damaged.

Disconnecting the batteries

- ▶ First remove the cable from the negative terminal (-) of the exterior battery and then from the negative terminal (-) of the flat battery.
- ▶ Remove the second cable from the positive terminal (+) of the exterior battery and then from the positive terminal (+) of the flat battery.
- ▶ Check the electrical function of the machine.

For battery care and maintenance, see the chapter “Battery care”.

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3.3.5 Emergency operations

Emergency control speed adjustment

In normal operation, the desired speed is entered using arrow keys **S228** and **S229** or using mode switch **S86** and the engine speed is controlled correspondingly using the excavator electronics.

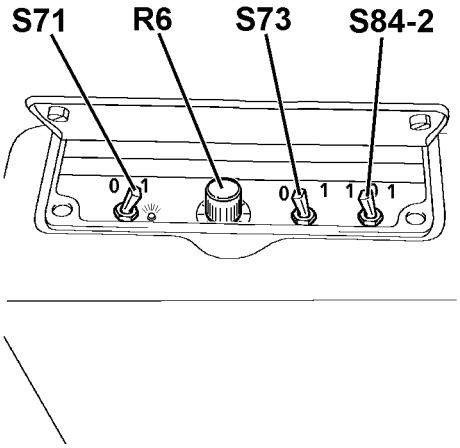


Fig. 3-62 *Emergency control speed adjustment*

This automatic system can be switched off in problem cases.

▶ Move toggle switch **S71** to the **MANU** position.
  ↳ The control light next to the switch goes on illuminates.
  ↳ The symbol **MANU** appears on the display.

▶ Control the speed manually.

The speed will be controlled using potentiometer **R6** :

– turning **R6** clockwise increases the RPM,
– turning **R6** counterclockwise reduces the RPM.

Emergency operation

If the function of the servo control and of the parking and slewing gear brakes can no longer be activated due to a defect in the electronics, it is possible to bypass the electronics.

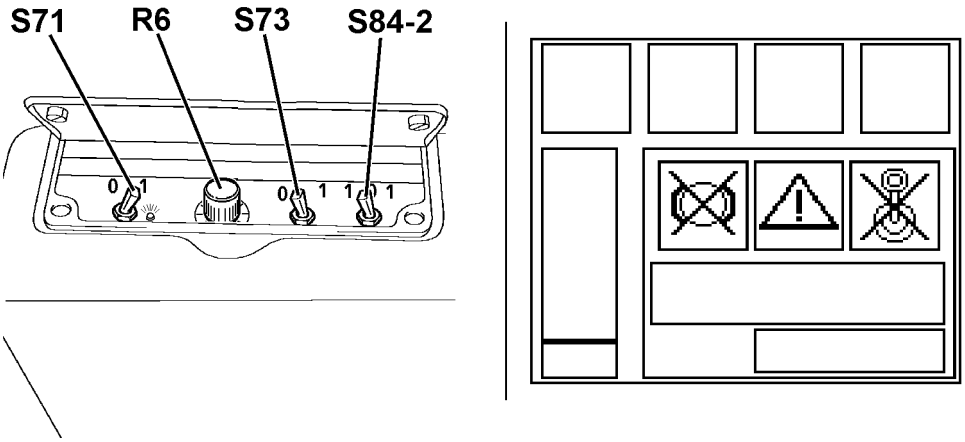


Fig. 3-63 *Emergency operation (Fig. left) and emergency switching screen display (Fig. right)*

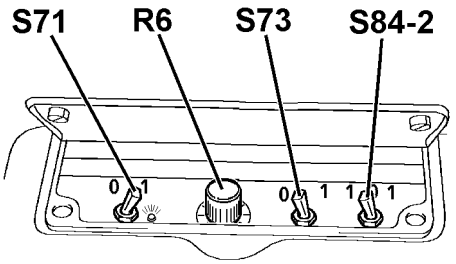
- ▶ Push the safety lever down.
- ▶ Move the toggle switch **S73** into the emergency position.
  - The symbols appear on screen.
  - The servo control will be activated when the swing gear motor is running.
  - When the hydraulics are ready to operate, the swing gear motor runs and the parking and swing gear brakes are released.

Danger!
In this toggle switch position, **S73**, the servo control and the parking and swing gear brakes can no longer be activated using the switches for this purpose on the keypad.

All three functions can only be activated or deactivated using the safety lever.

- ▶ Inform all personnel who are involved in the operation or maintenance of the machine about the emergency switching and of the changed operation.
- ▶ Rectify the damage to the machine which caused the emergency functions to be used as quickly as possible.

Safety operation of the central lubrication



Switch S84-2 for safety operation of the central lubrication

When the control unit **U15** of the central lubrication is out of order,

- ▶ tilt the switch **S84-2** briefly to the left or to the right,
- ▶ the lubrication system will start a complete lubrication cycle.

If the control unit of the lubrication is on and operative, the actuation of the switch **S84-2** will solely start an additional lubrication cycle.

Emergency operation of operating pumps

When a fault occurs in the electrical power or regulating circuits, pump efficiency is reduced to a minimum.

In this case, however, it is still possible to continue to work with reduced pump efficiency.

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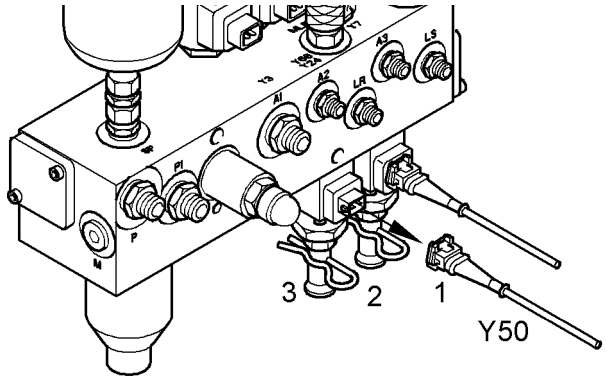

Fig. 3-64 *Preparing emergency operation of operating pumps*

❑ Toggle the lever **3** on the control oil unit on the back of the hydraulic tank and:

▶ pull out the plug connector **1 (Y50)**.

▶ pull out the cotter pin **2**.

▶ toggle the lever **3** to a horizontal position (emergency position).
↳ Emergency operation is prepared.

3.3.6 Driving

Driving straight ahead

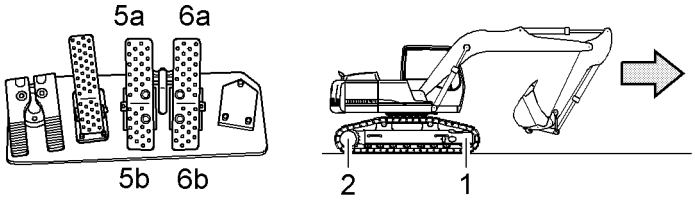

Fig. 3-65 *Driving straight ahead*

1 Leading wheel
2 Tumbler wheel
5a / 5b Pedal for left drive unit
6a / 6b Pedal for right drive unit

Caution!
When driving, the upper carriage must be rotated to the chassis in such a way that when driving forwards, the leading wheel **1** is in front and the tumbler wheel **2** is at the rear.

Driving forwards:

▶ Push both pedals forward (**5a** and **6a**).

Reversing:

Caution!
Before reversing, ensure that the area behind you can be safely entered.

▶ Push both pedals down (**5b** and **6b**).

Turning on the spot

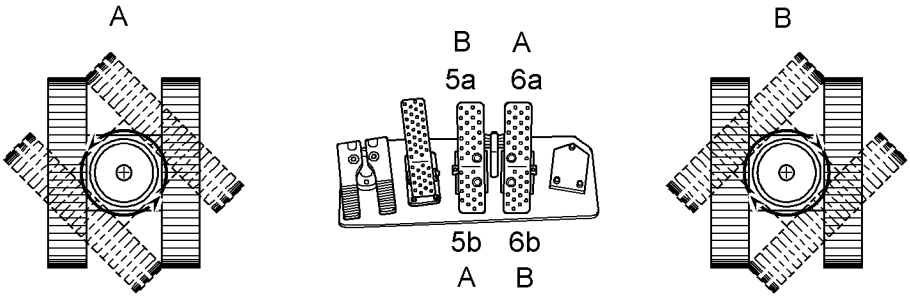

Fig. 3-66 *Turning on the spot*

Turning left (A):

▶ Push the left pedal down (**5b**).

▶ Push the right pedal forwards at the same time (**6a**).

Turning right (B):

▶ Push the right pedal down (**6b**).

▶ Push the left pedal forwards at the same time (**5a**).

Turning with a crawler

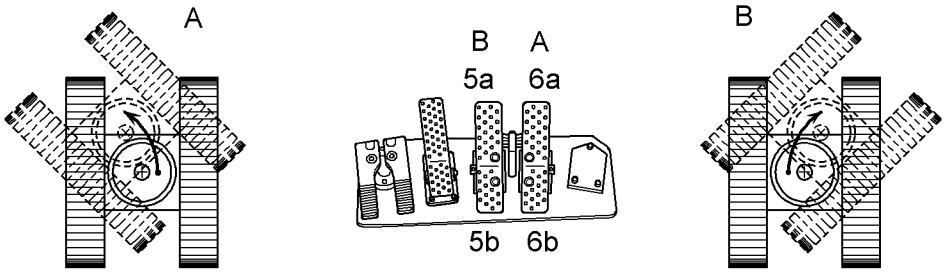

Fig. 3-67 *Turning with a crawler*

Turning to the left (A):

Push the right pedal forwards (**6a**).

Turning to the right (B):

Push the left pedal forwards (**5a**).

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Note!
If possible, avoid turning backwards in order to preserve the running gear parts.

Controlling the drive unit manually

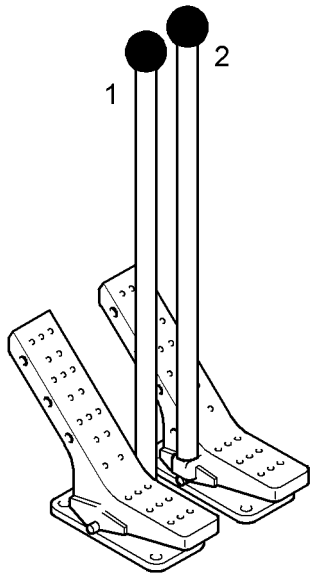

Fig. 3-68 *Manual drive unit control*

❑ Particularly careful driving is required here.

▶ Insert the hand levers (**1** and **2**) available in the tool kit into the pedals for the drive units.
  ↳ The drive units can be operated manually.

Note!
When driving the machine onto or off a low loader, the drive unit must be controlled manually for safety reasons.

Controlling the speed

The driving speed is influenced by switch **S21**. The travel motors can be operated in two different positions:

– **Normal drive** (position 1):
  Maximum tensile force of both drive units at moderate speed.
– **Fast drive** (position 2):
  Reduced tensile force of both drive units at maximum speed.

▶ Press switch **S21**.
  ↳ Transfer from normal drive to fast drive is activated.
  ↳ LED 1 in the switch illuminates.

While driving, the machine will automatically switch from normal drive to fast drive as the ground conditions permit. After transferring to fast drive, LED 2 illuminates. If the ground conditions become more difficult again, the system will automatically switch from fast drive to normal drive. LED 1 illuminates.

▶ Press switch **S21**.

- Transfer from normal drive to fast drive is deactivated.
- LED 1 in the switch goes out.

When switch **S21** is switched off, the travel motors remain continually in position 1.

Braking the machine

The hydrostatic travelling mechanism of the machine also functions as a service brake.

- ▶ Disengage the pedals for the drive units.
  - The pedals will return to the neutral position.
  - The travelling mechanism will be stopped.
  - The machine will be braked.

When the pedals for the drive units are in the neutral position, the hydrostatic drive prevents the machine from rolling off.

In the neutral position, the parking brake will be applied automatically after approx. 5 seconds. The work equipment can, however, still be moved.

Caution!
Disengaging the pedals quickly causes the machine to halt abruptly.

- ▶ Before starting the machine, always fasten the safety belt.

3.3.7 Drive warning device (optional extra)

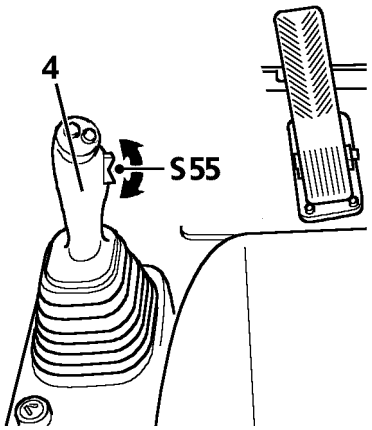

Fig. 3-69 *Drive warning device*

- ▶ Press drive pedal **5** or **6**.
  - The drive warning device switches on automatically.
  - An acoustic signal (warning tone) will be emitted.

Deactivating the drive warning device:

- ▶ Press and hold press button **S55** on leftt-hand joystick **4**.
  - The drive warning device will switch off.

Note!
The drive warning device can only be switched off 10 seconds after starting to drive. If the accelerator pedal is engaged once more, the drive warning device will reactivate.

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Note!
Depending on the special equipments on the machine, the rocker switch S55 on the left joystick handle may have different functions.

3.3.8 Overview of the control cab

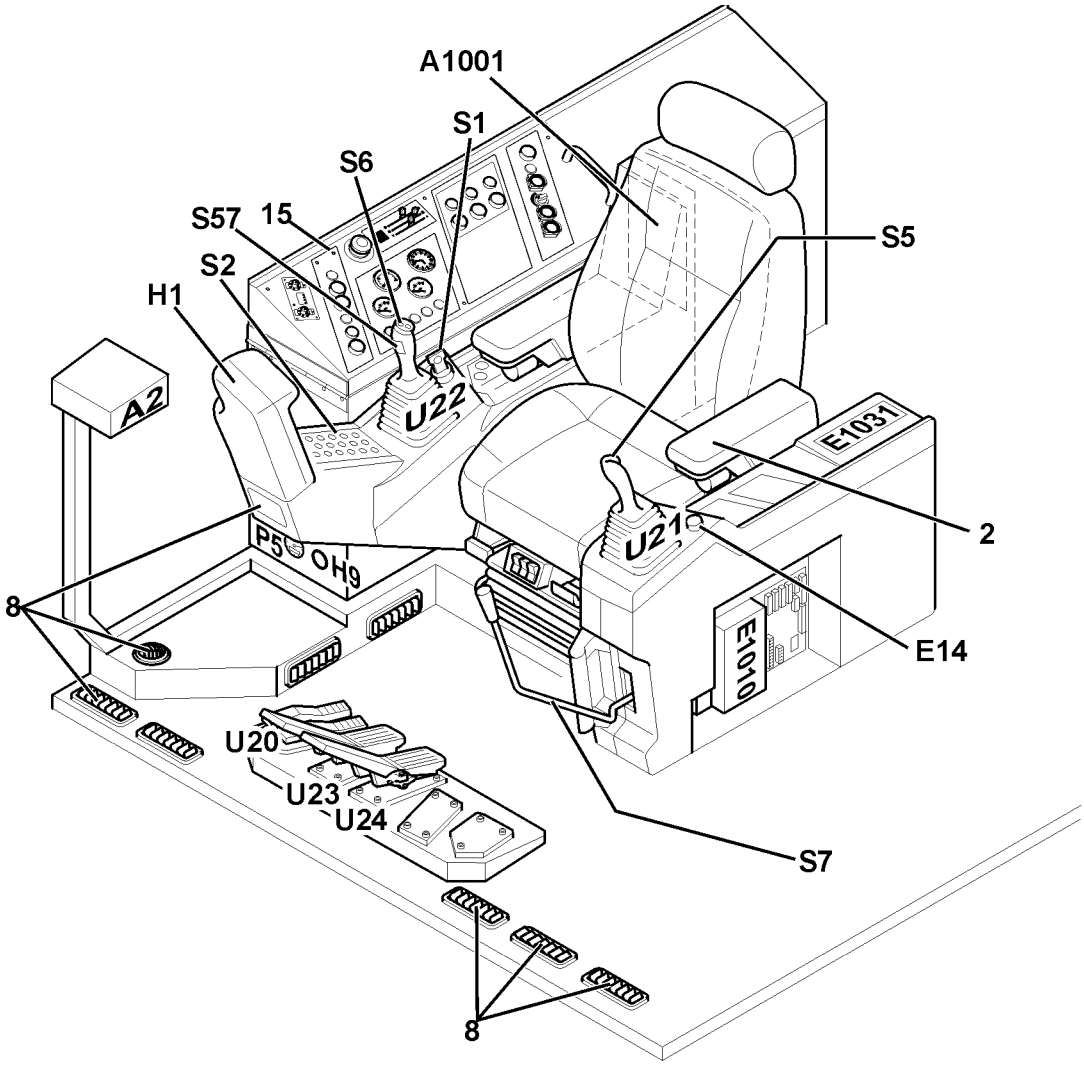

Fig. 3-70 *Control cab*

2	Arm rests	**S1**	Ignition key
8	Heater vent	**S2**	Switching unit
15	Control board	**S5**	Switch / horn
A2	Radio	**S6**	Switch / float position attachment
A1001	Printplate ESP01	**S7**	Safety lever / servo control
E14	Cigarette lighter	**S57**	Swing brake
E1010	Switching box central lubricationt	**U20**	Pedal for bottom dump shovel flap
E1031	Central lubrication control	**U21**	Left joystick
H1	Monitoring display	**U22**	Right joystick
H9	Horn	**U23**	Pedal for right travel gear
P5	Hourmeter	**U24**	Pedal for left travel gear

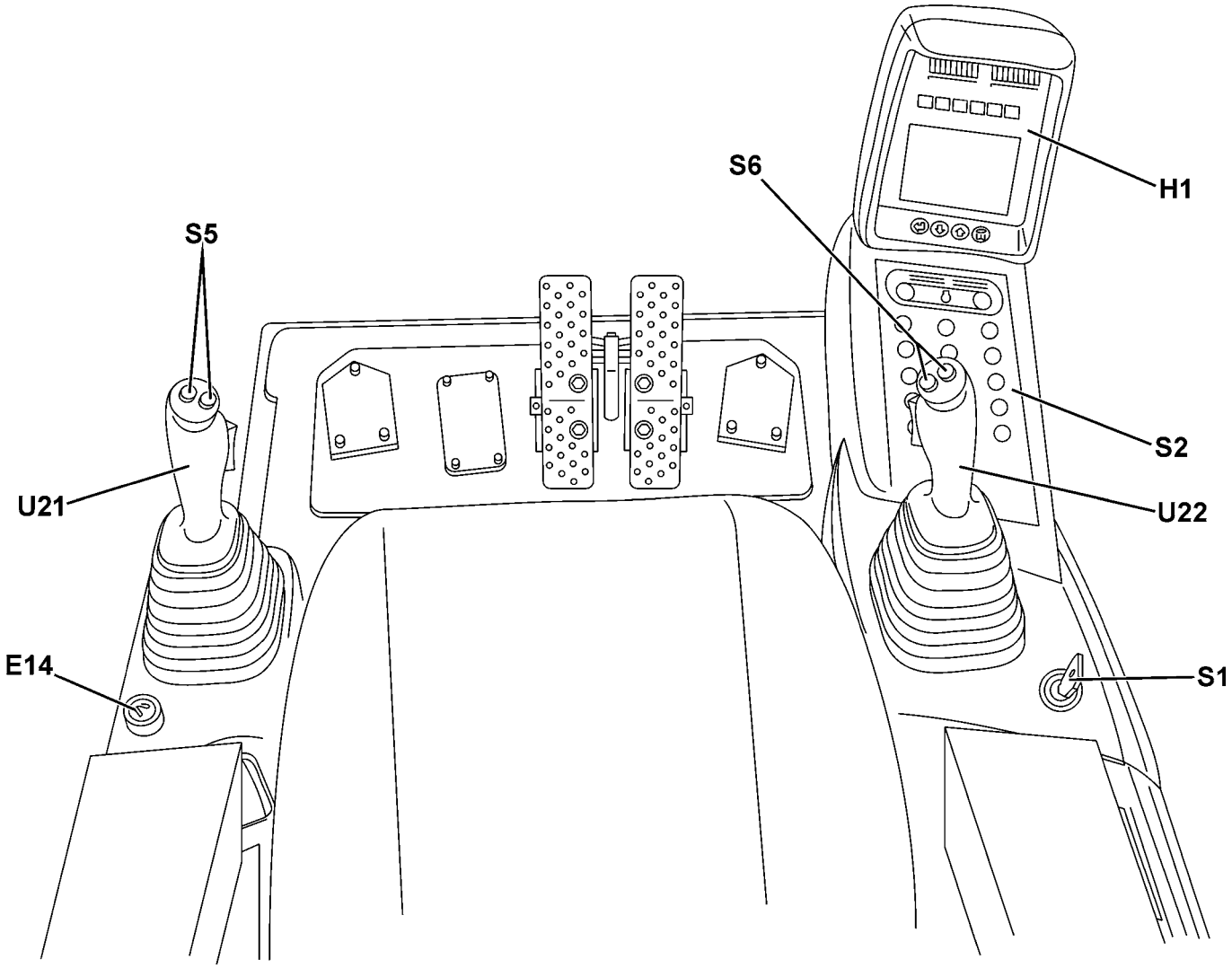

Fig. 3-71 *Control cab, seen from the operator's point of view*

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E14	Cigarette lighter	**S5**	Switch / horn
H1	Monitoring display	**S6**	Switch / float position attachment
S1	Ignition key	**U21**	Left joystick
S2	Keyboard	**U22**	Right joystick

3.4 Working with the machine

3.4.1 Safely getting up or down.

– When getting up or down, position the machine on even, horizontal ground. The upper structure should be positioned with the chassis in such a way that the steps and ladders are aligned with each other.

– Ensure that steps, ladders and hand-rails (grips) are in good condition. In particular, you should ensure that they are free of dirt, oil, ice and snow.
NOTE: To ensure that the doors open properly in all weather conditions, the door seals must be dusted with talc or silicon at least every two months or more often if required. The door hinges and locks should be greased regularly.

– Face the machine when getting in or out and always use three-point support, i.e. two hands and one foot or two feet and one hand must always be in contact with the access system at the same time.

– If you are able to reach the door handle with your free hand, open the doors before you climb any higher. External influences, such as wind, can make it more difficult to open doors. Because of this, always use your hand for control when opening doors. Ensure that the door is latched open to prevent it slamming open and shut.

– Now continue to climb up and sit down in the operator's seat as soon as you enter the cab. Close the doors and fasten the safety belt.

– When getting out of the machine, proceed as carefully as when you climbed into the machine.

– Stop the machine on level, horizontal ground. The upper structure should be positioned with the chassis in such a way that the steps and ladders are aligned with each other.

– Unfasten the safety belt. Position yourself with your face toward the machine when getting out and use three-point support. Climb down until you can close the doors safely. Always use your hand for control when closing the doors.

– Now climb down to the ground.

3.4.2 Working safely with the machine

– Before you start working, acquaint yourself with the special features of the job site and any special precautions and warning signals. Examples of particular work environments would be on-site or traffic obstructions, the load-carrying capacity of the ground and any requirements to make the job site safe from public use.

– Always maintain a safe distance from overhangs, edges, slopes and unsafe ground.

– Be particularly careful in conditions of reduced visibility and changeable ground conditions.

– Familiarize yourself with the location of power lines on the job site and take par-

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ticular care when working near them. If necessary, inform the responsible authorities.

– Maintain a safe distance from electrical aerial lines. Do not allow the equipment to come near cables when working near electrical aerial lines. Risk of fatality! Inform yourself about required safety distances.
– The following actions must be carried out in the event of any transfer of electricity:
  • do not move the machine or its equipment,
  • do not leave the driver's cab,
  • **warn any personnel in the vicinity not to come close to the excavator and not to touch it,**
  • instruct or initiate that someone turns off the voltage.
  • move the machine, if possible, from the danger zone to a sufficient distance,
  • Do not leave the machine until you are absolutely sure that voltage in the line, which had been touched or damaged, has been turned off !
– Before moving the machine, always ensure that any attachments are safely secured.
– When driving onto public roads, paths and squares, observe current traffic regulations and if necessary, ensure that the machine has been made safe as per regulations beforehand.
– Always turn on the lights in conditions of poor visibility or darkness.
– Do not permit any passengers in the machine.
– Only work when seated properly and with the safety belt securely fastened (if available).
– Report all function faults and ensure that all necessary repairs are carried out immediately.
– Assure yourself that no one is endangered when you start the machine moving.
– Before you start working, test the brake system in accordance with the regulations given in the operating instructions.
– Never leave the driver's seat while the machine is moving.
– Never leave the machine unattended while the engine is running.
– The machine must be positioned, moved and operated in such a way that it is stable and that there is no danger of overturning. Only known loads may be moved with the equipment; this applies particularly when using the grab.
– Position the upper structure in the longitudinal direction when moving and hold the load as close to the ground as possible.
  EXCEPTION: see USE WHEN LOADING AND UNLOADING
– Adjust your driving speed to suit local conditions.
– Avoid any working movements which may tip the machine. Should the machine start to tip or slide sideways, however, turn the upper structure to face downhill and lower the equipment at the same time.
– As far as possible, work downhill or uphill and not side on to the slope.
– Drive safely on stony, sleepery or inclined ground
– Only drive downhill at the permitted speed or you could lose control of the machine.
– Always shift down to a lower running step before a slope. When doing this, the diesel engine must run at nominal speed and the speed may only be reduced using the accelerator pedals.
– Load an occupied truck only if all safety requirements are fulfilled, notably in order to protect the truck operator.
– For demolition work, digging and crane operations etc., always use protective devices specifically designed for the purpose.
– For terrain which is difficult to gain an overview of and whenever necessary, ask

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for the assistance of a spotter. Only permit one person to give you signals.

– Only permit experienced personnel to attach loads and give signals to the machine operator. The spotter must be positioned within the visual range of the operator or be in voice contact with him.
– Depending on the equipment combination, there is a risk of collision between the work tool and the cab, the cab protection or the boom cylinders. The greatest degree of care must be taken to avoid damage when the hoe teeth come within this area.
– In case of a thunderstorm :
  • lower the attachment to the ground and if possible anchor the digging tool into the soil.
  • leave the cab and move away from the machine before the storm breaks out. Otherwise, you must stop the excavator, turn off the radio and keep inside the closed cab until the end of the storm.
– Auxiliary control units can have various functions. Always check their functions when starting up the machine.
– Stop the swinging motion of the uppercarriage when lowering the attachment into a ditch without striking the attachment on the ditch walls.
– Inspect the machine for damage if the attachment has been swung into a wall or any other obstacles.
– Applications in which the attachment is to be used to strike the material being extracted are not permitted, even when working in a longitudinal direction.
– Repeated strikes against an object leads to damage to the steel structures and machine components.
– Please refer to your LIEBHERR dealer if special teeth for heavy-duty or special applications are required.
– Do not attach too large bucket or bucket with side cutters or that are during operations with rocky material. This would prolong the work cycles and may lead to damage to the bucket as well as further machine components.
– With the 2x45° offset articulation, the offset position may only be employed if the working tool or the attachment does not touch the material.
– Operation of the offset articulation to drill into the material is not permitted.
– Do not lift the machine during operation. Should this happen, lower the machine slowly back to the ground.
– Do not let the machine fall heavily on the ground and do not hold it back with the hydraulics. This would damage the machine.
– During operation with the attachment it is forbidden to raise the machine with the dozing blade (e.g. carving at the ceiling when tunnelling).

Safe use white a hydraulic hammer

– The hydraulic hammer must be selected with particular care. When using a hydraulic hammer not permitted by LIEBHERR, steel structures or the other machine components can become damaged.
– Before beginning breaking tasks, position the machine on firm and level ground.
– Use a hydraulic hammer designed exclusively for breaking stone, concrete and other breakable materials.
– Only operate the hydraulic hammer in the longitudinal direction of the machine and with the windshield closed or with a front protective grid.
– Ensure during hammer operation that no cylinder is entirely extended or retracted and that the stick is not in the vertical position.
– In order to avoid damages to the machine, try not to break stone or concrete while performing retraction and extension motions of the hydraulic hammer.

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– Do not apply the hydraulic hammer uninterrupted for more than 15 secs. at a time to the same place. Change the breaking point. Too long uninterrupted operation of the hydraulic hammer leads to an unnecessary overheating of the hydraulic oil.
– Do not use the drop force of the hydraulic hammer to break stone or other materials. Do not move obstacles with the hydraulic hammer. Misuse of this nature would damage both the hammer and the machine.
– Do not use the hydraulic hammer to lift objects.

Safe use when loading and unloading (particularly when loading and unloading wood)

– According to use, it can be necessary when working with a grab to move with the equipment raised and the load lifted up; this applies, for example, when loading and unloading wood.
– Here, the centre of gravity of the machine will be displaced upwards in the vertical direction. The driving characteristics of the machine will thus be influenced persistently, e.g. through reduction of the dynamic stability.
  The following instructions are therefore to be observed at all times:
  • Adjust vehicle handling to suit the altered machine characteristics and environmental conditions.
  • Reduce your speed to prevent the need for sudden braking and steering manoeuvres.
  • Avoid sudden speed changes, such as braking, accelerating and changing direction.
  • Only rotate the upper structure when the chassis is stationary.
  • Only rotate the upper structure after you have picked up the load.
  • Only move the machine when you have picked up and lifted the load and rotated the upper structure to the driving position.
  • There is a danger of possible swinging movement and dropping of the load when the equipment is raised.
  • A protective grid (FOPS) in accordance with ISO 10262 must be attached to the cab.
  • A protective roof (FOPS) in accordance with ISO 10262 must be attached if there is a risk of objects falling from above.
  • Only the maximum permissible load may be taken up using the grab.
– NOTE: The weight of absorbent materials, such as logs, is dependent on length, diameter and specific weight. The influencing variables present in a natural product, such as moisture, must be noted.
– Working procedures when using machines with grabs require the machine operator to receive special instruction and training.
– Use as part of the work process is only permitted when the machine operator has sufficient training and practical experience.

Safe use of machines with tower elevation

– Due to the tower elevation, the centre of gravity of the machine will be displaced upwards in the vertical direction. The driving and work characteristics of the machine will thus be influenced persistently, e.g. through reduction of the dynamic stability.
– Due to the heightened centre of gravity, the machine must be aligned horizontally before use. In horizontal alignment, the centre of gravity of the upper structure is over the centre of the chassis, which reduces the risk of tilting.
– The machine can still sway and tilt despite being aligned!
  The following instructions are therefore to be observed at all times:

When moving the machine:
  • Rotate the upper structure parallel to the undercarriage chassis (transport posi-

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tion).
- Draw the equipment as close as possible to the machine.
- Only at this point may the support feet be retracted and the machine moved.
- Moving with loads is not permitted.
- Check the terrain to be covered to ensure that the ground is solid and even. Potholes and uneven surfaces jeopardize the stability of the machine.
- Adjust vehicle handling to suit the altered machine characteristics (high centre of gravity) and environmental conditions.
- Reduce your speed to prevent the need for sudden braking and steering manoeuvres.
- Avoid sudden speed changes, such as braking, accelerating and changing direction.
- Ascending gradients and obstacles may only be approached in the longitudinal direction in order to prevent unacceptable banking of the machine.
- Special care should be taken when driving through narrow passages - drive slowly!

When loading and unloading:
- The machine must be supported and aligned horizontally before moving (slewing) the upper structure out of the transport position.
- It is imperative that you check the contact surface of the support (load carrying capacity of the substrate). A support subsiding would have disastrous consequences!
- Carry out all movements with increased care.
- To slew the load, move the equipment as close as possible to the machine **(Caution! swinging grab)**and hold the load close to the chassis and above the substrate.
- Avoid braking or accelerating the equipment or upper structure abruptly.
- Do not lift any loads which are heavier than those given in the load chart.

Protection from vibration

– Vibrational loads on mobile building machinery are mainly the result of the type and method of use. The following parameters in particular are decisive influences:
  - Terrain conditions: Uneven areas and potholes;
  - Operational techniques: Speed, steering, brakes, controlling the machine's control elements when driving and working.
– To a large extent, the machine operator determines the vibrational loads since he selects the speed, gearbox ratio, working method and route himself.
  This means that there is a wide range of different vibrational loads for the same machine type.

Whole-body vibrational load for the machine operator can be reduced if the following recommendations are observed:

– Select suitable machines, equipment parts and auxiliary devices for each part of the job.
– Use a machine that has a suitable seat (i.e. for earth-moving machinery such as hydraulic excavators, this should be a seat which corresponds with EN ISO 7096).
– Keep the seat in good condition and adjust it as follows:
  - The seat and its damping action should be adjusted depending on the weight and height of the operator.
  - Check the seat's damping action and adjustment mechanisms regularly and ensure that these seat characteristics remain as per the seat manufacturer's instructions.
– Check the maintenance status of the machine, particularly with respect to: tyre pressure, brakes, steering, mechanical connections etc.

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– Do not steer, brake, accelerate, shift gears, move or load the machine's equipment jerkily.
– To reduce vibrational load, adjust the machine speed to suit the route as follows:
  • Reduce speed when driving on difficult terrain;
  • Drive around obstacles and avoid driving on very difficult terrain.
– Keep the terrain on which the machine is working and driving in good condition:
  • Remove large stones and obstacles;
  • Fill in ruts and holes;
  • Have machines ready to prepare and maintain suitable ground conditions and calculate in sufficient time to carry out any work required.
– Drive longer distances (e.g. on public roads) at an appropriate (medium) speed.
– Use special auxiliary systems (if available) which reduce vibration for machines that are driven frequently.
  If such auxiliary systems are not available, regulate speed to avoid "oscillating" the machine.

3.4.3 Low idle automatic

This device automatically reduces the engine speed to idle after several seconds if no hydraulic functions are activated by the joystick or the pedals. This saves fuel and reduces the amount of noise. Touching the joystick or operating the pedals takes the engine speed back to its original level.

Automatic idling is started by pressing switch **S20**.

▶ Press switch.
  ↳ Low idle automatic is activated.
  ↳ LED in switch illuminates.

▶ Press switch again.
  ↳ Low idle automatic is deactivated.
  ↳ LED in the switch goes out.

To set the time within which the engine is set back to idle after the joystick has been released:

▶ Press and hold switch.
  ↳ LED in the switch flashes.

❑ Desired time span is reached.

▶ Release the switch.
  ↳ LED in switch illuminates.
  ↳ Low idle automatic is activated.

In each case, when a hydraulic function is activated, the speed which was previously set using the electrical speed adjustment function will be reset automatically.

Caution!
Low idle automatic must be switched off when starting the diesel engine and when driving on gradients. The LED in the switch must not illuminate.

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3.4.4 Operating the swing gear

Caution!
The machine is dispatched as standard with **normal control**.
On request, the machine can be equipped with a control system that deviates from the norm (eg. with LIEBHERR control). The additional operating instructions for this control system apply in this case.

The joystick functions described here refer exclusively to **normal control**.

Rotating the upper carriage

The upper carriage is rotated using the left joystick.

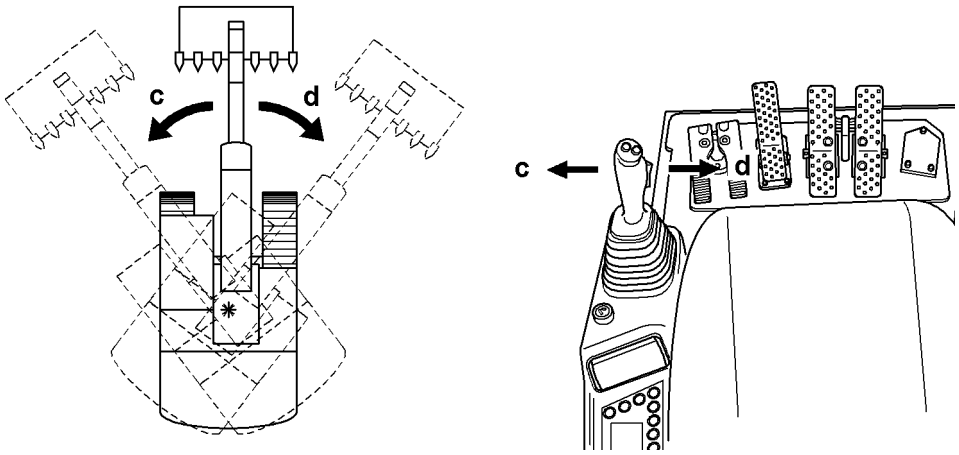


Fig. 3-72 *Rotating the upper carriage*

- ▶ Push the joystick to the left **c**.
  ↳ Upper carriage rotates to the left.
- ▶ Push the joystick to the right **d**.
  ↳ Upper carriage rotates to the right.

Braking the upper carriage

The machine is equipped with a hydraulic and a mechanical swing gear brake.

Hydraulic slewing gear brake

- ▶ Move the left joystick **4** to neutral.
  ↳ Upper carriage will be adequately hydraulically braked.
- ▶ Move the left joystick **4** in the opposite direction.
  ↳ Upper carriage will be hydraulically braked to the maximum degree.

Mechanical swing gear brake

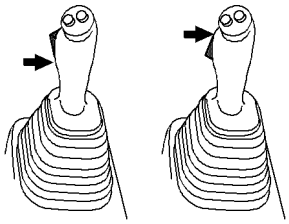
The upper carriage can be locked in any position using this brake.

Caution!
Damage to the machine.

- ▶ Only lock the mechanical swing gear brake when the upper carriage is stationary.

▶ Press switch **S17**.
  ↳ Swing gear brake is engaged.
  ↳ LED in switch illuminates.

▶ Press switch **S17** again.
  ↳ Swing gear brake is in mode semi-automatic.
  ↳ LED in the switch goes out.



  ▶Tilt down the rocker switch **S57**.
    ↳Slewing gear brake is applied as soon as the uppercarriage speed gets lower than a limit value.

  ▶Tilt up the rocker switch **S57**.
    ↳Swing gear brake remains released.

To check the mechanical slewing gear brake:

❑ Upper carriage must be stationary.

▶ Press switch **S17**.
  ↳ Swing gear brake is engaged.
  ↳ LED in switch illuminates.

▶ Push the left joystick **4** to the right and then to the left as far as the stop.
  ↳ Upper carriage may not rotate.
  ↳ Slewing gear brake function is OK.

Positioning swing brake (optional extras)

The positioning swing brake is used for progressive and sensitive braking of the upper carriage.

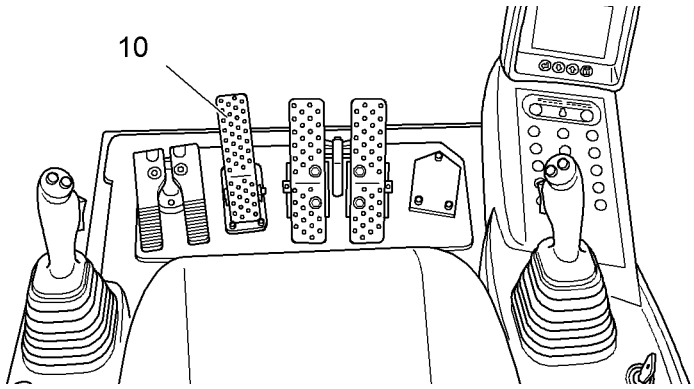


Fig. 3-73 *Positioning swing brake*

Note!
Increased wear.

▶ Do not use the positioning swing brake purely as a service brake, but only as a stop and parking brake for the swing gear.

▶ Brake the upper carriage hydraulically for preference (by countering).

▶ Engage pedal **10**.
  ↳ Upper carriage is located in the desired position after sensitive braking.

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3.4.5 Working position

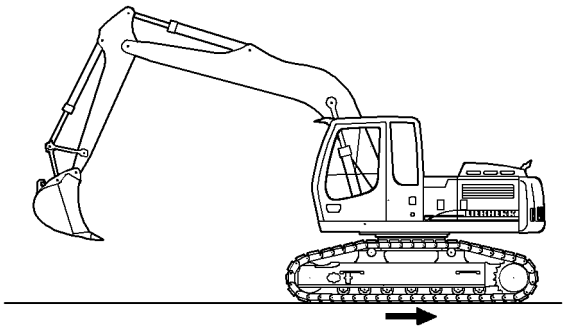

Fig. 3-74 *Working position – machine*

❑ Work with the machine is generally to be carried out over the leading wheel.

Note

▶ Drive backwards when you are working lengthwise with the hoe type bucket.

3.4.6 Joystick functions when setting up the machine

Caution!
The machine is dispatched as standard with **normal control**.
On request, the machine can be equipped with a control system that deviates from the norm (eg. with LIEBHERR control). The additional operating instructions for this control system apply in this case.

The joystick functions described here refer exclusively to **normal control**.

Operating the stanchion cylinder

The stanchion cylinder is operated using the left joystick **4**.

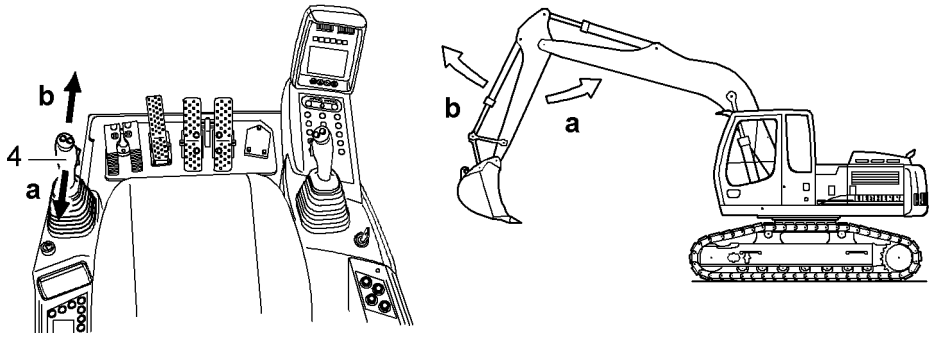

Fig. 3-75 *Operating the stanchion cylinder*

▶ Push the joystick back **a**.
↳ Stanchion will be drawn in.

▶ Push the joystick forwards **b**.
↳ Stanchion will be extended.

Operating the boom cylinder

The boom cylinder is operated using the right joystick **3**.

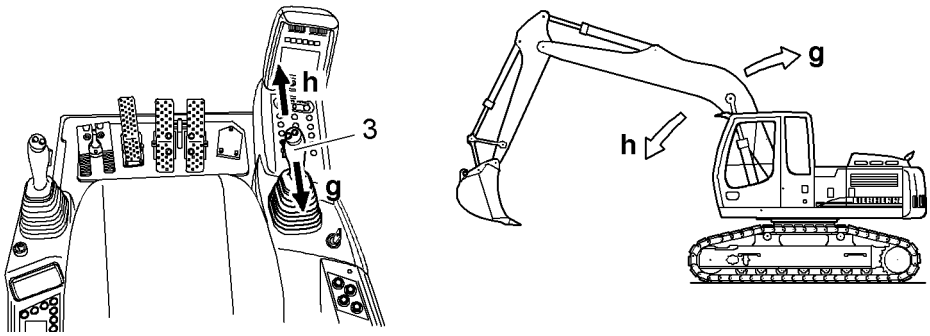

Fig. 3-76 *Operating the boom cylinder*

- ▶ Push the joystick back **g**.
  - ↳ Equipment will be raised.
- ▶ Push the joystick forwards **h**.
  - ↳ Equipment will be lowered.

Operating the shovel cylinder

The shovel cylinder is operated using the right joystick **3**.

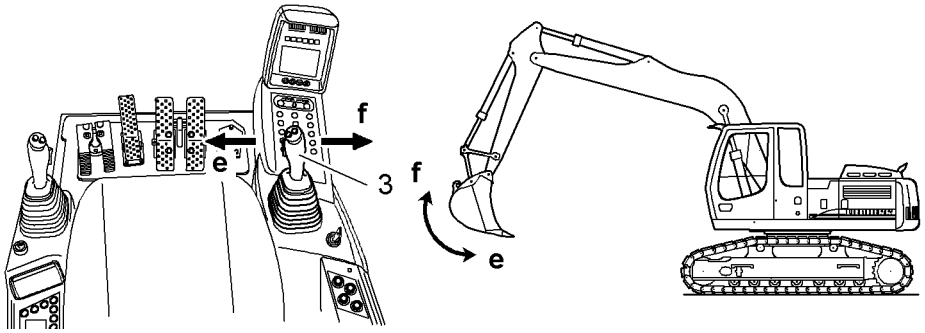

Fig. 3-77 *Operating the shovel cylinder*

- ▶ Push the joystick to the left **e**.
  - ↳ Shovel will be tilted inwards.
- ▶ Push the joystick to the right **f**.
  - ↳ Shovel will be tilted outwards.

Operating the grab cylinder

The grab cylinder is operated using the right joystick **3**.

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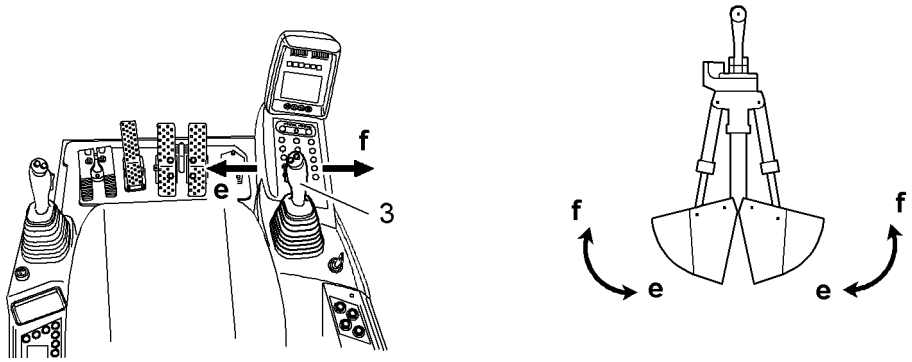

Fig. 3-78 *Operating the grab cylinder*

Danger!
The grab must never be guided by hand by auxiliary staff!

- ▶ Push the joystick to the left **e**.
  - ↳ Grab will close.
- ▶ Push the joystick to the right **f**.
  - ↳ Grab will open.

Operating the bottom dump shovel bucket

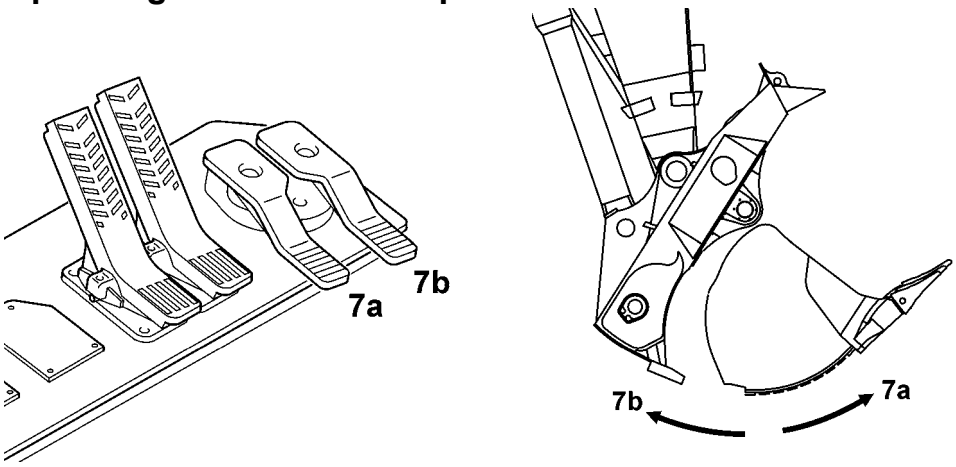

Fig. 3-79 *Operating the bottom dump shovel bucket*

The bottom dump shovel bucket is moved via two pedals, **7a** and **7b**.

- ▶ Push pedal **7a**.
  - ↳ Shovel bucket will be opened.
- ▶ Push pedal **7b**.
  - ↳ Shovel bucket will be closed.

Float position of boom cylinder for bucket operation (option-

al equipment)

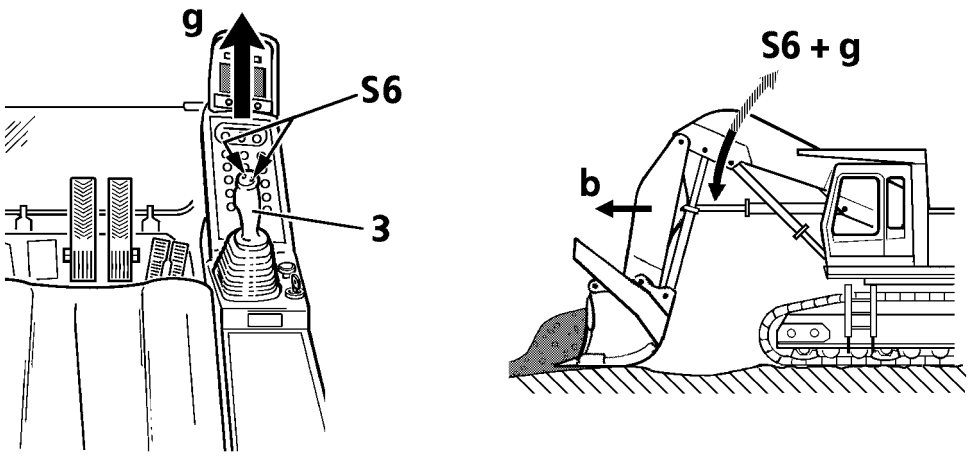

Fig. 3-80 *Float position*

To turn on the float position for the lift cylinders,

▶ Move the right joystick **3** forward (g),

▶ Push the button **S6** on top of the handle on top of handle at the same time.

Now the bucket can be used for grabing work while moving the joystick **4** forward to extend the crowd cylinders.

The attachment can then move freely up or down depending on grade and the bucket will automatically follow the ground contour.

Control of a special equipment (telescopic stick, pulling device, ...)

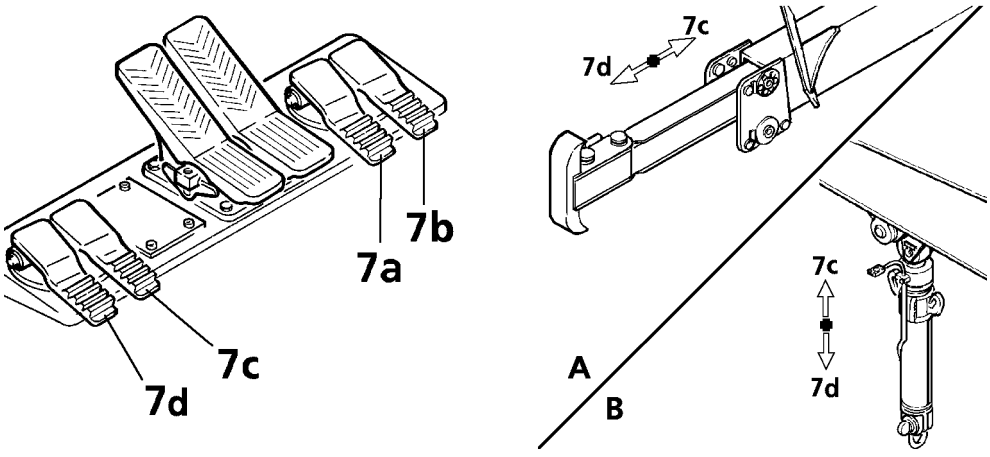

Fig. 3-81 *Telescopic stick (A) and pulling device (B)*

For the control of special equipments such as telescopic stick (A), pulling device (B), hydraulic adjustable boom, ... :

▶ Use the two pedals **7c** and **7d**.

For special equipment with two hydraulic cylinders :

▶ the second cylinder is controlled via the pedals **7a** and **7b** of the right pilot control.

If in case of an additional equipment having several hydraulic users, the right pedals **7a** and **7b** are used to control two different movements, the commutation from one

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movement into the other is obtained while tilling the rocker switch **S55** in the left joystick handle.

Caution!
Auxiliary control units can have various functions. Always check their functions when starting up the machine.
Depending on the function and on the type of the special tool, it may be necessary, before attempting to control the special equipment, to confirm the corresponding choice of pump parameters, using the menu **"Set Option"** of the display.

Combined movements

Moving a joystick diagonally results in the work functions concerned being combined. This allows different equipment movements to be activated at the same time.

The operator can do the following movements without any additional manipulations.

When the swing movement is actuated, all working functions / movements are possible without affecting the swing movement.

During travel, every attachment movement is possible, but the swing movement has priority. In this case, the travel movement is reduced.

3.4.7 Lowering the work equipment when the engine is not running

In an emergency, the equipment can be lowered when the diesel engine is not running.

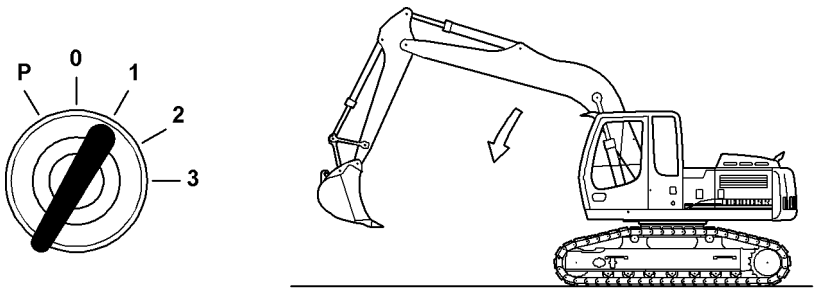

Fig. 3-82 *Lowering the equipment when engine is not running*

▶ Turn the ignition key to contact position **1**.

▶ Operate the joystick or the foot pedals until the equipment has lowered.

Note
The equipment can be lowered because of the control oil unit's pressure reserve. This reserve is limited and is only sufficient for small movements of the pilot control devices.

▶ Only operate the joystick in the directions for lowering the equipment.

3.4.8 Turning, rotating, bolting and unbolting the add-on unit

Switch **S19** is used to activate an additional function:

– rotating grab (A)

– slewing ditcher bucket (B)
– locking pin of a hydraulic quick change adapter (C)

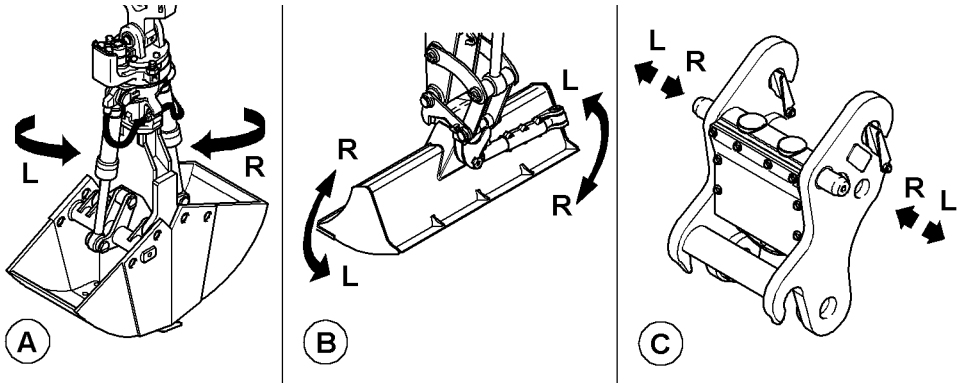

Fig. 3-83 *Add-on units example*

To operate, press the pushbutton. The pushbutton is located on the right and/or left joystick (depending on the machine's equipment):

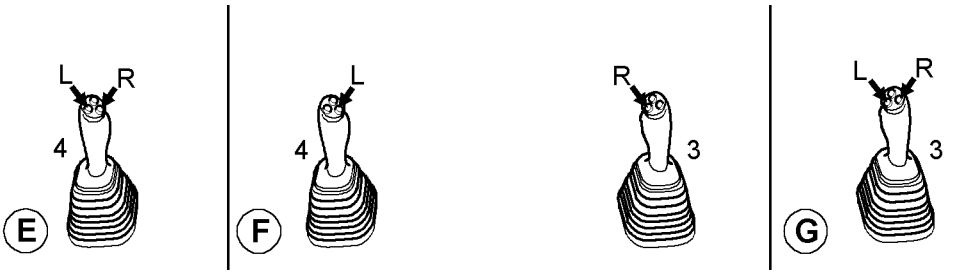

Fig. 3-84 *Pushbutton on the joystick*

E Operation with left joystick (standard)

F Operation with left and right joystick (optional extras)

G Operation with right joystick (optional extras)

Danger!
The grab must never be guided by hand by auxiliary staff!

▶ Press switch **S19**.
↳ Additional function (eg. rotating grab) is activated.

▶ LED in switch illuminates.

▶ Press and hold left pushbutton **L**.
↳ Grab will rotate left (anticlockwise).
- or -
↳ Slewing bucket will slew left (anticlockwise), i e. it moves down to the left.
- or -
↳ Locking pins will be drawn out.

▶ Press and hold right pushbutton **R**.
↳ Grab will rotate right (clockwise).
- or -
↳ Slewing bucket will slew right (clockwise), i e. it moves down to the right.
- or -

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↳ Locking pins will be inserted.

3.4.9 Magnetic system (special equipment)

Special equipment such as magnets for transferring scrap are operated using a magnetic system. The magnetic system is switched on by pressing switch **S46** on the right-hand control panel and is operated electronically using a pushbutton in the right-hand joystick.

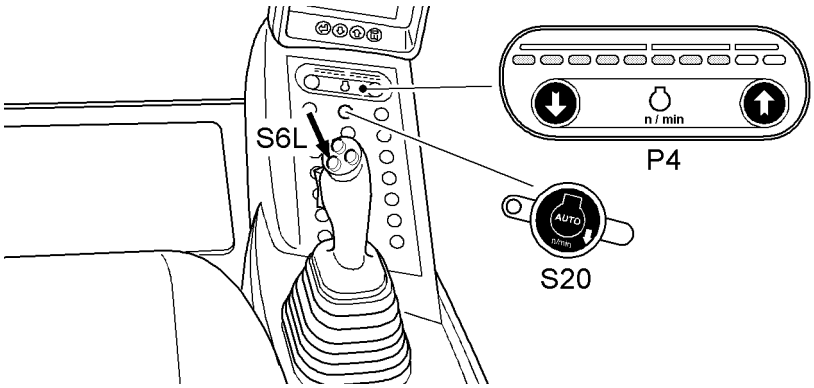

Fig. 3-85 *Activating the magnetic system*

▶ Press switch **S46**.
↳ The magnetic system starts to function.
↳ The engine speed **P4** increases to level 8.
↳ Automatic idling **S20** no longer functions.

Danger!
The magnet can lose its load in the event of a loss of current.

▶ Always ensure that noone is standing beneath the load.

▶ Do not press pushbutton **S6L** unintentionally.

▶ Press left-hand pushbutton **S6L**.
↳ The magnet is activated.

▶ Press left-hand pushbutton **S6L**again.
↳ The magnet is no longer activated.

3.4.10 Overload warning device

General

The overload warning device shows the machine operator when the permissible load carrying capacity has been reached both optically, via the warning symbol and acoustically, via a buzzer.

The overload warning device is designed to prevent the permissible load torque being exceeded unintentionally. In this event, the working radius will have to be reduced or the load set down without enlarging the working radius.

The overload warning device does not relieve the operator of the responsibility of lifting loads which are either known or are permitted on the basis of the load carrying capacity of the machine.

The permissible load carrying capacity is dependent on the condition of the machine (chassis, equipment) and should be taken from the load chart in the cab.

The load carrying capacity values attain a maximum of 75% of the tipping capacity or 87 % of the hydraulic lifting power in accordance with ISO 10567.

Note!
The load values are subject to change if equipment parts and work tools are attached or dismounted.

For hoe type bucket equipment (including shovel cylinder, reversing lever and connecting clip) the values on the stanchion tip apply. The machine can be rotated 360° on solid, level subsoil when the full floating axle is engaged.
If the shovel cylinder, reversing lever and connecting clip are dismounted, the values increase by the weight of the dismounted parts (as an example, see the indicated values in the rubric "lift capacities" in the chapter "Technical data").

When the machine is equipped with a quick-change adapter, the values decrease by the weight of the quick-change adapter.

For industrial equipment, the values on the lifting hook apply. The machine can be rotated 360° on solid, level subsoil when the full floating axle is engaged.

Using the overload warning device

Danger!
When carrying out load hoisting work with the machine, the relevant accident prevention precautions are to be observed.
The overload warning device does not shut down the machine if the permissible load torque is exceeded. The operator of the machine will only be informed of the situation.

Mode of operation

The overload warning device comprises a constant pressure switch which is connected to the piston of the boom hydraulic cylinders.

If the load pressure in the boom hydraulic cylinders reaches the level of the shift pressure, the pressure switch emits a signal, the warning symbol appears on screen and the buzzer sounds.

The shift pressure in the pressure switch is selected in such a way that the stability factors can be maintained even if in an unsupported state (small stationary torque).

Starting

Danger!
No load hoisting work may be carried out if the overload warning device is defective.

▶ Have the overload warning device repaired by a professional.

▶ Press switch **S18**.
  ↳ Overload warning device is activated.
  ↳ LED in switch illuminates.

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Note!
The overload warning device must be checked before first use and annually by a professional in accordance with the testing and setting information provided in the service manual.

The operator must check the function of the overload warning device before each work shift.

▶ To check the overload warning device, extend the boom hydraulic cylinders to the stop.

▶ Push the joystick further in the direction Raise boom.
  ↳ The warning symbol must illuminate.
  ↳ The buzzer must sound.

Note!
For work using a bucket, deactivate the overload warning device, since the increased effort of the machine will cause the overload warning device to be permanently active.

▶ Press switch **S18** again.
  ↳ Overload warning device is deactivated.
  ↳ LED in the switch goes out.

3.5 Attaching and dismounting equipment parts

3.5.1 Attaching and removing equipment parts safely

– Equipment or attachments made by other manufacturers or those which do not have general approval from LIEBHERR for installation or attachment may not be installed or attached to the machine without LIEBHERR's prior written consent.
– LIEBHERR must be provided with the appropriate technical documentation necessary for this purpose.
– Before carrying out any major repair work on the equipment, position the machine on level, firm ground.
– Do not work beneath the equipment if it is not safely positioned on the ground or supported with wooden blocks.
– Before loosening lines or unscrewing bolts, you must store the equipment, switch off the engine and press the start key to the contact position and both joysticks and the pushbuttons to "Turn grab" in order to reduce the pressure in the hydraulic system.
– Do not attempt to lift heavy parts. Use devices which are suitable for this purpose and which have sufficient load carrying capacity.
– Do not use cable which is damaged or does not have sufficient load carrying capacity. Wear work gloves when working with wire cables.
– When working on the equipment: switch off the engine and keep the safety lever tilted up. Never use your fingers to locate bores; use the correct punch for the procedure.
– During repair work: ensure that the hydraulic lines are secured correctly and that all bolts and connections are tight.
– When you have removed and chocked an equipment part, close open areas of the hydraulic circuit to stop dirt entering. Only allow authorized persons in the vi-

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cinity of the machine or the lifting device used.

3.5.2 Removing and installing equipment bolts safely

- If possible, always use a hydraulic bolt press to press out the equipment's bolts.
- If you have to remove a bolt using a sledge-hammer, a driving punch and a bore hole conductor held by another person must be used.
- To drive in a bolt, screw the drive screws provided in the toolbox into the bolt's threaded hole and only hammer these screws.
- When installing bolts locked by means of castle nuts and cotter pins, first drive the bolt to the stop, then screw the castle nut by hand until contact and then only pull it far enough to push in the cotter pin.

3.5.3 Mechanical quick-change adapter (optional extra)

Safety information

- Ensure that nobody is located in the working area of the equipment when attaching and dismounting work tools. Move the work equipment as slowly as possible when attaching and dismounting a work tool.
  Get to know the mode of operation of the quick-change adapter before attaching or dismounting work tools.
- Always keep the work tool as close to the ground as possible when locking and unlocking to avoid creating conditions which may lead to danger.
- If necessary, use a platform to reach the locking pins and connections. Never stand on the work tool.
- Each time a work tool is changed, the machine's operator must ensure that the locking pin for the quick-change adapter inserts in the bore holes on the work tool which are designed for the purpose and that the work tool raises correctly. A direct visual check must be made to ensure that the work tool is correctly positioned.
- A working cycle should also be carried out with the work tool, where the work tool is only raised to the point where the correct position of, for example, the pin in the pin eye can be tested by tilting in and out.
- The correct positioning of the locking screw must be checked daily.
- The load carrying capacity of the quick-change adapter or the integrated lifting hook can exceed or fall short of the load carrying capacity of the carrier device. When operating, it should be ensured that the values provided in the load chart and the technical data for the carrier device are adhered to.

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Overview

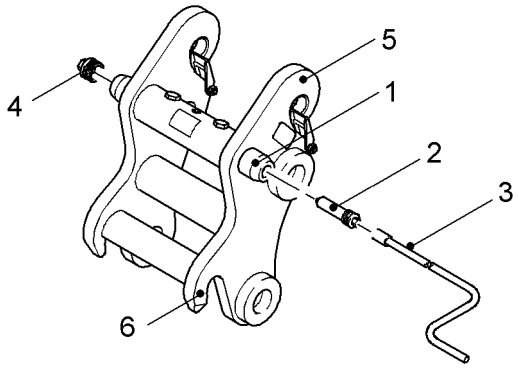

Fig. 3-86 *Mechanical quick-change adapter*

1 Locking pin (removed)
2 Locking screw
3 Crank
4 Sealing plug
5 Lifting hook
6 Take-up hook for work tool

Attaching the work tool

To move the equipment into position:

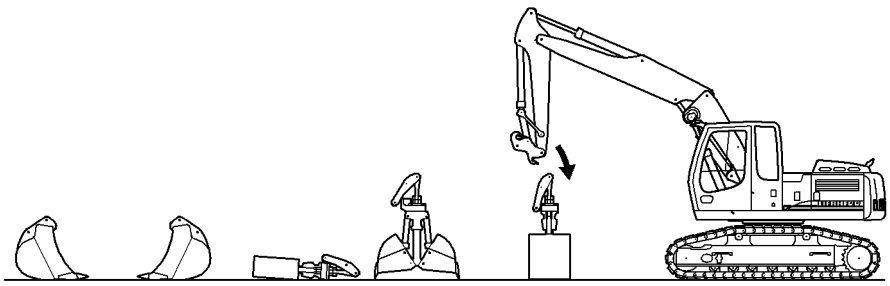

Fig. 3-87 *Positioning the equipment*

❑ The equipment must be standing stable or lay loose on the ground.

▶ Move the stanchion and work tool into position.

▶ Insert the shovel tilting cylinder fully.

To unlock the quick-change adapter:

Danger!
Risk of injury.

▶ Ensure that the work equipment cannot be moved by others when this action is being carried out.

▶ Approach the quick-change adapter from the side and unscrew the locking screw **2** using the crank **3** from the locking pin **1** (siehe Fig. 3-86).

▶ Insert the crank **3** in the locking pin **1** and turn to the left (anti-clockwise), until both locking pins **1** are inserted as far at the stop.

Taking up the work tool:

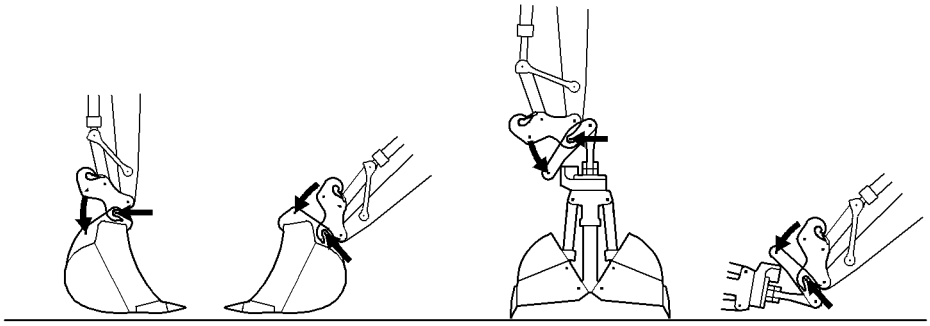

Fig. 3-88 *Taking up the work tool*

- ▶ Move the quick-change adapter into a position that allows the work tool to be picked up using the take-up hook.
- ▶ Raise the work tool from the ground and extend the shovel tilting cylinder fully until the bearing panel for the work tool is laying on the quick-change adapter stop.
  - ↳ The bore holes of the work tool and the locking pins of the quick-change adapter must form a row.

To lock the quick-change adapter:

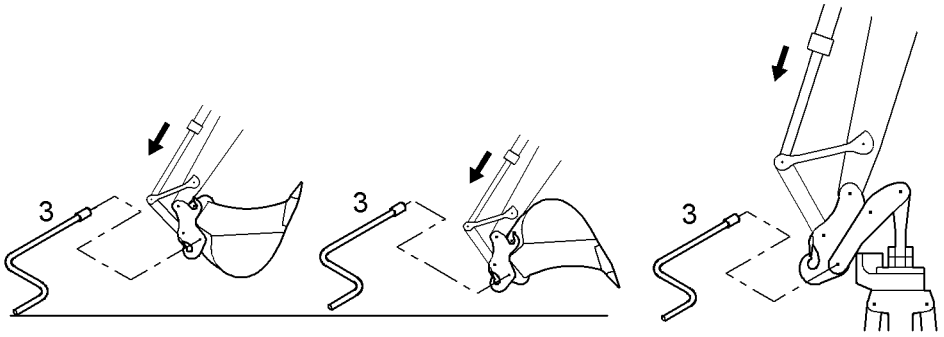

Fig. 3-89 *Locking the quick-change adapter*

Danger!
Before locking, there is no fixed connection between the work tool and the quick-change adapter. The work tool could under certain circumstances fall out and injure people.

- ▶ Approach the quick-change adapter with the utmost care.
- ▶ Push the safety lever up to secure the work equipment against unintentional movement.
  - ↳ No work movements can be carried out when pilot control devices, eg. the joystick or foot pedals, are operated.

- ▶ Insert the crank **3** in the locking pin **1** and turn to the right (clockwise), until both locking pins **1** are extended as far as the stop.
  - ↳ The work tool is bolted on when taking up normally.
- ▶ Screw the locking screw **2** into the locking pin.

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Danger!
An incorrectly locked quick-change adapter could open when operating!

- ▶ Ensure that the locking pins are always locked by the sealing plug **4** on the one side and by the locking screw **2** on the other side.
- ▶ Check daily to ensure that the locking screw **2** is correctly positioned.

Caution!
Hydraulic lines are pressurized!

- ▶ Remove the pressure using the joystick before connecting the hydraulic lines (switch off the diesel engine, turn the ignition key into the contact position, operate the joystick).
- ▶ Connect hydraulic lines or electrical lines, if necessary (eg. when attaching a grab).

Detaching a work tool

To move the equipment into position:

Caution!
Hydraulic lines are pressurized!

- ▶ Remove the pressure using the joystick before removing the hydraulic lines (switch off the diesel engine, turn the ignition key into the contact position, operate the joystick).
- ▶ Disconnect hydraulic lines or electrical lines, if necessary (eg. when dismounting a grab).
- ▶ Extend the shovel tilting cylinder fully.

To unlock the quick-change adapter:

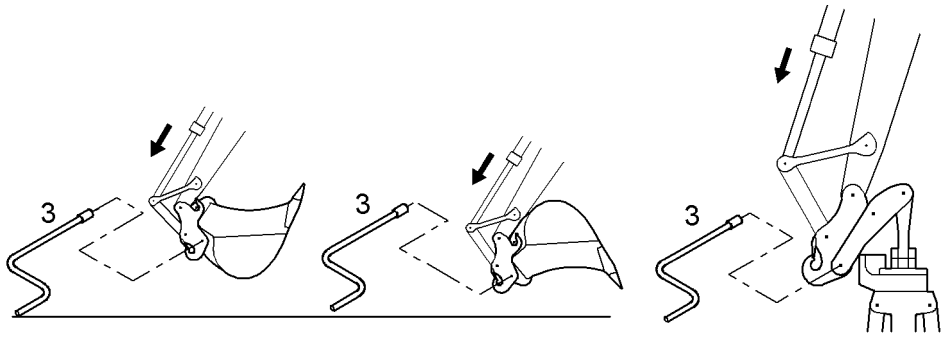

Fig. 3-90 *Unlocking the quick-change adapter*

Danger!
Risk of injury.
Once unlocked, there is no fixed connection between the adapter and the work tool. The work tool could work itself out independently.

- ▶ Ensure that the work equipment cannot be moved by others when this action is being carried out.
- ▶ Always keep the work tool as close to the ground as possible when unlocking to avoid creating conditions which may lead to danger.

- ▶ Approach the quick-change adapter from the side and unscrew the locking screw **2** using the crank **3** from the locking pin **1**.
- ▶ Insert the crank **3** in the locking pin **1** and turn to the left (anti-clockwise), until both locking pins **1** are inserted as far at the stop.

To put down the work tool:

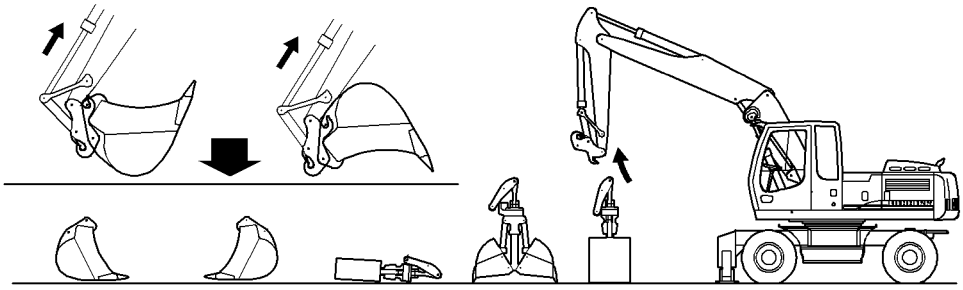

Fig. 3-91 *Putting down the work tool*

- ▶ Slowly insert the shovel tilting cylinder and lay the work tool on the ground.
- ▶ The new work tool can be taken up.

Using the quick-change adapter for hoisting work

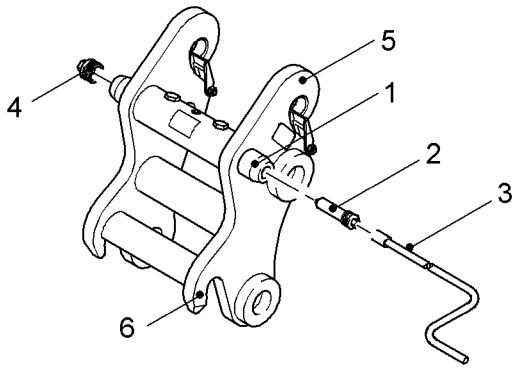

Fig. 3-92 *Mechanical quick-change adapter*

The quick-change adapter has two integrated lifting hooks. The machine may only be used for hoisting work if the safety devices required for the purpose are present and functioning correctly (see chapter "Hoisting work" or "Overload warning device").

The maximum load carrying capacity of each individual lifting hook is given on the quick-change adapter. The load carrying capacity of the quick-change adapter or the integrated lifting hook can exceed or fall short of the load carrying capacity of the carrier device.

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When operating, it should be ensured that the values for the carrier device / quick-change adapter given in the load chart and the technical data are adhered to.

Load hoisting work can be carried out with attached or dismounted work tools. With dismounted work tools, it is sensible to fully insert the locking pins when carrying out hoisting work. This prevents the load take-up device being turned round too strongly by the locking pins and damaged.

Danger!

▶ Never use the take-up hook **6** to fasten a load because there is no secure hold for the load take-up device, eg. rope or chains, in the take-up hook.

▶ Fasten the load on the lifting hook as described in the chapter “Hoisting work”.

3.5.4 Hydraulic quick-change adapter (optional extra)

Safety information

– Ensure that nobody is standing in the working area of the equipment when attaching or dismounting work tools. Move the work equipment as slowly as possible when attaching and dismounting a work tool.
Familiarize yourself with the mode of operation of the quick-change adapter without attached work tools if possible.
– The proper functioning of the quick-change adapter is monitored by a visual and acoustic warning device (buzzer and telltale light). The function of the warning device should be checked daily by operating the quick-change adapter.
– If the buzzer and telltale light are activated without a deliberate locking or unlocking procedure being carried out, stop all work at once. If the buzzer and telltale light are not activated while a deliberate locking or unlocking procedure is being carried out, stop all work at once.
This could be caused by an unmonitored position change of the locking pins or by mechanical or hydraulic damage. A defect may also be present in the electrical system (eg. proximity switch or buzzer).
Only resume working once defective parts have been repaired or replaced.
– The quick-change adapter unlocks as soon as the switch / button designed for the purpose is pressed.
Always keep the work tool as close to the ground as possible when unlocking to avoid creating conditions which may lead to danger. Only activate the quick-change adapter to carry out a deliberate locking or unlocking procedure.
– Each time a work tool is changed, the machine’s operator must ensure that the locking pins for the quick-change adapter insert in the bore holes on the work tool which are designed for the purpose and that the work tool raises correctly. A direct visual check must be made to ensure that the work tool is correctly positioned.
– A working cycle should also be carried out with the work tool ,where the work tool is only raised to the point where the correct position of, for example, the pin in the pin eye can be tested by tilting in and out.
– The load carrying capacity of the quick-change adapter or the integrated lifting hook can exceed or fall short of the load carrying capacity of the carrier device. When operating, it should be ensured that the values provided in the load chart and the technical data for the carrier device are adhered to.

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Overview

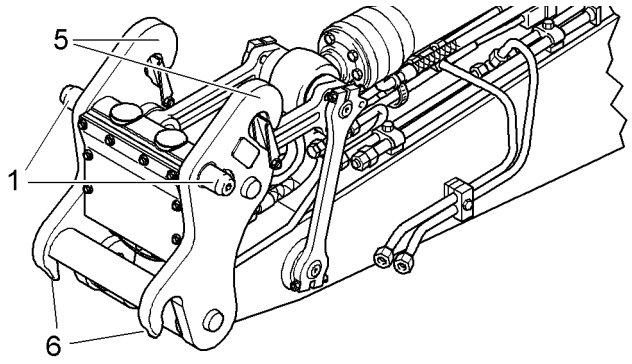


Fig. 3-93 *Hydraulic quick-change adapter*

1 Locking pin (extended)

5 Lifting hook

6 Take-up hook for work tool

Operating elements

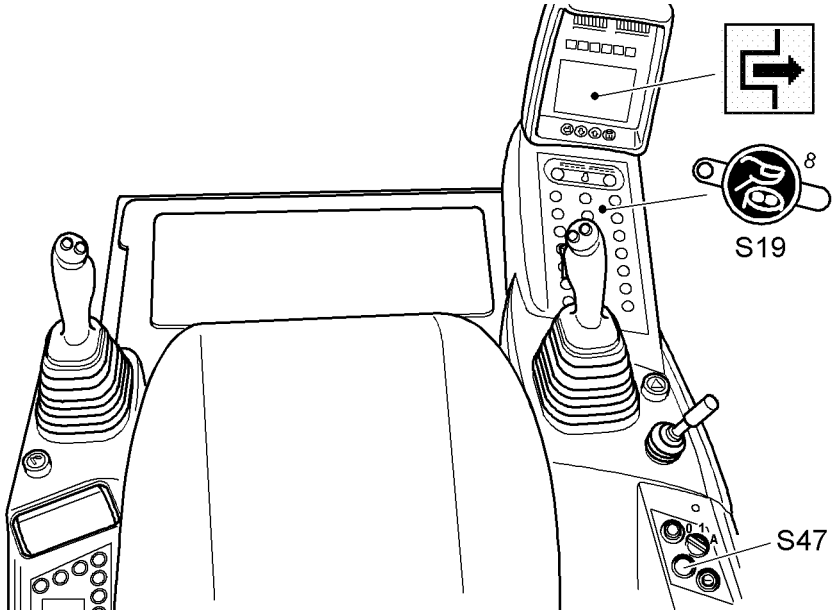


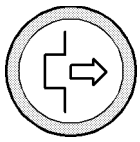
Fig. 3-94 *Operating elements for the hydraulic quick-change adapter*

Switch S19

Use switch **S19** to activate the auxiliary hydraulic device for the grab torsional mechanism and quick-change adapter.

▶ Press switch.
  ↳ Auxiliary device is activated.
  ↳ LED in switch illuminates.

▶ Press switch again
  ↳ Auxiliary device is deactivated.
  ↳ LED in the switch goes out.



Key switch S47:

Pressing the button activates the quick-change adapter – it is possible to operate the

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locking pins.

Pushbuttons L and R

Pushbutton **L** = extend locking pin (lock)
Pushbutton **R** = retract locking pin (unlock)

The pushbuttons are located on the left and/or right joystick (depending on the machine's equipment):

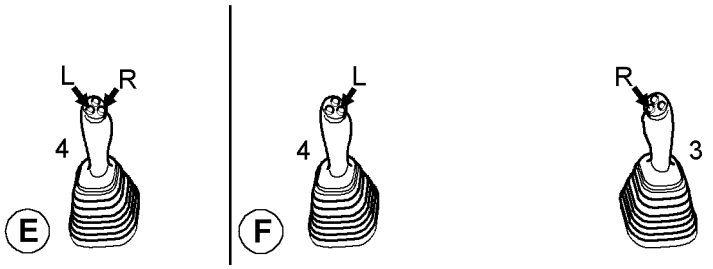

Fig. 3-95 *Pushbutton on the joystick*

E Operation with left joystick (standard)

F Operation with left and right joystick (optional extras)

Symbol "Quick change adapter"

The symbol appears:

– during the locking process or
– when the locking pins are retracted.

Two-hand operation

The quick-change adapter is activated using two-hand operation. The locking pins can only be moved at first if button **S47** and one of the pushbuttons **L** or **R** are pressed.

The control has a hold function which allows both joysticks to be operated simultaneously when attaching and dismounting work tools. If one of the pushbuttons, **L** or **R** is continued to be pressed, button **S47** can be released and the direction of movement of the locking pins is retained.

If the direction of movement is to be changed, button **S47** and the relevant pushbutton **L** or **R** must be pressed.

Caution !
The extension of the locking pins (locking of the coupler) is possible even without depressing **S47**.
However this must be absolutely avoided since it causes a quick wear of the sealing rings in the LIKUFIX hydraulic coupling system.

Attaching the work tool

To move the equipment into position:

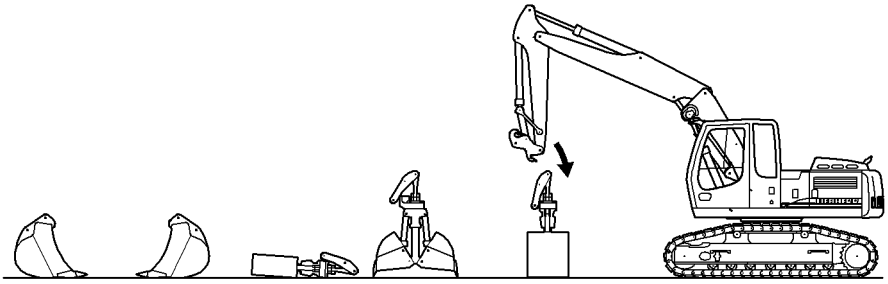

Fig. 3-96 *Positioning the equipment*

- ❑ The equipment must be standing stable or lay loose on the ground.
- ▶ Move the stanchion and work tool into position.
- ▶ Insert the shovel tilting cylinder fully.

To unlock the quick-change adapter:

- ▶ Press switch **S19**.
  - ↳ Quick-change adapter is activated.
  - ↳ LED in switch illuminates.
- ▶ Press and hold button **S47**.
  - ↳ Quick-change adapter is activated.
- ▶ Press and hold pushbutton **R** until the locking pins are fully inserted.
  - ↳ The buzzer sounds.
  - ↳ The symbol “Quick changer” appears on screen.
  - ↳ The quick-change adapter is unlocked.

Taking up the work tool:

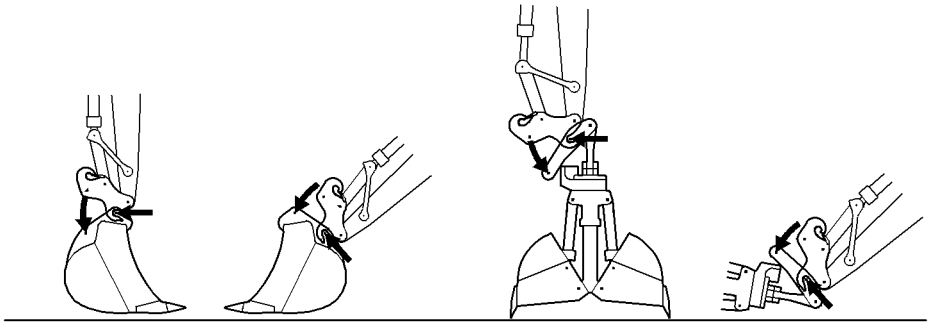

Fig. 3-97 *Taking up the work tool*

- ▶ Move the quick-change adapter into a position that allows the work tool to be picked up using the take-up hook.
- ▶ Raise the work tool from the ground and extend the shovel tilting cylinder fully until the bearing panel for the work tool is laying on the quick-change adapter stop.
  - ↳ The bore holes of the work tool and the locking pins of the quick-change adapter must align.

To lock the quick-change adapter:

- ▶ Press switch **S19**.

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↳ Quick-change adapter is activated.
↳ LED in switch illuminates.

▶ Press and hold button **S47**.
↳ Quick-change adapter is activated.

▶ Press and hold pushbutton **L** until the locking pins are fully removed.
↳ The buzzer goes off.
↳ The symbol “Quick changer” disappears from the screen.
↳ The quick-change adapter is locked.
↳ The work tool is bolted on when taking up correctly.

▶ Release button **S47**.

▶ Press switch **S19**.
↳ Quick-change adapter is deactivated.
↳ LED in the switch goes out.

Caution!
Hydraulic lines are pressurized!

▶ Remove the pressure using the joystick before connecting the hydraulic lines (switch off the diesel engine, turn the ignition key into the contact position, operate the joystick).

▶ Connect hydraulic lines or electrical lines, if necessary. (eg. when attaching a grab).

▶ A direct visual check must be made to ensure that the work tool is correctly positioned.

A “working cycle” should also be performed with the work tool.
This means that the work tool should be raised before use to the point at which the correct positioning of, for example, the pin in the pin eye, can be checked by tilting in and out.

Danger!
The electronic monitoring system for the quick-change adapter displays defective functions. These could be caused by an unmonitored position change of the locking pins or by mechanical or hydraulic damage. A defect may also be present in the electrical system (eg. proximity switch or buzzer).

▶ If the buzzer and telltale light are activated without a deliberate locking or unlocking procedure being carried out, stop all work at once.

▶ If the buzzer and telltale light are not activated while a deliberate locking or unlocking procedure is being carried out, stop all work at once.

▶ Only resume working once defective parts have been repaired or replaced.

▶ Performing the working cycle

▶ Before starting to use the work tool (eg. grab, ditcher bucket), the special installation information in the chapter “Attaching and dismounting equipment parts” is also to be noted.

Detaching a work tool

To move the equipment into position:

Caution!
Hydraulic lines are pressurized!

- ▶ Remove the pressure using the joystick before removing the hydraulic lines (switch off the diesel engine, turn the ignition key into the contact position, operate the joystick).

- ▶ Disconnect hydraulic lines or electrical lines, if necessary (eg. when dismounting a grab).
- ▶ Extend the shovel tilting cylinder fully.

To unlock the quick-change adapter:

Danger!
Risk of injury!
Once unlocked, there is no fixed connection between the adapter and the work tool. The work tool could work itself out independently.

- ▶ Always keep the work tool as close to the ground as possible when unlocking to avoid creating conditions which may lead to danger.

- ▶ Press switch **S19**.
  - ↳ Quick-change adapter is activated.
  - ↳ LED in switch illuminates.
- ▶ Press and hold button **S47**.
  - ↳ Quick-change adapter is activated.
- ▶ Press and hold pushbutton **R** until the locking pins are fully inserted.
  - ↳ The buzzer sounds.
  - ↳ The symbol “Quick changer” appears on screen.
  - ↳ The quick-change adapter is unlocked.

To put down the work tool:

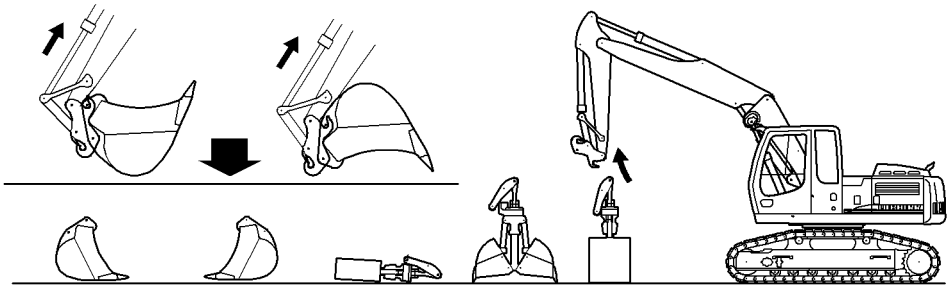

Fig. 3-98 *Putting down the work tool*

- ▶ Slowly insert the shovel tilting cylinder and lay the work tool on the ground.
- ▶ The new work tool can be taken up.

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Using the quick-change adapter for lifting work

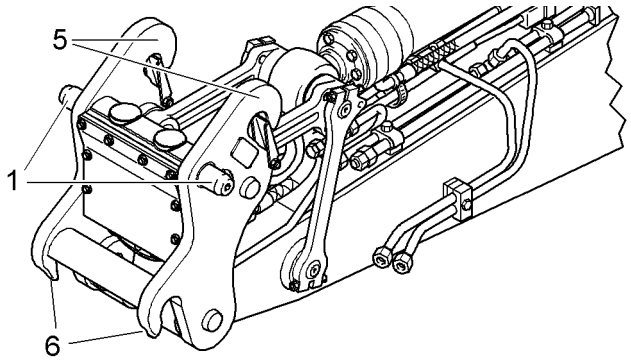

Fig. 3-99 *Hydraulic quick-change adapter*

The quick-change adapter has two integrated lifting hooks. The machine may only be used for hoisting work if the safety devices required for the purpose are present and functioning correctly (see chapter “Hoisting work” or “Overload warning device”).

The maximum load carrying capacity of each individual lifting hook is given on the quick-change adapter. The load carrying capacity of the quick-change adapter or the integrated lifting hook can exceed or fall short of the load carrying capacity of the carrier device.

When operating, it should be ensured that the values for the carrier device / quick-change adapter given in the load chart and the technical data are adhered to.

Load hoisting work can be carried out with attached or dismounted work tools. With dismounted work tools, it is sensible to fully insert the locking pins when carrying out hoisting work. This prevents the load take-up device being turned round too strongly by the locking pins and damaged.

Danger!

- ▶ Never use the take-up hook **6** to fasten a load because there is no secure hold for the load take-up device, eg. rope or chains, in the take-up hook.
- ▶ Before using for hoisting work, deactivate the quick-change adapter.
  - ↳ LED in switch **S19** has gone out.
  - ↳ Release button **S47**.
  - ↳

To cancel the buzzer (warning tone)

The symbol “Quick changer” on screen and the buzzer (warning tone) indicate that the quick-change adapter is not locked or is incorrectly locked.

After putting down the work tool, the buzzer (warning tone) continues to sound if the locking pins are not removed.

When the overload warning device is switched on, the warning tone for the quick-change adapter can be cancelled.

If no new work tool is to be taken up, it is sensible to switch off the warning tone so avoid constant noise disturbance. Also, another buzzer (overload warning device) can be heard more easily.

- ▶ Press switch **S349**.
  - ↳ The buzzer will switch off.
  - ↳ The symbol “Quick changer” on screen will continue to be displayed.

↳ The acoustic warning device will only activate automatically once the locking pins have been removed again.

▶ To reactivate the warning tone for the quick-change adapter, remove the locking pins fully once until the “Quick changer” symbol goes out on screen.
↳ The buzzer (warning tone) for monitoring the quick-change adapter is reactivated.

3.6 General working methods

3.6.1 Minimum impact working methods for your machine

To increase the service life of the machine and avoid unnecessary damage and the resulting repairs, please note the following points:

– Do not stop the rotary motion of the upper carriage when slewing into a ditch by stopping the equipment on the walls of the ditch.
– Using the machine for applications where the equipment is knocked against the material to be removed, in the longitudinal direction too, is not permitted. Repeatedly hitting the work equipment against rock or other hard material will damage steel parts and machine components.
– With specific combinations of boom, stanchion and work tool, the work tool could hit or break through into the cab. This could damage the cab and injure the machine’s operator.
– Do not attach buckets which are too big or side cutters when using the machine in rocky material. This will extend the work cycles and could result in damage to the bucket and other machine components.
– Please contact your LIEBHERR contractual partner if special teeth are required for heavy or special applications.
– Operating the drag bearing to bore into material is not permitted.
– Do not raise the machine when working. If this should occur, slowly lower the machine to the ground. Do not permit the machine to lower quickly and do not intercept the falling movement using the hydraulics, since this could result in damage to the machine.

3.6.2 Preparatory activities

Danger!
Risk of fatal injury and damage to the machine when working.

▶ Observe the safety information “Notes for safe working” at the start of these operating instructions.

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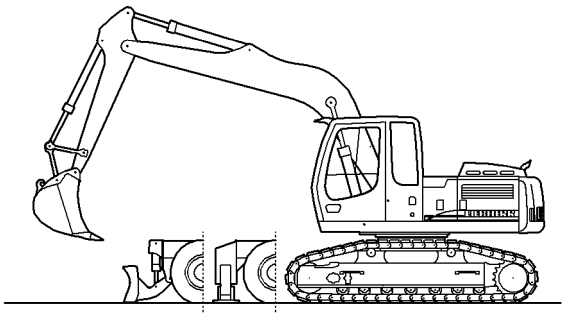

Fig. 3-100 *Working position – machine*

- ▶ Position the machine so that the load or grab material can be taken up above the rigid axle or the leading wheel.
- ▶ For mobile devices, lower the support when possible and lock the full floating axle.

Danger!
Insufficient support and machine damage.
Do **not** use a skimming shield to support the machine.

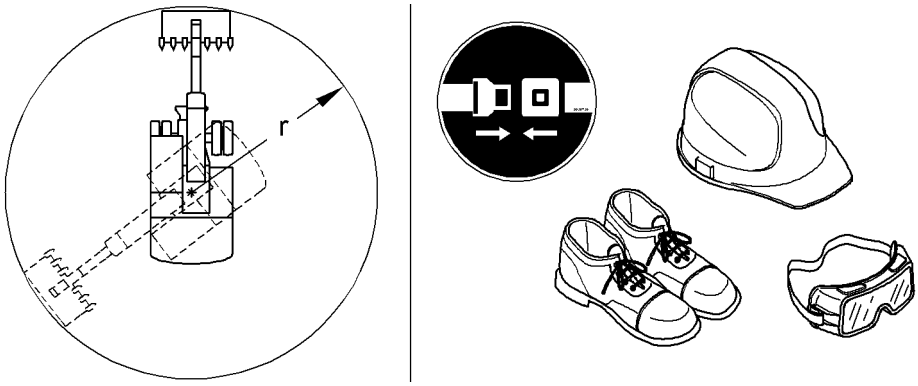

Fig. 3-101 *Safe working*

Danger!
Risk of fatal injury due to rotating the machine.

- ▶ Ensure that nobody stands within the danger area **r** of the machine.

Caution!
Risk of injury when working.

- ▶ Always wear safety shoes and, particularly when leaving the cab when demolition work is going on, a protective helmet and goggles.
- ▶ Always wear the seat belt.
- ▶ Use the horn to give a short warning signal before starting work.

3.6.3 Working with the hoe type bucket

Danger!
Risk of fatal injury and damage to the machine when moving the hoe type bucket.

- ▶ Ensure that the hoe type bucket is not slewed too close to the cab.
  - ↳ The hoe type bucket could damage the cab and injure the machine's operator.
- ▶ Ensure that nobody is standing within the danger area of the hoe type bucket.

- ❑ The machine must be in the working position.

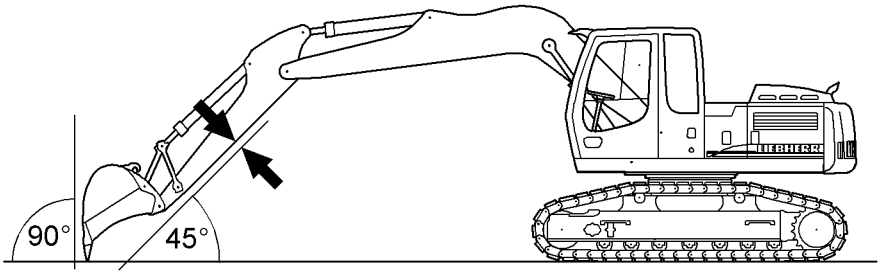

Fig. 3-102 *Aligning the shovel arm and hoe type bucket*

- ▶ Align the shovel arm in such a way that its underside is at an angle of approx. 45° to the ground.
- ▶ Align the hoe type bucket in such a way that its ground side can enter the ground at an angle of approx. 90°.

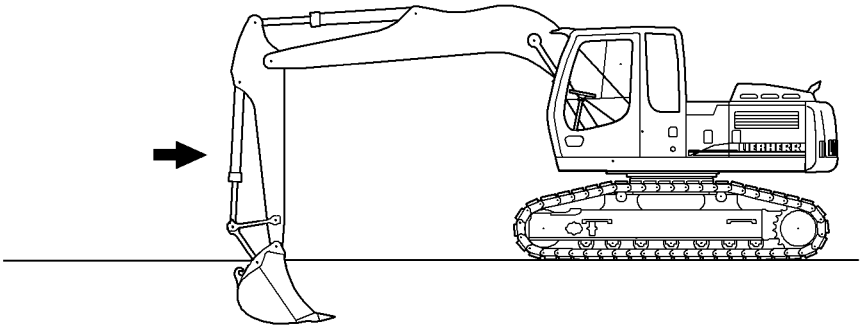

Fig. 3-103 *Taking up grab material*

- ▶ To lift out the grab material, slowly and evenly slew in the shovel arm and slowly and evenly slew in the hoe type bucket simultaneously.
- ▶ As soon as the shovel arm is perpendicular to the ground, raise the boom slowly and evenly in addition to slewing in the shovel arm and the hoe type bucket. Stopping suddenly will result in impact loads and vibrations.

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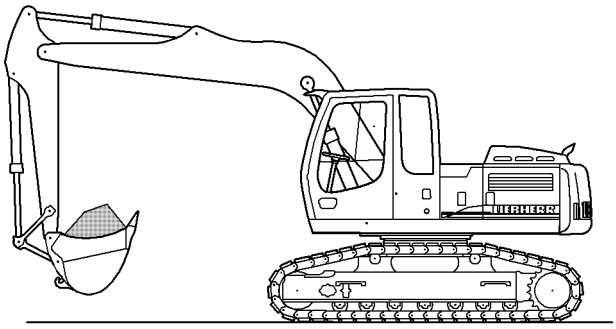

Fig. 3-104 *Raising grab material*

▶ When the hoe type bucket is full or the shovel arm can no longer be slewed in, raise the boom and hoe type bucket until the filled surface is parallel to the ground.

3.6.4 Loading the transport vehicle

Danger!
Risk of fatal injury due to falling grab material.

▶ Do not load the transport vehicle so high that the grab material could drop out over the walls of the vehicle.

▶ Ensure that nobody is standing in the danger area or in the transport vehicle when loading.

▶ Do not slew the equipment over the driver's cab.

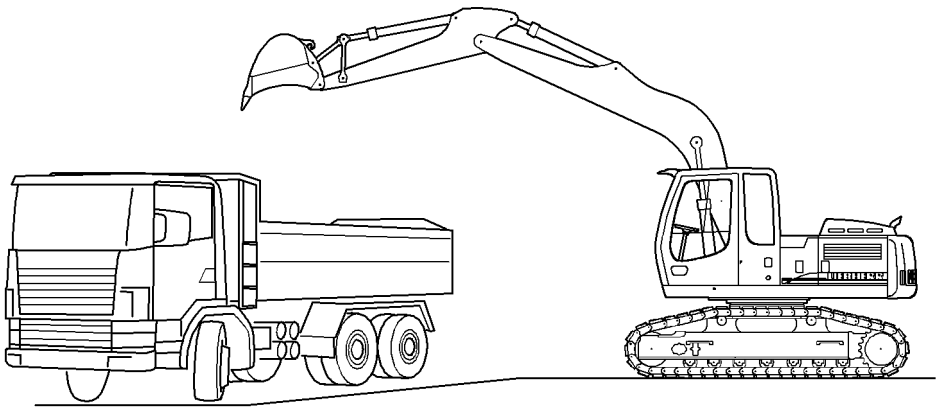

Fig. 3-105 *Emptying grab material*

❑ If possible, the machine should stand higher than the transport vehicle to avoid having to lift the grab material unnecessarily.

▶ Stop the transport vehicle in a position that allows it to be loaded from the rear or the side.

▶ Slew the machine's equipment above the loading area of the transport vehicle.

▶ Distribute the grab material evenly over the loading area of the transport vehicle by slewing the hoe type bucket and shovel arm out, slewing the upper carriage

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and possibly also moving the boom.

- If the hoe type bucket is not sufficiently emptied or there is still grab material in the hoe type bucket, slew the hoe type bucket in and out several times to loosen the grab material.

3.6.5 Working with the Shovel bucket

Digging

To maximise machine power and breakout, maintain grade and fill the bucket, correct digging angles and technique should be used.

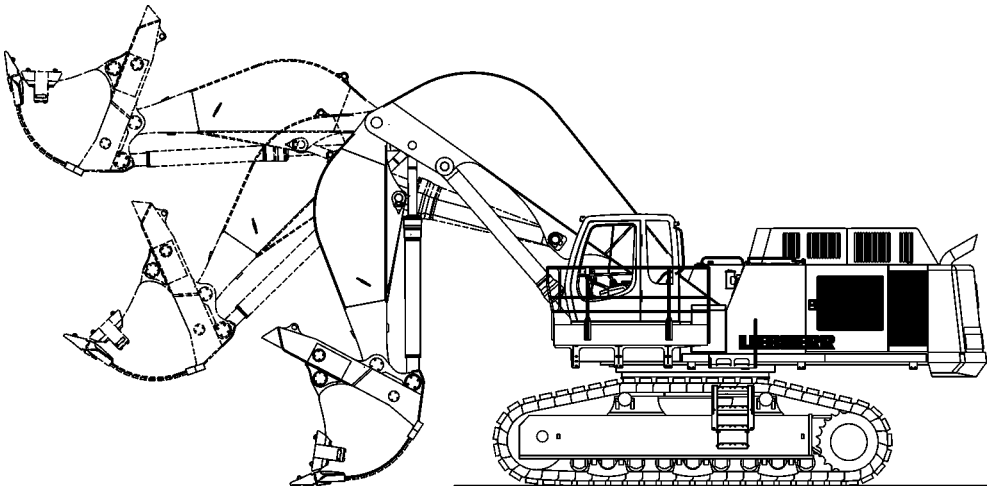

Fig. 3-106 *Digging*

- Most digging should be started with the bucket almost fully crowded back (50mm off stops or end of cylinders).
- When cleaning up or digging at floor level, angle the teeth aggressively to break out any toe that may be encountered.
- Keeping the heel of the bucket off the ground therefore creating a void under the rear of the bucket.
- Operate with the teeth and bucket lip doing all the work.

Note!
Avoid digging at right angles to the tracks.

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Caution!

- Each time the stick is crowded back to commence a cut, extreme caution must be taken not to hit the tracks.
- The clam must always be closed when digging, although don't slam it shut. Avoid working on the cylinder limits and bucket stops during the digging cycle. Continual use of these practises will lead to premature failure of seals and O-rings and can cause stress fractures to the clam, stick and bucket and damage to the boom and superstructure.
- Crowd the bucket in (down) while closing the clam. This practise makes use of gravity to help minimise shock loading on the bucket cylinders.
- Never dig, or attempt to bring down any material overhang, with the bucket while the clam is open or partly open.
- Do not attempt to dig or clean the floor or face with the clam open. These practises can cause considerable damage to the clam cylinders.

Unload the bucket

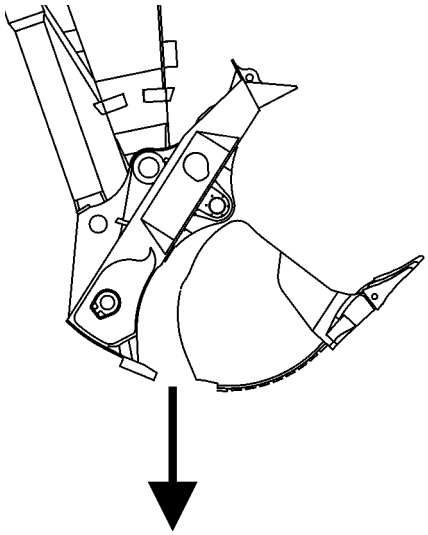

Fig. 3-107 *Unloading of the bucket*

When dumping the load, tip the bucket forward slightly as the clam opens. This helps direct the material to fall centrally into the tray ans avoids spillage.

The position of the bucket backboard when the clam opens, directly affects the position of the load in the tray.

Bucket in ideal position resulting in material falling straight down. Loading centre of the haul truck.

3.6.6 Working with the clamshell bucket (construction equipment)

Danger!
Risk of fatal injury and damage to the machine due to a swinging shell type bucket.

- ▶ Ensure that the shell type bucket does not swing too close to the cab.
  - ↳ The shell type bucket could damage the cab when swinging and injure the machine's operator.
- ▶ Ensure that the shell type bucket does not swing towards anyone in the working area.
  - ↳ The shell type bucket could injure people standing in the vicinity when swinging.
- ▶ Move the joystick slowly and evenly to prevent the shell type bucket swinging.
- ▶ Hold the stanchion in such a way that the shell type bucket cannot swing towards the machine when driving or braking.
- ▶ Do not lift a load with the boom and stanchion extended too far and do not slew a heavy load too far to the left or right.
  - ↳ The stability of the machine could be affected.

❑ The machine must be in the working position.

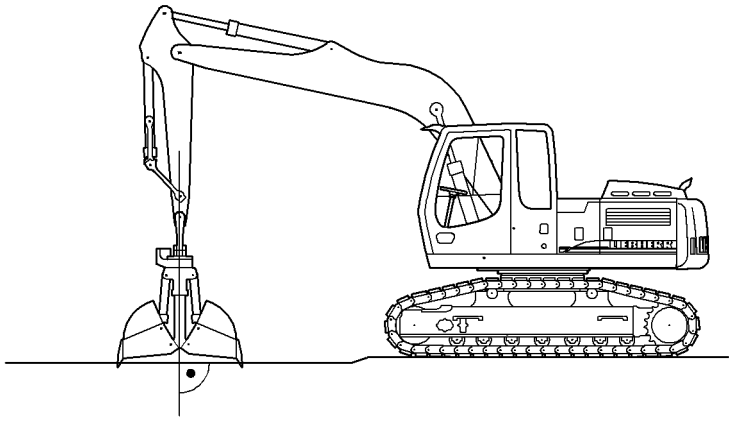

Fig. 3-108 *Straightening the stanchion*

- ▶ Open the grab shells fully.
- ▶ Lower the stanchion perpendicular to the excavation area.

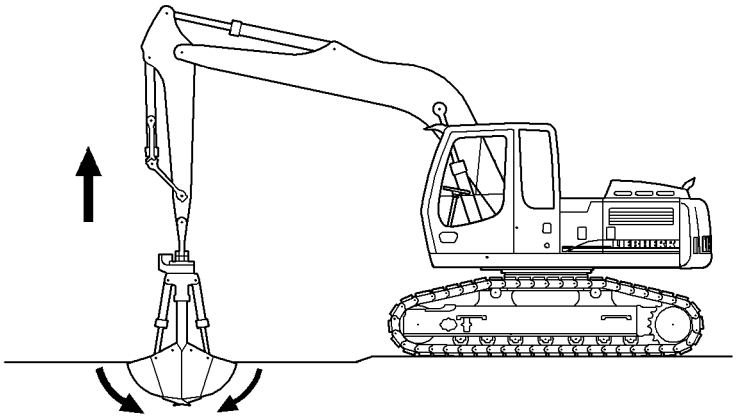

Fig. 3-109 *Closing the grab shells*

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- Close the grab shells.
- Raise the stanchion slightly when doing this in order to reduce ground pressure.

Danger!
The device could lift out when closing the shell type bucket.

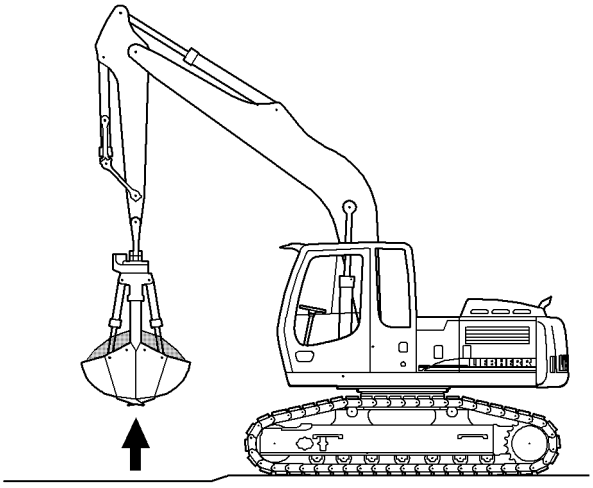

Fig. 3-110 *Raising grab material*

- Close the grab shells fully.
- Raise the boom.
- Move the machine to the unloading area (eg. transport vehicle).

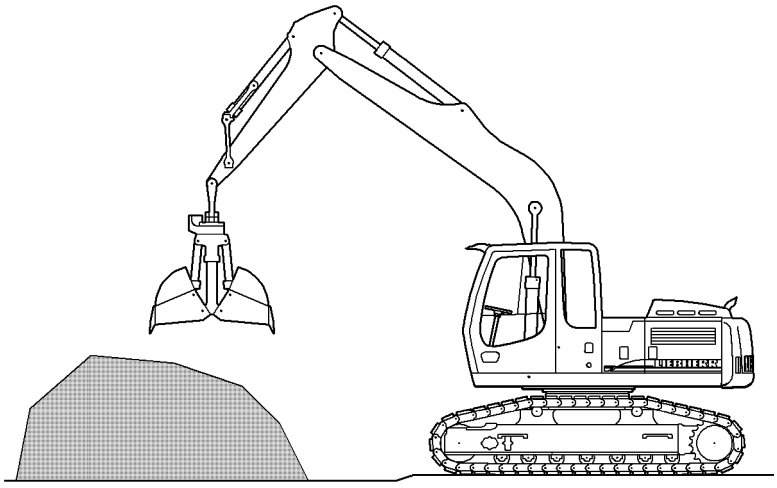

Fig. 3-111 *Emptying grab material*

- Slew the stanchion out as far as possible to prevent any risk due to the swinging grab.
- Open the grab shells, empty the grab material.

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3.6.7 Hoisting work

Hoisting work is understood as being lifting, transporting and unloading loads using a securing method (rope, chain etc.) and where personnel are required to assist in securing and unloading the load. This includes, for example, the lifting and unloading of pipes, shaft-top supporting rings or containers.

Danger!
The machine may only be operated for hoisting work if the prescribed safety devices are present and functioning correctly.

Machines used for hoisting work must be equipped with the following safety devices, in accordance with European standard EN 474-5:

- **Load take-up device for safe securing of a load (optional extra)**
  Safe take-up devices include for example lifting hooks which are mounted in place of the bucket. Lifting hooks can also be replaced with safety hooks welded to the bucket.
- **Overload warning device (optional extra)**
  The overload warning device must alert the machine operator visually or acoustically if the permitted load value according to the load chart has been reached or exceeded.
- **Line break fuse on the hydraulic jacks (optional extra)**
  The line break fuse must correspond with the requirements of ISO 8643.
- **Load chart inside the cab**.

If the points referred to above are not or are only partially fulfilled, the machine may not be used for hoisting work.

3.6.8 Working with the hydraulic hammer

Please also refer to the operating instructions provided by the manufacturer of the hydraulic hammer.

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Danger!
The hydraulic hammer must be selected very carefully. Operating requires increased care and attention.

- ▶ Only use hydraulic hammers approved by LIEBHERR.
  - ↳ The use of a hydraulic hammer not approved by LIEBHERR could damage steel parts or other machine components.
- ▶ Only use the hydraulic hammer to break up rocks, concrete and other breakable objects.
- ▶ To avoid damaging the machine, do not try to break up rocks or concrete by moving the lever on the work equipment or by the hydraulic hammer.
- ▶ Do not use the drop power of the hydraulic hammer to break up rocks or other objects. Do not move objects with the hydraulic hammer. Do not lift the machine when using the hydraulic hammer.
  - ↳ This could damage both the hydraulic hammer and the machine.
- ▶ Do not use the hydraulic hammer to lift objects.
- ▶ Only use the hydraulic hammer in the machine's longitudinal direction.
- ▶ Do not operate the hydraulic hammer in the direction of the machine, since exploding rocks or concrete could damage the machine and / or injure the driver.
- ▶ Close all windows in the cab before working.

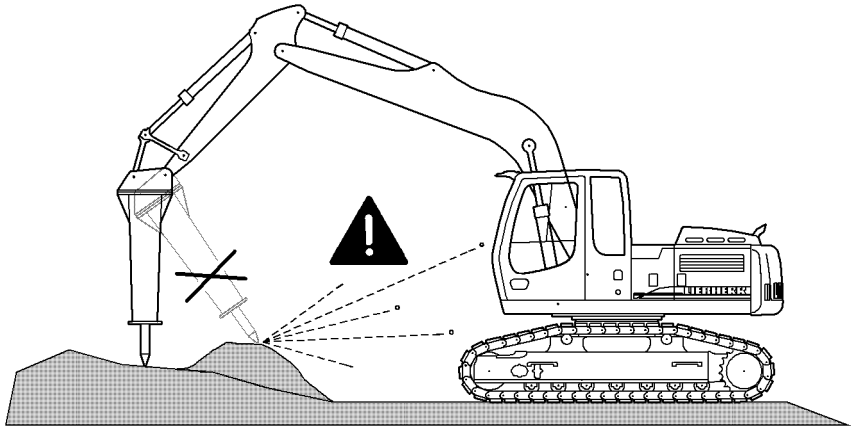

Fig. 3-112 *Hydraulic hammer*

- ❑ The machine must be positioned in the working position on level, solid ground.
- ❑ The stanchion may not stand vertically.
- ❑ No cylinder may be fully taken in or extended.
- ▶ Do not operate the hydraulic hammer on the same spot continually or for longer than 15 seconds.
  - ↳ Overly continual operation of the hydraulic hammer leads to the hydraulic oil overheating unnecessarily.
- ▶ Change the position of the machine and resume hammering work.

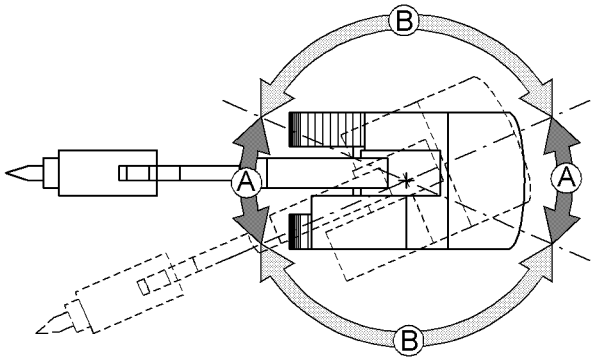

Fig. 3-113 *Permissible **A** and not permissible **B** work areas of the machine with hydraulic hammer*

Danger!
The stability of the machine could be affected.
When using a hydraulic hammer, only work with the machine in area **A**.

3.6.9 Working with the grapple (industrial equipment)

❑ The machine must be in the working position.

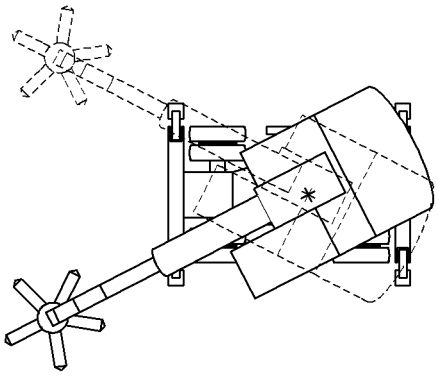

Fig. 3-114 *Taking up the load*

▶ Take the load up above the supported corners of the machine to attain maximum stability.

▶ The maximum lifting capacity is attained when the load is taken up as close to the chassis as possible.

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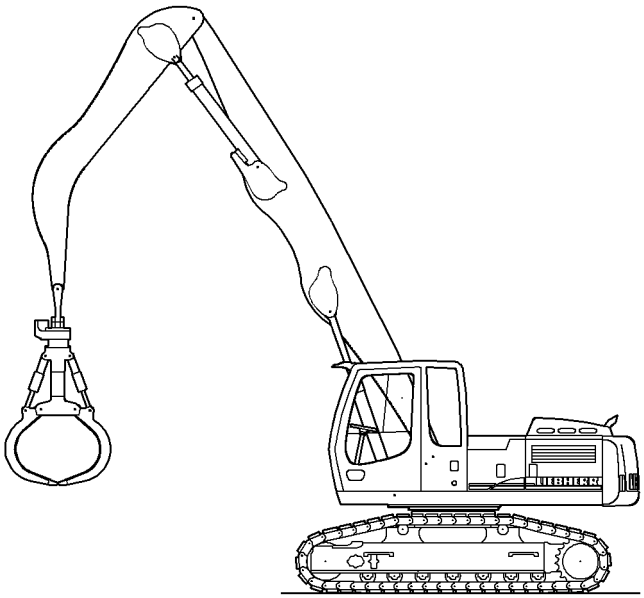

Fig. 3-115 *Transporting a load*

▶ Transport the load close to the chassis, but with sufficient safety distance to the cab (swinging grab!) and as close to the ground as possible.

Caution!
Particularly when loading wood, it can be necessary when working with a grab to move with the working equipment raised and the load taken up. This will shift the centre of gravity of the machine upwards. The way the machine drives will be negatively affected because of this.

▶ Please note the safety information “Use for loading work” at the beginning of these operating instructions.

3.6.10 Skimming

Skimming work can either be carried out using the bucket or with a skimming shield (optional extra).

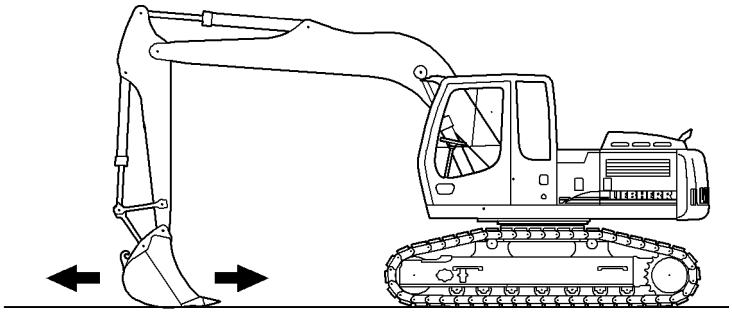

Fig. 3-116 *Skimming*

❑ The machine must be in the working position.

❑ The support should be raised.

Danger!
Serious risk of injury when moving the machine.

▶ Ensure that nobody is standing within the working area of the machine.

Caution!
The machine could be damaged.

▶ Never move the machine while the work equipment is touching the ground.

▶ To skim with a hoe type bucket, lay this on the ground (siehe Fig. 3-116) and move the stanchion slowly forwards and backwards. Move the boom steadily up and down while the stanchion is moving.

▶ If a skimming shield is present (optional extra), lower it to the ground and move slowly forwards and backwards with the machine.

3.7 Transport

3.7.1 Transporting the machine safely

– Due to transport restrictions, use only suitable means of transport and lifting devices with sufficient load-carrying capacity.
– Park the machine on a flat surface and wedge the crawler or wheels securely.
– If required, detach a part of the machine's working equipment during transportation.
– The ramp used to drive the machine up onto the flatbed trailer should not exceed an inclination of 30° and should have a wooden cover to prevent sliding back.
– The undercarriage chassis should be swept clean, i.e. before driving up the ramp, clean any snow, ice and mud from the crawler / wheels of the machine.
– Align the machine precisely with the loading ramp.
– Attach the hand lever for fine-tune driving (crawler excavator) onto the accelerator pedals.
– Ensure that a spotter gives the machine operator the required signal.
– Prepare the placing block to ensure against rolling back when the machine is driving up onto the flatbed.
– Tilt the equipment up and drive up the loading ramp. While doing this, always hold the equipment securely over the loading area, drive very carefully up the ramp and onto the transportation vehicle.
– Rotate the upper structure carefully to the rear and lower the equipment. Due to restrictions during transport on hoe equipment, tilt the arm in and dismantle the bucket during transportation.
– After loading the machine onto the flatbed trailer, the upper structure must be secured facing the chassis using the stop bolts (only A devices).
– Secure the chassis and the remaining individual parts using chains and blocks to prevent slipping.
– Before you leave the machine, reduce pressure on all pressure lines, remove the ignition key and tilt up the safety lever.
– Lock all cab and panel doors.

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– Before transportation, find out all details about the route to be travelled, particularly as they relate to width, height and weight restrictions.
– Pay particular attention when driving under electrical lines and bridges and through tunnels.
– When unloading the machine, take the same amount of care as was taken when it was loaded. Remove all chains and blocks. Start the engine as per the operating instructions. Drive carefully off the trailer's loading area and down the ramp. Hold the working equipment as securely as possible over the ground while doing this. Have a spotter guide you.

3.7.2 Transporting the machine on a low loader

Note
Respect the respective local legal circulation rules and safety instructions of profession corporations and in case adapt the machine, its transportation means, loading and fasten materials befor into the local legal permitted state.

Preparatory activities

Before driving onto the low loader, the following arrangements must be made :

Fig. 3-117 *Loading ramp*

❑ The ramp inclination must be flatter than the machine's given hill climbing ability. Ramp inclination angle **W** < = 30°.

❑ Have the chocks ready.

▶ Lay down and secure wooden planks carefully on the steel surface of the ramp.

▶ Clean any ice, snow or mud off the crawlers before starting to drive up the ramp.

Loading the machine onto the low loader

To drive the machine up onto the low loader :

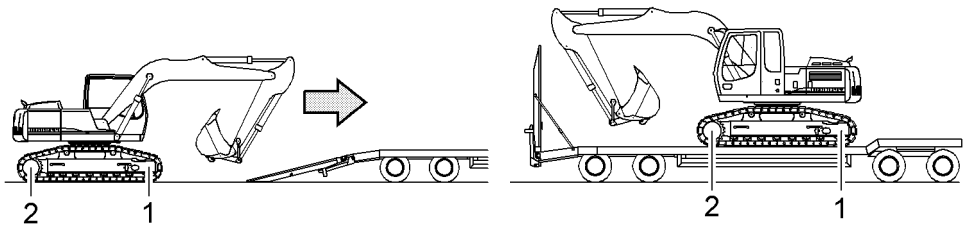

Fig. 3-118 *Driving up onto the low loader*

1 Leading wheel **2** Tumbler wheel

▶ The machine must be driven up on to the low loader with the leading wheel **1** leading. For this, the upper carriage must be rotated 180°.

Danger!
If the upper carriage is rotated 180° to the chassis, the driving and steering directions are reversed.

- ▶ Drive and steer with increased caution.

- ▶ For sensitive driving, insert the lever which is found in the tool kit into the pedals for the drive units.
- ▶ Align the machine precisely to the loading ramp.
- ▶ Drive the machine onto the low loader.

Note

Note
Have a signaller provide the necessary signs.

- ▶ Rotate the upper carriage carefully 180° (direction of travel over leading wheel) and lower the equipment (siehe Fig. 3-119).

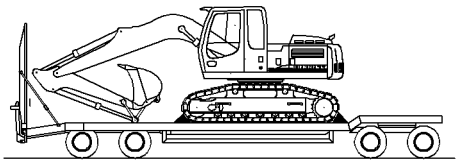

Fig. 3-119 *Transport position - machine*

- ▶ Switch off the engine.
- ▶ Turn the ignition key to the contact position and relieve pressure lines by moving the joystick carefully several times.
- ▶ Remove the ignition key and push the safety lever up.
- ▶ Close and lock all doors, covers and panels on the machine.

Note

Note
If necessary, remove the attachments from the excavator for the duration of the transport.

To secure the machine :

The machine must be secured against slipping before starting the journey.

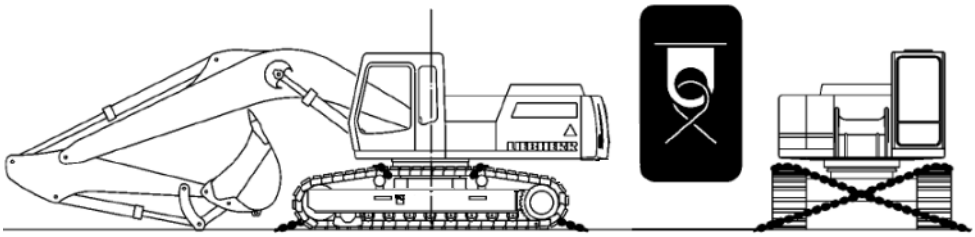

Fig. 3-120 *To secure the machine*

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Danger!
Serious accidents can happen if the machine is allowed to slip on the loading ramp.

- ▶ Secure the machine against slipping.
- ▶ To do this, use chocks and a tension cable or tension chains.

- ▶ Secure the machine at the points provided for the purpose using tension cables or tension chains (siehe Fig. 3-120). The loading points are identified on plate 45 on the chassis.
- ▶ Secure tension cables and tension chains on the low loader according to type.

Transport route

Danger

Danger!
Driving beneath obstacles which are too low can cause serious accidents.

- ▶ Drive under obstacles, particularly electrical lines, with increased caution.

- ▶ Find out about the route to be travelled before starting the journey.

3.7.3 Loading the machine with a crane

If the machine is to be loaded using a crane (eg. onto ships or rail freight cars), the type of suspension should be selected according to the equipment.

Danger!
The load could slip or fall if incorrectly loaded.

- ▶ Only permit experienced personnel to secure loads and signal the crane driver.
- ▶ The signaller must position himself within the view of the operator or be in voice contact with him.
- ▶ Ensure that the length of the suspension gear is sufficient.

Loading a machine with a gooseneck boom :

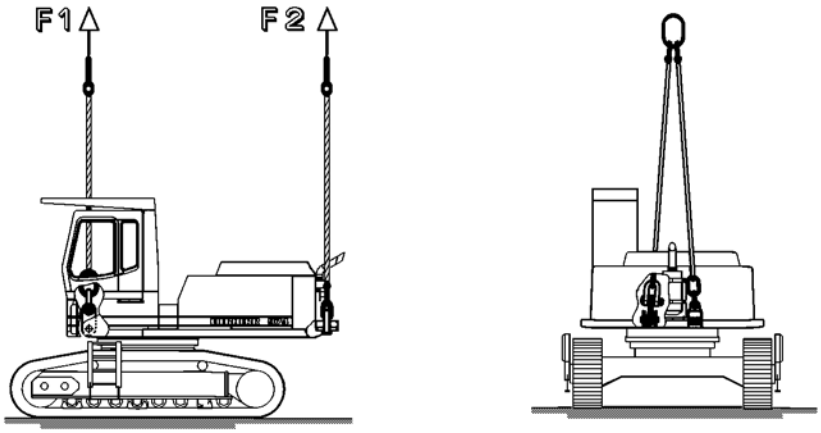

Fig. 3-121 *Suspending the machine with gooseneck boom*

- ❑ Only use cargo handling gear which is sufficiently dimensioned or which has been specially developed by LIEBHERR for this purpose.

- ▶ Lower the equipment, draw in the stanchion and tip the bucket as far as the stop.
- ▶ Switch off the engine.
- ▶ Turn the ignition key to the contact position and relieve pressure lines by moving the joystick carefully several times.
- ▶ Remove the ignition key and push the safety lever up.
- ▶ Close and lock all doors, covers and panels on the machine.
- ▶ Attach the cargo handling gear to the points provided for the purpose.

Danger!
Standing under the raised machine is not permitted!

- ▶ Raise the machine carefully with the crane and load.
- ▶ When restarting the machine, proceed only in accordance with the operating and maintenance instructions.

3.7.4 Travelling procedures for mining machine

The life expectancy of undercarriage components is based on standard working conditions with a maximum travel ratio of 5% per service meter unit. Working and / or travelling on uneven ground and / or abrassive material will influence the lifetime of the components and attract additional cost for the undercarriage components.

In general travel action has to be kept to the lowest level that is possible. Minimize travelling with turning through a narrow turning circle and long distance travel.

To minimize the travel ratio, professional mine planning with longfront winning sections is preferred. If digging operations at various spots are necessary, a proper short term and long term plan of winning operations has to be employed to guarantee long term use of the excavator at one place before moving to another location.

However, if frequent machine movement is necessary, the following set of procedures defined by LIEBHERR to minimize possible machine damage, downtime and wear have to be taken into consideration.

General

In order to move the machine forwards : with the excavator in standard forward position, depress travel pedals all the way forward with the toes. Direction of travel is in the direction of idlers.

In order to move the machine backwards : with the excavator in standard forward position, depress travel pedals all the way down with the heels. Direction of travel is in direction of the drive sprockets.

Moving the machine during loading operations

Moving the machine during loading operations means adjustment of excavator digging and / or truck loading position of some meters.

Important procedures

– Before moving the machine, empty the bucket and close up the attachment to a position as close as possible to the excavator undercarriage.

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– The practice of placing the attachment on the ground and lifting the machine, then counter turning the undercarriage, is not allowed, because it could cause premature structural damage to the machine.
– If there is a build up of material around the tracks where the machine will not turn, you must move the machine several meters forwards and / or backwards and attempt to turn again.
– If mine safety regulations allow, the operator can use the swing function to assist in turning the tracks, i.e. if turning to the right, swing upper deck to the left and vice versa.

Walking the machine over distance

Walking the machine distances means any movement of the machine of more than 100 m or for a time period longer than 3 minutes, whatever comes first.

In addition to above mentioned guidelines, when moving the machine during loading operatins, the following procedures apply :

– It is required to have somebody standby with a heat gun, to monitor the temperature of the drive components, including the track and carrier rollers.
– If temperature of any moving part is growing up about 20°C above ambiant temperature, interrupt travel and only commence again after parts have sufficiently cooled.
– To prevent overheating during travelling or to speed up cooling procedure it is advisable to have a water truck standby, to hose the heating components during travelling or cooling break.
– Move with idler and attachment forwards. Whenever possible, and not to contravene with mine safety regulations, swing whilst travelling to equally load track rollers. However, always ensure that clear forward vision is maintained.

Travelling the machine down grades or upgrades

In addition to above mentioned guidelines, when moving the machine during loading operations or when walking the machine distances, the following procedures apply :

– When travelling down grades greater than ten percent, it would be better to walk the machine down with the track motor first, i.e. the machine is moved backwards.
– When travelling up an incline, the final drives must be at the rear of the excavator.
– When walking down from a bench, firstly prepare a ramp, making it no more than a 30° slope (machine must be able to walk up unaided). When moving down the ramp never allow the machine to fall down on the attachment. When walking up the ramp never use attachment to assist the movement by pushing with the hydraulic power of the bucket, stick or booM.

Travelling the machine first time

The slide bearing (friction bearing) of the track rollers needs some time for running-in. If the bearing becomes hot at an early stage of machine life, this may cause lubrication problems during further life. Therefore when travelling the machine the machine the first time aside from all above mentioned guidelines it is strongly recommended to move carefully and at reduced speed.

Note!
Warranty may become void if failure to recognize and comply with the recommended travel operating procedures, as outlined in this document, is noted.

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4 Malfunctions

Warning messages and fault messages:

– Various faults are displayed on screen in the form of indicator lights or symbols (see chapter “Control and operating elements”).

– Warning functions can also be supported acoustically (buzzer).

Identifying and rectifying faults and errors:

– Faults can very often be traced back to incorrect operating or maintenance of the machine.
For each fault, therefore, read the relevant chapter in the operating instructions carefully once more.

– Analyse the cause of the fault and rectify it immediately.

– Describe the fault and all accompanying circumstances as precisely as possible if you contact LIEBHERR customer service.
Precise information makes it possible to find and rectify the cause of the fault quickly. Additionally, therefore, precise information on the type and serial number of the machine is also required.

– Do not carry out any work which you have not been trained to do.

Fig. 4-1 *LIEBHERR service*

If the cause of the fault cannot be recognised or rectified using the error codes and fault charts, please consult LIEBHERR customer service.

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4.1 Error code charts

Danger!
When switching over to emergency operation, the speed can no longer be changed using the arrow keys on the monitoring screen. The servo control, parking brake and swing gear brake can no longer be activated.

▶ Please also note the subheading “Emergency operations” in the chapter “Operating the machine” in this regard.

Error code	Effect	Cause	Measure / remedy
E 004	Engine coolant level	Short circuit to earth	Check engine coolant level.
E 005		Short circuit + 24 V	
E 006		Cable break	
E 010	Hydraulic oil level not being monitored.	Short circuit to earth	Check hydraulic oil level.
E 011		Short circuit + 24 V	
E 012		Cable break	
E 013	Hydraulic oil temperature not being monitored.	Short circuit to earth	Check that the radiator is not dirty.
E 014		Short circuit + 24 V	
E 015		Cable break	
E 016	Gear oil temperature	Short circuit to earth	Check gear oil temperature.
E 017		Short circuit + 24 V	
E 018		Cable break	
E 022	Diesel engine RPM	Short circuit to earth	
E 023		Short circuit + 24 V	
E 024		Cable break	
E 027	Solenoid valve for power control (LR)	Cable break	
E 033	Solenoid valve for cooler fan regulation (EV5)	Cable break	
E 036	Solenoid valve for flow control (hydraulic pump 1) EV1	Cable break	
E 039	Solenoid valve for flow control (hydraulic pump 1) EV2	Cable break	
E 042	Solenoid valve - Reserve (EV3)	Cable break	
E 045	Solenoid valve - Pressure operate (EV6)	Cable break	
E 068	Fan RPM	Fan RPM defective	
E 302	Keyboard	No coding plug	
E 303	Keyboard	No CAN bus connection to BST	
E 305	Keyboard	No CAN bus connection to ESP01 board	
E 308	Display	No connection between keyboard and display	

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Error code	Effect	Cause	Measure / remedy
E 309	Display	No Software compatibility between keyboard and display	
E 319	BST	No compatibility between hardware coding and software coding	
E 321	BST	No reception of recognised machine typ by BBT	
E 322	BST	Unknown Hardware coding	
E 442	Joystick left	Short circuit + 24 V	
E 443		Short circuit to earth or Cable break	
E 445	Joystick right	Short circuit + 24 V	
E 446		Short circuit to earth or Cable break	
E 450	The pressure for pressureless boom down movement not being monitored.	Cable break	
E 454	Rotation gear speed	Short circuit + 24 V	
E 455		Short circuit to earth or Cable break	
E 456	Fuel tank sensor	Short circuit + 24 V	
E 458		Short circuit to earth or Cable break	

4.2 Faults and remedies

4.2.1 Diesel engine and fuel system

Fault / error	Cause	Solution
Diesel engine does not start	Fuel tank almost or completely empty	Fill tank and vent fuel system
	Low pressure in tank	Remove fuel filler cap
	Fuel filter dirty	Clean or change filter and vent fuel system, drain fuel / clean tank
	Outside temperature below 0°C	For operation under specific climatic conditions, see operating instructions
	Starter motor not drawing through	Check line connections, overhaul starter motor
	Batteries have no power	Charge / replace

Fault / error	Cause	Solution
Engine starts but stops immediately after or runs irregularly	Fuel tank empty (low pressure in tank)	Fill tank and vent fuel system
	Fuel filter dirty	Clean or change filter and vent fuel system (tank)
	Particularly in winter: too viscous engine oil used	Use engine oil suitable for the outside temperature
	Dry-air filter dirty	Clean or change main filter element
	Air in fuel system	Vent fuel system
	Ventilation in fuel tank obstructed	Clean
	Fuel line bent	Check line and repair if required
Diesel engine emitting grey or black smoke	Dry-air filter dirty	Clean or change filter
Diesel engine continually emitting while smoke (steam)	Water in combustion chamber	Consult customer service
Diesel engine does not reach full speed	Speed adjustment not set to maximum value	Set speed adjustment to maximum value
	Injection system is set incorrectly	Consult customer service
	Dry-air filter dirty	Clean or replace filter
	Bad fuel supply	Clean or change fuel filter, check lines, drain water from tank
Diesel engine becomes too hot	Too little coolant	Fill coolant, check for leaks
	Water pump defective	Repair
	Thermostats do not work	Change thermostats
	Coolant contaminated	Clean coolant
Diesel engine has insufficient oil pressure **Note!** Switch off diesel engine immediately	Oil level too low	Correct oil level
	Oil pressure display faulty	Change oil pressure switch
Diesel engine consumes too much oil	External leak on diesel engine	Retighten screws, replace seals if required
Oil in coolant or coolant in oil		Consult customer service
Unusual noise / sounddevelopment on exhaust side	Exhaust system leaking	Check exhaust system / repair

4.2.2 Hydraulic system

Fault / error	Cause	Solution
Unusual noise / sounddevelopment at hydraulic pumps **Note!** Switch off diesel engine immediately	Shutoff valve on hydraulic tank closed	Open stop cock
	Hydraulic pumps taking in air	Check oil level in hydraulic tank, check intake lines for leaks
Modes E and P showing lack of power	No power adjustment via proportional solenoid valve Y50	Unplug cable of Y50 connection, remove safety cotter pin, move lever to emergency setting

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Fault / error	Cause	Solution
Hydraulic oil temperature too high	Coolant contaminated	Clean coolant
	Fan or fan control defective	Rectify error / consult customer service
Hydraulic oil level too low	Oil loss	Repair leaks, exchange hoses, refill oil via return-line filter
Cannot drive	Push the safety lever up	Push the safety lever down
	No direction of travel preselected	Use drive selection switch in right joystick to determine direction of travel
	Parking brake pressure switch defective	Consult customer service
	Parking brake not released	Release parking brake using switch
	Parking brake will not release despite switch being operated	Servo pressure present: Operate emergency function Y6
		Servo pressure not present: Consult customer service
	Service brake engaged	Release service brake
Slewing gear not functioning	No servo control	Push the safety lever down
		Switch on servo control
	Slewing gear brake activated	Push the safety lever down
		Release slewing gear brake
No working movement	No servo control	Push the safety lever down
		Switch on servo control
	No servo pressure present	Consult customer service
	No pump high pressure present	Consult customer service

4.2.3 Transmission

Fault / error	Cause	Solution
Oil flowing out on track rollers, support rollers or leading wheel	Seal defective	Replace seal
Insufficient crawler tracking on leading wheel	Leading wheel tracking on track roller mounting has too much play	Adjust the leading wheel tracking play
Crawler jumps off or over	Crawler tension too low / crawler wheel worn	Adjust crawler tension
Correctly tensioned crawler losing tension quickly during use	Crawler tensioning cylinder defective	Check crawler tensioning cylinder, change if required or seal (only authorized specialist personnel)
Track roller or support roller sticking	Running gear extremely dirty	Clean running gear

4.2.4 Electrical system

Fault / error	Cause	Solution
Battery charge telltale light does not goes out	Drive belt for alternator loose or torn	Tension or replace drive belt
	Alternator defective	Replace alternator
Batteries do not charge or charge poorly	Batteries defective	Replace batteries
	Battery connections dirty / oxidised	Clean battery connections
	Cable loose or damaged	Connect or replace cable
Telltale light or display instrument not functioning or functioning incorrectly	Bulb burnt out, display instrument defective	Replace defective part
Some or all functions on instrument panel drop out	Plug connector separated or damaged, earth lead interrupted, short circuit fuse defective	Mount plug connector correctly or change, rectify short circuit, replace fuse or activate overload cut-outs
Diesel speed adjustment via operating keypad (mode and arrow keys) not functioning	Automatic idling switch S20 is activated	Touch the joystick or deactivate automatic idling switch S20.
	Excavator speed adjustment electronics do not function	Switch the emergency function over from “AUTO” to “MANU” using switch S71 in the right control panel. Set speed using switch S72. Emergency function display appears on monitoring screen. Consult customer service.
	No signal emits from speed sensor B12	
Automatic idling not functioning, speed does not reduce	Permanent sensor signal	Consult customer service
	Switch S20 is deactivated	Activate switch S20
Servo control cannot be activated using switch	Excavator electrics faulty	Switch on emergency function using switch S73 in the right control panel Caution: Servo circuit and brake circuit can only be switched off using the safety lever. Keypad not functioning. Consult customer service.
Parking brake cannot be released using switch		
Slewing gear brake cannot be released using switch		

4.2.5 Heating/air-conditioning system

Fault / error	Cause	Solution
Heating not giving out warm air	Shutoff valves for coolant line on diesel engine closed	Open shutoff valve
	Engine not at operating temperature	Bring engine to operating temperature
Heating fan does not operate	No power supply	Check fuse and wiring / repair
	Fan motor defective	Change fan motor
Only low air flow in cab	Outside air filter / recirculated air filter dirty	Clean air intake opening, replace outside air filter
	Air vent closed	Open air vent

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4.2.6 Work equipment

Fault / error	Cause	Solution
Cylinder stretches when loaded	Piston seal in cylinder defective	Overhaul cylinder
Bearing clearance too high on equipment	Bearing points worn out	Replace bearing parts
Grab / bucket does not move	Valve block on tilting cylinder incorrectly switched	Switch over valve block
Add-on unit cannot be turned / rotated / operated	Auxiliary function has not been released	Release auxiliary function using switch S19
	Lines are not connected	Connect lines

4.3 Fuses and relays

4.3.1 Fuse box E50

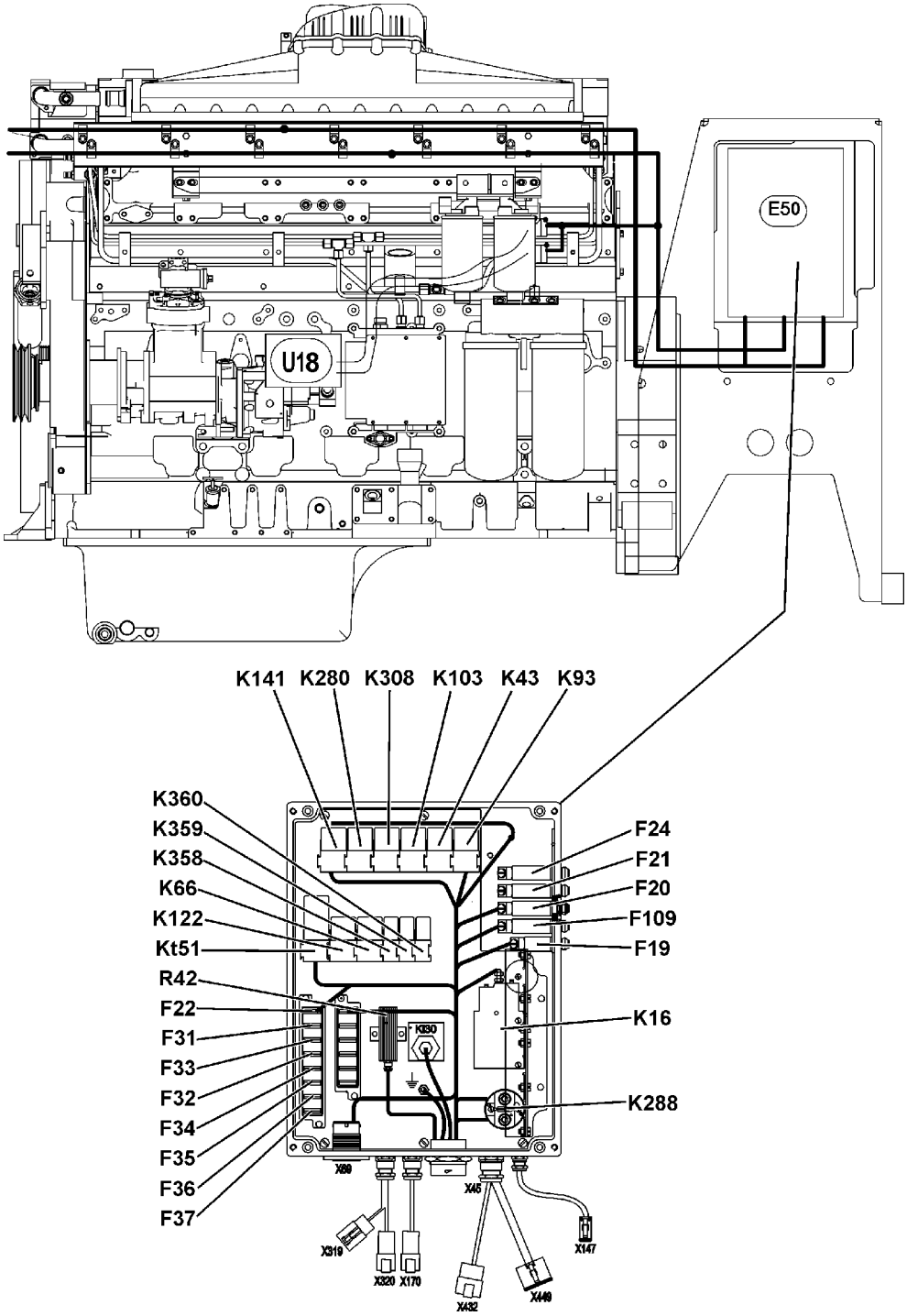

Fig. 4-2 *Fuse box E50*

Fuse box E50 is located next to the motor.

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F19	70 A	Circuit breaker / glow plug and preglow
F20	50 A	Main circuit breaker
F22	7,5 A	Reserve
F31	7,5 A	Fuse for heater and air conditionner KI15
F32	15 A	Fuse for heater and air conditionner KI30
F33	15 A	Reserve
F34	15 A	Reserve
F35	15 A	Reserve
F36	15 A	Reserve
F37	15 A	Reserve
F109	50 A	Circuit breaker / starter circuit

K16	Relay / starter
K43	Relay / engine stop (Quantum)
K66	Relay / unlocking of the end position cut-off
K93	Relay / startpilot
K103	Relay / engine on (12V for hourmeter)
K141	Relay / E5
K280	Relay / E150
K288	Main relay terminal 15
K308	Relay / floodlights

4.3.2 A1010 Plate

All other fuses are situated in the left control panel of the operator's standing position.

Danger
Incorrect or bypassed fuses do not offer the machine's operator or the electrical system the required degree of protection.

- ▶ Only use original fuses.
- ▶ Never bypass electrical fuses.

If required, order replacement fuses from LIEBHERR.

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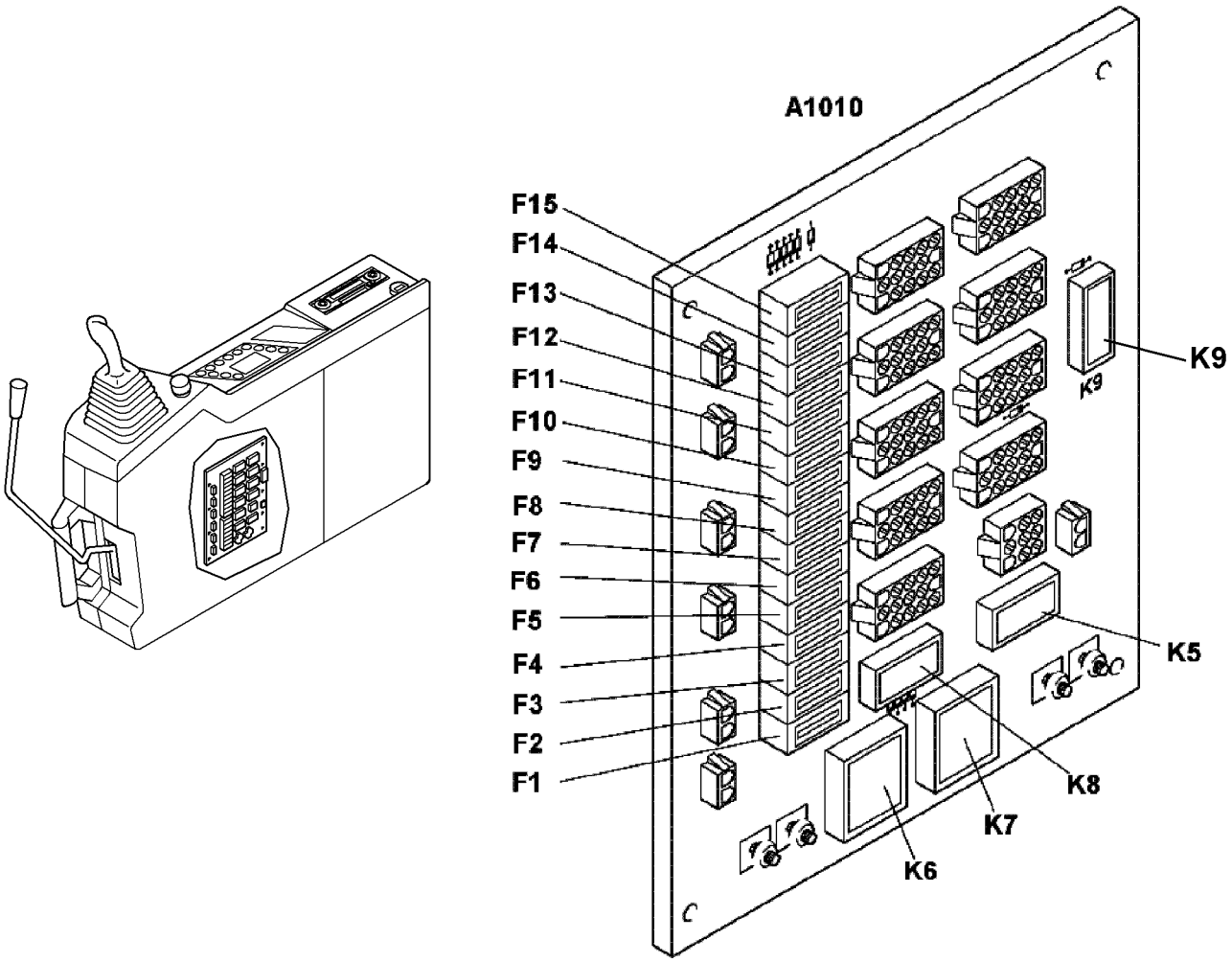

Fig. 4-3 *Fuses and relays, A1010 plate*

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F1	15 A	Reserve
F2	15 A	Reserve
F3	15 A	Reserve
F4	15 A	Windscreen washing system, windscreen wiper system, preheating system control circuit, rotating beacon*, slewing grab*
F5	7,5 A	Windscreen wiper motor
F6	7,5 A	Speed adjustment in “MANU” control
F7	7,5 A	Control unit and display
F8	15 A	Safety lever, solenoid valve for servo control, swing gear brake, fast drive, pressure cut in stage boom
F9	15 A	Engine throttle control, BST power supply
F10	25 A	Working headlight, Rotating deck headlights, additional headlights*
F11	15 A	Reserve
F12	15 A	Reserve
F13	7,5 A	Contact key, starting circuit, voltage transformer, Radio*, loudspeaker*, engine stop* (for engine oil low pressure or low coolant level)
F14	15 A	Interior lighting, cigarette lighter, signal horn
F15	15 A	Reserve
K5		Relay emergency control servo function, engine stop* (for engine oil low pressure or low coolant level)
K6		Horn relay
K7		Relay for additional headlights on cab roof
K8		Floating position relay

* en option

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5 Maintenance

5.1 Servicing the machine safely

5.1.1 General safety instructions

- Maintenance and repair work may only be carried out by specially trained personnel.
- Observe statutory timetables or intervals given in the operating instructions for repeat tests / inspections. It is imperative that a suitably equipped workshop is available in order to carry out maintenance work.
- The inspection and maintenance schedule given at the end of these operating instructions defines precisely who is required / permitted to carry out what work. Jobs listed as daily / weekly work may be carried out by the machine's driver or maintenance personnel when they have received appropriate instruction. The remaining work may only be carried out by specialist personnel with appropriate training.
- Replacement parts must correspond to the technical requirements determined by the manufacturer. Original replacement parts are always guaranteed to meet these criteria.
- Wear safe work clothes when carrying out maintenance work. Protective glasses and gloves are required in addition to a hardhat and safety shoes for some work.
- Do not permit unauthorised persons to approach the machine during maintenance work.
- Cordon off a wide maintenance area if required.
- Inform operational personnel before starting to carry out any special work and repair work. Designate persons in charge of supervision.
- In the absence of any other information in the operating instructions, carry out all maintenance work on the machine on level, firm ground with the working equipment set aside and the engine switched off.
- Pull out the ignition key and shut off the main battery switch.
- Always tighten any loose screw connections during maintenance and repair work.
- If safety devices have to be dismantled during set-up, maintenance and repair work, they must be immediately reinstalled and checked at the end of the work.
- When carrying out repair work, particularly when working under the machine, hang a “Do not start” warning sign in a clearly visible position on the starting lock. Pull out the start key and shut off the main battery switch.
- Operate combustion motors and fuel operated heaters only in well ventilated areas. Before operating these units, check ventilation.
- In addition, always follow applicable local regulations.

5.1.2 Cleaning

- Clean oil, fuel or care products off the machine before starting maintenance or repair work and pay particular attention to connections and screw fittings. Do not use aggressive cleaning products and use lint-free cleaning cloths.
- Do not use aggressive cleaning products or steam jet devices to clean the machine for the first two months after initial set-up of the machine (or after repaint-

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ing).

– Do not use combustible liquids to clean the machine.
– Before cleaning the machine with water or steam jets (high pressure cleaner) or other cleaning materials:
  • lubricate all bearing points, bolt connections and the rim bearing to prevent water or steam entering the bearing points.
  • cover or glue shut all openings into which for safety or functional reasons water or steam may not be permitted to enter.
    Electric motors, electrical components, control boxes, plug connections and air filters are particularly at risk.
– Ensure that the fire warning systems and fire extinguishers of the engine compartment's temperature sensor do not come into contact with hot cleaning products during cleaning work.
  The fire extinguisher could start.
– If you use a high pressure cleaner with steam or hot water to clean the machine, observe following recommendations :
– the distance between the nozzle and the surface to be cleaned must be no lower than 20 inches
– the water temperature should not exceed 60°c (140°F)
– limit the water pressure to 80 bar maximum (11500 PSI)
– if you employ cleaning fluid, only use neutral cleaning agents such as customary car shampoos diluted to 2 or 3 percent maximum
– After cleaning:
  • remove all covers completely.
  • check all fuel, engine oil and hydraulic lines for leakage, loosened connections, chafing and damage.
  • rectify any defects found immediately.
  • lubricate all bearing points, bolt connections and the rim bearing to displace any water or cleaning products that may have entered.

5.1.3 Crack testing

– Even when the machine is operated carefully, there is a possibility of individual cases of overloading occurring, which could lead to cracks or loose connections. The machine should therefore be checked regularly for cracks, loose connections or other visible damage to maintain operational safety.
– In order to be able to check for cracks, it is essential that the machine is kept clean and cleaned regularly.
– The tests should be carried out in accordance with the monitoring and maintenance plan:
  • every 250 operating hours by the machine owner's maintenance personnel.
  • every 500 operating hours by authorised specialist personnel.
– It is advisable to carry out these tests: supported, on firm, horizontal substrate, with the equipment in longitudinal and cross direction for variable loads. Current accident prevention regulations must be adhered to.
– Special care must be taken when testing load-bearing components, particularly:
  • the steel chassis members and axle and transmission mountings, the support, the lower rim bearing support and tower and ball rim bearing.
  • the steel upper structure members and bearing block for boom and boom cylinder, the upper rim bearing support, the cab mount and the mount for swing gear and ballast.
  • the steel components of the working equipment, e. g. the boom, stay, quick change adaptor, and bucket.

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- hydraulic cylinders, axles, steering, bolts and bolt connections, steps, ladders and mounting elements.

– The crack test should be carried out visually. If a crack is suspected, the dye penetration test should be carried out as a crack test on areas which do not have good visibility, such as the rim bearing support, in order to increase testing safety.
– Any damage found must be rectified immediately. Welding work on load-bearing parts of the earth-moving machinery, loading devices and transport devices may only be carried out by trained specialist personnel and only in accordance with the accepted rules of welding engineering. In case of doubt, contact the LIEBHERR customer support service to discuss suitable remedies.

5.1.4 Welding, drilling, firing and grinding work

– Any welding on structural parts (as undercarriage, uppercarriage, equipment parts,…) may only be done the manufacturer, or authorized official dealer. If this rule is neglected, the warranty is voided.
– Only carry out welding, drilling, firing and grinding work on the machine with express authorization. Clean dust and combustible materials off the machine and its surrounding areas before welding, drilling, firing or grinding.
Ensure adequate ventilation. Risk of fire or explosion.
– Before welding repairs on other parts, always disconnect the battery. Always remove the negative terminal first and reconnect it last.
– Nevertheless if welding repair should be done on components which may contain inflammable gases (welded counterweight, hydraulic tank, fuel tank, …), these components must be previously and sufficiently ventilated with pressurized air to avoid all fire or explosion hazard
– Before welding, connect the ground cable as close as possible to the welding point, so the welding current will not run through the swing ring, joints, gears, bushings, rubber parts and seals

5.1.5 Process materials

– When working with oils, greases and other chemical substances, observe the appropriate current safety regulations for the product.
– Ensure that process materials and replacement parts are disposed of in a safe and environmentally acceptable manner.
– Take care when handling hot process materials
(Risk of burning and scalding).

5.1.6 Repair work

– Do not attempt to lift heavy parts. Use devices which are suitable for this purpose and which have sufficient load capacity. When replacing single parts and larger subassemblies, carefully secure them on lifting devices them so that they do not present a risk. Only use suitable and correctly functioning lifting devices and load take-up devices with adequate load capacity.
Do not stand or work under swinging loads.
– Do not use lifting devices which are damaged or do not have sufficient load carrying capacity.
Wear work gloves when working with wire cables.
– Only permit experienced personnel to attach loads and give signals to the crane

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operator. The spotter must be positioned within the visual range of the operator or be in voice contact with him.

– When working above body height, use safe climbing devices and working platforms which are appropriate for the job.
  Do not use machine parts as climbing devices if they are not designed for this purpose.
  When working at height, wear a harness to prevent falling.
  Ensure that all grips, steps, rails, platforms and ladders are free of dirt, snow and ice.
– Be sure to support yourself safely when working on the equipment (e.g. replacing teeth). Prevent metal touching metal when doing this.
– For safety reasons, never open and remove a track chain unless having previously totally released the pretension of the chain tensioning unit.
– Never lay under the machine if it is raised with work equipment and has not been securely supported with wooden beams.
– Always jack the machine up in such a way that any weight displacement does not jeopardize stability and prevent metal touching metal while doing this.
– Work on the suspension, brake and steering systems may only be carried out by trained specialist personnel.
– If the machine has to be repaired on a slope, secure the crawler with chocks and connect the upper structure to the chassis using stop bolts.
– Only personnel with special training and experience may work on hydraulic equipment.
– When searching for leakage, wear protective gloves. A fine jet of liquid under pressure can penetrate the skin.
– Do not unscrew any lines or connections before you have set aside the equipment, switched off the engine and depressurized the hydraulic system. After switching off the engine, you must operate all pilot control devices (joystick and pedals) in all directions with the start key in contact position in order to reduce the actuating and dynamic pressures in the work circuits. You must then reduce the internal tank pressure as described in these operating instructions.

5.1.7 Electrical system

– Check the electrical system regularly.
  Have all faults, such as loose connections, blown fuses and lamps and clogged or abraded cables rectified by personnel.
– Only use original fuses with approved current strength.
– For machines with electrical neutral and high tension leads:
  • switch the machine off immediately in the event of malfunctions in the power supply.
– Work on the machine's electrical equipment may only be carried out by skilled electrical personnel or by trained personnel under the supervision of an electrician in accordance with electrical regulations.
– When working on live parts, ensure that a second person is available to operate the emergency-off or the main switch and overvoltage release. Cordon off the working area with a red and white safety chain and a warning sign. Only use insulated tools.
– When working on neutral and high tension subassemblies, after releasing the voltage, briefly disconnect the supply cable at earth and electronic devices such as capacitors using an earthing rod.
– First test the released parts to make sure that they are off circuit, earth them and then disconnect them briefly. Insulate adjacent live parts.

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– Disconnect the battery before working on the electrical system or carrying out any electric arc welding on the machine.
  First disconnect the negative, then the positive pole. When reconnecting, proceed in the reverse order.

5.1.8 Hydraulic accumulator

– All work on the hydraulic accumulators must be carried out by trained specialist personnel.
– Inexpert assembly and handling of hydraulic accumulators can cause serious accidents.
– Do not operate damaged hydraulic accumulators.
– Before working on a hydraulic accumulator, you must reduce the pressure in the hydraulic system (hydraulic system including hydraulic tank), as described in these operating instructions.
– Do not carry out welding or soldering or do any mechanical work on the hydraulic accumulator.
  The hydraulic accumulator can be damaged by heat penetration and can be made to rupture by mechanical working. RISK OF EXPLOSION!
– Only charge the hydraulic accumulator with nitrogen. There is a RISK OF EXPLOSION if oxygen or air is used.
– The accumulator body can become hot during operation; there is a risk of burning.
– New hydraulic accumulators must be charged with the pressure required for the purpose of use before installation.
– The operating data (minimum and maximum pressure) are marked permanently on hydraulic accumulators. Ensure that this marking remains visible.

5.1.9 Hydraulic hoses and sheathed cables.

– It is forbidden to carry out repair work on hydraulic hoses and sheathed cables!
– All hoses, sheathed cables and bolt connections must be checked regularly every 2 weeks for externally visible damage and any possible damage must be immediately checked for leakage.
  Never check for leaks with your bare hands, use a sheet of paper or something else.
  Any damaged parts must be removed immediately! Spurting oil can lead to injury and burns.
– Even with correct storage and permitted load, hoses and sheathed cables are subject to the natural aging process. This restricts their duration of use.
  • Incorrect storage, mechanical damage and unauthorized load are the most common causes of failure.
  • In relation to duration of use, current norms, regulations and guidelines pertaining to hoses and sheathed cables at place of use must be adhered to.
  • Use at the limit range of permissible load can shorten duration of use (e.g. high temperatures, frequent movement cycles, extremely high pulse frequencies, multiple shift usage).
– Hoses and sheathed cables should be replaced if the following are found during inspection:
  • Damage to the outer sheath as far as the liner (e.g. chafing, cuts and cracks);
  • Brittleness of the outer sheath (fracture formation in hose material);
  • Deformations which do not correspond to the natural form of the hose or sheathed cable, whether in a unpressurized or pressurized state or on bends

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e.g. sheath separation, blistering;
- Unsealed areas;
- Non-adherence to requirements during installation;
- Damage or deformations to the hose fittings which reduce the tightness of the fittings or the hose / fitting connection;
- Hoses working themselves out of the fittings;
- Corrosion of the fittings which reduces function and tightness;

– When replacing hoses and sheathed cables, use only original replacement parts.

– Install and mount hoses and sheathed cables correctly. Do not mix up the connections.

– The following is to be noted when replacing hoses and sheathed cables:
  - Always ensure that the hoses and sheathed cables are installed free of torsion. For high-pressure hoses, the screws from the half-clamps or full flange must always be attached to both hose ends and should only be tightened afterwards.
  - When tightening the flange on high-pressure hoses and sheathed cables with bent fittings, the side with the bent fitting must always be tightened first and then the side with the straight fitting tightened afterwards.
  - Any mounting clamps which are located in the centre of the hose may only be attached and tightened subsequently.
  - Check daily to ensure that all clamps, covers and protective devices are properly fastened. Doing this will prevent vibration and damage during operation.
  - Install the hoses and sheathed cables in such a way that they cannot chafe on other hoses, sheathed cables or parts.
  - A minimum distance from other parts of approx. half the exterior diameter of the hose is recommended. The distance should not, however, be less than 10 to 15 mm.
  - When replacing the hoses or sheathed cables on moving parts (e.g. from the boom to the stay), check before initial start-up that there are no chafing areas in the entire area of movement.

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5.2 Maintenance access doors

5.2.1 Overview of access doors

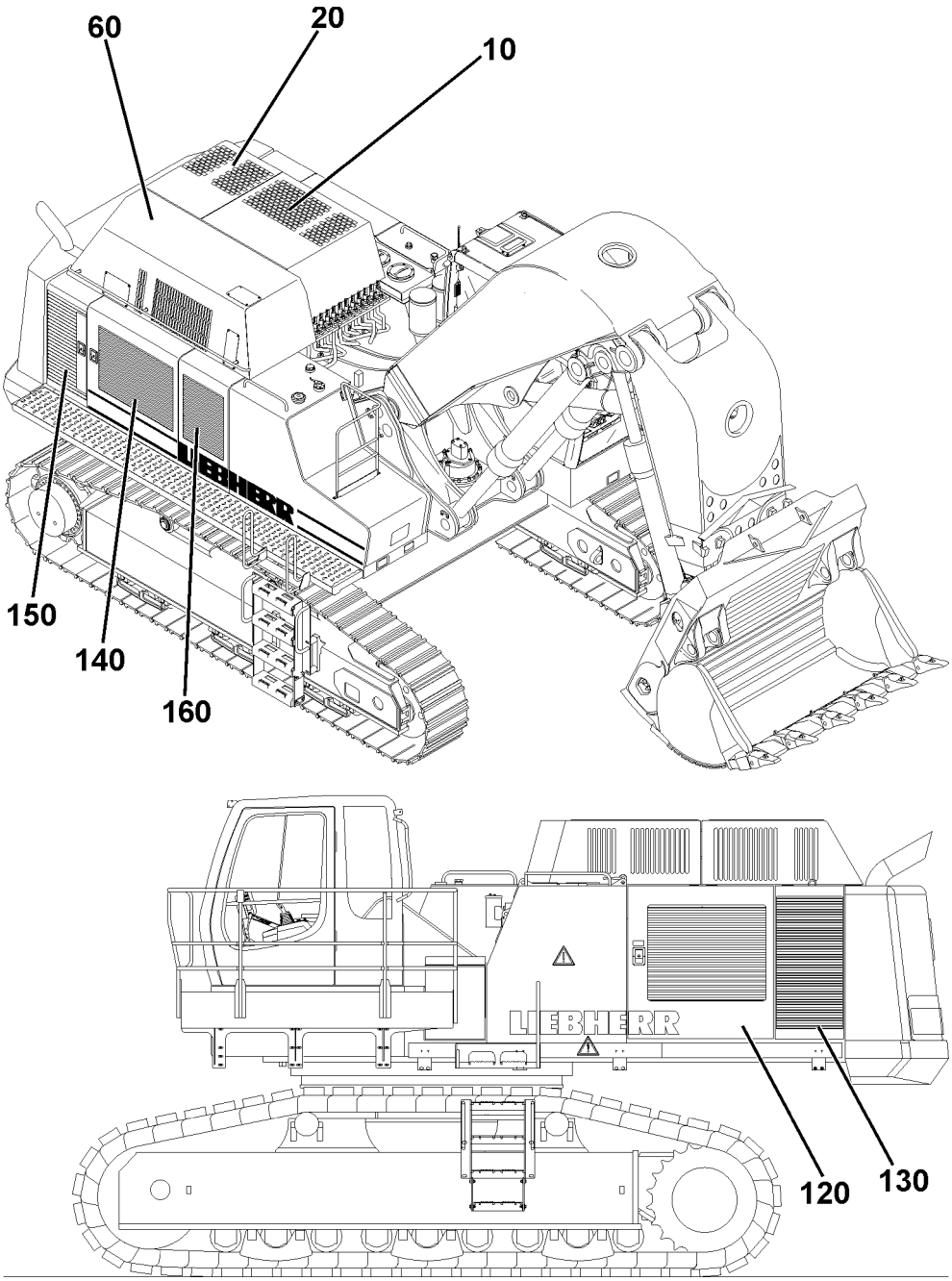

Fig. 5-1 *Access doors on the machine*

10	Engine cover	**130**	Side door, left
20	Engine cover	**140**	Side door, right
60	Radiator cover	**150**	Side door, right
120	Side door, left	**160**	Side door, right

The machine has 8 access doors for maintenance. The locks integrated in the han-

dles must be unlocked before starting to drive.

Caution!
Access doors can close accidentally and trap the operator or maintenance personnel.

▶ When you have opened the access doors, latch them using the retainer.

Access door	Lock	Access to:
Engine cover	Gas pressure spring, auxiliary mechanical retainer	– Diesel engine
Radiator cover	Gas pressure spring	– Radiator
Side door, left	Mechanical retainer	– Hydraulic pumps – Control oil unit – Electrics box E50 – Dry air filter
Side door, right	Mechanical retainer	– Radiator – Batteries – Main battery switch

Tab. 5-1 *Access doors*

5.2.2 Door lock

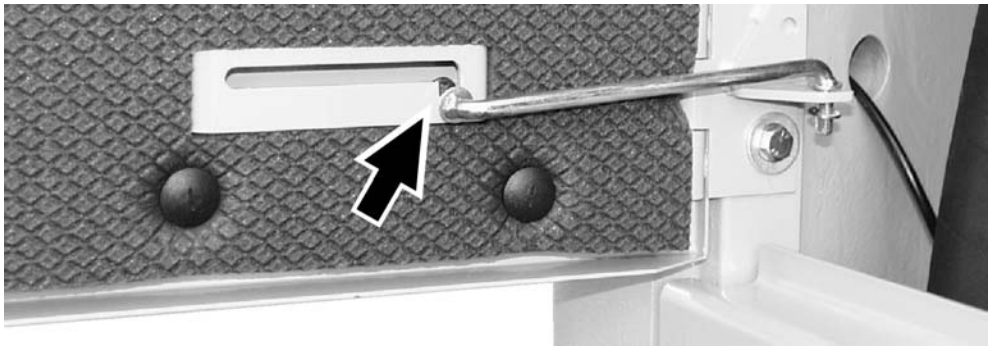

Fig. 5-2 *Door lock*

▶ To stop the access doors from moving unintentionally (eg. due to wind), open them fully and allow the door lock (see arrow) to latch in.

5.3 Lubricating and operating materials

5.3.1 General information on changing lubricating and operating

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materials

Note
The quantities given in the lubrication and operating material chart and on the lubrication chart in the cab are only guide values.

▶ After each oil change or refill, check the level in the relevant unit.

Note!
Adhering to regulations for lubrication, level checks and operating material changes guarantees a high degree of reliability and a long service life for the machine.
It is particularly important to adhere to the intervals for oil changes and use the lubricant quality indicated.

Note!
Cleanliness is of the utmost importance when changing oil.

▶ Clean all filler plugs, filler covers and drain plugs and their surroundings before opening.

▶ For preference, drain off oil when it is at operating temperature.

▶ Ensure that old oils are collected and disposed of in an environmentally acceptable manner using the removable oil filter cartridges.

Danger!
When checking and changing lubrication and operating materials, ensure that the following precautions are adhered to:

▶ Unless otherwise indicated, carry out all work on the machine on level, solid ground and with the engine switched off.

▶ Whenever you reach into the engine compartment, always secure the cover and side doors against accidentally falling back or closing.

▶ Only refuel the machine when the engine is switched off, do not smoke and avoid naked flame.

▶ Turn the main battery switch to position **0** (off) and remove the ignition key.

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5.3.2 Lubrication chart

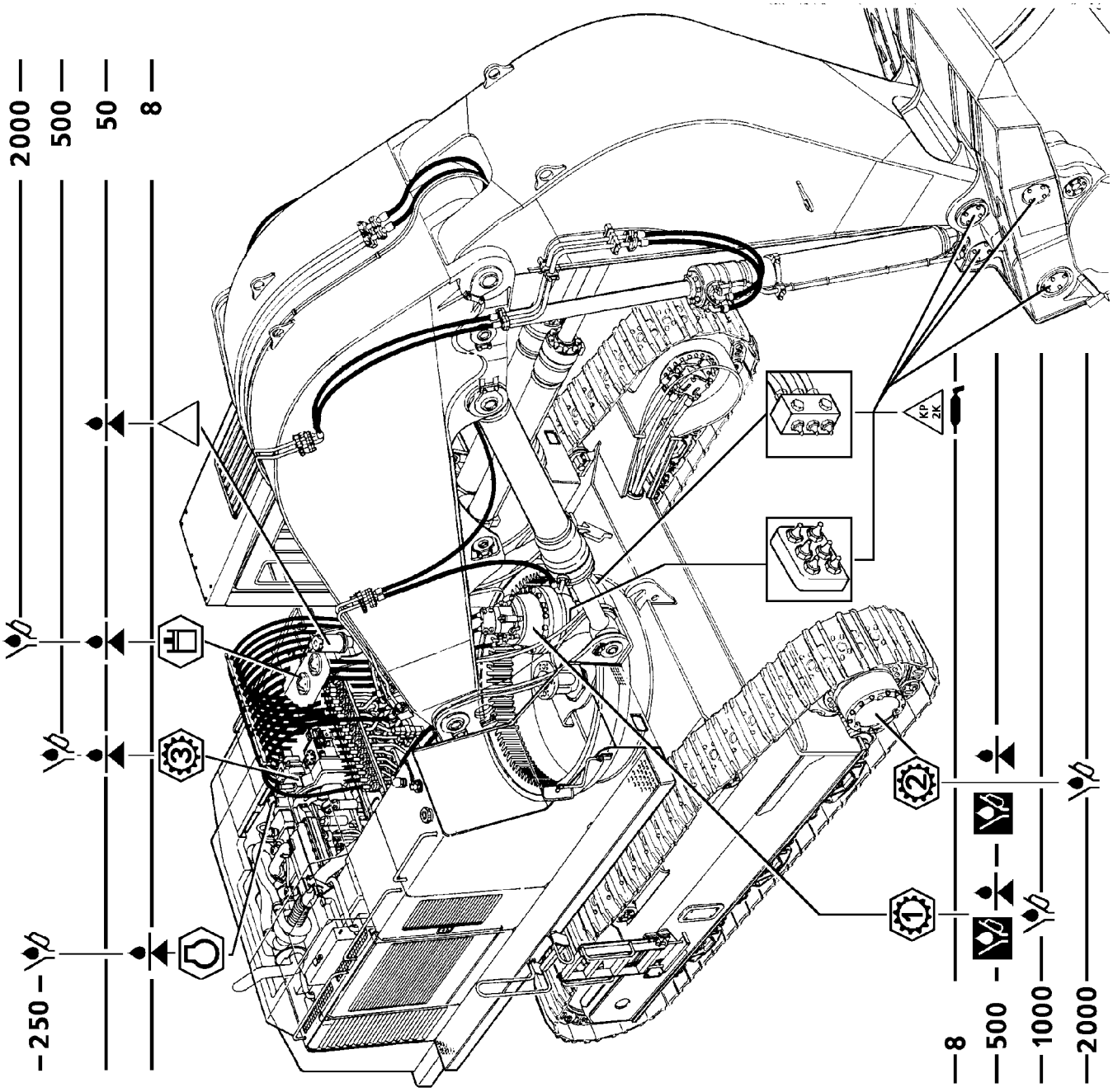

Fig. 5-3 *Lubrication chart - R 984 C-Litronic*

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5.3.3 Lubricant chart

Designation	Medium	Symbol	Classification	Viscosity	CI *	Quantity (litres)**
Diesel engine	Engine oil		**See the Operation and Maintenance Manual for CUMMINS engine**			58 l
Hydraulic tank	Engine oil		API-CD, CD + SF ACEA E1, E3 CCMC D4, D5 Mercedes Benz 226 et 227 227.5, 228.1 and 228.3	SAE 10W SAE 10W-30 SAE 10W-40 SAE 15W-40 SAE 20W-20 SAE 30W	EO 10 EO 1030 EO 1040 EO 1540 EO 20 EO 30	880 l
Swing gear (as parking brake)	Transmission oil		API-GL-5 MIL-L 2105 B, C or D	SAE 90	GO 90	31 l
Swing gear (as positioning swing brake)	Transmission oil		API-GL-5 MIL-L 2104 C or D MIL-L 2105 B	SAE 90 LS	GO 90 LS	
Travel gear	Transmission oil		API-GL-5 MIL-L 2105 B, C or D	SAE 90	GO 90	2 x 20 l
Splitterbox	Transmission oil		API-GL-5 MIL-L 2105 B, C or D	SAE 90	GO 90	14,5 l
Tracks and corresponding gearing of swing ring, equipment mounting	Lubricating grease		High pressure grease KP2k or EP2	Consistency 2 NLGI Class	MPG-A	-
Hinges, joints, locks	Engine oil	-	-	-	-	-
Rubber seal on doors and trim panels	Silicon spray or talc	-	-	-	-	-

Tab. 5-2 *Lubricant chart*

*CI = regulation lubricant for construction machines and vehicles according to the national German construction industry federation (see brochures in Bauverlag GmbH – Wiesbaden and Berlin, Notes on lubrication and operating materials charts).

** = Guide values

5.3.4 Operating material chart

Designation	Medium	Symbol	Quantity (litres)*
Fuel tank	**See the Operation and Maintenance Manual for CUMMINS engine**		1580 l
Coolant	**See the Operation and Maintenance Manual for CUMMINS engine**		88 l
Windscreen washing system	Commercially available windscreen washing fluid or methylated alcohol	-	3,5 l
Air conditioning system refrigerant	R 134 a	-	1,9 kg
Refrigerant oil in A/C compressor	PLANETELF PAG SP 20	-	0,21 l

Tab. 5-3 *Operating material chart*

* = Guide values

5.4 Lubricating and operating material specifications

5.4.1 Lubrication oil for the diesel engine

See the Operation and Maintenance Manual for CUMMINS Engine

5.4.2 Fuel

See the Operation and Maintenance Manual for CUMMINS Engine

5.4.3 Hydraulic oil

Mineral oil

Engine oils corresponding to the following specifications and regulations are stipulated:

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Single-grade oils:	API - CD / ACEA - E1 Mercedes-Benz regulations, sheet no. 226.0 and 227.0
Multigrade oils	API - CD + SF / ACEA - E3 Mercedes-Benz regulations, sheet no. 227.5, 228.1 and 228.3

Tab. 5-4 *Stipulated engine oils for use as hydraulic oil*

The engine oil for use as a hydraulic oil can be selected according to the following graphic.

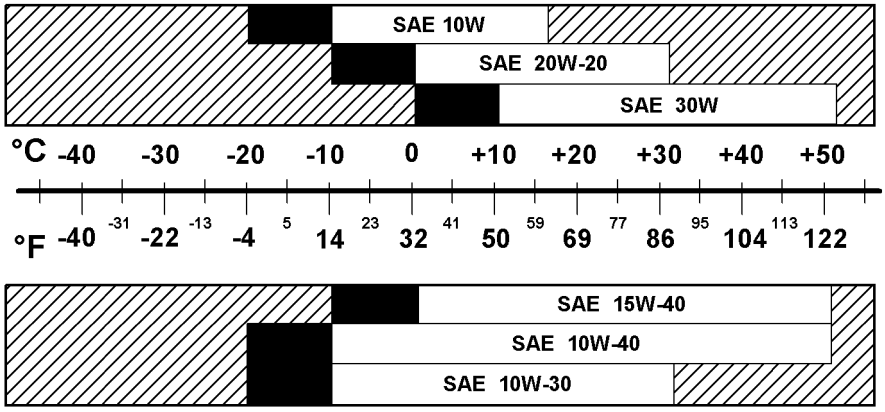

Fig. 5-4 *Engine oils for use as hydraulic oil*

Warm-up specification

At temperatures up to 10 °C below the given limit (black bar), the following warm-up specification applies:

Only adjust the diesel engine after starting to approx. 1 / 2 rated speed. Operate the hydraulic cylinder and motors, move cylinder briefly to the stop. Warm-up duration approx. 10 minutes.

At even lower temperatures: Prewarm the oil reservoir before starting the engine.

Environmentally acceptable hydraulic oils

Note!
Mixing environmentally acceptable hydraulic oils made by different manufacturers and mixing mineral oils with them should be avoided at all times.

The environmentally acceptable hydraulic oils recommended by LIEBHERR are limited to oils with a synthetic ester basis with a viscosity equivalent to ISO VG 46.

The initial oil fill is carried out at the works using an approved list. Any use of an environmentally acceptable hydraulic oil must first be agreed with LIEBHERR.

Plant-based oils are not to be used due to their insufficient temperature properties.

The use of partial flow filters is required.

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Hydraulic oil monitoring

Note!
Environmentally acceptable hydraulic fluids should generally **be checked** at regular intervals by oil analysis.
Oil analysis is recommended for mineral oils.

- Machines in normal use: at least every 500 operating hours
- Machines in heavy dust use: at least every 250 operating hours

LIEBHERR recommends that oil analyses be carried out by the company WEAR CHECK and that oil changes are performed on the basis of the lab report (see also customer service and product information).

Hydraulic oil monitoring

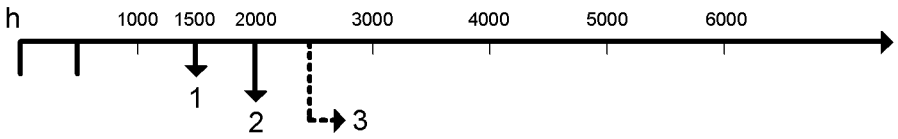

Fig. 5-5 *Taking an oil sample in normal use*

h	Operating hours	2	Second oil sample
1	First oil sample	3	Further oil samples every 500 operating hours

Oil change according to analysis and lab report.

Change intervals for hydraulic oil return-line filter (20.5 µm): initially after 500 operating hours, further changes every 1000 operating hours.

Notes on reducing hydraulic oil contamination in heavy dust use

If the machine is generally operated with the hydraulic hammer, or is used under similar circumstances (heavy dust occurrence), there is a risk that the hydraulic oil will become more than usually contaminated.

To prevent early wear of hydraulic components, the oil change intervals (and intervals between oil samples) should be reduced and the following regulations should also be noted:

– The filter cartridge(s) must be replaced every 500 operating hours.
– For the return-line filter, 10 µm filter cartridges must be used instead of the usual 20 / 5 µm filter cartridges.
– The vent filter on the hydraulic tank is to be replaced with a 2 µm fine filter (fineness of standard filter is 7 µm).
– The 2 µm vent filter must be replaced each time the hydraulic oil is changed (every 500 operating hours).

Note!
Machines fitted with a hydraulic hammer at the works and retrofitted hydraulic hammer kits possess these 10-µm filter cartridges and 2-µm vent filters.

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5.4.4 Transmission oil

Transmission oils must correspond to the specifications

– API-GL-5 and MIL-L-2105 B or C or D for viscosity class SAE 90

.

For viscosity classes SAE 80 and SAE 90 in accordance with MIL-L-2105 D, an oil of viscosity class SAE 80W90 can be used.

5.4.5 Lubricating grease and other lubricants

Lubricant	Description / manufacturer
Lubricating grease for the slewing ring / general oiling points 	The grease must correspond with the specification **KP2k**, consistency 2 or NLGI grade in accordance with DIN 51818 and DIN 51825 or EP 2 in accordance with NF-T-60 132. The grease must consist of a lithium complex and have a four ball tester value of at least 2300 N in accordance with DIN 51350 and ASTM D 2596.
Contact spray for slip rings	Cramolin
Lubricant for pistons, piston nuts and piston bearing installations on the hydraulic cylinders	Gleitmo 800
Special anti-corrosive material for installation areas of sealingelements on hydraulic cylinders	Castrol-Tarp
Anti-corrosion grease for open piston rods (cylinders that do not move often or transportation)	Liebherr special grease CTK

Tab. 5-5 *Lubricating grease and other lubricants*

5.4.6 Coolant

See the Operation and Maintenance Manual for CUMMINS Engine

5.5 Diesel engine

Refer to the CUMMINS Operation and Maintenance Manual for detailed description of maintenance work to be performed.

In addition, accurately observe the following items and perform all maintenance work according to the intervals given in the maintenance schedule.

5.5.1 Check air filter for contamination

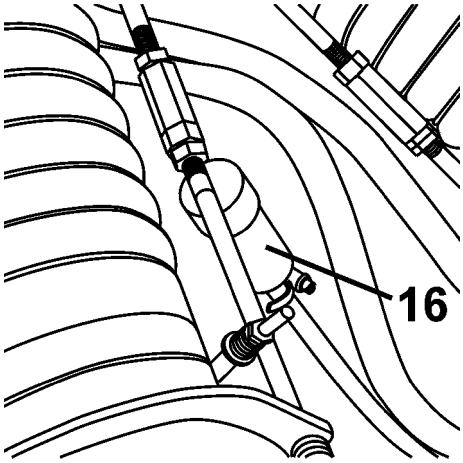

Fig. 5-6 *Air filter for contamination*

Check the dry air filter on side of the Diesel engine to determine the degree of contamination.

When the maximum permissible depression has been reached, a red stripe will appear in the inspection port of the maintenance indicator **16** and the filter must be serviced.

5.5.2 Checking the oil level in the diesel engine

Danger!
Risk of burning.
The engine oil is hot when it is at operating temperate.

▶ Avoid contact with hot oil and components containing oil, since it could cause severe burns.

❑ The machine must be standing level.

▶ Switch off the engine.

▶ Wait for a few minutes for the oil to collect in the oil pan.

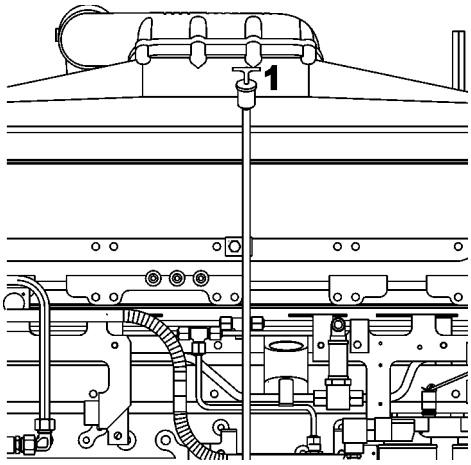

Fig. 5-7 *Oil level markings on the dipstick*

▶ Check the oil level in the engine.

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↳ The oil must be between the **min** and **max** marks on the dipstick 1.

5.5.3 Changing the diesel engine oil

Note!

▶ Only carry out the oil change when the engine is warm.

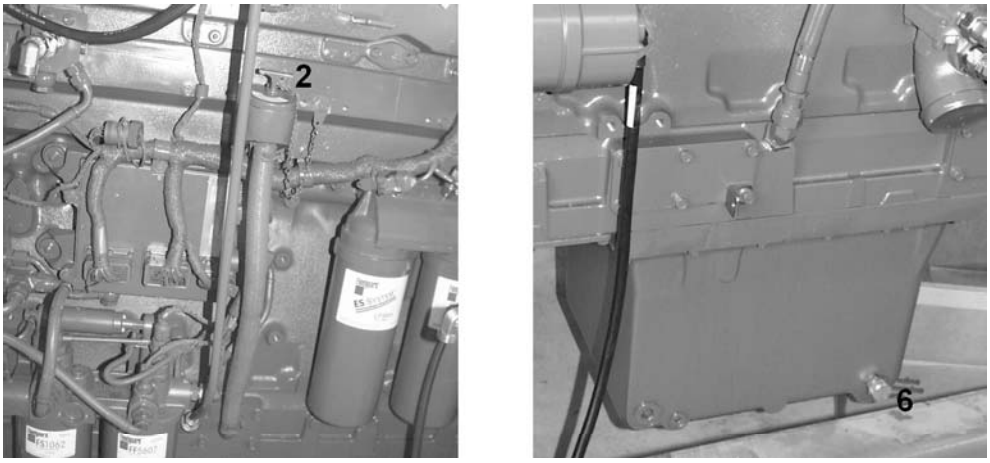

Fig. 5-8 *Filler neck **2** and drain **6***

To drain the oil :

▶ Drain the engine oil sump.

▶ Bring the engine to operating temperature.

▶ The oil is drained via the drain valve **6** on the oil pan of the Diesel engine.

▶ Remove the cap of the drain valve **6**, attach the drain hose (supplied in the tool-box) to the drain valve and drain the oil into a suitable container.

▶ Remove the hose, reinstall the cap on the drain valve and add oil via the filler neck 2.

To change the oil filter elements :

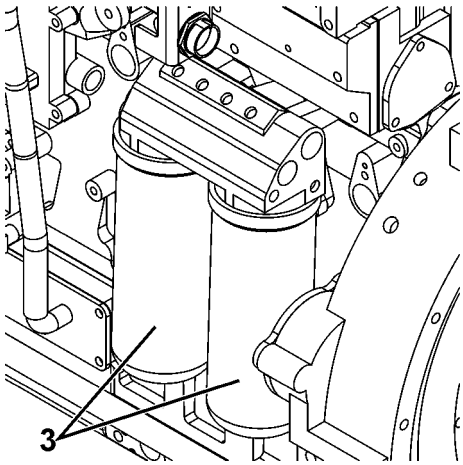

Fig. 5-9 *Oil filter elements*

- Unscrew and remove the 2 filter elements, pos. **3**.
- Each filter element is a combination oil filter comprising a full flow element and a by-pass element

Danger!
Risk of burning.

- When removing the engine oil filters, be careful to avoid contact with hot oil, it could cause severe burns.

- Clean the sealing surfaces on the filter mounts.
- Lightly lubricate the rubber seal on the new filters with oil.
- Install and tighten the filters with both hands (see also enclosed CUMMINS engine operation and maintenance manual).
- Check after every oil change or after adding oil to ensure that the oil level has reached the upper mark on dipstick **1**.

5.5.4 Refill the engine oil sump

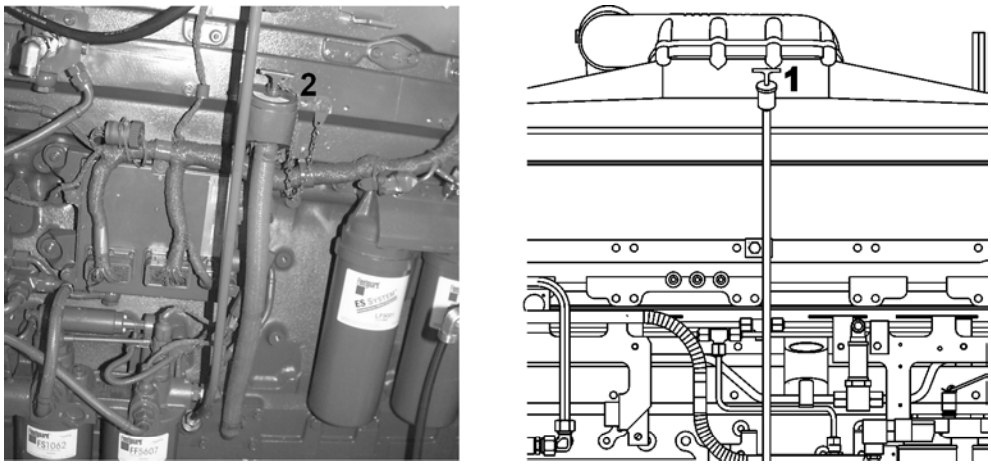

Fig. 5-10 *Filler neck and dipstick*

Refill via the filler neck **2**,

- Until the max. mark is reached on dipstick **1**.
- For oil quantities, oil specifications and oil change intervals, see lubrication and maintenance charts.

Note!
To extend the oil change interval, it is advised to use the chart method of CUMMINS.

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5.5.5 Engine and splitterbox mounting screws

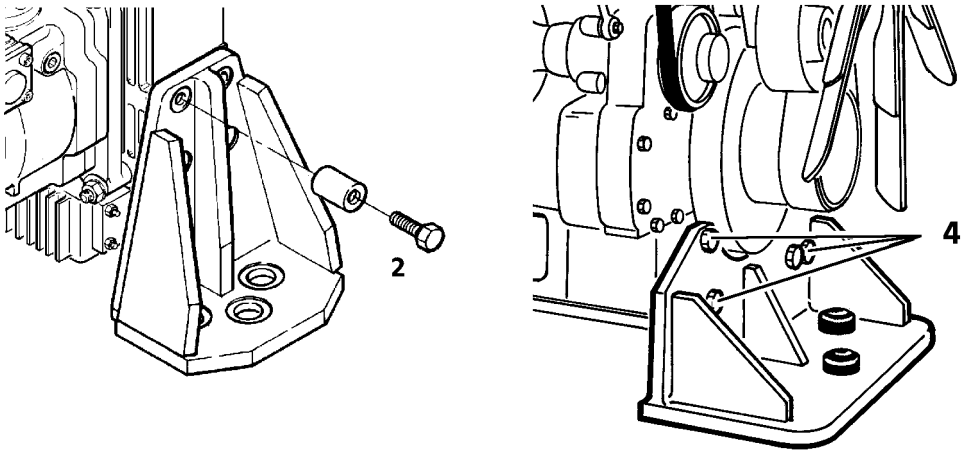

Fig. 5-11 *Engine mounting screws*

Check the mounting screws **2** and **4** on the engine brackets and the engine gear mounts regularly for tightness, retorque if necessary.

Tightening torque for screws **2** : 310 Nm (230 ft. lbs.)

Tightening torque for screws **4** : 203 Nm (150 ft. lbs.)

5.5.6 Splitterbox mounting screws

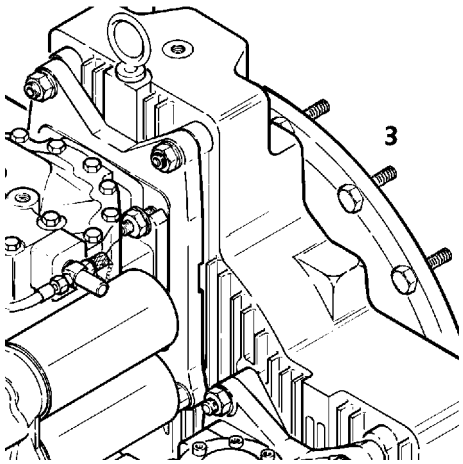

Fig. 5-12 *Splitterbox mounting screws*

Check the tightness of mounting screws **3** from the splitterbox to the Diesel engine SAE housing regularly. Retorque if necessary.

Tightening torque for screws **3** : 140 Nm (103 ft. lbs.)

For maintenance intervals, see maintenance schedule.

5.5.7 Belt for the alternator of the Diesel engine

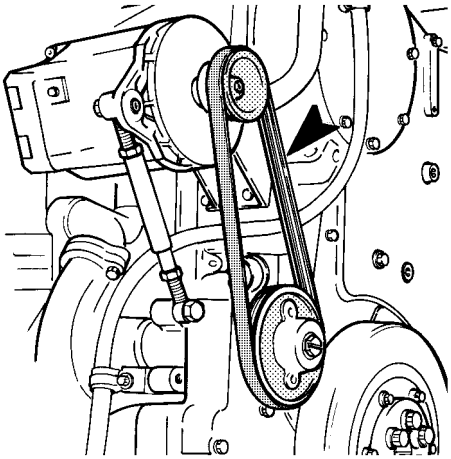

Fig. 5-13 *Belt*

Please refers to the enclosed CUMMINS Operation and Maintenance Manual.

5.6 Monitoring system of the Diesel engine (QSK system)

5.6.1 Indicator lights H60, H61 and H62

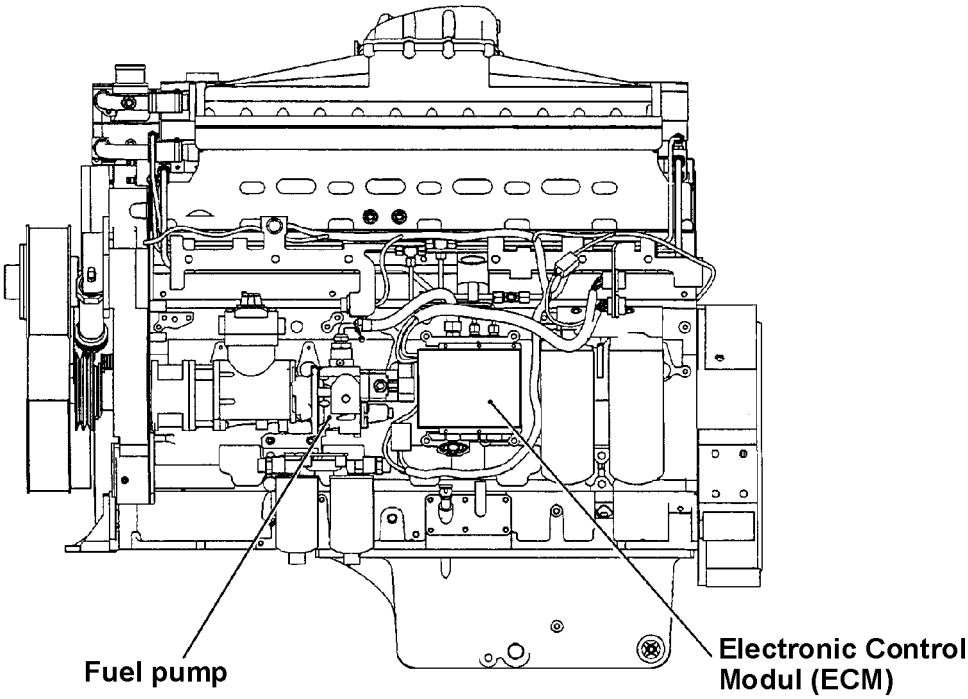

Fig. 5-14 *QSK system*

All the troubles appearing on the Diesel engine or in its monitoring circuit are centrally indicated via the 3 indicator lights **H60**, **H61** and **H62**.

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These 3 control lights are connected to the **ECM** (Electronic Control Modul) of the QSK system, which is mounted to the engine, next to the fuel pump.

Appart from its monitoring function, the QSK fuel system has been designed to control the engine speed and fuel pressure so to optimise the exhaust emissions.

The red indicator light STOP **H60** lights up when an important fault which could cause serious engine damage is detected.

For the other faults, the monitoring system protects the engine while reducing its power or RPM.

Also in this case, the engine has to be brought to low idle and stopped in a safe manner as soon as possible.

Afterwards recognize the detected error(s) using the diagnostic switches **S136** and **S82**.

Depending on the kind and the severity of the recognized trouble, the system may cause automatic engine shutdown, power or speed derating.

The yellow indicator light WARNING **H61** indicates an engine error which does not necessitate an immediate engine shutdown.

Recognize the detected error using the diagnostic switches, after stopping the engine.

Get the cause of the problem remedied as soon as is convenient regarding the cause of the problem.

The detected error can result in a power loss.

The red indicator light PROTECTION **H62** shows that any parameter supervised by the system has come out of its normal operation range.

The engine is automatically stopped by the monitoring system in case one of the following troubles is detected :

– Low engine oil pressure.
– High coolant temperature.
– Low engine coolant pressure.
– High intake air manifold temperature.

For some other parameters the monitoring system achieves protection by derating the engine speed or the corresponding torque.

The engine may be kept in operation temporarily (eventually the engine power is reduced by the monitoring system), the problem must be diagnosed via the switches **S136** and **S82**.

Automatic torque derate will happen in case one of the following troubles is detected :

– High fuel temperature.
– High blowby pressure (= pressure in crankcase housing).
– Low coolant pressure (first stage), also causes speed derate.
– Low oil pressure (first stage).
– High coolant temperature (first stage).
– High intake air manifold temperature (first stage).

5.6.2 Diagnostic switches S82 and S136 for engine monitoring

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system

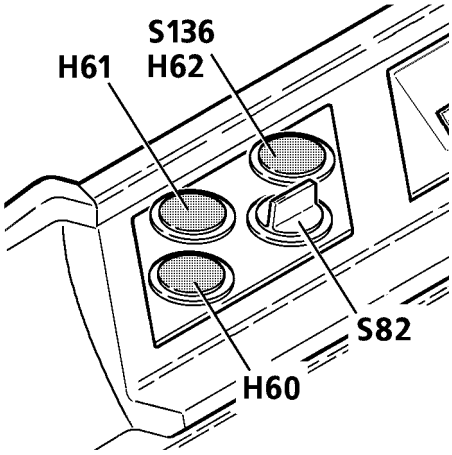

Fig. 5-15 *Diagnostic switches*

These switches permit to recognize the faults which are detected by the engine monitoring system (Electronic Control Modul). These faults are connected to the centralized warning lights **H60**, **H61** and **H62** of the control desk.

There are two types of fault codes :

– the engine electronic system fault code which will light up the indicator lights **H60** and **H61**.
– the engine protection system fault codes which will light up the indicator lights **H62**.

All faults codes recorded will either be active (fault code is presently actice on the engine) or inactive (fault code was active at some time, but is not presently active).

All active fault codes can be diagnosed as described below using both lamps **H60** and **H61**.

Inactive fault codes can only be viewed with the optional equipment "Insite".

Diagnostic of the detected faults using the switches S82 and S136

If an indicator light **H60**, **H61** and **H62** is lighting, proceed as follows to recognize the detected errors :

▶ turn the ignition key to "OFF" then to "contact" position,

▶ depress the switch **S136** to position "ON",

▶ the indicator lamp **H62** inside the switch lights up.

If no active fault codes are recorded, all three lights will come on and stay on.

If no active fault codes are recorded, all three lights will come on momentarily, and then ...

▶ first the yellow lamp **H61** will flash one time,

▶ then the red indicator light **H60** will blink, the sequence of blinking corresponds to the code of the error detected by the system.

▶ Between two consecutive blinking sequences for indication of fault code, the yellow light **H61** comes on. Also see the section "Diagnostic fault codes" and the chart for diagnostic fault codes in the CUMMINS operation and maintenance manual.

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- The sequence is repeated as long as the switch **S136** remains on "ON" position, the yellow indicator light **H61** goes briefly on between two consecutive flashing sequences.
- Remaining errors which are still detected can be recognized on the same way, using the rotary switch **S82**.
- Briefly turning the switch **S82** to the right "INC" causes the blinking sequence of the error with the code directly above to be displayed on indicator light **H60**, turning briefly **S82** to the left "DEC" will display the error with the code directly below.

5.7 Cooling system

5.7.1 Checking and cleaning the cooling system

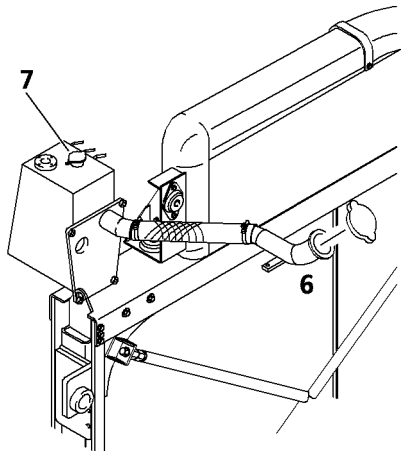

Fig. 5-16 *Expansion tank*

Optimal cooling can only be achieved when the cooler is kept clean.

- Check the engine, fan and cooler for damage and clean if necessary.
- If the safety valve of the cooling system in the radiator cap **6** of the expansion tank **7** is leaking, replace the cap.
- Regularly check the connector hoses between the radiator and the engine, as well as the heater hoses for condition and leaks.
- Check the tightness of hose clamps.

5.7.2 Checking the coolant level

Danger!
Risk of burning due to hot coolant.
The engine cooling system is hot and pressurized when at operating temperature.

- Avoid touching coolant or coolant-bearing parts.
- Only check the coolant level when the engine has cooled sufficiently.

- Turn the cover **6** a half turn.

▶ Relieve any pressure that may be present in this position. After balancing the pressure, slowly turn fully.

The coolant must always be visible in the filling eye (arrow).

▶ Add coolant if necessary.

▶ Close the lid.

▶ After adding coolant, allow the engine to run for a short time with the heating switched on and monitor the coolant level once again.

5.7.3 Coolant antifreeze and anti-corrosion fluid

The system must be filled with antifreeze all year round.

Upon dispatch, the coolant contains antifreeze for temperatures up to -35 °C (this is equal to approx. 50 % antifreeze).

Volume: see lubricant chart

▶ Keep the concentration of anti-corrosion additive contained in the cooling system constant, particularly when refilling.

▶ Check this concentration each time larger amounts of coolant are lost or at regular intervals. If necessary, add anti-corrosion additives to the coolant.

▶ If, however, no coolant is lost, only change the coolant filter regularly.

5.7.4 Changing the coolant

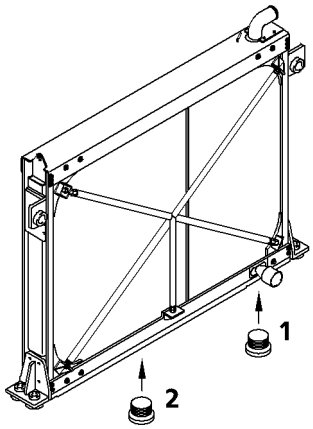

Fig. 5-17 *The drain plug on the radiator*

Danger!
Risk of burning due to hot coolant.

▶ Only change the coolant when the engine is cold.

The following point should be noted when changing the coolant:

– Change the coolant in the entire coolant circuit at least every two years.

Pos. **1** shows the drain plug on the radiator.

For procedure to drain and to refill the cooling circuit, refer to the attached operation and maintenance manual for the CUMMINS engine.

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Important!
When adding coolant, make sure that the expansion tank is filled all the way to the top of the fitting, add coolant until the level does no longer drop (it is not possible to overfill the tank if the pressure relief valve **7** is not removed).

5.7.5 Changing the water filter

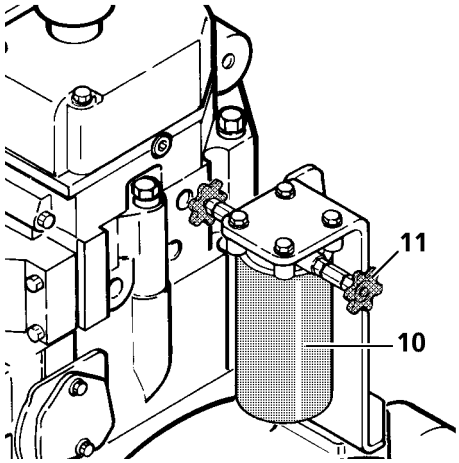

Fig. 5-18 *Water filter*

The water filter contains paste-like corrosion inhibitors which ensure the adequate corrosion protection of the coolant.

The water filter **10** must be replaced every 250 working hours.

- ▶ Close the shut-off valves **11** on the inlet and return lines,
- ▶ unscrew the used element,
- ▶ apply a light even coat of lubricating oil to the seal of the new element,
- ▶ install the new element, tighten until the seal touches the filter head.
- ▶ Tighten by hand an additional one-half to three-fourths turn (don't tighten using a tool as a filter wrench, ...),
- ▶ open the 2 shut-off valves **11**.

See also the attached operation and maintenance manual for the CUMMINS engine for further information.

5.8 Fuel system

Danger!
Risk of explosion!

- ▶ Avoid naked flame when working on the fuel system and when refuelling.
- ▶ Do not smoke.

5.8.1 Refuelling

Fuel cover

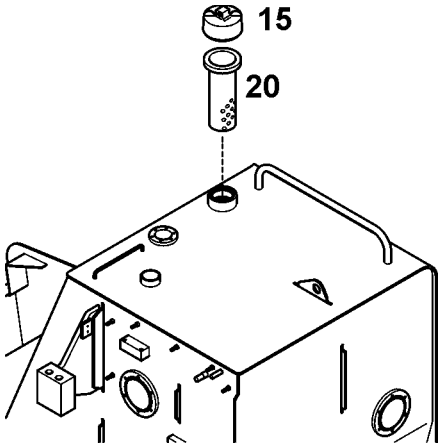

Fig. 5-19 *Fuel cover*

- Unscrew fuel cover **15**.
- Add fuel via the filter **20**.

5.8.2 Electrical refuelling pump (optional extra)

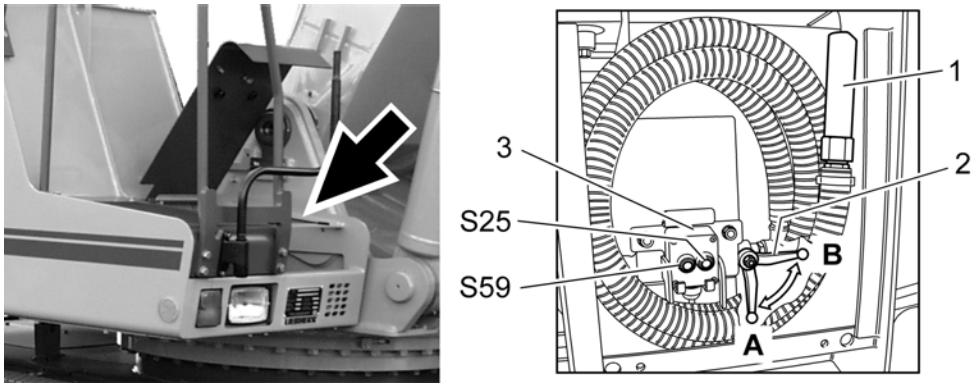

Fig. 5-20 *Electrical refuelling pump*

The electrical refuelling pump is used to put fuel into the machine's fuel tank.

It is located under the hatch on the front end of the hydraulic oil and fuel tank. The operating unit **3** is removable.

Proceed as follows when refuelling and stowing the hoses:

- Insert the free end of the intake hose **1** in the fuel supply tank.
- Open stop cock **2** (position **B**).
- Use switch **S25** (green) to switch on the refuelling pump in order to pump fuel into the machine's tank.
  - The pump switches off automatically as soon as the maximum fill level is reached.
  - The refuelling pump can be switched off at any time using switch **S59** (red).

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Caution!
The pump must not be permitted to run dry.

- ▶ Ensure that the fuel level does not drop below the intake level of the intake hose.

- ▶ Close stop cock **2** (position **A**).
- ▶ Ensure that no fuel remains in the intake hose **1** before stowing.
- ▶ Roll up the intake hose **1** and place it in the stowing compartment.
- ▶ Close the hatch again.

Draining the fuel tank

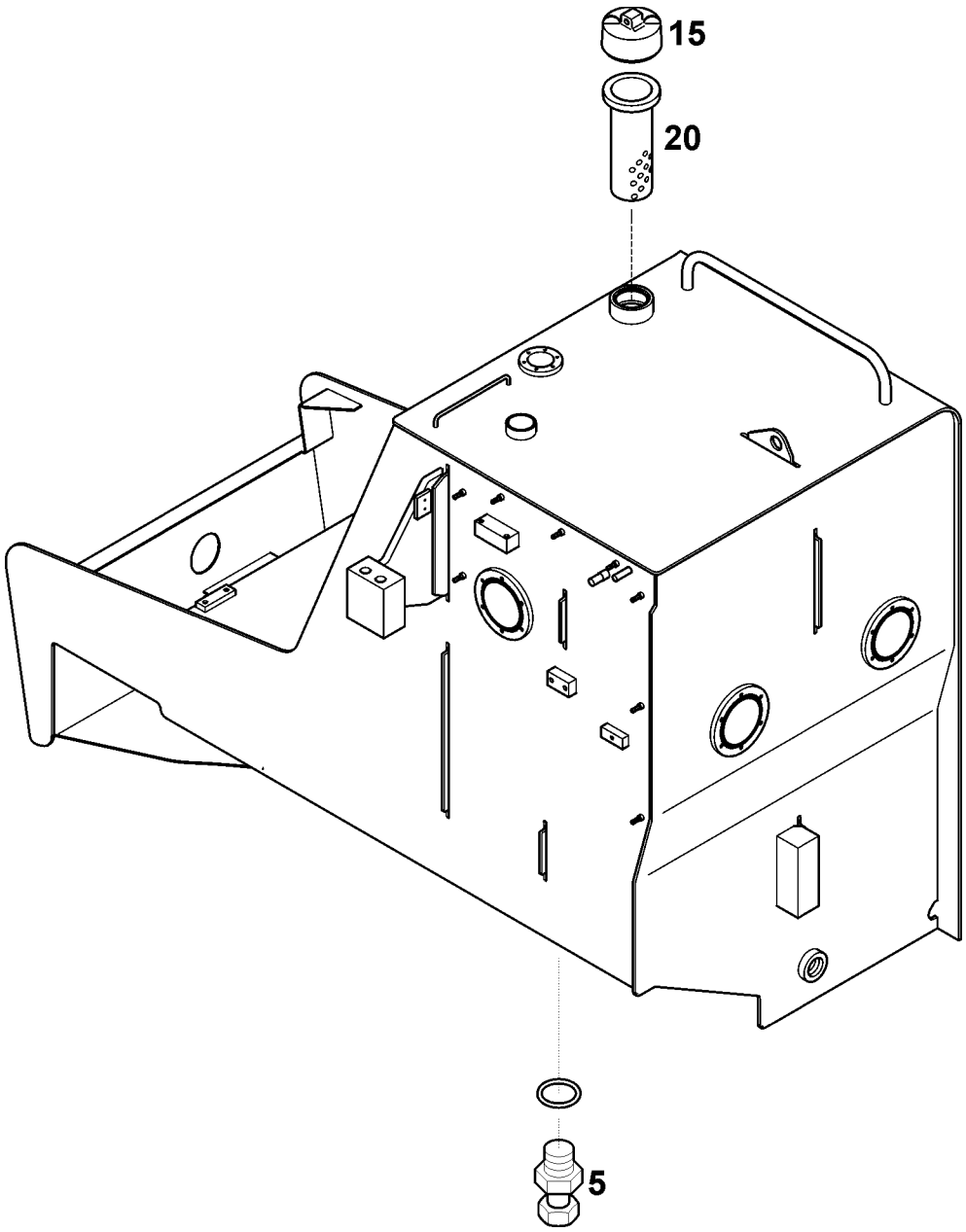

Fig. 5-21 *Draining the fuel tank*

To drain the water of the tank :

- ▶ Place a suitable container underneath.
- ▶ Unscrew the plug **5** about two turns.
- ▶ Then retighten the plug as soon as water free fuel flows out.
- ▶ Screw drain valve **28** closed again.

To drain the tank :

The fuel tank is equipped with a drain plug **5**.

- ▶ Place a suitable container underneath.
- ▶ To empty the tank remove the cover **4** and the drain plug **5**.

Regularly check the tank and filter **6** for contamination. If necessary, replace the fuel filter **6** and / or flush the fuel tank.

5.8.3 Check fuel system / fuel level

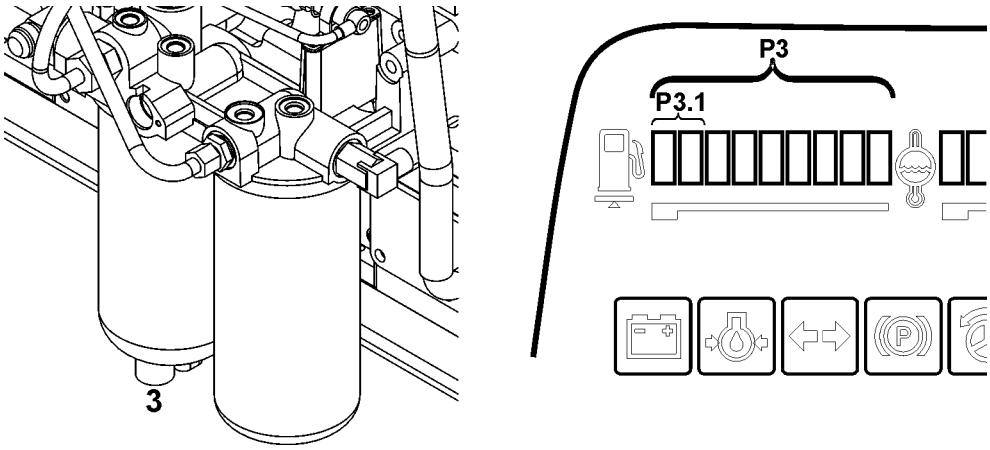

Fig. 5-22 *Fuel filter*

The condensation in the fuel system and fuel tank must be checked daily.

Turn the plug **3** on the water separator of the filters.

Drain the condensation until the fuel drains off and retighten the plug.

Under ideal operating conditions, this interval may be extended to one week.

Check the fuel gauge **P3** on the monitoring display before starting to work.

If the reds diodes **P3.1** on the left of the indicator **P3** lights up, only a little reserve of fuel remains in the tank.

Refill the tank, if the fuel level is low.

Notice!
Since a high fuel level in tank reduces condensation inside the tank, the refuelling should be done preferably at the end of the working day.

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5.8.4 Drain the water separator of the fuel filters

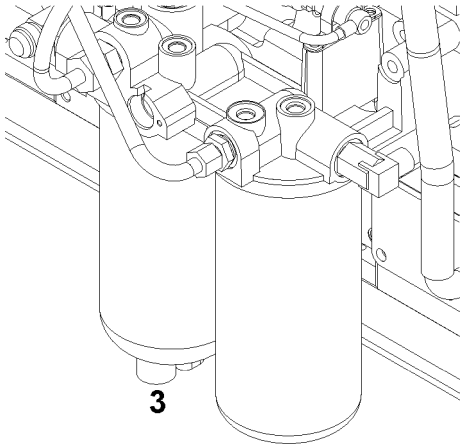

Fig. 5-23 *Water separator of the fuel filters*

Drain the contaminant from the fuel system daily.

- ▶ Open the drain plugs **3** of the filter elements,
- ▶ drain the water until fuel emerges,
- ▶ then retighten the drain plugs.

For other maintenance works on the fuel system refer to the Cummins Operation and Maintenance Manual.

5.9 Air system

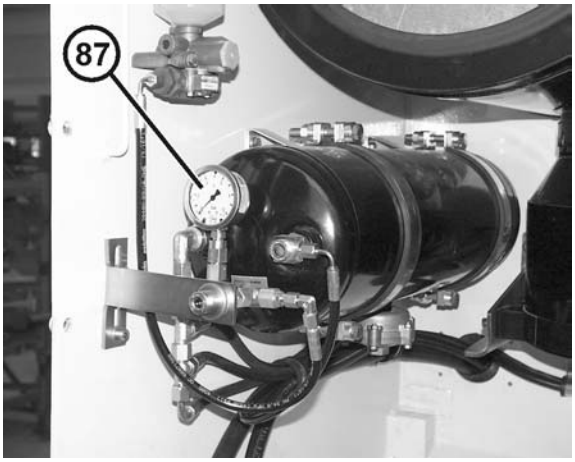

Fig. 5-24 *Air pressure gauge*

While working, the white pointer of the air pressure gauge **87** must read between 6,2 and 7,2 bar (90 - 105 PSI).

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5.9.1 Air pressure regulator and compressor

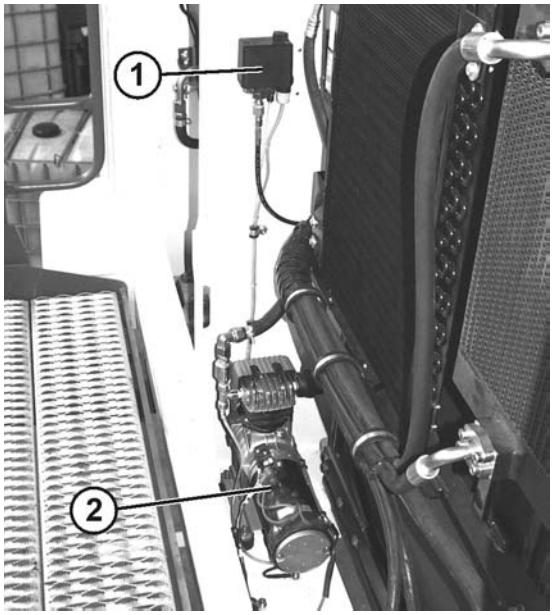

Fig. 5-25 *Air pressure regulator and compressor*

Listen to pressure regulator **1**, at regular intervals it should unload and switch back to charging the compressor **2**.

To check this :

– run the Diesel engine at low idle,
– slowly lower the air pressure down to less then 6,2 bar (as example by actuating the air pressure gun).
– the pressure regulator must then switch the compressor on,
– when a pressure of 7,2 bar is reached, it must turn it off.

Check this every 500 operating hours. If necessary, adjust the regulator until both pressures are correct.

5.9.2 Antifreeze pump

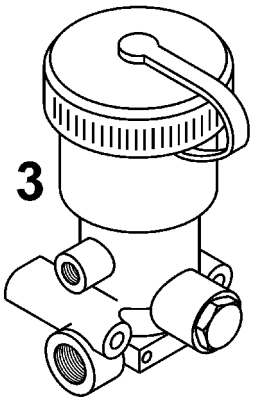

Fig. 5-26 *Antifreeze pump*

The antifreeze pump **3**, allows the compressed air system to work properly during the

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cold season.

Fill it with about .5 pt. (1/4 l) denatured alcohol.

Check alcohol level daily.

The antifreeze pump **3** injects 0,5 cm^3 of alcohol in the compressed air system every time the compressor turns on and off.

5.9.3 Drain the air tank

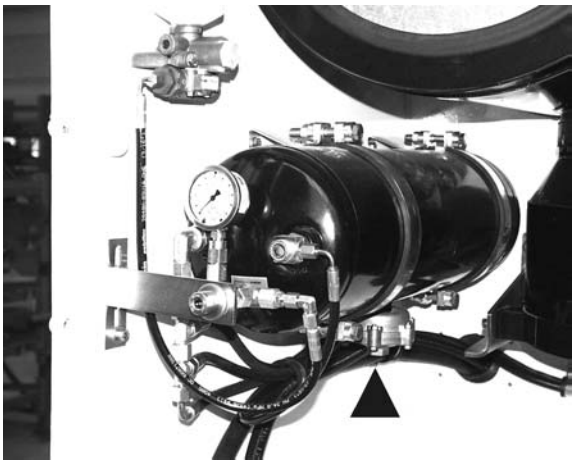

Fig. 5-27 *Drain valve*

Water in the air tank is automatically drained via the drain valve when the pressure in the system drops.

However, it is recommended to manually drain any remaining water from the air tank:

– during the summer, push the pin on the underside of the drain valve once a week,
– and during the winter months, push it once a day.

5.9.4 Air filter and air lubricator for central lubrication

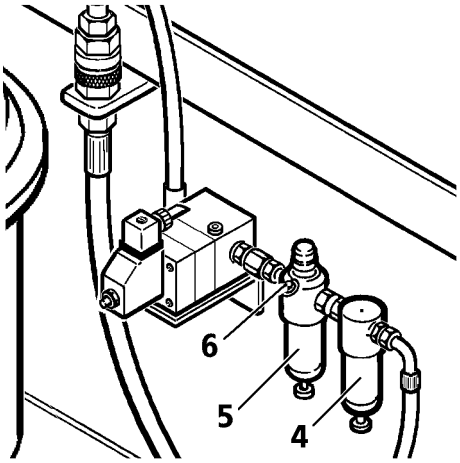

Fig. 5-28 *Air filter and lubricator*

The condensation and the impurities in the air filter **4** and in the lubricator must be drained weekly.

With the central lubricating in operation, turn the drain screw at the bottom of the transparent polycarbonate bowls from several turns.

If the polycarbonate bowls are dirty, stop the central lubrication, remove the bowls and clean them in a soapy solution.

If the element of the filter **4** clogged, replace it or clean it in alcohol.

Check the oil level in the lubricator weekly.

If necessary, remove the filter plug **6** and add oil (viscosity between SAE 10 and SAE 30) until the level is about 1 cm from the top of the transparent bowl.

5.10 Dry air filter

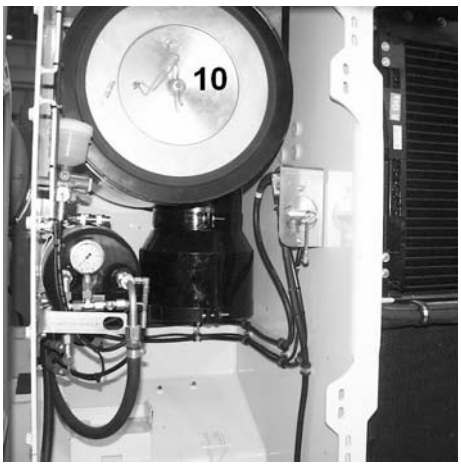

Fig. 5-29 *Dry air filter*

Maximum engine protection against early wear due to dust is only possible if the air filter is serviced at regular intervals.

The dry air filter is designed in such a way that it offers maximum protection and long maintenance intervals.

It is not recommended that filter elements be washed out for safety reasons.

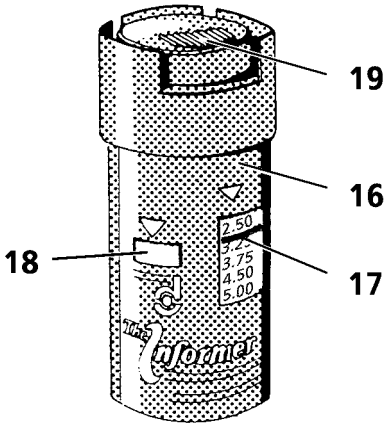

Fig. 5-30 *Vacuum gauge*

The vacuum gauge **9** stores the maximum intake low pressure reached on the filter

outlet while the diesel engine is operating.

The appearance of the red display strip in alarm window **18** indicates that the maximum permissible low pressure of 50 mbar has been reached.

- ▶ Replace the main element.
- ▶ Press the reset button **19** to clear the stored low pressure reading.
- ▶ Push the extractor slot on the dust discharge valve up by hand once a week to ensure that it does not stick due to humidity and dust.

5.10.1 Checking the air inlet hose

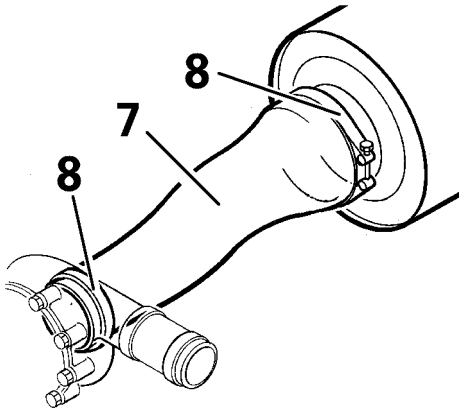

Fig. 5-31 *Air inlet hose*

The connection (pos. **7**), especially the air intake hoses between air cleaner, turbocharger, air exchanger (if mounted) and engine intake must be checked for damage and leaks whenever the filter elements are replaced.

If necessary, retighten the screws of the fixing clamps (pos. **8**).

5.10.2 Changing the primary filter element

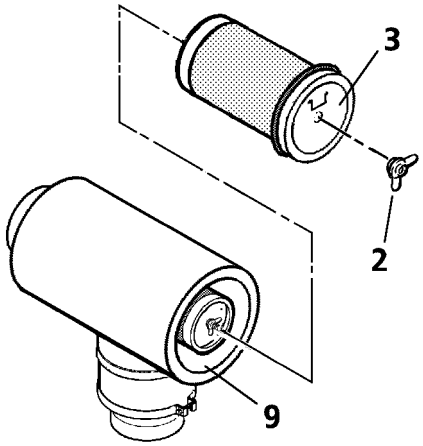

Fig. 5-32 *Changing the primary filter element*

Turn the engine off,

- ▶ remove the swing nut **2**,
- ▶ Carefully pull out the primary element **3**.
- ▶ Clean the inside of the filter housing **9** and the sealing surface with a damp rag.
- ▶ Do not direct compressed air into the housing.
- ▶ Insert the new element,
- ▶ make sure it is seated correctly,
- ▶ install and tighten the nut **2**.

5.10.3 Changing the safety element

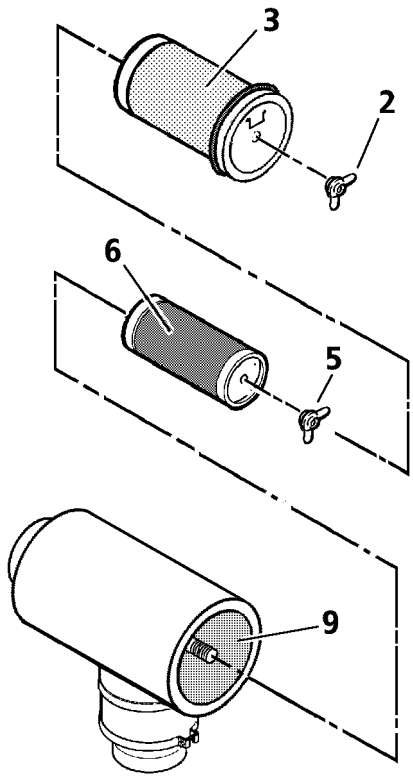

Fig. 5-33 *Changing the safety element*

Note!
Replace the safety element after replacing the main filter cartridge three times or at least once a year.
Replace the safety element immediately in the event that a visual check has shown that the safety element is very dirty.
This safety element should only be replaces by a LIEBHERR mechanic!

- ▶ Remove the main element as described before.
- ▶ Remove wing nut **5** and remove safety element **6**.
- ▶ Carefully clean the inside of the filter housing with a damp rag.

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- ▶ Clean the sealing surfaces and check for damage.
- ▶ Carefully insert the new safety element and reinstall wing nut **5**.
- ▶ Install the main filter element **3** as described on previous page and close filter housing.

5.11 Hydraulic system

Maintenance work on the hydraulic system is restricted mainly to the hydraulic tank.

All other units on the system do not require any special maintenance.

The pipe and hose network should be checked at regular intervals for leaks.

Note!
Strict cleanliness is of particular importance for the hydraulic system.

For this reason, the intervals given

– for changing the return-line filter
– for cleaning the oil cooler and
– for changing the oil must be adhered to.

5.11.1 Preparatory activities

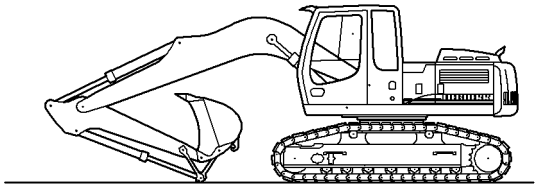

Fig. 5-34 *Machine position for checking the oil level of the hydraulic system*

When checking the oil level or refilling the oil:

– the machine must stand level,
– the work equipment must be laid down on even ground with the stanchion and tilt cylinder fully extended (bucket and stanchion fully tilted in),
– the support (shield or claw support if mounted) must also be extended.

5.11.2 Checking the oil level in the hydraulic tank

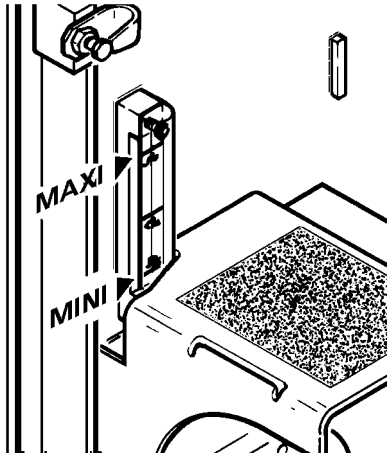

Fig. 5-35 *Hydraulic tank oil level*

When the machine is in the check position, the oil level may not drop below middle level on the sight gauge or oil must be added to the tank.

▶ If this is not the case, fill oil via the return-line filter until the level reaches the central level.

The level **MAXI** shows the maximum oil level if all cylinders are retracted.

The level **MINI** shows the minimum oil level if all cylinders are fully extended.

If the oil level drops below the level **MINI**, the symbol appears on screen when the lowest quantity is reached.

5.11.3 Depressurizing the hydraulic system

Danger!
A fine stream of liquid can penetrate the skin when under high pressure and cause serious injury.

▶ Before working on the hydraulic system, always remove the pressure.

▶ Do not inspect leaks with bare hands.

Note the following points:

❑ The machine must be in the position described above.

▶ Switch off the engine.

▶ Move the pilot control devices (joystick and pedals) in all directions (with the ignition key in the contact position).

Danger!
The hydraulic oil is hot when at operating temperature and could be pressurized.

▶ Do not allow the hot oil or oil-bearing parts to touch the skin.

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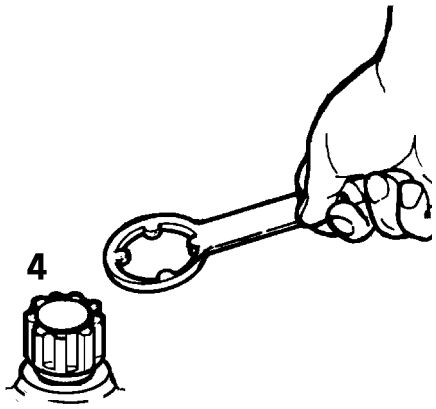

Fig. 5-36 Depressurizing the hydraulic system

▶ Unscrew the breather filter **4** only one turn.
↳ The hydraulic system will depressurize.

5.11.4 Emptying and refilling the hydraulic tank

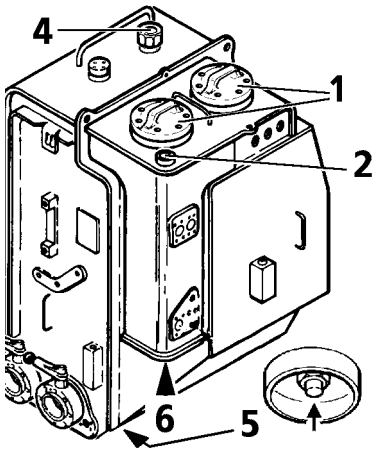

Fig. 5-37 Draining and refilling the hydraulic oil

1 Filter cover
2 Cover
4 Breather filter
5 Drain valve
6 Drain valve

▶ If possible, always fill and empty the hydraulic system using a filler unit.

To drain the oil:

❑ The hydraulic system must be depressurized.

▶ Unscrew the breather filter **4** by a maximum of one turn.
↳ The hydraulic system will depressurize.

▶ Remove the filter covers **1**.

▶ Screw the drain hose to the drain valve **5** and **6** on the collecting pipe and on the hydraulic tank and let the oil flow out into a suitable container.

To refill the hydraulic oil:

- Unscrew the breather filter **4** by a maximum of one turn.
  ↳ The hydraulic system will depressurize.
- Remove the filter covers **1**.
- Refill the oil through the filter cartridges until the level reaches precisely the central mark on the sight gauge.
- Tighten the breather filter **4**.
- Screw on the filter covers **1**.

Caution!

- After each hydraulic oil change, vent the hydraulic pumps.

To drain off condensate water (only for mineral oils):

- Drain off the condensate regularly.
- Place a suitable container underneath.
- Keep the drain hose on the drain valves **5** and **6** (siehe Fig. 5-37) until oil without water flows.

Intervals: see maintenance chart

5.11.5 Return-line filter

The return-line filter is located on the top of the hydraulic tank.

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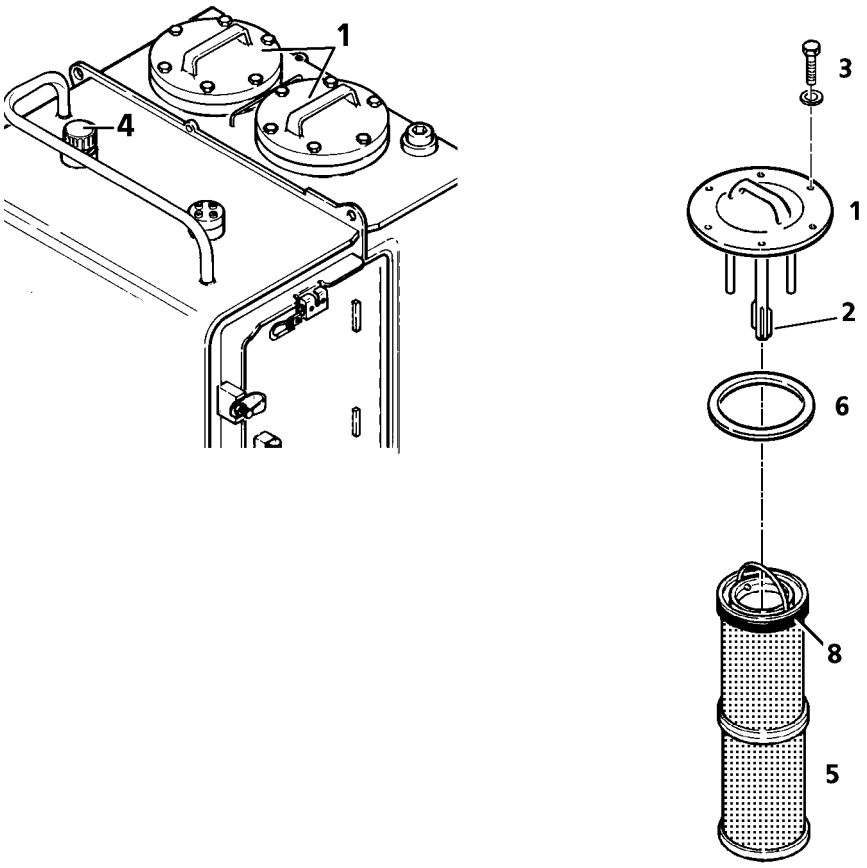

Fig. 5-38 *Return-line filter*

1	Cover	**5**	Filter element
2	Magnetic rod	**6**	sealr
3	Hexagonal screw	**8**	O-ring
4	Breather filter		

The magnetic rod **2** of the return-line filter must be cleaned at fixed intervals (see maintenance chart) and the filter element **5** replaced.

To clean the magnetic plug and replace the filter element:

❑ The hydraulic system must be depressurized.

▶ Unscrew the screws on the filter cover and lift out cover **1** and magnetic rod **2**.

▶ Carefully clean off any dirt sticking to the magnetic rod.

▶ Remove the used filter cartridge **5** on the bracket.

▶ Insert the new filter cartridge on the bracket vertically into the tank and press down lightly. Then lay the clamp to the side on the tank ring.

Caution!

▶ Ensure that the filter cartridge is standing vertical in the tank and that the O-ring **8** is not damaged.

▶ Centre the cover unit on the filter unit **5** and position. When doing this, ensure that the gasket **3** is positioned correctly and is in good condition.

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Note!
The filler aperture of the hydraulic tank is fitted with a protective cylinder. This prevents objects getting into the hydraulic tank. The protective cylinder can be removed from the filler aperture if required.

Note!

- Each time you replace the filter unit **5**, also replace the pressure filter cartridge that is integrated in the control oil unit.

To clean the filter:

- Remove the filter housing
- Pull out the filter element
- Clean the filter element and the housing.

To install the new or cleaned filter element

- Coat with hydraulic oil the O-rings, the threads and the sealing faces on the filter head and on the housing.
- Insert with care the new element onto the centring pin.
- Reattach the filter housing, screw it by hand to the stop and than tighten it with a wrench using the hexagon head at the bottom of the housing (tightening torque: 40^{+10} N.m).

5.11.6 Servo filter

The pressure filter **11** integrated in the control oil unit has to be cleaned regularly and the filter cartridge has to be changed.

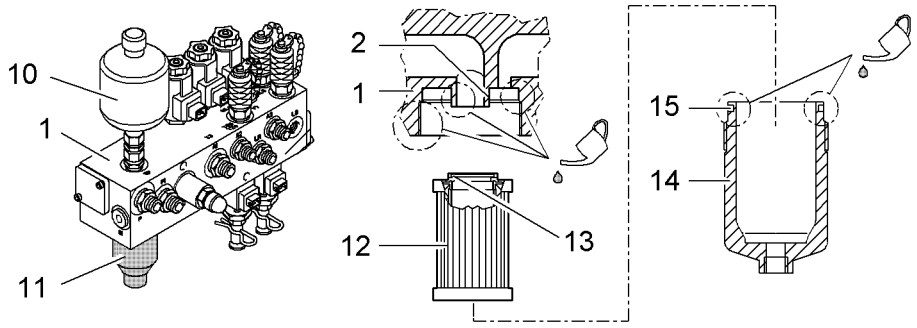

Fig. 5-39 *Control oil unit*

1	Control oil unit	**12**	Filter unit
2	Centering pivot	**13**	Filter unit sealing ring
10	Pressure accumulator	**14**	Filter housing
11	Pressure filter	**15**	O-ring

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Note!
It is not permitted to clean the filter unit.

▶ Change the filter unit each time you open the filter housing.

To replace the filter element:

❑ The hydraulic system must be depressurized.

▶ Unscrew filter housing **14** from pressure filter **11** and remove filter element **12**.

▶ Clean the filter housing.

▶ Oil the thread and sealing surfaces on filter housing **14** and on control oil unit **1** as well as sealing rings **13** and **15** with hydraulic oil.

▶ Push the new filter element **12** carefully onto the centering pivot **2**.

▶ Screw filter housing **14** as far as the stop and turn it back by hand with a **1/4** turn (approx. 90°).

5.11.7 Replenishing oil filter in swing circuit

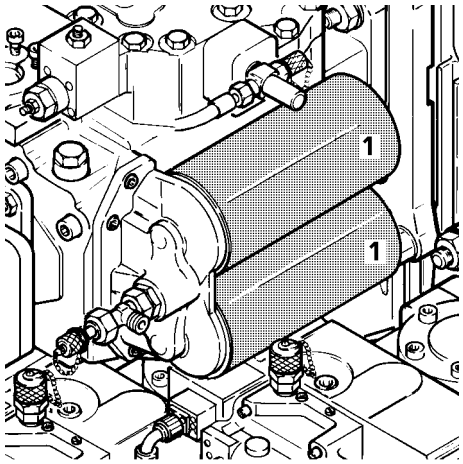

Fig. 5-40 *Replenishing oil filter in swing circuit*

The element in replenishing oil filter **1** has to be changed regularly.

For maintenance intervals, see maintenance chart.

5.11.8 High pressure filters in working circuit

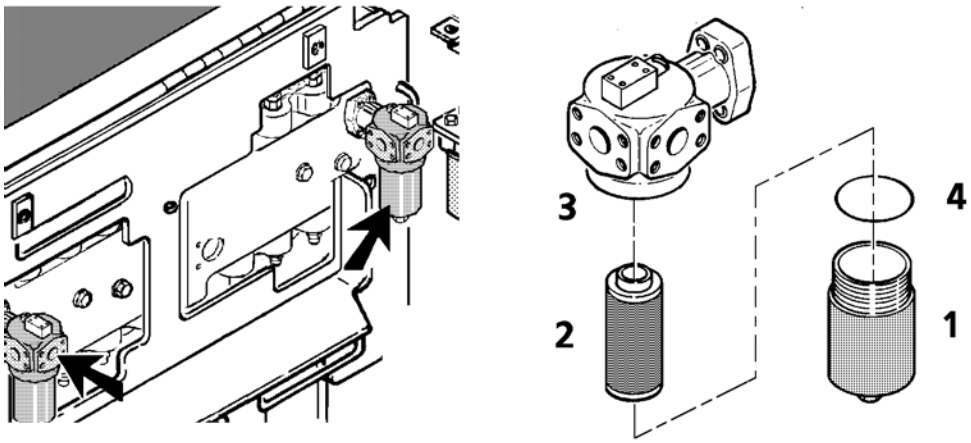

Fig. 5-41 *High pressure filters*

These filters are mounted to the inlets of the control valve blocks.

The filter elements must be checked and if necessary cleaned :

– regulary every 2000 operating hours.
– each time a working pump is replaced.

To clean a filter element :

▶ Relieve tank pressure.

▶ Remove filter housing.

▶ Remove filter element **2**, clean it in gasoline or replace it.

▶ Clean the filter housing **1** and filter top **3** and reinstall;

▶ replace the O-ring **4** by a new one and make sure it is seated correctly.

▶ Tighten the breather filter on the hydraulic tank.

Important!
Anytime the element is cleaned or replaced, check for leaks.
Start the engine, work with the machine for a short period and then check for leaks between the filter housing **1** and the filter top **3**.

5.11.9 Control circuit

The sensor devices do not require any special maintenance.

▶ Inspect the pipe network and connections on all units (pressure accumulator, pressure limiting valve, pressure filter etc.) regularly for leaks.

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Danger!
The pressure accumulator keeps the control circuit under pressure for certain operations which also take place after the diesel engine has been switched off.
Before working on the control circuit, the control pressure must be depressurized as follows:

- ▶ Lay the work equipment on the ground.
- ▶ Switch off the engine.
- ▶ Operate both joysticks (with ignition key in contact position).

5.11.10 Bleeding the hydraulic pumps

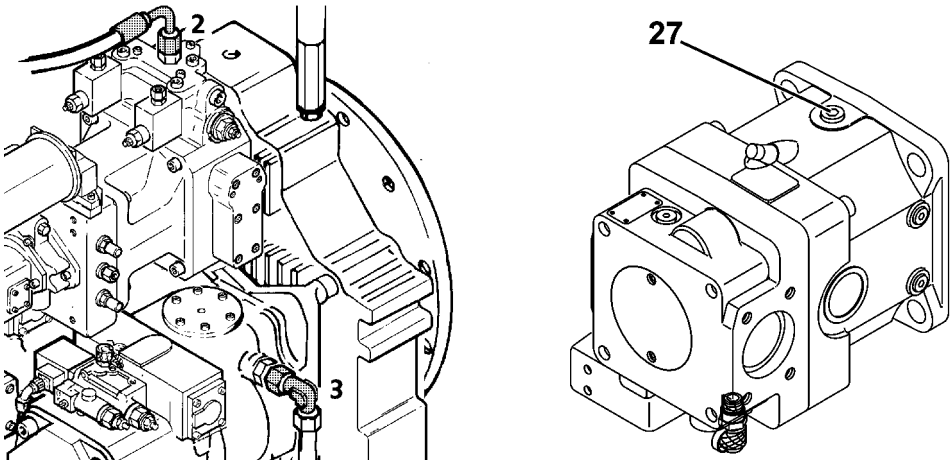

Fig. 5-42 *Hydraulic pumps and pump for fan drive*

Bleeding the hydraulic pumps

After working on the pumps or after changing oil in the hydraulic system, the hydraulic pumps must be bled.

To bleed the swing pump,

- ▶ loosen the union at the leak oil hose **2**,
- ▶ let the air escape.
- ▶ As soon as hydraulic oil flows out of the hose, reconnect the leak oil hose.

To bleed a working pump,

- ▶ loosen the corresponding union **3**,
- ▶ let air escape and retighten the screw as soon as hydraulic oil flows out.

Fill the pumps with hydraulic oil through the same connection or plug before initial start up, or after repairs or replacement.

Caution!
Bleed the pump for fan drive after any bleeds on the hydraulic pumps

Bleeb the pump for fan drive

To bleed the pump for fan drive,

- ▶ loosen the locking plug **27**,
- ▶ let the air escape and retighten the locking plug as soon as hydraulic oil flows out.

Removing the suction hose

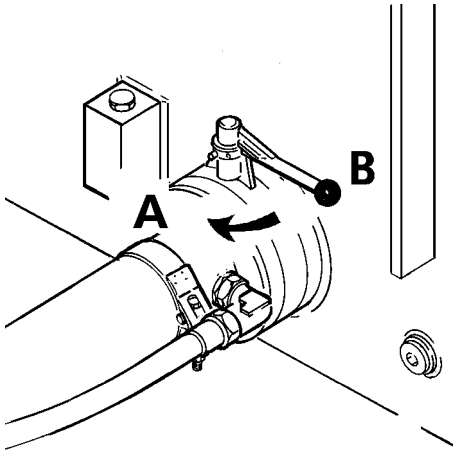

Fig. 5-43 *Shut off valve on the hydraulic tank*

If the suction hose have to be removed, the shut off valve at the hydraulic tank has to be closed.

Turn the valve by 90° to close :

– **A** open
– **B** closed

After the tank pressure is relieved,

- ▶ remove the drain valve on the suction hose fitting on the side of the pump,
- ▶ drain the hydraulic oil from the pump into a suitable container.

After repair, be certain to return the valve to its original position, push it in its notch and retighten the bleeder filter of the hydraulic tank.

Bleed the hydraulic pumps.

Breather filter on the hydraulic tank

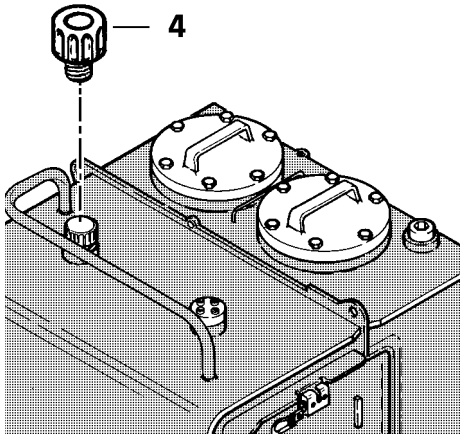

Fig. 5-44 *Hydraulic tank breather filter*

This breather filter **4** must be replaced each hydraulic oil change.

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5.11.11 Bypass oil filter for hydraulic circuit (option)

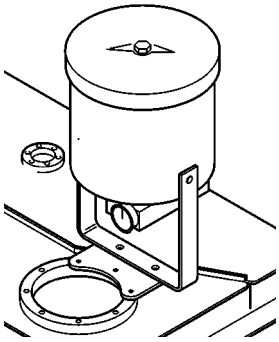

Fig. 5-45 *Bypass oil filter for hydraulic circuit*

The machine can be equipped with an additional oil filter. This filter can be mounted in the bypass of the hydraulic circuit between control valve block - return and the hydraulic tank. This filter can although be mounted in lubrication circuit of the engine. This additional oil filter is fixed on the hydraulic tank. During operation a small quantity of oil flows threw this filter in the bypass of the main return filter.

This filter is designed to drain water by absorbing the water contained in the oil. Monting bypass oil filter is especially recommended when using environmentally acceptable hydraulic fluids because these fluids have a greater capacity to absorb water than mineralhydraulic fluids.

Note !
IUsing this filter does not relieve the operator of the responsability of draining the water condensation from the hydraulic tank.

The filter element must be replaced every time the return filter element is changed. , but at least every six months.

Danger!
A fine stream of liquid can penetrate the skin when under high pressure and cause serious injury.

▶ Before working on the hydraulic system, always remove the pressure.

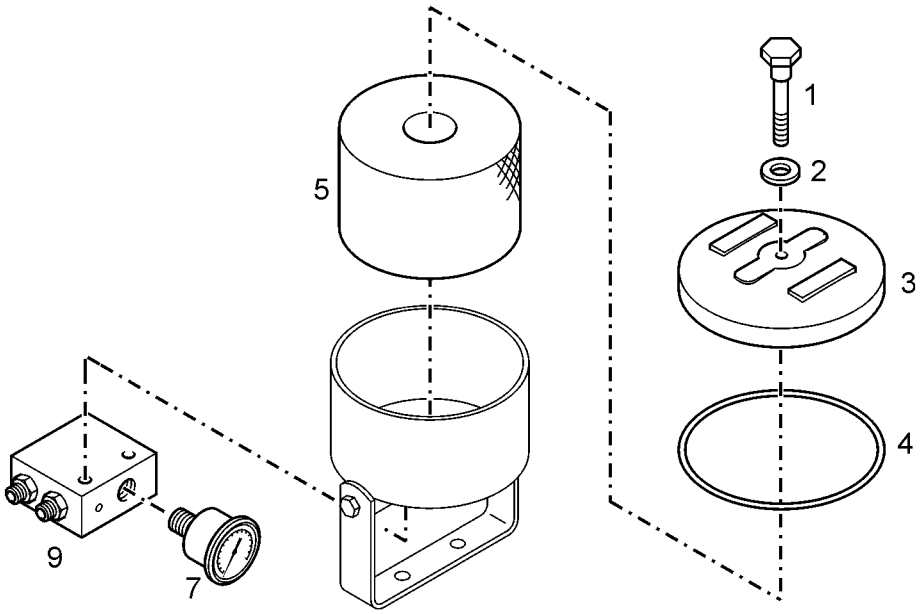

Fig. 5-46 *Change of the filter element*

1 Screw
2 Washer
3 Cover
4 Gasket ring
5 Filter element

- ▶ Loosen the screw **1**, remove the cover **3** and pull out the old filter element **5**.
- ▶ Insert a new filter element, clean the cover **3** and put in a new gasket ring **4**.
- ▶ Put on the cover **3** eand retighten the screw **1**.

5.11.12 Servicing the hydraulic cylinder

Checking the condition of the piston rod mount

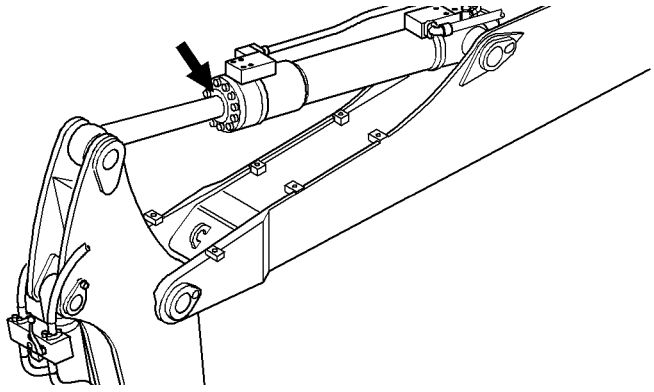

Fig. 5-47 *Piston rod mount*

Note
When a leak appears on the piston rod mount of a hydraulic cylinder (see arrow), the sealing kit must be replaced by a LIEBHERR fitter.

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Protecting the piston rods

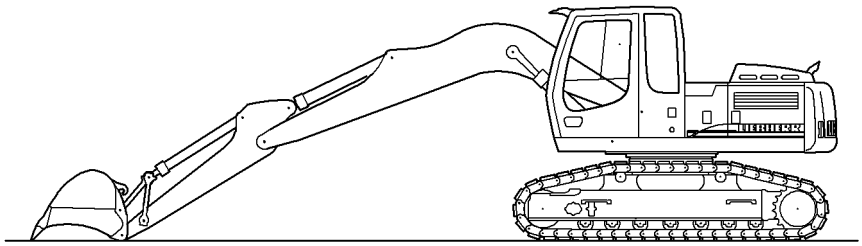

Fig. 5-48 *Machine with piston rods drawn in*

When the machine is out of service for more than 4 weeks and particularly for transportation by sea, the following measures must be taken:

- ▶ Position or transport the machine in such a way that the piston rods are fully drawn into the cylinders.
- ▶ Cover any loose piston rods with a thick layer of non-corrosive anti-corrosion fluid.

Grease quality: see “Lubricating and operating materials”

- ▶ For sea transportation, check the condition of the piston rods once more after loading.
- ▶ Additionally, cover piston rods with anti-corrosion fluid if a cylinder only has a low stroke for certain work, meaning that the piston rod is not regularly moistened with hydraulic oil (eg. cylinder on slewing arm when working over ground).
- ▶ Check the condition of hydraulic cylinders which are not moved a great deal regularly.

5.11.13 Replacing hydraulic hoses

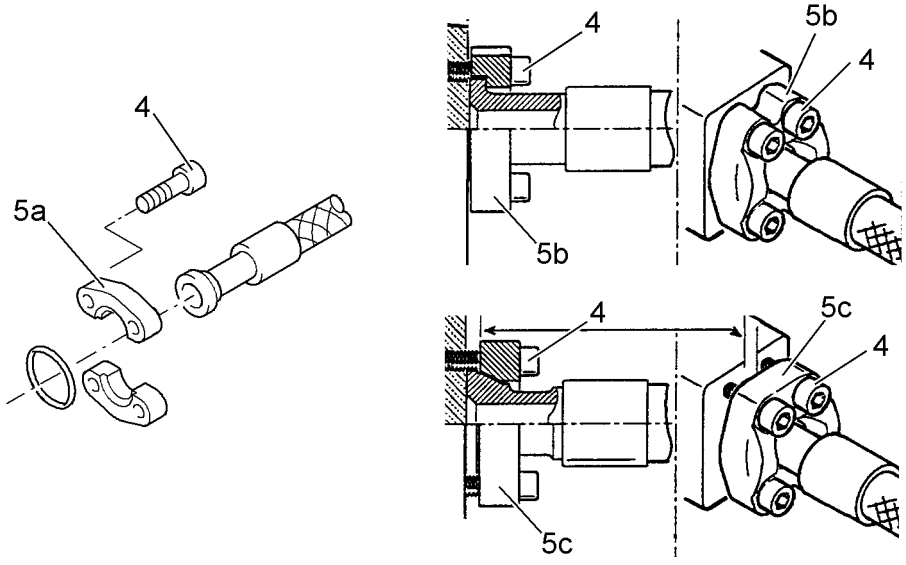

Fig. 5-49 *High pressure hose with SAE fitting*

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Danger!
A defective hydraulic hose can cause accidents and injuries.

- ▶ Replace defective hydraulic hoses (bubbles, moisture, damaged top edge etc.) immediately.
- ▶ Install new hoses in such a way that torsion loading is avoided.
- ▶ Ensure that the hydraulic hose is not twisted when mounting.

Installed high pressure hoses with SAE connections have a nominal diameter of 16, 20 or 25.

You must tighten the mounting screws of the SAE fittings with the following tightening torques.:

Size of screw 4	**Torque value in Nm - Quality 10.9**		
	Half flanges 5a	**Flat flange 5b**	**Conical flange 5c**
M8	31	/	/
M10	62	45	65
M12	108	70	110
M14	172	120	180
M16	264	170	250
M20	350	250	450

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Tab. 5-6 *Tightening torques for SAE fittings - Quality 10.9*

Size of screw 4	Torque value in Nm - Quality 8.8
	Half flanges 5a
M8	22
M10	44
M12	76
M14	122
M16	187

Tab. 5-7 *Tightening torques for SAE fittings - Quality 8.8*

5.12 Oil changes on components

5.12.1 General information

- ❑ The machine must be standing level.
- ▶ Switch off the engine.
- ▶ Wait briefly until the oil has collected in the oil sump.
- ▶ Drain off the oil (preferably when oil is at operating temperature)
- ▶ Add the oil.
- ▶ Check the oil level.

Oil quality and quantity: see lubricant chart.

Change intervals: see lubrication and maintenance chart.

5.12.2 Swing gear - Oil change

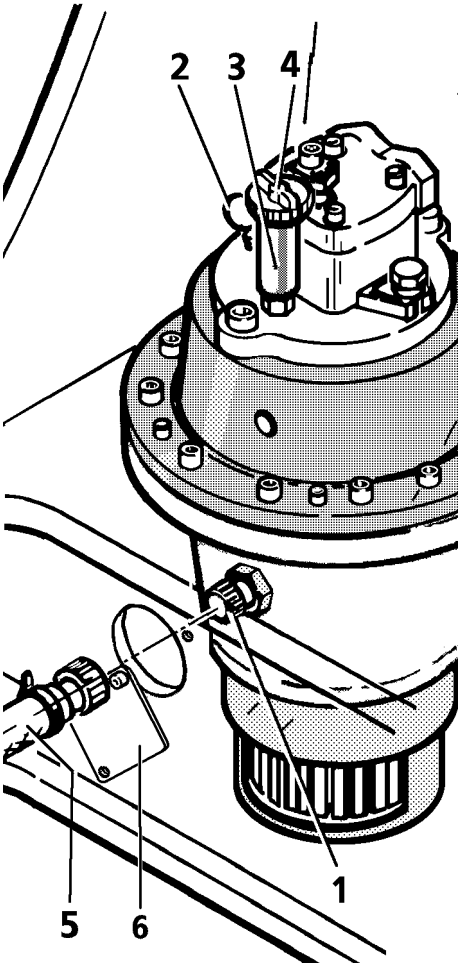

Fig. 5-50 *Changing oil in swing gear*

1 Oil drain valve
2 Dipstick
3 Oil filler tube
4 Oil filler cover / breather cover

Note!
If possible, drain the oil when the oil is at operating temperature.

To drain the oil:

- ▶ Remove the protective plate **6**.
- ▶ Remove the cover **4** through the opening in the front sheet of the uppercarriage,
- ▶ unscrew the cover of the drain valve **1**.
- ▶ Attach the oil drain hose **5** to the valve **1**,
- ▶ drain the oil into an appropriate container.
- ▶ Remove the drain hose and reinstall the plug of the drain valve **1**.
- ▶ Reinstall the protective plate **6**.

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To add oil :

- ▶ Remove the cover **4**.
- ▶ Add oil via the filler tube **3** until the level reaches the upper mark on the dipstick **2**.
- ▶ Reinstall the cover **4**.

See lubrication charts for quantities and specifications, see maintenance chart for oil change intervals.

5.12.3 Changing the oil in the splitterbox

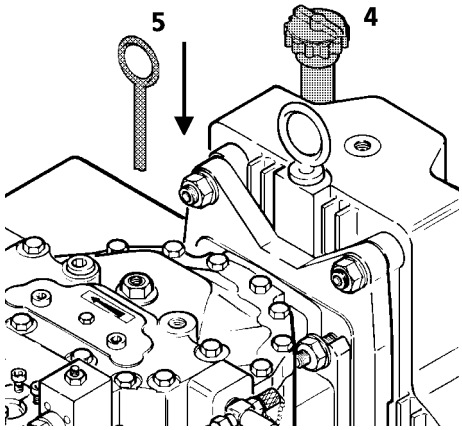

Fig. 5-51 *Changing oil in splitterbox*

Pos. **4** shows the oil filler and bleeder screw of the splitterbox and pos. **5** shows the dipstick to check the oil level

To check the oil level

Check the oil level a few minutes after turning off the engine.

To drain the oil

Drain the oil when the oil is at operation temperature.

To drain,

- ▶ remove the cap on the drain **7**,
- ▶ install drain hose **6**,
- ▶ drain the oil into an appropriate container.

To add oil

- ▶ Add oil to the oil level mark on the dipstick,
- ▶ run the engine for a few minutes,
- ▶ stop it and recheck the oil level.

See lubrication chart for oil quantities and specifications.

See maintenance chart for oil change intervals.

5.12.4 Travelling gear - changing the oil

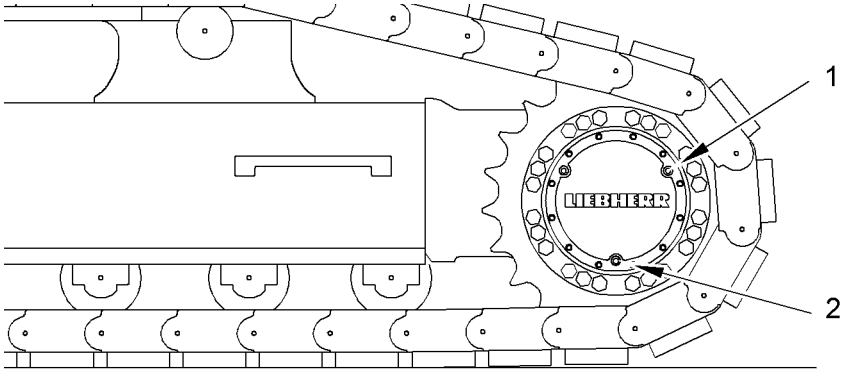

Fig. 5-52 *Travelling gear - adding and draining oil*

- ❑ Before draining the oil, the drive unit must be operated until one sealing plug is positioned exactly vertical to the centre axle of the transmission (position **2**).

To drain the oil:

- ❑ Ensure that you have a suitable oil drainage container to hand.
- ▶ Place the container beneath the drive unit.
- ▶ Remove sealing plug **1**.
- ▶ Remove sealing plug **2**.
  ↳ The oil drains into the container.

To add the oil:

- ▶ Screw in sealing plug **2**.
- ▶ Add the oil until the level reaches the bore hole **1**.
- ▶ Screw in sealing plug **1**.

5.13 Travel gear

The travel gear is maintenance-free until the regeneration of the treads or the cylinder or until all travel gear parts are completely worn.

The lifetime design of the support rollers, track rollers and idlers increases the travel gear's lifetime and metal seals make it insensitive to dirt.

5.13.1 Checking mounting screws of travel gears, track pads and

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sprocket wheels

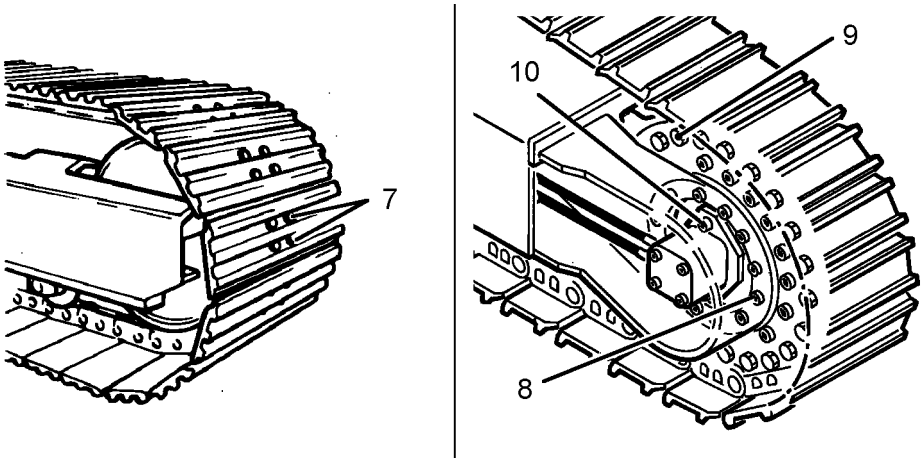

Fig. 5-53 *Travel gear component mountings*

- ▶ Carry out regular checks for loose mounting screws on the base plates and travel gears.
- ▶ Monitor tightening torques.
- – Mounting screws **7** on track pads:
  - Torque the track pad bolts - 1" 1/8 - 12 UNF to : **2300 Nm (1700 ft.lbs.)**
- – Mounting screws **8** of the travel gears onto the side frames : **2100 Nm (1550 ft.lbs.)**
- – Mounting screws **9** of the sprocket wheels onto the travel gears : **2100 Nm (1550 ft.lbs.)**
- – Mounting screws **10** of the hydraulic motors onto the travel gears : **960 Nm (710 ft.lbs.)**

5.13.2 Monitoring the track tension

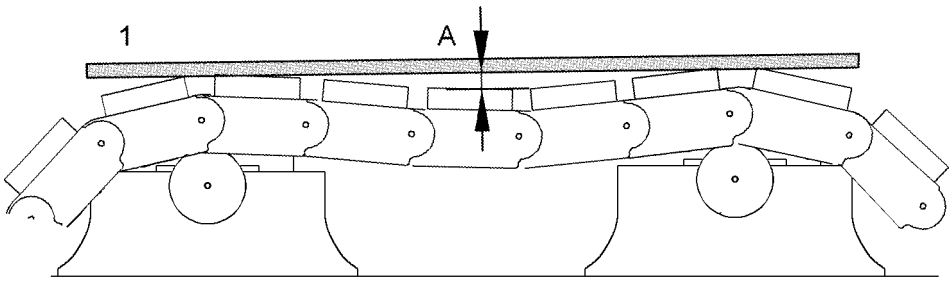

Fig. 5-54 *Monitoring the track tension*

- ▶ Relieve the tracks by driving the machine forwards and backwards.
- ▶ Place the measuring rod **1** in the area between the carrier rollers
- ▶ Measure distance **A** between the measuring rod lower edge.
  - ↳ The track should, under operating conditions, sag **25 to 30 mm** between the carrier rollers.
  - ↳ Retighten the crawlers if necessary.

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5.13.3 Retightening the track

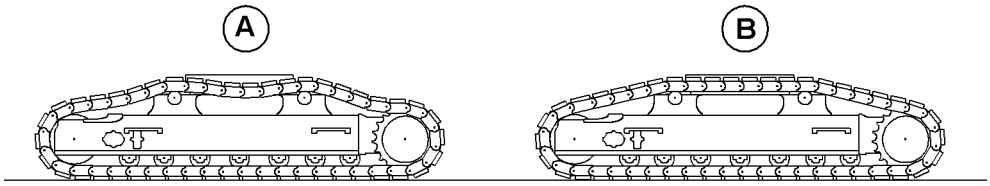

Fig. 5-55 *track when insufficiently (**A**) and correctly (**B**) tightened.*

With normal wear on the travel gear, it is necessary to check the track tension regularly and retighten the track if necessary.

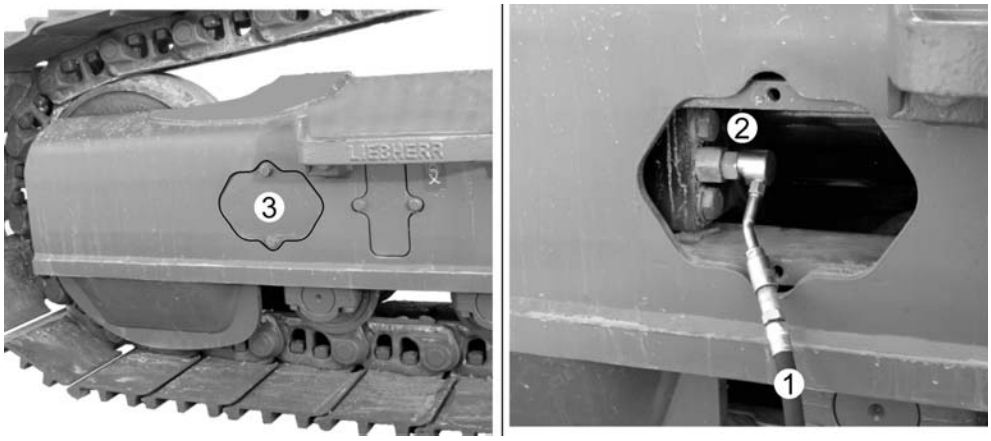

Fig. 5-56 *Retightening the track*

- ▶ Remove the cover **3** on the sideframe of the undercarriage.
- ▶ Screw high pressure hose **1** onto the manual grease gun.
- ▶ Through the opening, connect the high pressure hose **1** with the lubricating nipple **2** of the grease tension jack.
- ▶ Inject grease until the track is sufficiently tightened.
- ▶ Monitoring the track tension

5.13.4 Releasing the track tension

Danger!
Risk of injury due to sudden dropping of the track and spraying grease.

- ▶ When releasing the tension on the track, keep your head away from the sideframe.

- ▶ Carefully unscrew lubricating nipple **2** (siehe Fig. 5-56) by several thread pitches until the grease oozes out of the nipple's annular groove.
- ▶ Tighten lubricating nipple **2** as soon as the desired track tension is attained.
- ▶ After the adjustment procedure, drive the machine forwards and backwards and monitor the track tension once again.

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5.13.5 Cleaning the travel gear

Do not operate the machine if larger stones, pieces of wood or metal, wires or cables are trapped in the travel gear.

Dried or frozen mud and stones or other foreign bodies in the travel gear parts could result in considerable damage to the machine if the machine is operated or an attempt is made to free the machine using engine power.

▶ In sub zero temperatures, set the machine on boards to prevent the tracks becoming frozen to the subsoil.

Caution!
To avoid causing considerable damage to the frozen machine, never use force to tear it free.

▶ A frozen track can be freed by carefully heating the base plates.

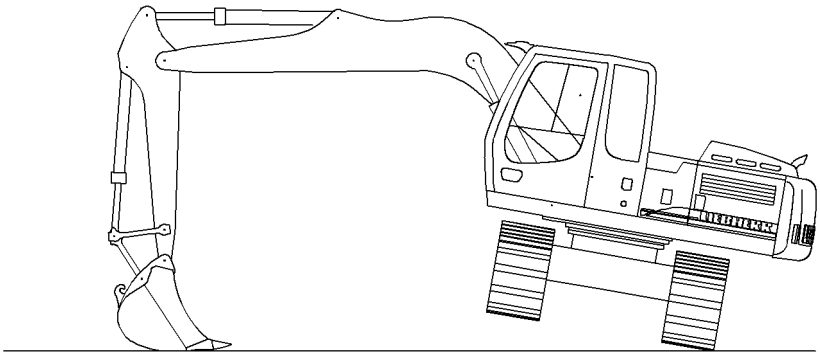

Fig. 5-57 *Raising the machine*

Caution!
The machine could slide away or back.

▶ Once you have supported the machine, prop it securely with wooden beams.

▶ Before setting down the machine, clean any very dirty parts of the travel gear.

▶ Clean sand and dirt off the sliding surfaces on the tensioning units and grease.

▶ By using the work equipment to support the machine at the side, one side of the undercarriage can be raised to clean the travel gear (siehe Fig. 5-57).

5.14 Electrical system

5.14.1 Notes on the electrical system

Danger!
Risk of injury due to formation of sparks.

▶ Avoid sparks and naked flame when charging batteries or working on the batteries.

▶ Always wear protective goggles and gloves.

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- Check that the machine's electrical system is functioning correctly at regular intervals.
- Burnt-out fuses and bulbs should be replaced immediately once the cause of the defect has been rectified.
- Rectify defects such as loose connections, abraded cables or badly fastened clamps immediately.
- Disconnect the batteries when working on the electrical system or when carrying out electric arc welding on the machine.

Danger!
Risk of injury due to formation of sparks.

- Disconnect the negative terminal (-) first and connect it last.

5.14.2 Main battery switch

Caution!
Take particular care with machines with built-in independent heating.

- Only switch off the main battery switch when the independent heating's run-on is over.

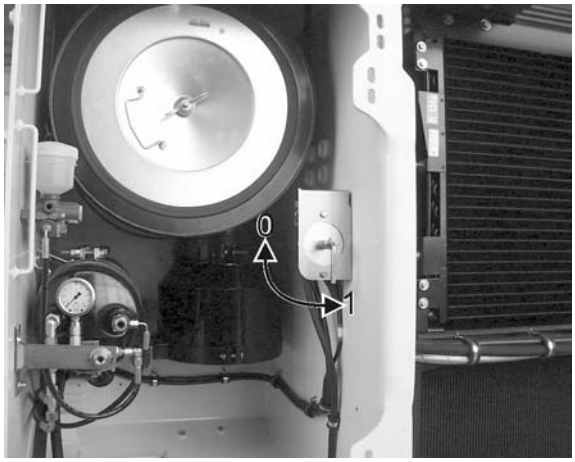

Fig. 5-58 *Main battery switch*

- Before starting any work on the electrical system, including welding work on the machine, switch the main battery switch to position **0**.
- When washing the machine, cover the electrical units (particularly the alternator, generator, cabling, electronic components and measured value sensor) to prevent water penetrating.
- When cleaning the engine with a water / steam jet, do not subject electrical measured value sensors such as oil pressure switches to any direct jets.
  - If this happens, moisture could penetrate and lead to contact corrosion and the failure of the measuring function.
  - Oil pressure switches are not watertight due to the necessary presence of membrane ventilation.

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Note!
Batteries can become flat if the machine is out of service for longer periods.

▶ Before laying up the machine for longer periods, switch the main battery switch to position **0** (off).

5.14.3 Battery care

The battery must always be kept clean to ensure that it is able to function perfectly.

▶ Particular care should be taken to clean the pole ends and cable terminals **A** regularly and to then cover them with a thick layer of acidproof grease (siehe Fig. 5-59).

Danger!
Bent rubber hoses on the central gas outlet increase the risk of explosion!
The hydrogen contained in the batteries should not be allowed to build up in the accumulator box and must be able to escape via the rubber hoses. The central gas outlet hoses must be routed without kinks.

▶ Check the condition of the hoses **B** regularly, particularly after installing a battery (siehe Fig. 5-59).

The fluid level in the cells should be 10 to 15 mm above the top of the plate. Only distilled water is to be used for any refilling.

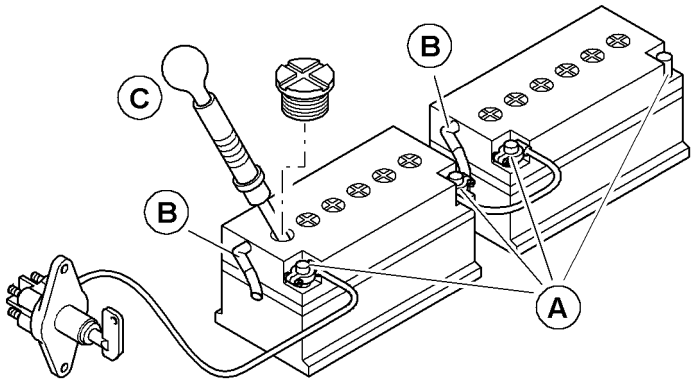

Fig. 5-59 *Battery care*

▶ From time to time, measure the acid concentration **C** using an acid tester.

When the battery is fully charged, the **unit weight is 1.28 kg/l (31.5° Bé)**.

▶ If the acid tester displays a lower value, the batteries is virtually flat and should be charged if necessary.

5.15 Heating/air-conditioning system

The machine has a combined heating / air-conditioning system as standard.

5.15.1 Recirculated and fresh air filters

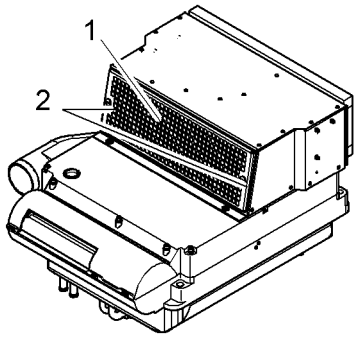

Fig. 5-60 *Recirculated air filter*

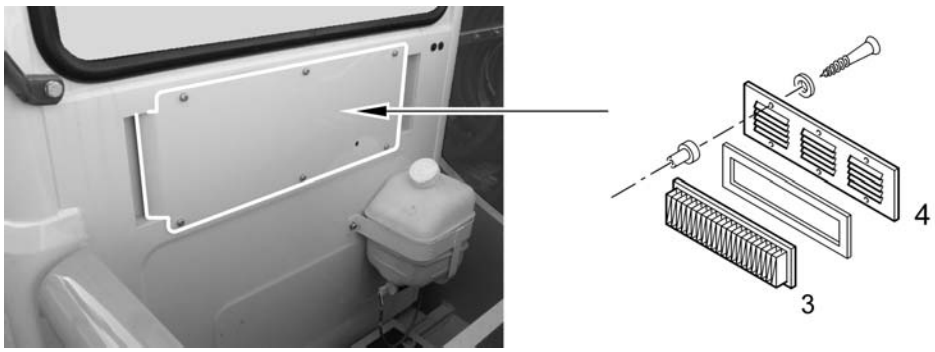

Fig. 5-61 *Fresh air filter*

The air flow in the heating / air-conditioning system is reduced when the filters are dirty and this frequently results in the system icing up or shutting down.

– Remove and clean the recirculated and fresh air filter **1** and **3** every 500 operating hours.
– Shorten cleaning intervals when working in heavy dust conditions.
– Do not operate the machine, even briefly, without these filters, since the heat exchanger **6** will otherwise quickly become blocked (siehe Fig. 5-62).

To clean and change the recirculated and fresh air filters:

▶ Push the backrest of the operator's seat forwards to remove the recirculated air filter **1**.

▶ Open the quick-release fasteners **2** by a quarter turn.

▶ Remove the recirculated air filter **1**.

▶ Remove the deflector **4**.

▶ Remove the fresh air filter **3**.

Note!

▶ Never wash the filter elements with hot water or a steam jet.

▶ If damaged or in a bad condition, replace the filter elements.

▶ Blow out the filter elements **1** and **3** using compressed air or clean in cold or lukewarm water.

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5.15.2 Heating system

Carry out the following maintenance work on the heating system each year before the start of the heating period:

– Check the entire coolant circuit for leaks.
– Retighten the connection points for the coolant circuit, the hose connections on the heat exchanger, the seals on the shutoff valves and the hose clamps.
– Only operate the system with DCA 4 anti-corrosion fluid / antifreeze in the coolant.

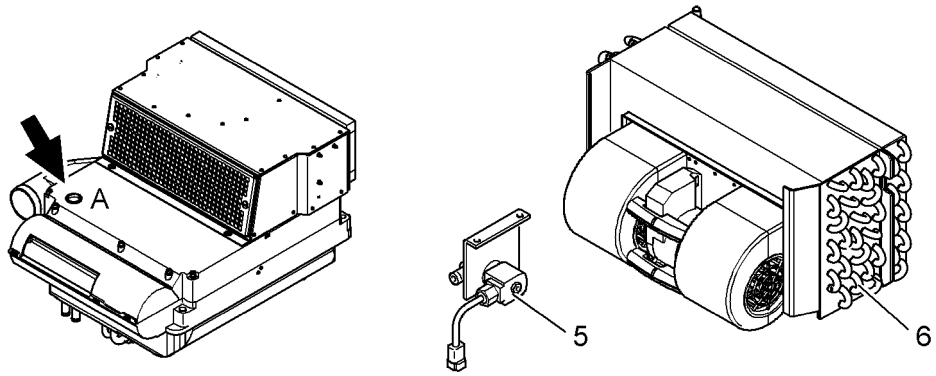

Fig. 5-62 *Heating unit with solenoid valve*

To vent the heating system:

▶ To vent, unscrew the red cap of the vent valve over opening **A** (see arrow).

▶ Push in the valve to allow the air to escape.

To clean solenoid valve 5:

▶ Annually, before the start of the heating period, remove and clean solenoid valve **5** (Y46) for the hot water supply.

▶ Also clean the solenoid valve if heating performance is not sufficient.

▶ Rinse out the solenoid valve membrane with water.

▶ Also ensure that the equalizing hole on the membrane is not blocked with dirt.

To check the heat exchanger:

▶ Check the heat exchanger plates **6** annually for damage.

▶ Blow out with compressed air if dirty.

▶ Align the plates if necessary.

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5.15.3 Air-conditioning system

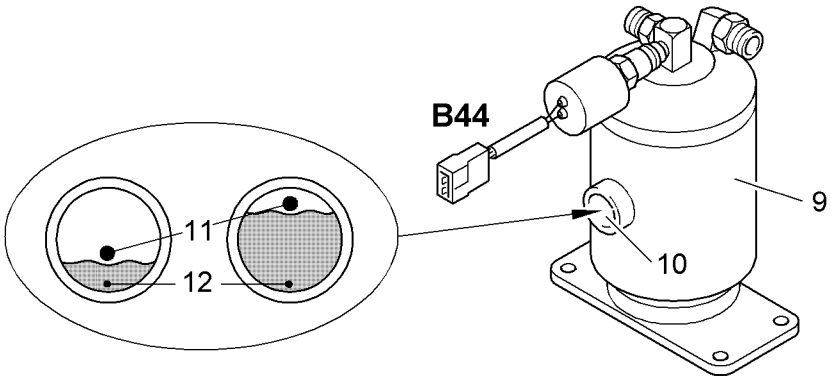

Fig. 5-63 *Dryer-accumulator unit*

To check the dryer-accumulator unit:

▶ With the diesel engine running and the air-conditioning system switched on, check the refrigerant level in the inspection glass **10** of dryer-accumulator unit **9**.

Note!
If there is insufficient refrigerant, the white float **11** lays at the bottom of the inspection glass.

▶ If the cooling effect is diminishing, have the system refilled by a refrigeration engineer.

▶ Determine the degree of moisture of the desiccant in dryer-accumulator unit **9**.

▶ To do this, observe the colour of the indicator pearl **12** in the inspection glass.

If the pearl is orange, the degree of moisture in the coolant circuit is OK. If, however, the pearl is not coloured, the dryer-accumulator unit is saturated with moisture.

▶ Change dryer-accumulator unit **9** immediately.

▶ Perform a visual check on the condition of dryer-accumulator unit **9**.

▶ If it is observed that dryer-accumulator unit **9** is rusted or damaged (e g. on the panel fastening or on the hose connection), replace dryer-accumulator unit **9** (pressure tank).

In the two cases referred to above and at least once a year, have the dryer-accumulator unit **9** replaced by a fitter trained in refrigeration engineering.

The coolant circuit must be emptied, checked for leaks and refilled. Check for abrasion, replace and if necessary retighten the hose connections on the hoses.

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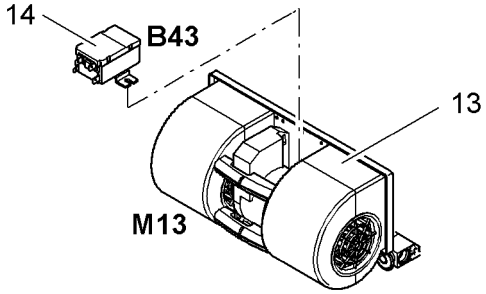

Fig. 5-64 *Fan motor on the heating/air-conditioning device*

Additional maintenance work:

The following maintenance work must also be carried out at least once a year by a fitter trained in refrigeration engineering:

- Check the function of the fan motor **13** (M13).
- Check the function of the ventilation flaps on the heating / air-conditioning system.
- Check the electrical connections for correct positioning (good contact).
- Check the electrical lines for abrasions.
- Check the defrost thermostat **14** (B43) in the evaporator (function, correct positioning and for damage).
- Check the function of the pressure switch **B44** on the dryer-accumulator unit **9** (siehe Fig. 5-63).

5.16 Greasing the machine

5.16.1 Swing ring lubrication

Lubrication of the swing ring teeth

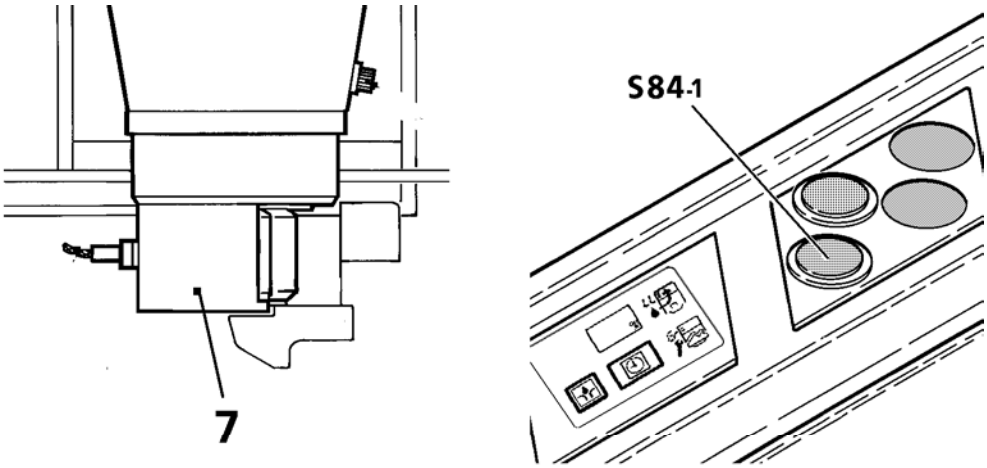

Fig. 5-65 *Lubrication of the swing ring teeth*

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A housing around the pinion of the swing gear contains all the necessary lubrication reserves for the swing ring teeth lubrication **7**.

During operation lubricate the teeth at regular intervals to replace this reserve.

To lubricate,

- ▶ hold the push button **84-1** depressed for approx. one minute.
- ▶ During the lubrication procedure, turn the uppercarriage by at least one complete rotation (360°) to make sure that the complete gear is lubricated.
- ▶ Afterward, turn the uppercarriage once more by 360°, without adding more grease.

This procedure must occur at least once per shift. In heavy applications, lubricate the gear at least once every four hours.

Check the grease tank

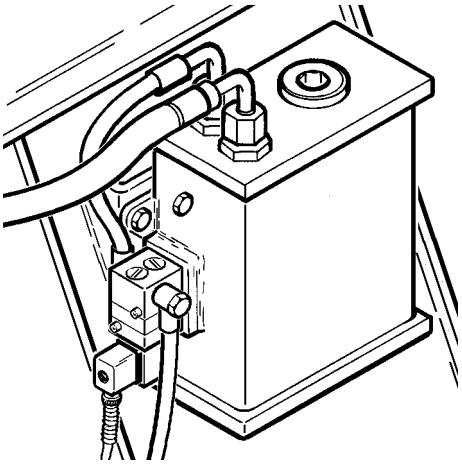

Fig. 5-66 *Grease tank*

The grease tank level must be checked at least once a week. If necessary, add more grease.

See lubrication chart for grease specifications.

Lubricating of swing ring roller races

The swing ring races are greased by the semi-automatic centralized lubrication system, simultaneously with the lubrication points of the working attachment.

5.16.2 Lubrication of attachment bearing points

All the lubrication points of the working attachment, including those in the area of the grab tool are connected to the semi-automatic lubricating system and are greased automatically at regular intervals while working.

See the lubricant chart for grease specification.

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5.17 Quick-change systems

5.17.1 Greasing the mechanical quick-change adapter (optional extra)

The mechanical quick-change adapter is not lubricated via the central greasing system. The bearing points must be greased using the grease gun.

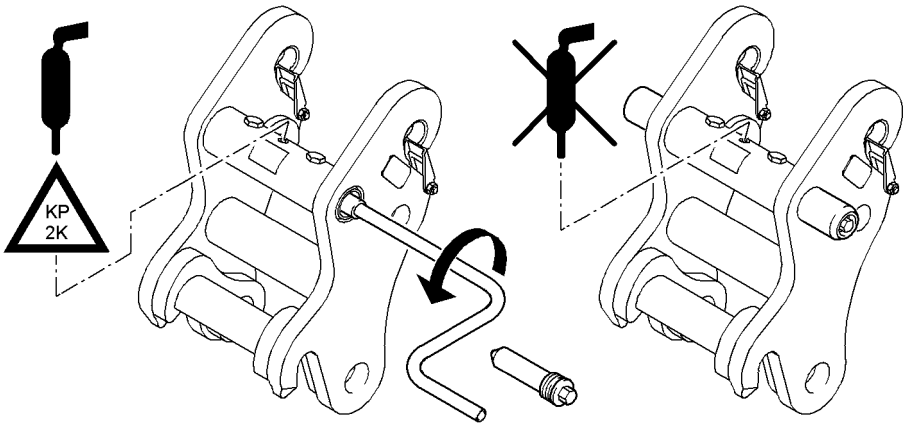

Fig. 5-67 *Greasing the mechanical quick-change adapter*

▶ Grease the bearing points via the lubricating nipple using a grease gun.

Grease quality: see “Lubricating and operating materials”

Note!
If the mechanical quick-change adapter is greased when the pin is drawn out, the hollow area between the locking pins fills with grease and the pins can no longer be reinserted.

▶ Ensure that the locking pins are inserted when greasing.

5.17.2 Hydraulic quick-change adapter (optional extra)

Greasing the quick-change adapter

The hydraulic quick-change adapter is not lubricated via the central greasing system. The bearing points must be greased using the grease gun.

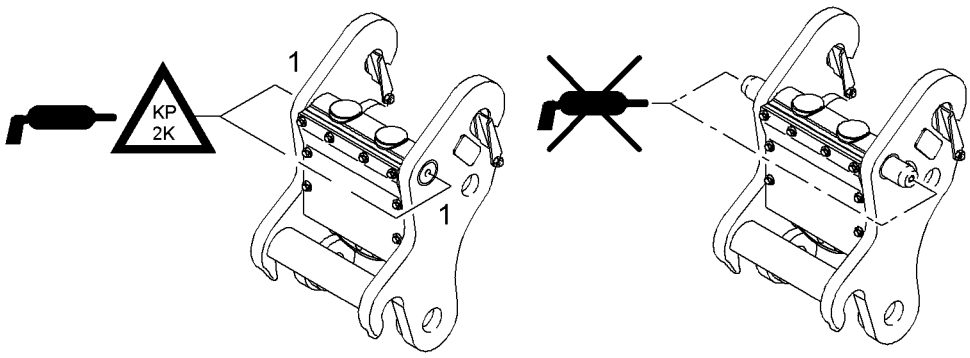

Fig. 5-68 *Greasing the quick-change adapter*

▶ Grease the locking pins **1** via the lubricating nipple using a grease gun.

Note!
The hydraulic quick-change adapter cannot be sufficiently greased if the locking pins are drawn out.

▶ Ensure that the locking pins are inserted when greasing.

Cleaning the sieve filter

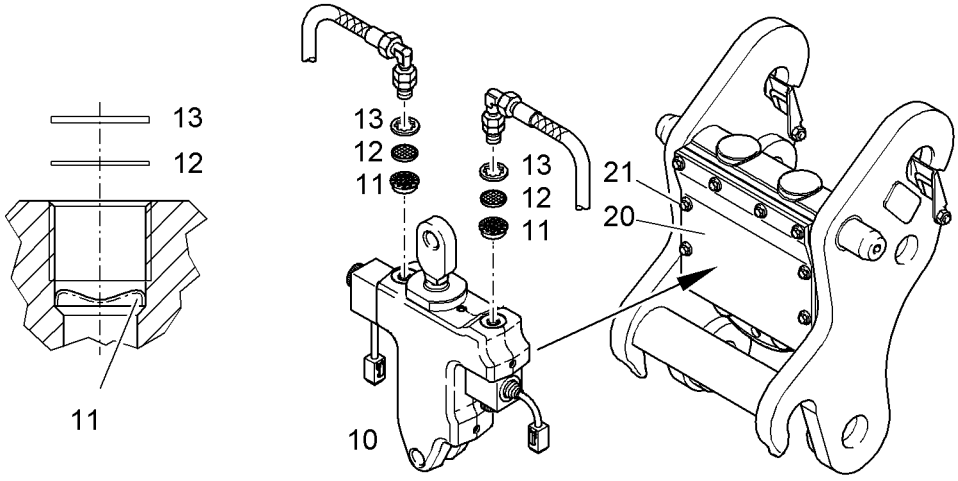

Fig. 5-69 *Cleaning the sieve filter*

The filter disc **12** in the bolt connections between the connecting hoses and the hydraulic cylinder must be checked for blockages and, if necessary, cleaned every 2000 operating hours.

▶ Remove the cover **20** and the screws **21** from the quick-change adapter.

▶ Remove bolt connections and hydraulic hoses from the hydraulic cylinder **10**.

▶ Screw out the outer mounting assembly **13** using a suitable tool (e g. a scribe).

▶ Remove the filter disc **12** , check and if necessary clean or replace it.

▶ Place the filter disc **12** on the inner mounting assembly **11** and mount the outer mounting assembly **13**.

▶ Connect bolt connections and hydraulic hoses to hydraulic cylinder 10.

▶ Fasten the cover **20** with the screws **21** on the quick-change adapter.

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5.18 Drive unit brakes and swing gear brakes

Both the drive unit brakes and the swing gear brakes are spring-applied, pressure-released multi-plate brakes. They are ventilated hydraulically and are fully sealed and integrated in the travel gear or swing gear transmission.

Their usage purely as parking brakes makes them wear-free and therefore maintenance free.

5.19 Check mounting bolts for tightness

The mounting bolts listed below must be regularly be checked and retighten if necessary. See maintenance schedule for checks intervals.

Notice : when installing bolts of size bigger than M40 the thread of the screw must be slightly coated with a MoS2 based grease. Also grease the bolt head supporting surface, unless hereafter otherwise specified.

5.19.1 Mounting bolts of the counterweight

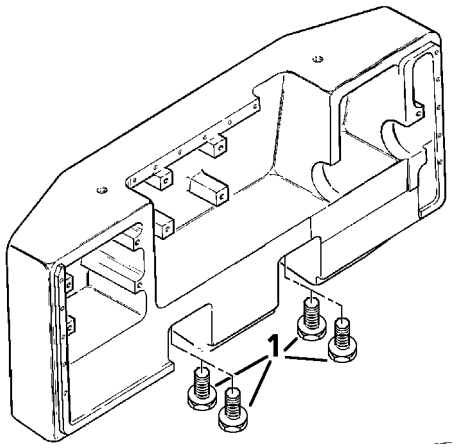

Fig. 5-70 *Counterweight bolts*

The mounting bolts **1** (M42) must be torqued to 5940 Nm (4380 ft.lbs).

5.19.2 Mounting screws of the swing ring

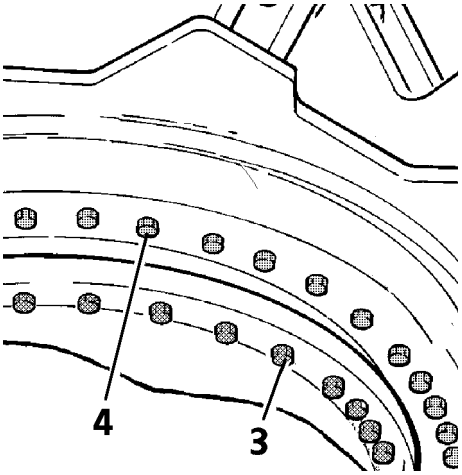

Fig. 5-71 *Swing ring bolts*

The mounting screws M30 swing ring to undercarriage (**3**) and uppercarriage to swing ring (**4**) must be torqued to 1900 Nm (1400 ft.lbs.).

Danger!
The special tool may only be operated by qualified personnel, especially trained for the use of this high pressure tensioning device and aware of the operating instructions as well of the recommendations for accident and damage prevention concerning this tool.
Use appropriate working platforms and lifting devices to install and hold in position the special tool while tensioning the bolts.

5.19.3 Mounting screws of the hydraulic oil and fuel tank

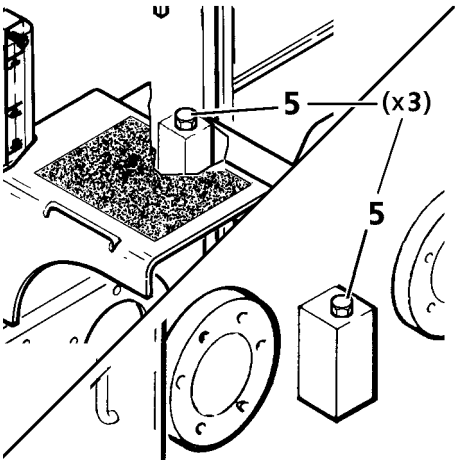

Fig. 5-72 *Hydraulic oil and fuel bolts*

The mounting screws **5** (M20) must be torqued to 560 Nm (413 ft.lbs.)

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5.19.4 Mounting screws of the swing gear and motor

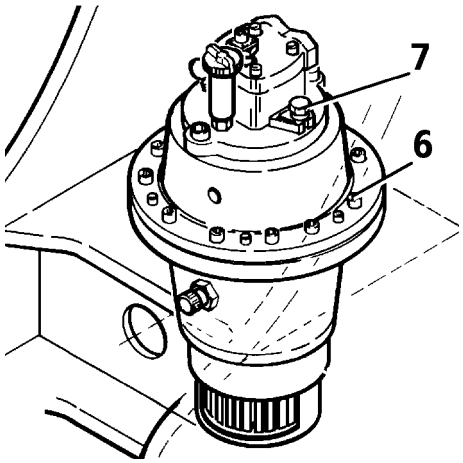

Fig. 5-73 *Swing gear and motor bolts*

The mounting bolts **6** (M30) of the swing gear must be torqued to 1900 Nm (1400 ft.lbs)

The mounting bolts **7** (M24) of the swing motor must be torqued to 960 Nm (708 ft.lbs).

5.19.5 Connection of central piece and side frames

The bolts must be checked every 500 working hours, and if necessary retightened.

The lower bolts M42 must be torqued to 5940 Nm (4380 ft.lbs).

The upper bolts M30 must be torqued to 1900 Nm (1400 ft.lbs).

5.20 Use environmentally friendly hydraulic fluids in LIEBHERR earthmoving machines

5.20.1 General

If specific applications require that even in the case of accidents or leakage there may be no damage caused to the environment, hydraulic excavators using environmentally friendly hydraulic fluids can be operated.

These lubricants are free of mineral oils, they are water-soluble in every propostion and meet the requirements for biodegradability.

Never mix them together or with lubricants based on mineral oils.

The following recommendations state how to proceed when using these biodegradable hydraulic fluids in LIEBHERR earthmoving machines.

5.20.2 Prescriptions for biodegradable hydraulic fluids

When using environmentally friendly hydraulic fluids, we exclusively recommend

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synthetic ester oils with a viscosity according to ISO VG46.

Note :

Due to their limited high temperature stability, vegetable oils cannot be used.

Polyglycols decompose various machine paints and should only be used in special cases. In this instance, the material compatibility in regard to seals, paints, etc..., has to be observed.

Due to the lack of experience with the various products, a "Warranty Declaration" has to be inquired from the Oil Supplier if LIEBHERR earthmoving machines are to be operated with environmentally friendly hydraulic fluids based on synthetic ester upon "customer's demand". The declaration applies for hydraulic components in the case of damage caused by the hydraulic fluid. This "warranty declaration" together with the completely filled out confirmation has to be sent to LIEBHERR.

Fundamentally, the supplier is responsible to maintain the standard of quality, standards ans specifications of his product when environmentally friendly products are being used.

In order to avoid misunderstandings, a distinct reference must be made on the hydraulic tank, stating the fluid which the machine is operating with.

Attention :

Mixing various "environmentally friendly hydraulic fluids" together is prohibited.

The name "synthetic ester" for example does not mean, that all products carrying this name have the same contents. The lack of experience with biodegradable products does not allow a general statement.

5.20.3 Oil change intervals

The oils changes in preset intervals are not allowed for environmentally friendly hydraulic fluids.

The time for oil change must be determined by oil sample analysis and according to the laboratory reports.

To take the oil samples, LIEBHERR offers its customers a complete analysis-set for wear check lubrication-analysis (Id. No. 7018368), which consists of 6 coded sample containers, 6 sample cover letters, 6 envelopes as well as a 3 mtr. silicon hose. Oil analysis and laboratory report are already included in the price for the set! Furthermore, only with the first command, a hand pump (Id. No. 8145666) or, as an alternative, an extraction valve (Id. No. 7019068) and a high pressure hose for pressure test-point (Id. No. 7002437), will be necessary only once.

Further oil analysis or oil change intervals have to be carried out according to the sample analysis in the laboratory report from wear check. The evaluation result has to be sent to LIEBHERR and the customer.

5.20.4 Oil filters change intervals

The filters change intervals as stated by LIEBHERR must be adhered to.

Use only Original LIEBHERR filters. We recommend the use of special "bio oil filters" to reduce the percentage of zinc in the system (see also chart of return filters).

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5.20.5 Water condensation

Water condensation must be drained from the hydraulic tank in regular intervals (drain plug on the tank). It is recommended to do this after the machine was stopped for a longer period of time, for example monday morning.

The percentage of condense water is not allowed to exceed 0,1 wgt.%.

5.20.6 Changing to environmentally friendly hydraulic fluid

If machines which used to operate with mineral oils or other hydraulic fluids are modified to operate with environmentally friendly hydraulic fluids, it is imperative to observe all LIEBHERR guidelines for modifications. Flushing the system is absolutely necessary to ensure trouble-free operation.

Never install attachments from other machines without strictly adhering to all guidelines for modifications with regards to the interior coating of components (e.g. the hydraulic tank), and procedure for flushing with flusher oil (to drain the mineral oil, ...).

The percentage of mineral oil, resulting from changing or mixing with other mineral oil based fluids, remaining within the system is not allowed to exceed 2 wgt. %.

If the changing guidelines stated by LIEBHERR are not adhered to, warranty will be refused in case of damage. In case of doubt, first obtain these guidelines from your LIEBHERR representative.

Having changed to environmentally friendly hydraulic fluid or when initially filling the system a reference fresh oil sample must be taken after initial warn-up and sent to the laboratory for analysis. The sample must be taken while the machine is running using pressure test-point valve (Id. No. 7019068) or right after stopping the engine via the breather valve using the vacuum pump.

5.20.7 Particular precautions

– When disposing of these fluids make sure that this medium is not treated as a mineral oil, i.e. there are special regulations for the disposal of these fluids in individual countries. In case you have any questions please contact your representative waste oil recycler.
– When handling the medium simply use gloves and, in case there is a risk of spraying, use safety goggles as well. Wash your hands before taking a break and at the end of your shift. In case the fluids come into contact with skin, rinse with lots of water; in case of eye contact, rinse with water for 10 to 15 minutes.
– After any fluid is spilled or runs out, wash away any smaller amounts with lots of water; larger amounts must be properly collected and disposed of.
– In case of fire, the usual fire extinguishers may be used (like water vapor, CO_2, foam, dry ice extinguishers, ...). Never aim a stream of water directly at hot, burning material (risk of splattering). Thermal decomposition generates CO and or CO_2.

5.21 Fire suppression system

The maintenance of the fire suppression system must only be done by the system supplier or the system dealer.

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The maintenance intervals must be strictly observed.

5.22 Control and maintenance chart

Caution!
Careful maintenance can only be carried out when the machine is clean. In particular, visual checks such as crack testing are only possible on a clean machine.

▶ Clean the machine before you start maintenance work (see also the chapter “Safe maintenance of the machine”, subheading “Cleaning and crack testing”).

Note
The daily maintenance work that the device operator has to carry out comprises a function check of the brakes (swing brake and travel brake), and the electrical and hydraulic systems.
Additionally, a visual check must be made for leaks on the engine, hydraulic system and transmission.

Maintenance / inspection at operating hours							**WORK TO BE CARRIED OUT R 984 C - Litronic**		
On delivery	Every 8 - 10	Every 10 -50	At 250, 750	At 500, 1500	At 1000, 3000	At 2000, 4000	**By maintenance personnel (machine owner)** ■ First and only interval ● Repeat interval ♦ Special interval every 250 hours	**By authorized specialist personnel** ❑ First and only interval ❍ Repeat interval	**Note**
							DIESEL ENGINE AND SPLITTERBOX		
❍	●	●	❍	❍	❍	❍	Check engine oil level		
❍	●	●	❍	❍	❍	❍	Check oil pressure and coolant temperature during operation		
❍	●	●	❍	❍	❍	❍	Check for air filter clogging at the maintenance indicator		
❍	●	●	❍	❍	❍	❍	Check coolant level		
		●	❍	❍	❍	❍	Empty water separator at fuel filter and drain fuel tank		
		●	❍	❍	❍	❍	Check oil level in splitterbox		
			❍	❍	❍	❍	Replace oil in the splitterbox		
			❍	❍	❍	❍	Check and clean cooler, hoses, ventilator		
			❍	❍	❍	❍	Check condition and tension of V-belts		
			❍	❍	❍	❍	Replace lube oil filter cartridge		
			❍	❍	❍	❍	Change engine oil		1)

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Maintenance / inspection at operating hours							WORK TO BE CARRIED OUT R 984 C - Litronic		
On delivery	Every 8 - 10	Every 10 -50	At 250, 750	At 500, 1500	At 1000, 3000	At 2000, 4000	**By maintenance personnel (machine owner)** ■ First and only interval ● Repeat interval ♦ Special interval every 250 hours	**By authorized specialist personnel** ❑ First and only interval ❍ Repeat interval	**Note**
			❍	❍	❍	❍	Replace the water filter, check the concentration of anticorrosion additive DCA4 in the coolant		
			❍	❍	❍	❍	Check crankcase breather tube, clean it if necessary		
			❍	❍	❍	❍	Replace fuel filter elements		
				❍	❍	❍	Check and if necessary adjust engine speed control		
					❍	❍	Check mounting screws of engine consoles, oil pan and splitterbox		
					❍	❍	Check intake and exhaust system for condition and tightness		
							Replace main element on air filter (as necessary, at least once a year)		
							Replace safety element on air filter (as necessary, at least once a year)		
							Check air hoses between air filter and engine (at filter maintenance)		
							Replace antifreeze and anticorrosive coolant mixture (every 2 years)		
							Every 1500 hours or 1 year perform a complete "1500 hours" Maintenance Work, as stated in Operation and Maintenance Manual for Cummins Engine		
							Every 6000 hours or 2 years perform a complete "6000 hours" Maintenance Work, as stated in Operation and Maintenance Manual for Cummins Engine		
AIR SYSTEM									
	●	●	❍	❍	❍	❍	Check alcohol level in the antifreeze pump (during cold season)		
	●	●	❍	❍	❍	❍	Drain air tank (in winter daily and in summer weekly)		
❍				❍	❍	❍	Check cut in and cut out pressures of air pressure regulator		
HYDRAULIC SYSTEM									
❍	●	●		❍	❍	❍	Check oil level in hydraulic tank		
❍	■	●		❍	❍	❍	Clean magnetic rods in return filters (daily during first 300 hrs.)		
				❍	❍	❍	Replace oil filter in the servo control circuit		
				❍	❍	❍	Replace replenishing oil filter on swing pump		
				❍	❍	❍	Check mounting of components		
				❍	❍	❍	Drain condensation water at hydraulic tank (When using environmentally friendly hydraulic fluids keep water percentage below 0,1%, if necessary install a bypass oil filter)		

Maintenance / inspection at operating hours							WORK TO BE CARRIED OUT R 984 C - Litronic		
On delivery	Every 8 - 10	Every 10 -50	At 250, 750	At 500, 1500	At 1000, 3000	At 2000, 4000	**By maintenance personnel (machine owner)** ■ First and only interval ● Repeat interval ♦ Special interval every 250 hours	**By authorized specialist personnel** ❑ First and only interval ❍ Repeat interval	**Note**
				❍	❍	❍	If mounted check return filter for hydraulic hammer for cleanliness, replace element if necessary		
				❑	❍	❍	Replace return filter cartridge (first at 500 hours)		
				❑	❍	❍	If mounted, replace bypass oil filter element (first 500 hours and at least every 6 months)		
					❍	❍	Check cleanliness of hydraulic oil cooler, clean it as necessary		
					❍	❍	Check hydraulic system for function and leaks		
					❍	❍	Check and adjust primary and secondary pressure relief valves		
					❍	❍	Bleed servo system and hydraulic pumps		
						❍	Replace hydraulic oil (or optimise intervals according to oil sample analysis reports)		3)
						❍	Replace breather filter on hydraulic tank		
						❍	Check filter elements of high pressure filters, if necessary clean or replace them		
ELECTRICAL SYSTEM									
❍	●	●		❍	❍	❍	Check indicator lights and gauges on control panel when starting		
❍				❍	❍	❍	Check head and floodlights		
				❍	❍	❍	Check level and specific gravity of electrolyte in the batteries		
				❍	❍	❍	Check and clean battery terminals		
❍					❍	❍	Check system and components for function		
SWING GEAR									
❍				❍	❍	❍	Check oil level and for leaks		
				❑	❍	❍	Replace gear oil (first at 500 hours)		
					❍	❍	Check function and operation of swing brake		
					❍	❍	Check mounting of gear and oil motor		
SWING RING									
	●	●		❍	❍	❍	Lube swing ring teeth		
	●	●		❍	❍	❍	Check grease level in lube pump for swing ring teeth		

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Maintenance / inspection at operating hours							WORK TO BE CARRIED OUT R 984 C - Litronic		
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					❍	❍	Check, if necessary tighten mounting screws		
					❍	❍	Check pinion gear mesh		
							TRAVEL GEARS		
❍				❍	❍	❍	Check oil level and for leaks		
					❍	❍	Check function and operation of travel brakes		
				❑	❍	❍	Check mounting screws of gears, sprocket wheels and oil motors		
				❑		❍	Replace gear oil (first at 500 hours)		SAE 90 or SAE 80W90
							TRACKS		
❍	●	●		❍	❍	❍	Check track chain tension visually, retighten if necessary		
	●						Clean track chains (after working hours)		
		●		❍	❍	❍	Check and tighten mounting screws of track pads and sprocket wheels		
				❍	❍	❍	Clean and lubricate sliding surfaces of chain tensioners		
				❍	❍	❍	Check idlers, carrier and track rollers for leaks		
							CENTRAL LUBRICATION		
❍	●	●		❍	❍	❍	Check movement of control pins and hoses for leaks		
	●	●		❍	❍	❍	Perform a complete weekly maintenance		
							Yearly perform a lube pump control head maintenance		
							CAB & HEATER		
		●		❍	❍	❍	Check level in reservoir for winshield washer, refill if necessary		
❍					❍	❍	Check function of heater (before start of cold season)		
					❍	❍	Check heater system for leaks		
					❍	❍	Check and grease locks and hinges on doors and windows		
						❍	Check the warm water solenoid valve for function and chocking, clean it as necessary		

Maintenance / inspection at operating hours							WORK TO BE CARRIED OUT R 984 C - Litronic		
On delivery	Every 8 - 10	Every 10 -50	At 250, 750	At 500, 1500	At 1000, 3000	At 2000, 4000	**By maintenance personnel (machine owner)** ■ First and only interval ● Repeat interval ♦ Special interval every 250 hours	**By authorized specialist personnel** ❑ First and only interval ❍ Repeat interval	**Note**
							AIR CONDITIONER		
		●		❍	❍	❍	Operate the air conditioner (at least once every second week)		
				❍	❍	❍	Check the condition of condensator, blow it out if necessary		
				❍	❍	❍	Clean, if necessary replace both air filters in airco unit. Reduce maintenance interval in very dusty conditions		
				❍	❍	❍	Check the mounting screws and the drive belt of airco compressor		
				❍	❍	❍	Check the drier / receiver unit for moisture degree, coolant level and good condition (no rust), replace it if necessary		
						❍	Check the condition of evaporator unit, clean as necessary		
						❍	Check electrical wires for damage and for loose connections		
						❍	Check pressure switch for function		
						❍	Check efficiency of air conditioner after opening the circuit, repairs or as necessary		
							Yearly replace the drier receiver unit, for the occasion check the whole circuit for leaks and replace refrigerating agent and refrigerator oil		
							Yearly have the function of the air flaps and of the defrosting thermostat checked by a refrigeration specialist		
							UNDERCARRIAGE + UPPERCARRIAGE + ATTACHMENT		
	●	●		❍	❍	❍	Check bucket teeth visually for wear		
❍	●	●		❍	❍	❍	Lubricate all grease and lubrication points		
		♦			❍	❍	Check all parts for cracks		
		♦			❍	❍	Check mounting screws of counterweight and tanks for tightness		
					❍	❍	Check and lubricate cover hinges and locks, check mounting and efficiency of cover lifting cylinders		
❍					❍	❍	Check the lowering speed of the attachment		~5 sec.
❍							Explain proper use and maintenance to the operator		

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Maintenance / inspection at operating hours							WORK TO BE CARRIED OUT R 984 C - Litronic		
On delivery	Every 8 - 10	Every 10 -50	At 250, 750	At 500, 1500	At 1000, 3000	At 2000, 4000	**By maintenance personnel (machine owner)** ■ First and only interval ● Repeat interval ♦ Special interval every 250 hours	**By authorized specialist personnel** ❑ First and only interval ❍ Repeat interval	**Note**
❍							Ask the operator to lubricate the machine using the lube chart, explain defects and deficiencies.		
	●						The daily maintenance work of the driver include the check of the proper function of hydraulic, electric and brakes systems before starting operation. He must alos perform daily a visual check of engine, hydraulic system, gears and track parts for leaks.		

Tab. 5-8 *Control and maintenance chart*

1 Depending on temperature, fuel and oil qualities, the intervals for engine lube oil changes may be reduced.

3 When using environmentally friendly hydraulic fluids, the maintenance interval must be determined through oil sample analysis reports.

5.23 Centralized lubrication system

1 Function

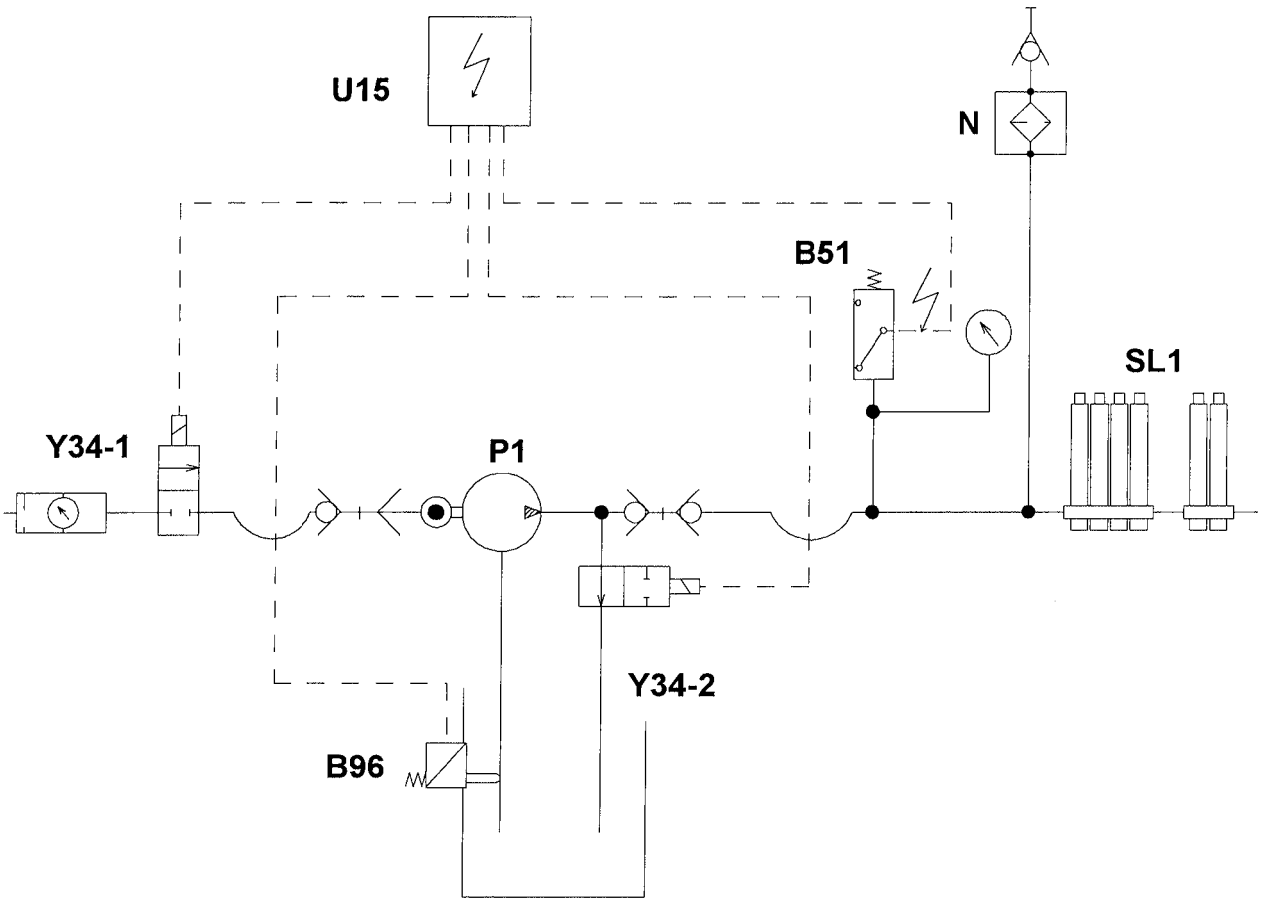
Structure
The lubrication unit comprises a grease reservoir, a pneumatic lubrication pump and a control unit which triggers the lubrication operations.
The grease reservoir and pneumatic lubrication pump are situated behind the cab. The command unit U15 is into the cab rear control panel integrated.

1.2 Sequence of a lubrication cycle

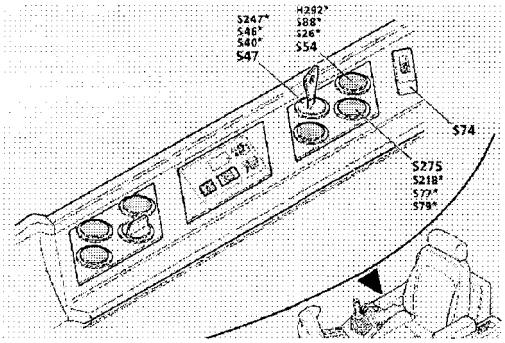
Upon expiration of the pause phase the pump P1 begins operation and delivers the lubricant via the main line to the injectors SL 1. The pistons in the injectors are actuated by the lubricant pressure and issue a metered quantity of lubricant to the connected lubrication points.
The pressure in the main line increases further until the value (240 bar) set at the pressure switch B51 is reached. The control unit closes the pneumatic solenoid valve Y34-1 (the pump stops) and, at the same time, the main line is relieved by means of the solenoid valve Y34-2. The depressurized lubricant reaches the reservoir of the pump via a bypass.
The pistons in the injectors SL 1 return to their original position by means of spring power.
The pause phase begins. The system is ready for a new lubrication cycle.

1.3 Manual Emergency Lubrication

To provide the lube points with lubricant by hand, first of all the 2/2-way solenoid valve (Y34-2) must be closed by pressing down the solenoid pin (see 9.3A-68001-A97 Page 5, Fig. 5 of attachment). Thus, a backflow of the lubricant to the reservoir can be avoided.
In continuation, the system can be lubricated by hand on the tube fitting block (N) via an external pump. (see 984_9419A.2D Page 2)
Pressurize the system with a pressure of 240 bar for 30 seconds in order to make sure that all lubricant metering devices have been activated.



2 Operation

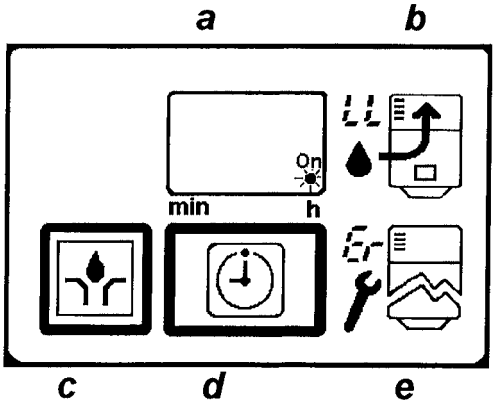


CAUTION

- **Only allow operation by properly instructed personnel**
- **Do not exceed permissible system pressures**
- **Top up lubricant or change drum in good time**

When the excavator is started the lubrication system is automatically alive.
The lubrication pump then carries out a complete lubrication cycle, is stopped only for the duration of the set pause time, etc....
The pause time is factory set at 2 hours.

During lubrication the diesel engine must be in operation because the lubrication pump is driven via the compressed air of the excavator.
During a lubrication cycle, the pump function is represented by a rotating girder on the field indicator.
The delivery of grease can be checked by ensuring that the control pin of each injector moves back and forth.

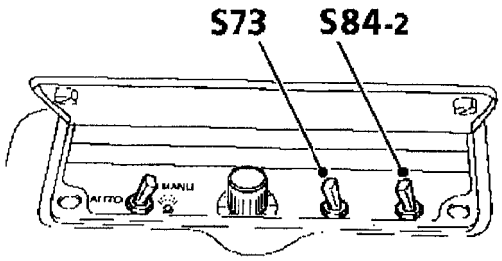


The flashing of the pushbutton ***C*** indicates a malfunction in the automatic lubrication system (lubrication cycle still not completed after about one hour).

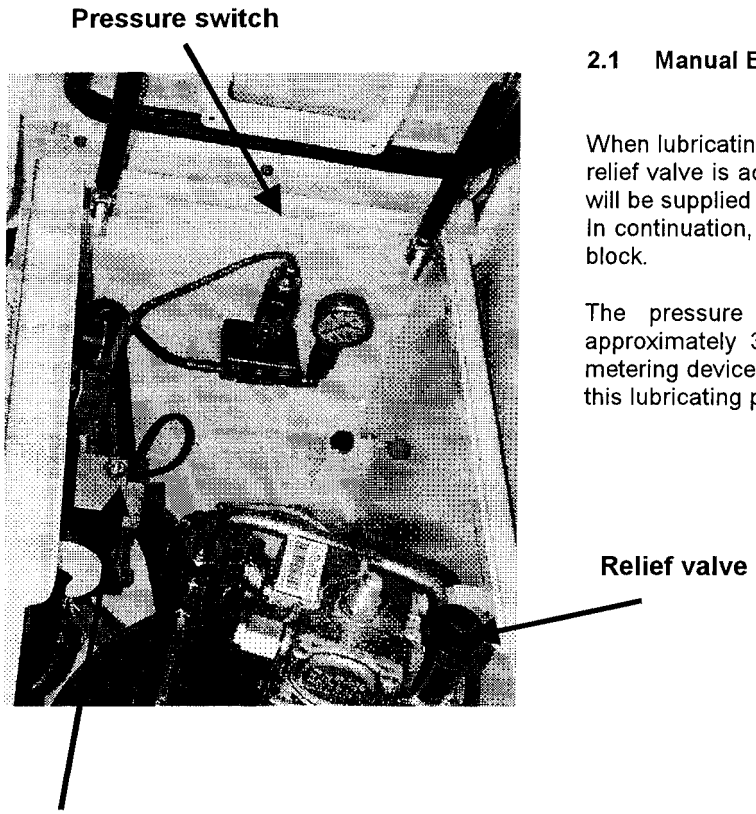
The fault is also indicated by means of an intermittent whistling sound at the control unit. Possible causes of malfunction are:

- Blockage or breakage of the main line
- Fault at the pressure switch
- Lack of lubricant in the grease reservoir
- Fault in the power supply of the lubrication system
- Fault in the compressed air system

An additional lubrication cycle can be triggered at any time by pressing the key ***c*** on the control unit U15 (at least 2 sec).



On malfunction of the command unit U15, an additional lubrication cycle can be triggered by key S84-2 of the emergency unit command E52.



2.1 Manual Emergency Lubrication:

When lubricating the system with an external pump make sure that the relief valve is actuated by hand at the same time so that the lubricant will be supplied to the system and not back to the reservoir.
In continuation, the system can be lubricated via the lubrication fitting block.

The pressure switch must be pressurized with 240 bar for approximately 30 seconds in order to make sure that all lubricant metering devices have been activated. In case of a failure of the pump, this lubricating procedure has to be carried out every two hours daily.

3 Inspection and maintenance

- **Do not perform any repairs while system is pressurized.**
- **To relieve pressure open a threaded connection carefully.**
- **Caution: Lubricant may escape while pressurized.**

Regular inspection and maintenance are the prerequisites for proper operation of the centralized lubrication system over a prolonged period of time. The warranty on our product can only be valid if the prescribed maintenance intervals are adhered to. The regular inspections and maintenance procedures are described below:

1. System as a whole

Daily: Visual check of the hose connections for leaks or wearing.
Visual check of the lubrication points for escaping lubricant.

Weekly: Visual check of the screwed pipe connections for leakage.
Determining the time for one operating cycle. If the time determined differs from the usual operating time, the individual components (pump station, injectors, pipes) must be checked.
Functional check of the pressure switch.

2. Pump station

Weekly: Check that threaded connections and hoses are firm and tight.
Visual check that connections and couplings have no leaks.
Check function of the solenoid valve.
Check electrical cable connections.
Clean outside of pump station.

Yearly: Pump 82716: Maintenance of the control head (grease according to maintenance instruction, page 16 in User's Information 7.3A-38015-A98).

3. Injectors

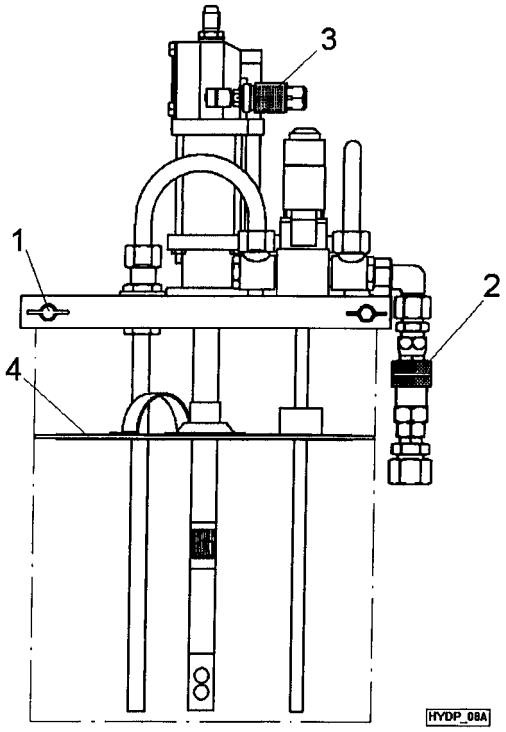
Daily: Check movement of control pins: During the work cycle the pins must be retracted depending on the metering quantity; in the resting phase all the pins must be extended.

Weekly: Visual check for leaks.

4 Exchanging / topping up grease reservoirs

CAUTION

- **Lines are pressurized. Be careful when decoupling.**
- **Observe extreme cleanliness when exchanging or topping up the grease reservoirs.**
- **Contaminated lubricant causes malfunctions and premature wear of the grease pump and other components of the system.**
- **Clean surroundings before exchanging or topping up.**
- **Switch off centralized lubrication system (turn off engine).**



* Open cover of the lubrication box and lock in place
* Loosen air coupling 3 and grease coupling 2
* Loosen three thumb screws 1 of the drum cover
* Pull pump out of the empty drum. Also remove the follower plate from the drum, grasping it by the handle.
  Caution: Do not place on a dirty surface!
* Replace the empty drum with a full one
* Place follower plate on top of the grease in the full drum. Try not to trap any air under the follower plate.
* Sink pump into the full drum and tighten the thumbscrews 1
* Reattach grease hose and air hose

5 Malfunctions and their remedy

In the following, only malfunctions of the system as a whole are described. You will find detailed remedies for malfunctions of the individual units in the respective User's Information.

• **Malfunction: No pressure build-up in the system**	
• **Cause:**	• **Remedy:**
• Malfunctions of the pump	• See Troubleshooting: Pump
• Leakage in the main line	• Check main lines, eliminate leaks, tighten threaded connections, replace defective hoses
• Air trapped in the main line	• De-aerate the line
• Injectors leaky or worn	• See Troubleshooting: Injectors

• **Malfunction: No pressure relief or too slow pressure relief in the main line**	
• **Cause:**	• **Remedy:**
• Pressure control device faulty	• Replace pressure control device, check electric cable
• Solenoid valve faulty	• Replace solenoid valve, check voltage supply
• Grease too hard or not suitable for low temperatures	• Change lubricant