

Operating manual

Hydraulic excavator
R 964 C-Litronic

from serial number 30836

Document identification

ORIGINAL OPERATING MANUAL

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Product identification

Manufacturer: LIEBHERR France S.A.S.
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Type no.: 448 / 1008 / 1009 / 1126 / 1145 / 1165 / 1278 / 13000 /
1364 / 1370 / 1377 / 1416 / 1447 / 1448
Conformity: CE

Address

Liebherr France S.A.S.
2 avenue Joseph Rey
B.P 287 F - 68005 Colmar Cedex

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:

. . / . . / . .

Introduction

This operating manual has been specifically devised for **machine operators** and **maintenance personnel**. It contains important warnings, information and tips regarding the maintenance and proper operation of the machine. It assists you in becoming familiar with the functions and features of the machine and helps prevent incorrect operation.

By strictly adhering to the instructions in the operating manual, you can significantly enhance the reliability and service life of the machine.

The operating manual is an integral part of the scope of delivery of the machine. Ensure that a copy is at all times available in the storage compartment in the operator's cab.

Carefully read the operating manual before starting the machine and then regularly read it again. All persons carrying out work on or with the machine must be fully familiar with the content of the operating manual and must adhere to the instructions.

Such work include:

- **Machine operation** including tooling, troubleshooting during work, general care and cleaning, disposal of fuels and lubricants.
- **Maintenance** including inspection, servicing and repair.
- **Transport** or loading of the machine.

The machine owner must ensure that this operating manual is complemented with the relevant statutory regulations for accident prevention and the protection of the environment. Apart from the instructions in this operating manual and the statutory accident prevention, health and safety regulations applicable in the country of operation, all personnel working on or with the machine must adhere to best practice for safe and proper operation.

Certain sections in this manual might not apply to your specific model.

Some of the figures in this operating manual might show details or equipment that differ from those in your machine.

Some of the figures show the equipment with guards or covers removed (for better depiction).

As our products are constantly being improved, certain changes might be made to the equipment which are not referred to specifically in this operating manual.

Should you require additional information or if you have any queries, please contact the LIEBHERR customer service department.

Warranty and liability

Due to the range of products (e.g. fuels, lubricants, tool attachments, spare parts) available from other manufacturers, LIEBHERR is not in a position to assess the compatibility of these products with its own machines. This also applies in relation to possible effects that third-party products have on LIEBHERR products and vice versa.

It is therefore the responsibility of the machine owner to assess whether third-party products can be safely used in conjunction with the LIEBHERR machine. LIEBHERR shall not be liable for damage to or downtimes of LIEBHERR machine caused by the use of third-party products. Such damage is not covered by the LIEBHERR warranty.

LIEBHERR shall not be liable for damage caused by improper operation, insufficient maintenance or non-compliance with safety instructions.

Amendments, general terms and conditions, copyright

We reserve the right to modify our products and amend the instructions in this operating manual without prior notice.

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The warranty and liability clauses of the general business terms and conditions of LIEBHERR apply.

Table of contents

1	Product description	1-1
1.1	Assembly - overview.....	1-1
1.1.1	Machine with backhoe attachment.....	1-1
1.1.2	Machine with shovel attachment	1-2
1.1.3	Uppercarriage.....	1-2
1.1.4	Undercarriage.....	1-3
1.2	Vibration emissions.....	1-3
1.3	Sound emission	1-5
1.4	EC Declaration of Conformity	1-6
1.5	Technical data	1-7
2	Safety instructions, Signs on the machine	2-1
2.1	Meaning of the symbols in this manual.....	2-1
2.2	Use in accordance with the regulations.....	2-2
2.3	Safety Instructions	2-2
2.4	Servicing the machine safely	2-13
2.5	Signs on the machine	2-19
2.5.1	Introduction.....	2-19
2.5.2	Arrangement of signage	2-20
2.5.3	Explanation of signage	2-21
2.5.4	Nameplates on the machine.....	2-26
3	Control and operation	3-1
3.1	Operating and control elements.....	3-1
3.1.1	Controls in the operator's cab	3-1
3.1.2	The joysticks.....	3-3
3.1.3	Control unit.....	3-7
3.1.4	Monitoring display	3-11
3.1.5	Main screen.....	3-14
3.1.6	Information provided in the menus (Software Version V6.0).....	3-22
3.1.7	Controls on side control desks.	3-37
3.1.8	Controls and instrumentation for optional equipments	3-38
3.1.9	Display for LIEBHERR particle filter (option).....	3-43
3.2	Access and equipment of the cab.....	3-45
3.2.1	Entering or leaving the cab.....	3-45
3.2.2	The safety lever	3-47
3.2.3	Operator seat	3-48
3.2.4	Putting on and releasing the safety belt	3-51
3.2.5	Windscreen	3-51
3.2.6	Sunshade	3-52
3.2.7	Emergency exit – rear window	3-53
3.2.8	Interior lighting.....	3-53
3.2.9	Fire extinguisher*	3-53
3.2.10	The heater and air conditioner	3-54
3.2.11	Additional standstill heater (option)	3-60
3.3	Setting the machine into operation	3-64
3.3.1	Before starting the machine	3-64
3.3.2	Turning on the electrical system.....	3-65
3.3.3	Starting the Diesel engine	3-67
3.3.4	Speed adjustment and operating modes.....	3-68
3.3.5	Notes after starting the engine	3-70
3.3.6	Warm-up phase for Diesel engine and hydraulic circuit	3-70
3.3.7	Switching the Diesel engine off	3-71
3.3.8	Automatic motorstop after low idle (option)	3-72

3.3.9	Starting aids.....	3-73
3.3.10	Jump start procedure.....	3-74
3.3.11	Immobilizer with electronic ignition key (option)	3-75
3.4	Working with the machine.....	3-77
3.4.1	The travel movements	3-77
3.4.2	Drive warning device (option)	3-82
3.4.3	The uppercarriage swing movements	3-82
3.4.4	Working position	3-85
3.4.5	Working attachment control	3-85
3.4.6	Lowering the working attachment with the engine shut down	3-88
3.4.7	Rotating, tilting, locking and unlocking a working tool	3-88
3.4.8	Lifting magnet control system (optional equipment)	3-90
3.4.9	Control of additional attachments via the additional pedals	3-91
3.4.10	Commutation of control for an additional attachment (option)	3-93
3.4.11	Cut off by end switches of attachment movements (option)	3-95
3.4.12	Use of the excavator for lifting loads overhead	3-98
3.4.13	Overload warning device (Option)	3-99
3.4.14	Hydraulically adjustable cab (option).....	3-101
3.5	Operating the excavator in safety modes	3-104
3.5.1	Board E52 for safety mode of Diesel engine & servo control	3-104
3.5.2	Safety operation of the main working pumps	3-107
3.5.3	Emergency attachment lowering with defective servo circuit	3-108
3.5.4	Emergency supply of the boom cylinders (optional)	3-109
3.6	Recovering, towing the machine	3-111
3.6.1	Towing with the machine, emergency towing of the machine	3-111
3.7	Attaching and dismounting equipment parts.....	3-114
3.7.1	Removal and installation of a bucket.....	3-114
3.7.2	Attaching and dismounting the bucket with improved sealing	3-116
3.7.3	Attaching and dismounting the grab on stick	3-118
3.7.4	Attaching and dismounting the grab on the industrial stanchion	3-121
3.7.5	Attaching and dismounting the stick to the boom	3-123
3.7.6	Mechanical quick-change adapter (option).....	3-125
3.7.7	Hydraulic quick-change adapter (option).....	3-129
3.7.8	LIKUFIX – hydraulic coupling system (option).....	3-136
3.8	General working methods	3-139
3.8.1	Minimum impact working methods for your machine.....	3-139
3.8.2	Preparatory activities	3-139
3.8.3	Using a backhoe bucket	3-140
3.8.4	Loading a transport vehicle	3-142
3.8.5	Skimming.....	3-142
3.8.6	Using a clamshell bucket (earthmoving attachment)	3-143
3.8.7	Using a multiple tine grapple (industrial attachment).....	3-145
3.8.8	Using an hydraulic hammer	3-146
3.8.9	Working with a bottom dump bucket	3-148
3.9	Installing & removing the serial counterweight.....	3-150
3.10	Transport.....	3-152
3.10.1	Transporting the excavator on flatbed trailers	3-152
3.10.2	Loading the machine with a crane	3-154
4	Malfunctions.....	4-1
4.1	Error code list.....	4-2
4.2	Faults and remedies	4-14
4.2.1	Diesel engine and fuel system.....	4-14
4.2.2	Hydraulic system	4-15
4.2.3	Transmission	4-16
4.2.4	Electrical system.....	4-16
4.2.5	Work equipment	4-17
4.2.6	Heating/air-conditioning system	4-17

4.2.7	LIEBHERR particles filter system	4-19
4.3	Fuses and relays	4-21
4.3.1	Electrical power box E50 with main fuses	4-21
4.3.2	Control plate A1010 with fuses	4-22
5	Maintenance	5-1
5.1	Maintenance access doors	5-1
5.1.1	Overview of access doors	5-1
5.1.2	Door retaining rods	5-2
5.1.3	Opening, closing, locking the engine hood 21	5-3
5.2	Cleaning machine	5-4
5.3	Care for rubber components	5-4
5.4	Lubricants and fluids	5-5
5.4.1	General information	5-5
5.4.2	Filling quantities and lubricating chart	5-5
5.5	Lubricants and fluids specification	5-8
5.5.1	Diesel fuels	5-8
5.5.2	Lubricating oil for the diesel engine	5-9
5.5.3	Coolants for diesel engine	5-11
5.5.4	Hydraulic oil	5-14
5.5.5	Lubricants for gearboxes	5-19
5.5.6	Grease	5-21
5.5.7	Lubricants and care products for electrical and mechanical components	5-21
5.6	Diesel engine	5-22
5.6.1	Checking the oil level in the Diesel engine	5-22
5.6.2	Replacing the engine oil and the engine oil filter elements	5-23
5.6.3	Polyvee belt for the airco compressor and alternator drive	5-25
5.6.4	Lubricating the starter ring gear	5-26
5.6.5	Checking mounting bolts	5-27
5.6.6	Oil separator	5-27
5.6.7	Heater flanges	5-29
5.6.8	Checking and adjustment of valve clearance	5-30
5.7	LIEBHERR particles filter (option)	5-32
5.7.1	Drain the condensation water	5-32
5.7.2	Water separator maintenance	5-32
5.8	Cooling system	5-33
5.8.1	Checking and cleaning the cooling system	5-33
5.8.2	Checking the coolant level	5-34
5.8.3	Changing the coolant	5-34
5.8.4	Checking coolant, adjusting mixing ratio	5-37
5.9	Fuel system	5-40
5.9.1	Refuelling	5-40
5.9.2	Electrical refuelling pump (optional extra)	5-41
5.9.3	Draining the fuel tank	5-44
5.9.4	Emptying and cleaning the fuel tank	5-44
5.9.5	Draining the fuel prefilter	5-45
5.9.6	Replacing the fuel filter elements	5-45
5.9.7	Bleeding the fuel system	5-48
5.10	Dry air filter	5-49
5.10.1	Changing the main element	5-51
5.10.2	Changing the safety element	5-52
5.10.3	Checking the intake air lines	5-52
5.11	Hydraulic system	5-52
5.11.1	Depressurizing the hydraulic system	5-53
5.11.2	Checking the oil level, emptying and refilling the hydraulic tank	5-54
5.11.3	Checking and cleaning the oil cooler system	5-57
5.11.4	Return filter	5-57
5.11.5	Servofilter	5-59

5.11.6	Replenishing oil filter in swing circuit	5-59
5.11.7	Servo control circuit	5-60
5.11.8	Air bleeding of the servo control chambers	5-60
5.11.9	Bleeding the hydraulic pumps	5-61
5.11.10	Bleeding the hydraulic cylinders	5-62
5.11.11	Removing the suction hose to the pumps	5-64
5.11.12	Breather filter on the hydraulic tank.....	5-65
5.11.13	Bypass oil filter for hydraulic system (option)	5-65
5.11.14	High pressure filters in working circuit	5-67
5.11.15	Servicing the hydraulic cylinder	5-68
5.11.16	Replacing hydraulic hoses.....	5-69
5.12	Oil changes on components	5-70
5.12.1	General information	5-70
5.12.2	Swing gear - Oil level check and oil change	5-71
5.12.3	Travel gear oil change	5-71
5.12.4	Splitterbox - Oil change	5-73
5.13	The track components	5-73
5.13.1	Checking the mounting screws of the track components	5-74
5.13.2	Checking the track chains tension	5-74
5.13.3	Retensioning the track	5-76
5.13.4	Releasing the track chain tension.....	5-76
5.13.5	Cleaning the track components	5-77
5.14	24 V circuit	5-78
5.14.1	General checks on the 24 V electrical system.....	5-78
5.14.2	Batteries care	5-79
5.14.3	Batteries switch	5-80
5.14.4	Protection of the 24 V circuit during maintenance works.....	5-80
5.15	Heating/air-conditioning system.....	5-81
5.15.1	Recirculated and fresh air filters	5-81
5.15.2	Heating system	5-82
5.15.3	Air-conditioning system	5-82
5.16	Greasing the machine.....	5-85
5.16.1	The centralized lubrication system	5-85
5.16.2	Operation of the full automatic system	5-87
5.16.3	Emergency lubrication with defective lubrication system.....	5-88
5.16.4	To refill a grease container	5-89
5.16.5	Changes in the lubrication circuit.....	5-90
5.16.6	Greasing the grab (optional extra)	5-91
5.17	Quick-change systems.....	5-92
5.17.1	Greasing the mechanical quick-change adapter (option)	5-92
5.17.2	Hydraulic quick-change adapter (option)	5-92
5.17.3	LIKUFIX (option).....	5-93
5.18	Check mounting bolts for tightness.....	5-94
5.18.1	Mounting bolts of the counterweight.....	5-95
5.18.2	Mounting screws of the swing ring	5-95
5.18.3	Mounting screws of the hydraulic oil and fuel tank	5-96
5.18.4	Mounting bolts of the swing gear and motor.....	5-96
5.18.5	Mounting bolts central piece to side frames (option "removable side frames")	5-96
5.19	Drive unit brakes and swing gear brakes.....	5-97
5.20	General maintenance points.....	5-97
5.20.1	Replacing working parts	5-97
5.20.2	Checking or replacing the teeth on the bucket	5-98
5.20.3	Welding work on the machine	5-100
5.21	Maintenance chart	5-102

1 Product description

1.1 Assembly - overview

This section comprises an overview of the machine and gives, for the shown components, the denominations currently employed in this manual.

1.1.1 Machine with backhoe attachment

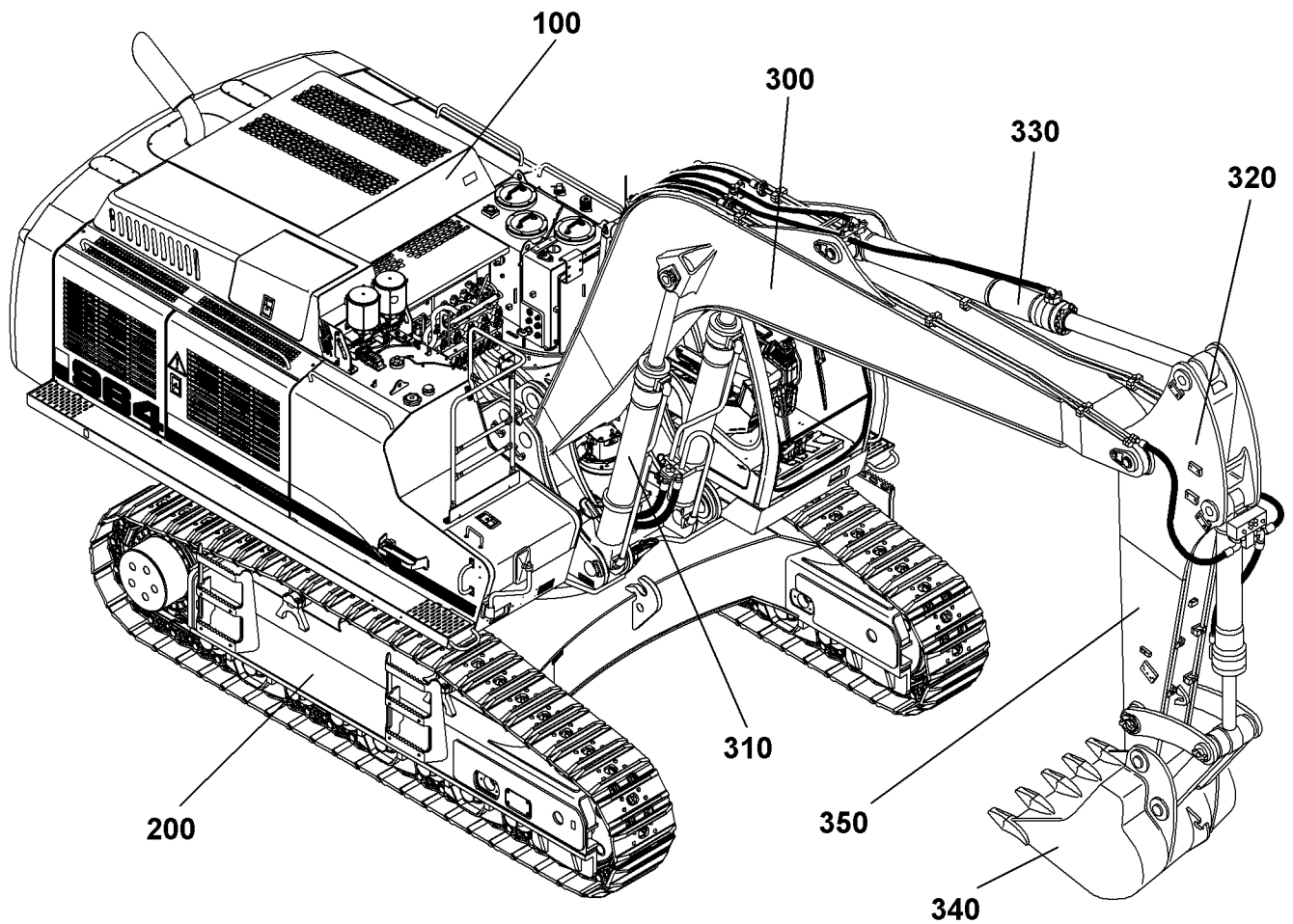


Fig. 1-1 Machine with backhoe attachment

100	Uppercarriage	200	Undercarriage	300	Monobloc boom
310	Boom cylinders	320	Stick	330	Stick cylinder
340	Backhoe bucket	330	Bucket tilt cylinder		

1.1.2 Machine with shovel attachment

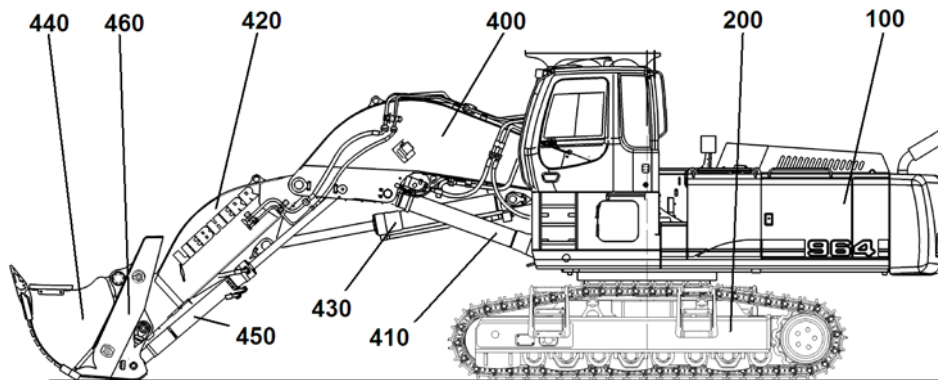


Fig. 1-2 Machine with shovel attachment

100	Uppercarriage	200	Undercarriage	400	Main arm
410	Boom cylinders	420	Shovel stick	430	Stick cylinder
440	Shovel	450	Shovel tilt cylinders	460	Shov. flap cylinders

1.1.3 Uppercarriage

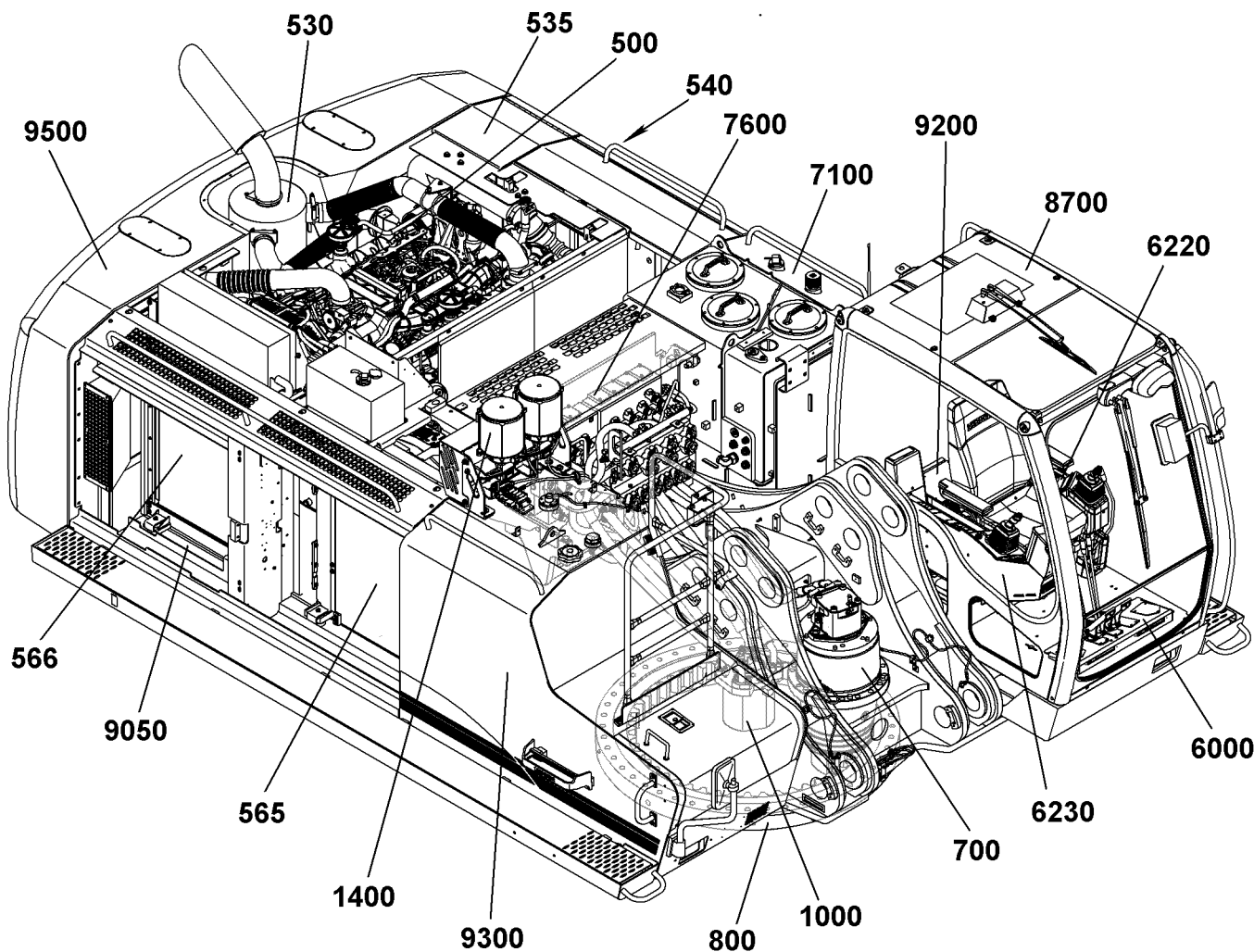


Fig. 1-3 Uppercarriage

LFR/en/Edition: 07 / 2011

500 Diesel engine	530 Exhaust system
535 Air filter	540 Hydraulic pumps
565 Radiator unit (Hydraulic oil-, Split-terbox oil- and fuel cooling)	566 Radiator unit (Engine coolant and boost air cooling)
700 Swing gear	800 Swing ring
1000 Rotary connection	1400 Central lubrication system
6000 Cab bottom part	6220 Control board left
6230 Control board right	7100 Hydraulic oil tank
7600 Control valves assembly	8700 Driver's cab
9050 Batteries	9300 Fuel tank
9500 Counterweight	

1.1.4 Undercarriage

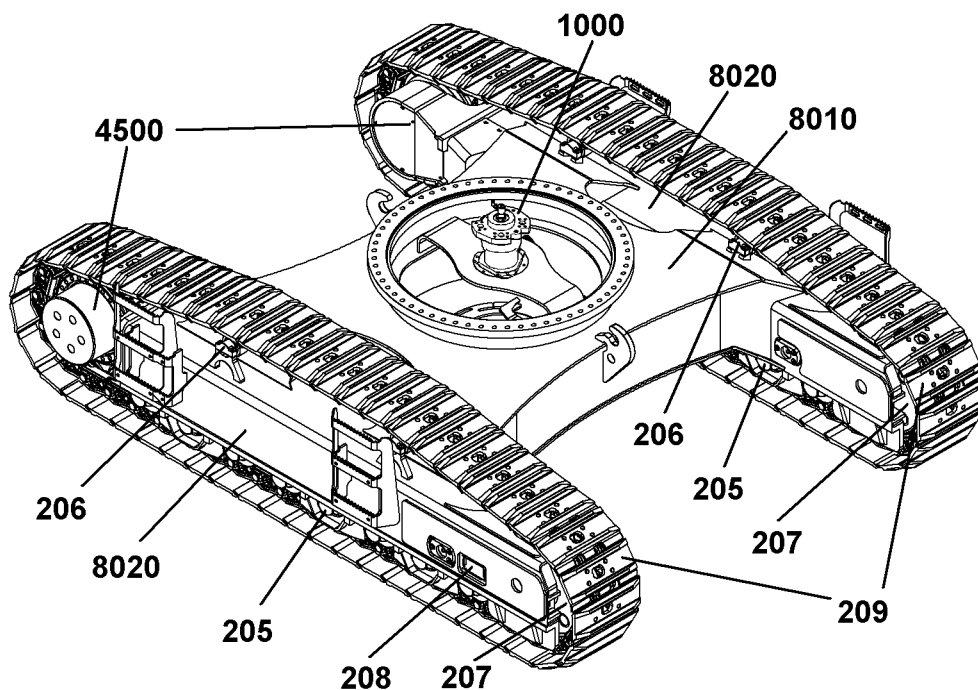


Fig. 1-4 Undercarriage

205 Track roller	206 Carrier roller
207 Idler wheel	208 Tension unit
209 Chain	1000 Rotary connection
4500 Travel gear with sprocket wheel	8010 Undercarriage central piece
8020 Side frame	

1.2 Vibration emissions

The operator seat built into the machine by the manufacturer conforms to ISO

7096:2000, EM 6. When replacing the seat, ensure that the new seat also conforms to this standard.

Hand-arm vibration

If the machine is operated according to the manufacturer instructions, the weighted (frequency-rated) effective hand-arm vibration is below 2.5 m/s² according to ISO 5349-1:2001.

Whole-body vibration

If the machine is operated according to the manufacturer instructions, the weighted (frequency-rated) effective vibration shown for specific machine applications in the table below apply. These values conform to the specifications in the technical report ISO/TR 25398:2006 "Earth-moving machinery – Guidelines for assessment of exposure to whole-body vibration of ride-on machines – Use of harmonized data measured by international institutes, organizations and manufacturers". The method of assessment conforms to ISO 2631-1:1997. The effective values in the table for representable machines are shown with the applicable standard deviations. These deviations are classified according to the operating conditions in the classes "light-duty", "normal" and "heavy-duty". It is the responsibility of the machine owner to assess the operating conditions according to the classes, taking into account the terrain, site conditions, site organisation, material, machine equipment, working procedure and training of the operator.

As the quoted values are effective values for specific, common applications, the whole-body vibration to which the operator is exposed can only be estimated. For a more detailed assessment of the daily exposure of the operator across an 8-hour shift, please refer to the LIEBHERR brochure on whole-body vibration and the software designed for the assessment. This document and software are available from the LIEBHERR dealer and are included as standard on the documentation CD (Lipart) shipped with new machines.

For instructions how to reduce whole-body vibration during operation of mobile construction machinery, please refer to chapter "Control, operation / working with machine / safety instructions / vibration protection".

Machine type	Typical working cycles	Weighted effective vibration in m/s ² at operating conditions "light-duty" (1), "normal" (2) and "heavy-duty" (3)								
		x-axis			y-axis			z-axis		
		1	2	3	1	2	3	1	2	3
Crawler excavator	Excavator	0.14	0.31	0.49	0.08	0.19	0.31	0.13	0.30	0.47
	with hydraulic hammer	0.16	0.38	0.59	0.09	0.22	0.35	0.27	0.55	0.83
	Use for mining	0.31	0.46	0.61	0.19	0.30	0.41	0.29	0.61	0.93
	Transfer travel	0.21	0.34	0.48	0.09	0.23	0.37	0.56	0.79	1.02
Mobile excavator	Excavator	0.19	0.37	0.56	0.09	0.25	0.41	0.16	0.29	0.42
	Transfer travel	0.21	0.29	0.38	0.24	0.38	0.52	0.42	0.61	0.80

The measurement uncertainty is defined in standard EN 12096:1997.

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1.3 Sound emission

The sound values of the machine are specified in the technical data.

The sound power level (L_{wa}) is determined according to Directive 2000/14/EG. The measurement uncertainty of the sound power level value corresponds to the difference between the guaranteed and the measured value.

The sound pressure level (L_{pa}) is determined according to ISO 6396. The measurement uncertainty is defined in the above standard.

1.4 EC Declaration of Conformity

LIEBHERR

EC Declaration of Conformity Original Declaration of Conformity

Herewith we declare that the machine/equipment designated below is designed and built in the version sold by us in such a way as to comply with the relevant fundamental safety and health criteria of the applicable EC Directive(s). This declaration shall cease to be valid if alterations are made to the machine/equipment without our prior agreement.

Category:	Hydraulic excavator
Make:	LIEBHERR
Type:	R XXX Litronic
Serial number:	WLHZ????????????
Engine power:	XXX kW at 1800 min ⁻¹

1. Relevant regulations:

1.1. 2006/42/EC

1.1.1. Documentation officer:

Liebherr-France SAS, Design Manager, 2, av. Joseph Rey, F-68005 Colmar Cedex

1.1.2. Submitted voluntary for a design type examination with:

Fachausschuss Bauwesen, Prüf- und Zertifizierungsstelle im DGUV Test (ID no 0515), Landsberger Straße 309, D-80687 München

1.2. 2004/108/EC

1.3. 2000/14/EC

1.3.1. Measured sound power level on machines representative for this type:

XXX dB(A)

1.3.2. Guaranteed sound power level:

XXX dB(A)

1.3.3. Applied conformity assessment procedure according to Annex VIII

1.3.4. Technical documentation archive location: Technical office

1.3.5. Notified body:

Fachausschuss Bauwesen, Prüf- und Zertifizierungsstelle im DGUV Test (ID no 0515), Landsberger Straße 309, D-80687 München

2. Applied harmonised standards, in particular:

2.1. EN 474-1

3. Applied national technical standards and specifications, in particular:

3.1. EN 474-5

Liebherr-France SAS

NB 20613g-20A-11/09

Done at Colmar, jj/mm/aaaa

(Head of Quality Management Dept.)

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R.C. Colmar 61 B 48
SIRET 301374690-00016
Code APE : 2892Z
Code ID TVA : FR 80 301 374 690
Ust-ID-Nr. DE811607663
Steuer Nr. 08008/10334
Lieu de juridiction : Colmar

Fig. 1-5 Sample EC Declaration of Conformity

Valid for countries in the European Economic Area (EEA): An EC Declaration of Conformity is included in the scope of delivery. Keep the EC Declaration of Conformity in a safe place.

1.5 Technical data

This should be taken from the accompanying technical description.

Crawler Excavator

R 964 C
Litronic®

Operating Weight with Backhoe Attachment: 66,400 – 79,600 kg
Operating Weight with Shovel Attachment: 68,400 – 78,300 kg
Engine Output: 320 kW / 434 HP
Bucket Capacity: 1.50 – 5.00 m³
Shovel Capacity: 3.50 – 5.00 m³



LIEBHERR

Technical Data



Engine

Rating per ISO 9249	320 kW (434 HP) at 1,800 RPM
Model	Liebherr D9508
Type	8 cylinder V-engine
Bore/Stroke	128/157 mm
Displacement	16.16 l
Engine operation	4-stroke diesel common rail injection turbo-charged inter-cooled reduced emissions
Cooling	water-cooled
Air cleaner	dry-type air cleaner with pre-cleaner, primary and safety elements, automatic dust discharge
Fuel tank	1,250 l
Standard	sensor controlled engine idling
Electrical system	
Voltage	24 V
Batteries	2 x 170Ah/12 V
Starter	24 V/7.8 kW
Alternator	three phase current 28 V/80 A



Hydraulic System

Hydraulic pump for attachment and travel drive	2 Liebherr variable flow, swash plate pumps
Max. flow	2 x 410 l/min.
Max. pressure	350 bar
Pump regulation	electro-hydraulic with electronic engine speed sensing regulation, pressure compensation, flow compensation, automatic oil flow optimizer, flow summation
Hydraulic pump for swing drive	reversible, variable flow, swash plate pump, closed-loop circuit
Max. flow	245 l/min.
Max. pressure	340 bar
Hydraulic tank	565 l
Hydraulic system	1,050 l
Hydraulic oil filter	2 full flow filters in return line with integrated fine filter area (5 µm), 1 high pressure filter for each main pump
Cooler	radiator, consisting of cooling unit for coolant and aftercooler as well as 2nd cooler for hydraulic oil with hydrostatically regulated fan drive
MODE selection	adjustment of machine performance and the hydraulics via a mode selector to match application
LIFT	for lifting
FINE	for precision work and lifting through very sensitive movements
ECO	for especially economical and environmentally friendly operation
POWER	for maximum digging power and heavy duty jobs
RPM adjustment	stepless adjustment of engine output via the rpm at each selected mode
Menu for auxiliary functions	4 fixed adjustable oil flow parameters for optional working tool



Hydraulic Controls

Power distribution	via control valves in single block with integrated safety valves
Flow summation	to boom and stick
Closed-loop circuit	for uppercarriage swing drive
Activation	electro-hydraulic control
Attachment and swing	proportional via joystick levers
Travel	proportional via foot pedals or removable hand levers
	– speed pre-selection
Additional functions	via foot pedals or joystick toggle switch



Swing Drive

Drive by	Liebherr swash plate motor with integrated brake valves
Transmission	Liebherr compact planetary reduction gear
Swing ring	Liebherr, sealed single race ball bearing swing ring, internal teeth
Swing speed	0 – 5.6 RPM stepless
Swing torque	233 kNm
Holding brake	wet multi-disc (spring applied, pressure released)
Option	pedal-controlled positioning brake



Uppercarriage

Design	torque resistant modular upper frame design
Attachment mounting	parallel length girders
Catwalks	on both sides



Operator's Cab

Cab	profiles and deep drawn technology, resiliently mounted, sound insulated, tinted windows. Front window armored glass, door with sliding window
Operator's seat	shock absorbing suspension, adjustable to operator's weight, 6-way adjustable seat
Joysticks	integrated into adjustable seat consoles
Monitoring	menu driven query of current operating conditions via the LCD display. Automatic monitoring, display, warning (acoustical and optical signal) and saving machine malfunction data, for example, engine overheating, low engine oil pressure or low hydraulic oil level
Heating system	standard automatic air conditioning, combined cooler/heater, additional dust filter in fresh air/recirculated
Noise emission	
ISO 6396	L_{pA} (inside cab) = 75 dB(A)
2000/14/EC	L_{WA} (surround noise) = 107 dB(A)



Undercarriage

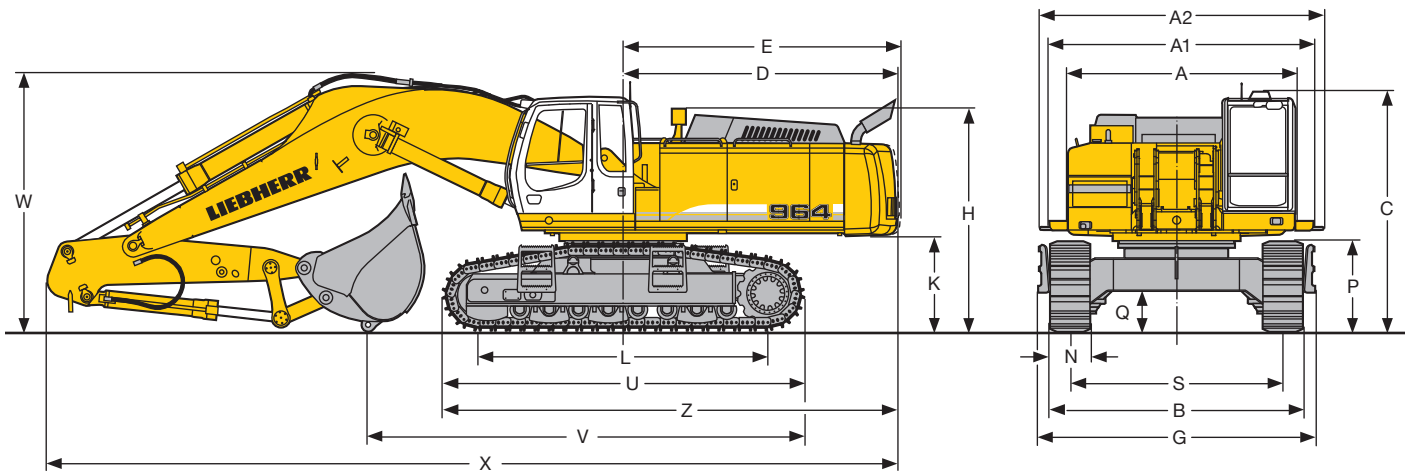
Versions	
HD	heavy duty
HD-SL	heavy duty, long undercarriage
S-HD	heavy duty version for extreme and difficult application
Drive	Liebherr swash plate motors with integrated brake valves on both sides
Transmission	Liebherr planetary reduction gears
Travel speed	HD/HD-SL: low range – 2.9 km/h high range – 4.1 km/h S-HD: low range – 2.6 km/h high range – 3.7 km/h
Drawbar pull max.	HD/HD-SL: 553 kN S-HD: 715 kN
Track components	HD/HD-SL: D 8 K, maintenance-free S-HD: B 9 S, maintenance-free
Track rollers/Carrier rollers	HD/S-HD: 8/2 HD-SL: 9/2
Tracks	HD/HD-SL: sealed and greased
Track pads	double-grouser beveled
Digging locks	wet multi-discs (spring applied, pressure released)
Brake valves	integrated into travel motor



Attachment

Type	combination of resistant steel plates and cast steel components
Hydraulic cylinders	Liebherr cylinders with special seal-system, shock-absorbed
Pivots	sealed, low maintenance
Lubrication	automatic central lubrication system (except link and tilt geometry)
Hydraulic connections	pipes and hoses equipped with SAE split-flange connections
Bucket	standard equipped with Liebherr tooth system

Dimensions

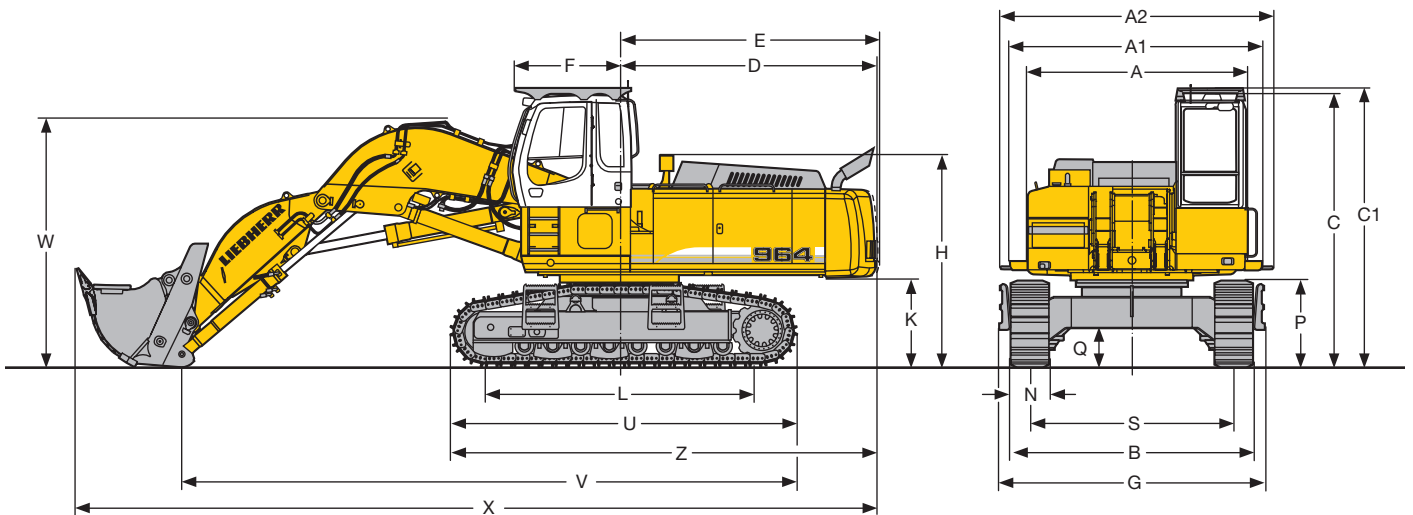


	HD			HD-SL		
	mm			mm		
A	3,506			3,506		
A1	3,976			3,976		
A2	4,235			4,235		
C	3,640			3,640		
D	4,120			4,120		
E	4,155			4,155		
H	3,345			3,345		
K	1,440			1,440		
L	4,345			4,575		
P	1,350			1,350		
Q	605			605		
S	3,200			3,200		
U	5,460			5,700		
N	500	600	750	500	600	750
B*	4,120	4,120	4,120	4,120	4,120	4,120
G**	4,170	4,170	4,320	4,170	4,170	4,320
Z	6,850			6,970		

* Width without access steps
** Width with access steps

	Stick Length	Gooseneck Boom 7.00 m	Gooseneck Boom 8.20 m	Gooseneck Boom 10.00 m
	m	mm	mm	mm
V with HD-Undercarriage	2.60	6,600	8,000	-
	3.40	6,150	7,050	10,300
	4.20*	5,800	7,550	9,400
	5.00	-	6,350	8,400
	5.00	-	6,350	8,400
V with HD-SL-Undercarriage	2.60	6,750	8,150	-
	3.40	6,300	7,200	10,450
	4.20*	5,950	7,700	9,550
	5.00	-	6,500	8,550
W	2.60	3,900	4,300	-
	3.40	4,200	4,250	4,500
	4.20*	3,800	4,350	4,550
	5.00	-	4,200	4,600
X	2.60	12,800	14,150	-
	3.40	12,750	14,000	15,800
	4.20*	12,650	14,000	15,800
	5.00	-	14,000	15,800

* without bucket



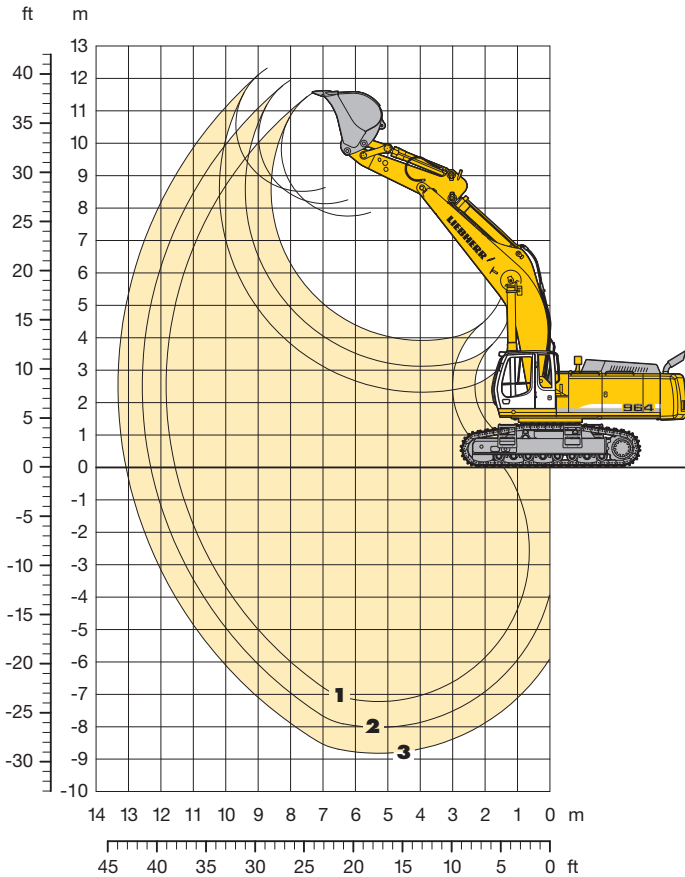
	HD			HD-SL		
	mm			mm		
A	3,506			3,506		
A1	3,976			3,976		
A2	4,235			4,235		
C	4,440			4,440		
C1	4,490			4,490		
D	4,120			4,120		
E	4,155			4,155		
F	1,680			1,680		
H	3,345			3,345		
K	1,440			1,440		
L	4,345			4,575		
P	1,350			1,350		

	HD			HD-SL		
	mm			mm		
Q	605			605		
S	3,200			3,200		
U	5,460			5,700		
N	500	600	750	500	600	750
B*	4,120	4,120	4,120	4,120	4,120	4,120
G**	4,170	4,170	4,320	4,170	4,170	4,320
Z	6,850			6,970		
V1	9,800			9,800		
W1	4,000			4,000		
X1	12,900			12,900		

* Width without access steps
** Width with access steps

Backhoe Attachment

with Gooseneck Boom 7.00 m



Digging Envelope

		1	2	3
Stick lengths	m	2.60	3.40	4.20
Max. digging depth	m	7.25	8.05	8.85
Max. reach at ground level	m	11.55	12.30	13.10
Max. dump height	m	7.75	8.15	8.50
Max. teeth height	m	11.55	11.95	12.35
Digging force ISO	kN	308	260	225
	t	31.4	26.5	22.9
Breakout force ISO	kN	335	335	335
	t	34.2	34.2	34.2

Breakout force ISO max.

356 kN/36.3 t

Operating Weight and Ground Pressure

Operating weight includes basic machine with gooseneck boom 7.00 m, stick 2.60 m and bucket 4.00 m³.

Undercarriage		HD			HD-SL		
Pad width	mm	500	600	750	500	600	750
Weight	kg	66,400	67,100	68,100	67,400	68,000	69,100
Ground pressure	kg/cm ²	1.40	1.18	0.96	1.36	1.14	0.93

Buckets

		Std						HD				
		1,550	1,750	1,950	2,150	2,400	2,600	1,550	1,750	1,950	2,100	2,100
Cutting width	mm	1,550	1,750	1,950	2,150	2,400	2,600	1,550	1,750	1,950	2,100	2,100
Capacity ISO 7451	m ³	2.50	3.00	3.50	4.00	4.50	5.00	2.00	2.50	3.00	3.50	4.00
Weight Standard bucket with Liebherr teeth size 25	kg	2,950	3,150	3,450	3,650	3,850	4,100	-	-	-	-	-
Weight HD bucket with Esco teeth size 61	kg	-	-	-	-	-	-	3,300	3,500	3,800	4,150	4,350
Suitable for material up to a specific weight of												
with stick 2.60 m	t/m ³	-	2.20	2.20	1.80	1.80	1.50	-	-	2.20	2.20	1.80
with stick 3.40 m	t/m ³	2.20	1.80	1.80	1.50	1.20	-	-	2.20	1.80	1.50	1.20
with stick 4.20 m	t/m ³	1.80	1.50	1.20	-	-	-	1.80	1.50	1.20	-	-

Lift Capacities

with Gooseneck Boom 7.00 m

Stick 2.60 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m)								
		3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
10.5	HD HD-SL									
9.0	HD HD-SL				6.9# (6.9#) 6.9# (6.9#)					
7.5	HD HD-SL				10.7# (10.7#) 10.7# (10.7#)					
6.0	HD HD-SL				11.6# (11.6#) 11.6# (11.6#)	10.4 (10.6#)				
4.5	HD HD-SL	22.5# (22.5#) 22.5# (22.5#)	16.1# (16.1#) 16.1# (16.1#)	13.0# (13.0#) 13.0# (13.0#)	10.1 (11.2#) 10.1 (11.2#)					
3.0	HD HD-SL	28.1# (28.1#) 28.1# (28.1#)	18.3 (18.7#) 18.6 (18.7#)	12.9 (14.4#) 13.1 (14.4#)	9.5 (12.0#) 9.6 (12.0#)					
1.5	HD HD-SL	26.0# (26.0#) 26.0# (26.0#)	17.0 (20.7#) 17.2 (20.7#)	12.1 (15.6#) 12.3 (15.6#)	9.0 (12.7#) 9.1 (12.7#)					
0	HD HD-SL	16.7# (16.7#) 16.7# (16.7#)	26.0 (29.7#) 26.4 (29.7#)	16.3 (21.5#) 16.5 (21.5#)	11.5 (16.3#) 11.7 (16.3#)	8.7 (12.4) 8.8 (13.0#)				
- 1.5	HD HD-SL	24.7# (24.7#) 24.7# (24.7#)	26.1 (28.7#) 26.5 (28.7#)	16.1 (21.2#) 16.3 (21.2#)	11.3 (16.2#) 11.5 (16.2#)	8.6 (12.3) 8.7 (12.8#)				
- 3.0	HD HD-SL	32.5# (32.3#) 32.5# (32.3#)	26.0# (26.0#) 26.0# (26.0#)	16.3 (19.6#) 16.5 (19.6#)	11.4 (15.1#) 11.6 (15.1#)					
- 4.5	HD HD-SL	28.5# (28.5#) 28.5# (28.5#)	21.6# (21.6#) 21.6# (21.6#)	16.5# (16.5#) 16.5# (16.5#)						
- 6.0	HD HD-SL		13.8# (13.8#) 13.8# (13.8#)							
- 7.5	HD HD-SL									
- 9.0	HD HD-SL									
- 10.5	HD HD-SL									

Stick 3.40 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m)								
		3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
10.5	HD HD-SL									
9.0	HD HD-SL									
7.5	HD HD-SL							7.6# (7.6#) 7.8# (7.8#)		
6.0	HD HD-SL							10.1# (10.1#) 9.3# (9.3#)		
4.5	HD HD-SL							14.1# (14.1#) 11.6# (11.6#)	10.1 (10.1#) 6.1# (6.1#)	
3.0	HD HD-SL		25.0# (25.0#) 25.0# (25.0#)	17.0# (17.0#) 17.0# (17.0#)	13.1 (13.2#) 13.2# (13.2#)	9.5 (11.0#) 9.6 (11.0#)	7.0 (8.5#) 7.1 (8.5#)			
1.5	HD HD-SL		27.3 (29.0#) 27.7 (29.0#)	17.3 (19.5#) 17.6 (19.5#)	12.1 (14.7#) 12.3 (14.7#)	8.9 (11.9#) 9.1 (11.9#)	6.7 (9.4#) 6.8 (9.4#)			
0	HD HD-SL	15.0# (15.0#) 15.0# (15.0#)	26.1 (29.6#) 26.5 (29.6#)	16.3 (20.9#) 16.6 (20.9#)	11.5 (15.7#) 11.7 (15.7#)	8.5 (12.3) 8.6 (12.5#)	6.5 (7.6#) 6.6 (7.6#)			
- 1.5	HD HD-SL	20.8# (20.8#) 20.8# (20.8#)	25.8 (29.8#) 26.2 (29.8#)	15.9 (21.2#) 16.1 (21.2#)	11.1 (16.0#) 11.3 (16.0#)	8.3 (12.0) 8.4 (12.7#)				
- 3.0	HD HD-SL	26.9# (26.9#) 26.9# (26.9#)	26.0 (27.9#) 26.4 (27.9#)	15.8 (20.4#) 16.1 (20.4#)	11.0 (15.5#) 11.2 (15.5#)	8.3 (12.0) 8.4 (12.0#)				
- 4.5	HD HD-SL	33.6# (33.6#) 33.6# (33.6#)	24.3# (24.3#) 24.3# (24.3#)	16.2 (18.1#) 16.5 (18.1#)	11.3 (13.7#) 11.5 (13.7#)					
- 6.0	HD HD-SL	25.1# (25.1#) 25.1# (25.1#)	18.4# (18.4#) 18.4# (18.4#)	13.6# (13.6#) 13.6# (13.6#)						
- 7.5	HD HD-SL									
- 9.0	HD HD-SL									
- 10.5	HD HD-SL									

Stick 4.20 m

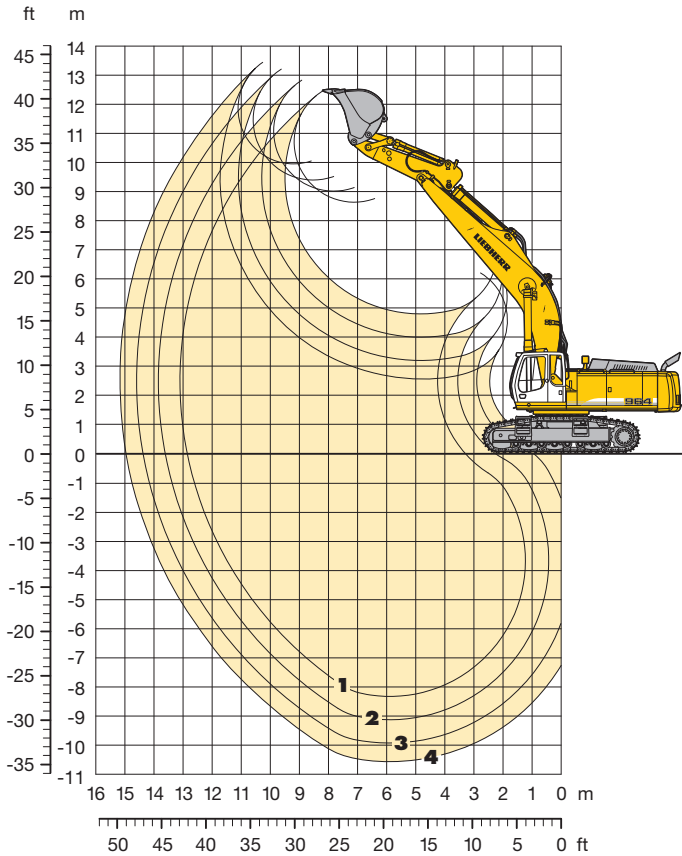
Height (m)	Under-carriage	Radius of load from centerline of machine (m)								
		3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
10.5	HD HD-SL									
9.0	HD HD-SL									
7.5	HD HD-SL					7.5# (7.5#) 7.5# (7.5#)	2.6# (2.6#) 2.6# (2.6#)			
6.0	HD HD-SL					8.0# (8.0#) 8.0# (8.0#)	6.1# (6.1#) 6.1# (6.1#)			
4.5	HD HD-SL					10.1# (10.1#) 10.1# (10.1#)	8.9# (8.9#) 8.9# (8.9#)	7.4 (8.2#) 7.5 (8.2#)		
3.0	HD HD-SL	23.9# (23.9#) 23.9# (23.9#)	21.4# (21.4#) 21.4# (21.4#)	15.0# (15.0#) 15.0# (15.0#)	11.9# (11.9#) 11.9# (11.9#)	9.6 (10.0#) 9.7 (10.0#)	7.0 (8.8#) 7.2 (8.8#)			
1.5	HD HD-SL	12.3# (12.3#) 12.3# (12.3#)	26.8# (26.8#) 26.8# (26.8#)	17.8 (18.0#) 18.0# (18.0#)	12.3 (13.6#) 12.5 (13.6#)	8.9 (11.0#) 9.1 (11.0#)	6.6 (9.4#) 6.8 (9.4#)			
0	HD HD-SL	14.4# (14.4#) 14.4# (14.4#)	26.5 (29.5#) 26.9 (29.5#)	16.5 (20.0#) 16.8 (20.0#)	11.5 (14.9#) 11.7 (14.9#)	8.4 (11.9#) 8.6 (11.9#)	6.3 (9.3) 6.5 (9.9#)			
- 1.5	HD HD-SL	18.3# (18.3#) 18.3# (18.3#)	25.7 (30.1#) 26.1 (30.1#)	15.8 (20.9#) 16.1 (20.9#)	11.0 (15.6#) 11.2 (15.6#)	8.1 (11.8) 8.2 (12.3#)	6.1 (9.1) 6.3 (10.0#)			
- 3.0	HD HD-SL	23.1# (23.1#) 23.1# (23.1#)	25.6 (29.1#) 26.0 (29.1#)	15.6 (20.7#) 15.8 (20.7#)	10.8 (15.6#) 10.9 (15.6#)	7.9 (11.7) 8.1 (12.2#)				
- 4.5	HD HD-SL	28.5# (28.5#) 28.5# (28.5#)	26.0 (26.5#) 26.4 (26.5#)	15.7 (19.3#) 16.0 (19.3#)	10.8 (14.6#) 11.0 (14.6#)	8.1 (11.0#) 8.2 (11.0#)				
- 6.0	HD HD-SL	32.0# (32.0#) 32.0# (32.0#)	22.0# (22.0#) 22.0# (22.0#)	16.1# (16.1#) 16.1# (16.1#)	11.3 (11.8#) 11.5 (11.8#)					
- 7.5	HD HD-SL		14.0# (14.0#) 14.0# (14.0#)							
- 9.0	HD HD-SL									
- 10.5	HD HD-SL									

The load values are quoted in tons (t) on the backhoe bucket's load hook, and may be swung 360° on firm and even ground. Values quoted in brackets apply to the undercarriage when in longitudinal position. Capacities are valid for 600 mm wide, double-grouser pads. Indicated loads are based on ISO 10567 standard and do not exceed 75 % of tipping or 87 % of hydraulic capacity (indicated via #). Maximum load for the backhoe bucket's lifting eye is 27 t. Without bucket (3.00 m³), the lift capacities will increase by 3,150 kg, without bucket cylinder, link and lever they increase by an additional 1,100 kg. Lifting capacity of the excavator is limited by machine stability, hydraulic capacity and maximum permissible load of the load hook.

According to European Standard, EN 474-5 in the European Union: Excavators must be equipped with an overload warning device, a load diagram and automatic check valves on the hoist cylinders when they are used for lifting operations which require the use of lifting accessories.

Backhoe Attachment

with Gooseneck Boom 8.20 m



Digging Envelope

		1	2	3	4
Stick lengths	m	2.60	3.40	4.20	5.00
Max. digging depth	m	8.30	9.10	9.90	10.55
Max. reach at ground level	m	12.80	13.55	14.35	14.95
Max. dump height	m	8.65	9.00	9.40	9.95
Max. teeth height	m	12.45	12.80	13.20	13.40
Digging force ISO	kN	308	260	225	204
	t	31.4	26.5	22.9	20.8
Breakout force ISO	kN	335	335	335	313
	t	34.2	34.2	34.2	31.9

Breakout force ISO max.

356 kN/36.3 t

Operating Weight and Ground Pressure

Operating weight includes basic machine with gooseneck boom 8.20 m, stick 3.40 m and bucket 2.50 m³.

Undercarriage		HD			HD-SL		
Pad width	mm	500	600	750	500	600	750
Weight	kg	66,600	67,300	68,300	67,600	68,200	69,300
Ground pressure	kg/cm ²	1.40	1.18	0.96	1.36	1.14	0.93

Buckets

		Std							HD			
Cutting width	mm	1,300	1,500	1,700	1,550	1,750	1,950	2,150	1,550	1,750	1,950	2,100
Capacity ISO 7451	m ³	1.65	2.00	2.35	2.50	3.00	3.50	4.00	2.00	2.50	3.00	3.50
Weight Standard bucket with Liebherr teeth size 25	kg	-	-	-	2,950	3,150	3,450	3,650	-	-	-	-
Weight HD bucket with Esco teeth size 61	kg	-	-	-	-	-	-	-	3,300	3,500	3,800	4,150
Weight R 954 C Standard bucket with Liebherr teeth size 25	kg	2,100	2,250	2,500	-	-	-	-	-	-	-	-
Suitable for material up to a specific weight of												
with stick 2.60 m	t/m ³	-	-	-	2.20	1.80	1.50	1.20	2.20	1.80	1.50	1.20
with stick 3.40 m	t/m ³	-	-	-	1.80	1.50	1.20	-	1.80	1.50	1.20	-
with stick 4.20 m	t/m ³	-	-	-	1.50	1.20	-	-	1.50	1.20	-	-
with stick 5.00 m	t/m ³	2.20	1.80	1.50	-	-	-	-	-	-	-	-

Lift Capacities

with Gooseneck Boom 8.20 m

Stick 2.60 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m)								
		3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
10.5	HD HD-SL									
9.0	HD HD-SL					7.8# (7.8#)				
7.5	HD HD-SL					8.4# (8.4#)				
6.0	HD HD-SL		13.0# (13.0#)	10.5# (10.5#)	9.0# (9.0#)	7.2 (8.2#)				
4.5	HD HD-SL		15.7# (15.7#)	11.9# (11.9#)	9.2 (9.8#)	6.9 (8.6#)				
3.0	HD HD-SL		15.7# (15.7#)	11.9# (11.9#)	9.4 (9.8#)	7.0 (8.6#)				
1.5	HD HD-SL		15.8 (18.2#)	11.5 (13.3#)	8.6 (10.7#)	6.5 (9.1#)				
0	HD HD-SL	14.0# (14.0#)	14.3 (19.7#)	10.1 (14.9#)	7.6 (11.4#)	5.9 (8.9#)				
- 1.5	HD HD-SL	23.3# (23.3#)	14.3 (19.3#)	10.0 (14.9#)	7.8 (11.2#)	5.8 (8.8#)				
- 3.0	HD HD-SL	24.9# (24.9#)	23.2# (23.2#)	14.6 (18.1#)	10.1 (14.3#)	7.5 (11.3#)				
- 4.5	HD HD-SL	25.7# (25.7#)	20.5# (20.5#)	15.1 (16.2#)	10.5 (12.8#)					
- 6.0	HD HD-SL		16.2# (16.2#)	13.0# (13.0#)						
- 7.5	HD HD-SL									
- 9.0	HD HD-SL									
- 10.5	HD HD-SL									

Stick 3.40 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m)								
		3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
10.5	HD HD-SL									
9.0	HD HD-SL									
7.5	HD HD-SL					7.3# (7.3#)	6.9# (6.9#)			
6.0	HD HD-SL					7.3# (7.3#)	6.9# (6.9#)			
4.5	HD HD-SL					9.2# (9.2#)	8.0# (8.0#)	7.3# (7.3#)		
3.0	HD HD-SL					9.2# (9.2#)	8.0# (8.0#)	7.3# (7.3#)		
1.5	HD HD-SL					11.1# (11.1#)	15.1 (18.5#)	10.7 (13.5#)	8.0 (10.7#)	6.0 (8.9#)
0	HD HD-SL					11.1# (11.1#)	15.3 (18.5#)	10.9 (13.5#)	8.1 (10.7#)	6.1 (8.9#)
- 1.5	HD HD-SL	14.7# (14.7#)	20.8# (20.8#)	14.1 (19.4#)	9.8 (14.7#)	7.2 (11.0#)	5.5 (8.5#)			
- 3.0	HD HD-SL	20.1# (20.1#)	23.8 (25.1#)	14.2 (18.7#)	9.7 (14.4#)	7.2 (10.9#)	5.6 (8.5#)			
- 4.5	HD HD-SL	25.7# (25.7#)	22.7# (22.7#)	14.5 (17.2#)	9.9 (13.4#)	7.4 (10.5#)				
- 6.0	HD HD-SL	25.7# (25.7#)	19.1# (19.1#)	14.7# (14.7#)	10.5 (11.4#)					
- 7.5	HD HD-SL		13.3# (13.3#)	10.2# (10.2#)						
- 9.0	HD HD-SL									
- 10.5	HD HD-SL									

Stick 4.20 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m)								
		3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
10.5	HD HD-SL									
9.0	HD HD-SL									
7.5	HD HD-SL									
6.0	HD HD-SL					6.9# (6.9#)	6.3# (6.3#)	5.2# (5.2#)		
4.5	HD HD-SL					6.9# (6.9#)	6.3# (6.3#)	5.2# (5.2#)		
3.0	HD HD-SL		23.2# (23.2#)	14.9# (14.9#)	11.1# (11.1#)	8.7 (8.9#)	6.4 (7.6#)	4.7 (6.7#)		
1.5	HD HD-SL		15.2# (15.2#)	15.6 (17.3#)	11.0 (12.6#)	8.0 (9.9#)	6.0 (8.2#)	4.5 (6.9#)		
0	HD HD-SL	8.0# (8.0#)	15.9# (15.9#)	14.5 (18.7#)	10.2 (13.7#)	7.5 (10.7#)	5.6 (8.6#)	4.2 (6.7#)		
- 1.5	HD HD-SL	12.5# (12.5#)	19.1# (19.1#)	14.0 (19.3#)	9.7 (14.3#)	7.1 (10.8#)	5.3 (8.3#)	4.1 (6.5#)		
- 3.0	HD HD-SL	16.8# (16.8#)	23.2 (23.5#)	13.9 (19.0#)	9.5 (14.3#)	6.9 (10.6#)	5.2 (8.2#)			
- 4.5	HD HD-SL	21.4# (21.4#)	23.8 (24.5#)	14.1 (19.0#)	9.5 (13.8#)	7.0 (10.7#)	5.3 (8.3#)			
- 6.0	HD HD-SL	26.5# (26.5#)	21.5# (21.5#)	14.5 (16.1#)	9.9 (12.3#)	7.3 (9.4#)				
- 7.5	HD HD-SL	23.4# (23.4#)	16.9# (16.9#)	12.7# (12.7#)	9.5# (9.5#)					
- 9.0	HD HD-SL									
- 10.5	HD HD-SL									

Stick 5.00 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m)								
		3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
10.5	HD HD-SL									
9.0	HD HD-SL									2.2# (2.2#)
7.5	HD HD-SL									2.2# (2.2#)
6.0	HD HD-SL									6.1# (6.1#)
4.5	HD HD-SL									5.3# (5.3#)
3.0	HD HD-SL									6.1# (6.1#)
1.5	HD HD-SL									5.9# (5.9#)
0	HD HD-SL									6.2 (6.2#)
- 1.5	HD HD-SL									6.5# (6.5#)
- 3.0	HD HD-SL									6.5# (6.5#)
- 4.5	HD HD-SL									8.0# (8.0#)
- 6.0	HD HD-SL									7.2# (7.2#)
- 7.5	HD HD-SL									5.9 (6.6#)
- 9.0	HD HD-SL									2.6# (2.6#)
- 10.5	HD HD-SL									2.6# (2.6#)

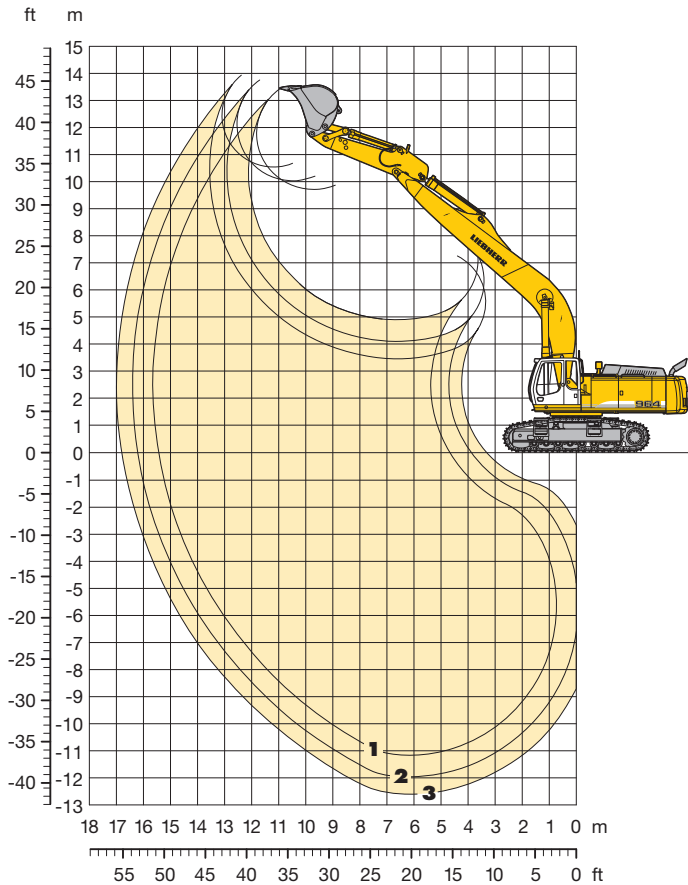
The load values are quoted in tons (t) on the backhoe bucket's load hook, and may be swung 360° on firm and even ground. Values quoted in brackets apply to the undercarriage when in longitudinal position. Capacities are valid for 600 mm wide, double-grouser pads. Indicated loads are based on ISO 10567 standard and do not exceed 75 % of tipping or 87 % of hydraulic capacity (indicated via #). Maximum load for the backhoe bucket's lifting eye is 27 t. Without bucket (3.00 m³/2.00 m³*), the lift capacities will increase by 3,150 kg/2,250 kg*, without bucket cylinder, link and lever they increase by an additional 1,100 kg/750 kg*. Lifting capacity of the excavator is limited by machine stability, hydraulic capacity and maximum permissible load of the load hook.

According to European Standard, EN 474-5 in the European Union: Excavators must be equipped with an overload warning device, a load diagram and automatic check valves on the hoist cylinders when they are used for lifting operations which require the use of lifting accessories.

* Capacities only for stick 5.00 m

Backhoe Attachment

with Gooseneck Boom 10.00 m



Digging Envelope

		1	2	3
Stick lengths	m	3.40	4.20	5.00
Max. digging depth	m	11.15	11.95	12.60
Max. reach at ground level	m	15.45	16.20	16.80
Max. dump height	m	9.70	10.05	10.50
Max. teeth height	m	13.40	13.75	13.90
Digging force ISO	kN	260	225	204
	t	26.5	22.9	20.8
Breakout force ISO	kN	335	335	313
	t	34.2	34.2	31.9

Breakout force ISO max.

356 kN/36.3 t

Operating Weight and Ground Pressure

Operating weight includes basic machine with heavy counterweight, gooseneck boom 10.00 m, stick 4.20 m and bucket 1.50 m³.

Undercarriage		HD			HD-SL		
Pad width	mm	500	600	750	500	600	750
Weight	kg	71,200	71,900	72,900	72,200	72,800	73,900
Ground pressure	kg/cm ²	1.50	1.27	1.03	1.45	1.22	0.99

Buckets

		Std						
Cutting width	mm	1,300	1,500	1,700	1,150	1,350	1,550	1,750
Capacity ISO 7451	m ³	1.65	2.00	2.35	1.50	2.00	2.50	3.00
Weight Standard bucket with Liebherr teeth size 25	kg	–	–	–	2,550	2,750	2,950	3,150
Weight R 954 C Standard bucket with Liebherr teeth size 25	kg	2,100	2,250	2,500	–	–	–	–
Suitable for material up to a specific weight of								
with stick 3.40 m	t/m ³	–	–	–	2.20	1.80	1.50	1.20
with stick 4.20 m	t/m ³	–	–	–	1.80	1.50	1.20	–
with stick 5.00 m	t/m ³	1.80	1.50	1.20	–	–	–	–

Lift Capacities

with Gooseneck Boom 10.00 m

Stick 3.40 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m)								
		3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
10.5	HD									
	HD-SL									
9.0	HD									
	HD-SL							4.2# (4.2#)		
7.5	HD							4.7# (4.7#)		
	HD-SL							4.7# (4.7#)	4.4# (4.4#)	
6.0	HD			10.5# (10.5#)	7.6# (7.6#)	6.1# (6.1#)	5.2# (5.2#)	4.7# (4.7#)	4.2# (4.2#)	
	HD-SL			10.5# (10.5#)	7.6# (7.6#)	6.1# (6.1#)	5.2# (5.2#)	4.7# (4.7#)	4.2# (4.2#)	
4.5	HD			13.9# (13.9#)	9.2# (9.2#)	7.1# (7.1#)	5.8# (5.8#)	5.1# (5.1#)	4.5 (4.7#)	
	HD-SL			13.9# (13.9#)	9.2# (9.2#)	7.1# (7.1#)	5.8# (5.8#)	5.1# (5.1#)	4.6 (4.7#)	
3.0	HD				10.7# (10.7#)	8.0# (8.0#)	6.5# (6.5#)	5.5# (6.5#)	4.3 (4.9#)	
	HD-SL				10.7# (10.7#)	8.0# (8.0#)	6.5# (6.5#)	5.5# (6.5#)	4.4 (4.9#)	
1.5	HD				10.9 (11.8#)	8.4 (8.8#)	6.6 (7.1#)	5.2 (5.9#)	4.1 (5.2#)	
	HD-SL				11.1 (11.8#)	8.6 (8.8#)	6.7 (7.1#)	5.3 (5.9#)	4.2 (5.2#)	
0	HD			12.1# (12.1#)	10.4 (12.4#)	7.9 (9.5#)	6.2 (7.6#)	4.9 (6.3#)	3.9 (5.5#)	
	HD-SL			12.1# (12.1#)	10.6 (12.4#)	8.1 (9.5#)	6.3 (7.6#)	5.0 (6.3#)	4.0 (5.5#)	
- 1.5	HD			15.0 (16.9#)	10.3 (12.7#)	7.7 (9.9#)	6.0 (7.9#)	4.8 (6.6#)		
	HD-SL			15.3 (16.9#)	10.5 (12.7#)	7.9 (9.9#)	6.1 (7.9#)	4.9 (6.6#)		
- 3.0	HD	15.0# (15.0#)	16.4# (16.4#)	15.3 (16.5#)	10.4 (12.7#)	7.7 (10.0#)	5.9 (8.1#)	4.7 (6.7#)		
	HD-SL	15.0# (15.0#)	16.4# (16.4#)	15.5 (16.5#)	10.5 (12.7#)	7.8 (10.0#)	6.1 (8.1#)	4.8 (6.7#)		
- 4.5	HD	18.9# (18.9#)	20.6# (20.6#)	15.6 (15.9#)	10.6 (12.4#)	7.8 (9.9#)	6.0 (8.0#)	4.9 (6.5#)		
	HD-SL	18.9# (18.9#)	20.6# (20.6#)	15.9# (15.9#)	10.8 (12.4#)	7.9 (9.9#)	6.2 (8.0#)	5.0 (6.5#)		
- 6.0	HD	23.4# (23.4#)	19.1# (19.1#)	14.8# (14.8#)	11.0 (11.7#)	8.1 (9.4#)	6.3 (7.5#)			
	HD-SL	23.4# (23.4#)	19.1# (19.1#)	14.8# (14.8#)	11.2 (11.7#)	8.2 (9.4#)	6.5 (7.5#)			
- 7.5	HD	22.7# (22.7#)	16.8# (16.8#)	13.1# (13.1#)	10.4# (10.4#)	8.2# (8.2#)				
	HD-SL	22.7# (22.7#)	16.8# (16.8#)	13.1# (13.1#)	10.4# (10.4#)	8.2# (8.2#)				
- 9.0	HD		13.1# (13.1#)	10.3# (10.3#)	8.0# (8.0#)					
	HD-SL		13.1# (13.1#)	10.3# (10.3#)	8.0# (8.0#)					
- 10.5	HD									
	HD-SL									

Stick 4.20 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m)								
		3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
10.5	HD									3.4# (3.4#)
	HD-SL									3.4# (3.4#)
9.0	HD									3.4# (3.4#)
	HD-SL									3.4# (3.4#)
7.5	HD									3.7# (3.7#)
	HD-SL									3.6# (3.6#)
6.0	HD									4.0# (4.0#)
	HD-SL									3.7# (3.7#)
4.5	HD									4.5# (4.5#)
	HD-SL									4.0# (4.0#)
3.0	HD									11.6# (11.6#)
	HD-SL									8.0# (8.0#)
1.5	HD									12.1# (12.1#)
	HD-SL									10.9# (10.9#)
0	HD									13.6# (13.6#)
	HD-SL									10.7 (11.8#)
- 1.5	HD									9.9# (9.9#)
	HD-SL									14.9 (16.6#)
- 3.0	HD	11.7# (11.7#)	14.2# (14.2#)	14.8 (16.7#)	10.1 (12.5#)	7.4 (9.7#)	5.7 (7.7#)	4.5 (6.3#)	3.6 (5.0#)	
	HD-SL	11.7# (11.7#)	14.2# (14.2#)	15.1 (16.7#)	10.3 (12.5#)	7.6 (9.7#)	5.8 (7.7#)	4.6 (6.3#)	3.7 (5.0#)	
- 4.5	HD	15.4# (15.4#)	18.5# (18.5#)	15.1 (16.2#)	10.2 (12.4#)	7.5 (9.7#)	5.7 (7.7#)	4.5 (6.3#)		
	HD-SL	15.4# (15.4#)	18.5# (18.5#)	15.3 (16.2#)	10.4 (12.4#)	7.6 (9.7#)	5.8 (7.8#)	4.6 (6.3#)		
- 6.0	HD	19.2# (19.2#)	20.7# (20.7#)	15.4# (15.4#)	10.5 (11.9#)	7.7 (9.4#)	5.9 (7.5#)	4.7 (6.0#)		
	HD-SL	19.2# (19.2#)	20.7# (20.7#)	15.4# (15.4#)	10.7 (11.9#)	7.8 (9.4#)	6.0 (7.5#)	4.8 (6.0#)		
- 7.5	HD	23.5# (23.5#)	18.6# (18.6#)	14.0# (14.0#)	10.9# (10.9#)	8.1 (8.6#)	6.3 (6.8#)			
	HD-SL	23.5# (23.5#)	18.6# (18.6#)	14.0# (14.0#)	10.9# (10.9#)	8.2 (8.6#)	6.4 (6.8#)			
- 9.0	HD	21.8# (21.8#)	15.5# (15.5#)	11.9# (11.9#)	9.2# (9.2#)	7.0# (7.0#)				
	HD-SL	21.8# (21.8#)	15.5# (15.5#)	11.9# (11.9#)	9.2# (9.2#)	7.0# (7.0#)				
- 10.5	HD									
	HD-SL									

Stick 5.00 m

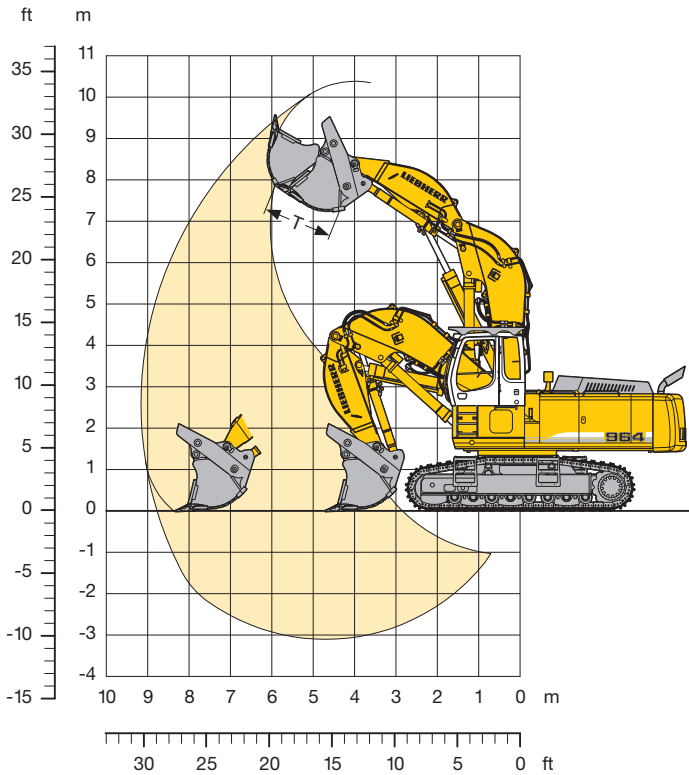
Height (m)	Under-carriage	Radius of load from centerline of machine (m)								
		3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
10.5	HD									
	HD-SL									
9.0	HD									3.6# (3.6#)
	HD-SL									3.6# (3.6#)
7.5	HD									3.9# (3.9#)
	HD-SL									3.9# (3.9#)
6.0	HD									4.7# (4.7#)
	HD-SL									4.2# (4.2#)
4.5	HD									4.0# (4.0#)
	HD-SL									2.8# (2.8#)
3.0	HD									4.7# (4.7#)
	HD-SL									4.2# (4.2#)
1.5	HD									4.7# (4.7#)
	HD-SL									4.0# (4.0#)
0	HD									4.7# (4.7#)
	HD-SL									4.0# (4.0#)
- 1.5	HD	7.2# (7.2#)	10.0# (10.0#)	15.5 (16.7#)	11.0 (12.8#)	8.3 (9.9#)	6.5 (7.9#)	5.2 (6.6#)	4.2 (5.7#)	3.1# (3.1#)
	HD-SL	7.2# (7.2#)	10.0# (10.0#)	15.7 (16.7#)	11.2 (12.8#)	8.5 (9.9#)	6.7 (7.9#)	5.3 (6.6#)	4.3 (5.7#)	3.1# (3.1#)
- 3.0	HD	10.5# (10.5#)	13.3# (13.3#)	15.4 (17.7#)	10.8 (13.2#)	8.1 (10.3#)	6.3 (8.3#)	5.0 (6.9#)	4.1 (5.9#)	
	HD-SL	10.5# (10.5#)	13.3# (13.3#)	15.7 (17.7#)	11.0 (13.2#)	8.2 (10.3#)	6.4 (8.3#)	5.1 (6.9#)	4.2 (5.9#)	
- 4.5	HD	13.7# (13.7#)	16.9# (16.9#)	15.6 (17.4#)	10.8 (13.2#)	8.0 (10.4#)	6.2 (8.4#)	5.0 (7.0#)	4.1 (5.9#)	
	HD-SL	13.7# (13.7#)	16.9# (16.9#)	15.9 (17.4#)	11.0 (13.2#)	8.2 (10.4#)	6.4 (8.4#)	5.1 (7.0#)	4.2 (5.9#)	
- 6.0	HD	17.1# (17.1#)	20.9# (20.9#)	15.9 (16.8#)	11.0 (12.9#)	8.1 (10.3#)	6.3 (8.3#)	5.1 (6.8#)		
	HD-SL	17.1# (17.1#)	20.9# (20.9#)	16.2 (16.8#)	11.2 (12.9#)	8.3 (10.3#)	6.5 (8.3#)	5.2 (6.8#)		
- 7.5	HD	20.8# (20.8#)	21.0# (21.0#)	15.7# (15.7#)	11.3 (12.2#)	8.4 (9.7#)	6.6 (7.9#)			
	HD-SL	20.8# (20.8#)	21.0# (21.0#)	15.7# (15.7#)	11.5 (12.2#)	8.6 (9.7#)	6.7 (7.9#)			
- 9.0	HD	25.0# (25.0#)	18.3# (18.3#)	13.9# (13.9#)	10.9# (10.9#)	8.6# (8.6#)				
	HD-SL	25.0# (25.0#)	18.3# (18.3#)	13.9# (13.9#)	10.9# (10.9#)	8.6# (8.6#)				
- 10.5	HD	20.0# (20.0#)	14.3# (14.3#)	10.9# (10.9#)	8.3# (8.3#)					
	HD-SL	20.0# (20.0#)	14.3# (14.3#)	10.9# (10.9#)	8.3# (8.3#)					

The load values are quoted in tons (t) on the backhoe bucket's load hook, and may be swung 360° on firm and even ground. Values quoted in brackets apply to the undercarriage when in longitudinal position. Capacities are valid for 600 mm wide, double-grouser pads. Indicated loads are based on ISO 10567 standard and do not exceed 75 % of tipping or 87 % of hydraulic capacity (indicated via #). Maximum load for the backhoe bucket's lifting eye is 27 t. Without bucket (2.00 m³/1.65 m³), the lift capacities will increase by 2,750 kg/2,100 kg*, without bucket cylinder, link and lever they increase by an additional 1,100 kg/750 kg*. Lifting capacity of the excavator is limited by machine stability, hydraulic capacity and maximum permissible load of the load hook.

According to European Standard, EN 474-5 in the European Union: Excavators must be equipped with an overload warning device, a load diagram and automatic check valves on the hoist cylinders when they are used for lifting operations which require the use of lifting accessories.

* Capacities only for stick 5.00 m

Shovel Attachment



Digging Envelope

Max. reach at ground level	8.79 m
Max. dump height	7.25 m
Max. crowd length	3.61 m
Bucket opening width T	1,650 mm
Max. crowd force	500 kN/51.0 t
Max. crowd force at ground level	410 kN/41.8 t
Max. breakout force	370 kN/37.7 t

Operating Weight and Ground Pressure

Operating weight includes basic machine with cab elevation, shovel attachment and bottom dump bucket 4.00 m³, level II.

Undercarriage		HD		HD-SL	
Pad width	mm	500	600	500	600
Weight	kg	68,400	69,100	69,400	70,000
Ground pressure	kg/cm ²	1.44	1.22	1.40	1.17

Bottom Dump Bucket

Cutting width SAE	mm	2,270 ¹⁾	2,270 ¹⁾	2,570 ¹⁾	2,570 ¹⁾	2,570 ¹⁾
Capacity SAE	m ³	3.50	3.50	4.00	4.00	4.50
Weight	kg	6,300	6,900	6,100	6,700	6,300
Suitable for material up to a specific weight of	t/m ³	2.20	2.20	1.80	1.80	1.65
Wear kit level		II	III	I	II	I

¹⁾ Bottom dump bucket with Delta cutting edge and teeth size 25

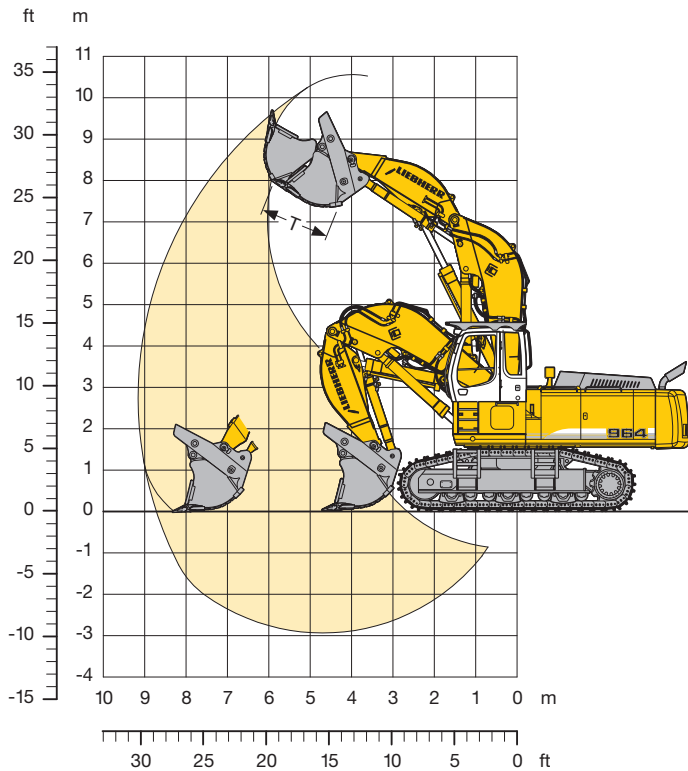
Level I: For non-abrasive materials, such as limestone without flint inclusion, shot material or easily breakable rock, i.e., deteriorated rock, soft limestone, shale, etc.

Level II: For pre-blasted heavy rock, or deteriorated, cracked material (classification 3 to 4, accord. to DIN 18300).

Level III: For highly-abrasive materials such as rock with a high silica content, sandstone etc.

Shovel Attachment

Super Mass Excavation



Digging Envelope

Max. reach at ground level	8.75 m
Max. dump height	7.40 m
Max. crowd length	3.66 m
Bucket opening width T	1,650 mm
Max. crowd force	500 kN/51.0 t
Max. crowd force at ground level	410 kN/41.8 t
Max. breakout force	370 kN/37.7 t

Operating Weight and Ground Pressure

Operating weight includes basic machine with counterweight 14.5 t, cab elevation, shovel attachment and bottom dump bucket 4.50 m³, level II.

Undercarriage	S-HD	
Pad width	mm	500 600
Weight	kg	77,600 78,300
Ground pressure	kg/cm ²	1.57 1.32

Bottom Dump Bucket

Cutting width SAE	mm	2,570 ¹⁾	2,570 ¹⁾	2,570 ¹⁾	2,570 ¹⁾	2,570 ¹⁾	2,570 ¹⁾
Capacity SAE	m ³	4.00	4.50	4.50	4.50	5.00	5.00
Weight	kg	7,300	6,300	6,900	7,500	6,500	7,100
Suitable for material up to a specific weight of	t/m ³	2.20	1.80	1.80	1.80	1.65	1.65
Wear kit level		III	I	II	III	I	II

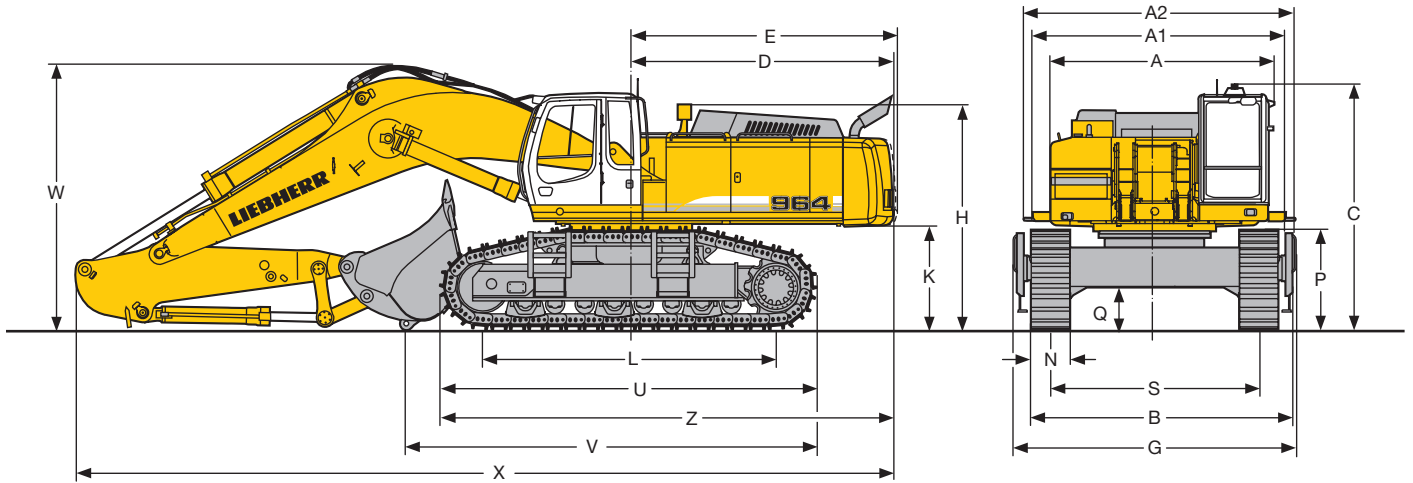
¹⁾ Bottom dump bucket with Delta cutting edge and teeth size 25

Level I: For non-abrasive materials, such as limestone without flint inclusion, shot material or easily breakable rock, i.e., deteriorated rock, soft limestone, shale, etc.

Level II: For pre-blasted heavy rock, or deteriorated, cracked material (classification 3 to 4, accord. to DIN 18300).

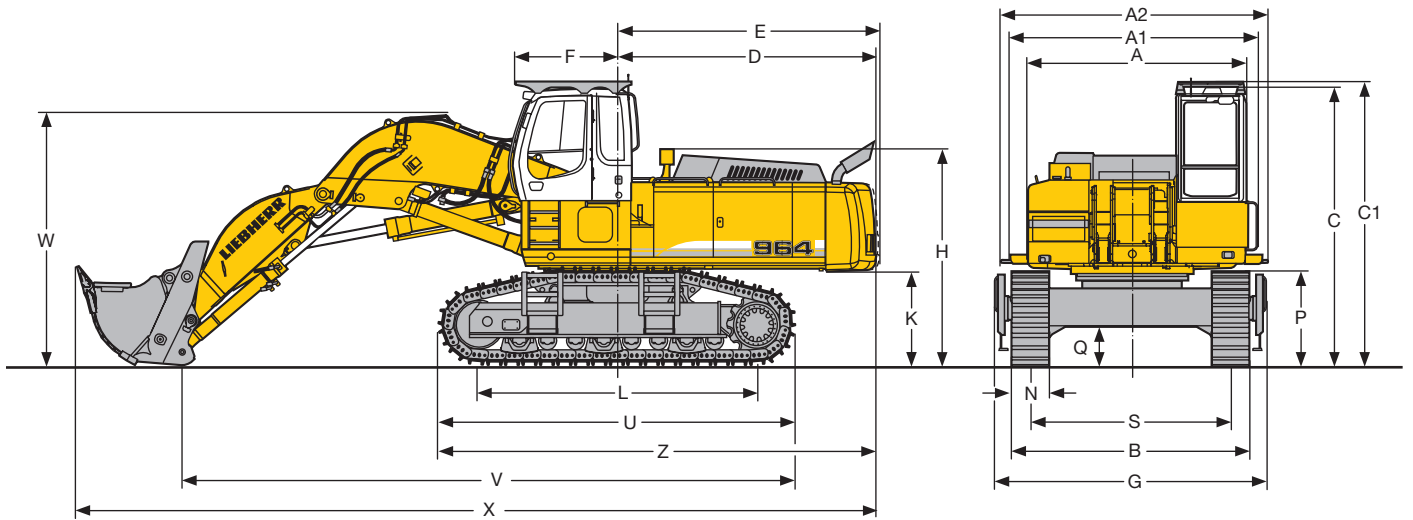
Level III: For highly-abrasive materials such as rock with a high silica content, sandstone etc.

Dimensions SME



	S-HD		mm
A			3,506
A1			3,976
A2			4,235
C			3,790
D			4,120
E			4,155
H			3,490
K			1,585
L			4,540
P			1,527
Q			650
S			3,250
U			5,740
N	500	600	750
B	3,985	3,985	4,000
G	4,410	4,410	4,410
Z			7,000

	Stick Length	Gooseneck Boom
	m	7.00 m
		mm
V with S-HD-Undercarriage	3.00	6,350
W	3.00	4,100
X	3.00	12,750

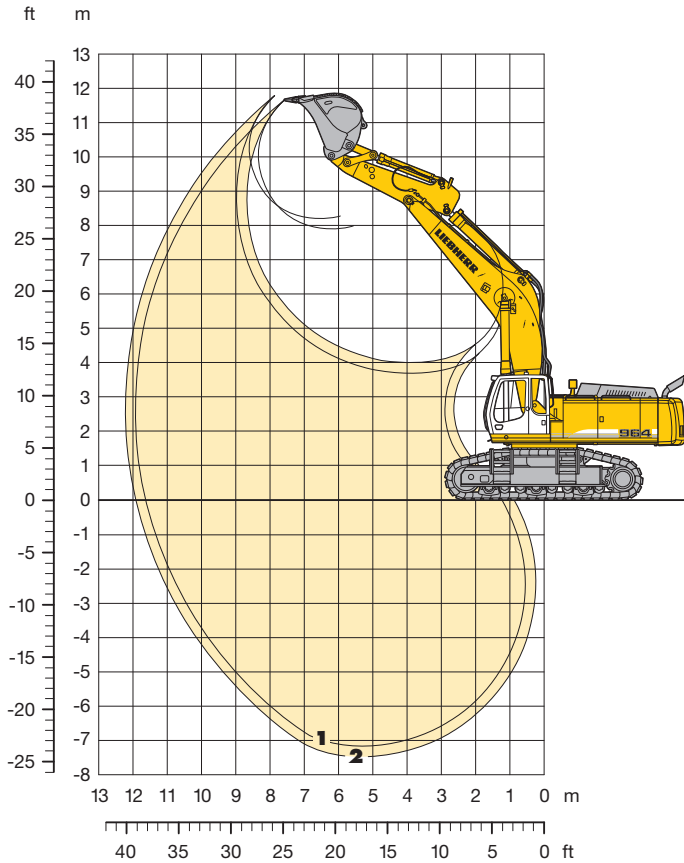


	S-HD		mm
A			3,506
A1			3,976
A2			4,235
C			4,585
C1			4,635
D			4,120
E			4,155
F			1,680
H			3,490
K			1,585
L			4,540

	S-HD		mm
P			1,527
Q			650
S			3,250
U			5,740
N	500	600	750
B	3,985	3,985	4,000
G	4,410	4,410	4,410
Z			7,000
V1			9,950
W1			4,100
X1			12,900

Backhoe Attachment

Super Mass Excavation with Gooseneck Boom 7.00 m SME



Digging Envelope

		1	2
Stick lengths	m	2.60 SME	3.00 SME
Max. digging depth	m	7.15	7.45
Max. reach at ground level	m	11.60	11.90
Max. dump height	m	7.90	8.20
Max. teeth height	m	11.65	11.80
Digging force ISO	kN	358	328
	t	36.5	33.4
Breakout force ISO	kN	395	395
	t	40.2	40.3

Operating Weight and Ground Pressure

Operating weight includes basic machine with counterweight 14.5 t, gooseneck boom SME 7.00 m, stick SME 3.00 m and bucket 4.50 m³.

Undercarriage		S-HD		
Pad width	mm	500	600	750
Weight	kg	77,900	78,600	79,600
Ground pressure	kg/cm ²	1.57	1.32	1.07

Buckets

		HD	HD-V
Cutting width SAE	mm	2,350 ¹⁾	2,100 ³⁾
Capacity ISO 7451	m ³	4.50	4.00
Weight	kg	4,700	5,000
Suitable for material up to a specific weight of			
with stick 2.60 m SME	t/m ³	2.20	2.20
with stick 3.00 m SME	t/m ³	1.80	1.80

- ¹⁾ Heavy duty rock bucket with teeth size V 61 SD (appropriate for material above classification 6, according to VOB, section C DIN 18300)
²⁾ Heavy duty rock bucket with delta cutting edge and teeth size V 61 SD (appropriate for material above classification 6, according to VOB, section C DIN 18300)
³⁾ HD-V rock bucket with teeth size V 61 SD (appropriate for material above classification 6, according to VOB, section C DIN 18300)

Lift Capacities

Super Mass Excavation with Gooseneck Boom 7.00 m SME

Stick 2.60 m SME

Height (m)	Under-carriage	Radius of load from centerline of machine (m)								
		3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
9.0	S-HD				9.0# (9.0#)					
7.5	S-HD				9.2# (9.2#)					
6.0	S-HD				10.0# (10.0#)	8.9# (8.9#)				
4.5	S-HD		20.5# (20.5#)	14.2# (14.2#)	11.2# (11.2#)	9.5# (9.5#)				
3.0	S-HD		25.3# (25.3#)	16.6# (16.6#)	12.5# (12.5#)	10.2# (10.2#)				
1.5	S-HD		27.2# (27.2#)	18.2# (18.2#)	13.5# (13.5#)	10.5 (10.8#)				
0	S-HD	17.3# (17.3#)	26.6# (26.6#)	18.9# (18.9#)	13.6 (14.1#)	10.2 (11.0#)				
- 1.5	S-HD	27.0# (27.0#)	25.3# (25.3#)	18.4# (18.4#)	13.4 (13.9#)	10.1 (10.7#)				
- 3.0	S-HD	31.0# (31.0#)	22.7# (22.7#)	16.9# (16.9#)	12.8# (12.8#)					
- 4.5	S-HD	24.2# (24.2#)	18.3# (18.3#)	13.8# (13.8#)						
- 6.0	S-HD									

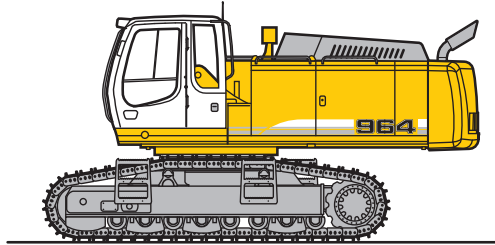
Stick 3.00 m SME

Height (m)	Under-carriage	Radius of load from centerline of machine (m)								
		3.0	4.5	6.0	7.5	9.0	10.5	12.0	13.5	15.0
9.0	S-HD									
7.5	S-HD					7.8# (7.8#)				
6.0	S-HD				9.2# (9.2#)	8.2# (8.2#)				
4.5	S-HD	20.5# (20.5#)	18.8# (18.8#)	13.2# (13.2#)	10.5# (10.5#)	8.9# (8.9#)				
3.0	S-HD		23.9# (23.9#)	15.7# (15.7#)	11.8# (11.8#)	9.6# (9.6#)	7.8# (7.8#)			
1.5	S-HD		26.6# (26.6#)	17.6# (17.6#)	13.0# (13.0#)	10.3# (10.3#)	7.8 (8.0#)			
0	S-HD	16.4# (16.4#)	27.0# (27.0#)	18.5# (18.5#)	13.5 (13.7#)	10.0 (10.7#)				
- 1.5	S-HD	24.6# (24.6#)	25.9# (25.9#)	18.4# (18.4#)	13.2 (13.7#)	9.8 (10.6#)				
- 3.0	S-HD	33.1# (33.1#)	23.5# (23.5#)	17.2# (17.2#)	12.9# (12.9#)					
- 4.5	S-HD	27.2# (27.2#)	19.6# (19.6#)	14.5# (14.5#)	10.6# (10.6#)					
- 6.0	S-HD		12.9# (12.9#)							

The load values are quoted in tons (t) on the backhoe bucket's load hook, and may be swung 360° on firm and even ground. Values quoted in brackets apply to the undercarriage when in longitudinal position. Capacities are valid for 600 mm wide, double-grouser pads. Indicated loads are based on ISO 10567 standard and do not exceed 75 % of tipping or 87 % of hydraulic capacity (indicated via #). Maximum load for the backhoe bucket's lifting eye is 27 t. Without bucket (4.50 m³), the lift capacities will increase by 4,700 kg, without bucket cylinder, link and lever they increase by an additional 1,100 kg. Lifting capacity of the excavator is limited by machine stability, hydraulic capacity and maximum permissible load of the load hook.

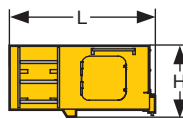
According to European Standard, EN 474-5 in the European Union: Excavators must be equipped with an overload warning device, a load diagram and automatic check valves on the hoist cylinders when they are used for lifting operations which require the use of lifting accessories.

Component Dimensions and Weights



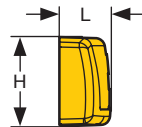
Basic Machine

Track pads	mm	500	600	750
Weight with HD-Undercarriage	kg	50,550	51,200	52,200
Weight with HD-Undercarriage and counterweight 14,500 kg	kg	54,050	54,700	55,700
Weight with HD-SL-Undercarriage	kg	51,500	52,150	53,200
Weight with HD-SL-Undercarriage and counterweight 14,500 kg	kg	55,000	55,650	56,700
Weight with S-HD-Undercarriage and counterweight 14,500 kg	kg	59,500	60,200	61,250



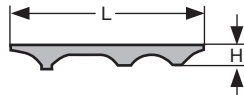
Cab Elevation

L Length	mm	1,820
H Height	mm	930
Width	mm	1,370
Weight	kg	600



Counterweight

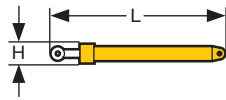
L Length	mm	790	790
H Height	mm	1,390	1,390
Width	mm	3,260	3,260
Weight	kg	11,300	14,800



Upper Protection Screen

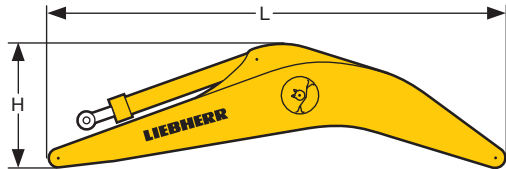
L Length	mm	1,960
H Height	mm	185
Width	mm	1,110
Weight	kg	75

Component Dimensions and Weights



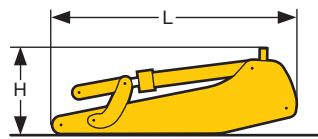
Hoist Cylinders (two)

L Length	mm	2,650
H Height	mm	490
Width	mm	360
Weight	kg	2 x 750



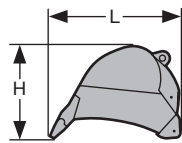
Gooseneck Boom with Stick Cylinder

Stick length	m	7.00	7.00	8.20	10.00
		SME			
L Length	mm	7,350	7,350	8,550	10,350
H Höhe	mm	2,250	2,200	2,050	2,350
Height	mm	1,450	1,450	1,450	1,450
Weight	kg	7,400	7,200	7,850	9,000



Stick with Bucket Cylinder

Stick length	m	2.60	3.00	2.60	3.40	4.20	5.00
		SME		SME			
L Length	mm	4,000	4,400	3,950	4,650	5,450	6,250
H Höhe	mm	1,350	1,350	1,250	1,250	1,200	1,200
Height	mm	950	950	950	950	950	850
Weight	kg	4,500	4,750	3,500	3,800	4,100	4,000



Backhoe Buckets Std

Cutting width	mm	1,150	1,350	1,550	1,750	1,950	2,150	2,400	2,600
I Capacity	m ³	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
L Length	mm	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250
H Height	mm	1,650	1,650	1,650	1,650	1,650	1,650	1,650	1,650
Breite	mm	1,200	1,400	1,600	1,800	2,000	2,200	2,450	2,650
Weight	kg	2,550	2,750	2,950	3,150	3,450	3,650	4,100	4,200

Backhoe Buckets Std R 954 C

Cutting width	mm	1,300	1,500	1,700
I Capacity	m ³	1.65	2.00	2.35
L Length	mm	2,100	2,100	2,100
H Height	mm	1,500	1,500	1,500
Breite	mm	1,350	1,550	1,750
Weight	kg	2,100	2,250	2,500

Backhoe Buckets HD

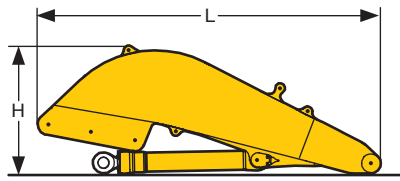
Cutting width	mm	1,550	1,750	1,950	2,100	2,100
I Capacity	m ³	2.00	2.50	3.00	3.50	4.00
L Length	mm	2,200	2,200	2,300	2,300	2,300
H Height	mm	1,600	1,600	1,600	1,600	1,700
Breite	mm	1,600	1,800	2,000	2,150	2,150
Weight	kg	3,300	3,500	3,800	4,150	4,350

Backhoe Buckets SME

Cutting width	mm	2,350	2,350*	2,100
I Capacity	m ³	4.50	4.50	4.00
L Length	mm	2,400	2,500	2,400
H Height	mm	1,700	1,800	1,700
Breite	mm	2,400	2,400	2,150
Weight	kg	4,700	4,800	5,000

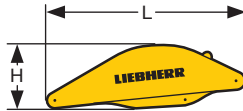
* with Delta-cutting edge

Component Dimensions and Weights



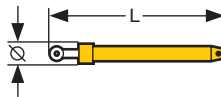
Shovel Boom

L Length	mm	4,750
H Height	mm	1,950
Width	mm	1,900
Weight without crowd cylinder	kg	5,050
Weight crowd cylinder	kg	650



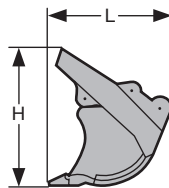
Shovel Stick

L Length	mm	3,250
H Height	mm	1,100
Width	mm	1,500
Weight	kg	2,500



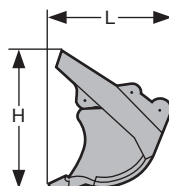
Shovel Bucket Cylinders (two)

L Length	mm	2,550
Ø Diameter	mm	350
Width	mm	500
Weight	kg	2 x 400



Bottom Dump Buckets

Cutting width	mm	2,270	2,570	2,570
I Capacity	m ³	3.50	4.00	4.50
L Length	mm	2,300	2,300	2,300
H Height	mm	2,400	2,400	2,400
Width	mm	2,300	2,600	2,600
Weight				
Level I	kg	-	6,100	6,300
Level II	kg	6,300	6,700	-
Level III	kg	6,900	-	-



Bottom Dump Buckets SME

Cutting width	mm	2,570	2,570	2,570
I Capacity	m ³	4.00	4.50	5.00
L Length	mm	2,300	2,300	2,500
H Height	mm	2,400	2,400	2,500
Width	mm	2,600	2,600	2,600
Weight				
Level I	kg	-	6,300	6,500
Level II	kg	-	6,900	7,100
Level III	kg	7,300	7,500	-

Equipment



Undercarriage

Three track guides per track	•
Integrated travel drive	•
Digging locks	•
Tracks greased and sealed	•
Protection on idler end	•
Different undercarriage versions	+
Different track pad widths	+



Uppercarriage

Engine hood with lift assistance	•
Lockable tool box	•
Handrails, non slip surfaces	•
Tool kit	•
Maintenance-free swing brake lock	•
Maintenance-free HD-batteries	•
Sound insulation	•
Electric fuel tank filler pump	+
Pedal controlled positioning swing brake	+
Customized paint – compl. machine	+
Protection for front working light	+
Heavy counterweight	+



Hydraulics

Electronic pump regulation	•
Stepless work mode selector	•
Pressure storage for controlled lowering of attachments with engine turned off	•
Hydraulic tank shut-off valve	•
Pressure compensation	•
Filter with integrated fine filter area (5 µm)	•
Pressure test ports	•
Additional hydraulic circuits	+
Bio-degradable hydr. oil	+
Filter for secondary circuit	+



Engine

Common rail injection	•
Turbo charger	•
Main switch for electric circuit	•
Dry-type air cleaner w/pre-cleaner, main and safety elements	•
Automatic engine idling	•
Air filter with automatic dust ejector	•
Conform with standard level IIIA/Tier 3	•
Engine cold starting aid	•
Fuel pre-heater	+



Operator's Cab

Load bearing sectional profile structure, covered with deep-drawn panels	•
Tinted side windows	•
Armored windshield	•
Door with sliding window	•
Washer-wiper for front and roof window	•
6-way adjustable cloth suspension seat	•
Seat and consoles independently adjustable	•
Coat hook	•
Automatic climate control with defroster function	•
Dome light	•
Sun blinds	•
Radio installation prep-kit	•
Removable handles for travel pedals	•
Cigarette lighter and ashtray	•
Removable custom floor mat	•
Storage and literature tray	•
Digital instrumentation	•
Digital instruments for oil temp., engine RPM and oil pressure	•
Digital hour meter visible from outside	•
AM/FM stereo radio	+
Electric cool box	+
Air power seat adjustment with heating	+
Warning beacon	+
Additional headlights on cabin roof (front and rear)	+
Upper protection screen (FOPS)	+
Front guard tiltable	+
Electric drive away lock	+
Extinguisher	+



Attachment

Cylinders with shock absorbers	•
Automatic central lubrication system (except link and tilt geometry)	•
Re-Generation plus	•
Sealed pivots/O-ring sealed between bucket and stick	•
SAE split flanges on all high pressure lines	•
Work light on boom	•
27 t lifting hook on quick change coupler	•
27 t lifting hook on bucket	+
Overload warning device	+
Hydraulic quick change coupler	+
Piston rod protection	+
Completely sealed bucket linkage	+
Quick disconnect hose couplers for additional tools	+
Hydraulic lines for additional tools	+
Central lubrication for lever with protection cover	+
Liebherr working tools	+
Special application buckets	+
Customized colors	+

• = Standard, + = Option

Options and/or special attachments, supplied by vendors other than Liebherr, are only to be installed with the knowledge and approval of Liebherr to retain warranty.

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www.liebherr.com, E-Mail: info.lfr@liebherr.com

2 Safety instructions, Signs on the machine

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 2009 / 104 / EC contains the minimum safety information applicable to the owner.

2.1 Meaning of the symbols in this manual

Work processes and actions that could cause danger are accompanied by safety informations in these operating instructions. These safety informations describe 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 meaning:



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-

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").
- Machines used underground (deep mining and tunnel construction) must be equipped with exhaust gas reducing equipment (e.g. diesel particle filter). Always comply with the statutory regulations applicable at the location of operation.
- Special tasks require special attachments and possibly also special safety devices. This equipment may only be attached to the machine and used with the explicit consent of and according to the instructions of the manufacturer of the basic machine.
- Any other use, in particular transporting persons or working in explosive atmospheres or contaminated environments is not deemed to be in accordance with regulations. The manufacturer is not liable for any 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

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 instruc-

- tions by third parties. This also applies in relation to traffic regulations.
- 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.
 - Always wear safe work clothes when you are working on or with the machine. Avoid wearing rings, wrist watches, ties, scarves, open jackets, baggy clothing etc... There is a risk of injury from, for example, getting caught up or being drawn in.
 - Wear individual protective equipment (protective goggles, safety helmets, safety shoes and gloves, reflective vests and ear protection etc...).
 - 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.
 - In the absence of any other instructions, proceed as follows for all maintenance and repair work:
 - switch off the machine on firm, level ground
 - align the uppercarriage with the undercarriage so that the sprockets locate at the back-end
 - 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 and with the security lever lowered, 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 equipped 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 forbidden to repair the structure of the cab.
 - Not original equipment and component parts or such kind, which has generally 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.

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.
- Near operating temperature, the parts of the engine cooling system, of the exhaust system and of the hydraulic system can reach very high temperatures. Avoid coming into contact with coolant carrying parts, with parts from the exhaust system and with hot oil or oil-bearing 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.
- 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.

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.
- It is possible to install an extinguisher into the driver's cab.
- Covers and boxes locks have to be unlocked, to facilitate the fight against fire in case of.

Bringing the machine safely into service

- Carry out a careful inspection tour around the machine each time before starting it.
- Ensure that no one, except an authorized person, is in the work and movement area of the machine.
- 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.
- Ensure that all hoods and covers are closed, but that locks are unlocked, to facilitate the fight against fire in case of.
- 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.

Safely getting up

- Before getting up or down to the cab of the machine, position the machine on even, horizontal ground. Position the upper structure with the undercarriage 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, ensure that they are free of dirt, oil, ice and snow.
- To assure that the cab door opens easily 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 up or down and always adopt three-point support method, 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.
- As soon as you can reach the door handle with your free hand, unlock the door as necessary and open it, while paying attention to remain out of its swing radius before you climb any higher. External influences, such as wind, can make it more difficult to open doors.
Because of this, always lead along the door with your hand during the whole opening motion. Ensure that the door locks in place when reaching its open position, so to prevent it can slam open and shut.
- Now continue to climb up, still using the three-point support and sit down in the operator's seat as soon as you enter the cab.
- Close the door and fasten the safety belt, unlock the door using the destined lever,
Close the door thereafter using the both handholds mounted to the inner face of the door frame. Only after it tilt down the safety lever, and start the machine.
- It is essential to fasten your safety belt if you wish to work with the door open.
- For the excavators mounted on a special support or employed as a component of a larger installation (uppercarriage used on a pontoon, on a gantry crane,...), also consider the safety instructions in to the operator's manual of the complete machine relating to a safe getting up.

Adjusting the operator's standing position

- 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.

Protection from vibration - seat adjusting

- 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.

Utilisation in confined spaces

- 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.

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.
- Before stopping the machine, each time it is possible, align the uppercarriage with the undercarriage so that the sprockets locate at the back-end. This is the only one position which enables a secured access to every maintenance locations on the uppercarriage.
- Use the stop bolts to secure the upper structure facing the undercarriage, if available.
- Lower the equipment and anchor the grab lightly in the ground.
- Position every control lever into neutral position and 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, included hoods and compartments, retire every keys and secure the machine against unpermitted use and vandalis.

Safely getting down

- Proceed with the the same precautions to climb up or down onto the machine, as to instal yourself.
- Stop the machine on level, horizontal ground. The upper structure should be positioned with the undercarriage in such a way that the steps and ladders are aligned with each other.
- Open and lock the door. Be sure of it's locking. Take care of weather conditions ! Unfasten the safety belt.
- Position yourself with your face toward the machine when getting out and 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. Climb down until you can close the doors safely. Always use your hand for control when closing the doors. Lock the door.
- Now climb down to the ground.

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 particular 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: "Safe use when loading and unloading (particularly when loading and unloading wood)" on page 9.
- 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 engine must run at maximal 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 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.
- Depending on the equipment combination, there is a risk of collision between the lift ring of the attachment and the cab or the cab protection. Before operating, ensure that there is no risk of collision, especially on excavator with cab elevation. If necessary remove the lift ring.
- 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 with 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.
- 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 di-

- rection.
- Only rotate the upper structure when the undercarriage 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 undercarriage, 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 (transport position).
- 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 undercarriage 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.
- 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.

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 vicinity of the machine or the lifting device used.

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.

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 undercarriage 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 undercarriage using the stop bolts (only A devices).
 - Secure the undercarriage 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.
 - 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.

2.4 Servicing the machine safely

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.
- Always wear safe work clothes when carrying out maintenance work. Avoid the wearing of rings, wrist watches, ties, scarves, open jackets, baggy clothing etc... There is a risk of injury from, for example, getting caught up or being drawn in. Protective goggles, safety helmets, safety shoes and gloves, reflective vests and ear protection etc. are required for specific jobs.
- Do not remain in direct proximity of the diesel engine while the diesel engine is running. Persons with pacemakers should not approach within 20 cm of the running diesel engine. Do not touch voltage-carrying parts on the electrical connection of the individual solenoid injection pumps (Unit Pumps UP) while the diesel engine is running.

- 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.
- For some machines, the only one position which enables a secured access to every maintenance locations on the uppercarriage, is when the uppercarriage is aligned with the undercarriage so that the sprockets locate at the back-end. The ladder situated on the undercarriage only corresponds with the uppercarriage's access when the excavator is in this configuration.
- Pull out the ignition key and shut off the main battery switch.
- Always tighten any loose screw connections during maintenance and repair work.
- The mounting bolts of the main components, of the hydraulic hoses and of the counterweight must be replaced after every removal.
- 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.

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 repainting).
- 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.

Sight field

- Mirrors, which were possibly removed for the transport, must be inevitably reinstalled and correctly adjusted before the initial set-up of the machine.
- Regularly check that the interior and exterior mirrors are correctly adjusted.
- Control the surroundings, and particularly the nearness area of the machine, during operation or when travelling.
- Mirrors are installed on the machine :
 - on the left on the cab to check the left side of the machine.
 - on the front left on the cab to check the front side of the machine.
 - on the right on the uppercarriage to check the right side of the machine.
 - above the counterweight to check the rear side of the machine; on some machines, this mirror is replaced or completed with a camera.
- At each extension, construction or change on the machine, the sight conditions must be maintained. These conditions must otherwise be checked according to ISO 5006.
- Mirrors must be cleaned at least at daily intervals.
- Damaged mirrors must be immediately replaced.
- The site has to be organised so that the dangers due to a restricted sight field are minimized, particularly for machines with an operating weight which is superior to 40 tons.

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.
 - 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.

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

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).

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 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 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.

- Pneumatic cylinders do not have to be used as handles. Open doors and covers carefully, so that pneumatic cylinders do not hit their stops, because this could cause mechanical damages.
- 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, with the start key in contact position and with the safety lever down into its lowest position, you must operate all pilot control devices (joystick and pedals) in all directions 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.

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.

- 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.

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.

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 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.

2.5 Signs on the machine

2.5.1 Introduction

The excavator comprises several types of signs:

- **the safety plates** provide warnings relating to dangers of accidents which could result in serious injury or death.
- **the information plates** indicate specific points relating to the operation, maintenance and characteristics of the machine.
- **the nameplates** are attached to components for which the machine serial 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 and information plates immediately. You will find the ordering numbers of these plates in the spare parts book of the excavator.

2.5.2 Arrangement of signage

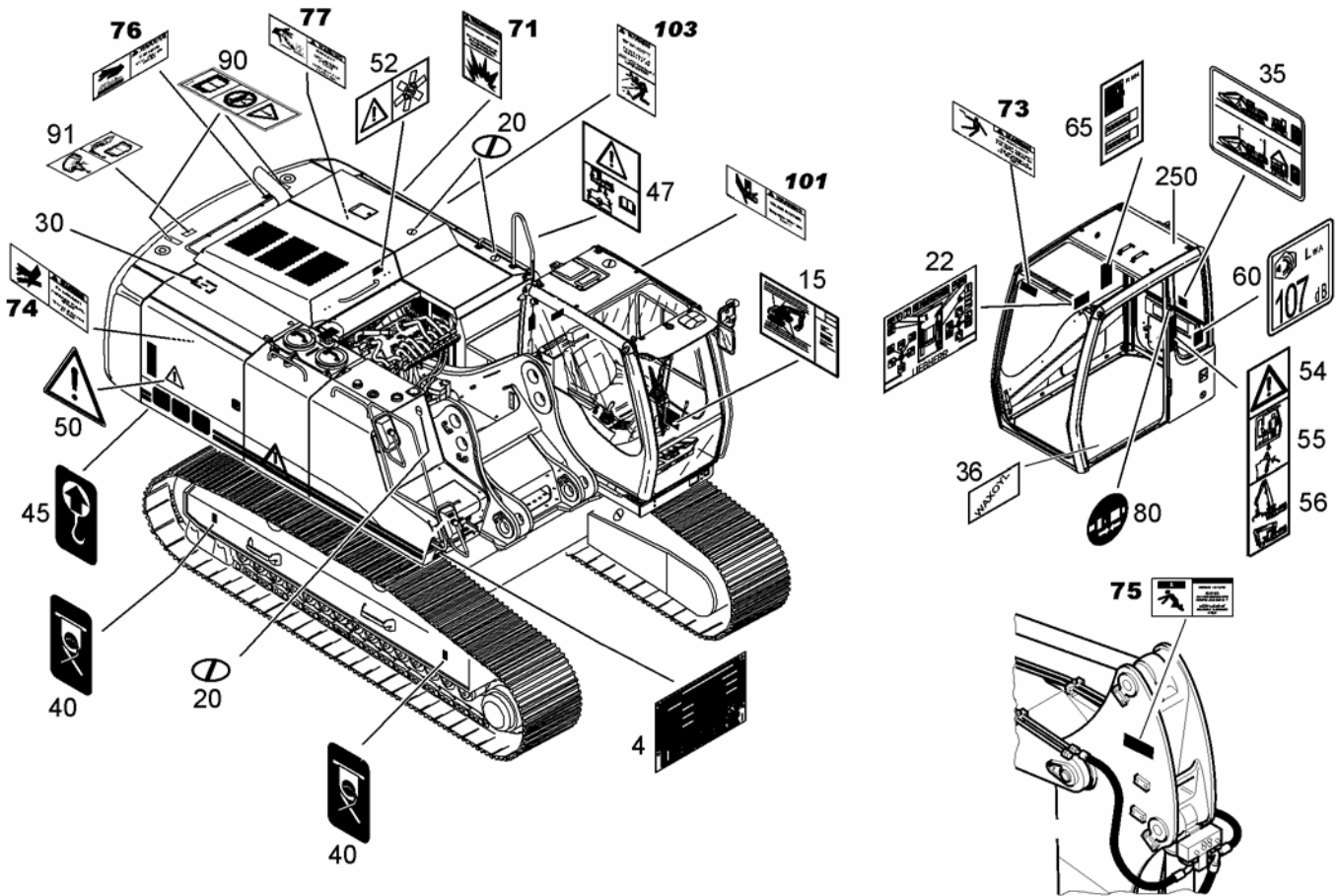


Fig. 2-1 Arrangement of signage on the machine

- | | | | |
|-----|----------------------------|------|-------------------------------------|
| 4 | Nameplate | 60 | Sound / power level [truck] |
| 15 | Lubrication chart | 65 | Load chart |
| 20 | Prohibiting sign | 71 | Explosion hazard |
| 22 | Operating symbols plate | 73 | High voltage |
| 30 | Lubrication chart (engine) | 74 | High pressure |
| 35 | Loading and lashing points | 75 | Hazard of impact and crushing |
| 36* | Waxoyl | 76 | Hot machine parts |
| 40 | Lashing point | 77 | Hot fluids |
| 45 | Lifting point | 80 | Safety belt |
| 47 | External start | 90* | Prohibiting sign - no lifting point |
| 50 | Obstruction | 91* | Counterweight removal |
| 52 | Engine-off | 101 | Crushing hazard |
| 54 | Accident prevention | 103 | Hazard of thrown out objects |
| 55 | Safety lever | 250* | Emergency exit - Rear window |
| 56 | Equipment | | |

* = Depends on the excavator's model



Note !

In order to be in accordance with specific local safety regulations, the safety signs may be different depending on the delivery country of the machine. For machines destined to the North American market (United States and Canada), there are specific safety signs.

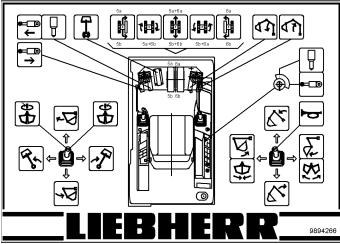

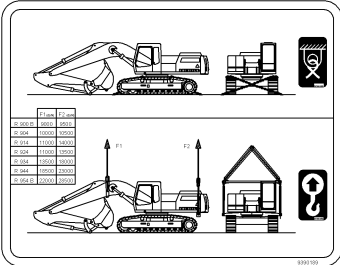
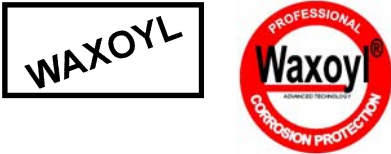


The meaning of the signs is explain in the chapter below.

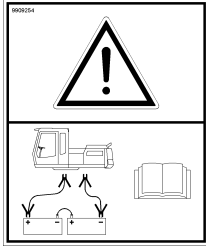






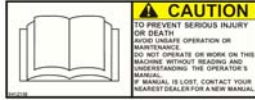

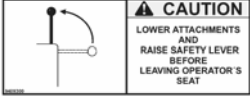
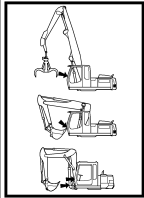

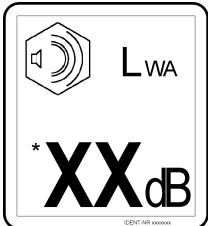
2.5.3 Explanation of signage

Serially installed signage

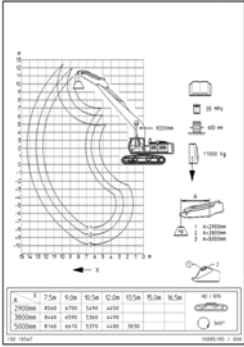


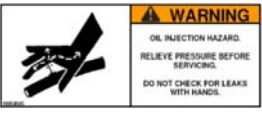


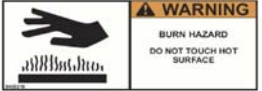

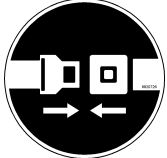

Signs for all countries (except the USA and Canada)	Signs for the USA and Canada	
		<p>Plate 4: Machine nameplate LFR (Liebherr France)</p> <p>Displays the following information:</p> <ul style="list-style-type: none"> – Vehicle identification number (PIN) – Type – Year of construction – Nominal engine power – Maximal speed – Operating mass
		<p>Plate 4: Machine nameplate LAM (Liebherr America)</p> <p>Displays the following information:</p> <ul style="list-style-type: none"> – Model number – Vehicle identification number (PIN)
		<p>Plate 15: Lubrication chart</p> <p>Displays the filling and lubrication positions.</p>
		<p>Plate 20: Prohibiting sign</p> <p>Entering the marked area is forbidden.</p>


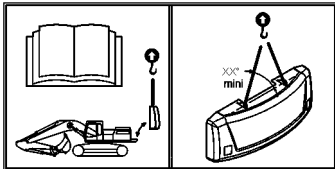

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Signs for all countries (except the USA and Canada)	Signs for the USA and Canada	
		<p>Plate 22: Operating symbols</p> <p>Describes the functions of the controls.</p>
		<p>Plate 30: Lubrication chart (engine)</p> <p>Indicates the maintenance operations for the Diesel engine.</p>
		<p>Plate 35: Loading and lashing points</p> <p>Identifies the positions of the loading and lashing points, as well as the relevant weight of the machine.</p> <p>They are maximal values. The real values may be different.</p>
		<p>Plate 36: Waxoyl*</p> <p>Indicates the corrosion protection of the pistons rods.</p>
		<p>Plate 40: Lashing point</p> <p>The use of lashing points depends on the transport method. See chapter "Transport".</p>
		<p>Plate 45: Lifting point</p> <p>The use of lifting points depends on the transport method. See chapter "Transport".</p>

Signs for all countries (except the USA and Canada)	Signs for the USA and Canada	
		<p>Plate 47: External start</p> <p>The operating instructions must be consult prior any battery connection.</p>
		<p>Plate 50: Obstruction</p> <p>It is forbidden to stand in the danger zone.</p>
		<p>Plate 52: Engine-off</p> <p>The engine hood may only be opened when the engine is switched off.</p>
		<p>Plate 54: Accident prevention</p> <p>The accident prevention regulations given in the operating instructions must be carefully followed.</p>
		<p>Plate 55: Safety lever</p> <p>Raise safety lever before leaving the operator's seat.</p>
		<p>Plate 56: Equipment</p> <p>Work equipment reaches as far as the cab! Caution – work equipment retracted.</p>
	<p>Plate 60: Sound/power level [truck]</p> <p>Indicates the sound/power level of the machine to the environment in dB(A).</p> <p>*XX = The applicable value for the machine is provided in the operator's cab.</p>	


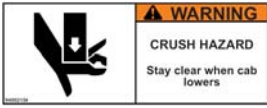

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Signs for all countries (except the USA and Canada)	Signs for the USA and Canada	
		<p>Plate 65: Load chart*</p> <p>Shows the permissible loads at the end of the stick depending on the working radius.</p>
		<p>Plate 71: Explosion hazard</p> <p>Indicates that it is forbidden to smoke or to use an open flame. Explosion hazard is especially important near the batteries when they are being charged.</p>
		<p>Plate 73: High voltage</p> <p>Informs that any part of the working attachment must be kept away at least 50 feet from high voltage electrical lines.</p>
		<p>Plate 74: High pressure</p> <p>Warns that a jet of fluid under high pressure can cause serious injury.</p>
		<p>Plate 75: Hazard of impact and crushing</p> <p>Hazard of impact and crushing during machine operation.</p>
		<p>Plate 76: Hot machine parts</p> <p>Hazard due to hot machine parts, especially in the area of exhaust silencer.</p>
		<p>Plate 77: Hot fluids</p> <p>Hazard due to hot fluids under pressure, especially by opening of the coolant tank.</p>
		<p>Plate 80: Safety belt</p> <p>The safety belt must be fastened before starting the machine.</p>

Signs for all countries (except the USA and Canada)	Signs for the USA and Canada	
		<p>Plate 90: Prohibition sign - no lifting point*</p> <p>This sign is situated beside a lifting point. It is forbidden to use this point for lifting the complete machine. Refer to the operator's manual and to the position of the plates 45 for lifting the complete excavator.</p>
		<p>Plate 91: Counterweight removal *</p> <p>Indicates the minimum angle to be respected by the loading slings when the counterweight is lifting off the machine.</p>
		<p>Plate 250: Emergency exit – rear window*</p> <p>The rubber weatherstrip can be loosened and removed and the rear window pushed out by pulling the clip on the inside of the rear window.</p>

* = Depends on the excavator's model

Signage relating to optional equipments

Signs for all countries (except the USA and Canada)	Signs for the USA and Canada	
		<p>Plate 101: Crushing hazard</p> <p>Signals of the high crushing hazard in those zones.</p>
		<p>Plate 103: Hazard of thrown out objects</p> <p>Signals the hazard of injuries by thrown out objects wenn the fan is activated. (On machines fitted out with reversible cooler fan).</p>

2.5.4 Nameplates on the machine

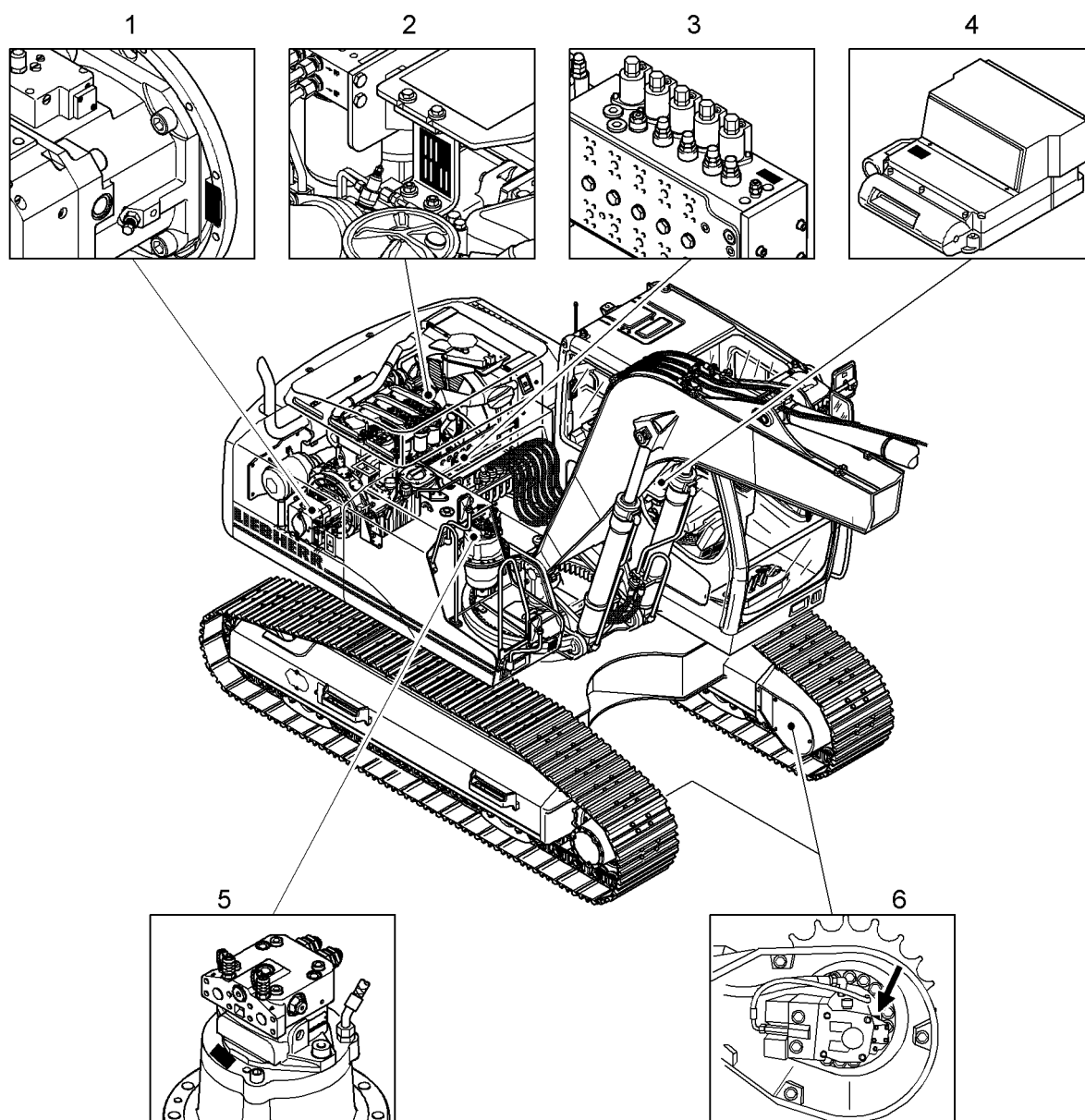


Fig. 2-2 Important nameplates on the machine

- | | | | |
|---|----------------|---|-----------------------------------|
| 1 | Hydraulic pump | 4 | Heating/air conditioning device |
| 2 | Diesel engine | 5 | Slewing gear transmission |
| 3 | Control block | 6 | Drive transmission with oil motor |

3 Control and operation

3.1 Operating and control elements

3.1.1 Controls in the operator's cab

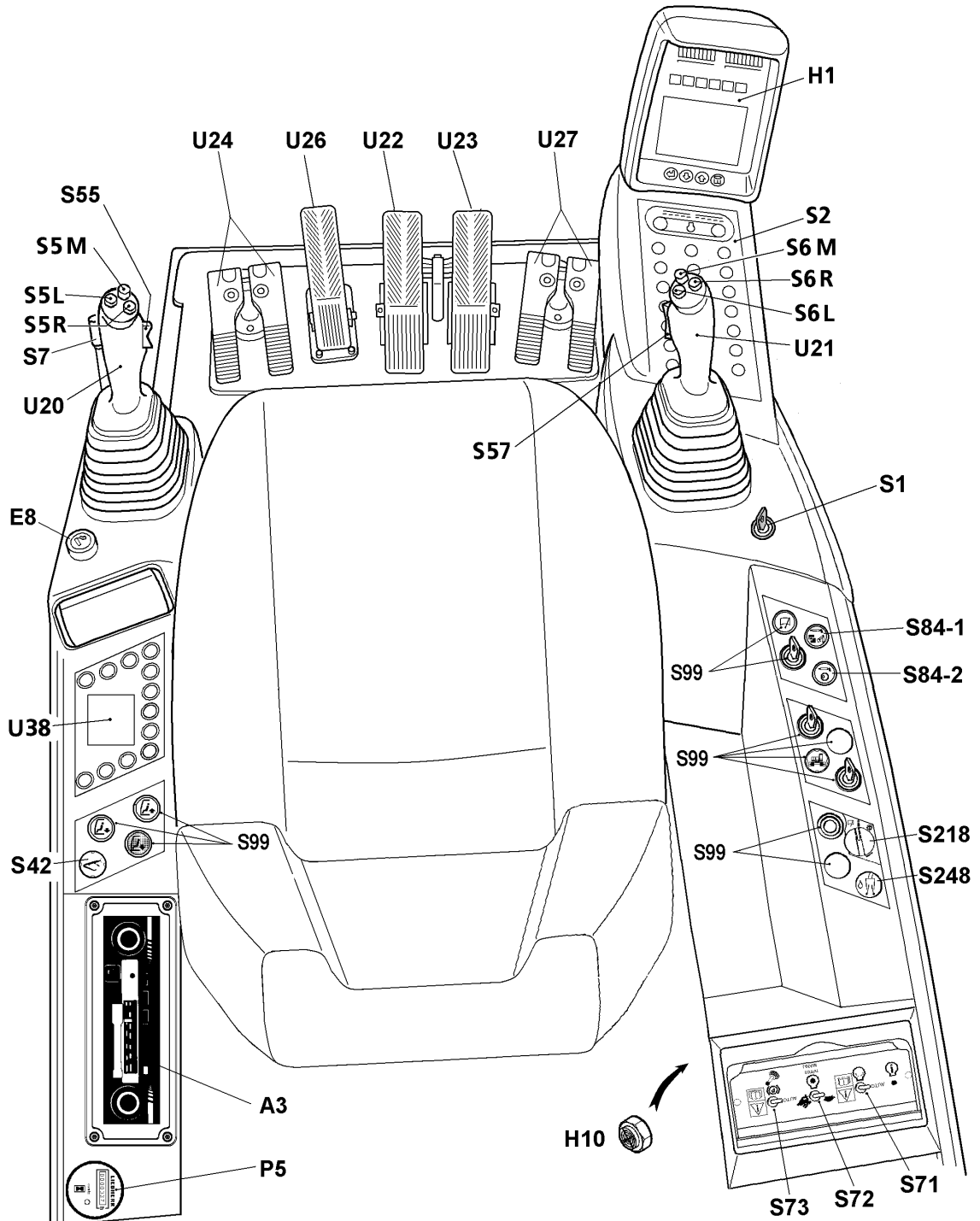


Fig. 3-1 Controls in the cab

A3	Radio *	E8	Cigarette lighter
H1	Monitoring display	H10	Buzzer
P5	Hourmeter		
S1	Ignition key	S2	Control unit
S5L	Push button for rotating device left (grapple, shear, ...), or unlocking of cylinder cut-off ^(NA)	S5R	Push button for rotating device right (grapple, shear, ...) or travel alarm on/off ^(NA)
S5M	Horn	S6L	Push button for lifting magnet or rotating device left ^(NA)
S6M	Float position of boom cylinders for shovel attachment - Reserve	S6R	Push button –travel alarm on/off or rotating device right ^(A)
S7	Safety switch- Servo control	S42	Push button / Emergency lowering of working attachment
S55	Switch – unlocking of cylinder cut-off or lifting magnet ^(NA)	S57	Switch / Preselection of swing brake operating mode
S71	Diesel engine emergency start	S72	RPM adjustment during emergency operation
S73	Safety mode of the servo circuits		
S84-1	Push button / Central lubrication	S84-2	Push button / Swing ring teeth lubrication
S99	Controls for optional equipments *		
S218	Push button / Cab roof windshield wiper	S248	Push button / Air bleeding of servo control circuits
U20	Left joystick	U21	Right joystick
U22	Pedal for left travel gear	U23	Pedal for right travel gear
U24	Double pedal for special equipments *	U26	Positioning swing brake *
U27	Double pedal for special equipments *	U38	Control unit - heater and air conditioner
*	Optional equipments		
^(NA)	<i>This location only for North America</i>		

3.1.2 The joysticks

Control of the working movements

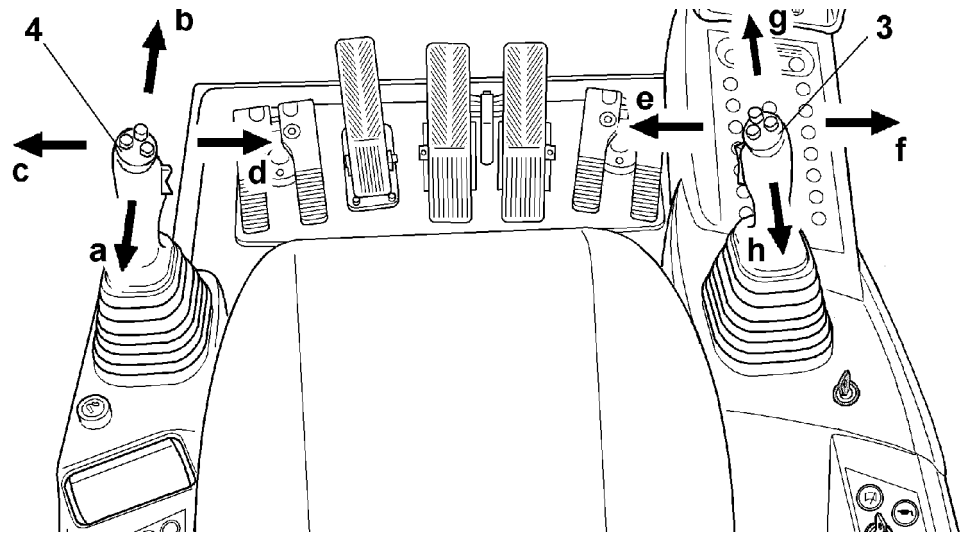


Fig. 3-2 Joystick right (3) and left (4)

Standard control system according to ISO

The left joystick 4 controls the stick and swing movements:

- Actuate the joystick 4 towards a resp. b to move the stick in resp. out.
- Actuate the joystick 4 towards c resp. d to swing the uppercarriage to the left resp. to the right.

The right joystick 3 controls the boom and bucket or grab movements:

- Actuate the joystick 3 towards e resp. f to tilt the bucket in or close the grapple, resp. to tilt the bucket out or open the grapple.
- Actuate the joystick 3 towards g resp. h to lower resp. to lift the attachment.

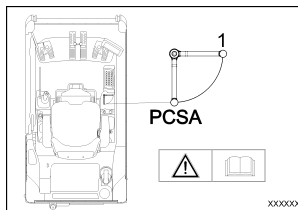
Special control systems



Note !

The machines are always delivered with the above described control system according to ISO standards.

At customer's wish, the machine may be fitted in addition with a special control system (**Liebherr resp. John Deere control system,**).



The operator can activate the special control system using the switching lever situated on the floor of the cabin, under the right joystick.

See also "Special control system of the joysticks" in this chapter.

Push buttons and switches in the joysticks

a) Standart execution: two positions controls for additional functions

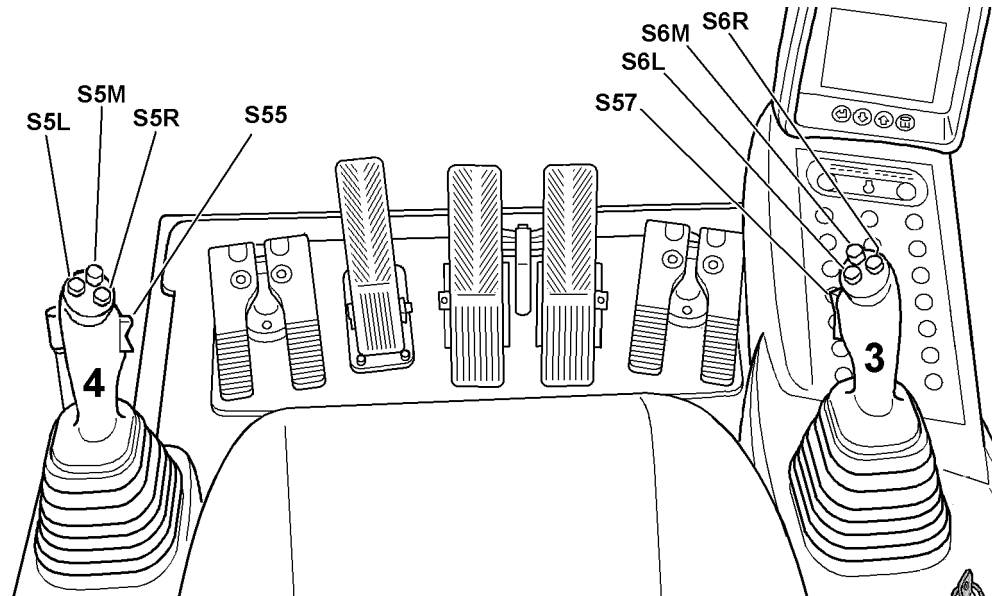


Fig. 3-3 Arrangement of push buttons and switches in the control levers

Button -Switch	Function
Push button S5L	Rotating device left See in this chapter " control of rotating device (rotating, tilting, locking and unlocking a working tool)".
Push button S5M	Horn
Push button S5R	Rotating device right See in this chapter " control of rotating device (rotating, tilting, locking and unlocking a working tool)".
Push button S6L	Lifting magnet See in this chapter "Lifting magnet (optional equipment)".
Push button S6M	Reserve or float position of the boom cylinders with shovel attachment See the section "working attachment control", further in this chapter.
Push button S6R	Travel alarm cut-off See in this chapter "Drive warning device (optional extra)".
Push switch S55 Tilt down	Unlocking of a movement cut-off by end position switch See in this chapter "Cut-off by end switches of attachment movements (optional equipment)" and "Mechanical station cylinder shut-down (option)".
Push switch S55 Tilt up	Turning on the pressure limitation for boom cylinders for exemple when operating a grapple See also S98 in the heading "Controls for optional equipment".
Rocker switch S57	Swing brake control in semi automatic mode See in this chapter "The uppercarriage swing movements".



Caution!

With some specific combinations of optional equipments and/or at customer's wish, the functions may be different.

Always check the functions of special equipments before beginning to work with the machine.

b) optional execution from May 2010:

Joystick levers with proportional mini joystick for additional functions

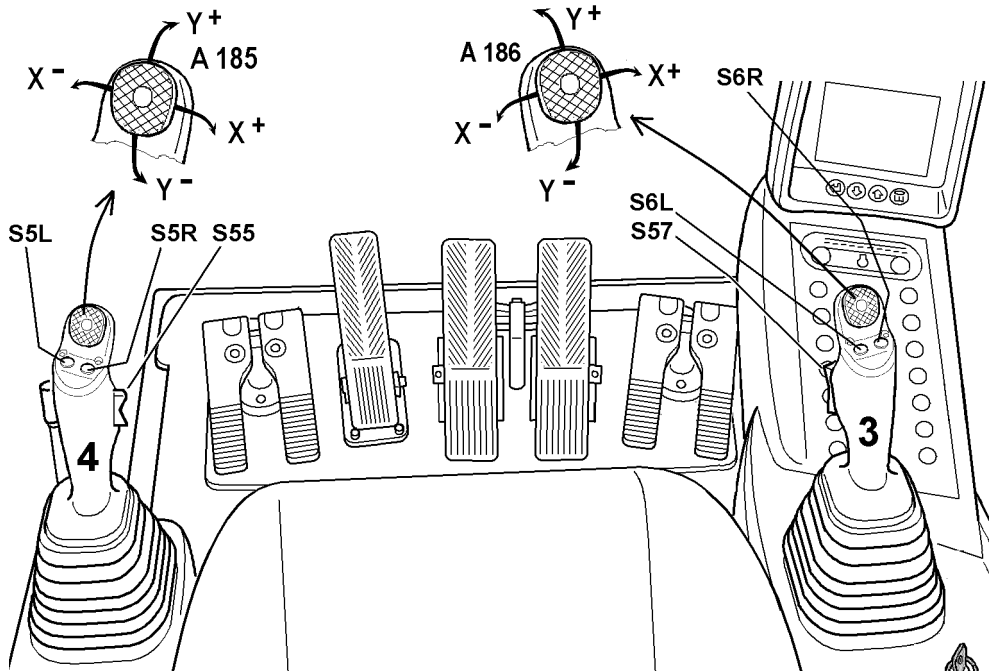


Fig. 3-4 Control levers with push buttons, switches and mini joysticks

Button -Switch	Function
Mini joystick A185 Moved toward X+	Rotating device right See in this chapter " control of rotating device (rotating, tilting, locking and unlocking a working tool)".
Mini joystick A185 Moved toward X-	Rotating device left See in this chapter " control of rotating device (rotating, tilting, locking and unlocking a working tool)".
Mini joystick A185 Moved toward Y+	Reserve
Mini joystick A185 Moved toward Y-	Reserve
Mini joystick A186 Moved toward X+	Retraction of the cylinder of anAHS type additional user, actuation of hydraulic hammer.
Mini joystick A186 Moved toward X-	Extension of the cylinder of anAHS type additional user, respec.
Mini joystick A186 Moved toward Y+	Reserve
Mini joystick A186 Moved toward Y-	Reserve
Push button S5L	Horn

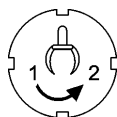
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Button -Switch	Function
Push button S5R	Reserve
Push button S6L	Lifting magnet, see in this chapter "Lifting magnet (optional equipment)". or float position of the boom cylinders with shovel attachment, see the section "working attachment control", further in this chapter. or turning on the pressure limitation for boom cylinders for exemple when operating a grapple, see also S98 in the heading "Controls for optional equipment"..
Push button S6R	Travel alarm cut-off See in this chapter "Drive warning device (optional extra)".
Push switch S55	Unlocking of a movement cut-off by end position switch See in this chapter "Cut-off by end switches of attachment movements (optional equipment)" and "Mechanical station cylinder shut-down (option)".
Rocker switch S57	Swing brake control in semi automatic mode See in this chapter "The uppercarriage swing movements".

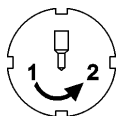
**Caution!**

With some specific combinations of optional equipments and/or at customer's wish, the functions may be different.
Always check the functions of special equipments before beginning to work with the machine.

The operator can select an other characteristic for the proportional control of additional function.



By pressing on the touch **S251** on the right side control panel, the indicator integrated in the touch lights up and the second characteristic curve for the proportional function of the left mini joystick is selected.



By pressing on the touch **S252** on the right side control panel, the indicator integrated in the touch lights up and the second characteristic curve for the proportional function of the right mini joystick is selected.

3.1.3 Control unit

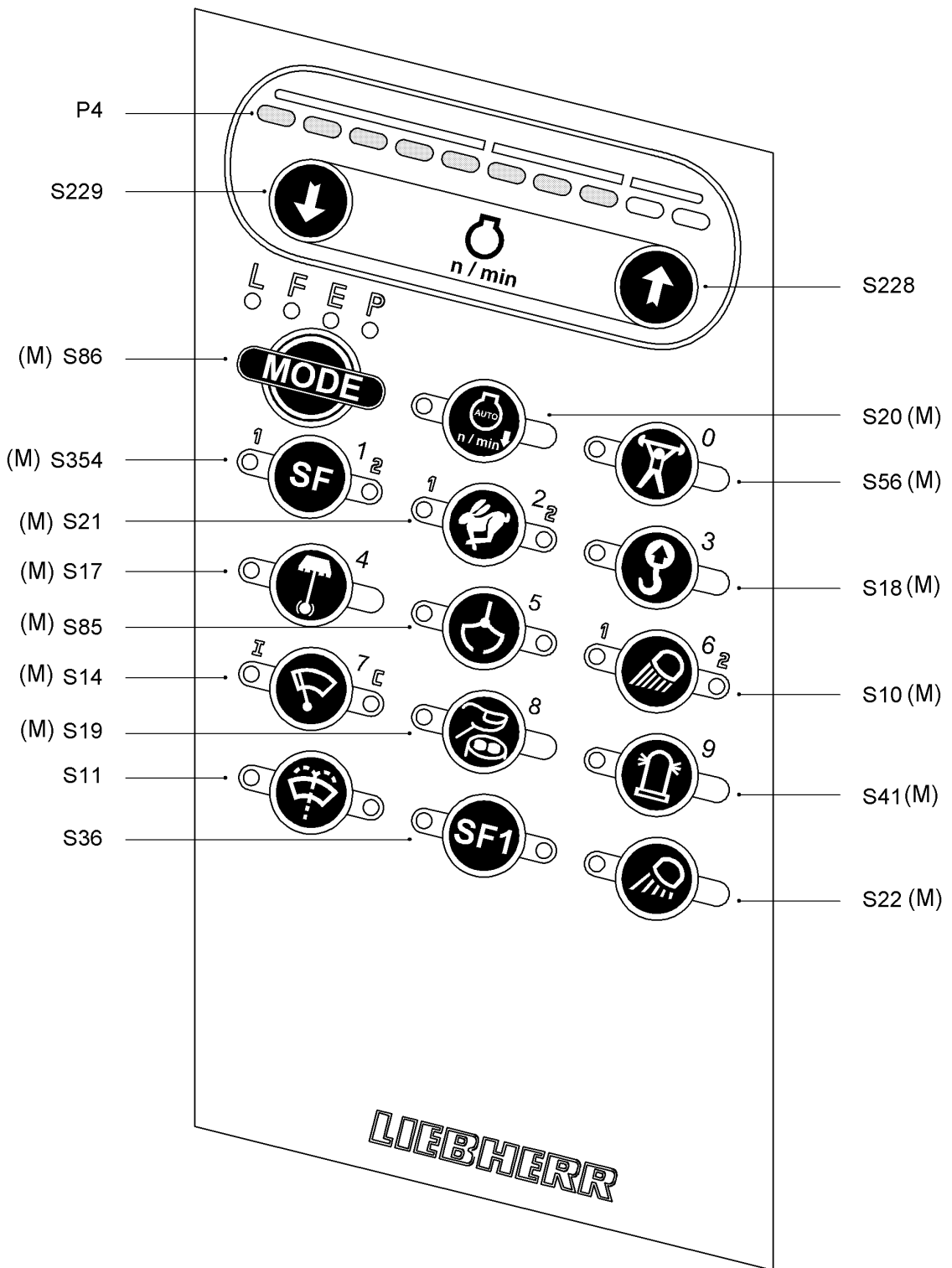
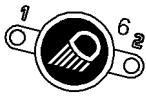


Fig. 3-5 Excavator control unit

M The function of the push buttons marked with (M) are memorized when the excavator is stopped. This means that, when turning on the excavator, the controlled function recovers the previous state (on-off, 1-2, I-C, ...) before the machine had been turned off.



S10 – Working floodlights

- ▶ Press the touch. Each touch actuation will successively:
 - ↗ turn on the uppercarriage floodlights (LED 1 illuminates),
 - ↗ turn on the attachment floodlights (LED 2 illuminates)
 - ↗ switch off the uppercarriage floodlights (LED 1 go out),
 - ↗ turn on both the uppercarriage and the attachment floodlights (LEDs 1 and 2 illuminate),
 - ↗ switch off both the floodlights on the uppercarriage and the floodlights on attachment (LEDs 1 and 2 in the touch go out).



S11 – Windshield washer

- ▶ Press the touch and keep it depressed:
 - ↗ washer fluid is sprayed onto the windshield,
 - ↗ the windshield wiper runs continuously.
- ▶ Release the touch:
 - ↗ the washer fluid spraying is stopped,
 - ↗ the windshield wiper will stop after approx 3 seconds.



S14 – Windshield wiper

- ▶ Press the touch:
 - ↗ the windshield wiper is turned on in intermittent mode,
 - ↗ LED I in the touch illuminates.
- ▶ Press the touch again:
 - ↗ the windshield wiper is turned on in continuous,
 - ↗ LED C in the touch illuminates and LED I goes out.
- ▶ Press the touch again:
 - ↗ the windshield wiper is switched off,
 - ↗ LED C in the touch goes out.

The touch S14 also allows to adjust the pause time for the intermittent mode of the windshield wiper:

- ▶ press the touch to select the intermittent mode and keep the touch depressed,
 - ↗ after a few seconds the LED I starts blinking rapidly,
- ▶ release the touch as soon as the blinking duration has reached the desired pause time (settings from 2 - 9 seconds).



S17 – Preselection of swing brake operating mode

- ▶ Press the touch:
 - ↗ LED in the touch illuminates,
 - ↗ the swing brake is applied.
- ▶ Press the touch again:
 - ↗ LED in the touch goes out,
 - ↗ the swing brake is switched in semi automatic operating mode. In this mode the brake is controlled depending on the position of the rocker switch S57 situated in the right joystick lever.



S18 – Overload warning device (optional equipment)

- ▶ Press the touch:
 - ↖ LED in the touch illuminates,
 - ↖ the overload warning device is activated.
- ▶ Press the touch again:
 - ↖ LED in the touch goes out,
 - ↖ the overload warning device is deactivated.
- If no overload warning device is installed or if it is not correctly initialized on the machine:
 - ↖ the indicator symbol "No overload warning device recognized" will appear on the monitoring display at warning device activation (LED in the touch illuminates).



S19 – Rotating device (optional equipment)

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

- ▶ Press the touch:
 - ↖ LED in the touch illuminates,
 - ↖ the control circuit for the rotating device is activated. Now the special equipment (as an ex. the rotating grapple) can be actuated using the push buttons S5L and S5R in the handle of the left joystick unit.
- ▶ Press the touch again:
 - ↖ LED in the touch goes out,
 - ↖ the control circuit for the rotating device is deactivated. The actuation of the special equipment via S5L and S5R is no longer possible.



S20 – Engine low idle automatic

- ▶ Press the touch:
 - ↖ LED in the touch illuminates,
 - ↖ The low idle automatic is activated.
- ▶ Press the touch again:
 - ↖ LED in the touch goes out,
 - ↖ The low idle automatic is deactivated.

Adjustment of the time lag for low idle automatic

The time lag between the return to neutral of all joysticks and pedals and the automatic reduction of the engine RPM to low idle can be adjusted using the touch S20 as follows:

- ▶ press the touch to activate the low idle automatic and keep the touch depressed.
 - ↖ after a few seconds the LED starts blinking rapidly,
- ▶ release the touch as soon as the blinking duration has reached the desired time lag for low idle automatic (settings from 2 - 9 seconds).



S21 – Travel speed increase

- ▶ Press the touch:
 - ↖ LED 1 in the touch illuminates,
 - ↖ the automatic shifting from normal to increased travel speed is activated.

During travel, the oil motors mounted to the travel gears now change automatically from normal speed to increased speed each time the terrain conditions allow it, and inversely, they return to normal travel speed when ground conditions become difficult.

- ▶ Press the touch again:
 - ↖ LED 1 in the touch goes out,
 - ↖ the automatic shifting between normal and increased travel speed is deactivated. The travel motors remain permanently in the normal travel speed position.



S22 – Auxiliary floodlights (optional equipment)

- ▶ Press the touch:
 - ↖ LED in the touch illuminates,
 - ↖ the auxiliary floodlights are turned on.
- ▶ Press the touch again:
 - ↖ LED in the touch goes out,
 - ↖ the auxiliary floodlights are switched off.



S36 – No function



S41 – Rotating beacon (optional equipment)

- ▶ Press the touch:
 - ↖ LED in the touch illuminates,
 - ↖ the **rotating beacon** is turned on.
- ▶ Press the touch again:
 - ↖ LED in the touch goes out,
 - ↖ the **rotating beacon** is switched off.



S56 – Working pressure increase (optional equipment)

- ▶ Press the touch:
 - ↖ LED in the touch illuminates,
 - ↖ the relief pressure of the primary relief valves increases,
 - ↖ the maximum possible forces at the working attachment are raised.
- ▶ Press the touch again:
 - ↖ LED in the touch goes out,
 - ↖ the relief pressure of the primary relief valves is reduced to its initial value.



S85 – No function

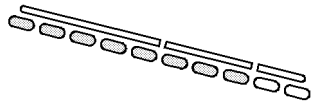


S86 – Operating mode preselection

Four different operating modes can be selected by pressing the touch.

- **L**: Mode LIFT (RPM stage 5)
- **F**: Mode FINE (RPM stage 10)
- **E**: Mode ECO (RPM stage 8)
- **P**: Mode POWER (RPM stage 10).

The currently active mode is displayed by the LED under the letter.



P4 – Engine RPM indicator

The indicator P4 displays the speed range of the Diesel engine in 10 levels.



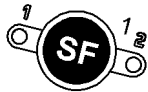
S228 – Engine RPM increase

- ▶ Press the touch:
 - ↖ the engine RPM will be increased by one level,
 - ↖ an additional LED toward right illuminates on indicator P4.



S229 – Engine RPM decrease

- ▶ Press the touch:
 - ↖ the engine RPM will be decreased by one level,
 - ↖ the most right burning LED on indicator P4 goes out.



S354 – No function

3.1.4 Monitoring display

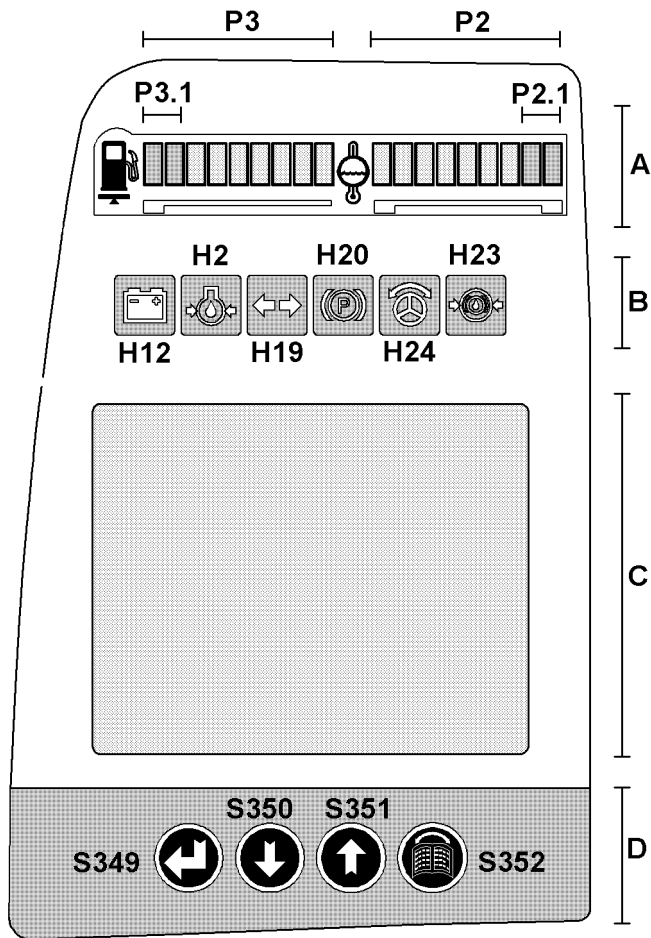


Fig. 3-6 Monitoring display

A Analog-value gauges

H24 Function not used

B	Indicator lights	P2	Coolant temperature gauge
C	LCD screen	P2.1	Coolant temp. gauge - red area
D	Menu control keys	P3	Fuel level gauge
H2	Indicator light, engine oil pressure	P3.1	Fuel level gauge - red area
H12	Indicator light, battery charge	S349	Back key
H19	Function not used	S350	Down key
H20	Function not used	S351	Up key
H23	Function not used	S352	Menu key

Area A : Display of analog-values



P2 – Diesel engine coolant temperature gauge

During the operation of the machine the gauge must be in the green area.

- In the event of an overheating, i. e. if the coolant temperature is above 100 °C / 212 °F :
 - ↪ the red LEDs **P2.1** at the end of indicator **P2** start blinking,
 - ↪ the buzzer in the cab sounds,
 - ↪ the error is memorized under error code **E 503**,
 - ↪ the engine power is automatically reduced.
- ▶ Stop working as soon as possible.
- ▶ Keep the engine running at high idle.
- If the overheating exceeds 60 seconds:
 - ▶ bring the engine to low idle and keep it running at low idle for another 3 to 5 minutes.
 - ▶ Turn the engine off.
- If the temperatur increases some more (above 104 °C / 219 °F)
 - ↪ the corresponding symbol is displayed on the main screen after 7 seconds
 - ↪ the error is memorized under error code **E 523**.
- ▶ Turn the engine off immediately.
- ▶ Find out and remedy the cause of the trouble.



P3 – Fuel level display

The number of lighting LEDs on this gauge indicate the amount of fuel remaining in the tank.

When the red LEDs **P3.1** illuminate, a reserve allowing to operate the machine for approx. one or two hours is still in the tank.



Area B :Indicator lights



H2 – Indicator light, low engine oil pressure

The indicator light illuminates if, during machine operation, the engine oil pressure drops below a value depending on the engine RPM for more than 3 seconds.

The buzzer in the cab also sounds.

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

- ▶ Bring the engine to a low idle immediately.
- ▶ Allow the engine to idle for a short moment and switch it off.
- ☐ If the pressure remains too low for 5 other seconds:
 - ↪ the corresponding symbol is displayed on the main screen,
 - ↪ the error is memorized under error code **E 522**.
 - ↪ the engine is turned off automatically.
- ▶ Find and correct the cause of the problem (oil level, oil viscosity,,...)



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 alternator belt or the electrical charging system is defective.

- ▶ Bring the engine to low idle immediately.
- ▶ Allow the engine to idle for approximately 5 seconds.
- ▶ Switch off the engine.
- ▶ Find out and remedy the cause of the problem.



H19 – No function



H20 – No function



H23 – No function



H24 – No function

Area D : Menu control keys



S349



S350



S351



S352

Fig. 3-7 Menu control keys

The screen can be operated using the following four keys:

- **S349: Back key**
- **S350: Down key**

- **S351: Up key**
- **S352: Menu key**

These **keys** are used to jump from the main menu to the submenus or to move from page to page, to scroll inside a menu,

Area C: LCD Screen

To change the contrast of the LCD screen:

- ▶ Press the **Menu** key and the arrow key **Up** (higher contrast) or **Down** (lower contrast) simultaneously.
 - ↪ The contrast will be changed.
 - ↪ When releasing the both keys the set value of the contrast is memorized.

To change the brightness of the LCD screen:

- ▶ Press at the same time the **Back** key and the arrow key **Up** (brighter) or **Down** (darker).
 - ↪ The brightness will be changed.
 - ↪ When releasing the both keys the set value of the brightness is memorized.



Note

A light sensor built in to the top left of the monitoring screen adapts the illumination on the main screen to the brightness of the environment. The adaptation takes place from the saved brightness value. Illumination will be automatically reduced in conditions of low environmental brightness and inversely.

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

- ▶ Turn off the ignition.
- ▶ Press and hold the **Up** and **Down** keys simultaneously.
- ▶ Turn on the ignition again.
- ▶ After completion of the automatic display check release the both keys.:
 - ↪ the settings for the brightness and for the contrast of the LCD screen retrieve their initial values set at machine delivery.

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** key.

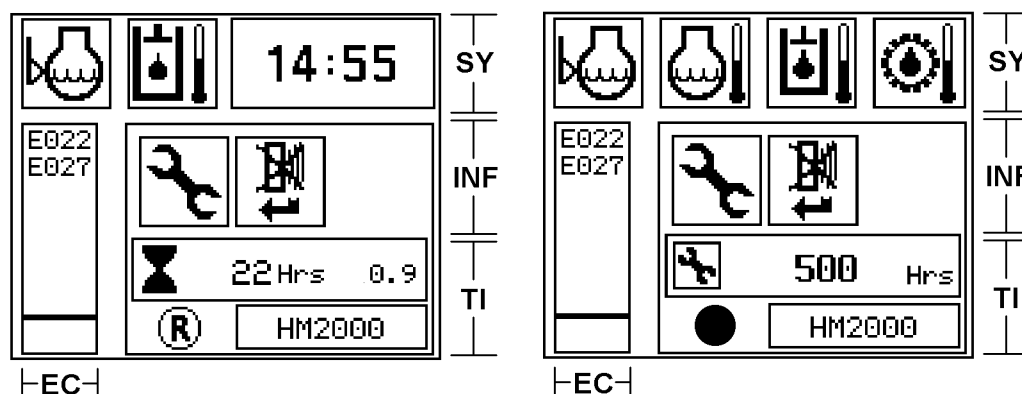


Fig. 3-8 Main screen - Division into four fields

EC	Error codes of electrical errors	SY	Symbols of operating faults, clock
INF	Information symbols	TI	Display of hour meters, flow limitations, ...

Constitution of the main screen

SY field

The upper field of the screen shows the warning symbols for the actual operating faults and also the 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.

See the list of the possible symbols in section "Warning symbols in the SY field", further in this chapter.

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 list is shifted in the selected direction.

See the complete list of the error codes in section "Error codes charts", in chapter 4.

INF field

The INF field displays temporary information in 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 (also see the section "Information symbols in the INF field", further in this chapter).

TI field

The machine operating hours and the daily operating hours counter are displayed in this field at the bottom right of the screen. During the start-up phase, the operator will be alerted about a possible up-coming service time, by a graphic symbol and an hour indication displayed instead of the machine hour-meter during about 8 seconds.



The symbol ① is displayed when an external flow limitation is activated (see the description of the menu "Info In/Outputs", further in this chapter).



The symbol ● indicates that no external flow limitation is actually activated. But an internal flow limitation (travel, swing,...) may be activated.

In this field can also be indicated the denomination (for example HM2000) of the option which is actually assigned to the external flow limitation input I1 (see the description of the menu "Set option", further in this chapter).

Control of the screen at error recognition

In case a new operating fault displayed in the field SY is recognized, the presentation will return to the main screen, and the relevant symbol is displayed.



Depending on the fault (level of urgency), the buzzer will sound either continuously or in short consecutive bursts. At the same time the symbol "acknowledge error" will be displayed in the INF field.



Danger!

If the displayed fault is not remedied immediately, this could lead to persons sustaining injury or the machine being damaged.

- ▶ Immediately remedy the occurred error or get it remedied.
- ▶ Press the **Back** key.
 - ↪ The error will be acknowledged, this means that the buzzer signal alerting to the upcoming of this fault is stopped.

Warning symbols in the SY field

A) Warning symbols for operating faults

Each of the following symbols will be assigned an error code in the form "E 5xx". When the trouble is occurring, the corresponding symbol is displayed in the field SY of the screen. The error code will not be displayed in the field EC too, but the occurred error will be memorized under this error code in the error list.



E 502 – Low coolant level

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.

Caution!

This coolant level monitoring device achieves an increased security for the engine 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 expansion reservoir.



E 503 – Coolant overheat - Warning stage

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

If the temperature increases some more, the symbol E523 will also be displayed.

**E 504 – Low hydraulic oil level**

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.
- ▶ Depressurize the hydraulic tank.
- ▶ Carry out repairs.
- ▶ Only refill the hydraulic oil using the return-line filter.

**E 505 – Hydraulic oil overheat**

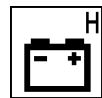
This symbol appears if the hydraulic oil temperature in the tank exceeds 99 °C.

- ▶ Bring the engine to a low idle immediately.
- ▶ Switch the engine off after a few seconds.
- ▶ Find out and remedy the trouble (radiator dirty etc.).

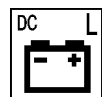
**E 506 – Splitterbox oil overheat**

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

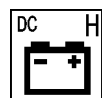
- ▶ Bring the engine to a low idle immediately.
- ▶ Switch the engine off after a few seconds.
- ▶ Localise and rectify the error.

**E 511 – High voltage of batteries**

This symbol appears if the momentaneous voltage of the batteries exceeds 30 volts for at least 0.5 seconds.

**E 512 – Under voltage for the Diesel control system**

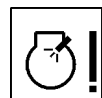
This symbol appears if the operating voltage for the Diesel control system is lower than the minimum permissible value.

**E 513 – Over voltage for the Diesel control system**

This symbol appears if the operating voltage for the Diesel control system exceeds the maximum permissible value.

**E 516 – Safety shut off for EDC default**

This symbol appears if an EDC default is detected. The engine shuts off automatically.

**E 517 – Safety shut off for injector default**

This symbol appears if an injector default is detected. The engine shuts off automatically.

**E 518 – Safety shut off for starting synchronisation default**

This symbol appears if a starting synchronisation default is detected. The engine shuts off automatically.

**E 519 – Overspeed of Diesel engine - Warning stage**

This symbol appears if the RPM of the Diesel engine is above the preprogrammed warning stage.

**E 520 – Overspeed of Diesel engine - Safety stage**

This symbol appears if the RPM of the Diesel engine is above the preprogrammed safety stage. The engine stops automatically.

**E 521 – Both engine RPM sensors defective**

This symbol appears if both engine RPM sensors are simultaneously defective. The engine shuts off automatically.

For machine equipped with a lifting magnet, the symbol appears if one only of the both sensor is defective. In this case, the engine does not shut off automatically.

**E 522 – Low engine oil pressure - Safety stage**

This symbol appears if the engine oil pressure is, during at least 7 seconds, below a programmed value depending on the engine RPM. The buzzer sounds simultaneously.

**E 523 – Coolant overheating - Safety stage**

This symbol appears if the coolant temperature exceeds 104°C during at least 7 seconds. The buzzer sounds simultaneously and the engine power is reduced.

**E 524 – Boost air overheating - Safety stage**

This symbol appears if the boost air temperature exceeds 80°C during at least 7 seconds. The buzzer sounds simultaneously and the engine power is reduced.

**E 525 – Engine in safety mode**

This symbol appears if, when the engine is in safety mode, one of the following engine error is detected: E501, E503, E597, E522, E523 or E524. Simultaneously the buzzer sounds and the LED H60 lights up

► Bring the engine to a low idle and turn it off as soon as possible.

**E 526 – Fuel overheating - Warning stage**

This symbol appears if the fuel temperature is above the warning limit.

**E 527 – Fuel overheating - Safety stage**

This symbol appears if the fuel temperature is above the safety limit.

**E 528 – High water level in the fuel filter**

This symbol appears if a high water level is detected in the fuel filter.



E 530 – Centralized symbol - safety limit exceeded

This symbol appears simultaneously with the one of the safety stage errors : E522, E523, E524, E527, E533, E535, E537 or E539.



E 532 – Low fuel pressure - Warning stage

This symbol appears if the fuel pressure is under the warning limit.



E 533 – Low fuel pressure - Safety stage

This symbol appears if the fuel pressure is under the safety limit.



E 534 – High fuel pressure - Warning stage

This symbol appears if the fuel pressure is above the warning limit.



E 535 – High fuel pressure - Safety stage

This symbol appears if the fuel pressure is above the safety limit.



E 536 – Low fuel pressure in Rail 1 - Warning stage

This symbol appears if the fuel pressure in the Rail 1 of the injection system passes below the warning limit.



E 537 – Low fuel pressure in Rail 1 - Safety stage

This symbol appears if the fuel pressure in the Rail 1 of the injection system passes below the safety limit.



E 538 – Low fuel pressure in Rail 2 - Warning stage

This symbol appears if the fuel pressure in the Rail 2 of the injection system passes below the warning limit.



E 539 – Low fuel pressure in Rail 2 - Safety stage

This symbol appears if the fuel pressure in the Rail 2 of the injection system passes below the safety limit.



E 597 – Boost air overheat - Warning stage

This symbol appears if the boost air temperature exceeds 75°C during at least 3 seconds. The buzzer sounds simultaneously and the engine power is reduced.

If the temperature increases some more, the symbol E524 will also be displayed.

Tab. 3-1 Warning symbols for operating faults with corresponding error codes

B) Warning symbols for special operating states und system errors

In addition to the above mentioned operating faults, also the symbols of the list below may appear in the SY field of the screen to warn the operator of the occurrence of

particular operating sequences or of some particular system errors.



Quick change adapter (optional equipment)

This symbol appears during the unlocking procedure or when the locking pins of the quick change adapter are not completely out. No error code is corresponding to this symbol.



Quick change adapter (optional equipment)

This symbol appears when no tool is detected. No error code is corresponding to this symbol.



One or several solenoid valves are off in the servo control circuit.

This symbol informs that the current flowing to (at least) one solenoid valve in the electro hydraulic servo control circuit is interrupted, due to the faulty connection(s) in the system.



Servo control pressure too low

This symbol shows that the servo pressure has dropped below a given limit value. The trouble free control of the excavator movements is in the case no longer guaranteed.

The symbol also lights up, even if no disturbance exists, if the safety lever S7 is tilted upward, or after several actuations of a servo control device with turned off engine and ignition key in contact position.



Internal default in Master module (U47)

This symbol appears if an internal default is recognized in the module U47 (Master module of the electronic servo control system).



Internal default in one Slave module

This symbol appears if an internal default is recognized in one of the Slave modules (printing plates U48-1, U48-2 or U46) of the electronic servo control system.



CAN communication default

This symbol appears if a communication default is recognized in the CAN network of the electronic servo control system.

Tab. 3-2 Warning symbols for special operating sequences and system errors

Information symbols in the INF field



Preheating

This symbol appears as long as the preheating of the air in the intake manifold is activated (preglow process).



End of preheating

Preheating will stop automatically after about 20 seconds and the symbol **End of preheating** is displayed for approx. 2 seconds on the main screen.



Manual Diesel speed adjustment

This symbol informs the excavator's operator that the Diesel engine is actually operated in safety mode, either after starting the engine using the switch S71, or due to an automatic commutation consecutive to a communication default in the control system.



Service due

This symbol indicates that the moment for carrying out the next recurring service work is due. When the electrical system of the machine is turned on, this symbol and the hours for the next service falling due are displayed for approx. 10 seconds in place of the current operating hours.

- Get the the service work carried out within the prescribed delay, or report the falling due to your supervisor.

The symbol will go out after the execution of the programmed service work has been confirmed, see the menu "set service" thereafter.



Acknowledge error

This symbol appears if an operating fault of the machine (**E5xx type error code**) has occurred and the buzzer sounds simultaneously.

It informs the operator that he can, after having recognised the occurred fault, press the **back** key to stop the buzzer.



"Increased care required" - servo-control circuit in safety mode

This symbol alerts the operator that the servo-pressure circuits have been turned into safety mode (switch **S73** is tilted in safety position).



Swing brake not operative

This symbol alerts the operator that the swing brake control circuit is out of function due to the turning into safety mode of the servo-control via switch S73.



Servo control operation changed

This symbol appears if switch **S73** is tilted into the safety mode position.



Overload warning device (optional equipment)

For a machine fitted with the optional equipment "overload warning device", and if this equipment has been turned on via the switch S18, this symbol alerts the operator that the load limit of the machine has been reached

At the same time the buzzer sounds to alert the operator to this fact.



No overload warning device recognized

This symbol appears if switching on the overload warning device via switch **S18** though no overload warning device has been installed and/or correctly initialised on the machine.



Warm up procedure

This symbol appears during a warm up procedure of the Diesel engine or of the hydraulic oil.



Working pumps swivelled back to minimum delivery



Diesel engine stop



Current air bleeding procedure

This symbol is displayed as long as the air bleeding of the servo control chambers of the control spool is in progress, due to actuation of the push button S248 in the right rear instruments console.



Air bleeding procedure achieved



Pontoon operation

This symbol is displayed, when the excavator is switched to mode "pontoon operation".



Hydraulic system failure

This symbol appears simultaneously with the detection of the system errors signaled by the error codes E451, E452 in the field EC of the screen.

It alerts the operator that an automatic process may be out of order, and that, by the fact, the maximum efficiency of the hydraulic system may be no longer ensured.

The coming up of the symbol at the same time as the error code E451 signals that the control circuit for the pressureless lowering of the stick for bottom dump shovel is possibly out of function (pressure transmitter B167 defective).

The coming up of the symbol at the same time as the error code E453 signals an error in the circuit of the pressure transmitter B149, which is not actually used.

3.1.6 Information provided in the menus (Software Version V6.0)

Menu selection from main screen:

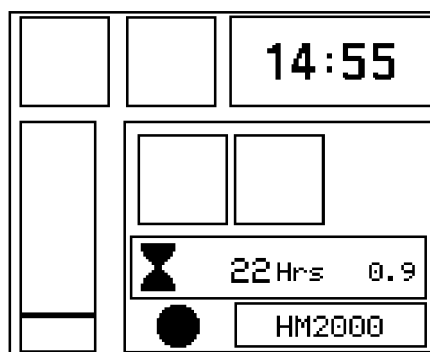


Fig. 3-9 Main screen

- To change to the list of menus, the main screen must be visible.



- ▶ With the main screen visible, press the **Menu** key of the display.
 - ↳ The list of accessible menus is displayed.

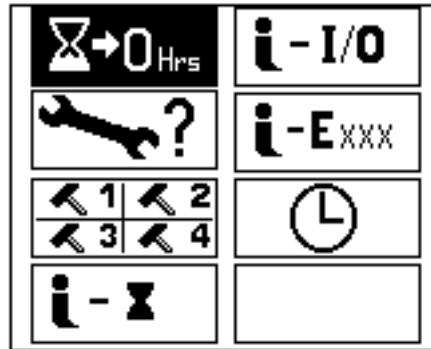


Fig. 3-10 List of menus

To select a menu:



- ▶ Press arrow key **Down** or **Up**.
 - ↳ The following or previous menu will be displayed on the screen with a black background.
- ▶ If the desired menu is displayed with a black background, as an example here the **Reset daily operating hours** menu:



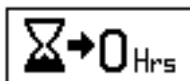
- ▶ Press the **Menu** key again.
 - ↳ The sub-menu for the function selected is displayed.



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

Symbol of menu	Denomination of menu	Role of the menu
	Reset Data	Reset of daily operating hours counter
	Set Service	Confirmation of the execution of a recurring service work
	Set Option	Selection of the flow and pressure limitations relating to the mounted working tool (e.g. hammer)
	Info - Hours	Display of the operating hours of the machine components and general machine data.
	Info - In/Outputs	Information about the status of the hydraulic pumps and of the electrical inputs and outputs
	Info - Errors	Memory of the stored operating faults and electrical system errors
	Set Clock	Setting of the clock

Tab. 3-3 Overview of the possible menus



Menü "Reset Data" - reset of daily operating hours counter

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

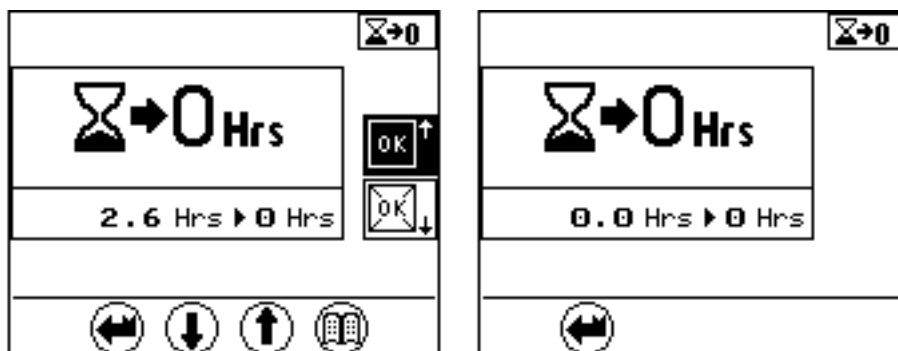


Fig. 3-11 Resetting the daily operating hours counter

- ▶ Press the **Up** arrow key.
 - ↪ The OK which is not crossed out will be displayed with a black background.
- ▶ Press the **Menu** key.
 - ↪ 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** key.
 - ↪ The sub-menu will be aborted.



Menu "Set Service" - confirmation of the execution of a service work

This menu gives information about the falling due of the next service work and allows to confirm the execution of the service work after it just has been carried out.

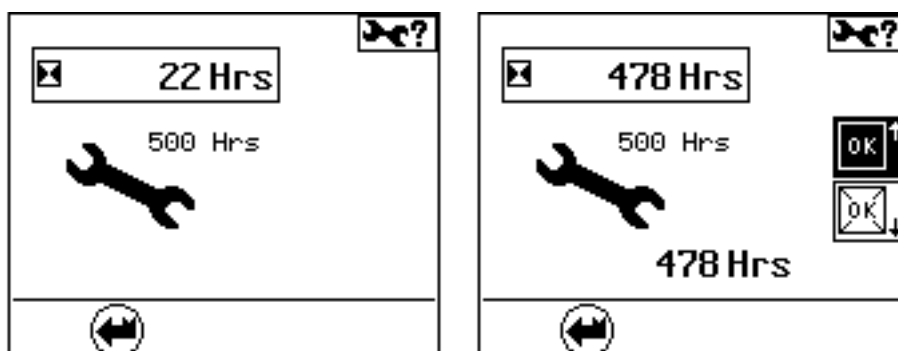


Fig. 3-12 Menu "Set Service"

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

An upcoming service work 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.

- If the service work has been carried out.
- ▶ Press the **Up** arrow key.

- ↪ The choice "OK not crossed out" will be displayed with a black background.
- ▶ Press the **Menu** key.
 - ↪ The current operating hour will be stored as the time for the last carrying out of a recurring service work.
 - ↪ The operating hours indicating the next service due will be increased by the duration of a service interval (as an example they augment from 500 to 1000 working hours).
- If the service work has not been carried out.
- ▶ Press the **Back** key.
 - ↪ The sub-menu will be aborted.



Menu "Set option" - selection of the flow and pressure limitations

This menu allows to allocate flow and pressure limitation options to external input I1 (choice of the maximum oil flows and system pressure depending on the mounted working tool).

In this menu, the operator can choose between 10 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).



Caution!

Selecting a wrong option for a tool can damage it (for example: hydraulic hammer) or cause its restricted operation (for example: milling tool).

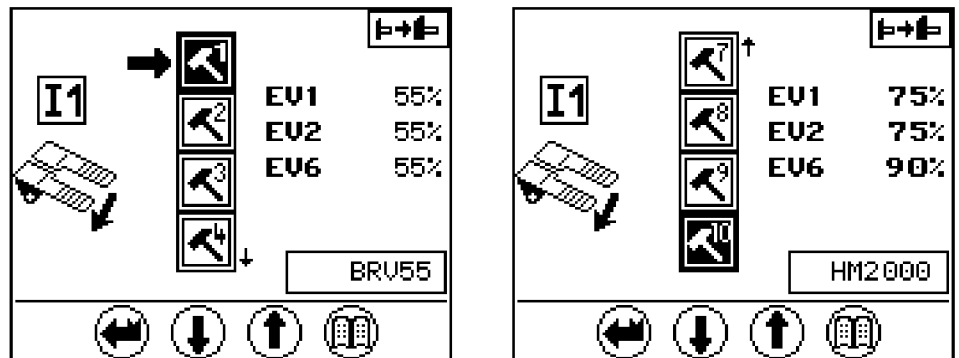


Fig. 3-13 Menu "Set option"

EV1 = Regulation solenoid valve for oil flow limitation on pump P1
EV2 = Regulation sol. valve for pressure limitation in hydraulic system

EV2 = Regulation solenoid valve for oil flow limitation on pump P2

The black field represents the active option.

In the left figure, the option 1 is active for the input I1. This means, if the external hardware input I1 is activated, then the nominal pump values allocated in option 1 for the excavator control are given as maximum nominal values.

**Note!**

The values EV1 and EV2 determine the flow limitation of the main pumps when the special attachment is actuated.

The value EV6 determines the maximum allowed pressure level for the actuation of the special attachment.

- If another option must be allocated to input I1 (as an example due to replacement of the working tool),
 - ▶ Press the **Up** or **Down** key to **select another attachment** in the vertical symbol range.
 - ▶ Press the **Menu** key.
 - ↪ The selection is confirmed. The new active option is displayed on a black background (in the example above, right figure the Option 10).
 - ↪ At the same time the denomination that has been assigned to the option is displayed in the bottom right corner of the screen (in this example "HM2000").

To exit the menu:

- ▶ Press the **Back** key.
 - ↪ The sub-menu will be aborted.
 - ↪ In the main screen the denomination of the chosen option (HM200) is also displayed.
 - ↪ The tool will be supplied with the reduced pressure and the reduced flow predefined for the option 10.

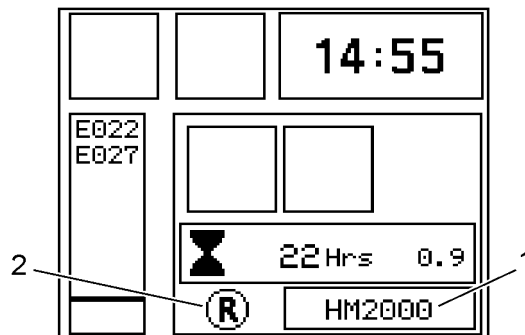


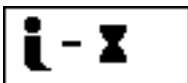
Fig. 3-14 Main screen, the chosen option is displayed

- 1 Denomination of the active option 2 The symbol "R" indicates that an external flow limitation is active

**Note!**

The standard denominations of the options are "Option 1", "Option 2"...

The Liebherr after sales department can assign a more concrete name to each option, for example "HM2000" or "Grapple", ...



Menu "Info-hours" - operating hours of components, duration of processes, ..

In this menu the screens 1/... to 3/... provide an overview of the operating hours of specific components, of duration of processes and operating types.

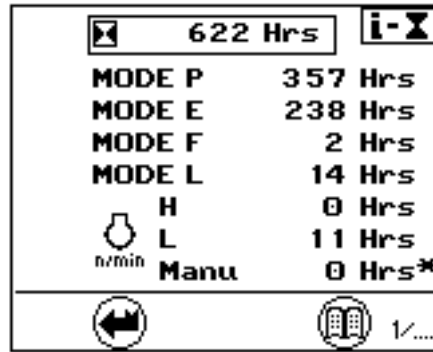


Fig. 3-15 Menu "Info Hours" operating hours of Diesel engine

The screen 1/... indicates the operating 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
- Diesel engine at low idle
- Diesel engine with RPM adjustment in manual control

- ▶ Press the **Menu** key.
 - ↳ the screen 2/... is displayed.

The screen 2/... provides the operating hours for:

- Working attachment movements using the joystick
- Travelling motion with normal and increased travel speed.

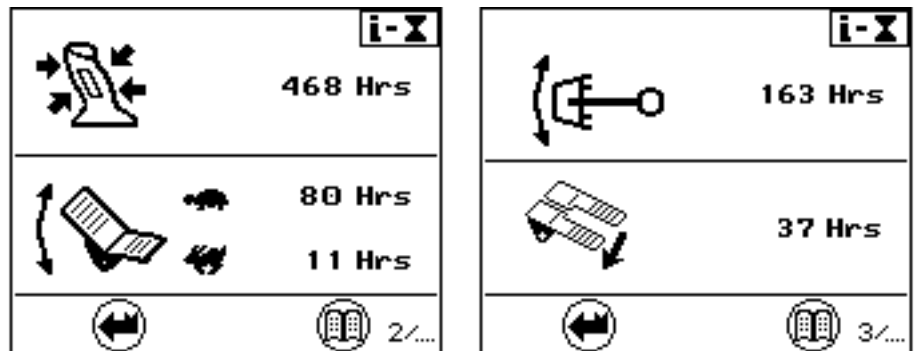


Fig. 3-16 Menu "Info Hours" duration of the various movements

- ▶ Press the **Menu** key again.
 - ↳ the screen 3 ... is displayed.

The screen 3 provides the operating hours for:

- the swing movements.
- the movements of the optional equipment (operated via the foot pedals)

- ▶ Press the **Menu** key again.
 - ↳ the screen 4/... is displayed.

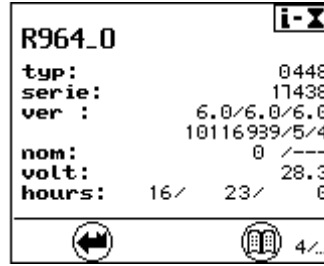


Fig. 3-17 Menu "Info Hours" general machine data

The menu General Data, 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, the pump regulator BST, and, on the second line, the identification nb and the SPF nb. (specification number) of the engine regulator unit and a number characterising the engine type and the injection system:
 - 1 : 6 cylinders PLD engine (Pump line nozzle injection system)
 - 2 : 4 cylinders PLD engine (Pump line nozzle injection system)
 - 3 : 6 cylinders common rail engine
 - 4 : 8 cylinders common rail engine

Example : 10116989 / 5 / 4 means:

- identification nb of the engine regulator = 10116989
- SPF nb = 05
- Diesel engine = 8 cylinders engine with common rail injection
- "nom" : the both indications beside "nom" are not used
- "volt" : indication for the momentary operating voltage.
- "hours" : this last line indicates respectively:
 - the operation with the input X2.8 activated (special equipment – not used actually),
 - the operation with the input X2.14 activated (special equipment – not used actually),
 - the operation with the Diesel engine at its standart power curve (at maximum power)
- ▶ Press the **Menu** key again.
 - ↳ the screen 5/... is displayed.



Fig. 3-18 Menu "Info Hours" Data of the Master modul of the machine

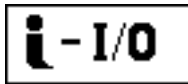
This screen displays respectively:

- the identification nb of the coding module
- the Software Version of the Master module
- the Checksum of the Master module

- ▶ Press the **Menu** key again.
 - ↳ The screen 1/... is displayed.

To exit the menu:

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



Menu "Info In/Outputs"- Status of hydraulic pumps and of electrical inputs and outputs

The screens 1 to 3 provide information on the regulation parameters for the hydraulic pumps.

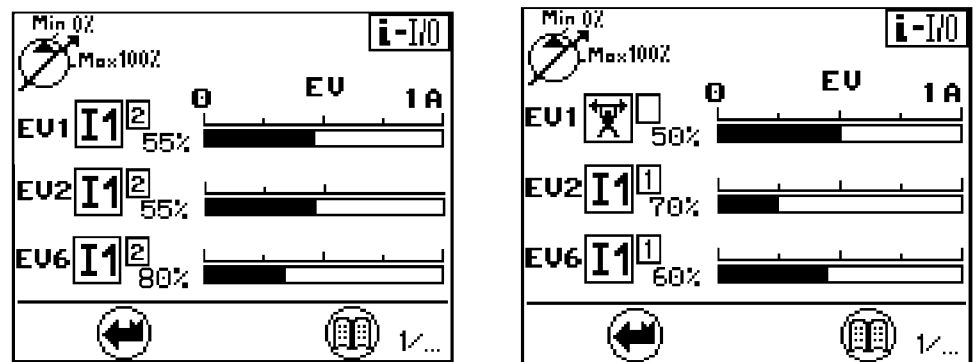



Fig. 3-19 Menu "Info In/Outputs" Active flow and pressure limitations

The screen 1/... displays:

- for each of the both working pumps the active flow limitation option and which percentage of the maximum flow is set (solenoid valves EV1 and EV2).
- which is the active pressure limitation for the hydraulic system and which percentage of the maximum pressure is set (solenoid valve EV6).
- graphic bars indicating the momentary electric current flowing to the different regulation solenoid valves..

On the left picture, an external limitation (Hardware input I1, option 2) is activated. The currents supplying the flow limitation solenoid valves EV1 and EV2 limit these flows to 55% of their maximal values. The current supplying the pressure limitation solenoid valve EV6 limits the pressure to 80% of its maximal value.

On the right picture, an internal limitation (Pressure increase ) and an external limitation (Hardware input I1, option 1) are activated at the same time.

Due to the internal limitation, the flow of the pump P1 is limited to 50% of its maximum value via the solenoid valve EV1.

Due to the external limitation, the flow of the pump P2 is limited to 70% of its maximum value via the solenoid valve EV2 and the pressure in the hydraulic system to 60% of its maximal value via the solenoid valve EV6.

When several limitations are activated at the same time, only the one with the small-

est percentage value is decisive for each regulating solenoid valve.



Note!

An external limitation becomes active for example when a pedal controlling an additional equipment is actuated.

The three internal limitations which are the most currently used are the followings:

- 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 actuating the shovel flap on machines with shovel attachment.

- ▶ Press the **Menu** key again.
 - ↳ The screen 2/... is displayed.

The screen 2 shows the instantaneous LR current (current flowing to the solenoid valve for power regulation).

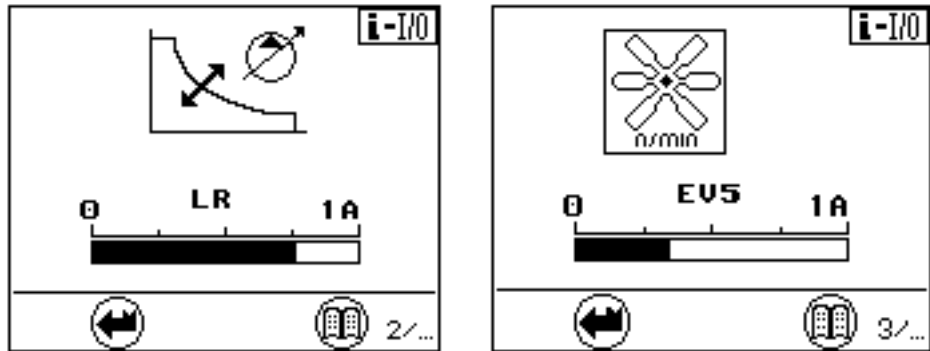


Fig. 3-20 Menu "Info In/outputs" Currents to the solenoid valves LR and EV5

- ▶ Press the **Menu** key again.
 - ↳ The screen 3/... is displayed.

This screen shows the instantaneous current flowing to the regulation solenoid valve EV5 which determines the RPMs of the hydrostatic driven cooler fan.

- ▶ Press the **Menu** key again.
 - ↳ The screens 4, 5, 6 and 7/... are successively displayed.

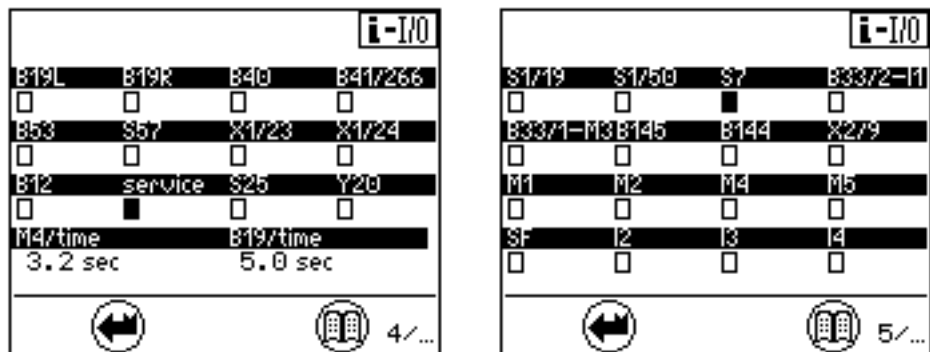


Fig. 3-21 Menu "Info In/outputs" Status of electrical inputs and outputs

The screens 4/... to 7/... provide an overview of the status of the different electrical inputs and outputs.

A "□" means "Input not active".

A "■" means "Input active".

An "NC" beneath the terminal designation means that the corresponding input has been deactivated in the software.

The durations indicated in the last line of the screen 4/7, under M4/Time respectively B19/Time correspond to the pause time for the windshield wiper in intermittent mode, respectively to the delay time for the engine low idle automatic system.

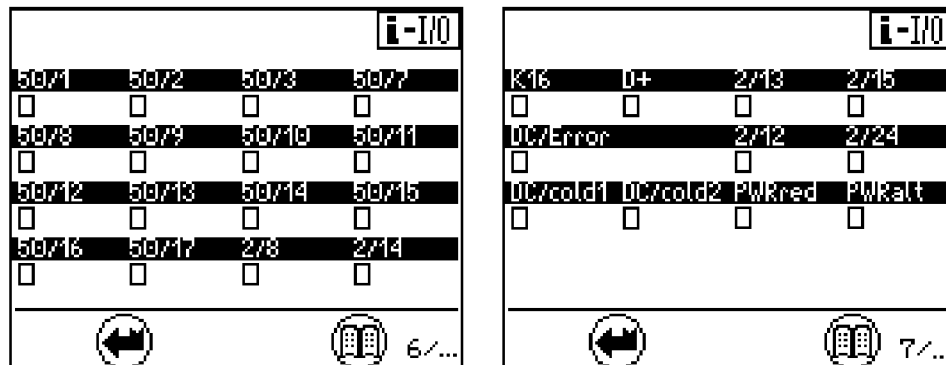


Fig. 3-22 Menu "Info In/outputs" Status of electrical inputs and outputs

The screen 7/... gives information concerning the PLD control system of the Diesel engine (Pump line nozzle injection system):

- Input K16 controls the starter operation.
 - Input D+ indicates if the generator delivers current.
 - 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.
 - Input DC/Error indicates if an error is detected in the function of the Diesel engine monitoring system.
 - PWRred refers to power reduction of the Diesel engine in case of an intake air, engine coolant or fuel overheating.
 - Input PWRalt control the Diesel engine power limitation in accordance with the atmospheric pressure.
 - Input DC/cold1 controls the function of the preglow of the Diesel engine.
 - Input DC/cold2 controls the function of the postglow of the Diesel engine.
 - Input X2/24 indicates if the engine control is in safety mode.
 - Input X2/12 indicates if an operating fault is detected in the engine monitoring circuit when the engine is in safety mode.
- Press the **Menu** key again.
- ↳ At each key actuation, the screens 8, 9, 10, ... up to 15 are successively displayed.

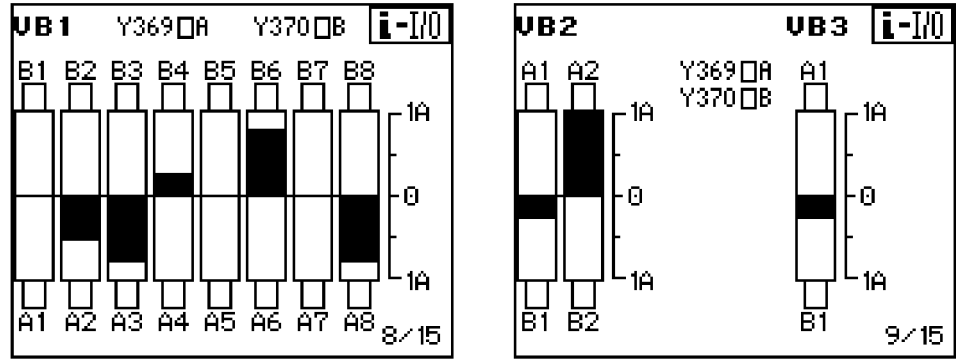


Fig. 3-23 Menu "Info In/outputs" Currents to the regulation valves on the spools

The screens 8 and 9 give an overview of the status of the outputs to the regulation and commutation solenoid valves on the main control valves (movements of the working attachment and travel gears).

The represented bar lengths in the spool valves A1, B1, A2, B2,...etc. are determining for the values of the regulating currents (0 up to 100%) flowing to the regulating solenoid valves Yr1-A1, Yr1-B1, Yr1-A2, Yr1-B2,a.s.o.

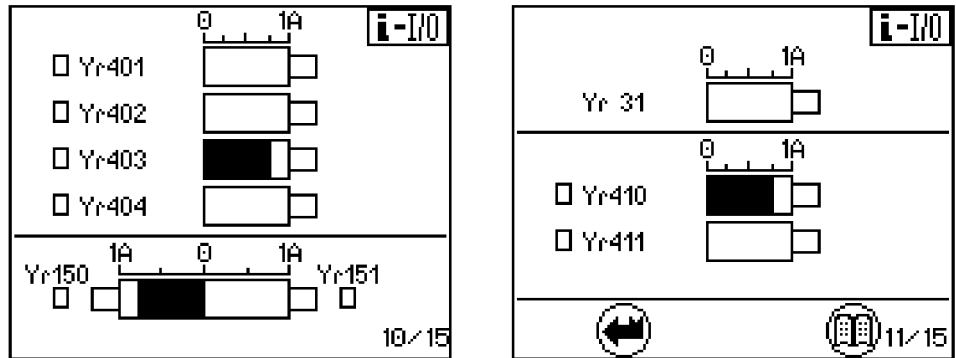


Fig. 3-24 Menu "Info In/outputs" Currents to the regulation solenoid valves for swing movements and pressureless lowering

The screens 10 and 11 show the values of the currents to the regulation solenoid valves for the uppercarriage swing movements und for the pressureless lowering of the working attachment.

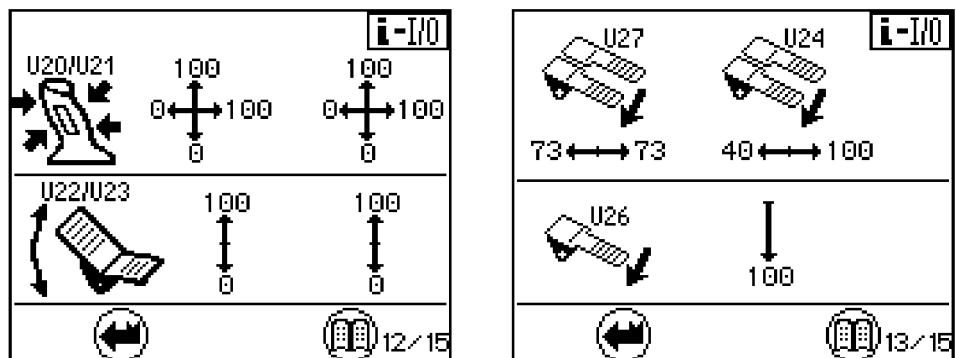


Fig. 3-25 Menu "Info In/outputs" Output signals of joysticks and pedals

The screens 12 and 13 show a representation of the electrical servo controls with indication of the momentary deflections (in percent of maximum deflection and for the different deflection directions).

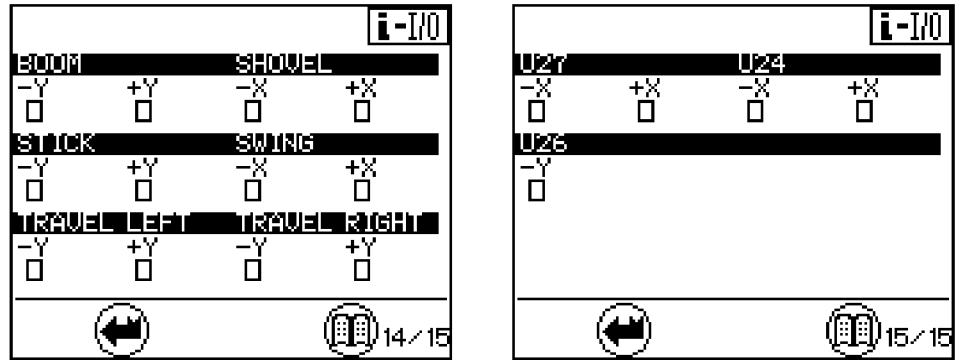


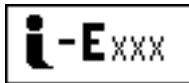
Fig. 3-26 Menu "Info In/outputs" Presentation of actuated servo control units

The screens 14 and 15 indicate on which electrical servo control units and for which deflection directions the momentary deflection is above 10% of the maximum deflection:

- A "□" means: deflection smaller than 10%
- A "■" means: deflection above or equal 10%

To exit the menu:

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



Menu "i-errors" - operating faults and electrical system errors

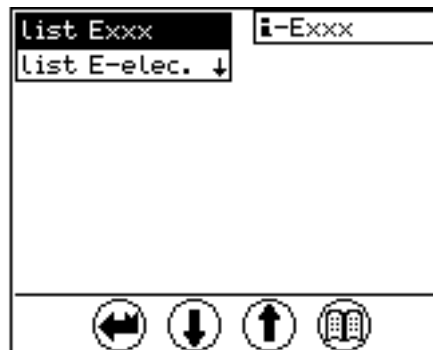


Fig. 3-27 Menu "i-errors" Display of the memorized errors

There are 3 possible choices in this menu:

- By selecting **list Exxx**, all the operating faults detected by the switches and sensors monitoring the machine parameters are listed.
- By selecting **list E-elec**, all the electrical system errors (cable errors, sensor errors, ...) detected during the operation of the machine are listed.
- With **list S-Exxx**, all the operating faults are listed, just as with the selection **list Exxx**, but this time only faults which appeared when the service connector was connected.

To select the desired error type:

- ▶ Press the **Down** or **Up** arrow key:
 - ↳ the previous, respec. the next error typ is preselected
- ▶ Press the **Menu** key.
 - ↳ The sub-menu on a black background will be displayed.

- ↵ If more than 6 error codes are listed, use the arrow keys **Down** or **Up** to scroll in the list.

"list Exxx": Operating faults

list Exxx		i-Exxx	
list E-elec. ↓			
	Error	Nr	
	E501	5	
	E502	4	
	E504	2	
	E505	1	
	E503	1	
	E511	1	

list Exxx		i-Exxx	
list E-elec. ↓			
Nr :	Hrs	Error	min/sec
1	543	E501	23 s*
2	629	E501	35 s*
3	892	E501	12 s*
4	1442	E501	105 s*
5	1893	E501	20 s*

Fig. 3-28 List of the operating faults (fig. left) and occurrences of a fault (fig. right)

- ▶ Select **list Exxx**.
- ▶ Press the **Menu** button:
 - ↵ the first page of the sub-menu appears.

All the operating faults are listed with their error code and number of occurrences.

- ▶ Select the desired error code using the **Down** or **Up** arrow key.
- ▶ Press the **Menu** key again:
 - ↵ the second page of the sub-menu appears.

A screen appears with the operating hours and the duration for the ten first and the ten last occurrences of the selected error.

- ▶ Press the **Back** key:
 - ↵ the first page of the sub-menu appears.
- ▶ Press the **Back** key again, to select another error type, or press the **Down** or **Up** arrow key, to preselect another error code.

The asterisk "*" shows that the error was also indicated by the buzzer and then acknowledged using the **Back** key. .

- s*: signals that the duration is given in seconds.
- m*: signals that the duration is given in minutes.



Notice!

Only operating faults with an error code **E 5xx** are displayed in the **list Exxx** menu.

- ▶ Press the **Back** key.
 - ↵ The first page of the sub-menu appears.
- ▶ Press the **Down** or **Up** key to select a new error code or press the **Back** key again to select another error type .

"list E-elec.": Errors of the electrical system

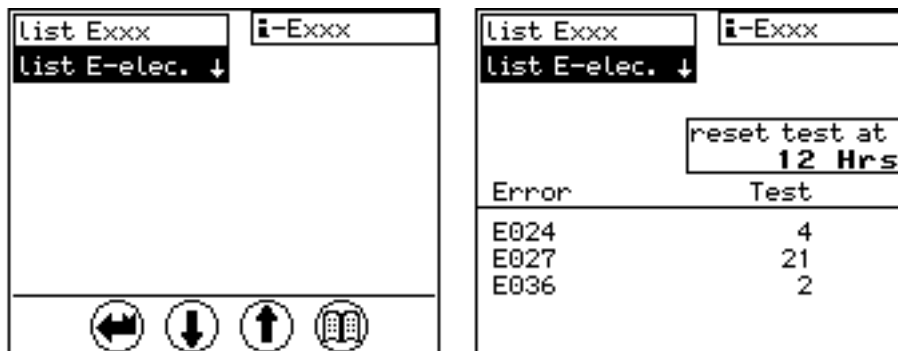


Fig. 3-29 List of the electrical errors

- ▶ Select **"list E-elec."**.
- ▶ Press the **Menu** key:
 ↳ the sub-menu is entered.

The screen displays the list of all electrical errors with their error code.

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 the last time deleted.

- ▶ Press the **Back** key to return to the first page of the sub-menu.
- ▶ Press the **Down** key and then the **Menu** key to confirm the new choice.

"list S-Exxx": Operating faults in service mode

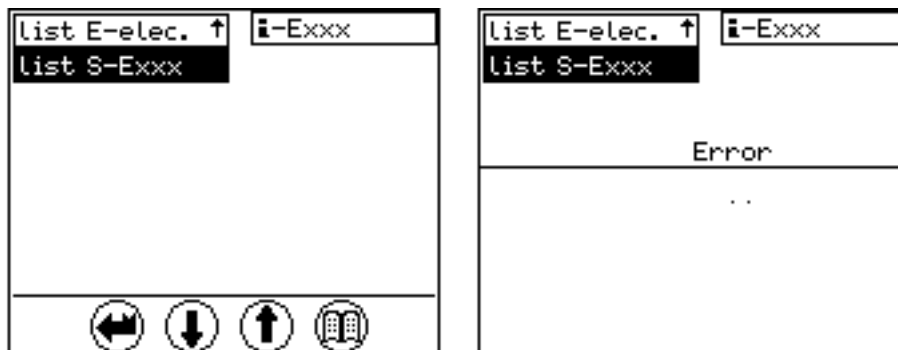


Fig. 3-30 List of operating faults appeared in service mode

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

- When a service connector is plugged in:

The submenu **list S-Exxx** lists all the operating faults, just like the submenu **list E-xxx**, but this time only faults appeared in service mode, i. e. when a service connector was connected.

The sub-menu allows to separate the faults occurring during maintenance works, in particular during the troubleshootings.

For each error, an overview is shown and can be paged in just like for the "list E-xxx" selection.

When exiting the service mode, the memory "list S-Exxx" is reset, the service mode operating faults are not stored.

LFR/en/Edition: 07 / 2011

Menu "set clock" - Time setting

Via this menu the clock displayed in the upper right corner of the main screen can be set.

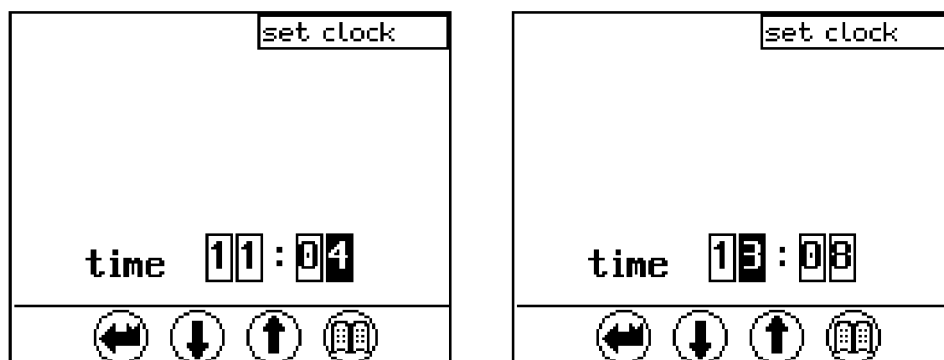


Fig. 3-31 Setting of the clock

After function start, the presently set time will appear in the lower section of the screen with the digit completely right inversely displayed (unity digit of the minutes).

- ▶ Press the **UP** or **DOWN** key to adjust the selected digit.
- ▶ Press the **MENU** key:
 - ↪ the immediately more left digit is now inversely displayed.
- ▶ Repeat the procedure until all the digits have been set.
- ▶ Press the **Enter** key:



Fig. 3-32 Confirmation of the storage of the new time

- ↪ The confirmation message "update xx : xx" will appear momentarily on the screen and the new time is stored.
- ↪ The menu "set clock" is closed and the main menu is displayed on the screen.

3.1.7 Controls on side control desks.

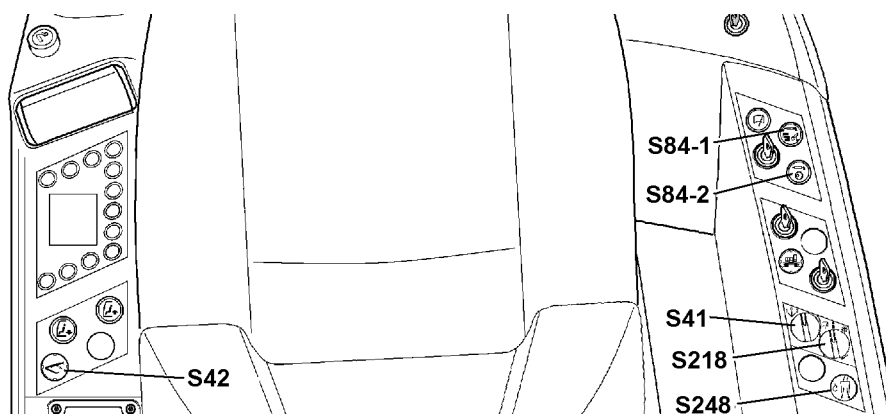
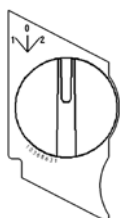


Fig. 3-33 Switches and control lights on the side control desks

Note: In this section, only the serially mounted controls are mentioned. The functions of the control lights and switches concerning optional mounted special equipments are described in next section.



S41 – Selector switch / Emergency lowering movements

This 3 positions selector switch is installed only on machines equipped with some well defined types of working attachments (industrial attachment, demolition attachment, ...).

On these machines, the switch S41 allows the preselection of the attachment part which will be emergency lowered when actuating the touch S42.

- With the selector switch S41 in position "0" (central), the actuation of the touch S42 will cause the emergency lowering of the boom of the machine.
- With the selector switch S41 in position "1" (to the left), the actuation of the touch S42 will cause the emergency lowering of the industrial stick or of the demolition stick of the machine.
- With the selector switch S41 in position "2" (to the right), the actuation of the touch S42 will cause the emergency lowering of the intermediate on machines with a demolition attachment.



S42 – Touch / Emergency lowering of working attachment

This push button allows to carry out an emergency lowering of the working attachment in case of a malfunction in the servo control circuit.

See the corresponding paragraph under the heading "Emergency operation", further in this chapter.

Note: On machines also fitted with a selector switch S41, the position preselected on S41 determines which is the attachment part to be emergency lowered at actuation of the touch S42.



S84-1 – Touch / Central lubrication of attachment and swing ring roller races

This push button allows to monitor the automatic greasing system as well to release an additional lubrication procedure in the lubrication circuit for working attachment and swing ring roller races.

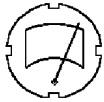
See the section "Greasing the machine" in chapter Maintenance.



S84-2 – Touch / Central lubrication of swing ring teeth

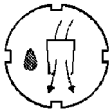
This push button allows to monitor the automatic greasing system as well to release an additional lubrication procedure in the lubrication circuit for swing ring teeth.

See the section "Greasing the machine" in chapter Maintenance.



S218 – Touch / Cab roof window wiper

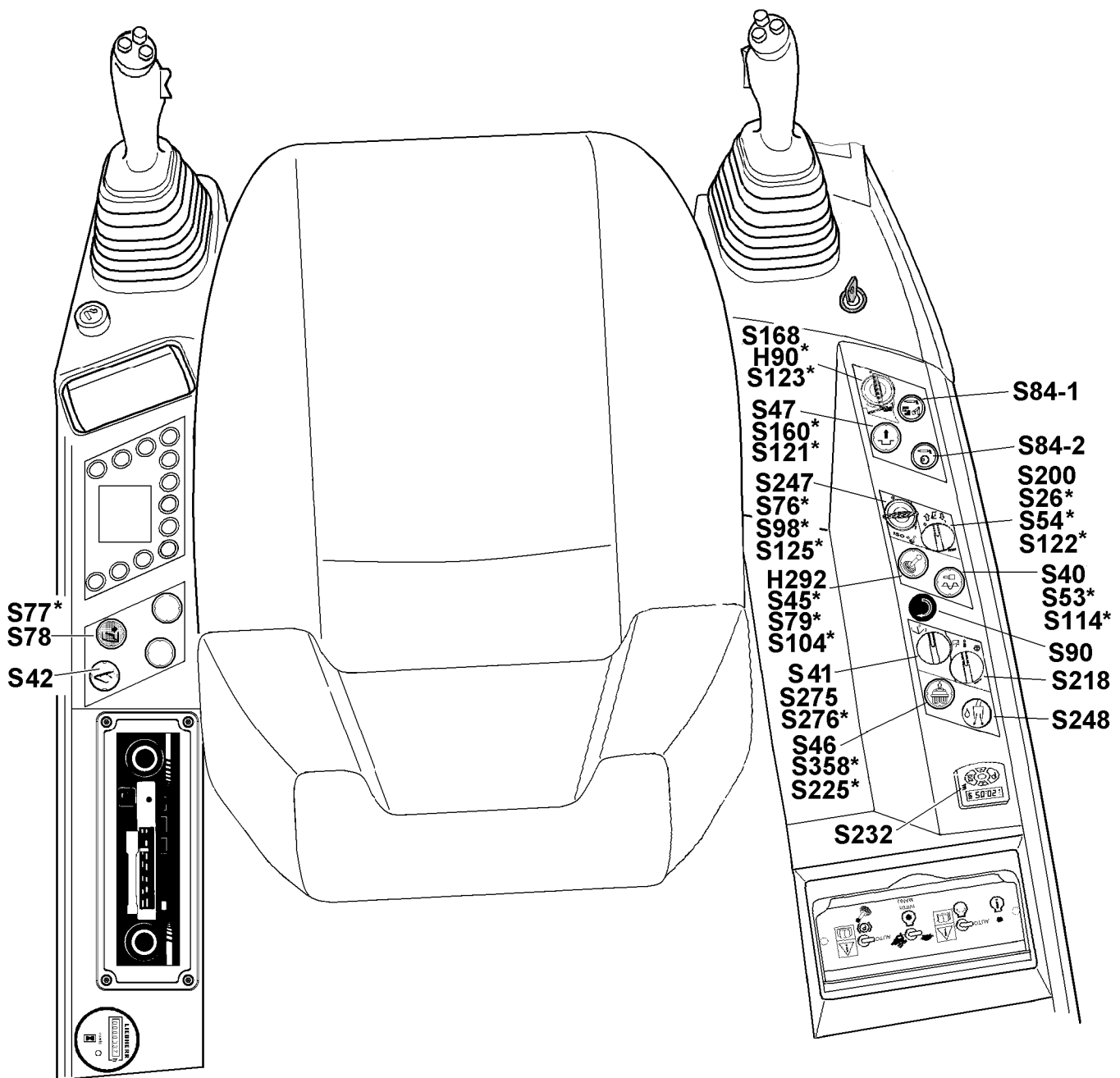
This touch allows to control the window wiper and the window washer which are mounted in the cab roof.



S248 – Touch / Air bleeding of main control valves

This push button allows to control the bleeding procedure of the air possibly accumulating in the servo control chambers of the main control valves. This bleeding procedure must be performed at regular intervals and also in case of too slow or erratic reactions of the hydraulic cylinders and motors, see the corresponding section in the chapter Maintenance - hydraulic circuit.

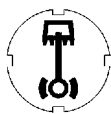
3.1.8 Controls and instrumentation for optional equipments



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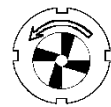
Fig. 3-34 Controls for optional equipments

The location of the controls may be different, depending on the type of the other installed optional equipments.



H31 – Control light / Ladder problem

This control light lights up to indicate that the ladder is not correctly pushed up. The uppercarriage swing movements are blocked.



H90 – Control light / Rotation in opposite direction of reversible fan

On machines fitted with the special equipment "cooler fan reversible", this control light lights up to indicate that the fan has been changed over to rotation in opposite direction via the push button S160, see also the section "Reversible cooler fan (Optional equipment)" in the chapter "maintenance".



S26 – Touch / Fuel preheater

This button turns on the electrical fuel pre heating system, see the section "Starting aids" in this chapter.



S40 – Touch / Frequency commutation for hydraulic hammer

When actuating this touch a pressure signal is send to the reversing hydraulic hammer, causing the hammer to change over to the second cycle frequency.



S41 – Rotary switch / Emergency lowering of attachment parts

For the function of this rotary switch, refer to the heading "Controls on side desks" previously in this manual.



S42 – Touch / Emergency lowering of working attachment

Note :This push button is mounted serially, not as an option, see previous section.



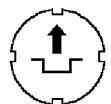
S45 – Touch / Priority for special equipment

If an hydraulic actuator (cylinder, hydraulic motor,) of a special equipment requires a constant oil flow, the speed of the remaining attachment movements can be reduced by depressing the push button S45 (control light inside the button must light). The necessary oil flow for the hydraulic actuator is maintained, even in case of simultaneous actuation of other attachment movements.



S46 – Touch / Lifting magnet operation

This button turns on and off the control circuit for an optionally mounted lifting magnet, see "Lifting magnet control system (optional equipment)" in this chapter.



S47 – Push button / Quick change adapter

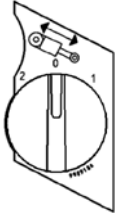
The push button S47 turns on the control circuit for the quick change adapter for the working tool. See also the section "Hydraulic quick change adapter for working tools (optional equipment)" in this chapter.



S53 – Touch / Special control circuit supply

Actuating this touch makes alive an additional control circuit for a special equipment. The green indicator light in the touch lights up to show that the additional servo control circuit is under pressure.

LFR/en/Edition: 07 / 2011



S54 – Rotary switch / Unlocking of cylinder end position

On some special working attachments, or on attachment showing particular cinematic capacities (as example on industrial attachment), certain movement(s) may be stopped automatically by electrical end switches. The main purpose of this movement limitation is to prevent possible damages due to components frequently reaching their end stops.

See "Cutoff by end switches of attachment movements (option)" in this chapter.



S76 – Touch / Travel parking brake

This touch controls the travel parking brake on the machines fitted with a special undercarriage, or on machines mounted on a loading bridge, a wagon, ...

When the red indicator light in the touch lights up, the travel brake is applied.

On machines with a standard undercarriage, the travel brakes are controlled directly via the travel pedals and the touch S76 does not exist.



S77 – Touch / Pressurized driver's cab

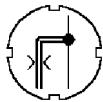
When the touch is depressed, the green indicator light in the touch lights up and an air fan is started to maintain a slight pressurization inside the driver's cab.

The entering of dust or not filtered air into the cab is then almost prevented.



S78 - Push button / Height adjustable cab - emergency down

See the section "Height and inclination adjustable cab (optional equipment)" in this chapter.



S79 – Touch / Flow divider for special attachment

Should a certain user (cylinder, hydraulic motor, ...) has to be fed with a constant oil flow during the actuation of a special attachment, so the necessary oil flow can be reserved to give priority to this user while depressing the touch S79. The indicator light in the touch is then lighting up.

The velocity of the other simultaneously actuated working movements is correspondingly reduced.



S84-1 – Touch / Central lubrication of attachment and swing ring roller races

Note :This push button is mounted serially, not as an option, see previous section.



S84-2 – Touch / Central lubrication of swing ring teeth

Note :This push button is mounted serially, not as an option, see previous section.



S90 –Potentiometer / Intermittent mode of the cab roof window wiper

The pause time of the intermittent mode of the cab roof window wiper can be adjusted by turning this button. (The window wiper is switched on and off using the touch S218).



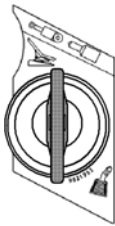
S98 – Touch / Low pressure protection for boom cylinders

If the touch S98 is actuated, the pressure protection value for lowering the attachment (circuit for retraction of the boom cylinders) is reduced, so to limit the possible downward thrust exerted by the working attachment onto the materials to be dug out. This safety device must be turned on, as an example, when unloading a boat or a barge, so to avoid damage to its bottom.



S104 – Touch / Hydraulic width adjustment of undercarriage

On excavators fitted with an undercarriage with adjustable track gauge, this button activate the circuit which controls the adjustment of the undercarriage width.



S114 – Key switch / Control of a special attachments with the joysticks

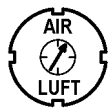
Thanks to this switch, the operator can control the movement of the additional user of an add on kit AHS either using the double pedal destined for this purpose (key switch in position "pedal")., or via the right joystick (key switch in position "joystick"). See also "Commutation of the control for the user of add on kit AHS" in this chapter.



S121 – Touch / Float position of working attachment on pontoon excavator

Via the touch S121 the function "float position of working attachment" can be turned on and off if the pontoon operation of the machine has been previously preselected via the rotary switch S123.

When the float position is turned on, the indicator light in the touch S121 is on and the working attachment can move up and down freely to compensate the differences in water level for example during tides or between locks, when the digging bucket is left on an embankment or a wharf.



S122 – Touch / Operation of the air compressor

Via the key S122, the compressed air compressor installed as an option is turned on and switched off



S123 – Rotary switch / Excavator operation - Pontoon operation

This selection switch is installed on excavators mounted on undercarriage and which are used on a ship or a barge as pontoon excavator.

The selection switch S123 must be turned in 0-position when the machine is used in normal operation, this means when it is no longer operated on a barge.

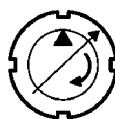
At the opposite, the position 1 must be selected when the excavator with undercarriage is working as a pontoon excavator.



S125 – Touch / Deactivation of the travel motions

When depressing this touch, the indicator light in the touch is turned on and the travel movements are deactivated. This means that the travel drive will no longer be actuated when the travel pedals are depressed.

This touch must be turned on each time when it is essential that any unintentional movement of the track chains is avoided, as an example when operating an excavator with undercarriage on a pontoon.



S157 – Touch / Flow reduction for special tools

When operating a specific user (smaller grapple or bucket, ..), having a maximum admissible oil flow sweepingly below the delivery of the working pumps, the touch S157 must be actuated so to adapt the oil flow of one or several pumps to the specific user.



S160 – Push button / Control of reversible fan in opposite direction

On machines fitted with the special equipment "cooler fan reversible", the direction of revolution of the cooler fan can be inverted while actuating the push button S160. In some particular working conditions, this inversion of the direction of the fan rotation allows an easy cleaning of the radiator core and of suction area of the fan.

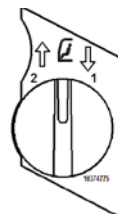
See also the section "Reversible cooler fan (Optional equipment)" in the chapter "maintenance".



S168 – Key switch / Oil flow limitation when operating a super long working attachment

When using a long reach attachment (super long working attachment with a smaller digging tool), this device allows to limit the working pumps oil flows to a value admissible for all the hydraulic cylinders of the working attachment.

Turn the key switch S168 to the right, in position „1“ to limit the velocity of all the movements of the working attachment.



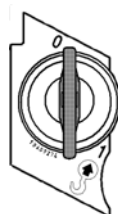
S200 – Rotary switch / Height adjustable cab - up or down

With an optionally installed height adjustable cab, this switch allows to lift up or to lower down the cab into the desired position, see the section "Height adjustable cab (option)" further in this chapter.



S218 – Touch / Cab roof window wiper

Note :This push button is mounted serially, not as an option, see previous section.



S225 – Key switch / Activation of a charge limitation

This function is used for the loading working of a machine. The charge limitation is activated for determinate positions, for example to stop a dangerous movement of the working attachment.

- S225 is in position "0", the charge limitation is not required when the machine is working.
- S225 is in position "1", the charge limitation is required to supervise the machine's stability during the work.

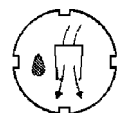
Wenn the key switch is in position "1":

- the charge limitation is on,
- the speed of the attachment is automatically reduced,
- the function "pressureless lowering" is off,
- it is not possible to lower the working attachment in case of emergency with the touch S42.



S232 – Control unit / Standstill cab heater

This unit controls an eventually installed standstill heater for the cab or for other circuits on the uppercarriage. Refer to the special issued operation and maintenance manual of the maker of the additional heater.



S248 – Touch / Air bleeding of main control valves

Note :This push button is mounted serially, not as an option, see previous section.



S275 – Touch / Additional floodlight on rear of cab roof

This touch switch on and off the additional floodlight.



S276 – Touch / Additional floodlight on counterweight

This touch switch on and off the additional floodlight.



S357 – Touch / Lifting the attachment while the grapple is being closed

With this function, the working attachment is lifted slightly while the grapple is being closed. This reduces the risk of damage to the surface on which the grapple is used. Example: Protection of loading areas, ship bottoms and similar surfaces.

Note! This function is an auxiliary tool designed to assist the machine operator. Even if the function is activated, the surface can still be damaged due to lack of care.



S358 – Push button / Washer for cab roof window

The button turns on the electric cab roof window washer system. Washer fluid will be sprayed to the window and the cab roof window wiper will be actuated as long as the push button S358 is depressed.

3.1.9 Display for LIEBHERR particle filter (option)

The particle filter replacing the normal silencer in the exhaust line reduces the hydrocarbon, carbon monoxide and soot particles emissions.

The particle filter regenerates itself if the exhaust temperature is over 250°C, the use of Diesel additive to improve the regeneration is not necessary.

The control unit **A175** in the operator’s cab allows to monitor the particle filter system. The indications of exhaust back-pressure, Diesel engine RPM. and exhaust gas temperature show the charge conditions of the particle filter. Warning signals are optic and acoustic. The operator can thereby react to possible disturbance cases in the filter system and avoid any imminent damage to the filter and to the Diesel engine.

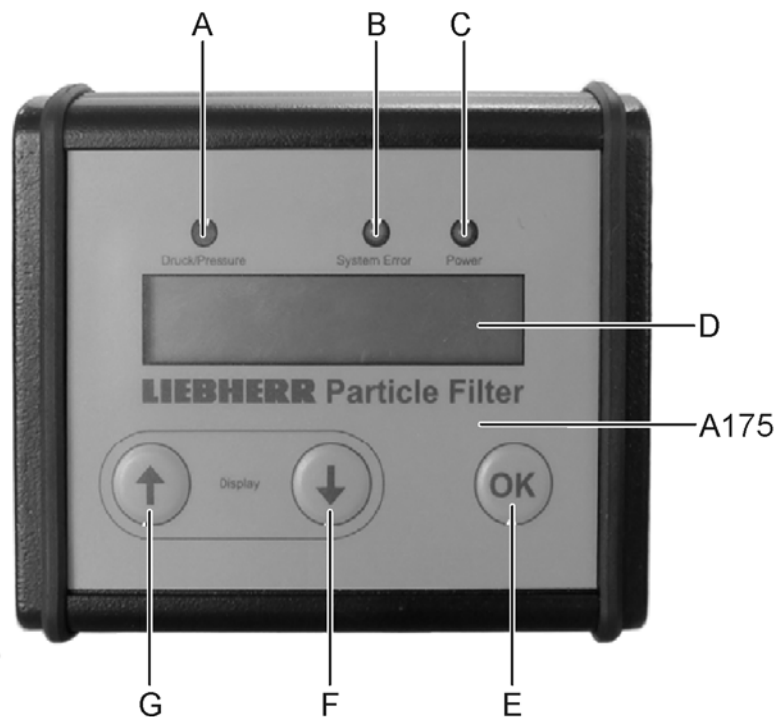


Fig. 3-35 Control unit A175

- | | | | |
|---|--------------------|---|---------------------------|
| A | Red LED (pressure) | B | Orange LED (system error) |
| C | Green LED (power) | D | LCD Display |
| E | Acknowledge key | F | Menu key |

LFR/en/Edition: 07 / 2011

G Without function

A175 Control unit for particles filter

Use / monitoring of the particle filter system

After turning the ignition key to contact position, the LCD display shows "Data Logger ready for use" (or "Datenlogger betriebsbereit").

After starting the Diesel engine, the last consulted menu appears.

The key **F** is used to change between the LCD display menus.

► Hold key **F** depressed for approx. 2 seconds to change to the next menu.

Following menus could be displayed:

- "Exhaust back pressure (mbar)" (or "Abgasgegendruck (mbar)") .
Shows the exhaust gas back pressure - only.
- "Exhaust back pressure (mbar) / Exhaust temperature 1 (°C)"
(or "Abgasgegendruck (mbar) / Abgastemperatur 1 (°C)")
Shows in addition the exhaust gas temperature before the filter (engine side)
- "Exhaust back pressure (mbar) / Exhaust temperature 2 (°C)"
(or "Abgasgegendruck (mbar) / Abgastemperatur 2 (°C)")
Shows in addition the exhaust gas temperature after the filter (exhaust side)
- "Exhaust back pressure (mbar) / Speed (rpm)"
(or "Abgasgegendruck (mbar) / Drehzahl (U/min)")
Shows in addition the Diesel engine RPM.



Note:

The exhaust temperature must be higher than 250°C for approx. 50% of the overall operating time of the Diesel engine, so to allow the particle filter to work optimal and regenerate itself.

For meaning of the error messages on the display see chapter 4 "Faults and remedies".

3.2 Access and equipment of the cab

3.2.1 Entering or leaving the cab

Climbing up



Caution!

Entering or leaving the cab incorrectly could lead to injury.

- ▶ Proceed with the same attention on exit or entry of the cab, as while climbing the machine.
- ▶ 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.
- ▶ 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.
- ▶ Do not hold onto the controls to steady yourself.
- ▶ Never jump from the machine.

Cab:

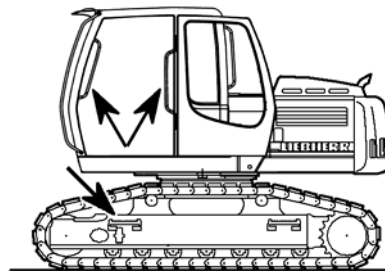


Fig. 3-36 Climb up using the handholds

Getting in

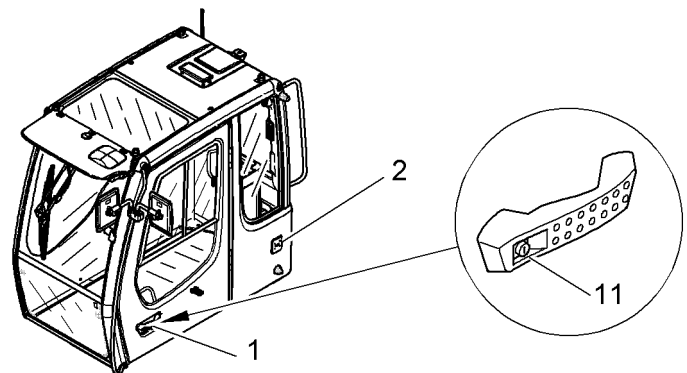


Fig. 3-37 Door - exterior

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.

Getting out



Caution!

Entering or leaving the cab incorrectly could lead to injury.

- ▶ Proceed with the same attention on exit or entry of the cab, as while climbing the machine.
- ▶ 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.
- ▶ 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.
- ▶ Do not hold onto the controls to steady yourself.
- ▶ Never jump from the machine.

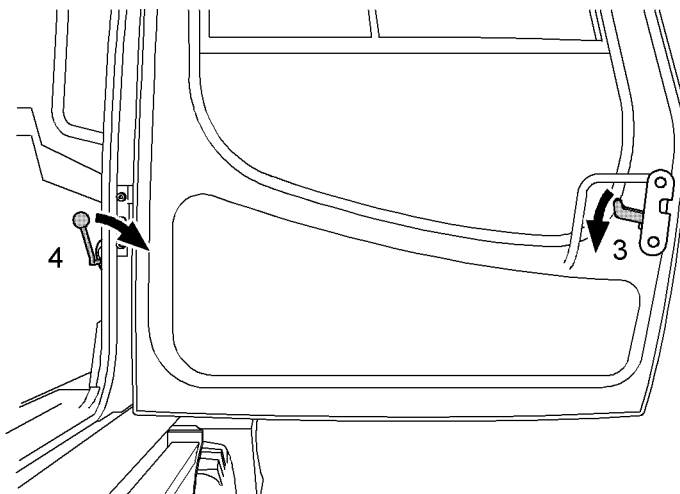


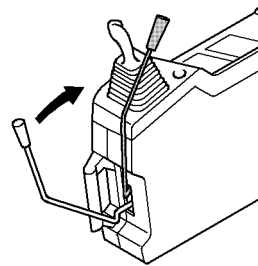
Fig. 3-38 Door - interior

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 The safety lever**Fig. 3-39** Safety lever

The safety lever is mounted to the left control console and is designed so to obstruct the way to the cab when tilted down in lower position.

**Caution !**

The operator must move this safety lever up before leaving the operator's seat. The operator may only push the lever down when he is again seated in the operator's seat, ready to work.

- ▶ Before you leave the operator's cab, pull the safety lever in upper position so to interrupt the servo control circuit:
 - ↪ no working movements are possible if the joysticks or pedals are accidentally actuated while entering or leaving the cab,
 - ↪ the swing brake applies automatically (the LED in the touch **S17** is lighting),
 - ↪ the swing brake can no longer be released using the touch **S17**.
- ▶ After you are seated again and before you begin operating the machine, push the lever down in lower position:
 - ↪ the swing brake recovers the previous state (applied or released) before the lever had been pulled up,
 - ↪ the pilot control devices (joysticks and pedals) become active again.

3.2.3 Operator seat



Danger!

The adjustment of the operator seat could result in an inadvertent actuation of control elements, moving the machine or the attachment. This can lead to injury to persons or damage to property.

- ▶ Do not adjust the operator seat while driving the machine.
- ▶ Move the safety lever up.

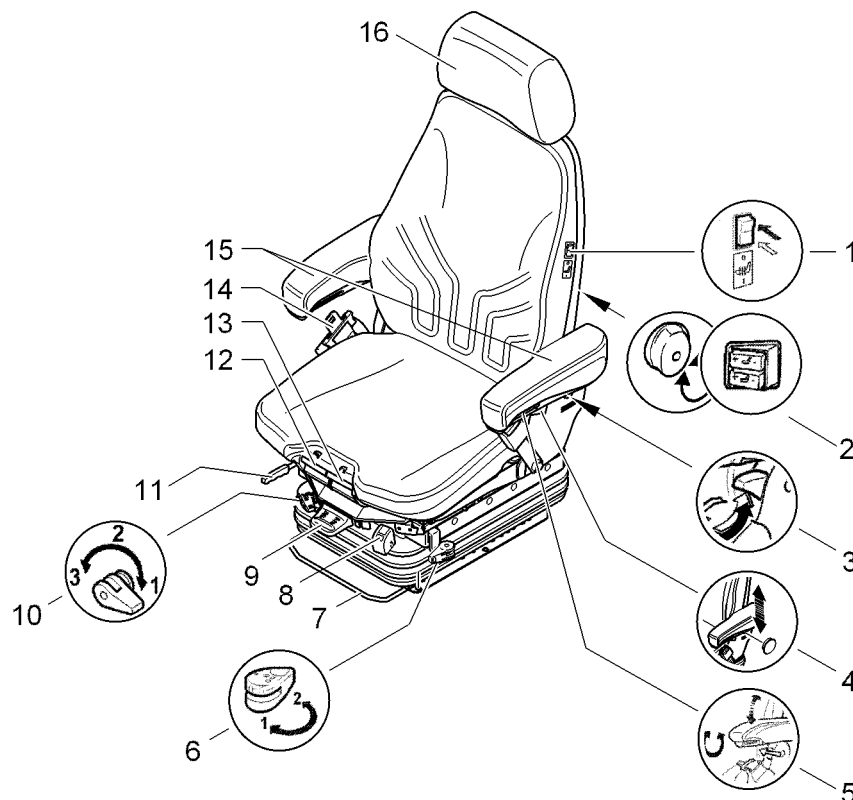


Fig. 3-40 Operator seat

- | | |
|--|--|
| 1 Operator seat heating | 2 Mechanical / pneumatic lumbar support* |
| 3 Backrest adjustment | 4 Armrest height adjustment |
| 5 Armrest adjusting wheel | 6 Horizontal suspension* |
| 7 Horizontal adjustment with control consoles | 8 Display for weight settings* |
| 9 Manual/automatic adjustment for body weight and seat height* | 10 Shock absorber* |
| 11 Horizontal adjustment | 12 Seat depth |
| 13 Seat inclination | 14 Safety belt |
| 15 Armrests | 16 Headrest |

* Model variant

Adjusting seat to body weight/seat height (in models with manual adjusting mechanism):

- ▶ Sit down on the seat.

- ▶ Adjust the seat height/body weight by pulling or pushing the lever **9** to the stop.
- ▶ Check the display **8**.
 - green = settings correct
 - yellow = correction required
- ▶ If necessary: Adjust the settings by pulling or pushing the lever **9** to the stop.

Adjusting seat to body weight (in models with automatic adjusting mechanism)*:

- ▶ Before adjusting the body weight settings, set the shock absorber* to "soft".
- ▶ Sit down on the seat.
- ▶ Pull the lever **9** briefly upwards.
 - ↳ The seat is automatically adjusted to suit the body weight of the operator.

Adjusting seat height (in models with automatic adjusting mechanism)*:

- ▶ Before adjusting the height, set the shock absorber to "soft".



Caution!

Risk of damage to compressor.

- ▶ Do not run the compressor continuously for more than 1 minute.

- ▶ Adjust the seat height by pulling or pushing the lever **9** to the stop.

Adjusting seat depth:

- ▶ Lift the button **12**.
- ▶ Sit on the seat and move it horizontally to the desired position.
- ▶ To adjust the angle of inclination of the seat, press the button **13**.
 - ↳ Sit on the seat and move it to the desired angle.

Horizontal adjustment:

- ▶ Pull up the lever **11**.
- ▶ Adjust the operator seat in horizontal direction.
- ▶ Release the lever. Ensure that the lever engages properly in the desired position (audible click).
- ▶ Carry out the following check: After locking, it must be impossible to move the operator seat to a different position.

Horizontal adjustment with control consoles:

- ▶ Pull up the lever **7**.
- ▶ Adjust the operator seat together with the control consoles in horizontal direction.
- ▶ Release the lever. Ensure that the lever engages properly in the desired position (audible click).
- ▶ Carry out the following check: After locking, it must be impossible to move the operator seat to a different position.

Adjusting backrest:

- ▶ Pull up the lever **3**.
- ▶ Sit on the seat and move the backrest to the desired position.

- ▶ Release the lever. Ensure that the locking lever engages in the desired position.
- ▶ Carry out the following check: After locking, it must be impossible to move the backrest to a different position.

Adjusting lumbar support (in models with mechanical adjusting mechanism):

- ▶ Adjust the height and curve of the lumbar pad by turning the hand wheel **2** at the back of the seat.

Adjusting lumbar support (in models with pneumatic adjusting mechanism)*:

- ▶ Adjust the curve of the upper and lower section of the backrest upholstery by pressing the two switches **2** at the rear of the seat.

Adjusting shock absorber*:

The shock absorption level can be adjusted to suit the actual road or terrain conditions.

- ▶ Turn the handle **10** to the desired position and release it.
 - Position 1 = hard
 - Position 2 = medium
 - Position 3 = soft

Adjusting horizontal cushioning*:

Under certain operating conditions, you can improve the operator comfort by adjusting the horizontal cushioning mechanism. This helps reduce impact stress in travel direction on the operator as these impacts are better cushioned by the seat.

- ▶ Move the handle **6** to the desired position.
 - Position 1 = horizontal cushioning OFF
 - Position 2 = horizontal cushioning ON
- ▶ After the handle has been moved to position 1, ensure that it engages properly in this position: push the seat back until you hear an audible click.

Adjusting armrests:

- ▶ Turn the hand wheel **5** until the armrests are in the desired position.

If required, the height can be adjusted individually for each armrest:

- ▶ Remove the cover cap **4** from the seat covering.
- ▶ Loosen the hex (wrench size 13 mm).
- ▶ Set the armrest to the desired position.
- ▶ Tighten the hex nut (25 Nm).
- ▶ Replace the cover cap on the hex nut.

Adjusting headrest:

- ▶ Adjust the headrest **16** by pulling it from the engaging mechanism.
- ▶ Adjust the headrest angle by pushing it forward or back.
- ▶ To remove the headrest, move it to the upper stop and then pull it with force from the seat.

Seat heating:

- ▶ Actuate the switch **1** to switch on the seat heating.
 - Position 0 = seat heating OFF
 - Position 1 = seat heating ON

* Model variant

3.2.4 Putting on and releasing the safety belt



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.

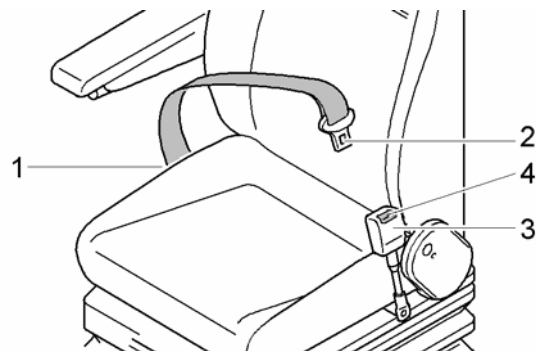


Fig. 3-41 Safety belt

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.
- ▶ 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**.

3.2.5 Windscreen

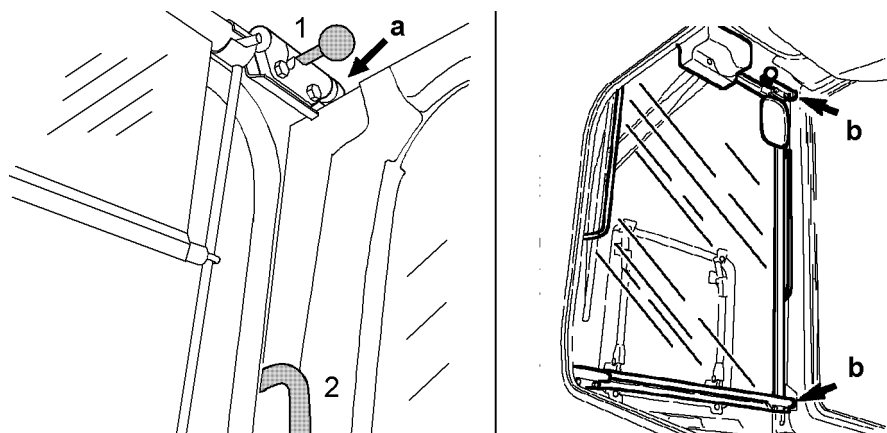


Fig. 3-42 Locked positions of the windscreen

The windscreen can be locked in two positions.

LFR/en/Edition: 07 / 2011

- In the position **a** the windscreen is closed.
- In the position **b** the windscreen is fully opened (locked in place on the roof of the cab)

**Caution!**

It is not allowed to work with the machine when the windscreen is in an intermediate position!

To change the position of the windscreen

- ▶ Pull the lever **1** in and down to unlock the windscreen.
- ▶ Move the windscreen using the handle **2**, secure it in one of the two positions **a** or **b** and relock using the lever **1**.

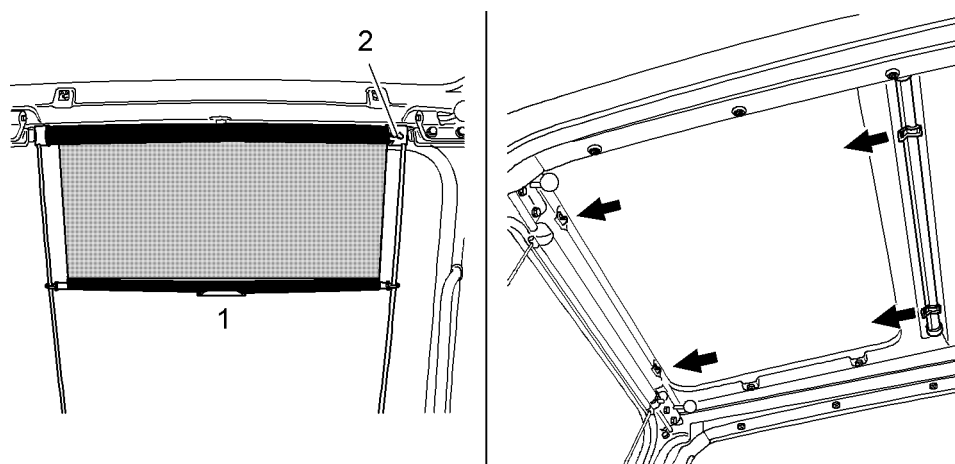
3.2.6 Sunshade

Fig. 3-43 Sunshades at windscreen and at cab roof

The cab is provided with two sunshades, located at the windscreen and at the cab roof window.

Maneuvering the sunshade at the windscreen

- ▶ Using the strengthening tongue **1**, pull the sunshade down to the desired position.
- ▶ Press the red button **2**, the sunshade will roll itself up.

Maneuvering the sunshade at the 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

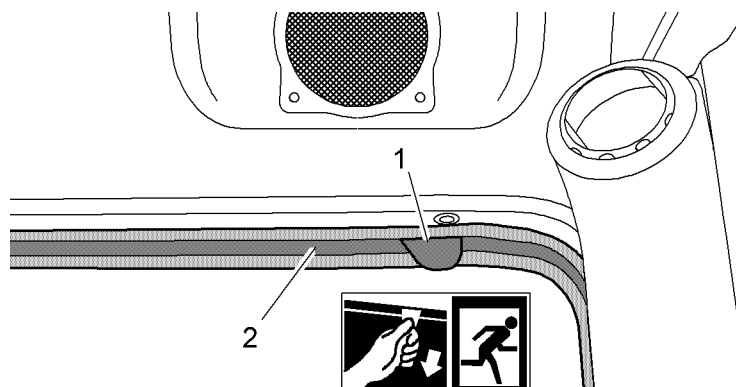


Fig. 3-44 Emergency exit – rear window

- ▶ In case of emergency, remove the rubber seal **2** from all around the rear window by pulling the clip **1** on the inner side of the rear window. Thereafter push the window out.



Note !

For the machines equipped with a cab elevation, steps, ladders and hand-rails (grips) are installed to secure the descent.

3.2.8 Interior lighting

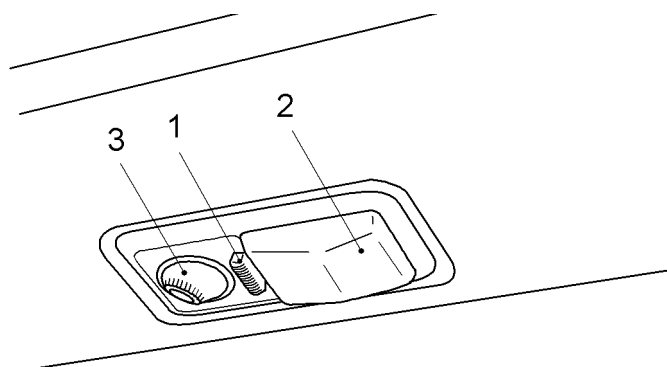


Fig. 3-45 Dome light for cab interior lighting

The dome light is controlled via the button **1**.

- ▶ Push the button **1** to the right to switch on the light **2**.
- ▶ Push the button **1** to the left to switch on the spot **3**.
- ▶ Push the button **1** into central position to switch the dome light off.

3.2.9 Fire extinguisher*

The interior of the cab of Your machine is fitted with fixing points allowing the mounting of a fire extinguisher. These fixing points are on the right side wall of the cab, in the front area for machine models up to R954C, in the rear corner for machine models R964C and above.

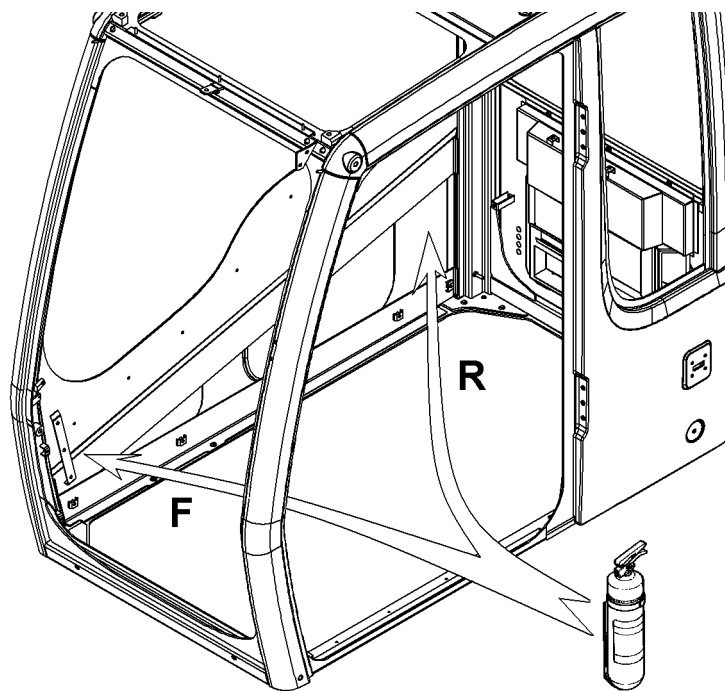


Fig. 3-46 Possible locations for fixing the fire extinguisher

The fire extinguisher is mounted as an option; at delivery the machine is fitted with only at customer's wish.



Note!

It is the responsibility of the owner of the machine to decide if it must be fitted with a fire extinguisher or not, considering the operating conditions and the regulations which apply in the country and at the point of use of the machine.

A kit for retrofit adaptation, suitable for the cab of Your machine, and comprising a fire extinguisher and its mounting bracket can be ordered any time in Your LIEBHERR customer support service.



Caution!

If Your machine is fitted with a fire extinguisher:

- ▶ always comply with the operating guide on the body of the extinguisher,
- ▶ make sure, all the inspections of the fire extinguisher which are prescribed by the regulations applicable to the operating place of the machine are accomplished.

3.2.10 The heater and air conditioner

The cab is equipped with a heating and air conditioning system as standard. The heating and air conditioning system is used to heat, cool and ventilate the cab.

Control unit of the heating and air conditioning system

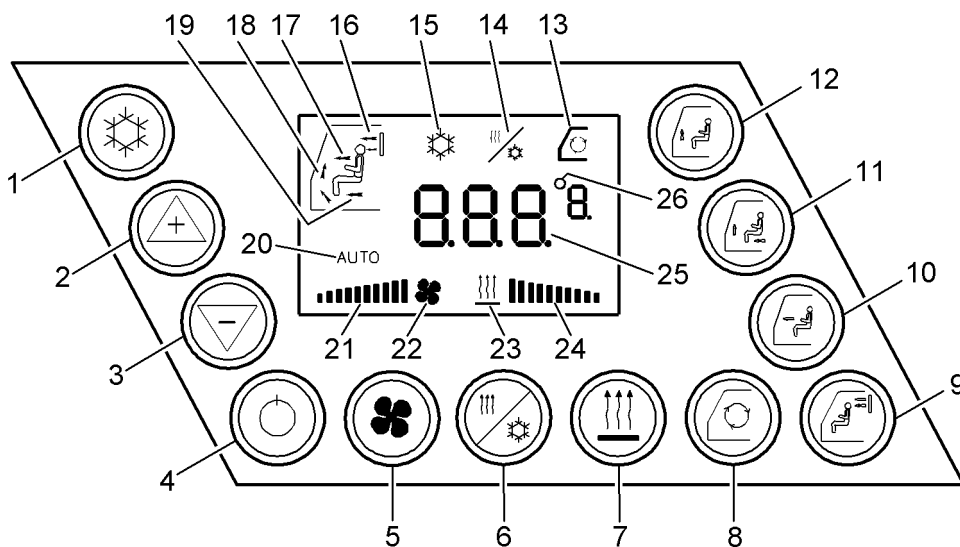


Fig. 3-47 Control unit of the airco system

Control keys	Indications at the LCD display
1 – Air conditioning (cooling)	13 – Air circulation
2 – Increase cab temperature	14 – REHEAT operation
3 – Decrease cab temperature	15 – Air conditioning (cooling)
4 – Control ON / OFF	16 – Air flap to rear wall OPEN
5 – Evaporator fan speed – manual / automatic	17 – Air flap to right control panel (8b) OPEN
6 – REHEAT operation	18 – Air flap to front windshield, legroom CENTER
7 – Heating – manual / automatic	19 – Air flap to front windshield, legroom OPEN
8 – Fresh air / recirculated air	20 – Automatic operation
9 – Air flap to rear wall vent OPEN / CLOSED	21 – Bar graph indicator for fan speed
10 – Air flap to right control panel (8b) OPEN / CLOSED	22 – Symbol, fan speed (in manual operation)
11 – Air flap to front window, legroom CENTER / CLOSED	23 – Symbol, heater operation (in manual operation)
12 – Air flap to front windshield, legroom CENTER / OPEN	24 – Bar graph indicator for heating output
	25 – Temperature value or error code
	26 – Temperature unit (°)



Note!

► If the control unit recognizes a system error in the air conditioning circuit, a flashing error code number **F1-F5** is displayed, see the section "faults and remedies", further in this manual.

Turning the control unit on

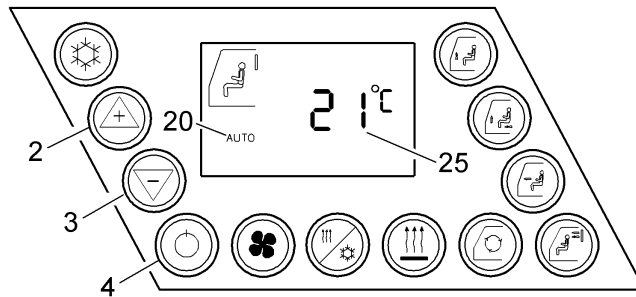


Fig. 3-48 Turning the control unit on and setting the cab temperature

- ▶ Turn the system on using the key 4.
 - ↪ The software version will be displayed for approx. 12 seconds while the control unit carries out a self test.

The heating and the ventilation of the cab are operating. The heating output and the fan speed will be controlled automatically if the **AUTO** symbol (20) is displayed.

Setting the desired cab temperature

The four-digit segment indicator 25 shows the desired cab temperature.

- ▶ Use the key 2 to increase the temperature.
- ▶ Use the key 3 to reduce the temperature.

The adjusted temperature will remain until the next change via keys 2 and 3 is made.

Manual setting of the heating output

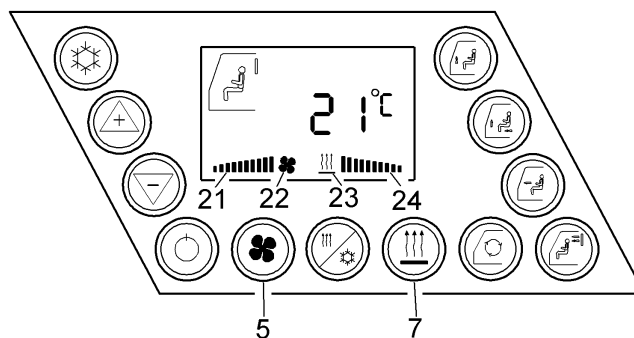


Fig. 3-49 Setting of the heating output and of the fan speed

- ▶ Press the key 7 to adjust the heating output manually.
 - ↪ the heating symbol 23 is displayed and will flash for 5 seconds.
 - ↪ the bar graph 24, showing the adjusted heating output, is displayed.
- ▶ As long as the heating symbol 23 is flashing, the heating output can be increased or reduced manually using the keys 2 or 3.
- ▶ Press the key 7 again, to return to automatic operation.
 - ↪ the symbols 23 and 24 will go off, the symbol 20 is displayed again.

Manual setting of the fan speed

- ▶ Press the key 5 to adjust the fan speed manually.
 - ↪ the fan symbol 22 is displayed and will flash for 5 seconds.
 - ↪ the bar graph 21, showing the adjusted fan speed, is displayed.

- ▶ As long as the fan symbol 22 is flashing, the fan speed can be increased or reduced manually using the keys **2** or **3**.
- ▶ Press the key **5** again, to return to automatic operation.
 - ↪ the symbols **22** and **21** will go off, the symbol **20** is displayed again.

Air conditioning operation

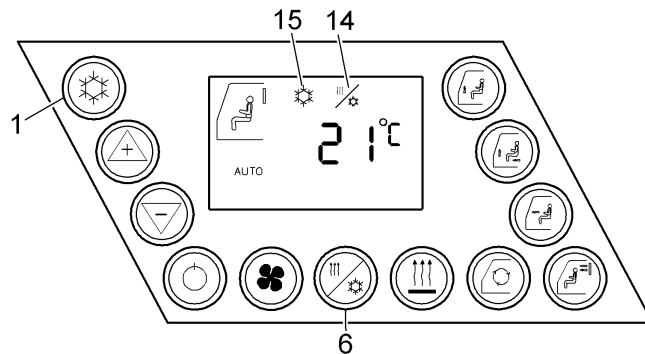


Fig. 3-50 Air conditioning operation and Reheat-operation

- ▶ Press the key **1** turn on the air conditioning operation.
 - ↪ the symbol **15** is displayed.
 - ↪ the control unit now turns the airco compressor on and off automatically.
 - ↪ the control unit automatically adjusts the fan RPM.
- ▶ Press the key **1** again, to turn off the air conditioning operation.
 - ↪ the symbol **15** is no longer displayed, the airco compressor remains off.



Note!

In case of high outside temperature, and especially if the cab has been heated up by the sun, decrease the temperature inside the cab as far as possible before turning on the air conditioner.

- ▶ Open the windows and the door for a few minutes and adjust the blower fan to maximum RPM via the keys **5** and **2**.

Reheat-operation

In order to achieve a quick dehumidification of the cab, as an example on morning, when setting the machine into operation, it may be advisable to briefly turn on the air conditioning operation even when the heater is already operative.

- ▶ Press the REHEAT-key **6**:
 - ↪ the symbol **14** is displayed,
 - ↪ the compressor is constantly working,
 - ↪ the fan of the heater and airconditioner is running at maximum RPM,
 - ↪ the air flaps at the front window and at the legroom are open,
 - ↪ as necessary the control unit switches on the heating so to maintain the adjusted cab temperature.
- ▶ As soon as the windows are completely demisted, the Reheat-operation may be exited while pressing the REHEAT-key **6** again.

**Note!**

To avoid overloading the starter motor and the batteries, turn on the air conditioning operation and the REHEAT-operation only after the engine is running.

The REHEAT-operation is turned off automatically after 60 minutes.

- ▶ If the machine is used for a longer period of time without using the air conditioner, press the REHEAT key **6** about every 2 weeks so to turn on the airco compressor.

Recirculated air and fresh air operation

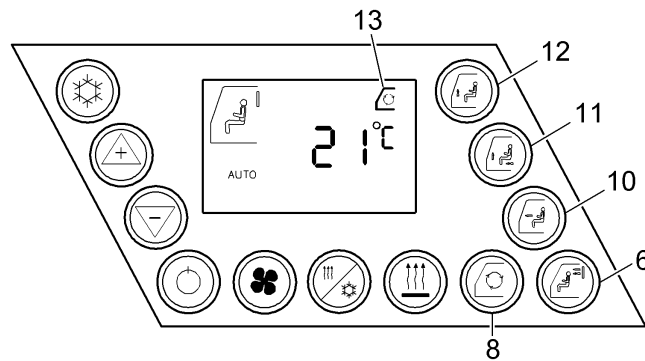


Fig. 3-51 Recirculated air and fresh air operation

The heating and air conditioning system can work either in recirculated air operation or in fresh air operation.

- ▶ Pressing the key switch **8** will alternately change from recirculated air operation into fresh air operation:
 - ↔ in recirculated air operation:
 - the symbol **13** is displayed,
 - the fresh air flap 33 in the rear cab wall is closed.
 - ↔ in fresh air operation:
 - the symbol **13** is no longer displayed,
 - the fresh air flap 33 in the rear cab wall is open and an amount of fresh air is admitted into the cab (about 10%, depending on the contamination of the filters 31 and 32).

**Note!**

The best heating, resp. cooling effect is reached in recirculated air operation!

Air repartition

The adjustment of the air flow in the cab is achieved via the keys 9 to 12 and via the partly closing and revolving louvers 8a to 8d:

- **8a** on the seat console
- **8b** on the right control panel
- **8c** on the front windshield
- **8d** on the rear wall of the cab

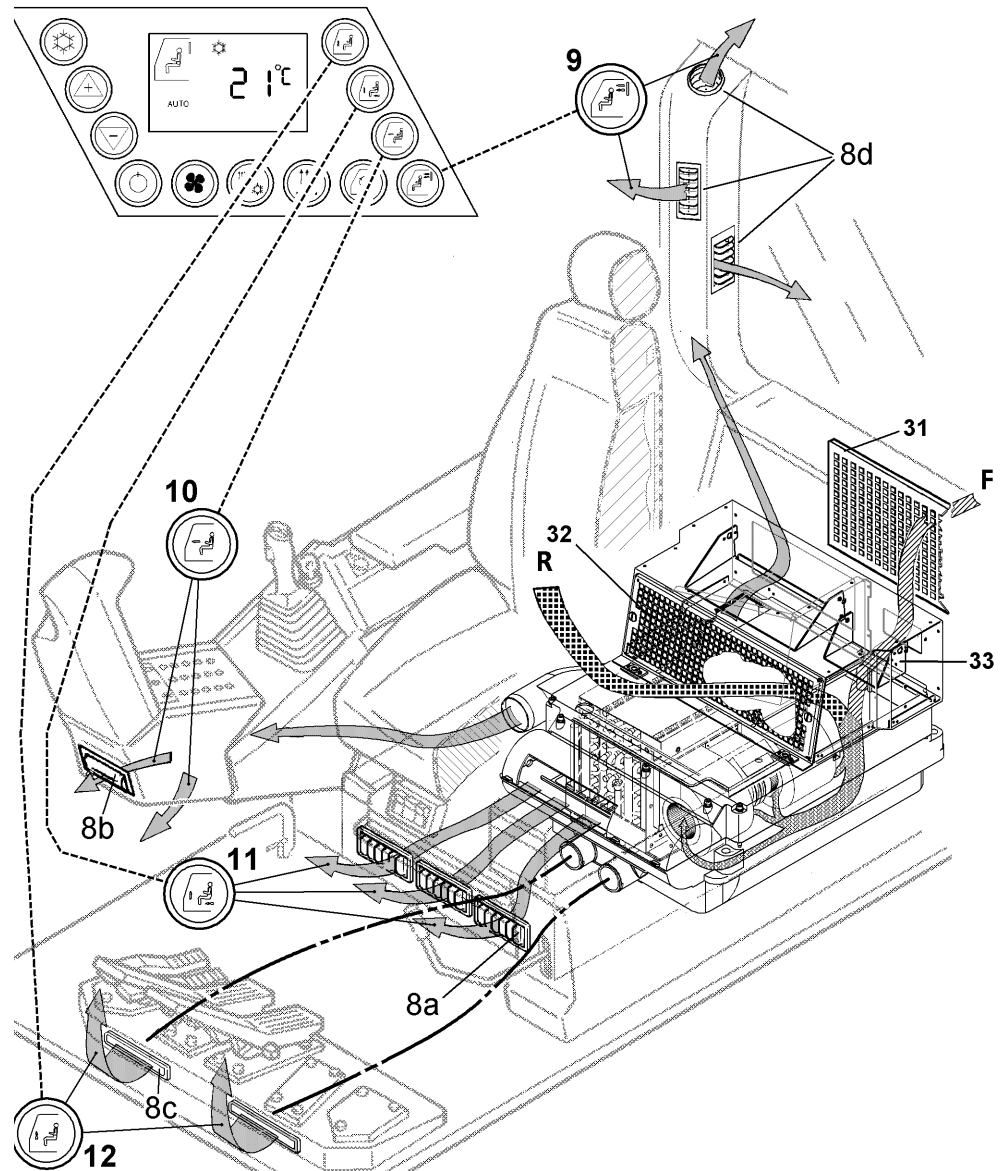


Fig. 3-52 Air repartition in the cab

To reach a maximal feeling of comfort:

- ▶ For **heating** the air flow must be blown into the cab via the louvers **8a**, **8b** and eventually **8c**. This is obtained while actuating the keys **10**, **11** and eventually **12**.
- ▶ For **air conditioner operation** the air flow must be blown into the cab via the louvers **8d** and eventually **8b**. This is obtained while actuating the keys **9** and eventually **12**.



Note!

To defrost or dehumidify the windshield quickly, blow the whole air flow only out of the louvers **8c** at the front windshield and **8b** on the right control panel.

- ▶ In case of very high outside temperature, preferably close the louvers **8c** to avoid an unnecessary warming up of the inside air along the windshield.

Changing the temperature from °Celsius to °Fahrenheit

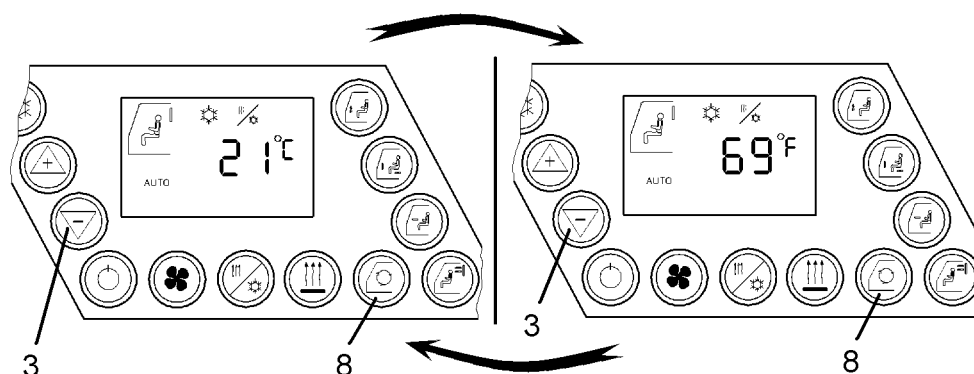


Fig. 3-53 Switching over °Celsius - °Fahrenheit

- ▶ Press the key **8** and keep it depressed. Press the key **3** at the same time.
 - ↳ the display of the adjusted cab temperature is changed from °Celsius into °Fahrenheit.
- ▶ Pressing again the keys **8** and **3** at the same time will cause the temperature to change back into °Celsius.

3.2.11 Additional standstill heater (option)

As an option, Your machine can be fitted with an additional heater mounted to the uppercarriage structure, out of the cabin. This heater is aimed to improve the starting ability of the Diesel engine and the working possibilities of the machine at very low temperatures.

This heater works with Diesel fuel and is used with the machine stopped to preheat the coolant circuit of the Diesel engine and thus the warm water circuit of the air conditioner serially installed in driver's cab.

In addition, and depending on the low temperature range planned for the machine operation, the additional standstill heater can also serve to heat various components on the machine via water to oil or water to air heat exchangers (such as splitterbox, fuel tank, batteries compartment, ...).

Operating the standstill heater



Notice!

The standstill heater can only be operated when the ignition of the machine is turned off.

If the ignition key is turned on during operation of the standstill heater, the message "SH" is displayed on the control unit on the left control console, informing that the standstill heater is on.

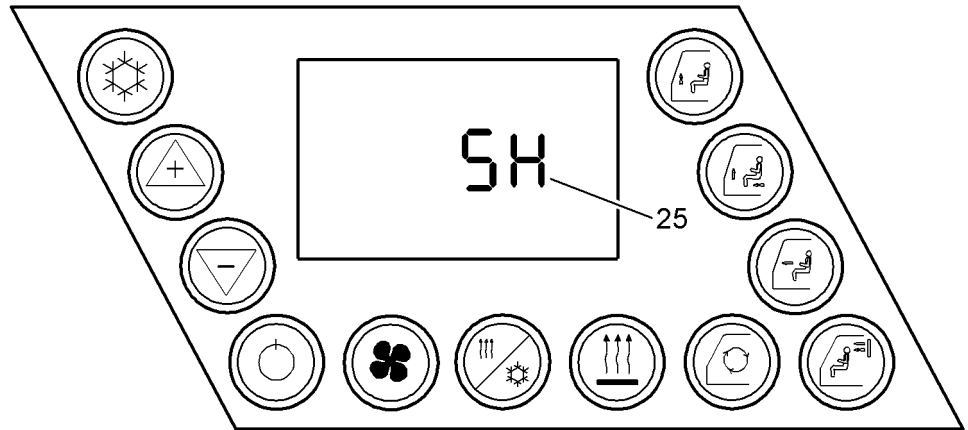


Fig. 3-54 Indication of the standstill heater operation on the control unit



Notice!

When the standstill heater is operating it is not possible to make any adjustments at the control unit of the serially mounted heater and air conditioner.

Turning on the standstill heater has following influences on the serially mounted heater and air conditioner:

- the heater function is turned on automatically, so the water circuit for the heating of the cab becomes operative.
- the fan in the cab starts running at middle RPM.

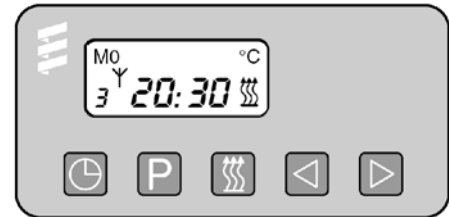
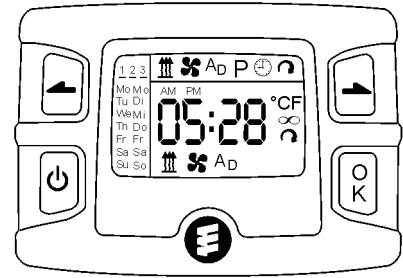
The control unit of the standstill heater

Depending on the execution of the installed standstill heater circuit and on customer's wish, the additional standstill heater can be operated using different control units:

- Either via the control module **S232**.
the "mini-Clock" control module **S232** allows a 24 hours programming of the standstill heater.
The operation with this control unit is described thereafter.



- Or via the control module **U103**.
With the control module **U103** a programming of the standstill heater over a whole week (7 days) is possible.



Functioning of the additional standstill heater

In operation the circulating pump is started automatically and the burning is put out and on thanks to a thermostat (65°C in the water circuit), when the circulating pump is working in continuous.

To guarantee an optimal preheating of the excavator (Diesel engine, splitterbox, battery compartment and cabin), the water heater must work so long that the thermostat comes to stop the warm water circuit before the engine is started.

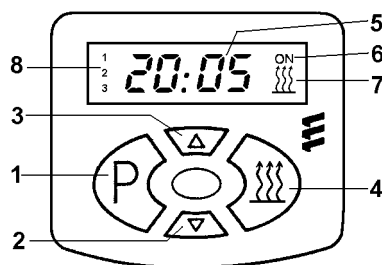
The start time of the heater, depends on the expected ambient temperature, and is to be programmed so that the cut-off temperature of the heater circuit is reached just before the starting time of the machine.

When the heater is turned off, the combustion will be immediately stopped, but the fan of the heater continues running for about 150 seconds (after running).

A heater re-throwing is authorised during the after running.

At temperatures between -10°C and -20°C, you should start up the heater 10 or 20 minutes before start to make the starting procedure easier.

Operation of the heater using the mini-clock



- 1 - Key to activate the setting capabilities
- 2 - Time setting key backwards
- 3 - Time setting key forwards
- 4 - Key ON / OFF
to activate - deactivate the preset time
- 5 - Current time, preset time and heating time
- 6 - Symbol for activated preset time
- 7 - Symbol for heater operation
- 8 - Symbol for preset time 1, 2 or 3

Setting functions on the mini-Clock



Notice!

- If no key of the control module is depressed within 15 seconds the display will return to its initial state, this means to the display of current time.
- When setting a time with the keys **2** or **3**, the setting speed is accelerated when the key is kept depressed.
- Up to three preset times can be set and activated on this mini-Clock. Each preset time is deactivated after the heating period, and it must be newly activated for each new heating period (see activating / deactivating the preset time).

Setting-up for the first time:

After the first connection to the power supply all symbols on the display will start to flash. The heater cannot be turned on in this state.

- ▶ The current time has to be set first:

Setting the current time:

- ▶ Press key **1** of the control module for more than 3 seconds
 - ↪ the current time is flashing.
- ▶ Set the time using keys **2** and **3**.
- ▶ Press key **1** within 5 seconds
 - ↪ The time is displayed
 - ↪ the colon in the time indication area 5 flashes.



Note!

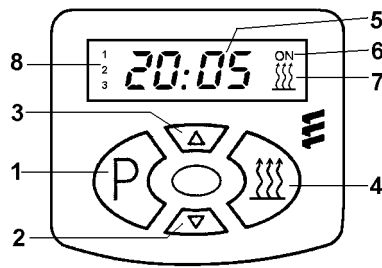
If, after the time has been set, the key **1** is not pressed within 5 seconds, the mini-Clock will be transferred to the mode "Setting the Heating Time".

Setting the heating time:

- ▶ Press the key **1** for more than 3 seconds.
 - ↪ The time flashes.
- ▶ Press no key.
 - ↪ the mini-Clock goes over to the mode "Setting the Heating Time".
 - ↪ the heating symbol **7** is displayed at the control module and the heating time **5** is flashing.
- ▶ Set the heating time (10 bis 120 min) using keys **2** and **3**.
- ▶ Press the key **1**.
 - ↪ The current time is now displayed
 - ↪ the colon in the time indication area **5** flashes.

Setting the preset times:

- ▶ Press the key **1** once, twice or three times to call the preset time "1, 2 or 3".
 - ↪ the corresponding preset 5 time is displayed in field **5** of the control module and the number of the preset time is indicated (symbol **8**).
- ▶ Set the preset time using keys **2** and **3**.
- ▶ Press the key **4** to activate or to deactivate the selected preset time.
 - ↪ when the preset time is activated, the symbol "ON" is displayed.
 - ↪ The number "1, 2 or 3" of the activated preset time is displayed in the symbol field **8**.



- 1 - Key to activate the setting capabilities
- 2 - Time setting key backwards
- 3 - Time setting key forwards
- 4 - Key ON / OFF
to activate - deactivate the preset time
- 5 - Current time, preset time and heating time
- 6 - Symbol for activated preset time
- 7 - Symbol for heater operation
- 8 - Symbol for preset time 1, 2 or 3

Operating functions of the Mini-Clock

Switching on the heater:

- ▶ Press the key 4.
 - ↪ The stanstill heater is on. The symbol 7 and the remaining heating time (in minutes) are displayed on the control module.

Turning off the heater:

- ▶ Press the key 4.
 - ↪ The heater fan continues running for about 150 seconds (after running).
 - ↪ On the control module the symbol 7 disappears and the current time is now displayed.

Continuous operation:

- ▶ Press the key 3 and keep it depressed, at the same time press the key 4.
 - ↪ the heater will now remain switched on until the key 4 (switching off the heater) is pressed again.

Activating / deactivating the preset time:

- ▶ Press the key 1 to select the preset time "1, 2 or 3".
- ▶ Press the key 4 to activate or to deactivate the selected preset time.
 - ↪ when the preset time is activated, the symbol "ON" is displayed.
 - ↪ The number "1 , 2 or 3" of the activated preset time is displayed.

3.3 Setting the machine into operation

3.3.1 Before starting 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.

On this machine, the maximum power of the LIEBHERR Diesel engine is automatically reduced by the electronic engine controller when operating in the above mentioned conditions (sea level and exterior temperature).

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 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.

3.3.2 Turning on the electrical system

Positions of the ignition key

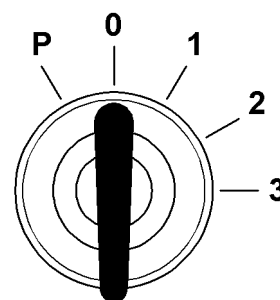
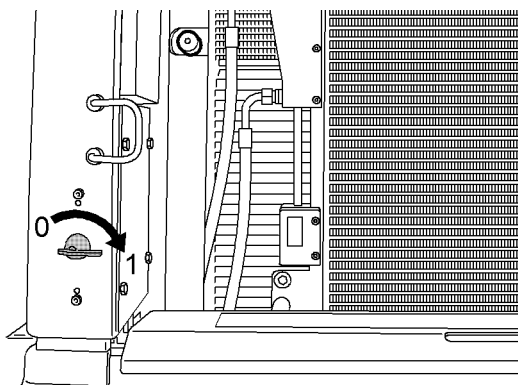


Fig. 3-55 Ignition switch

- | | | |
|---------------------------|-------------------------|------------------------|
| 0 Neutral | 2 not used | P Park position |
| 1 Contact position | 3 Start position | |

Switching on the electrical system



- ❑ The main battery switch must be in position 1 (on).
- ▶ Turn the ignition key to contact position 1.
 - ↪ As soon as the ignition is switched on, an automatic check of control unit and monitoring display takes place.



Note!

If no automatic check of the control unit and monitoring screen is carried out when the ignition key is in the contact position,

- check that the main battery switch is set to "on".
- check that the anti-theft device eventually installed on your machine is deactivated, refer to the corresponding sections further in this chapter.



- ▶ Check the function of display and indicator lights when you switch on the ignition.
 - ↪ All control lights must illuminate for a brief period with the exception of the LED of switch **S22** (Additional headlight).
 - ↪ The LIEBHERR logo appears on the LCD screen.

Display of the term of the next service work

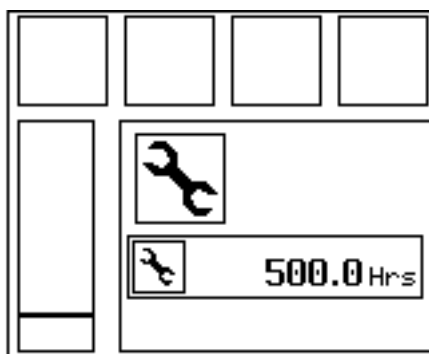


Fig. 3-56 Display of the term of upcoming maintenance works

After the automatic check is over, a graphic symbol may appear to indicate the nearness of the term of the next preprogrammed periodic maintenance works.

The term of the upcoming service is then displayed in place of the usual operating hours information.

The display of the term of the upcoming maintenance will go out after approx. 8 seconds.

3.3.3 Starting the Diesel engine

**Note !**

A wrong start can cause damages for the diesel engine !

- ▶ Only operate the starter motor when the Diesel engine is off.
- ▶ Do not operate the starter more than 20 seconds.
- ▶ If the engine does not start after 20 seconds, wait at least 1 minute before attempting to restart.
- ▶ First turn the ignition key back to position **0** before restarting the engine.
- ▶ If the engine does not start after three attempts, find the problem and correct it.

Starting procedure

- ▶ Turn the ignition key to start position **3**.
- ▶ Release the ignition key as soon as the engine starts.
 - ↳ Control lamps H2 and H12 must go out.
 - ↳ The buzzer will sound briefly when the engine starts until the engine oil pressure builds up.

Starting procedure for low temperatures

For low temperatures, the intake air is preheated automatically by flame glow plugs situated in the intake manifolds so, to improve the starting of the engine.

When the symbol "**Preheating ON**" appears on the screen, the ignition key must be maintained in position **1** until the symbol "**Preheating END**" appears. Then the diesel engine can be started.

- ▶ Turn the ignition key to position **1** and let it in this position.
 - ↳ The symbol "**Preheating ON**" appears on the screen during 20 seconds.
- ▶ After symbol "**Preheating END**" has appeared (about 2 seconds), turn the ignition key to start position **3**.
- ▶ Release the ignition key as soon as the engine starts.

Starting procedure for exterior temperature below -18 °C (0 °F).

So to improve the starting ability of the engine at temperatures below -18 °C, we recommend to equip the machine with one or several of the original LIEBHERR cold starting kits (see Starting aids).

3.3.4 Speed adjustment and operating modes

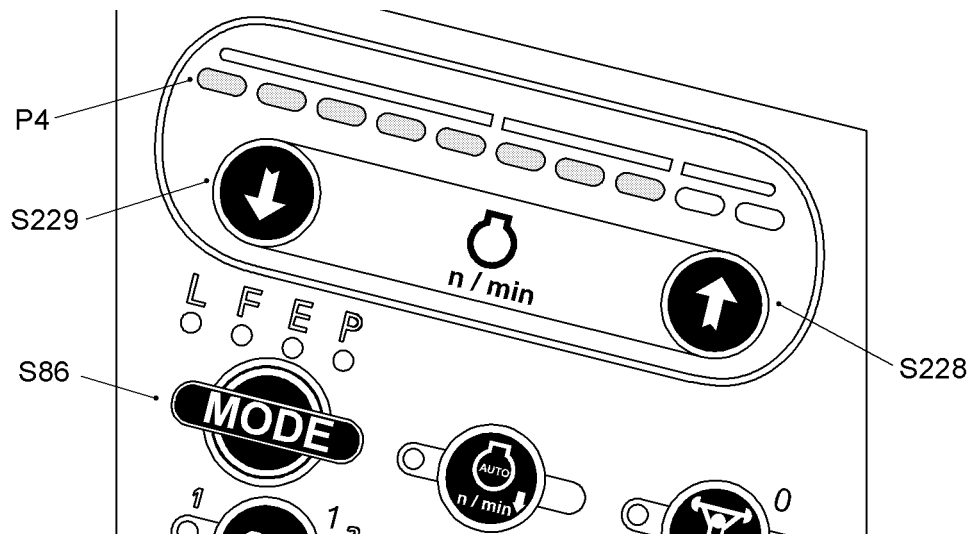


Fig. 3-57 Speed adjustment and operating modes selection

The LED chain **P4**, divided into 10 speed levels, displays the actual engine speed.

- ▶ There are two different ways to adjust the engine RPM.
 - press the mode switch **S86**.
 - or -
 - press arrow keys **S228** or **S229**.

Engine speed and operating mode selection via the mode switch

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



- **L** : LIFT mode (speed level 5 – sensitive lifting of loads).
- **F** : FINE mode (speed level 10 – levelling works).
- **E** : ECO mode (speed level 8 – economical work).
- **P** : POWER mode (speed level 10 - working at rated power).

- ▶ 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 and P, the engine is running at its rated power curve, in mode L and F it works at a power reduced by approx. 20%.

The speed level 8 corresponds to the range where the specific fuel consumption of the engine is optimal ("ECO" range).

Engine speed adjustment using the arrow keys



To increase the speed:

- ▶ Press switch **S228**.
 - ↗ Speed will be increased by one level.
 - ↗ One more LED to the right illuminates on the indicator **P4** at the display.



To decrease the speed:

- ▶ Press switch **S229**.
 - ↗ Speed will be decreased by one level.
 - ↗ The most right LED goes out on the indicator **P4** at the display.

The following picture shows the modifications of the speed level and of the engine

power by pressing the arrow keys **S228** and **S229**.

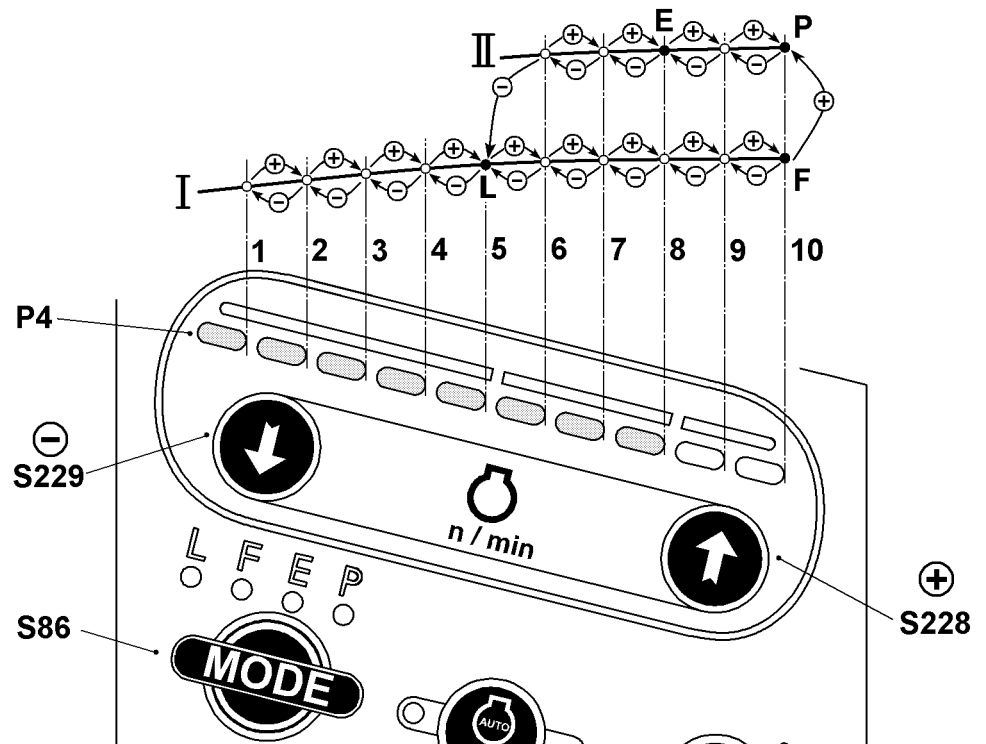


Fig. 3-58 Engine speed adjustment via the arrow keys **S228** and **S229**

The lighting LED under the letters next to the mode key **S86** shows which is the currently active mode. The selected mode will be memorized 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 mode indicating LED will flash also each time the engine RPM does not any more correspond to the speed lever of the currently selected operating mode (as an example if the speed has been adjusted via the arrow keys or if it has been decreased by the low idle automatic).

Immediately after the Diesel engine has been started, the speed will either be at level 1 (low idle of the Diesel engine) or at level 3, if a warm-up phase is required for the Diesel engine.

Lowering of the engine speed via the "low idle automatic" function



The low idle automatic is activated and deactivated via the touch **S20**, also see the heading "Control unit" before in this chapter.

If activated, this device automatically reduces the engine speed to the low idle if no hydraulic functions are actuated by the joysticks or the pedals for several seconds. This saves fuel and reduces the amount of noise.

When taking a joystick again or when actuating a pedal, the engine speed returns to the speed which was previously set, before it was reduced by the low idle automatic.

3.3.5 Notes after starting the engine



Danger!

Danger of suffocation.

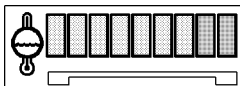
- ▶ When operating in enclosed spaces, only run the engine in areas with sufficient ventilation.
- ▶ Open doors and windows to ensure sufficient supplies of fresh air.



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.

3.3.6 Warm-up phase for Diesel engine and hydraulic circuit



Diesel engine

In cold condition, the engine speed will automatically be increased above the low idle speed. The RPM increase is depending on the coolant temperature.

- ▶ Increase the engine load slowly until the second green LED (from left) goes on at the temperature gauge **P2**.



Note !

Low 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 power of the main pumps is automatically limited when the hydraulic oil is cold (temperature below 8 °C).

As soon the hydraulic oil temperature rises above 8 °C, the full power of the machine is available.



Note !

The warm up phase for the hydraulic circuit can be activated and deactivated while programming the display.



During a warm up phase for Diesel engine or hydraulic oil, the symbol "current warm up phase" will be displayed on the screen.

3.3.7 Switching the Diesel engine off



Caution!

The engine and especially the turbocharger could be damaged.

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



- ▶ First set the engine speed to low idle using the arrow key **S229**.
 - ↳ Only the furthest left LED on the engine speed gauge **P4** is now lighting.
- ▶ Keep the Diesel engine running at low idle and unloaded for at least 30 seconds.
- ▶ Now turn the ignition key to position "0" in order to switch off the engine.
- ▶ Remove the ignition key.

Emergency stop of the Diesel engine (Option)

At customer's wish, the excavator can be fitted with an emergency stop switch **S2-1** (resp. **S34**). These switches occasion an immediate shutdown of the engine.



Caution!

The Diesel engine may be damaged if turned off suddenly when running at high RPM or at full load.

- ▶ Only actuate the emergency stop switches **S2-1** or **S34** very exceptionally, in an emergency case.
- ▶ Depress the emergency off switch **S2-1** on the right control desk or **S34** on the rear of the uppercarriage structure or under the counterweight.
 - ↳ The engine is turned off immediately.

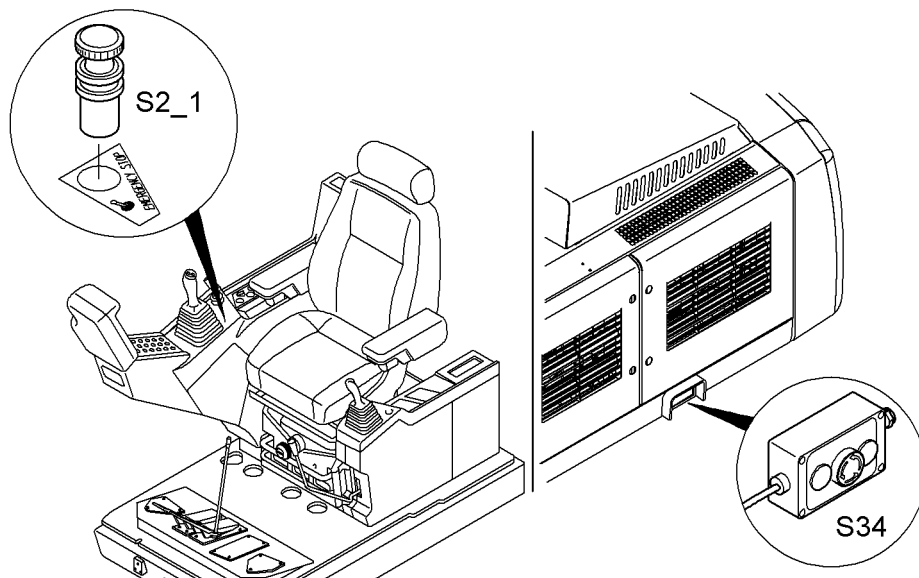


Fig. 3-59 Emergency off switches on keyboard and on uppercarriage structure

**Danger!**

When actuating the emergency off switch on machines fitted with a lifting magnet, the magnetic plate is demagnetized at the same time, this causing the holded load to fall down.

- ▶ Never fit out with an emergency off switch an hydraulic excavator that is already equipped with a lifting magnet!
And inversely!

After actuation of the emergency off switch **S2-1** or **S34**, the switch will remain in a locked position. The switch must then be unlocked before attempting to restart the Diesel engine.

- ▶ Lightly depress the operating knob of the emergency off switch and turn it clockwise.

Diesel engine stop with engine after running (Option)

To save the Diesel engine and its turbocharger, the machine can be fitted out at customer's request with the optional equipment "engine after running X minutes". With this optional equipment, the Diesel engine does not turn off immediately when the ignition key is returned to "0" position, but he continues running at low idle for a given lapse of time, allowing the temperature of components to equalize, and is turned off only thereafter.



- ▶ First set the engine speed to low idle using the arrow key **S229**.
 - ↪ Only the furthest left LED on the engine speed gauge **P4** is now lighting.
- ▶ Turn the ignition key to "0" position and remove the key.
 - ↪ The engine after running procedure begins, the engine is held running at low idle for some minutes.
 - ↪ After that it turns off automatically.

**Notice!**

Machines fitted with an engine stop after running also have an emergency off switch **S2-1** on the right control desk.

This switch remains operative during the engine after running procedure, it can be actuated in an emergency case in order to immediately stop the engine.

3.3.8 Automatic motorstop after low idle (option)

This system is a complement of the device "low idle automatic". If the operator do not use the machine during a predefined time, the diesel engine stop automatically.

The time begins to be measured when the engine reaches low idle.

The measure stops when the operator acts on a joystick or a pedal.

The time before the automatic stop is ajustable by the customers service Liebherr. By default, it is adjusted to 5 minutes.

20 seconds before the automatic stop, the operator is warned by a symbol shown on the display and with a beep.

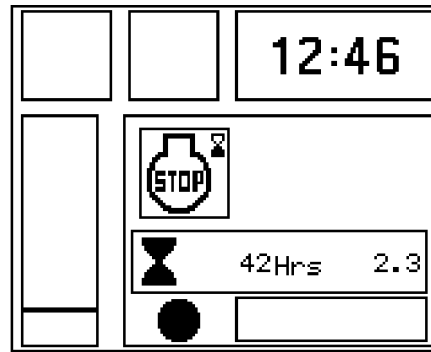


Fig. 3-60 Symbol admoniting that the engine will stopped

3.3.9 Starting aids

Fuel preheating S26 (option)

The fuel filter will be electrically heated using fuel preheating. This will prevent the fuel filter salting up at low temperatures.

- ❑ Fuel preheating should be activated at least 5 minutes before starting in conditions of low outside temperatures.
- ▶ Press switch **S26** on the right control panel before starting and with the ignition switched on.
 - ↙ The fuel filter will be heated electrically.
 - ↙ LED in switch illuminates.
 - ↙ This will prevent the fuel filter salting up at low temperatures.



Coolant / engine oil / hydraulic oil preheating (option)

The coolant, the engine oil and the hydraulic oil can be preheated before starting using coolant / engine oil / hydraulic oil preheating. In particular, this will considerably shorten the diesel engine's cold running phase at low temperatures. This will protect the diesel engine and reduce fuel consumption.

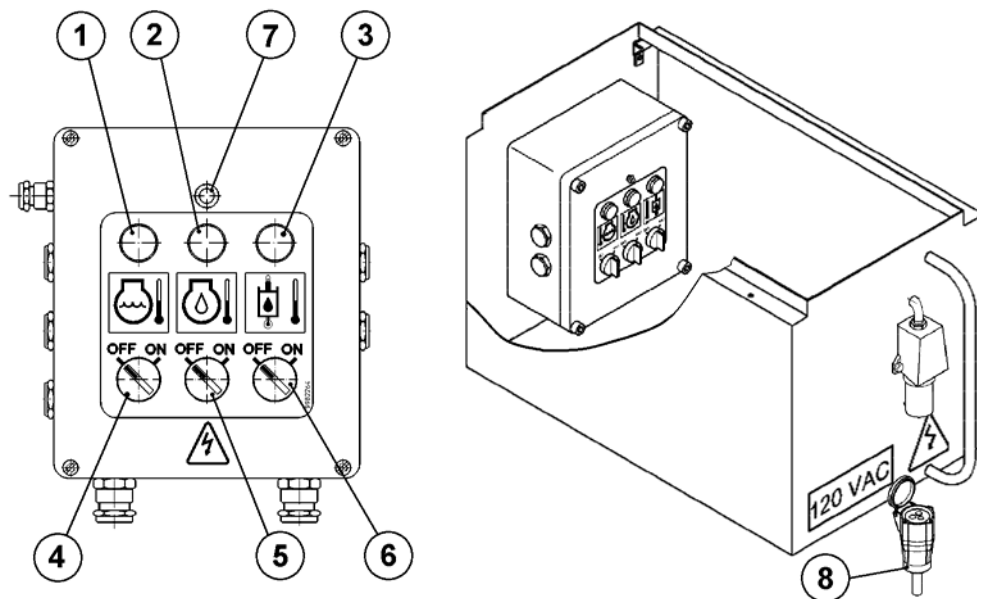


Fig. 3-61 Coolant / motor oil / hydraulic oil preheating

LFR/en/Edition: 07 / 2011

- | | | | |
|---|---|---|---|
| 1 | Coolant preheating indicator light | 5 | On / off toggle switch for engine oil preheating |
| 2 | Engine oil preheating indicator light | 6 | On / off toggle switch for hydraulic oil preheating |
| 3 | Hydraulic oil preheating indicator light | 7 | fuse |
| 4 | On / off toggle switch for coolant preheating | 8 | Power cable |

The electrical box for the coolant / engine oil / hydraulic oil preheating is located behind the right-hand side door.

- ▶ Connect power cable **8** to stationary connection (110 - 120 V / 220 - 240 V AC).
- ▶ Tip toggle switch **4**, Coolant / preheating.
 - ↖ The coolant preheating is switched on.
 - ↖ Indicator light **1** illuminates.
- ▶ Tip toggle switch **5**, engine oil preheating.
 - ↖ The engine oil preheating is switched on.
 - ↖ Indicator light **2** illuminates.
- ▶ Tip toggle switch **6** hydraulic oil preheating.
 - ↖ The hydraulic oil preheating is switched on.
 - ↖ Indicator light **3** illuminates
- ▶ After starting the engine, disconnect the power cable **8** on the machine.

3.3.10 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".

3.3.11 Immobilizer with electronic ignition key (option)

System description

The system consists of a mechanical locking system and an independently functioning, electronically coded, immobilizer.

When activated, the electronically coded immobilizer disconnects the starting and main control circuits of the machine.

The control of the immobilizer is microcomputer based. The electronic key of the immobilizer is a transponder, which is securely integrated into the key handle.

Activation of the immobilizer

- ▶ Turn the key in "0" position.
 - ↳ the immobilizer will be automatically activated after 5 seconds.
- ▶ Pull the key away from the ignition switch.



Note!

The immobilizer is activated and will stay activated, as long as the key stays in position '0', no matter if the key remains inserted or is pulled out of the switch.

Deactivation of the immobilizer

- ▶ Insert the key into the ignition switch and turn it to the contact position "1".
 - ↳ the immobilizer is deactivated.



Note!

Reading of the transponder will only take place when the mechanical key in the starting switch has made alive the control circuit of the machine (24V on clamp 15). This makes it necessary to first open the mechanical locking system before the electronic key is checked.

Thus, the immobilizer cannot be manipulated as long as the ignition is turned off.

Master key and operation keys

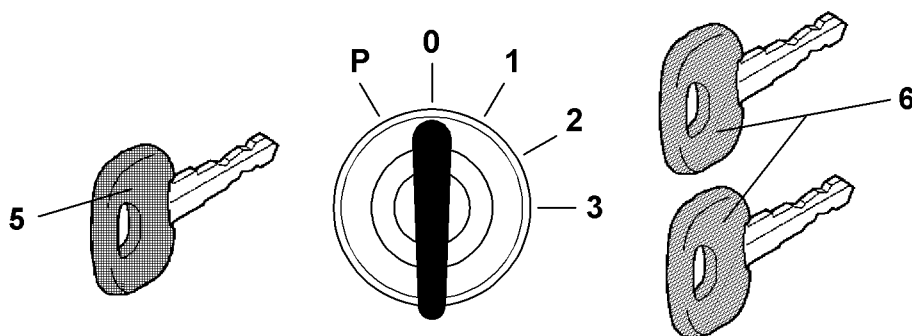


Fig. 3-62 Ignition switch with immobilizer via electronic operation keys

5 Master key (red coloured)**6 Operation keys (blue coloured)**

The master key 5 is marked by a red key knob.

The master key must be carefully stored as there is only one master key available for each immobilizer.

This master key is only to be used for imprinting new operation keys 6 (blue keys).

The master key can not be used for deactivating the immobilizer. This prevents the usage of the master key for operating the machine.

At delivery there are only two operation keys joined to the immobilizer. Other operating keys can be ordered separately.

Imprinting procedure of an operation key

To imprint an operation key, proceed as follows.

- ▶ Insert the master key into the ignition switch and turn it to the contact position "1" .
- ▶ After a maximum of 5 seconds turn the master key back to "0" position and take it off the ignition switch.
 - ↪ the electronic system of the immobilizer now expects the operational key to be imprinted within the next 15 seconds.
- ▶ During this lapse of time, insert the operation key to be imprinted into the ignition switch and turn it to the contact position "1" .
 - ↪ the key is registered as a new valid key.

**Note!**

If no key to be imprinted is recognized within 15 seconds, the imprinting procedure automatically terminates itself.

To imprint several operation keys, the keys may be inserted into the ignition switch in succession. The individual keys must stay in position "1" for at least 1 second.

Up to 10 operation keys may be imprinted per master key.

It is by the fact possible to enable one operation key to several immobilizers, e.g. to create a general operation key valid for several machines or for a machine pool.

Deleting imprinted operating keys

- Deleting imprinted operating keys may be necessary after the loss of an imprinted key.

During the deletion procedure, all imprinted keys will be deleted. After all keys have been deleted, they must be re-imprinted to recover validity.

- ▶ Insert the master key into the ignition switch, turn it to the contact position "1" and keep it for at least 20 seconds in this position.
 - ↪ all imprinted operation keys for this master key are deleted.
 - ↪ all existing operation keys may be reimprinted .

**Note!**

The code of the master key will not be deleted during the deletion procedure.

Operation security

Should more than 5 invalid keys be used in the ignition switch within 1 minute, so the immobilizer will be activated for 15 minutes and will not accept any valid keys during this period.

This procedure will prevent the 'trying out' of multiple keys and accidentally finding the correct key.

If several invalid keys are recognized without the ignition switch having been brought into the position '0', the immobilizer stays activated for 15 minutes and will not accept any valid keys during this period.

Only after those 15 minutes have expired, and after the ignition switch has recognized the position '0', will valid keys be accepted again. This will prevent keys from being tested without using the mechanical ignition switch, e.g. when the ignition switch is forcefully brought into position '1'.

Function security

An interruption of the supply line or other control lines will not deactivate the immobilizer or delete data (e.g. data codes).. All relevant data are stored in a non-volatile memory. Magnetic fields will not deactivate the immobilizer.

3.4 Working with the machine

3.4.1 The travel movements

Straight travel

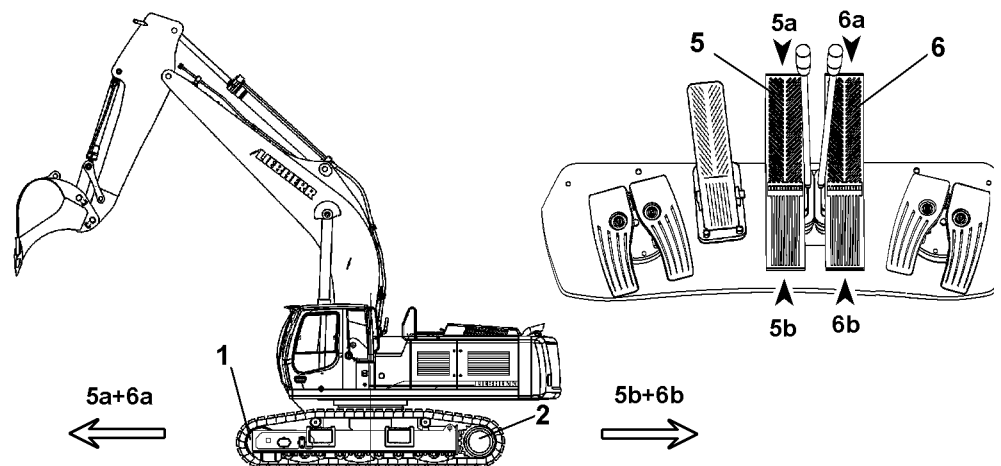


Fig. 3-63 Straight travel

- | | |
|------------------|----------------------|
| 1 Idler wheel | 5 Left travel pedal |
| 2 Sprocket wheel | 6 Right travel pedal |



Caution!

When travelling the machine, the upper carriage must be rotated to the undercarriage in such a way that ,during forwards travel, the idler wheel 1 is in front and the sprocket wheel 2 is at the rear.

Travelling forwards:

- ▶ Push the both travel pedals forwards (5a + 6a).

Travelling backwards:

- ▶ Push the both travel pedals down (5b + 6b).

**Caution!**

Before you travel in reverse, make sure the area behind the machine is free of any obstacle and nobody is in your way.

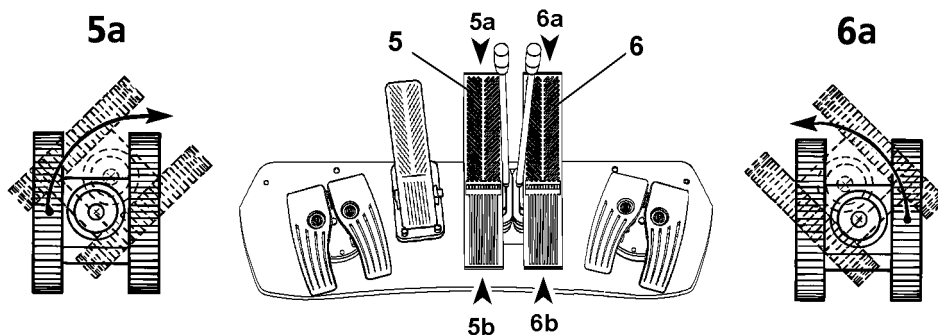
Turning over one track

Fig. 3-64 Turning over one track

Turning right:

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

Turning left:

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

**Notice!**

Avoid turning over one track in reverse, this exposes the track drive components to increased strain.

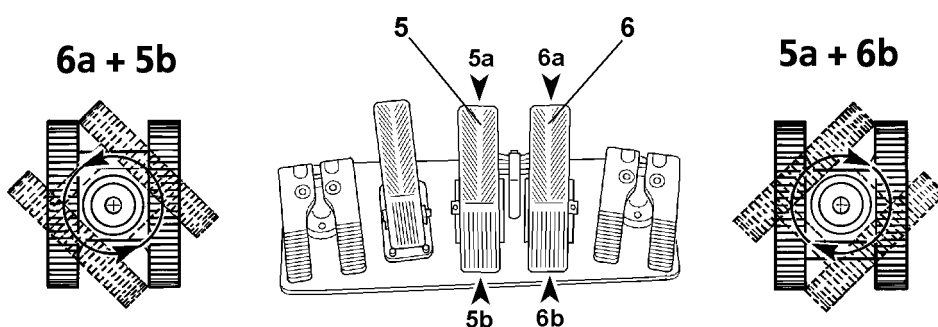
Counter rotation

Fig. 3-65 Counter rotation

Turning right:

- ▶ Push the left travel pedal **5** forwards (**5a**), ...
- ▶ ... and at the same time push the right travel pedal **6** down (**6b**).

Turning left:

- ▶ Push the right travel pedal **6** forwards (**6a**), ...
- ▶ ... and at the same time push the left travel pedal **5** down (**5b**).

**Danger!**

Pay attention that, if the uppercarriage is turned by 180° to the undercarriage, all the travel movements are inverted (left and right, forwards and backwards)!

Levers for manual control of travel movements

These levers allow a more sensitive control of the travel movements, they are installed to the travel pedals at machine delivery.

If not used, they can be removed and stored inside the cab.

- ▶ Each time when a particularly sensitive control is required, insert the levers into the travel pedals and operate the travel movements manually.

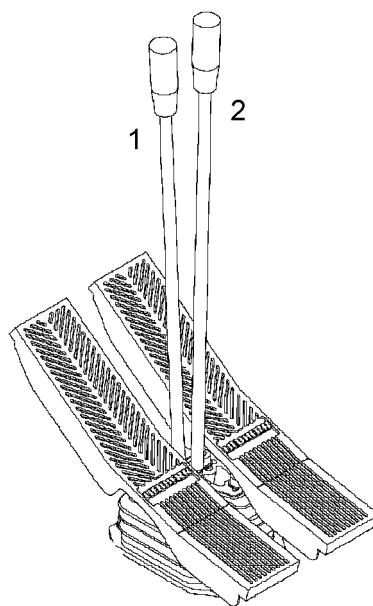


Fig. 3-66 Levers for manual travelling control

Travel speed preselection

The travel motors can be operated in two different positions:

- **travel in normal speed** (position 1):
The obtained track forces are maximum while the travel speed is moderate.
- **travel in increased speed** (position 2):
The track forces are reduced and the travel speed is maximum.

The preselection between the both positions is realized via the touch **S21**.



- ▶ die Taste **S21** drücken:
 - ↙ die LEDs in der Taste leuchten,
 - ↙ die Umschaltung von Normalfahrt auf Schnellfahrt ist zugelassen, das heisst:
 - Während der Fahrt wird jetzt automatisch von Normalfahrt auf Schnellfahrt umgeschaltet, wenn die Bodenverhältnisse es erlauben.
 - Wenn dagegen die Bodenverhältnisse wieder schwieriger werden, so erfolgt automatisch die Umschaltung von Schnellfahrt auf Normalfahrt.
- ▶ die Taste **S21 erneut** drücken:
 - ↙ die LEDs in der Taste gehen aus,
 - ↙ die Umschaltung von Normalfahrt auf Schnellfahrt ist deaktiviert, die Fahrmotoren bleiben stets in normaler Geschwindigkeit.

Depressing the touch causes the integrated LED 1 to light up and go off alternately.

- When the LED 1 in the touch **S21** is off.
 - The travel motors remain all the time in position 1 (normal speed).
- When the LED 1 in the touch **S21** is lighting.
 - During travel, the oil motors mounted to the travel gears now change automatically from normal speed to increased speed each time the terrain conditions allow it.
 - After changeover to position 2 (increased speed) the LED 2 illuminates.
 - Inversely, when ground conditions become difficult again, the travel motors automatically return to position 1 (normal speed). The LED 2 turns off.

The travel brakes

The travel drive of your machine is fitted with two different braking systems.

In the both systems, the releasing and the applying of the brakes occurs automatically when depressing and returning to neutral the travel pedals.

The hydraulic operating brakes

When the travel pedals are released, they automatically return to neutral position. This causes the hydraulic brakes valves **6** mounted to the travel motors to react and a rapid braking of the machine is achieved.



Caution!

Disengaging the travel pedals quickly causes the machine to halt abruptly. When ever possible, return the pedals to neutral progressively, in particular on machines which are equipped with very long working attachments or when they hold up a heavy load.

When these machines come to standstill too brutally, important forces of inertia are generated, which can endanger the stability of the machine.

The hydraulic brake valves also avoid overspeeding and run away of the machine when travelling down a slope.

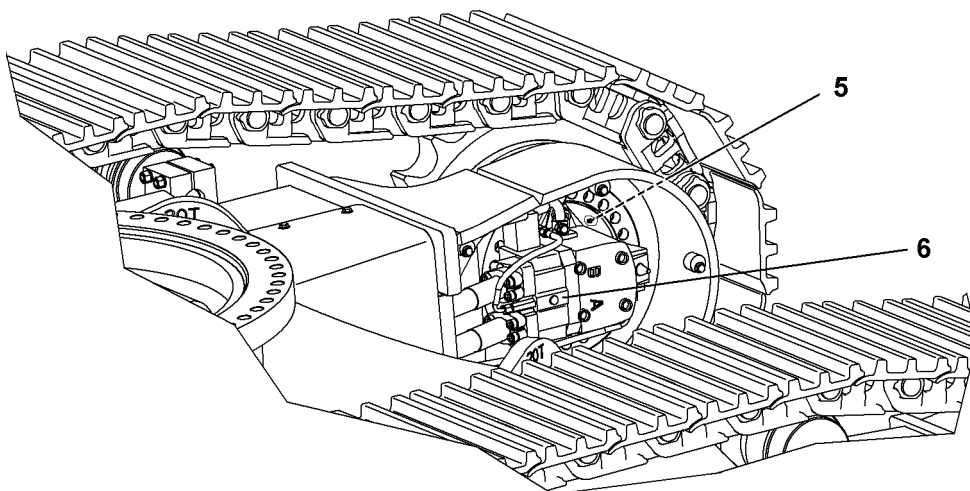


Fig. 3-67 Arrangement of mechanical brakes 5 and hydraulic brake valves 6

The mechanical stop and parking brake

A negatively acting, hydraulic operated multi-disc brake **5** is integrated in each travel gear.

When a travel pedal is actuated, hydraulic pressure builds up in the corresponding travel circuit and releases the brake. Inversely, when the travel pedal is returned to neutral position the pressure is annuled and the brake applies again.

Limit of gradeability



Danger!

The grade of the slope to travel across up or down must not exceed 35°. This limit of gradeability is valuable for a machine travelling straight down in front of the slope, with the uppercarriage aligned with the undercarriage and when the proper conditions (adherence, stability) of the ground allow this travel. This grade value only concerns the translation and not at all the work in slope. This grade value is valuable for a standard machine, with standard attachment and takes into account the hydraulic and mechanical powerlosses.



Note!

To know the maximal slope the machine can work in, contact the customer service because this value depends on the configuration of the machine. The stability values given in the technical datas of the machine (chapter 1.2 of this manual) are valuable only for an horizontal and firm level ground.

Travelling up

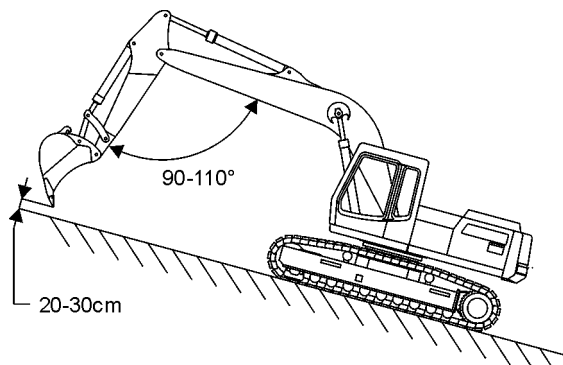


Fig. 3-68 Travelling up

- ▶ Position the attachment as shown on the picture.
 - The angle between boom and stick must be between 90° and 110°.
 - The tooth of the bucket must be oriented down at 20-30 cm of the ground.

Travelling down

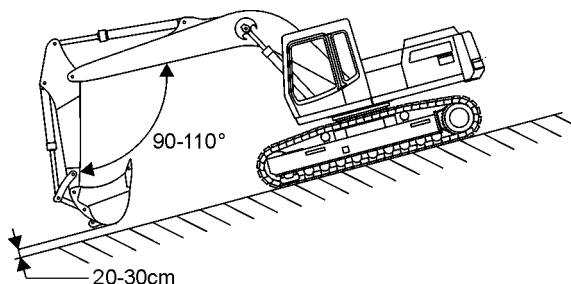


Fig. 3-69 Travelling down

- ▶ Position the attachment as shown on the picture.
 - The angle between boom and stick must be between 90° and 110°.
 - The tooth of the bucket must be oriented up with the bottom of the bucket at 20-

30 cm of the ground.

- ▶ Do not travel in fast speed.

3.4.2 Drive warning device (option)

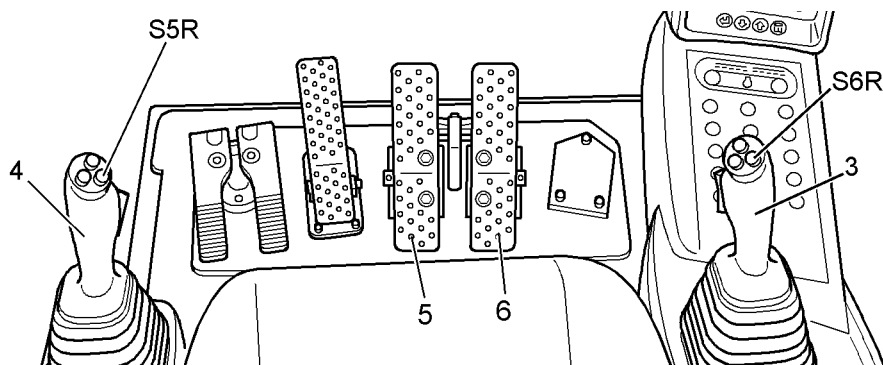


Fig. 3-70 Drive warning device

- ▶ 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 **S6R** on right-hand joystick **3**.
 - ↪ The drive warning device will switch off.



Caution!

If a magnetic system LIEBHERR AMERICA (LAM) is mounted, the drive warning device is controlled by the button **S5R** on left-hand joystick **4** instead of the button **S6R**.



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.

3.4.3 The uppercarriage swing movements

The swing movements of the uppercarriage are controlled by the left joystick **4**.

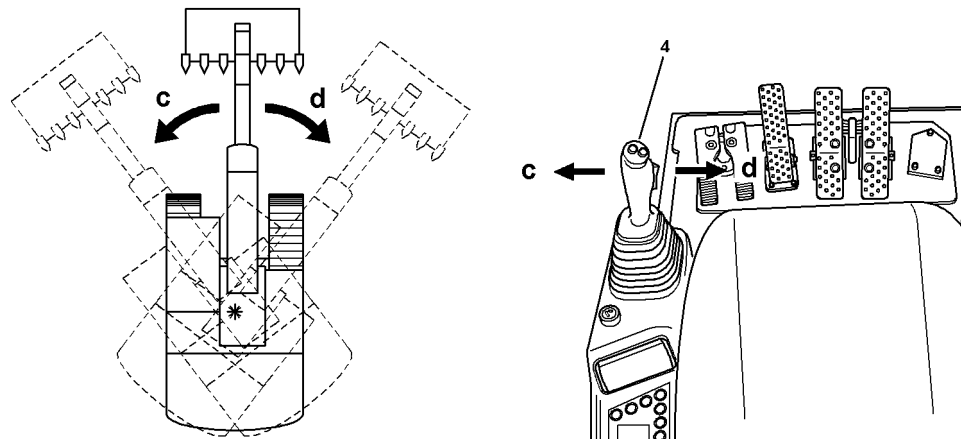


Fig. 3-71 Uppercarriage swing movements



Caution!

The joystick 4 functions described below refer to the **normal control, fitting out the machine at delivery**.and **according to ISO-standards**,
On machines equipped in addition with a special control system, and if this special control system is activated by the operator, the joystick functions correspond to the information on the label which is stucked on the side window of the cab and is specific to the installed special control system.

- ▶ Push the left joystick 4 to the left **c**:
↪ the uppercarriage rotates to the left.
- ▶ Push the joystick to the right **d**:
↪ the uppercarriage rotates to the right.

Braking the uppercarriage

The braking of the uppercarriage swing movements can be achieved via an hydraulic braking effect and also via a mechanical disc brake.

The hydraulic swing brake

- ▶ Let the left joystick 4 move back to neutral position.
↪ The hydraulically swing braking of the uppercarriage takes place. In normal working conditions, the braking efficiency is sufficient to bring the uppercarriage to a standstill rapidly.
- ▶ Move the left joystick 4 in the opposite direction.
↪ The maximum hydraulic braking action of the uppercarriage is achieved.

The mechanical swing brake

The mechanical brake is a negatively acting multidisc brake which is integrated in the swing gear. It allows to stop the uppercarriage in any desired position (for parking, when working on a slope, ...).



- ▶ Press the key **S17** a first time:
↪ the swing brake is switched in the automatic operating mode,
↪ the LED beside the key is out.
- If no swing movement is actuated via the joystick, and if at the same time the uppercarriage is at standstill or respec. if the swing speed is decreasing and approaches standstill:
↪ the swing brake is applied, respec. it applies as soon as the uppercarriage

LFR/en/Edition: 07 / 2011

speed passes under a given limit value.



Caution!

The brake only applies when the uppercarriage is near standstill.

In order to stop the uppercarriage when working on a slope, first reduce the uppercarriage speed by braking with joystick **4**.

Move the joystick **4** back to neutral position only after the brake has applied.

- If a swing motion of the uppercarriage is actuated while the swing brake is applied:
 - ↪ the swing brake is released.
- ▶ Depress the key **S17** again:
 - ↪ the swing brake is applied,
 - ↪ the LED beside the key **S17** illuminates.

Emergency stop of the uppercarriage swing motion

The swing brake can be applied independently of the uppercarriage RPM while switching the button **S17** back to position «applied».



Caution !

Only perform the braking via button **S17** of the swinging uppercarriage as an exception, i. e. in emergency cases, since it causes fast abrasion of the brake discs.

To check the mechanical swing gear brake

- When the uppercarriage is stationary.
 - ▶ Press the key **S17**:
 - ↪ **the mechanical swing brake** is applied,
 - ↪ the LED in the key **S17** illuminates.
 - ▶ Push the left joystick **4** to the right and then to the left as far as the stop.
 - ↪ If the swing brake function is in order, the uppercarriage does not start swinging.

The positioning swing brake (option)

The positioning swing brake allows a progressive and sensitive control of the mechanical disc brake.

This brake offers a significant advantage in some specific applications, as an example when working on a slope, digging a channel, lifting loads,



Note!

Increased wear.

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

Using this brake to stop the uppercarriage running at the full swing RPM is not permissible since this would result in a quick abrasion of the brake discs.

- ▶ In any case, first use the hydraulic braking to greatly reduce the speed of the uppercarriage.

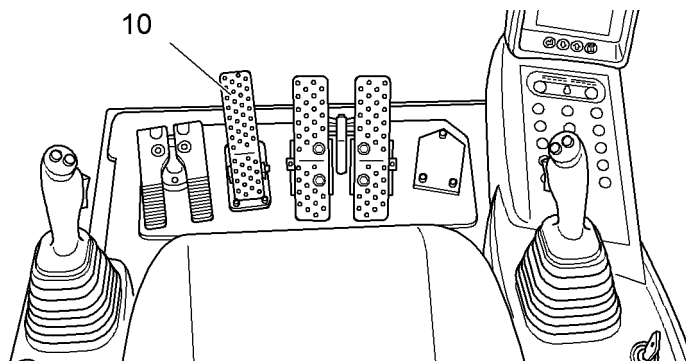


Fig. 3-72 Positioning swing brake pedal

- ▶ Press the pedal **10** when the uppercarriage is near standstill:
 - ↳ The uppercarriage can be stopped precisely and progressively in the desired position.

3.4.4 Working position

- Every time it is possible, work on a level, flat and firm ground. If necessary arrange the working place and free it of obstacles.
- As a general rule, work with the attachment over the idler wheels.

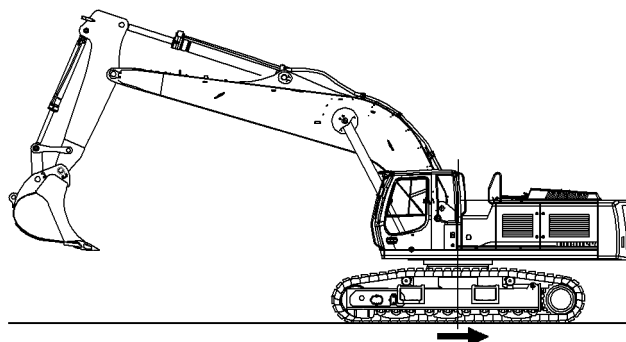


Fig. 3-73 Working position of the machine



Note!
Drive backwards when you are working lengthwise with a backhoe bucket attachment.

3.4.5 Working attachment control



Caution!
The joystick functions described below refer to the **normal control, fitting out the machine at delivery, and according to ISO-standards**,
On machines equipped in addition with a special control system, and if this special control system is activated by the operator, the joystick functions correspond to the information on the label which is stucked on the side window of the cab and is specific to the installed special control system.

Control of the stick cylinder

The stick cylinder is operated using the left joystick 4.

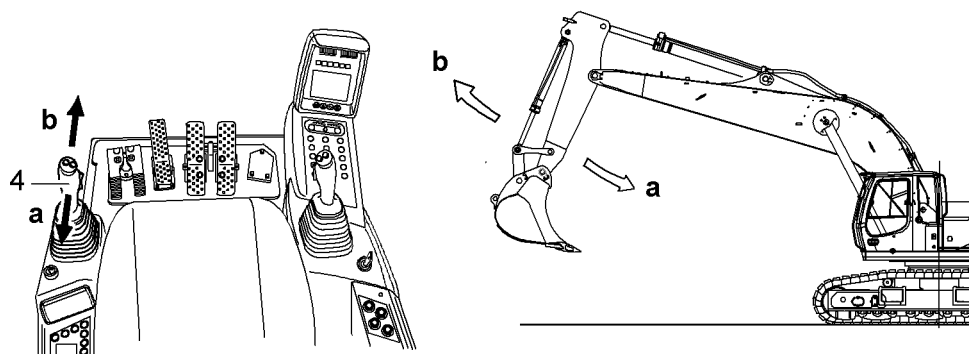


Fig. 3-74 Stick cylinder control

- ▶ Pull the joystick 4 back (a).
↪ The stick is moved in.
- ▶ Push the joystick 4 forwards (b).
↪ The stick is moved out.

Control of the boom cylinders

The boom cylinders are operated using the right joystick 3.

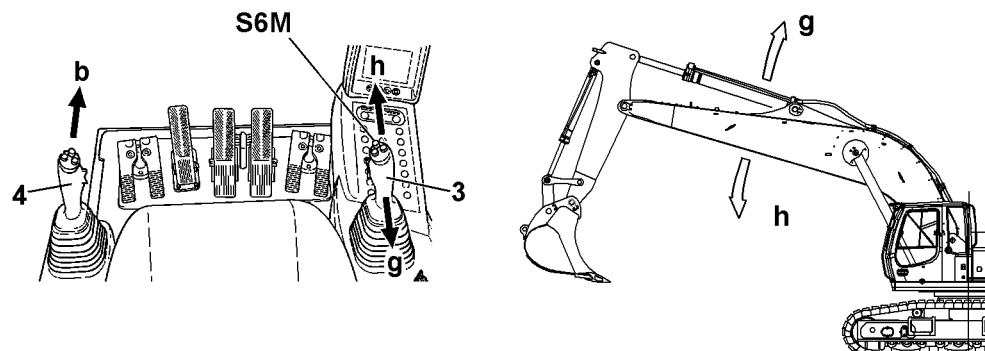


Fig. 3-75 Boom cylinders control

- ▶ Pull the joystick 3 back (g).
↪ The working attachment is raised.
- ▶ Push the joystick 3 forwards (h).
↪ The working attachment is lowered.

Float position of the boom with shovel attachment

When operating a machine fitted with a shovel attachment, it is possible to turn on the float position of the boom cylinders. Therefore:

- ▶ push the right joystick 3 forward h.
- ▶ press the touch **S6M** at the top of the handle of the right joystick 3 and keep it depressed.
 - ↪ the float position of the boom cylinders is now engaged,
 - ↪ the working attachment can move up and down freely, depending on the back-lash opposed by the excavated material.

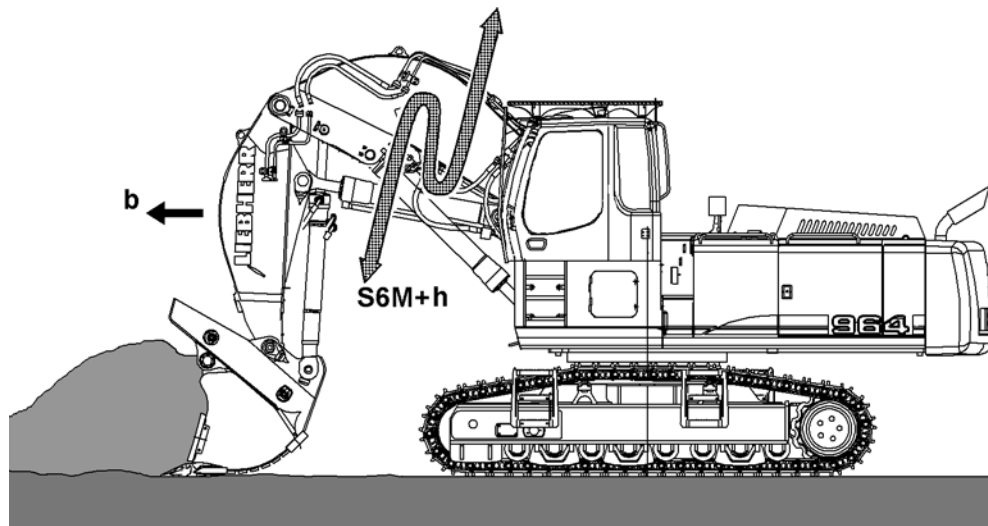


Fig. 3-76 Float position of the boom cylinders with a shovel attachment



Note!

Turning on the float position of the boom cylinders can, depending on the kind of the material, facilitate the penetration of the shovel in the heap to be hollowed. When leveling out the working area, the bucket follows automatically the solid ground contour during the stick extension (movement "b" controlled by the left joystick 3), and the shoveling up of the loosen material is made easier.

Control of the bucket or grapple cylinders

The bucket cylinder as well the grapple cylinders are controlled by the right joystick 3.

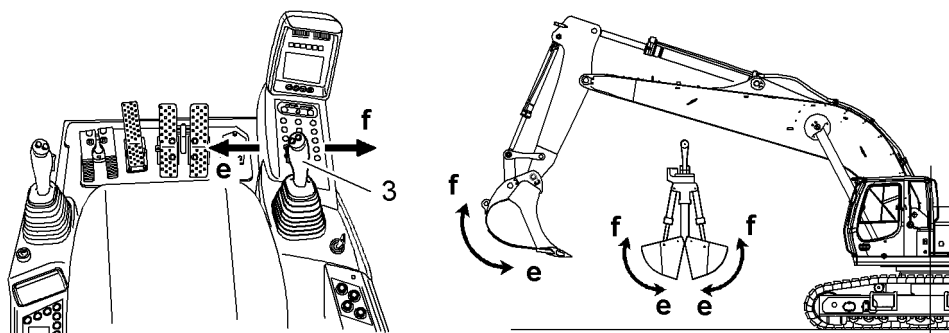


Fig. 3-77 Operation of the bucket or grapple cylinders

- ▶ Push the joystick 3 to the left e.
↪ The bucket is tilted in, or the grapple closes.
- ▶ Push the joystick 3 to the right f.
↪ The bucket is tilted out, or the grapple opens.



Danger

Never allow anybody to guide the grapple by hand!

Combined movements

A diagonal movement of the joystick combines the corresponding movements of the working attachment. This makes it possible for all attachment movements to be actuated at the same time.

3.4.6 Lowering the working attachment with the engine shut down

In an emergency, the attachment can be lowered also when the engine is not running.



Note

The attachment can be lowered thanks to a pressure accumulator mounted to the control oil unit. Due to the small volume of this accumulator only a limited number of movements can be actuated by the pilot control devices.

- ▶ Only operate the joysticks in the directions for lowering the attachment.

Only the movements resulting from the own weight of the attachment parts are possible.

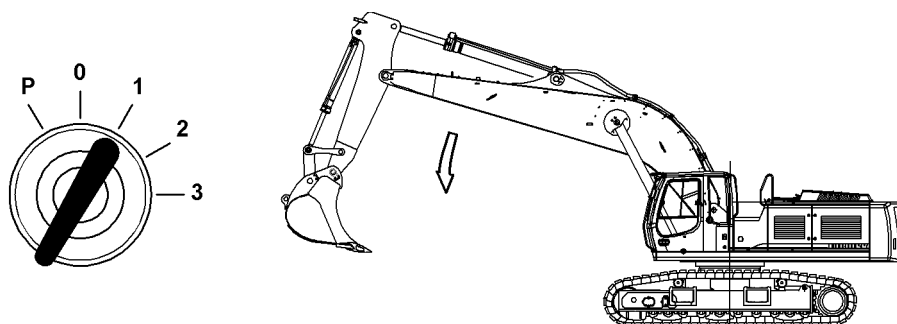


Fig. 3-78 Lowering the attachment with shut down engine

- ▶ Turn the ignition key to contact position 1.
- ▶ Actuate the desired movement(s) while deflecting the joysticks (eventually also the foot pedals in case of special attachment) until the equipment has lowered to the required position.

3.4.7 Rotating, tilting, locking and unlocking a working tool

An additional hydraulic circuit must be activated to operate some specific working tools such as:

- a rotating grapple (A),
- a rotating bucket (B),
- a hydraulic quick-change adapter (C).

The medium pressure circuit is activated via the touch **S19** on the main control unit.

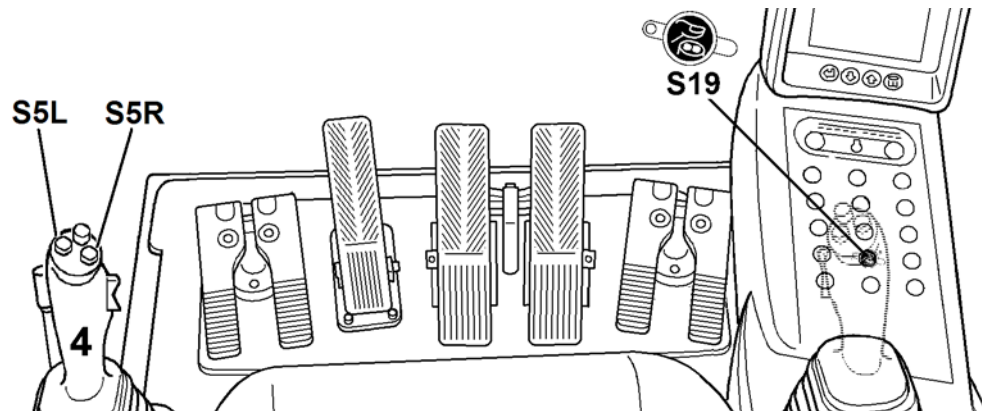


Fig. 3-79 Activation of the medium pressure circuit (S19) and actuation of the working tool (S5L/S5R)

The working tool is then actuated via the both push buttons **S5L** and **S5R** mounted at the top of the handle of the left joystick **4**.



- ▶ Press the touch **S19**.
 - ↪ The medium pressure circuit is activated.
 - ↪ The LED of the touch is lighting.
- ▶ Press the left push button **S5L** and keep it pressed.
 - ↪ The working tool is actuated to the left (the grapple is rotated to the left, or the bucket is swivelled to the left, or the locking pins of the hydraulic quick-change adapter are driving out, ...).

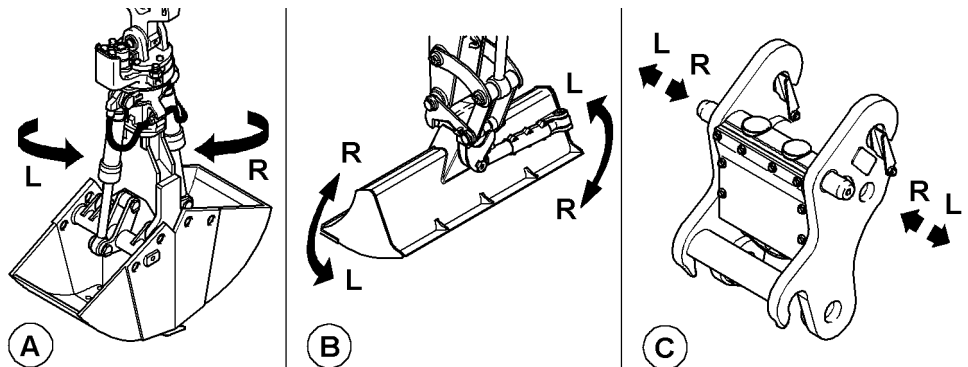


Fig. 3-80 Actuation of working tools

- ▶ Press the right push button **S5R** and keep it pressed.
 - ↪ The working tool is actuated to the right (the grapple is rotated to the right, or the bucket is swivelled to the right, or the locking pins of the hydraulic quick-change adapter are retracted, ...).

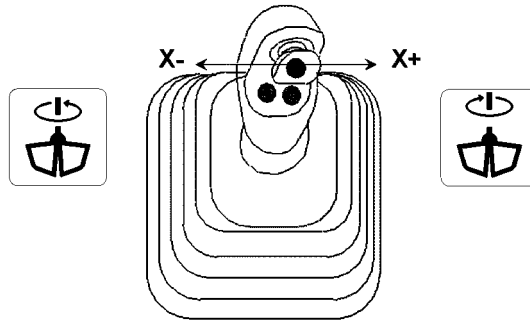
The movement of the working tool is stopped as soon as the push button S5L or S5R is released.

- ▶ Press the touch **S19** again.
 - ↪ The medium pressure circuit is deactivated and the working tool can not be actuated any more.
 - ↪ The LED of the touch goes out.



Notice!

With the option "Left joystick with proportional control" installed, the working tool can be actuated in a proportional way, while deflecting the mini joystick A185 on the left joystick to the left "X-" (resp. to the right "X+").

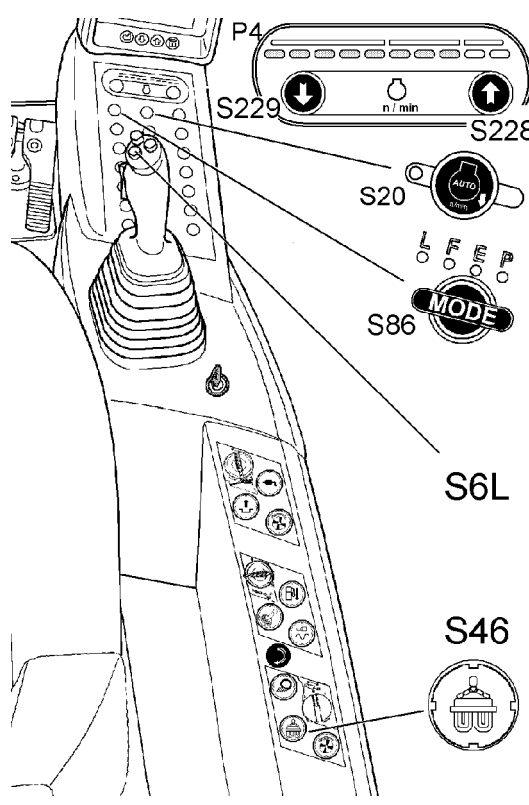


Caution!

On machines destined to the North American market, and which are fitted with a lifting magnet, the rotating device is controlled by the push buttons S6L and S6R in the handle of the right joystick 3. Also see the section "joysticks" in this chapter.

3.4.8 Lifting magnet control system (optional equipment)

A special circuit comprising an hydrostatic driven generator is installed as an option to supply the lifting magnet with the necessary electrical current. This special circuit is activated via the switch **S46**.



- ▶ Press the touch **S46** on the right rear control desk.
 - ↪ the control lights inside the button is lighting.
 - ↪ the generator is turned on.
 - ↪ the engine RPM is automatically set to a fixed value (level 8 on P4).
 - ↪ the engine RPM can no longer be changed via the touches **S228**, **S229** and **S86** (this to avoid a possible lost of the load due to a demagnetization of the magnetic plate when the RPM become to low).
 - ↪ the engine low idle automatic is deactivated and can no longer be turned on via touch **S20**.
 - ↪ The lifting magnet can now be controlled via the button **S6L** at the top of the right joystick handle.

Fig. 3-81 Lifting magnet control system

LFR/en/Edition: 07 / 2011



Danger!

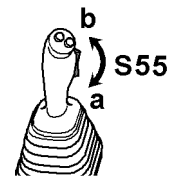
The magnet can lose its load in the event of a loss of current.

- ▶ Always ensure that no one is standing beneath the load.
 - ▶ Do not press pushbutton **S6L** unintentionally.
-
- ▶ Press the push button **S6L** at the top of the right joystick handle.
 - ↖ The magnetic plate of the magnet is magnetized,
 - ↖ the lifting magnet attracts and picks up the iron materials
 - ▶ Press the push button **S6L** again.
 - ↖ The magnetic plate of the magnet is demagnetized,
 - ↖ the iron materials are released by the magnet and fall down.



Caution!

For the machines with US Version (machines destined to the North American market), the lifting magnet is energized and de-energized by the rocker switch **S55** in the handle of the left joystick **4** instead of the push button **S6L**.



- ▶ Press the rocker switch **S55** up (b) to turn on the magnet.
- ▶ Press the rocker switch **S55** down (a) to release the load from the magnet.

3.4.9 Control of additional attachments via the additional pedals



- ▶ If necessary, select the mounted additional attachment in the menu "Set Option".

This selection determines pressure and oil flow adjustment in the hydraulic circuit, depending on the function and the size of the auxiliary user. A wrong selection could lead to damage or unsatisfactory operation of the additional attachment.



Notice!

The selection of the attachment does neither have an influence upon the allocation of the pedals, nor lead to the switching-off of pedal function.



Danger!

Additional pedals may have many functions. They are described on the operating sign in the cab, on the window on attachment side.

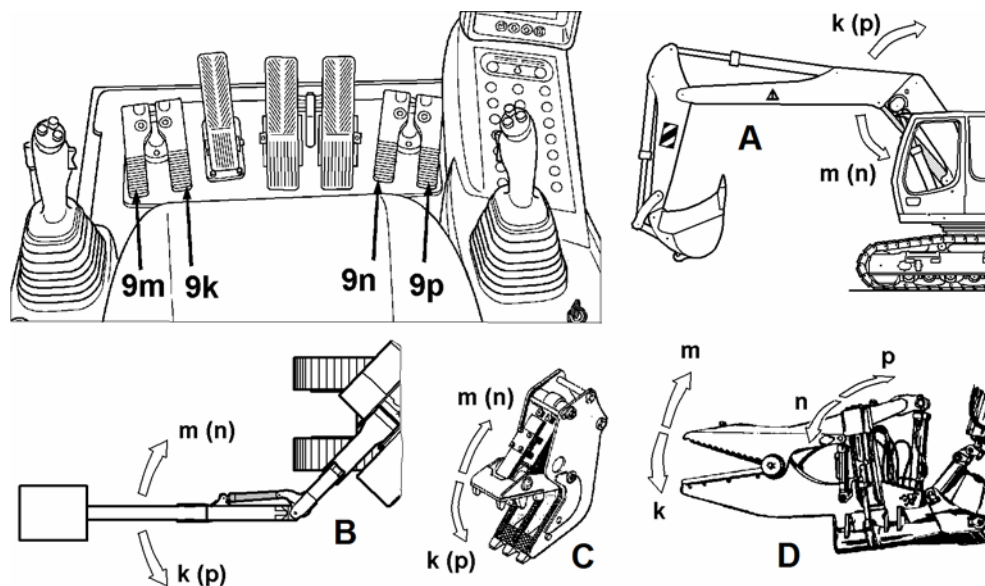
- ▶ Always check pedal's functions when you start up a machine fitted with additional attachments.

Control of the other additional attachments

The additional pedal **9m/9k** allows to control optionally mounted additional attachments. These additional attachments are, for example:

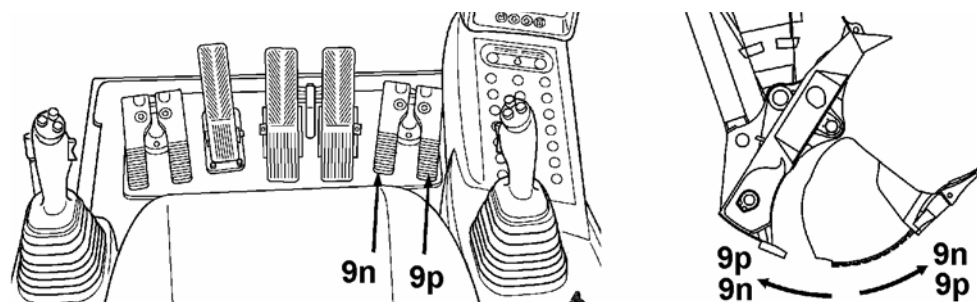
- a hydraulic adjustable boom **A**
- a hydraulic offset boom **B**
- a concrete breaker or a rock crusher **C**
- a scrap shear **D**

When two of these additional attachments are mounted simultaneously on the machine, the first is controlled by the left double pedal **9m/9k**, and the second is controlled by the right double pedal **9n/9p**.



- ▶ Push down the foot pedal **9m** (or **9n**).
↻ The cylinder of the additional user is retracted.
- ▶ Push down the foot pedal **9k** (or **9p**).
↻ The cylinder of the additional user is extended.

Control of a bottom dump shovel



For the excavators R934C - R944C - R954:

- ▶ Push down the foot pedal **9p**.
↻ The shovel flap closes.
- ▶ Push down the foot pedal **9n**.
↻ The shovel flap opens.

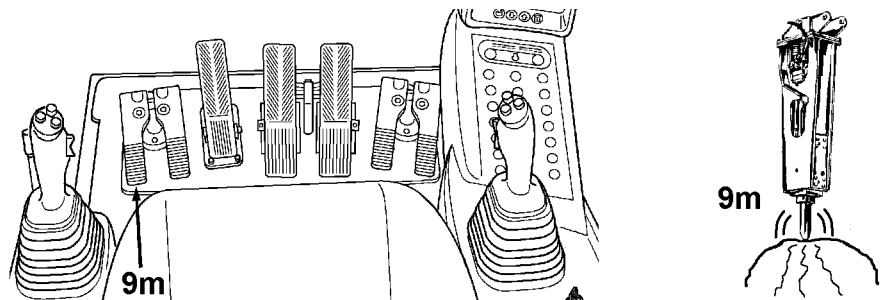
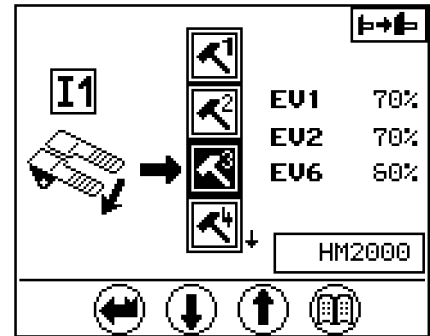
For the excavators R964C - R974C:

- ▶ Push down the foot pedal **9n**.
↻ The shovel flap closes.
- ▶ Push down the foot pedal **9p**.
↻ The shovel flap opens.

Control of the hydraulic hammer

- ▶ Select the mounted hydraulic hammer in the menu "Set Option"
 - ↳ The designation appears in the lower right corner of the screen (for example HM 2000).

In case of a doubt, contact your supervisor to obtain this information.



- ▶ Push down the foot pedal 9m.
 - ↳ The hydraulic hammer is activated.



Note!

If the machine is used frequently or for long periods for hammer work, the hydraulic oil will be more contaminated than in usual conditions.

- ▶ Adapt the maintenance intervals for hydraulic oil and for return filter cartridges to the work in heavy dust conditions.

3.4.10 Commutation of control for an additional attachment (option)



Danger!

Wenn the commutation of the control is turned on, the correspondence between the controls and the working movements is changed.

There is a danger of accident due to an unintentional movement by a not or bad informed machine driver.

With the key removed from the switch **S114** or **S195**, the machine can be operated only with the usual control system, installed at machine delivery.

It is the responsibility of the owner of the machine to decide which operator and for which works must or is approved to operate the machine with the activated special control system.



Caution!

- ▶ Check out the functions of the additional controls when starting the machine, and especially when a commutation of control is activated.

Standard control

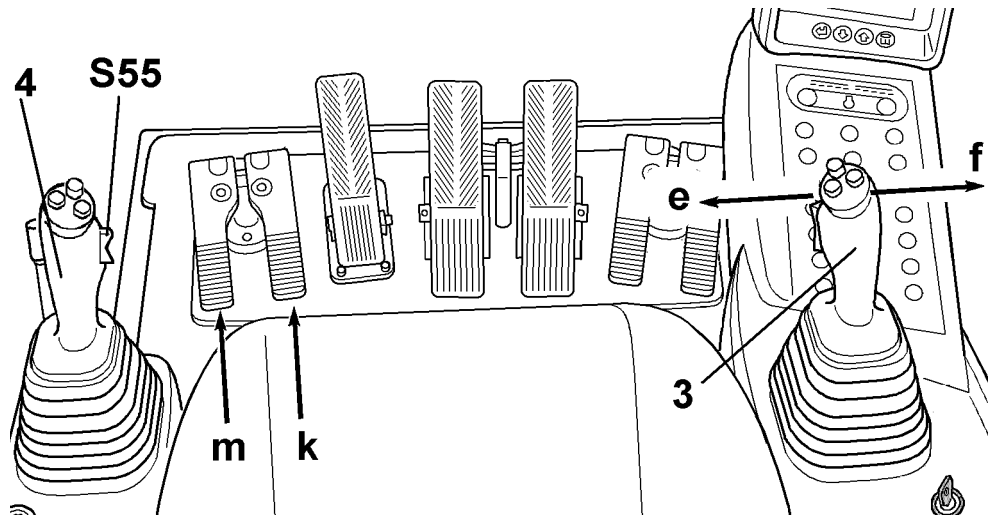
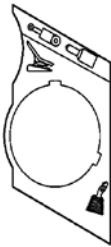


Fig. 3-82 Commutation of standard control for an additional attachment

The additional attachment can be operated alternatively with the left double pedal or with the right joystick. The commutation of control can be activated with the key switch **S114** on the rear right control desk.



- ▶ Turn the key switch **S114** to select the **joystick position**.
 - ↗ The additional attachment is now operated with the right joystick (movements to **e** and **f**).
 - ↗ The bucket tilt function is now operated with the left double pedal (**m-k**).
 - ↗ The key is locked in the switch **S114**.
- ▶ Turn the key switch **S114** to select the **foot pedal position**.
 - ↗ The additional attachment is now operated with the left double pedal again.
 - ↗ The key can be removed from the switch **S114**.

Proportional control

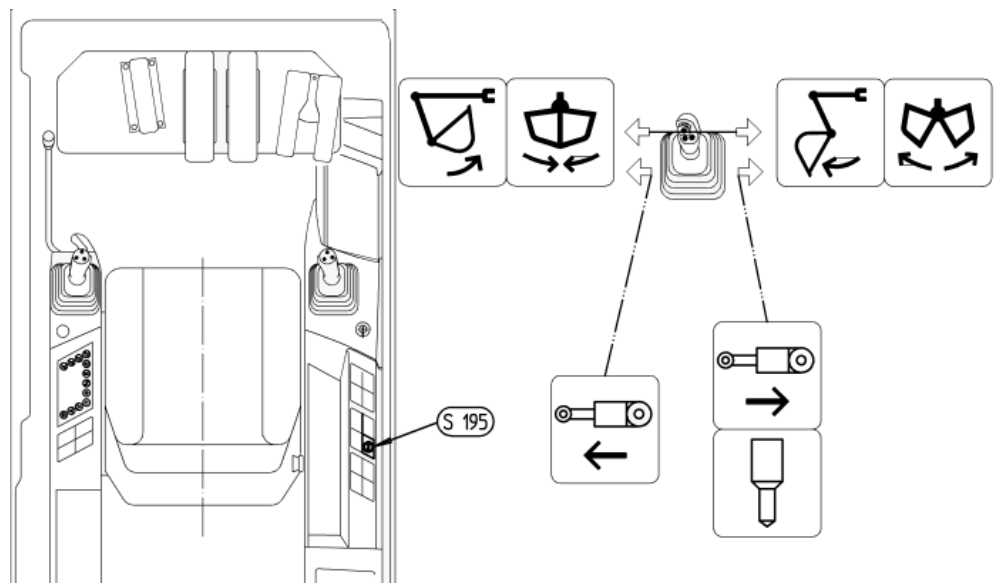
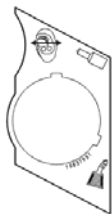


Fig. 3-83 Commutation of proportional control for an additional attachment

The additional attachment can be operated alternatively with the right mini joystick

or with the right joystick. The commutation of control can be activated with the key switch **S195** on the rear right control desk.



- ▶ Turn the key switch **S195** to select the **joystick position**.
 - ↪ The additional attachment is now proportionally operated with the right joystick (movements to **e** and **f**).
 - ↪ The bucket tilt function is now operated with the right mini joystick (movements to **X-** and **X+**).
 - ↪ The key is locked in the switch **S195**.
- ▶ Turn the key switch **S195** to select the **mini joystick position**.
 - ↪ The additional attachment is now proportionally operated with the right mini joystick again.
 - ↪ The key can be removed from the switch **S195**.



Note!

Wenn the shears are directly mounted on the boom, the commutation is activated via the switch **S31**.



3.4.11 Cut off by end switches of attachment movements (option)

Function

On some specific attachments, or on attachment showing particular cinematic capacities (for example on industrial attachments) certain movement(s) may be stopped automatically by electrical end switches.

The installation of a cylinder cut off can fulfill different purposes :

- It can serve to avoid the repeated stopping over the mechanical buffers, which would cause damage to hydraulic cylinders or to main structures.
- Frequently, the cylinder disconnection serves to restrict the possible working area and in particular:
 - the working height (as an ex. when working under a warehouse roof, under electrical overhead lines, ...).
 - the maximal reach (as an ex. to avoid the possible development of high reaction forces in the completely stretched position of the attachment).
 - the minimal reach (as an ex. so that, when retracting an industrial stick, the load taken up in the grapple cannot come into the range of the operator's cab and damage it).



Danger!

The disconnection of a cylinder movement does not constitute a safety device! It must only be considered as an assistance to the driver during actuation of a movement near a zone to be avoided !



Caution!

Avoid fast movements of an attachment part, if you move it in the vicinity of a cut off point.

With fast movements, the sudden disconnection can cause a rocking motion of the machine or a strong pendular movement of the attached grapple.

**Danger!**

In some cases, the equipment can enter the zone normally prohibited by the proximity switches (and for example arrive too close to the cab), due to:

- the oscillations of the working tool (for ex. a grapple) and because of the variation of its dimensions between the open position the closed position.
- Because of the inertia of the attachment at the disconnection. The stopping distance can increase by 0,5 m according to the temperature of oil or the type of equipment and 1,0 m additional following the speed and/or the load in the working tool.

You must keep a safety margin from at least 1.5 m to the dangerous position.
The precision of the setting lies in the responsibility of the machine operator!

**Note!**

A movement is interrupted only in the direction which corresponds to the crossing of the cut off point to enter the prohibited zone.

The movement in opposite direction which allows to leave the danger area remains always possible.

Adjustment of the cut off point

Prerequisite:

- ▶ Bring the attachment part whose movement has to be restricted into the position where the cut off of movement must occur.

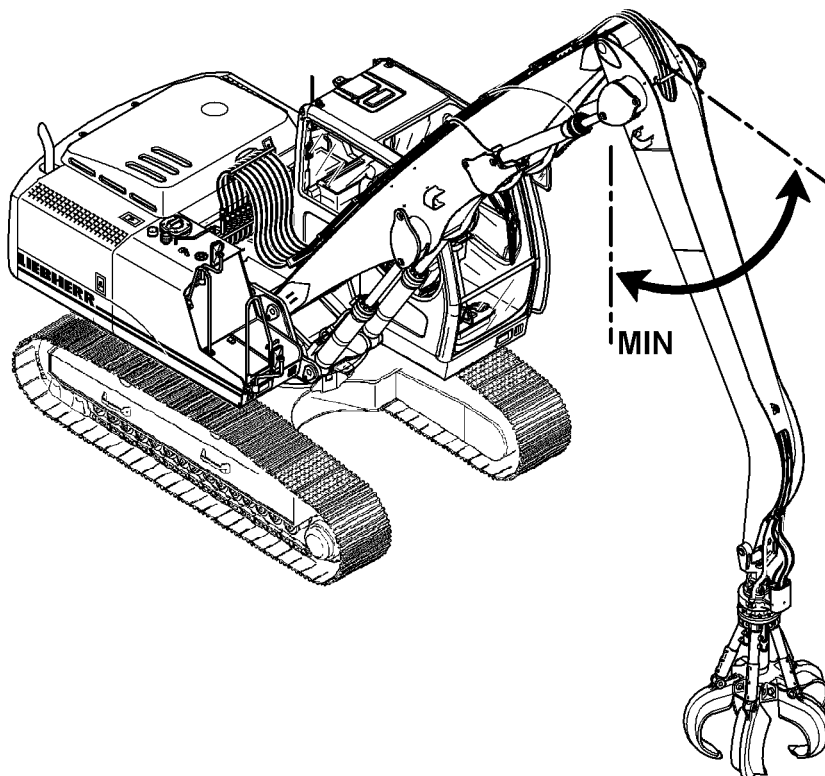


Fig. 3-84 Cut off position of an industrial stick

Setting:

- ▶ Loosen the screws 1.
- ▶ Shift the slide 2 so that its end just enters the induction zone of the proximity sen-

sor 3.

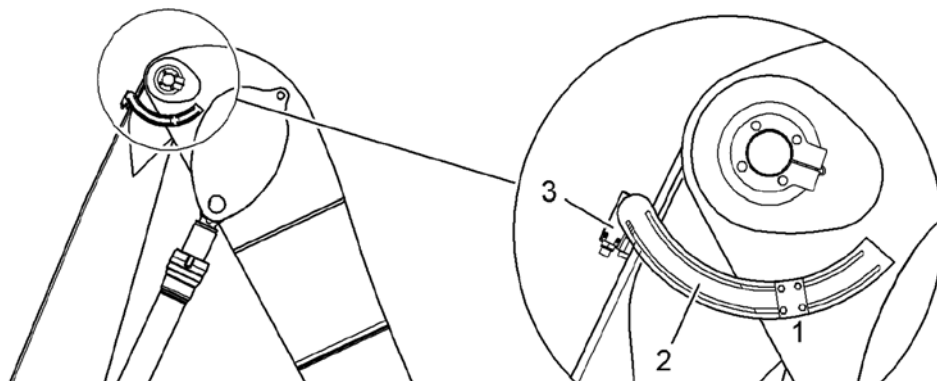


Fig. 3-85 Setting of the proximity switch

- ▶ Retighten the screws 1.
- ▶ Check the position for which the cut off of the cylinder movement occurs.
- ▶ If necessary repeat the adjustment procedure and check the cut off position again.



Note !

Should in the cut off position, the slide and the limit switch be in a difficult to reach raised position, then the adjustment can also be done with the equipment in a stretched and close to the ground position, first in an approximate way and afterwards while correcting by successive approaches this adjustment until the point of cut off matches exactly.

Unlocking of movements cut off



Fig. 3-86 Switch for the unlocking of attachment movements cut off

An attachment movement cut off can be unlocked while turning the key switch **S54** in the rear right control desk. Thus it remains possible to move a disconnected attachment part beyond the cut off point.

- Unlocking of a movement is possible only if the movement has already been cut off by the end switch.



Danger!

The displacement of attachment parts within a range normally prohibited by a cylinder cut off can bring to a situation presenting a danger for injury of persons and/or damage of material.

The operator is in all the cases responsible for the accidents which can occur when the attachment is working inside the zone of danger while keeping unlocked a cylinder movement cut off.

LFR/en/Edition: 07 / 2011



- ▶ Turn the key switch **S54** turned to the right (position **I**).
- ▶ Tilt up or down the rocker switch **S55** mounted to the left joystick handle.
 - ↳ the movement cut off is unlocked, it remains possible to move the attachment inside the prohibited zone as long as the switch **S55** is kept depressed.

Should a special attachment comprise two different automatic stops of movement, so the key switch **S54** must be turned to the left (position **II**) to be able to release from the second automatic limitation.

No unlocking via the rocker switch **S55** is possible with the switch **S54** in neutral (position **0**).



Note!

On machines destined to the north-American market and also fitted with a lifting magnet controlled via the rocker switch **S55**, the left push buttons **S5L** at top of the left joystick handle must be used to unlock the limitation.

3.4.12 Use of the excavator for lifting loads overhead

Under "lifting loads overhead" it is understood the lifting, transporting and unloading of loads requiring a securing method (ropes, chains, or other permitted lifting accessories) 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!

An hydraulic excavator may only be operated for lifting loads overhead if all the prescribed safety devices are present and functioning correctly.

In accordance with European standard EN 474-5, and so to guarantee the protections of the persons attaching or removing the loads during lifting operations, the machines used for lifting loads overhead must be equipped with the following safety devices:

- **a load hooking system ensuring the safe attaching and removing of the loads (optional equipment)**
Safe hooking systems include for example lifting hooks which are mounted in place of the bucket. Safety lifting hooks welded directly to the bucket are also allowed.
- **an overload warning device (optional extra)**
The overload warning device must alert the machine operator visually or acoustically if the permitted load value has been reached or exceeded, according to the rated lift capacity chart.
- **a boom lowering control device** (such as load check valves) to prevent unintentional lowering or dropping of the boom because of the weight of the load, which could happen if a line in this hydraulic circuit suddenly develops a leak (for example, should a hydraulic line break or a hose burst,...).
This boom lowering control device must correspond with the requirements of ISO 8643.
Such a boom lowering device can be installed as an option on all models up to R924C, it is serially installed on all models R934C and above.
- **a rated lift capacity chart** (commonly called load chart), attached inside the cab and within the view of the operator..

If the points referred to above are not or are only partially fulfilled, the machine may not be used for lifting loads overhead.

Every LIEBHERR hydraulic excavator can be fitted with all the safety devices required for lifting loads operation.



Danger!

- Only employ sling ropes and accessories which are permitted for lifting operation, regularly checked and in good condition.
- No person may fasten or unfasten a load without approval of the operator and this person may only approach the load from one side. The operator may only approve this action when the excavator has stopped and the attachment is not moving.
- Never lift loads over people.

3.4.13 Overload warning device (Option)

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 dismantled.

Always refer to the load chart, and make sure which are the attachment parts whose weights are considered or not in the indications of the rated lift capacity chart.

As an example, if the weight of the bucket is considered in the lift capacity chart and the bucket is dismantled for the lifting works, then the lifting capacities can be increased by the weight of the bucket.

In the same way, if the bucket tilt cylinder, the shifting lever and the connecting rod are dismantled even though their weights are considered in the lift capacity chart, then the indicated lifting capacities can be increased by the weights of these parts.

With the specified load, the machine can be rotated from 360° on even and horizontal ground.

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 the overload warning device



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.

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.



Caution!

This is only a functional test of the warning system (qualitative test), but it does not mean that the adjustment is correct.

For this reason, the overload device must in addition be checked by a professional in accordance with the testing and setting information provided in the service manual (quantitative test):

- before the first use of the overload warning device,
- each time it is required by the locally applying regulation for lifting operation.

Deactivation of the overload warning device



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.

3.4.14 Hydraulically adjustable cab (option)

A hydraulically adjustable cab is an auxiliary device enabling the cab to be adjusted either in height or in inclination.



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.

- The hydraulic adjustment of the cab is possible when the machine is ready to operate, with the safety lever pushed up and the engine running.

The hydraulic adjustment is controlled via the rotary switch **S200** on the right side control panel.

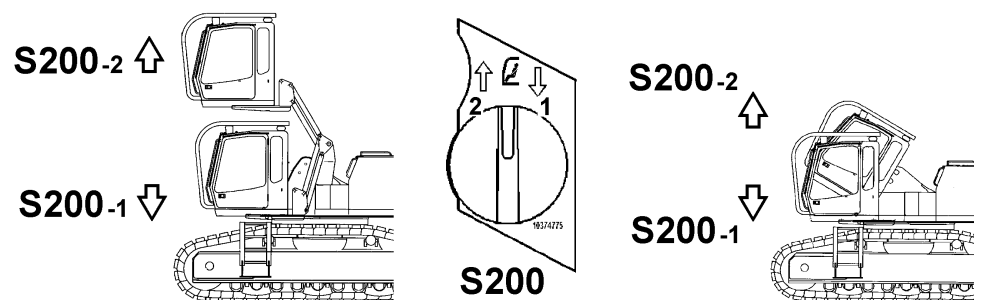


Fig. 3-87 Hydraulic adjustment of the cab

Raising the driver's cab:

- ▶ Turn and keep turned to the left the rotary switch **S200**.
 - ↪ the driver's cab raises, as long as the rotary switch **S200** is not released.

Lowering the driver's cab:

- ▶ Turn and keep turned to the right the rotary switch **S200**.
 - ↪ the driver's cab is lowered, as long as the rotary switch **S200** is not released.

Emergency operations

If the control of the hydraulically adjustable cab is lost due to a trouble in the engine or another defect, it remains possible to lower the cab thanks to an emergency function.

The emergency lowering can be controlled from two different places:

Emergency lowering from inside the cab:

From the inside of the cab it is possible to engage the emergency lowering procedure using a shutoff valve located on the floor of the cab under the right control panel.

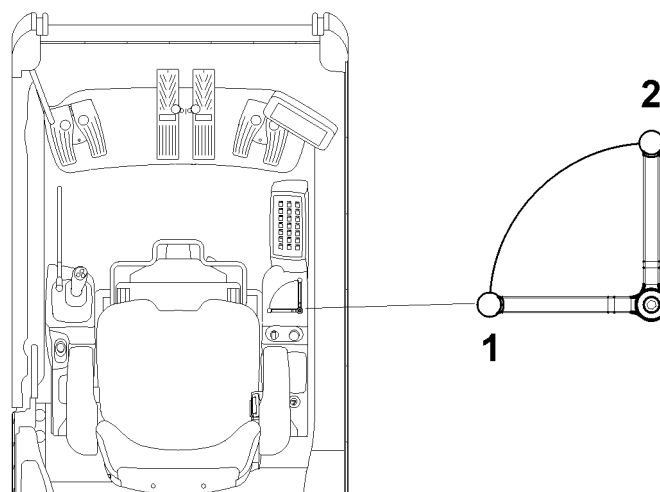


Fig. 3-88 Shutoff valve in the cab

- ▶ Turn the shutoff valve into position 2.
 - ↪ the driver's cab lowers as long as the shutoff valve is maintained in position 2.
- ▶ Return the shutoff valve into position 1 immediately after an emergency lowering.



Notice!

The driver's cab cannot be raised as long as the valve is in position 2.

Emergency lowering from outside:

From the outside of the cab it is also possible to engage the emergency lowering procedure using a shutoff valve located on the rear of the cab lifting device.

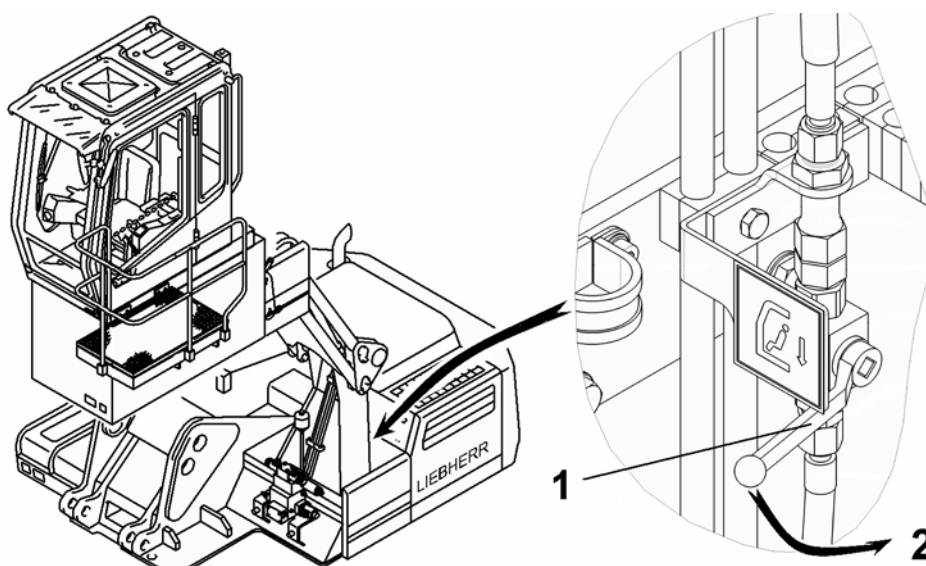


Fig. 3-89 Shutoff valve on the rear of the cab lifting device

**Danger!**

Danger of crushing.

- ▶ Ensure that nobody 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.

- ▶ Turn the shutoff valve into position **2**.
 - ↳ the driver's cab lowers as long as the shutoff valve is maintained in position **2**.
- ▶ Return the shutoff valve into position **1** immediately after an emergency lowering.

**Notice!**

The driver's cab cannot be raised as long as the valve is in position **2**.

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.

Cab adjustable on sliding rails (option)

With this specific execution, the height adjustable cab can be moved up and down vertically thanks to a height adjusting device moved by chains.

**Notice!**

The safety recommendations as well the information of the previous paragraphs concerning the cab height adjustment and the emergency lowering from inside the cab remain valid for this particular hydraulically height adjustable cab on sliding rails.

Only the procedure for emergency lowering the cab from the outside is different.

The cab can in this case be emergency lowered via the touch **S79** mounted at the rear of the lifting device **15**, and not using a shutoff valve as previously described.

Emergency lowering from the outside of the cab:

- ▶ Press the touch **S79** and keep it pressed.
 - ↳ the driver's cab lowers due to its own weight, as long as the touch **S79** is kept depressed.

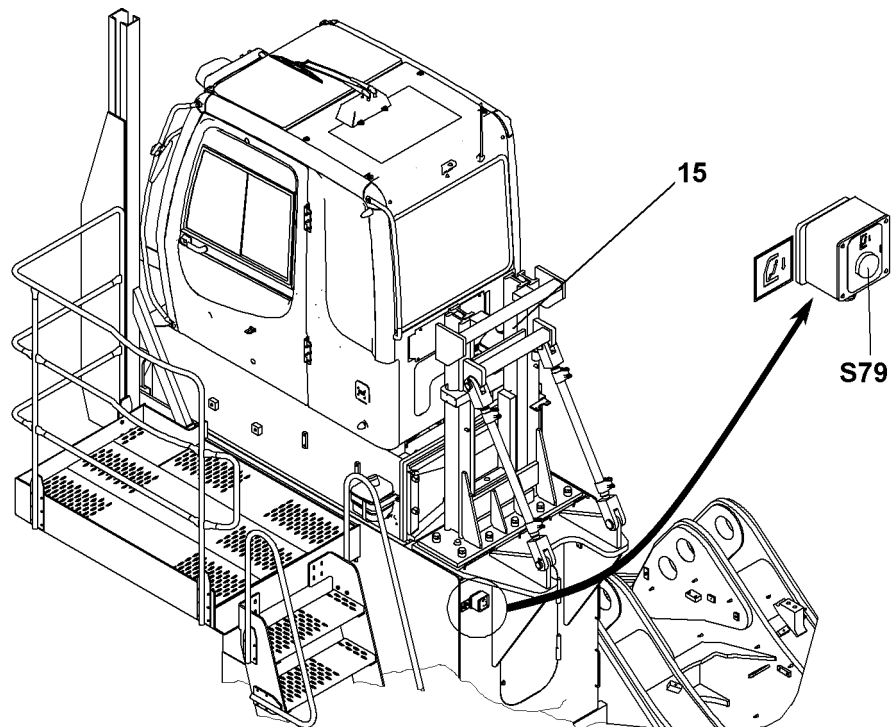


Fig. 3-90 External push button for emergency lowering

3.5 Operating the excavator in safety modes

3.5.1 Board E52 for safety mode of Diesel engine & servo control

The safety board E52 is situated at the rear end of the right side control desk. Thanks to this printed board, the excavator can, in case of a failure in the main electronic circuit, be maintained operating temporarily and with some restrictions.

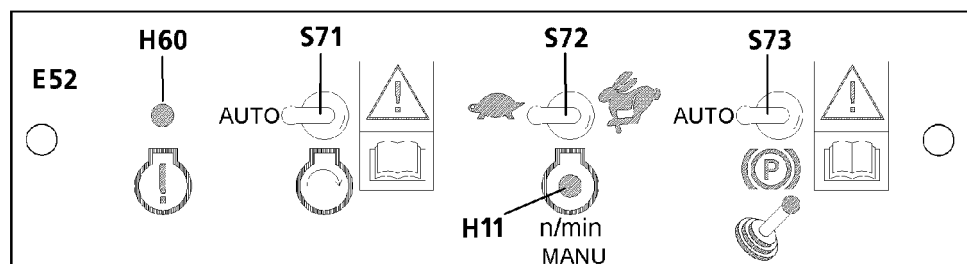


Fig. 3-91 Control board for safety operation E52

E52	Printed board for safety operation	S71	Switch / engine start in safety mode
H11	Warning light / Diesel engine in safety mode	S72	Switch / RPM selection in safety mode
H60	Warning light / operating error on Diesel engine with safety mode turned on	S73	Switch / servo pressure circuit in safety mode

Starting the Diesel engine in safety mode

In normal operation, the engine is started via the main electronic circuit when the ignition key is turned to start position.

In case the engine can no longer be started or kept running due to troubles in the control electronics, it can be started in safety operation via the starting switch S71

- ▶ Turn the ignition key in start position and at the same time push the safety start switch S71 to the right.
- ▶ Keep the switch pushed to the right until the engine starts
 - ↪ The warning light **H11** turns on.
 - ↪ The symbol **S71a** is displayed on the screen.
 - ↪ The engine is now operating in safety mode.



Safety operation of the Diesel engine

The engine can also be switched into safety operation automatically, as an example consecutively to a communication default in the control system.

In safety operation, the engine works with reduced output in comparison with the normal operation.

In safety operation the stop of the Diesel engine is achieved just like in normal operation, while turning back the ignition key to the "off" position.

It is not possible to return to normal operation when the engine is running, the rocker switch S71 must be tilted back from safety operation into normal operation (position AUTO) only when the excavator is turned off.



Notice !

In safety operation, the communication between the electronic control box of the engine and the main circuit of the excavator may be no longer possible. The engine operating error codes are in this case no longer displayed on the screen.



The occurrence of an operating error of the engine is then indicated as follows:

- the red warning light H60 lights on,
- a buzzer in the cab begins to sound.
- the error code E525 appears on the monitoring display.



Caution!

In case the warning light H60 lights up, the operator must shut the engine down as soon as possible and recognize which error has occurred. It's the operator's own responsibility to decide if the machine can be maintained operating or not!

In safety operation the following functions remain available:

- the automatic engine power reduction in case of overheating of the engine coolant or of the charge air.
- the memorization of the occurring engine faults into the inner error memory of the control box of the engine.

At the opposite, the following functions are no longer operative:

- the automatic engine shutdown in case of low lube oil pressure.
- the automatic engine shutdown when the maximum permitted coolant or charging air temperature has been exceeded.

Diesel engine RPM adjustment in safety mode

In normal operation, the desired value for the engine RPM is entered via the buttons S86, S228 and S229, and the engine speed is controlled in consequence by the electronic system of the machine.

If the engine has been started in safety mode via the rocker switch S71 so it can be operated only with two different RPM values. The commutation between the two values is achieved via the switch S72.

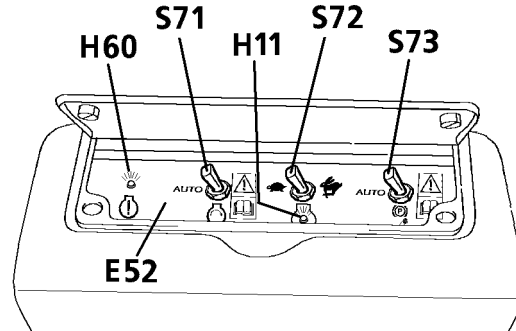


Fig. 3-92 Emergency control of the engine RPM

- ▶ Manually choose one of the values:
 - with the switch **S72** tilted to the left, the engine runs at the lower safety RPM.
 - with the switch **S72** tilted to the right, the engine runs at the upper safety RPM..



Notice !

When the engine is switched automatically into safety operation, the current engine speed is maintained as long as the engine is not shutdown.

Safety operation of the servo control circuits

During normal operation, the servo pressure supply to the swing brake and to the joysticks and pedals is controlled over the electronic circuit of the machine.

While tilting the switch S73 in safety position, this servo pressure supply can be enforced, and is maintained even in case of a trouble in the normal control circuit.

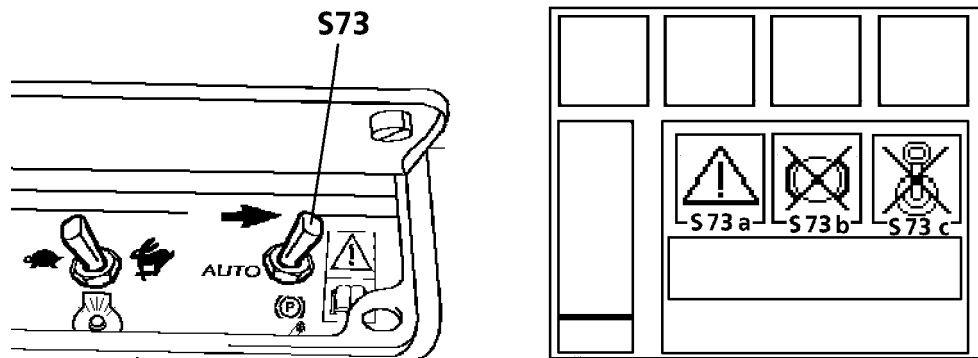


Fig. 3-93 Safety mode of servo circuits - Safety switch and symbols at the display

- ▶ Tilt the safety lever down.
- ▶ Commute the switch **S73** into safety position (tilt to the right).
 - ↖ the three indicator symbols S73a, S73b and S73c appear on the display.
 - ↖ the joysticks and pedals are supplied with servo pressure.
 - ↖ the swing brake is released.

**Danger!**

The safety mode must be turned on only temporarily and in order to move the machine for emergency reasons and when, due to a trouble in the normal control circuit, releasing the swing brake or supplying the pilot controls is hindered.

In safety mode, the swing brake will be released as soon as the ignition key is turned to contact position, and the normal brake control is out of function.

- ▶ Inform all personnel involved in the operation or maintenance of the machine that the safety mode has been turned on and that, by the fact, the control of the swing brake is modified.
- ▶ Locate the trouble which makes the operation in safety mode necessary and get it repaired as quickly as possible.

**Note !**

- ▶ Even with the switch S73 in safety position, the servo pressure supplying the joysticks and pedals is interrupted when tilting the safety lever .

3.5.2 Safety operation of the main working pumps

During normal operation of the excavator, the electronic horsepower control continuously adjusts the pumps flow to the pressure level of the working circuits

If a trouble occurs in the circuit of the regulator, the pumps are swivelled back to minimal flow.

However, it remains possible in this case to carry on the working with the machine (with somewhat reduced pump power) by changing over the lever 3 on the servo oil unit which is mounted to the rear face of the spool valve console.

However, it remains possible in this case to carry on the working with the machine (with somewhat reduced pump power).

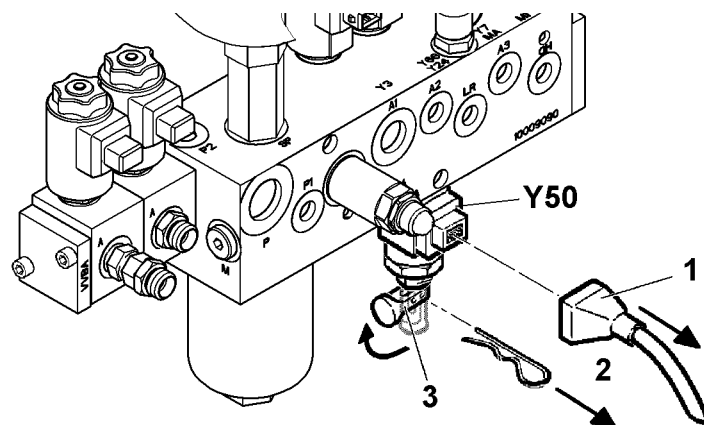


Fig. 3-94 Switching the main pumps in safety operation

- ▶ Change over the lever 3 on the servo oil unit which is mounted to the rear of the hydraulic tank:
 - Disconnect the connector 1 from the regulation solenoid valve Y50.
 - pull out the pin 2.
 - tilt the lever 3 in horizontal position (safety position)..
 - ↳ the safety operation of the main working pumps isturned on.

3.5.3 Emergency attachment lowering with defective servo circuit

In case of a trouble in the electronic servo control circuit (defective joystick, electronic plate, regulation solenoid valve, ...) the working attachment can be lowered, in case of a necessity, thanks to the push button S42 situated on the left control desk.

- ❑ The emergency lowering via S42 is possible only if the servo control circuit is under pressure. If necessary, start the Diesel engine to allow the servo-pressure to establish.

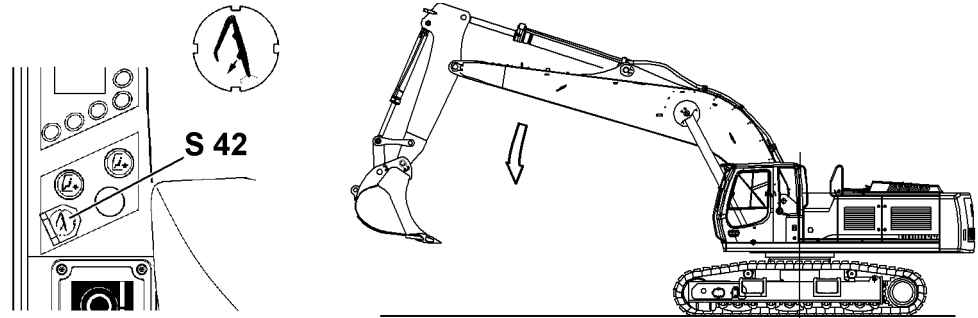


Fig. 3-95 Emergency lowering of the attachment

- ❑ Perform emergency lowering procedure as follows:
 - ▶ turn the ignition key to contact position.
 - ▶ tilt up the protective cover of the push button.
 - ▶ press down the push button and keep it depressed.
 - ↳ the working attachment lowers due to its own weight.
 - ▶ release the push button as soon as the attachment has reached the desired position.

Preselection of emergency lowering movements (Option)

On some types of working attachments it is advisable to have the possibility to actuate the downward movements separately for the different attachment parts. This allows to bring the special working attachment in its safety position, down to the ground level.

The 3-positions preselection switch S41 on the rear right control desk allows to select the attachment part to be emergency lowered.

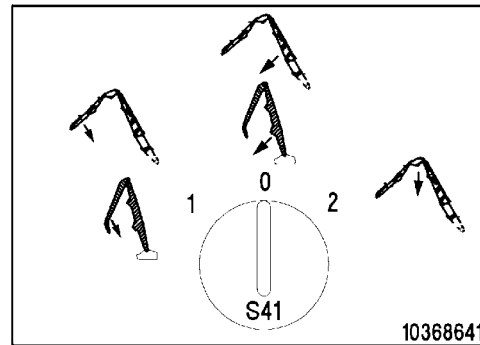


Hinweis

For the machines fitted with a demolition attachment or with an industrial attachment, the following chart gives the correspondances between the positions of the preselection switch S41 and the resulting downward movements. The label stucked on to the side window of the cab also indicates these correspondances.

Position of preselection switch S41	Induced movement for emergency lowering	
	Demolition attachment	Industrial attachment
1	Demolition boom	Demolition stickl
2	Demolition stick	Industrial stickl
3	Intermediate arm	keine

LFR/en/Edition: 07 / 2011



3.5.4 Emergency supply of the boom cylinders (optional)

Thanks to this at customer's wish mounted device, the boom cylinders can be fed with oil via an external pressure source.

By the fact, the working attachment can be moved upward or downward in an emergency, even in case of a trouble (defective Diesel engine, faulty hydraulic circuit of the machine,).



Caution!

The oil supplied by the external source must anyhow:

- correspond to the specifications for hydraulic fluid listed in the chapter "Maintenance" of the present manual,
- be miscible with the oil in the hydraulic circuit of the machine,
- be of a percentage of purity corresponding at least to the quality of oil in the hydraulic circuit of the machine (10 – 20 µm filtering).

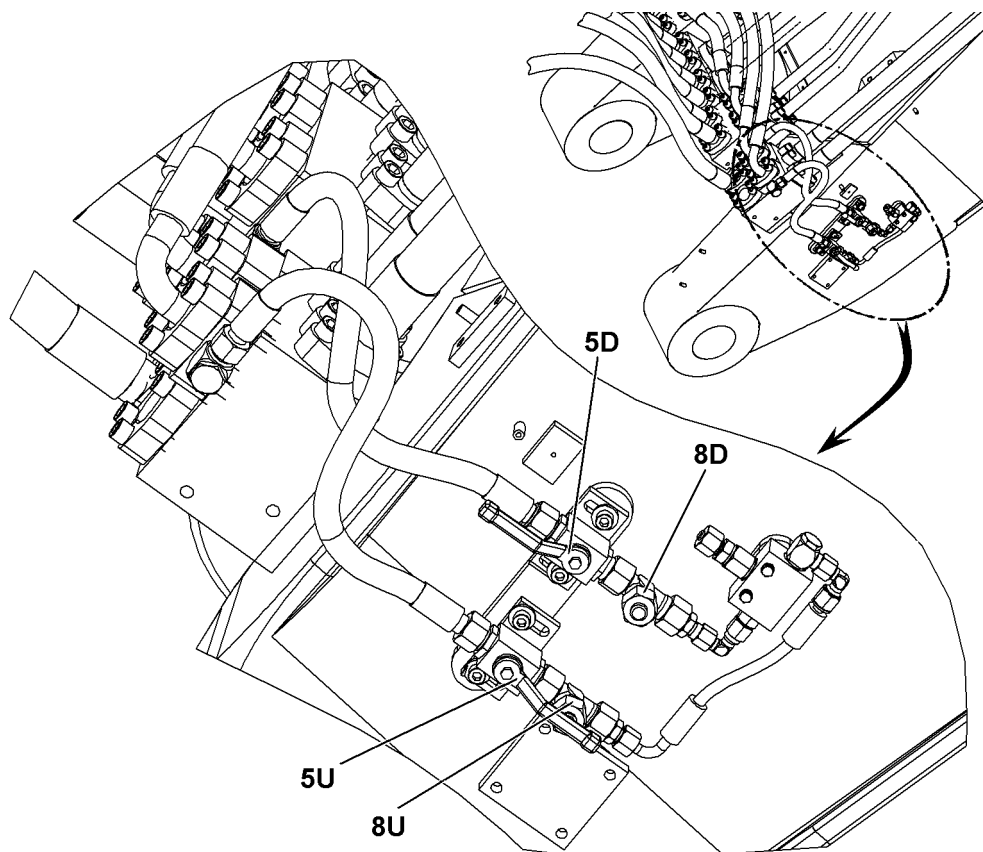


Fig. 3-96 Device for emergency supply of the boom cylinders

To connect an external pressure source:

The fittings for connection and the shut-off valves of the emergency supply device are installed to the lower part of the boom, on the right side.

- ▶ Loosen the box nut and the taper collet at the T-coupling **8U** or **8D** and connect the pressure source to the T-coupling.



Note !

When the pressure from the external source increases, it automatically grows up in the servo control circuit of the machine, even if the shut off valves **5U** and **5D** are let in the closed position.

To raise the working attachment:

- The external pressure source must be connected to the T-coupling **8U**.
- ▶ Tilt the safety lever down in lower position and turn the ignition key to "contact" position.
- ▶ Open the shutt off valve **5U** (Manoeuvring lever of the valve must be lined up with the hydraulic line).
- ▶ Carefully actuate the joystick for the boom cylinders in direction for lifting the working attachment until the attachment has reached the desired position.

To lower the working attachment:

- The external pressure source must be connected to the T-coupling **8D**.
- ▶ Tilt the safety lever down in lower position and turn the ignition key to "contact" position.

- ▶ Carefully actuate the joystick for the boom cylinders in direction for lowering the working attachment until the attachment has reached the desired position.
- ▶ Eventually, the shutt off valve **5D** can be opened (Manoeuvring lever of the valve must be lined up with the hydraulic line).

After ending the attachment movement with the external pressure source:

- ▶ Return the shutt off valves **5** immediately, in any case before disconnecting the external pressure source, to the closed position (Manoeuvring levers of the valves must be crosswise to the hydraulic lines).
- ▶ Check the oil level in the hydraulic tank, correct the level as necessary.

3.6 Recovering, towing the machine

3.6.1 Towing with the machine, emergency towing of the machine

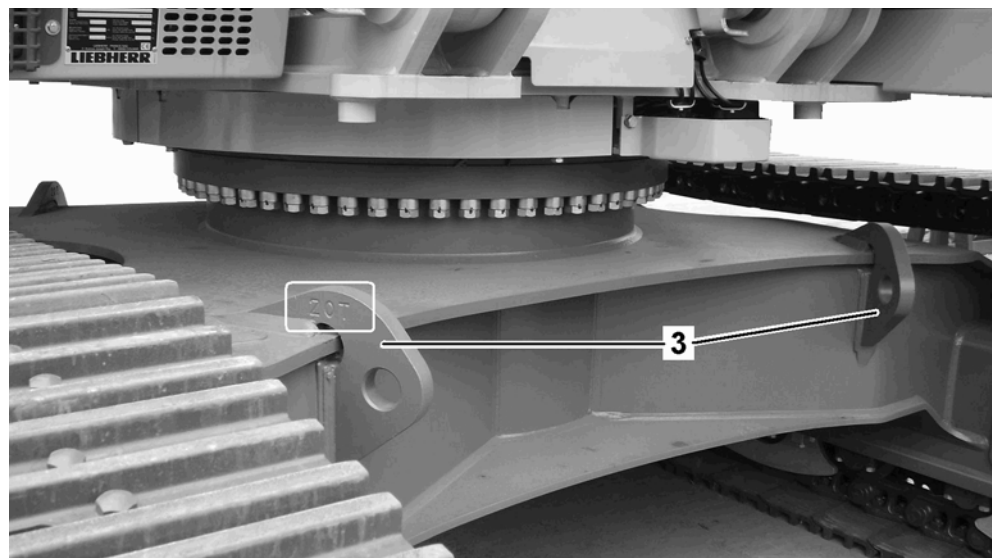
As well the towing of another machine with the excavator as the emergency towing of the excavator are difficult and problematic operations which are always realized under is the responsibility of the owner of the machine.

Damages or accidents, that could occur when towing another machine with the excavator or when emergency towing the excavator cannot be covered by the manufacturer's guarantee under any circumstances.

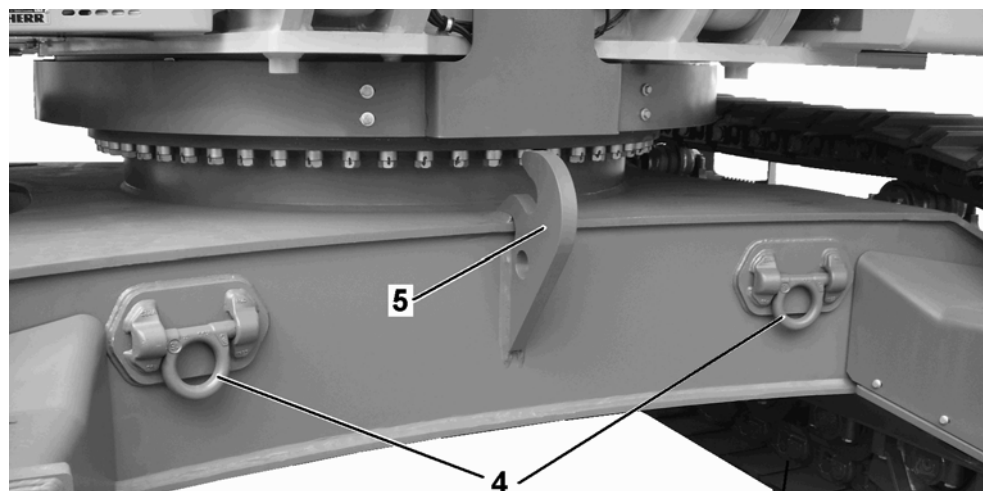
Towing and lashing hooks and eyes on the undercarriage

The hooks and eyes mounted to the undercarriage central piece are destined for the anchoring of the excavator during transportation, resp. for towing smaller machines or vehicles.

- ▶ Always notice the indication for the maximum authorized pulling force on the hooks **3** or on the eyes **4**.



- ▶ Always expect a maximum pulling force of 10 tons for hooks which are welded to the undercarriage central piece and which show no indication.



- 3 Towing hook with indication of a pulling force
- 4 Lashing eye with indication of a pulling force
- 5 Towing hook without indication of a pulling force



The indicated values are valid only when the pulling forces are applied in the middle axis of the hooks or of the eyes.



Caution!

Take care to never exceed the maximum possible pulling force. Going across the allowed pulling force could cause the destruction of the hooks or eyes, of their welding joints and / or of the surrounding undercarriage structure !

- ▶ When towing another machine or emergency towing the excavator, only employ proven towing and pulling devices presenting a sufficient rated traction force considering the pulling forces which may arise during the towing operation.



Danger!

Never allow anyone to stand near the cable when the excavator is towed! There is a danger of injury due to a torn rope.

- ▶ Start travelling with care so to tension the steel cables and other lashing devices slowly and progressively. Applying the tension too brutally to a sagging cable can cause the cable to rupture.
- ▶ During the whole towing operation keep the steel cable tensioned and free of kinks.

Emergency towing of the excavator

The machine may only be towed in exceptional circumstances, eg. in order to move the machine away from a dangerous place for repair.

The admissible traction force of the hooks **3** and lashing eyes installed to the undercarriage is in general insufficient to permit the emergency towing of the machine.

- ▶ On principle always attach the employed steel cable or the pulling device **2**

around the swing ring support on the undercarriage.
 As necessary set a protection under the pulling device, for instance pieces of wood, so to avoid any damage at the swing ring support.

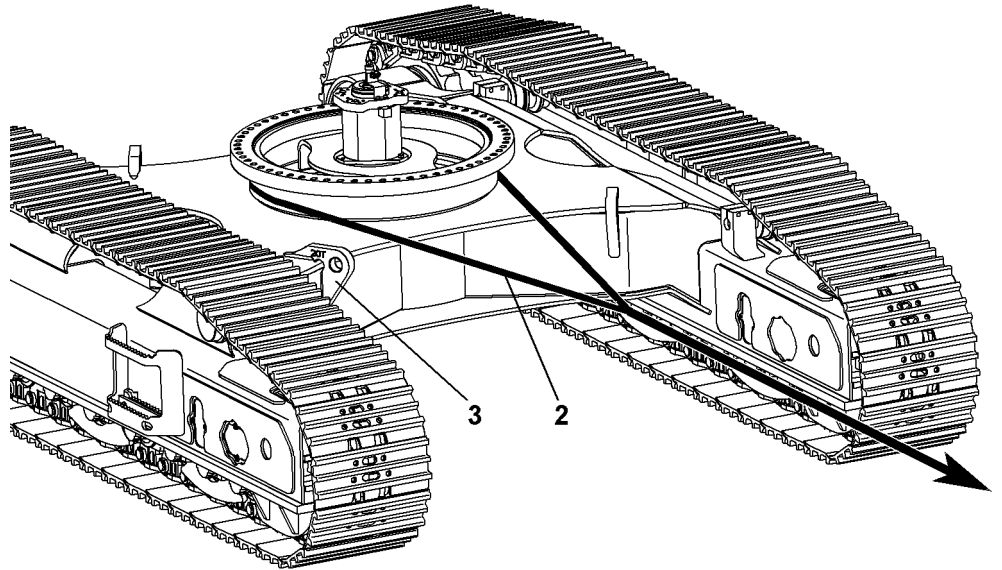


Fig. 3-97 Fastening of the pulling device around the swing ring support



Notice!

During the towing procedure of the machine the mechanical multidisc brakes in the travel gears must remain released.
 Likewise the high pressure must build up in the travel motors circuits, so that the hydraulic brake valves can be opened.

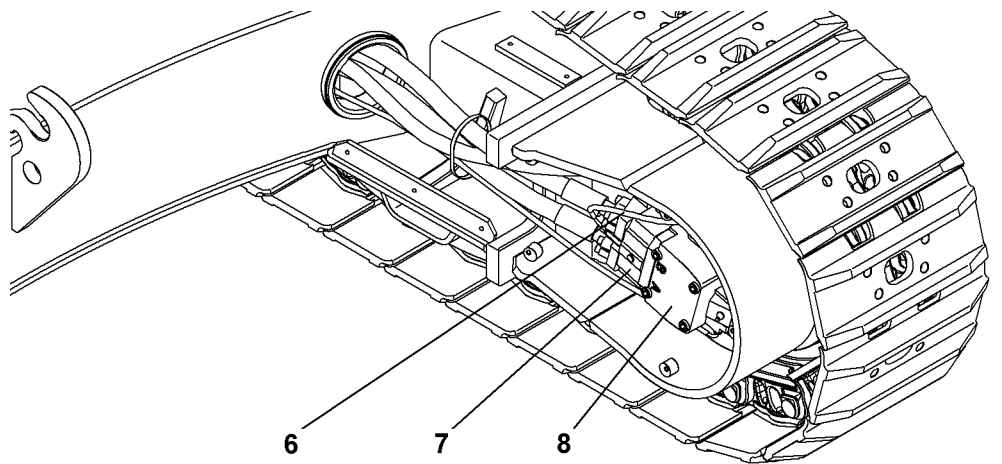


Fig. 3-98 Releasing the travel brakes

- 6 Hose for brake control pressure
- 7 Hydraulic brake valve
- 8 Travel motor

This means that the Diesel engine must be started, in order to establish the high pressure in the hydraulic circuits for travel drive.

If the Diesel engine cannot be started or if the hydraulic system is defective, the multidisc brakes must be released using an external pressure source and the hydraulic brake valves must be deactivated. As necessary, consult your LIEBHERR customer service.

**Notice!**

As a general rule, the easiest way to release the travel brakes is to use the hoses **6** for applying the external pressure and to loosen the hydraulic brakes valves **7** and to slightly disjoin them from the hydraulic motors **8**.

- ▶ Sufficiently lift up the working attachment of the machine so that the grab tool will not lay on the ground during towing.
If the Diesel engine cannot be started or if the hydraulic system is defective, the working attachment can be raised using an external pressure source, see also the heading "Emergency supply of the boom cylinders", previously in this chapter. As necessary, take advice in your LIEBHERR customer service.
- ▶ Return if necessary the excavator in its previous state after completion of the towing procedure.

3.7 Attaching and dismounting equipment parts

3.7.1 Removal and installation of a bucket

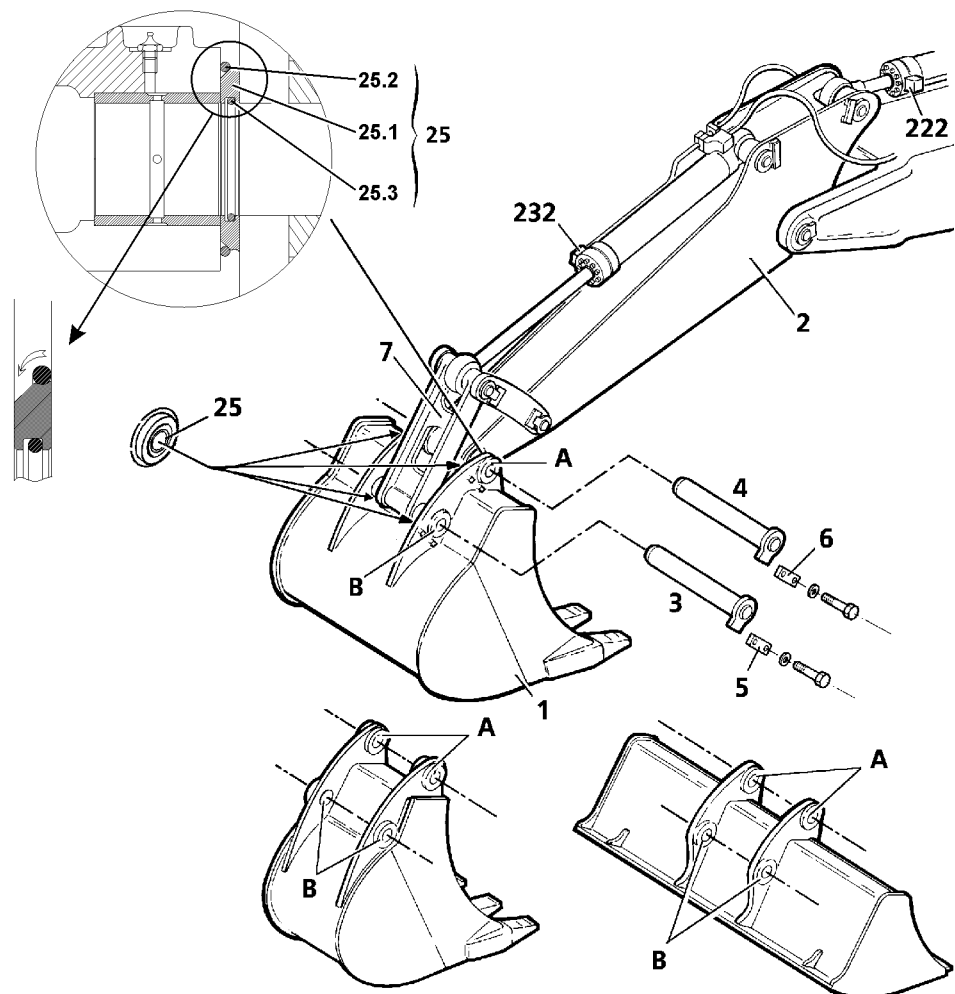


Fig. 3-99 Removing and installing the bucket

1	Digging bucket	222	Restrictor check valve
2	Stick	232	Restrictor check valve
3-4	Pin	25	Complete pin bearing sealing
5-6	Locking plate	25.1	Sealing ring
7	Connecting link	25.2	O-Ring
		25.3	O-Ring

The following is a description of how to attach and dismount buckets. Buckets are, for example, hoe type buckets, ditcher buckets or breaker teeth.

To remove a bucket

- ▶ Position the attachment in such a way that the entire lower part of the bucket is laying on the ground.
- ▶ Unscrew locking plate **5** and locking plate **6**.
- ▶ Knock out pin **3** and pin **4** and remove the complete pin bearing sealing **25**.
- ▶ If necessary, raise the equipment slightly when knocking out pin **4** to relieve it.

To reinstall a new bucket

- ▶ Position the bucket to be attached in such a way that its entire lower part is laying on the ground.
- ▶ Start the engine and move the equipment until the stick mount and the bearing points **A** of the bucket are squared.
- ▶ Engage the pin **4** in its bore and push it in the complete pin bearing sealings **25** between bucket and stick while pressing in the pin. Observe the correct installation direction of the complete pin bearing sealings **25**.
- ▶ Make the O-rings **25.1** slide to the interior.
- ▶ Secure the pin **4** with the locking plate **6**.
- ▶ Extend the shovel cylinder slowly until the bore hole in connecting clip **7** is located precisely between the bearing points **B**.
- ▶ Engage the pin **3** in its bore and push it in the complete pin bearing sealings **25** between bucket and stick while pressing in the pin. Observe the correct installation direction of the complete pin bearing sealings **25**.
- ▶ Make the O-rings **25.1** slide to the interior.
- ▶ Secure the pin **3** with the locking plate **5**.
- ▶ Lubricate all greasing points of pins **3** and **4** directly or with the automatic grease system (if mounted) until clean grease comes out of the greasing points.



Note!

After installation of a new digging bucket, the restrictor check valves **222** and **232** for stick, respectively bucket tilt cylinders must be eventually readjusted so to have the correct velocity of the working attachment (due to weight differences of the digging bucket). If necessary, consult a LIEBHERR mechanic.

In particular on machines, which are delivered without digging bucket or grapple, this restrictor check valves must be (if mounted) adjusted after installation of the digging tool, so to avoid uneven or jerky movements of the attachment parts.

3.7.2 Attaching and dismantling the bucket with improved sealing

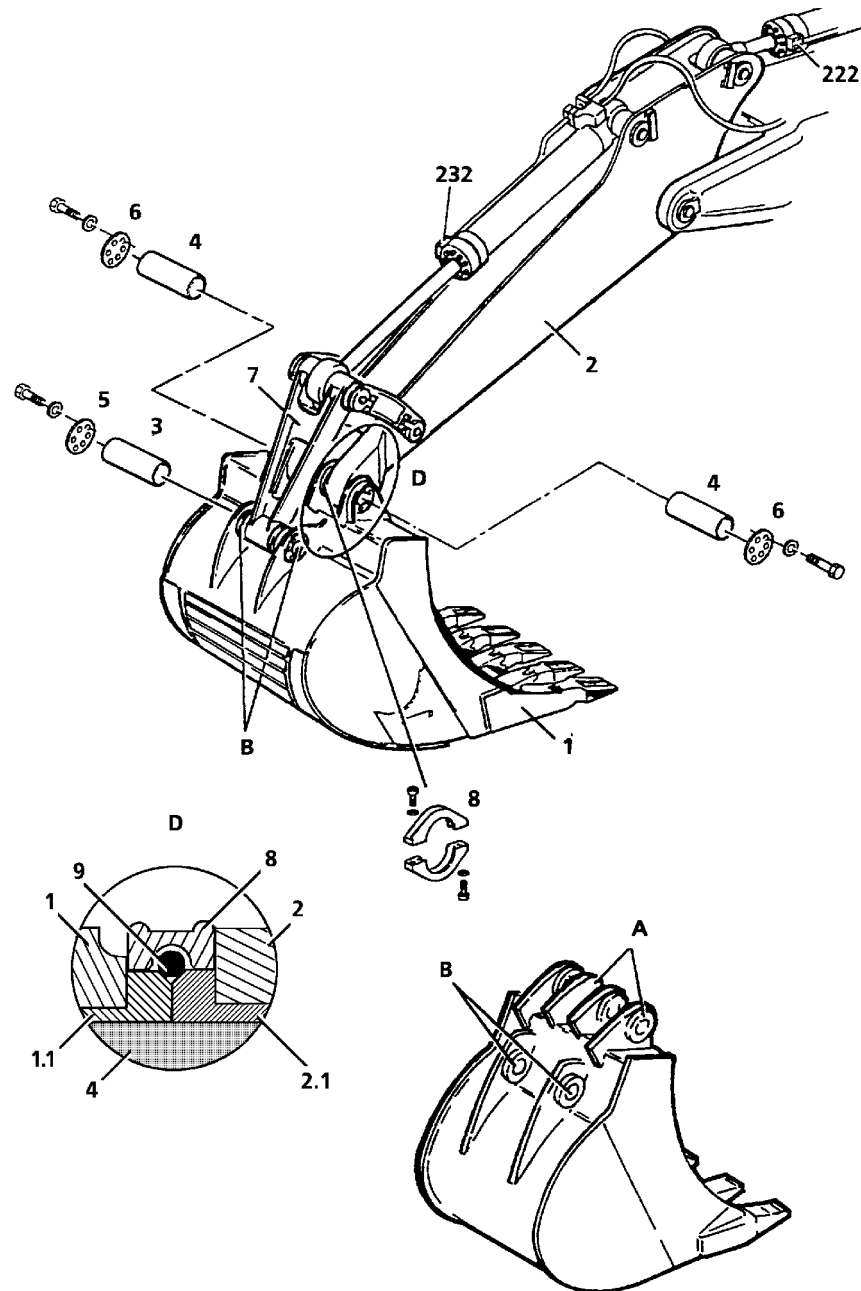


Fig. 3-100 Attaching and dismantling the bucket

1	Digging bucket	7	Connecting link
2	Stick	8	Protection ring
1.1	Bushing	9	O-ring
2.1	Bushing	222	Restrictor check valve
3-4	Pin	232	Restrictor check valve
5-6	Cover		

The following is a description of how to attach and dismantle buckets with improved sealing.

Dismounting a bucket

- ▶ Position the bucket to be attached in such a way that its entire lower part is laying on the ground.
- ▶ Remove the covers **5** and **6**.
- ▶ Remove the protection rings **8** of all the bearing points and draw the O-rings **9** up onto the bushing **1.1** on the bucket side.
- ▶ Drive out the pins **3** and **4**.
- ▶ If necessary, lift the attachment slightly to remove the pin **4**.
- ▶ Take off the O-rings **9** and if necessary replace them.

Attaching a new bucket

- ▶ Position the bucket **1** so that the flat part of the bucket rests on the ground.
- ▶ Draw the O-rings **9** up onto the bushing **1.1** of the digging bucket, as well on bearings bucket to stick as on bearings bucket to connecting link **7**.
- ▶ Start the engine and move the attachments until the stick and bucket bore holes **A** align.
- ▶ Insert pin **4** and reinstall the covers **6** with O-rings.
- ▶ Slowly extend the stick cylinder until the bore of the connecting link **7** is exactly between bore holes **B**.
- ▶ Insert pin **3** and reinstall the covers **5** with O-rings.
- ▶ Slip the O-rings **9** laterally until they are in the grooves between bushings **1.1** and **2.1** (see detail **D**) and install the two piece protection rings **8**.
- ▶ Lubricate all greasing points of pins **3** and **4** directly or with the automatic grease system (if mounted) until clean grease comes out of the greasing points.



Note!

After installation of a new digging bucket, the restrictor check valves **222** and **232** for stick, respectively bucket tilt cylinders must be eventually readjusted so to have the correct velocity of the working attachment (due to weight differences of the digging bucket). If necessary, consult a LIEBHERR mechanic.

In particular on machines, which are delivered without digging bucket or grapple, this restrictor check valves must be (if mounted) adjusted after installation of the digging tool, so to avoid uneven or jerky movements of the attachment parts.

3.7.3 Attaching and dismantling the grab on stick

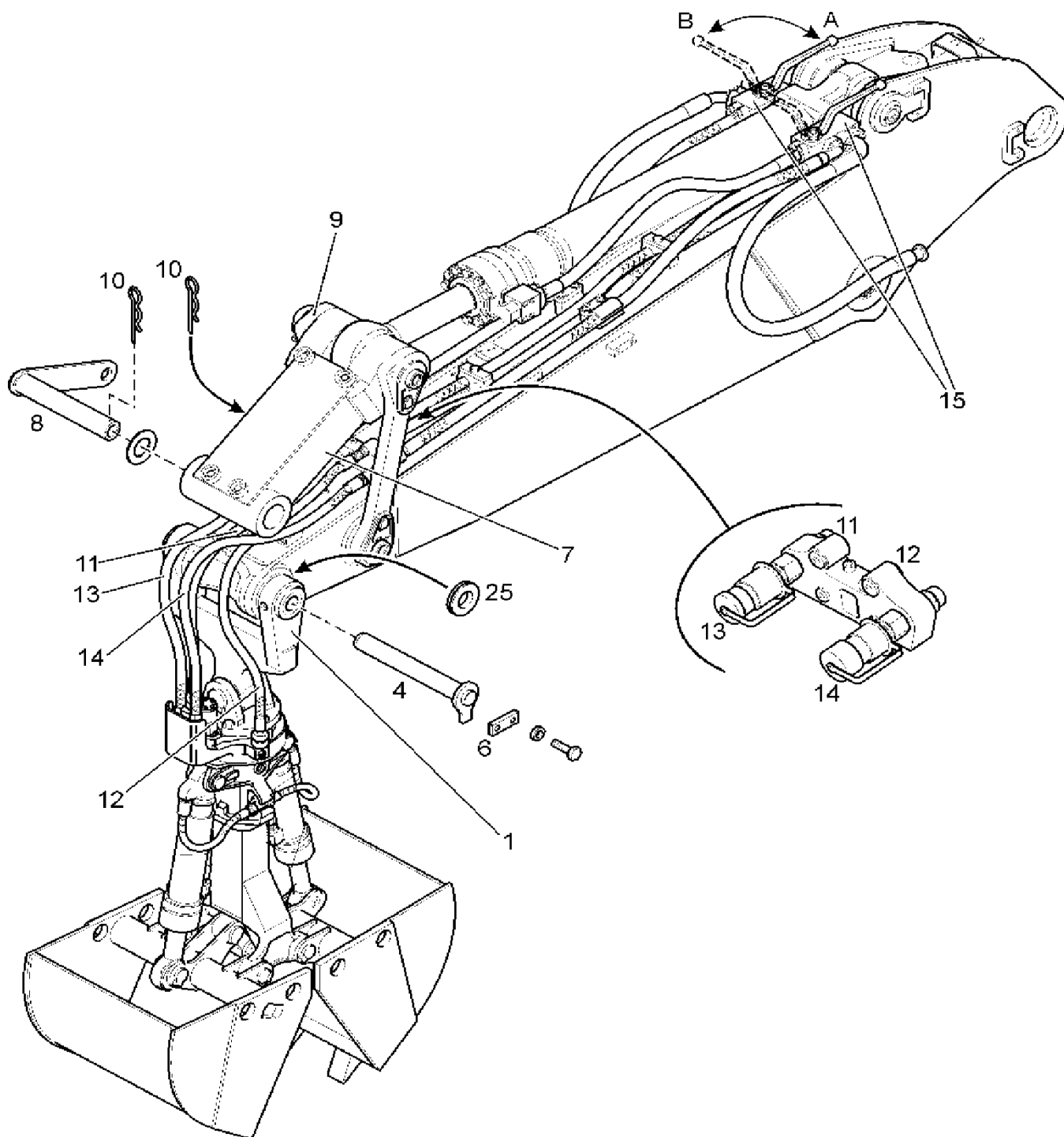


Fig. 3-101 Attaching and dismantling the grab on the stick

1	Grab mounting	11	Hose
4	Pin	12	Hose
6	Locking plate	13	Hose
7	Connecting link	14	Hose
8	Carrier bracket	15	Valve blocks
9	Reversing lever	25	Pin bearing sealing

10 Cotter pin

- Before attaching a clamshell bucket or grapple, ensure that the required hydraulic lines for operating the grab are built into the stick.
- Attaching and dismantling a grab should be carried out by two people.

**Danger!**

Risk of injury.

- ▶ Ensure that the machine's operator follows the signaller's hand signals when moving the attachment.

Attaching the grab

- ▶ If necessary, dismantle the bucket.
- ▶ Retract the bucket cylinder as far as the stop.
- ▶ Fix the connecting link **7** to the right reversing lever **9** with carrier bracket **8**. Secure with cotter pin **10**.
- ▶ Position the grapple with the shells fully opened.
- ▶ Move the equipment until the lower mount of the stick is between the bearing points of the grab mounting **1**.
- ▶ Guide in the pin **4** in its bore and push in the pin bearing sealings **25** complete with protection ring while pressing in the pin.
- ▶ Secure the pin **4** with plate **6**.
- ▶ Connect the hydraulic hoses **11** and **12** for the shell cylinder to the hydraulic lines of the bucket cylinder circuit.
- ▶ For grapple with hydraulic rotator, hoses **13** and **14** must be connected to the hydraulic lines for added functions on the stick.

Operating the grab

Two hydraulic lines on the shovel arm are set in for operating either the tilting cylinder or the grab.

The lines are reversible via two valve blocks **15**:

- **A** - Tilting cylinder operation (for buckets)
- **B** - grab operation (for grab, scrap cutter etc.)
- ▶ Turn the lever of the valve blocks **15** in position **B** (Position **B**, Grab operation).

**Note!**

If the machine is equipped with a hydraulic quick-change adapter and LIKUFIX, there is no need to switch between tilt cylinder operation and grab operation. There is no valve block **15**.

- ▶ Lubricate all greasing points of the pin **4** and of the grab directly or with the automatic grease system (if mounted) until clean grease comes out of the greasing points.
- ▶ Carry out all work movements several times without a load (open and close the shell or move the grab to the left and to the right) so that any air that may be present in the hydraulic circuits can escape.

Dismounting the grab

- ▶ Set the grab down onto level ground with the shells fully opened.
- ▶ Turn off the engine and, with the ignition key in the contact position, push the right joystick briefly to the left and then to the right in order to remove the pressure in the hydraulic circuits.
- ▶ To relieve the grab's torsional mechanism, press the two push buttons in the left (or left and right – optional extras) joystick for "Turn grab".
- ▶ Turn the lever of each valve block **15** in position **A** (Position **A**, bucket operation) and push the right joystick briefly to the left and then to the right in order to remove the pressure in the hydraulic circuits.
- ▶ Push the safety lever up.
- ▶ Separate hydraulic hose **11**, hydraulic hose **12** and, if present, hydraulic hoses **13** and **14** from the pipes on the stick.
- ▶ Close open lines immediately to prevent any dirt entering.
- ▶ Support the grab so that it is stable.
- ▶ Remove the plate **6**. Drive out the pin **4** and remove the pin bearing sealings **25**. If necessary, start the engine and lift the attachment slightly to remove the pin **4**.

3.7.4 Attaching and dismantling the grab on the industrial stanchion

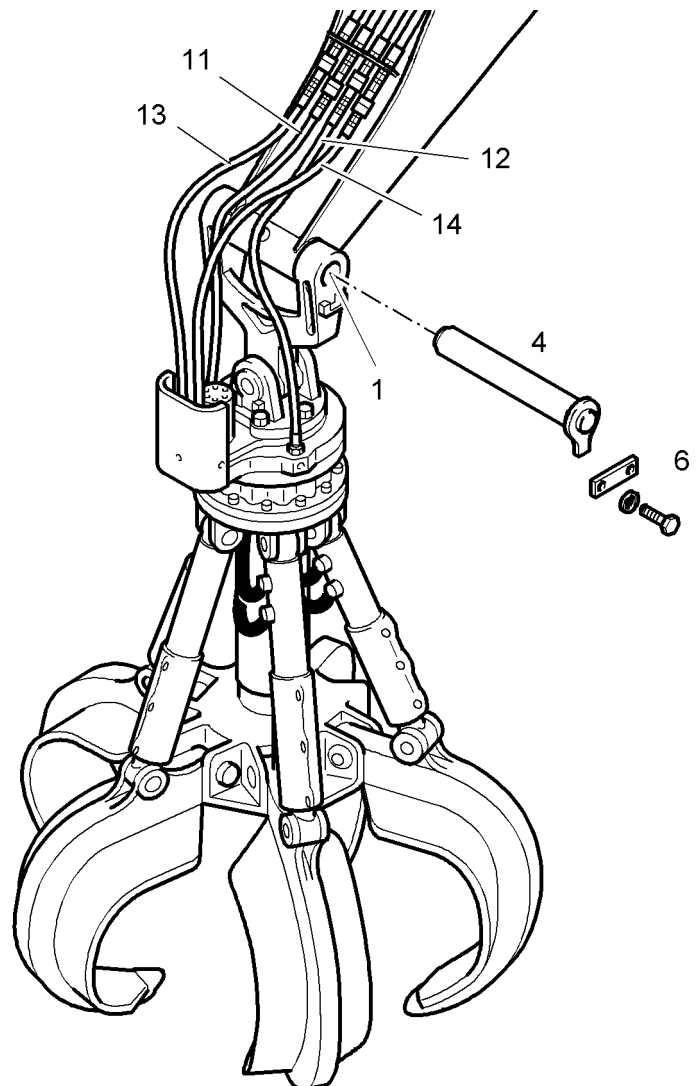


Fig. 3-102 Attaching and dismantling the grab on the industrial stanchion

- Before attaching a clamshell bucket or grapple, ensure that the required hydraulic lines for operating the grab are attached to the industrial stanchion.
- Attaching and dismantling a grab should be carried out by two people.



Danger!
Risk of injury.

- ▶ Ensure that the machine's operator follows the signaller's hand signals when moving the equipment.

Attaching the grab

- ▶ Position the grab with the shell fully open.
- ▶ Move the equipment until the lower mount of the industrial stanchion is between the bearing points of the grab mounting 1.
- ▶ Guide in bolt 4 and secure using disk 6.

- ▶ Connect hydraulic hose **11** and hydraulic hose **12** for the shell cylinder supply to the pipes for the shovel tilting cylinder.
- ▶ For a grab with a hydraulic torsional mechanism, also connect hoses **13** and **14** to the pipes for this auxiliary device.

Operating the grab

- ▶ Carry out all work movements several times without a load (open and close the shell or move the grab to the left and to the right) so that any air that may be present in the hydraulic circuits can escape.

Dismounting the grab

- ▶ Set the grab down onto level ground with the shell fully opened.
- ▶ Turn off the engine and, with the ignition key in the contact position, push the right joystick (for Open and Close grab) briefly to the left and then to the right in order to remove the pressure in the hydraulic circuits.
- ▶ To relieve the grab's torsional mechanism, press the two pushbuttons in the left (or left and right – optional extras) joystick for "Turn grab".
- ▶ Separate hydraulic hose **11**, hydraulic hose **12** and, if present, hydraulic hoses **13** and **14** from the pipes on the shovel arm.
- ▶ Close open lines immediately to prevent any dirt entering.
- ▶ Support the grab so that it is stable.
- ▶ Unscrew disk **6** and knock bolt **4** carefully out. You may have to start the engine and raise the equipment slightly to do this.

3.7.5 Attaching and dismantling the stick to the boom

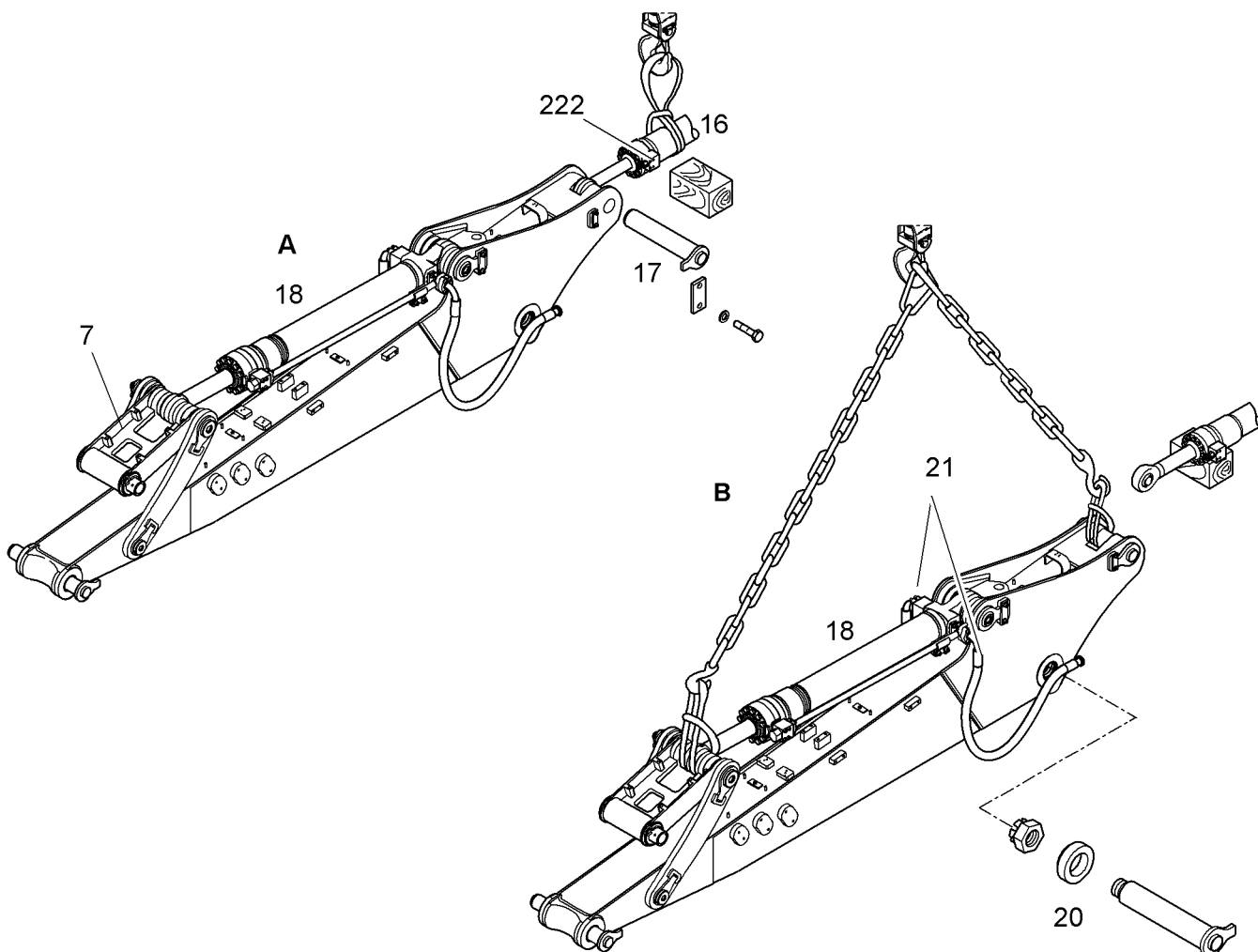


Fig. 3-103 Attaching and dismantling the stick to the boom

- | | | | |
|----|-----------------|-----|------------------------|
| 7 | Connecting link | 20 | Pin |
| 16 | Stick cylinder | 21 | Hoses |
| 17 | Pin | 222 | Restrictor check valve |
| 18 | Bucket cylinder | | |

Dismounting the stick

Figure A

- ▶ If necessary, remove the bucket.
- ▶ Retract the bucket and stick cylinder as far as the stop, position the attachment on the ground.
- ▶ If necessary, tie the connector bracket 7 to the bucket cylinder so it can not slip out.
- ▶ Turn the engine off.
- ▶ Release the pressure in bucket and stick cylinder circuit by turning the ignition key to contact position, tilting the safety lever down, and moving the right joystick to the left and right, the left joystick forward and backward.

LFR/en/Edition: 07 / 2011

- ▶ Release the pressure in the hydraulic tank.
- ▶ Attach the lower part of the stick cylinder **16** to the lift with a strap.
- ▶ Position a wooden block under the stick cylinder, remove the plate of pin **17**, lightly lift the the cylinder, drive out the pin **17** and position the stick cylinder **16** on wooden blocks.

Figure B

- ▶ Insert the pin **17** in the rear bearing of the stick and secure it with the plate, then attach the pin **17** to the lifting device with a strap.
- ▶ Attach the head of the bucket cylinder **18** (or to the hook of the bucket, if the stick is removed with the bucket in place), to the lift with a strap.
- ▶ Disconnect both hoses **21** from the tilt cylinder **18** and close them off to prevent contamination.
- ▶ Remove the cotter pin and the castle nut on pin **20** and drive the pin out. If necessary, start the engine and slightly lift the attachment to reduce the weight of the boom on pin **20**.
- ▶ Raise the stick (or the stick with the bucket) with a lift, pull the stick from the boom and position it on the ground, supported by wooden blocks and remove the lift.

Attaching the stick (or stick with bucket)

Figure B

- ▶ Insert the pin **17** in the rear bearing of the stick and secure it with the plate, then attach the pin **17** to the lifting device with a strap.
- ▶ Attach the top of the bucket cylinder **18** (or the hook of the bucket, if the stick is removed with the bucket in place), to the lifting device with a strap.
- ▶ Raise the stick (or the stick with the bucket) with a lift inside the bore holes of the boom so that the pin **20** can be inserted.
- ▶ Insert pin **20** and fix the castle nut and the cotter pin to the pin **20**.
- ▶ Remove the pin **17**.
- ▶ Reconnect both hoses **21** to the tilt cylinder **18**.

Figure A

- ▶ Attach the lower part of the stick cylinder **16** to the lift.
- ▶ Slightly lift the stick cylinder and if necessary run engine to extend or retract cylinder so that cylinder head fits between the bore holes of the stick.
- ▶ Insert the pin **17** and secure it with the plate.
- ▶ If necessary, install the bucket.
- ▶ Lubricate all greasing points between stick and boom and between bucket and stick directly or with the automatic grease system (if mounted) until clean grease comes out of the greasing points.
- ▶ Lift the attachment and tilt the bucket out and in several times to release the air from the hydraulic system.

**Note!**

After installation of a new stick and digging bucket combination, the restrictor check valve **222** for stick cylinder must be eventually readjusted so to have the correct velocity of the working attachment (due to weight difference of the attachment parts).

If necessary, consult a LIEBHERR mechanic.

3.7.6 Mechanical quick-change adapter (option)

Safety information

- Ensure that nobody is located in the working area of the equipment when attaching and dismantling work tools. Move the work equipment as slowly as possible when attaching and dismantling a work tool. Get to know the mode of operation of the quick-change adapter before attaching or dismantling 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.

Overview

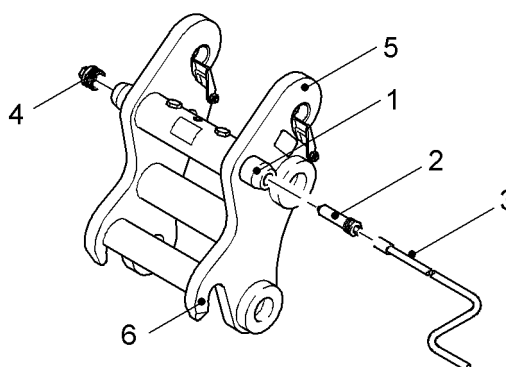


Fig. 3-104 Mechanical quick-change adapter

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

Attaching the work tool

To move the equipment into position:

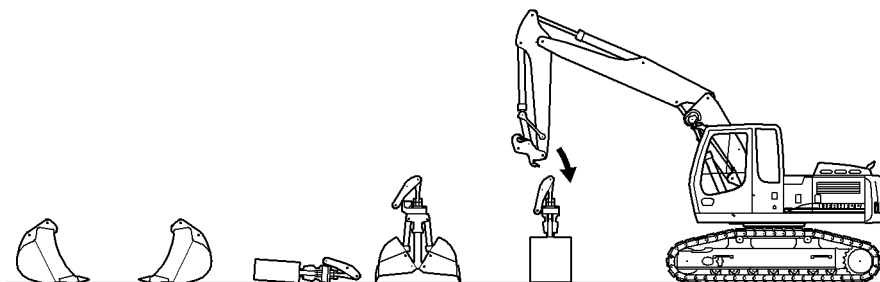


Fig. 3-105 Positioning the equipment

- 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** (see Fig. 3-104).
- ▶ 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:

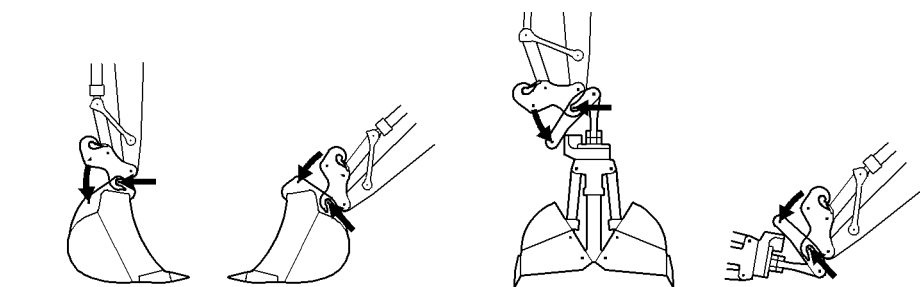
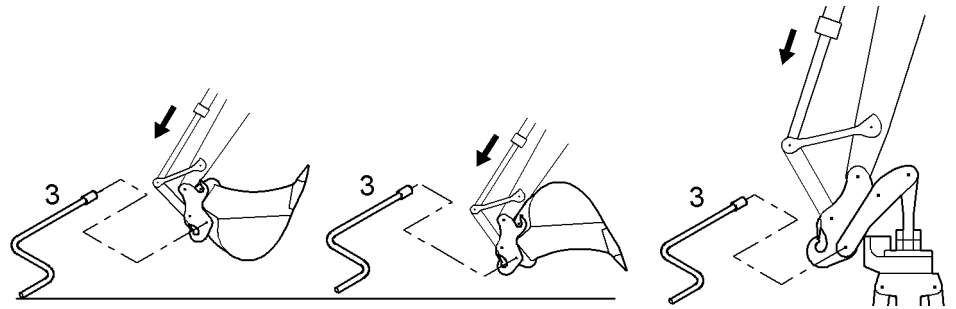


Fig. 3-106 Taking up the work tool

- ▶ 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. 3-107** 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.

**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 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 engine, turn the ignition key into the contact position, operate the joystick).
- ▶ Disconnect hydraulic lines or electrical lines, if necessary (eg. when dismantling a grab).
- ▶ Extend the shovel tilting cylinder fully.

To unlock the quick-change adapter:

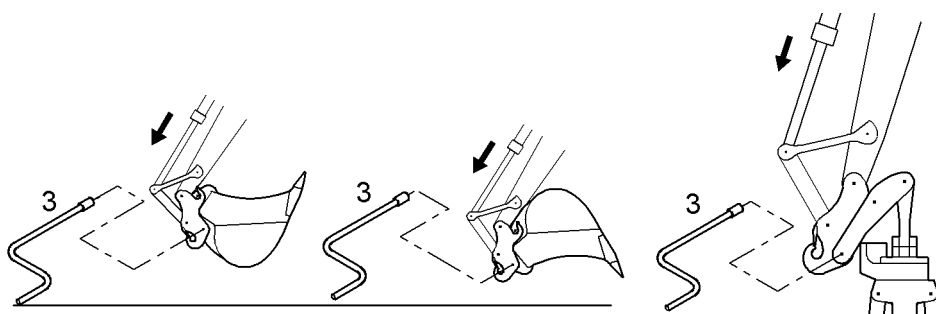


Fig. 3-108 Unlocking the quick-change adapter



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:

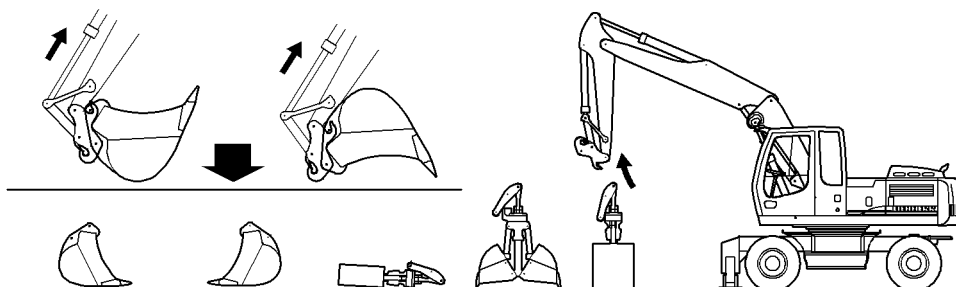


Fig. 3-109 Putting down the work tool

- ▶ 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

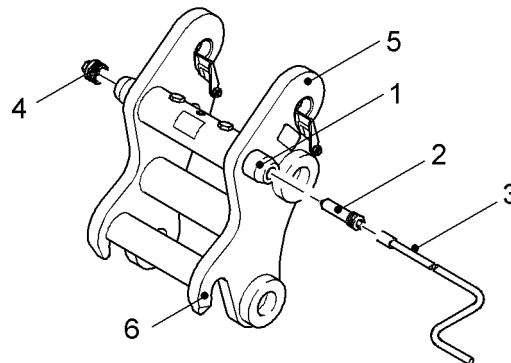


Fig. 3-110 Mechanical quick-change adapter

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.

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 dismantled work tools. With dismantled 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".

3.7.7 Hydraulic quick-change adapter (option)

Safety information

- Ensure that nobody is standing in the working area of the equipment when attaching or dismantling work tools. Move the work equipment as slowly as possible when attaching and dismantling 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 unloc-

king 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.

Overview

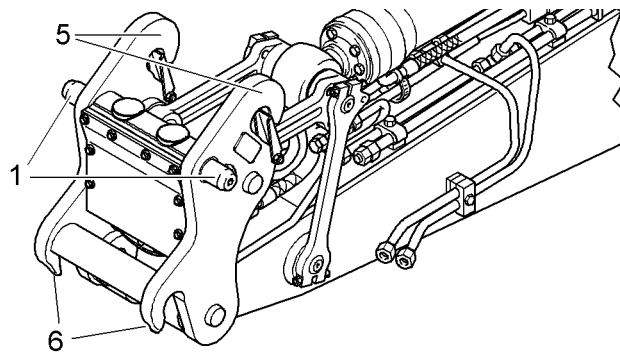


Fig. 3-111 Hydraulic quick-change adapter

1 Locking pin (extended)

5 Lifting hook

6 Take-up hook for work tool

Operating elements

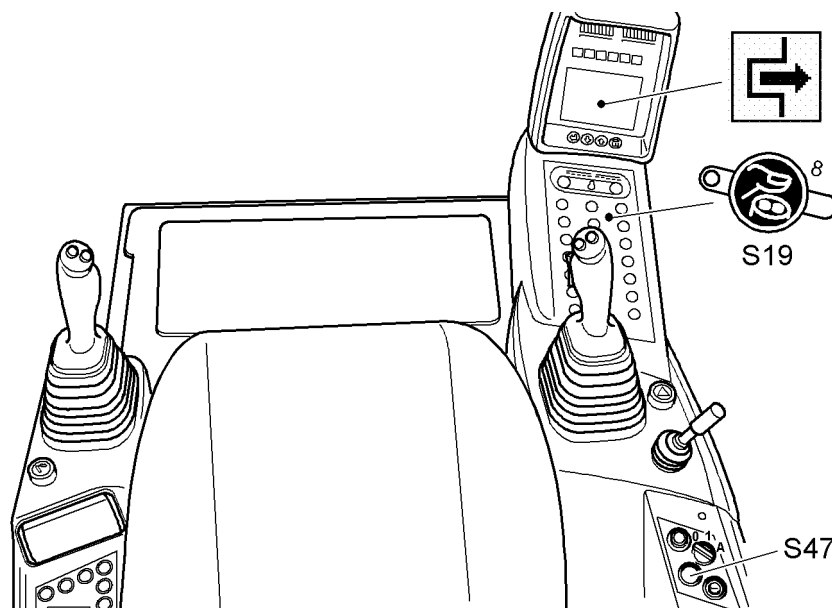


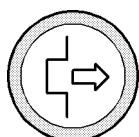
Fig. 3-112 Operating elements for the hydraulic quick-change adapter



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 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):

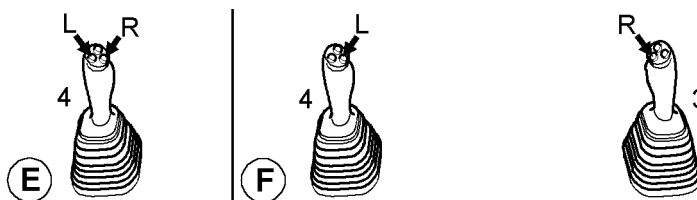


Fig. 3-113 Pushbutton on the joystick

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 dismantling 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:

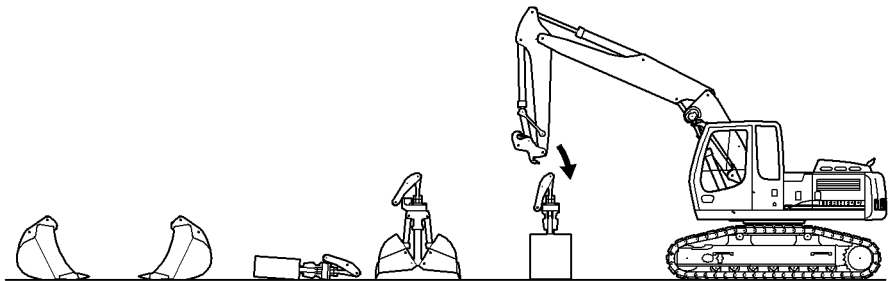


Fig. 3-114 Positioning the equipment

- 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:

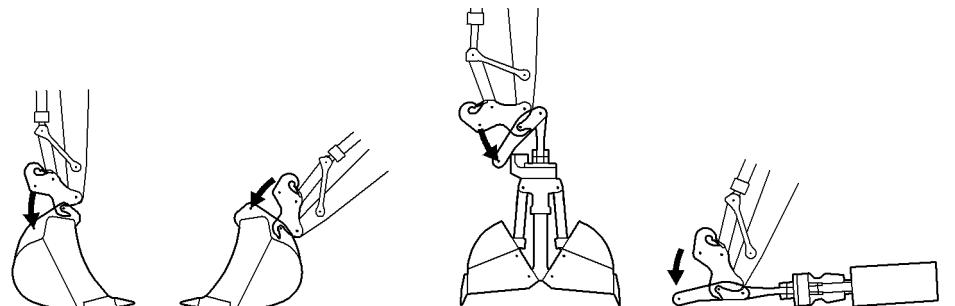


Fig. 3-115 Taking up the work tool, first step

- ▶ Move the quick-change adapter into a position that allows the work tool to be picked up using the take-up hook.

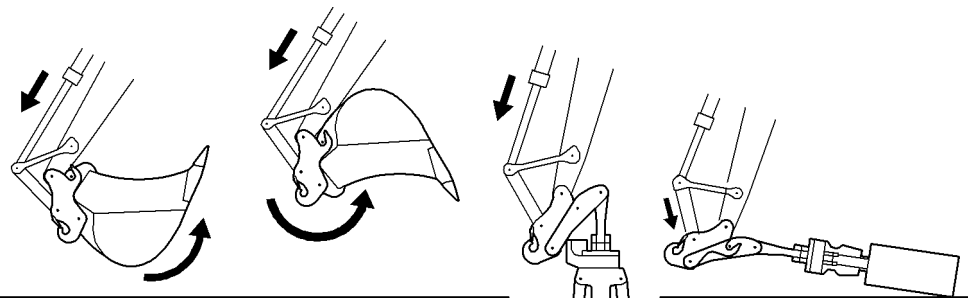


Fig. 3-116 Taking up the work tool, secondary step

- ▶ 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**.
 - ⌘ 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 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 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:

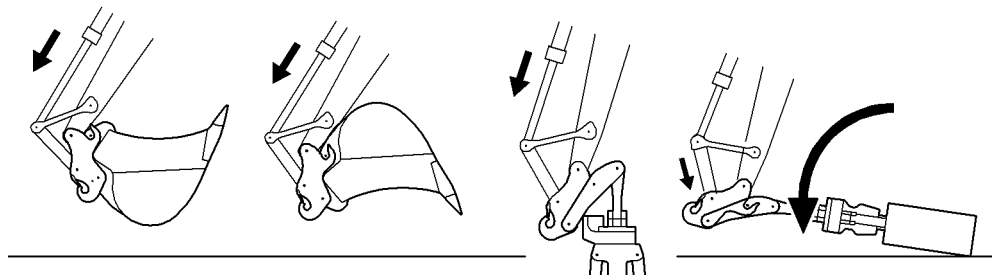


Fig. 3-117 To unlock the quick-change adapter



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:

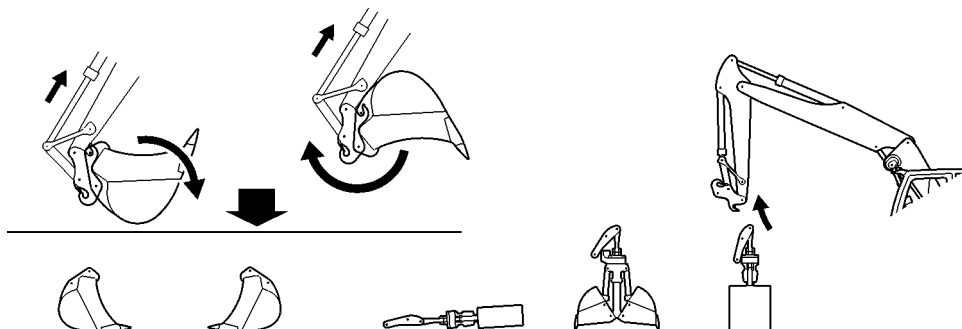


Fig. 3-118 Putting down the work tool

- ▶ 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 lifting work

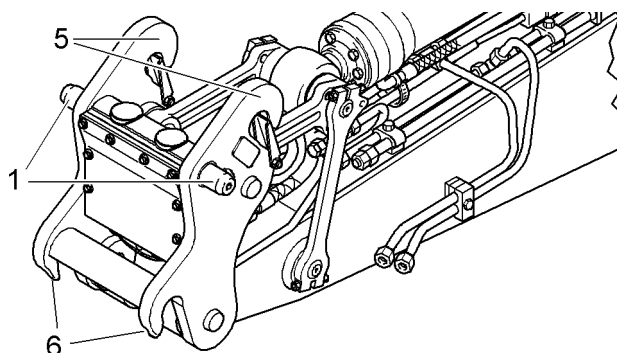


Fig. 3-119 Hydraulic quick-change adapter

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 dismantled work tools. With dismantled 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.

3.7.8 LIKUFIX – hydraulic coupling system (option)

LIKUFIX enables automatic coupling of hydraulic lines in connection with the hydraulic quick-change adapter. The machine operator does not have to connect or separate hydraulic lines for work tools himself.

Overview

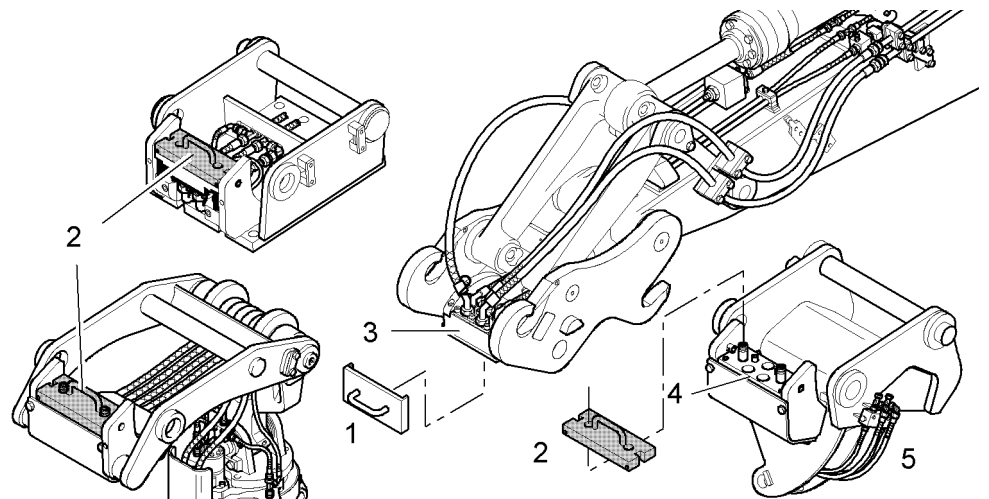


Fig. 3-120 LIKUFIX

- | | |
|--|---|
| <p>1 Protective cover on quick-change adapter</p> <p>2 Protective covering on work tool</p> <p>3 LIKUFIX hydraulic coupling on quick-change adapter</p> | <p>4 LIKUFIX hydraulic coupling on work tool</p> <p>5 Alternative hydraulic coupling on work tool</p> |
|--|---|

Attaching and dismantling work tools

Attaching and dismantling is carried out as described in the chapter “Hydraulic quick-change adapter”.

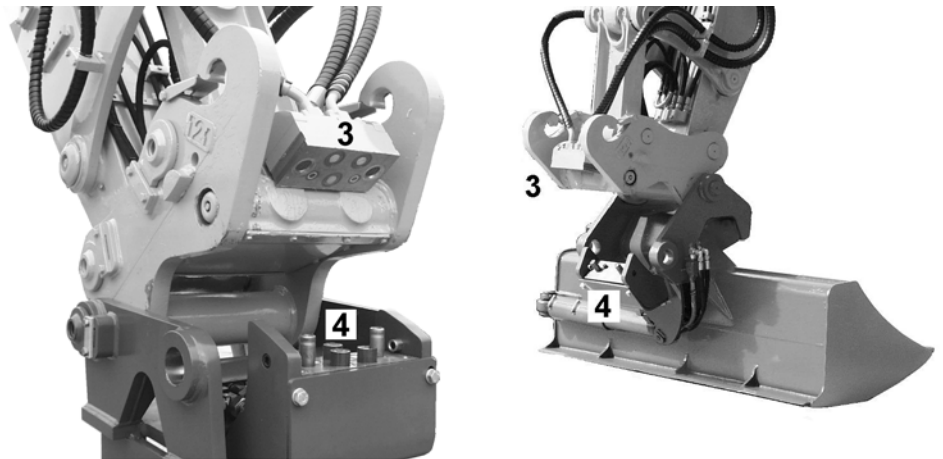


Fig. 3-121 Connecting LIKUFIX

Please also note:

- ▶ Before attaching, remove the protective coverings on the quick-change adapter **1** and the work tool **2**.
- ▶ Always keep hydraulic couplings **3** and **4** clean.
- ▶ Perform a visual check for cleanliness before attaching. If necessary, clean all coupling parts and the sealing surfaces with a clean, oil-soaked cloth.

- ▶ Connect or separate the hydraulic coupling slowly as with any change of work tool.
- ▶ When attaching the quick-change adapter, tilt until the coupling disks are connected as a result of the self weight of the work tool.
- ▶ Remove the locking pins.
- ▶ If the disks do not connect as a result of self weight, foreign matter (such as stones) may be the cause. In this case, clean all coupling parts to prevent damage occurring when connecting.
- ▶ Oil quantity and pressure must be adapted to suit the work device concerned.
- ▶ When the work is completed, and particularly before transportation, put the protective coverings **1** and **2** back on.

Attaching LIKUFIX work tools to a quick-change adapter without LIKUFIX

It is possible to attach a work tool with a LIKUFIX hydraulic coupling to a machine with a quick-change adapter (mechanical or hydraulic) at any time.

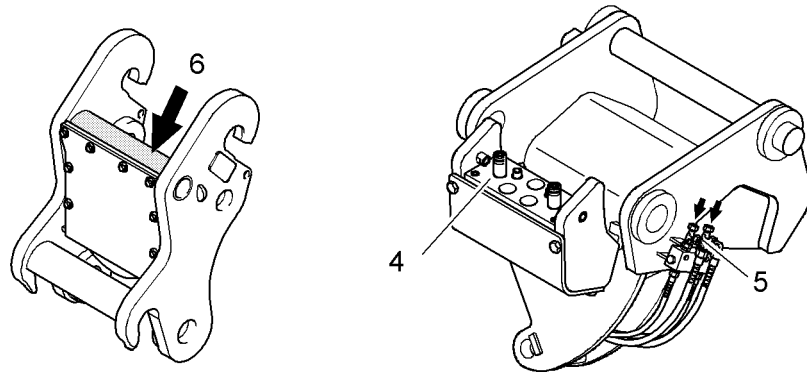


Fig. 3-122 LIKUFIX work tool on quick-change adapter without LIKUFIX



Caution!

The LIKUFIX hydraulic coupling could be damaged.

- ▶ Do not use a quick-change adapter with a reinforcement kit since the reinforced steel part **6** could damage the LIKUFIX hydraulic coupling on the work tool.
- ▶ In this case, ensure that you have the quick-change adapter reworked at the LIEBHERR customer service centre.

For attachment without LIKUFIX hydraulic coupling, LIEBHERR work tools usually have an alternative connection option.

Example:

On the ditcher bucket, hydraulic lines are either connected using LIKUFIX **4** or using an auxiliary hydraulic connection **5**.

3.8 General working methods

3.8.1 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, stick 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.

3.8.2 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.

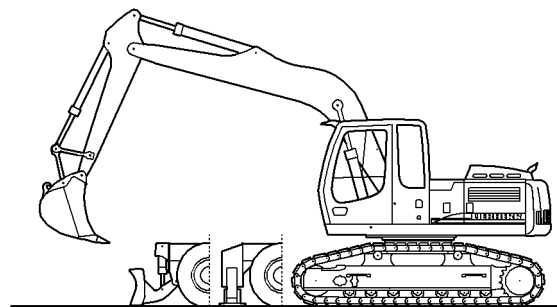


Fig. 3-123 Working position – machine

- ▶ 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.

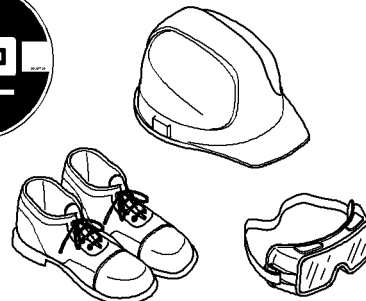
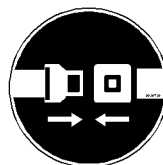
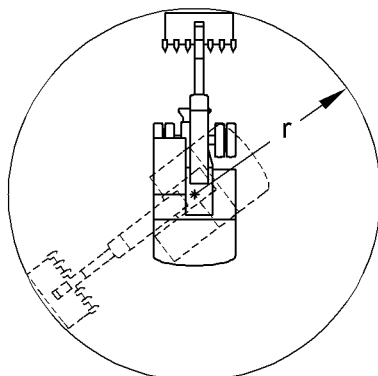


Fig. 3-124 Safe working

**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.

3.8.3 Using a backhoe bucket

**Danger!**

Risk of fatal injury and damage to the machine when moving the backhoe bucket.

- ▶ Ensure that the backhoe bucket is not slewed too close to the cab.
 - ↳ The backhoe bucket could damage the cab and injure the machine's operator.
- ▶ Ensure that nobody is standing within the danger area of the backhoe bucket.
- The machine must be in the working position.

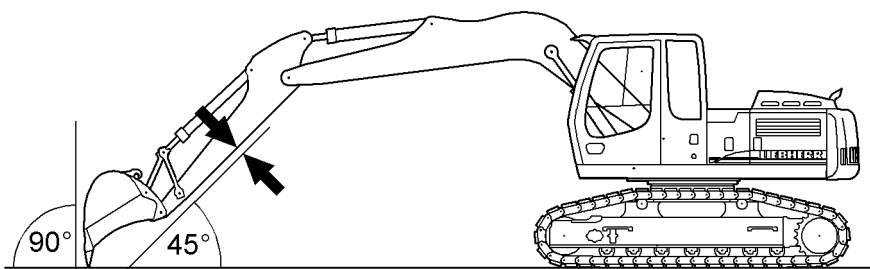


Fig. 3-125 Aligning the stick and backhoe bucket

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

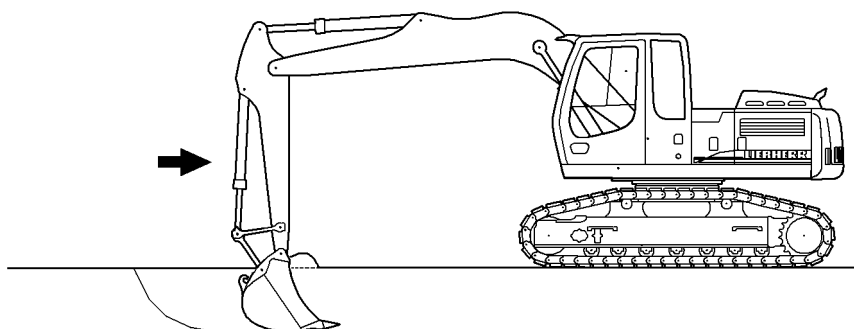


Fig. 3-126 Taking up grab material

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

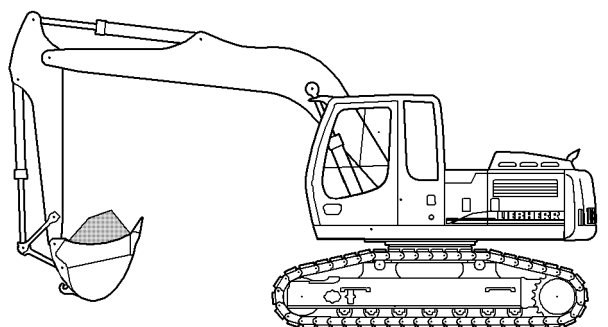


Fig. 3-127 Raising grab material

- ▶ When the backhoe bucket is full or the stick can no longer be slewed in, raise the boom and backhoe bucket until the filled surface is parallel to the ground.

3.8.4 Loading a 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.

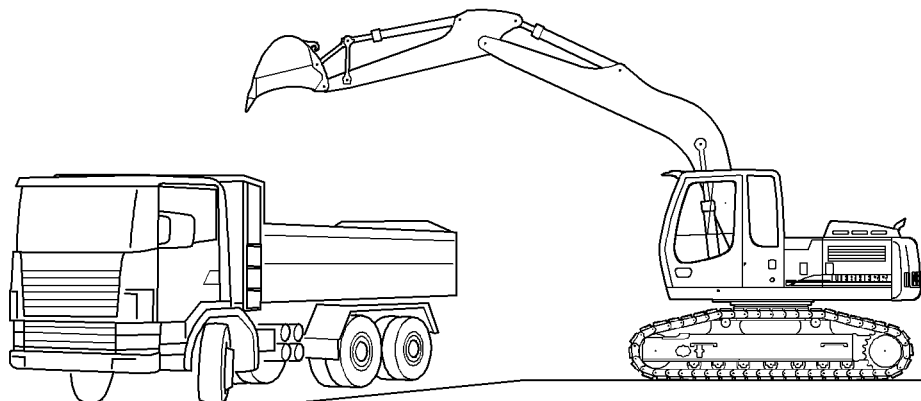


Fig. 3-128 Emptying grab material

- 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 backhoe bucket and the stick out, slewing the upper carriage and possibly also moving the boom.
- ▶ If the backhoe bucket is not sufficiently emptied or there is still grab material in the backhoe bucket, slew the backhoe bucket in and out several times to loosen the grab material.

3.8.5 Skimming

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

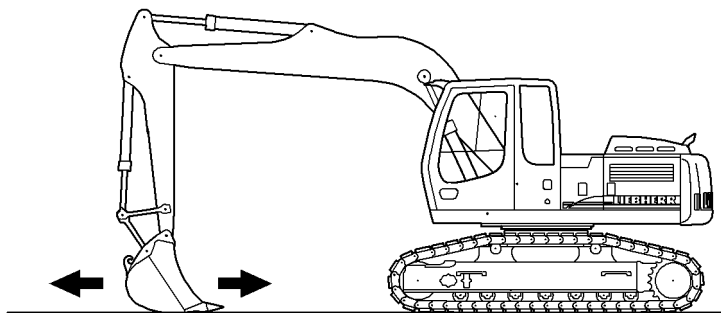


Fig. 3-129 Skimming

- 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 backhoe stick bucket, lay this on the ground (see Fig. 3-129) and move the stick slowly forwards and backwards. Move the boom steadily up and down while the stick is moving.
- ▶ If a skimming shield is present (optional extra), lower it to the ground and move slowly forwards and backwards with the machine.

3.8.6 Using a clamshell bucket (earthmoving attachment)



Danger!

Risk of fatal injury and damage to the machine due to a swinging clamshell.

- ▶ 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 stick 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 stick 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.

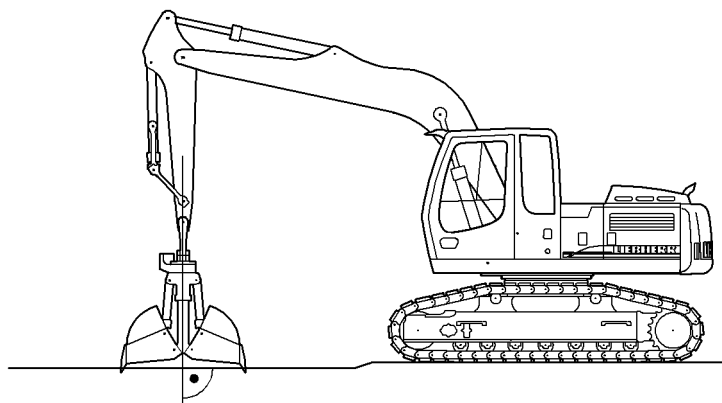


Fig. 3-130 Straightening the stick

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

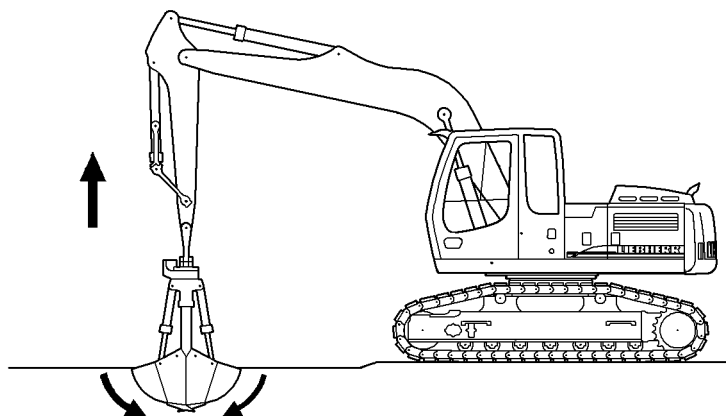


Fig. 3-131 Closing the grab shells

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



Danger!

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

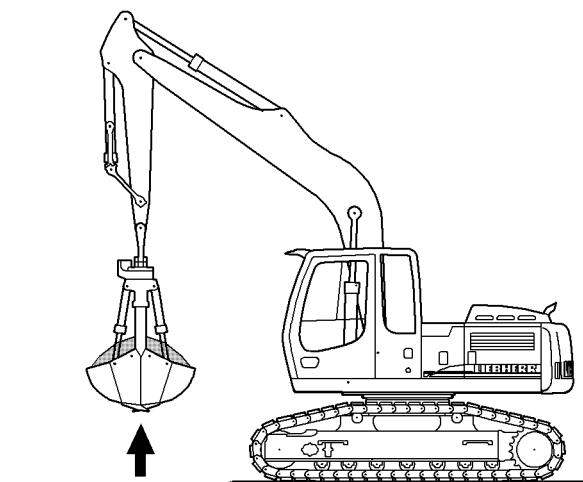


Fig. 3-132 Raising grab material

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

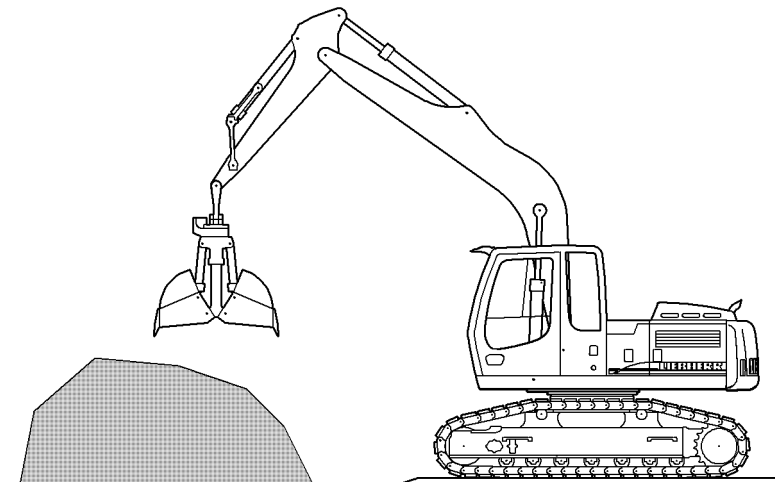


Fig. 3-133 Emptying grab material

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

3.8.7 Using a multiple tine grapple (industrial attachment)

- The machine must be in the working position.

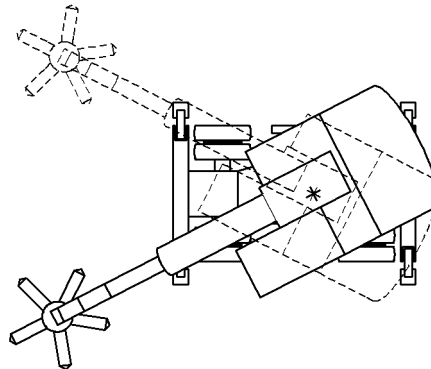


Fig. 3-134 Taking up the load

- ▶ 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.

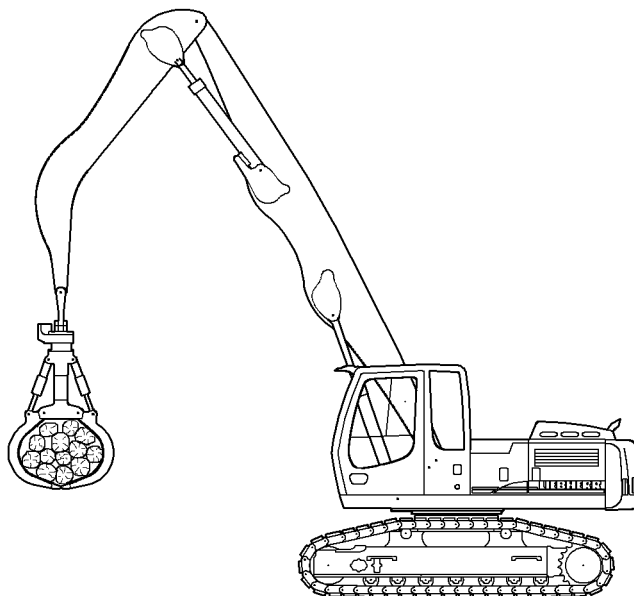


Fig. 3-135 Transporting a load

- ▶ 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.

3.8.8 Using an hydraulic hammer

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

**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.

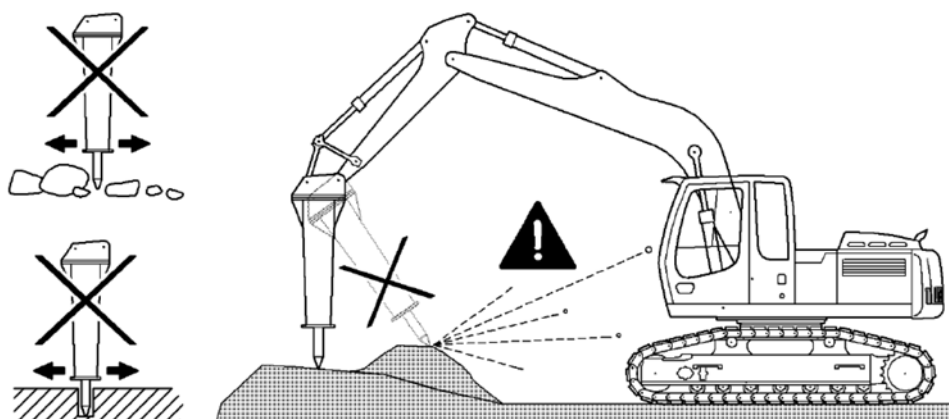


Fig. 3-136 Hydraulic hammer

- The machine must be positioned in the working position on level, solid ground.
- The stick 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.

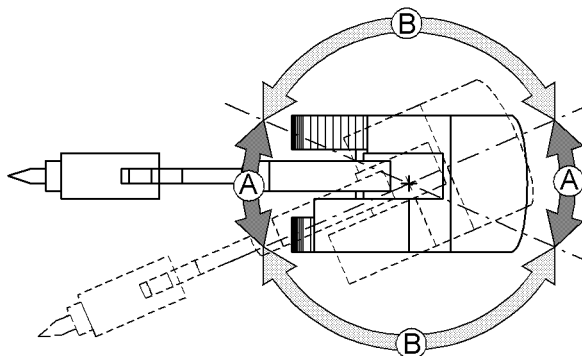


Fig. 3-137 Permissible **A** and not permissible **B** work areas of the machine with hydraulic hammer



Danger!

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

3.8.9 Working with a bottom dump bucket

Observe the following instructions in order to optimize the machine power as well the digging and breakout forces and the filling of the shovel and to help keeping the working place even and free of obstacles.

Filling the bottom dump shovel



Note!

Avoid digging with the attachment in a crosswise direction to the tracks.

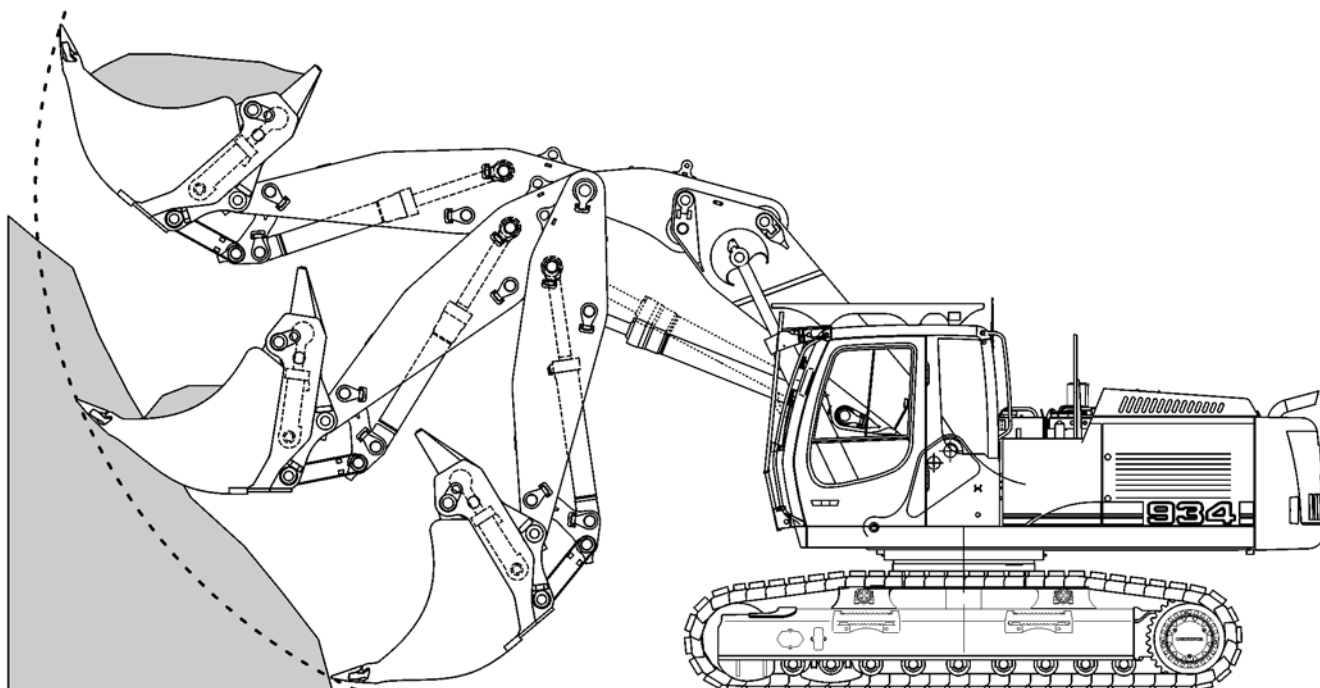


Fig. 3-138 Digging

- ▶ If possible, start digging with the shovel at ground level and with the stick almost fully crowded back (50mm of cylinders stops).
- ▶ When cleaning up the working place or digging, turn the teeth to an aggressive angle so to break out more easy the obstacles that may be encountered in the material to be excavated.
- ▶ Keep the bottom sheet of the shovel flap slightly raised up at the rear so ta avoid unnecessary friction forces between the soil and the bottom part of the shovel..



Caution!

- ▶ Take care not to hit the shovel against the tracks each time you crowd back the stick to commence a new digging operation.
- ▶ The flap must always be closed during digging operation. Take care not to reach the cylinder end positions or the mechanical stops of the shovel during the digging cycle. Continuously reaching the stops would lead to premature failure of seals and O-rings and can cause stress fractures to the flap, stick and shovel and damage to the boom and the uppercarriage.
- ▶ Tilt the shovel down just before closing the flap. Doing so you allow the closing movement to be helped by the weight of the flap, while reducing at the same time the strike of the flap against the shovel back.
- ▶ Never attempt to dig, level the working place, clean a cliff or bring down any material from an overhang, when the shovel flap is not fully closed. Such a practise can cause considerable damage to the flap cylinders.

Unloading the bottom dump shovel

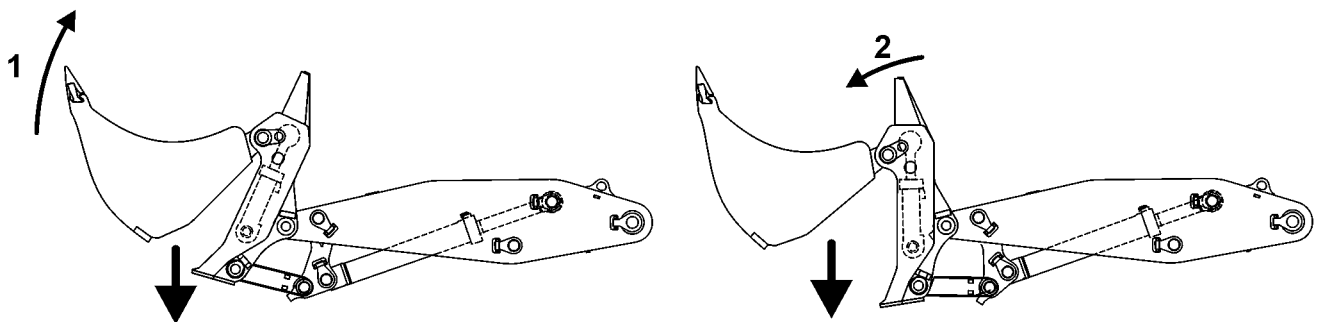


Fig. 3-139 Unloading the shovel

- ▶ Extend the stick and turn the uppercarriage at the same time, so to place the shovel over the carrier of the dump truck to be loaded.



Note!

The position of the shovel back when the flap opens, directly affects the falling down direction of the material.

Ideally, the load must fall straight down to the center of the dumper.

- ▶ Open the flap (pos 1) and tilt simultaneously the shovel forward slightly, so the trajectory of the material is as vertical as possible.
- ▶ When the shovel is empty, close the flap during the time the working attachment is returned to the ground level and to the position for starting a new digging sequence.

3.9 Installing & removing the serial counterweight



Danger!

In order to maintain the stability of the machine, a part of the working attachment is to be removed before removing the counterweight.

As a basic rule we recommend to remove all the attachment parts with exception of the boom (gooseneck boom, main boom or shovel boom) and to lower the boom to the ground.

- ▶ For a machine fitted with a special working attachment, always make sure which are the attachment parts to be dismantled before the counterweight is removed.

Suspension of the counterweight

The lifting points for suspending the counterweight with the lifting apparatus are situated at the upper face of the counterweight. The lifting points consist of two bolts integrated in the structure of the counterweight and become accessible after the removal of the cover(s) 6:

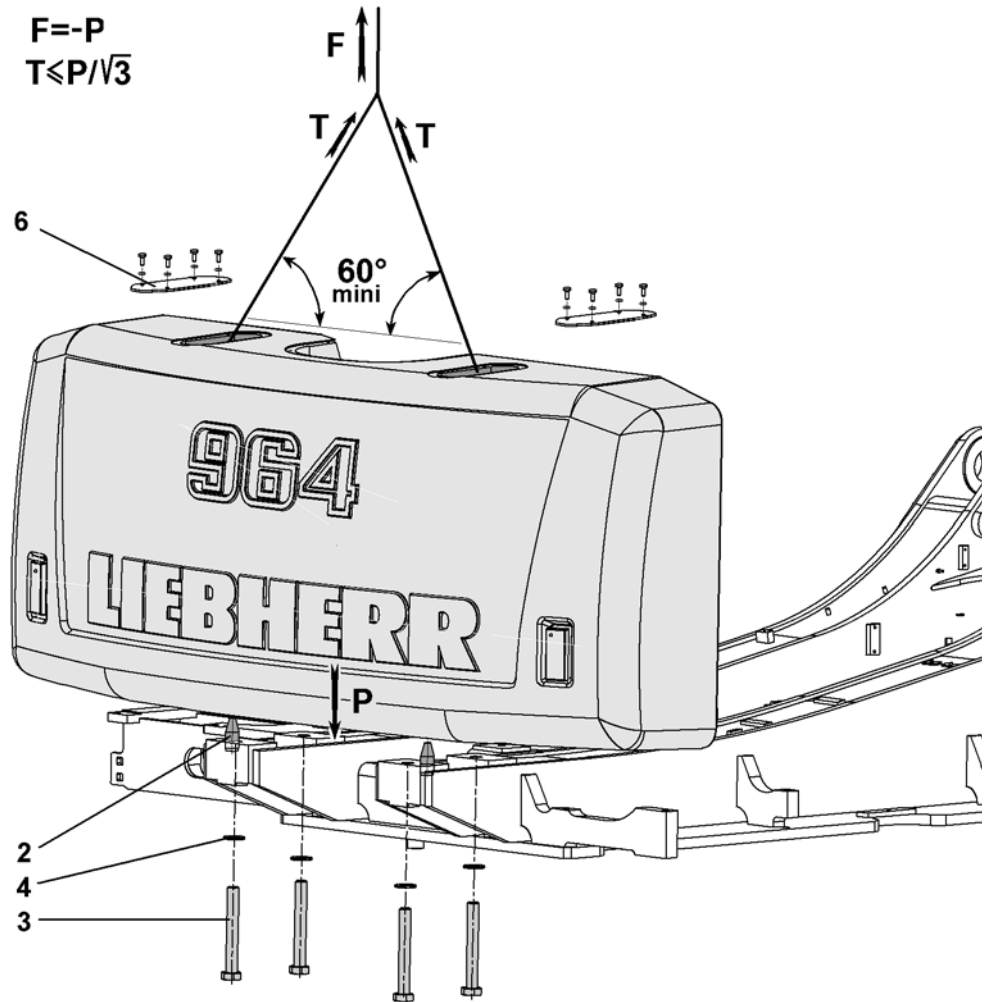


Fig. 3-140 Lifting points of the counterweight - Lifting forces

- 2 Centering pins
- 4 Washer

- 3 Mounting bolts
- 6 Cover



Caution!

The lifting points on the counterweight are not destined for lifting the complete basic machine or the complete uppercarriage. It is not allowed to employ them for this purpose! Machine parts may be damaged.

- ▶ Choose the lifting gear and devices so that the angle between the upper face of the counterweight and the lifting wires (see above figure) is at least 60°.
- ▶ Determine the lifting devices considering the weights and lifting forces indicated in the schedule below.

Machine modell - counterweight	Force F [kN]	Force T [kN]
R 964 C - 11 To	110	64
R 964 C - 14,5 To	144	83
R 964 C - 16,5 To	164	95
R 974 C - 14 To	138	80
R 964 C - 16 To	157	91

Removal of the counterweight

- ▶ Remove the cover(s) 6.
- ▶ Attach the lifting apparatus to the suspension points of the counterweight as described above.
- ▶ Loosen and remove the mounting bolts 3 of the counterweight.
- ▶ Lift up the counterweight using the crane and lay it down on supporting beams previously prepared on a firm, even and horizontal underground.

Installation of the counterweight

- ▶ Attach the lifting apparatus to the suspension points of the counterweight as described above.
- ▶ Check the correct position of the centering pins in the bores of the uppercarriage, lift the counterweight and set it down onto the supporting girders so that the centering pins 2 insert in the corresponding bores of the counterweight.



Danger!

- ▶ Never stand below the counterweight while it is hanged up on the lifting crane.
- ▶ Engage the mounting bolts 3 with washers 4 and tighten. For tightening torque, see the heading "Mounting bolts of the counterweight" in the chapter maintenance of this manual.



Caution!

It is forbidden to operate the machine if all the mounting bolts of the counterweight are not installed and correctly tightened. The steel construction structures may be seriously damaged

- ▶ Remove the lifting devices from the suspension points of the counterweight.

LFR/en/Edition: 07 / 2011

- ▶ Reinstall the cover(s) 6 at the upper face of the counterweight.

3.10 Transport

3.10.1 Transporting the excavator on flatbed trailers



Caution

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 before into the local legal permitted state.

- ❑ Before loading the machine, thoroughly check if the excavator can be transported with the complete working attachment or not, respect. which attachment parts must be removed during transportation, with regard to:
 - the maximal width, height and weight authorized by the local legal circulation rules,
 - the possible restrictions for width, height and load existing on the transport route,
 - the maximal load authorized for the flatbed trailer.
- ❑ Have some the chocks ready to secure the excavator.
- ▶ Clean any ice, snow or mud off the track chains before starting to load the machine.

Loading the machine onto the trailer

Bringing the machine onto the trailer:

- ▶ Drive the excavator on a flat, even and stable underground, and so that the undercarriage is lined up with the semi trailer of the transport truck. Slightly lift up the working attachment, and swing the uppercarrige so that the attachment is on the opposite side of the truck.

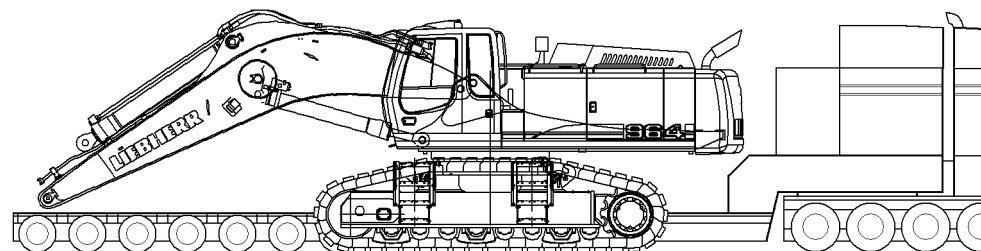


Fig. 3-141 Entering the flatbed trailer under the machine

- ▶ Drive the trailer back with care between the both side frames of the machine.



Note

Have a signaller provide the necessary signs.

- ❑ When the trailer is driven far enough under the machine, i. e. when the excavator is situated at the determined place above the trailer:

- ▶ Insert sufficiently dimensioned wooden blocks and wedges between the loading surface of the trailer and the structure of the undercarriage central part.

**Danger!**

- ▶ Avoid contact metal on metal.
- ▶ Slowly lift up the carrying surface of the trailer until reaching the transportation position and check that the wooden wedges are correctly positioned.
- ▶ Start the engine, if necessary turn the uppercarriage by 180° and lower the working attachment down to the trailer.
- ▶ Switch the engine off.
- ▶ Turn the ignition key to the contact position and depressurize the pressure circuits by briefly moving the both joysticks carefully in all directions and several times.
- ▶ Remove the ignition key and pull the safety lever up.
- ▶ Close and lock all doors, covers and panels on the machine.

To secure the machine on the flatbed trailer:

- ▶ Secure the machine against slipping before starting the transportation.

**Danger!**

Serious accidents can happen if the machine is allowed to slip on the semi trailer.

- ▶ Secure the machine against slipping.
- ▶ To do this, use chocks and a tension cable or tension chains.

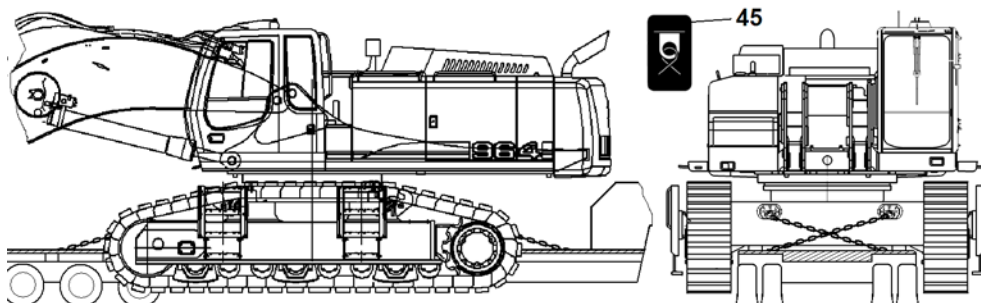


Fig. 3-142 To secure the machine using the stowage ears of the undercarriage

- ▶ Secure the machine using sufficiently dimensioned chains and cables, attached to the lashing points, destined for it, and which are indicated by the stickers 45 on the undercarriage.
- ▶ Lower the equipment, draw in the stanchion and tip the bucket as far as the stop

**Note**

Preferably get your machine fitted out with the LIEBHERR offered original stowage ears mounted to the central piece of the undercarriage. This equipment permits an optimal stowing possibility of the machine on the trailer surface.

- ▶ Attach the chains and cables to the trailer, paying attention to position them crosswise, so to empeach every gliding movement, especially lengthwise to the front or to the rear.

Transport route

**Danger!**

Driving beneath obstacles which are too low can cause serious accidents.

- ▶ Drive under obstacles, particularly electrical lines, with increased caution.
-
- ▶ Reconnoiter the route to be travelled before starting the transportation.
 - ▶ Pay particular attention to restrictions for width, height and load on transport route.

3.10.2 Loading the machine with a crane

If the machine is to be loaded using a crane (eg. flatbed trailers, 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 the loading procedure is not competently executed.

- ▶ 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.
 - ▶ Always observe the below described order of operation when removing or re-installing machine components and when coupling and unfastening the parts.
Non observance of prescribed procedure could cause the machine to tip over.
-

Loading the complete basic machine

The procedure thereafter describes the loading with a crane of the excavator with removed working attachment and counterweight.

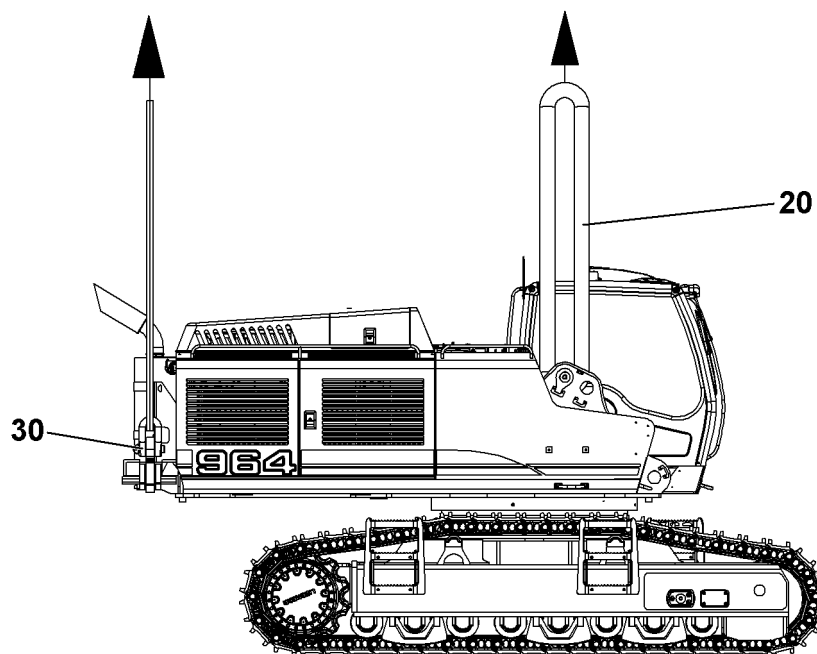


Fig. 3-143 Loading the machine with removed attachment and counterweight

Removing the machine components:

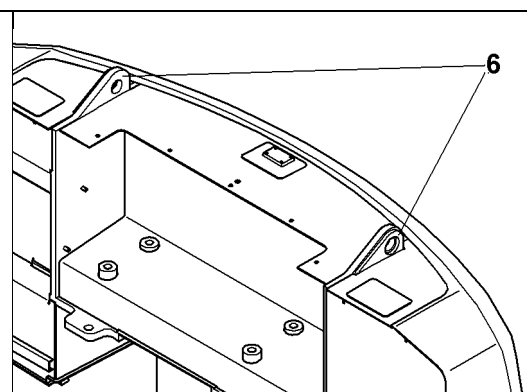
- ❑ If you employ other lifting tools that tools position 20 and 30 which has been specially developed by LIEBHERR for this purpose, make sure that they are sufficiently dimensioned.
- ▶ Park the machine on a flat, even and firm ground.
- ▶ Lower the working attachment to the soil, in a position suitable for a later removal of the attachment parts.
- ▶ For machines with backhoe, shovel or industrial attachments, remove the working tool and the stick (see also the heading "Removal & installation of attachment parts" previously in this manual) and next prop up the boom on the soil.
- ▶ Remove the counterweight from the uppercarriage.



Caution!

The lifting points at the top of the counterweight (Suspension eye in sheet, threaded holes,...) must only be used to lift the counterweight alone alleine verwendet werden.

- ▶ Never use the fixing points **6** at the top of the counterweight as lifting points to lift the complete basic machine or the complete uppercarriage.



- ▶ On machines fitted with an hydraulically removable counterweight, you must in addition:
 - Remove the counterweight 17 complete with the eventual installed additional counterweight, see also the section "Hydraulic removable counterweight" before in this manual.
 - Disconnect the lines feeding the telescopic cylinders of the removable counterweight at the quick couplings 19 and notice the correlation of the hydraulic

lines.

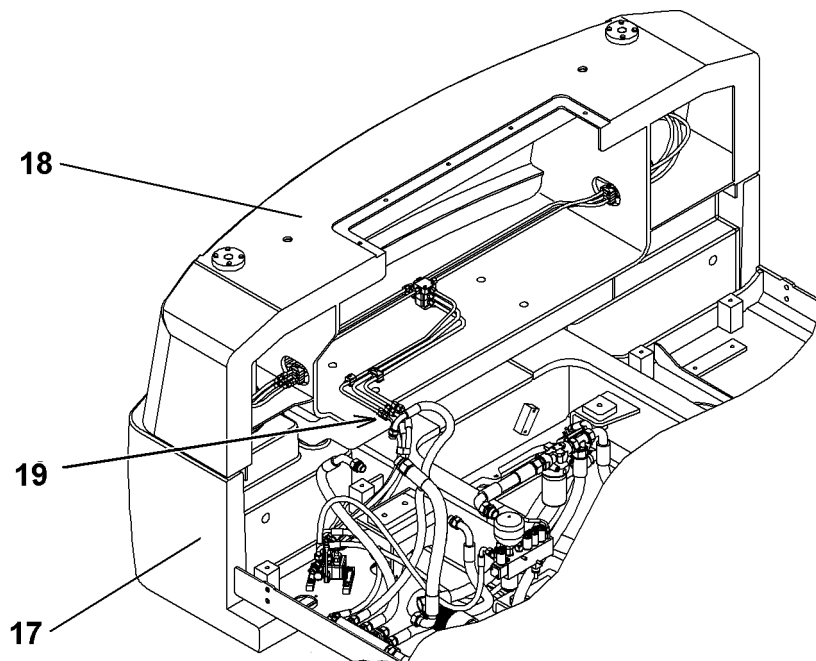


Fig. 3-144 disconnection of quick couplings

- Remove the mounting screws of the counterweight shell 18 and lift off the shell complete with the telescoping cylinders and lay it flatly down on the transport vehicle.



Caution!

During lowering, lifting up and transportation of the shell 18 take care that the telescopic cylinders are not damaged by knocking against or supporting the weight of any other items on the excavator or on the transport vehicle .

- ▶ Remove the boom from the basic machine.



Caution!

The removal and installation of the boom are only to be performed by authorized and specially trained persons!

- ▶ Observe all the safety regulations contained in the heading "Removal & installation of attachment parts" of this manual.

Attaching the lifting tools:

- ▶ Insert the both round lifting slings 20 between the main girders with the bearing bores for boom fixing.
- ▶ Reinstall the attachment fastening bolts 8 you have removed when dismantling the boom, taking care to catch the round slings 20. Secure the bolts 8.
- ▶ Draw up the both lifting tools 30 onto the rear part of the uppercarriage.
- On machines R964C
- ▶ Insert the securing rods 40 all the way through the openings of the lifting tools 30. Install the screws 6 to secure the rods 40.
- ▶ Connect the both shackles 5 to the rear lifting tools 30 and screw in the bolts of the shackles.

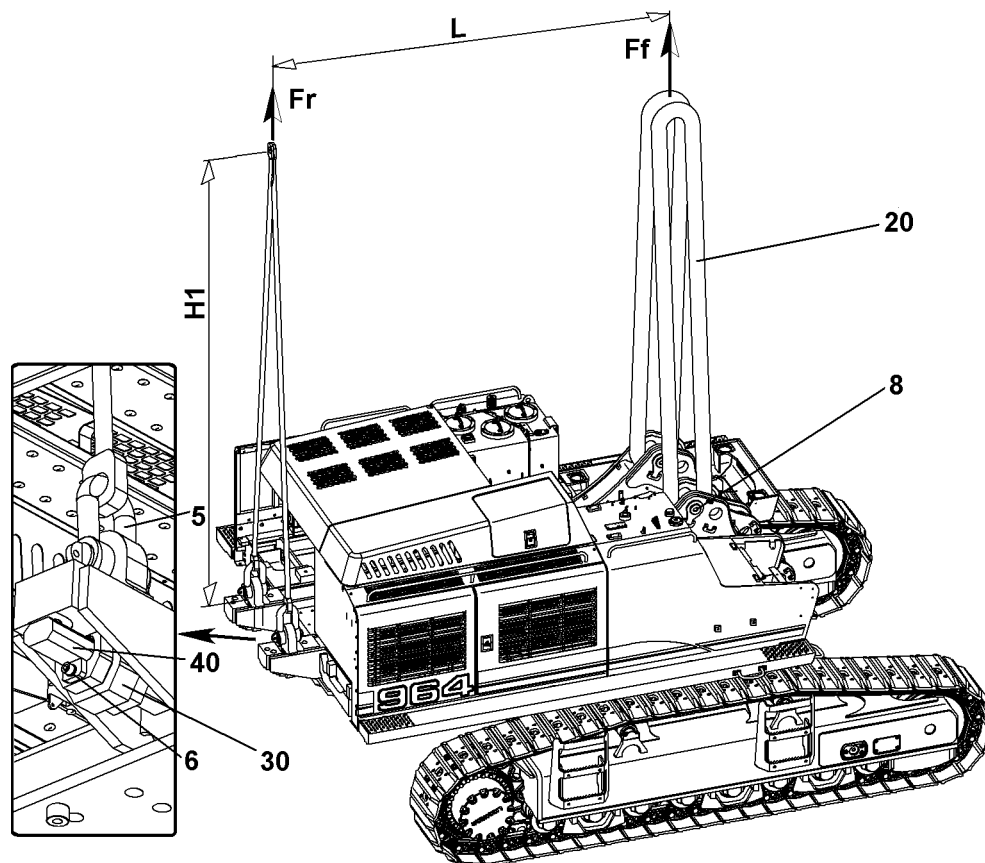


Fig. 3-145 Installing the lifting tools to the basic machine R964C

- ▶ On machines R974C
- ▶ Insert the fixing bolts 55 with washers 56 and nuts 57.
- ▶ Tighten the fixing bolts to the torque indicated further in this manual for the counterweight bolts.

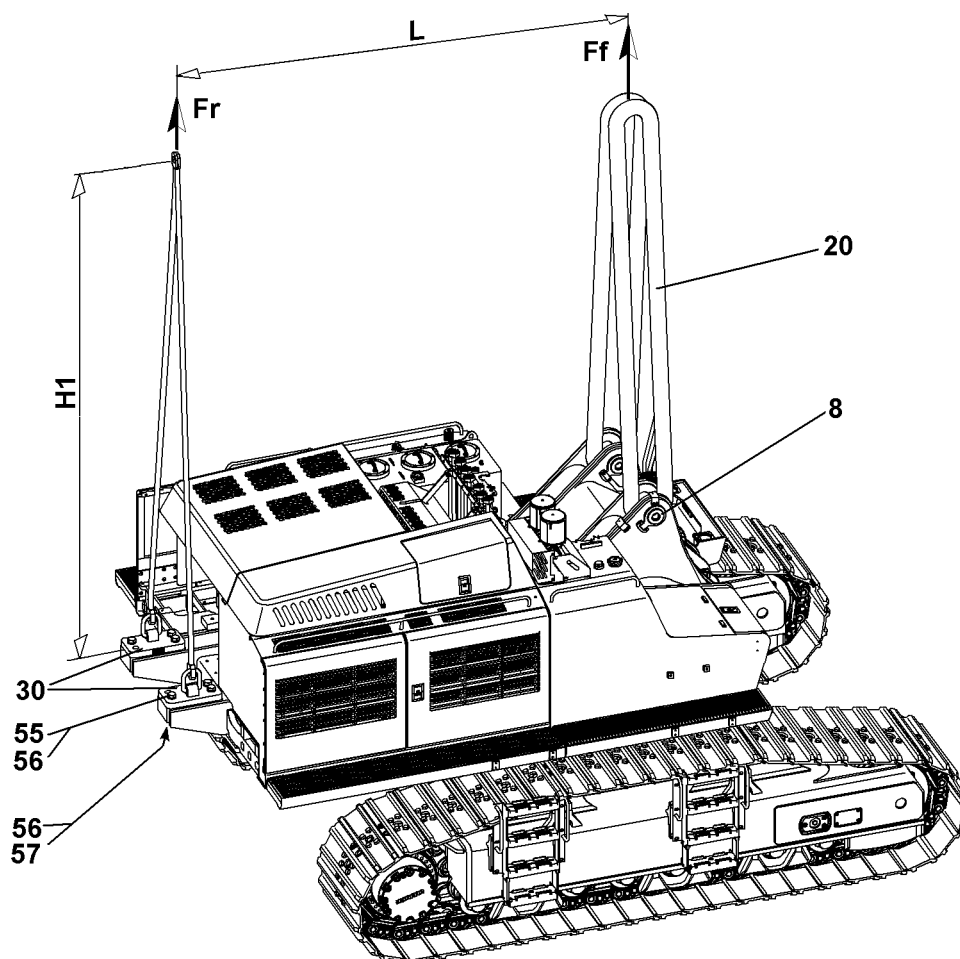


Fig. 3-146 Installing the lifting tools to the basic machine R974C

Hooking the machine to the lifting crane:

- Connect the upper shackles of the lifting devices with the lashing points of the lifting crane.



Note

Observe the below indicated value for distance L between the two fixing points, so that the both suspension cables, are approx. vertical when seen from the side. When selecting the lifting devices (cables, slings, shackles, ...), pay attention to observe the below indicated minimum length $H1$ so to ensure an horizontal lifting position of the machine.

The maximum necessary lifting forces F_f on the front side, resp. F_r on the rear side amount to approx:

Machine modell	F_r (kN)	F_f (kN)	L (mm)	$H1$ (mm)	Lifting tool Order Nb
R 964 C	200	600	3850	4300	10384183
R 974 C	200	790	4200	4600	10381405

**Note**

The indicated values for F_f and F_r are the maximum forces that are admissible for the lifting tools developed by LIEBHERR. These values are in any case sufficient for the determination of the lifting tools, the lifting crane and the transport vehicle. For certain machine types, with removed side frames,, lesser values may be sufficient, if necessary consult your LIEBHERR after sales representative.

**Danger!**

Use only suitable lifting devices, in good condition and with sufficient load carrying capacity.

Always wear work gloves when working with wire cables.

Loading the machine

- ▶ Slightly raise the machine with the crane to pretension the cables.
- ▶ Remove the ignition key and pull the safety lever up.
- ▶ Close and lock all doors, covers and panels on the machine .
- ▶ Carefully raise the machine with the lifting crane and load the machine onto the transport vehicle.

**Danger!**

Standing under the raised up machine is not permitted!

- ❑ If, on machine types with removable side frames, the side frames are removed for the transport, you must also:
 - disconnect all hydraulic lines to the travel motors at the travel motors and plug on both sides.
 - Loosen and remove the mounting bolts between side frames and undercarriage central part.
 - Carefully and vertically raise the machine with the lifting crane out of the both side frames and set it on the transport vehicle.

Securing the machine on the transport vehicle:

Secure the machine against slipping on the trailer, see under heading "Transporting the excavator on flatbed trailers" previously in this manual.

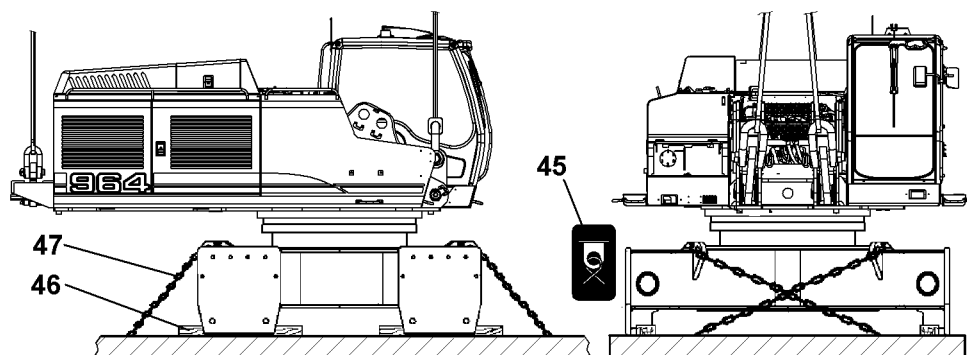


Fig. 3-147 Securing the machine (without sideframes) on the trailer

**Danger!**

Serious accidents can happen if the machine is allowed to slip on the semi trailer.

- ▶ Secure the machine against slipping.
- ▶ Secure the removed, separately transported components (counterweight, side frames, attachment parts, ...) against slipping.
- ▶ Underlay the machine and the separately transported components with wooden blocks 46 or wedges. Avoid contact metal on metal.

- ▶ Secure the machine using sufficiently dimensioned chains and cables 47, attached to the lashing points, destined for it, and which are indicated by the stickers 45 on the undercarriage.
- ▶ Attach the chains and cables to the trailer, paying attention to position them cross-wise, so to impeach every gliding movement, especially lengthwise to the front or to the rear.

Unloading and reassembling the machine after transport:

- ▶ Remove the anchoring cables and chains of the machine and of the separate transported components.
- ▶ Install the above described lifting tools and lifting devices to the machine (if they were removed for the transportation).
- ▶ Carefully raise the machine with the lifting crane and set the machine down to even, flat and firm ground.
- If, on machine types with removable side frames, the side frames are removed for the transport, you must also:
 - Unload first the both side frames from the transport vehicle and put them down on a firm, flat and horizontal surface, standing each other exactly parallel and at a distance corresponding to the central part width.
 - Carefully raise the machine with the lifting crane from the transport vehicle and lower it vertically in the supporting hooks of the side frames.
 - Insert and tighten the mounting bolts side frames to undercarriage central part (for indication of tightening torques, refer to heading "Check mounting bolts for tightness" further in this manual).

**Note**

The mounting bolts of the side frames must be replaced by new ones after 10 dis-mountings and mountings.

- reconnect all hydraulic lines to the travel motors at the travel motors .
- ▶ Remove all lifting tools 20 and 30 from the the rear part of the undercarriage and from the bearing bores of the boom cylinders.
- ▶ For machines with backhoe, shovel or industrial attachments, reinstall the stick and the working tool to the machine.
- ▶ Reinstall the counterweight to the uppercarriage
- On machines fitted with an hydraulically removable counterweight, you must in addition:
 - Reinstall the counterweight shell 18 complete with telescoping cylinders to the rear part of uppercarriage and insert and tighten the mounting bolts.
 - Reconnect the lines feeding the telescopic cylinders of the removable counterweight at the quick couplings 19.
 - Reinstall the counterweight 17 complete with the eventual installed additional counterweight, see also the heading "Hydraulic removable counterweight" be-

fore in this manual.

- ▶ Install the stick and the working tool to the machine, (see also the heading "Removal and installation of attachment parts" before in this manual).

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.

4.1 Error code list



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.

The error codes of warning symbols will not be displayed in the EC field of the operator's menu. They can only be read off the S-Exxx menu list. See Chapter 3 "Main screen".

Error code	Effect	Cause	Measure / remedy
E 002	Engine oil not being monitored.	Short circuit + 24 V	Check engine oil level, consult LIEBHERR customer service.
E 003		Short circuit to earth or Cable break	
E 004	Coolant level not being monitored.	Short circuit to earth	Check coolant level, consult LIEBHERR customer service.
E 005		Short circuit + 24 V	
E 006		Cable break	
E 007	Coolant temperature not being monitored.	Short circuit to earth	Check that the radiator is not dirty, consult LIEBHERR customer service.
E 009		Short circuit + 24 V or Cable break	
E 010	Hydraulic oil level not being monitored.	Short circuit to earth	Check hydraulic oil level, consult LIEBHERR customer service.
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, consult LIEBHERR customer service.
E 014		Short circuit + 24 V	
E 015		Cable break	
E 016	Splitterbox oil temperature not being monitored. (from R954)	Short circuit to earth	Check oil level, consult LIEBHERR customer service.
E 017		Short circuit + 24 V	
E 018		Cable break	
E 022	Diesel engine speed not being monitored, diesel engine speed cannot be adjusted using keypad, reduced hydraulic power.	Short circuit to earth	Switch to emergency control speed adjustment S71 and S72 and emergency operation work pumps Y50 , consult LIEBHERR customer service.
E 023		Short circuit + 24 V	
E 024		Cable break	
E 027	Faulty hydraulic power	LR cable error at output stage for power control of hydraulic pump	Switch to emergency control speed adjustment S71 and S72 and emergency operation work pumps Y50 , consult LIEBHERR customer service.
E 033	Maximum fan speed	EV 5 cable error at output stage of electric valve for hydraulic fan control	Consult LIEBHERR customer service.

Error code	Effect	Cause	Measure / remedy
E 036	Flow reduction for hydraulic equipment not being carried out.	EV 1 cable error at the output stage for flow regulation of hydraulic pump	Do not operate flow reduced equipment, consult LIEBHERR customer service.
E 039	Flow reduction for hydraulic equipment not being carried out (from R934, optional extra).	EV 2 cable error at the output stage for flow regulation of second hydraulic pump	Do not operate flow reduced equipment, consult LIEBHERR customer service.
E 042	Flow reduction for hydraulic equipment not being carried out. (for R984, optional extra)	EV 3 cable error at the output stage for flow regulation of third hydraulic pump	Do not operate flow reduced equipment, consult LIEBHERR customer service.
E 045	Pressure reduction for hydraulic equipment not being carried out.	EV6 cable error at the output stage for pressure regulation of the hydraulic circuit.	Do not operate pressure reduced equipment, consult LIEBHERR customer service.
E 063	Turbocharged air temperature not being monitored.	Short circuit to earth	Check that the radiator is not dirty, consult LIEBHERR customer service.
E 065		Short circuit + 24 V or Cable break	
E 070	Engine RPM not being monitored.	Transmitter output default	Switch to emergency control speed adjustment S71 and S72 and emergency operation work pumps Y50 , consult LIEBHERR customer service.
E 072	Turbocharged air pressure not being monitored.	Short circuit + 24 V	Check the turbocharged air circuit, consult LIEBHERR customer service.
E 073		Short circuit to earth or Cable break	
E 074	Engine does not start	Start time out	Consult LIEBHERR customer service.
E 075		Starter default	
E 078		Défaut hardware	Consult LIEBHERR customer service.
E 079		Défaut software	
E 081	Engine RPM not being monitored.	Transmitter B12-1 default	Switch to emergency control speed adjustment S71 and S72 and emergency operation work pumps Y50 , consult LIEBHERR customer service.
E 082		Transmitter B12-2 default	
E 084	Cold start command default	Unit 1 of cold start command over current	Consult LIEBHERR customer service.
E 085		Unit 1 of cold start command default	
E 086		Open load for Unit 1 of cold start command	
E 087	Engine RPM not being monitored.	The values registered by the transmitters B12-1 and B12-2 are different.	Switch to emergency control speed adjustment S71 and S72 and emergency operation work pumps Y50 , consult LIEBHERR customer service.
E 088	Atmospheric pressure not being monitored.	Short circuit + 24 V or short circuit to earth or cable break	Consult LIEBHERR customer service.
E 089	Water in fuel filter not being monitored. Engine does not start	Short circuit + 24 V or short circuit to earth or cable break	Consult LIEBHERR customer service.

Error code	Effect	Cause	Measure / remedy
E 090	Fuel temperature not being monitored.	Short circuit to earth	Consult LIEBHERR customer service.
E 091		Short circuit + 24 V or cable break	
E 092	Fuel pressure not being monitored.	Short circuit + 24 V	Consult LIEBHERR customer service.
E 093		Short circuit to earth or cable break	
E 094	Fuel pressure in rail 1 not being monitored.	Short circuit + 24 V	Consult LIEBHERR customer service.
E 095		Short circuit to earth or cable break	
E 096	Fuel pressure in rail 2 not being monitored.	Short circuit + 24 V	Consult LIEBHERR customer service.
E 097		Short circuit to earth or cable break	
E 098		D+ default on the alternator	Consult LIEBHERR customer service.
E 099		Alternator default	
E 100	Engine RPM not being monitored.	The value registered by the transmitter B12-1 is impossible.	Switch to emergency control speed adjustment S71 and S72 and emergency operation work pumps Y50 , consult LIEBHERR customer service.
E 101	Engine RPM not being monitored.	The value registered by the transmitter B12-2 is impossible.	Switch to emergency control speed adjustment S71 and S72 and emergency operation work pumps Y50 , consult LIEBHERR customer service.
E 102	Engine can not be started.	Crankshaft synchronisation default	Consult LIEBHERR customer service.
E 103		Camshaft transmitter default	Consult LIEBHERR customer service.
E 104		The value registered by the camshaft transmitter is impossible.	Consult LIEBHERR customer service.
E 105	Engine can not be started.	Camshaft synchronisation	Consult LIEBHERR customer service.
E 106	Cold start command default	Unit 2 of cold start command over current	Consult LIEBHERR customer service.
E 107		Unit 2 of cold start command default	
E 108		Open load for Unit 2 of cold start command	
E 109		Hardware CAN1 default	Consult LIEBHERR customer service.
E 110		CAN1 data impossible or time out	
E 111		Injector A1 default	Consult LIEBHERR customer service.
E 112		Injector A1 error BIP / FZM	
E 113		Injector A2 default	Consult LIEBHERR customer service.
E 114		Injector A2 error BIP / FZM	

Error code	Effect	Cause	Measure / remedy
E 115		Injector A3 default	Consult LIEBHERR customer service.
E 116		Injector A3 error BIP / FZM	
E 117		Injector A4 default	Consult LIEBHERR customer service.
E 118		Injector A4 error BIP / FZM	
E 119		Injector B1 default	Consult LIEBHERR customer service.
E 120		Injector B1 error BIP / FZM	
E 121		Injector B2 default	Consult LIEBHERR customer service.
E 122		Injector B2 error BIP / FZM	
E 123		Injector B3 default	Consult LIEBHERR customer service.
E 124		Injector B3 error BIP / FZM	
E 125		Injector B4 default	Consult LIEBHERR customer service.
E 126		Injector B4 error BIP / FZM	
E 127		Parameter default bank A	Consult LIEBHERR customer service.
E 128		Parameter default bank B	
E 129	Fuel pressure in rail 1 not being monitored.	Short circuit to earth or cable break	Consult LIEBHERR customer service.
E 130		Short circuit + 24 V	
E 131		Incoherent signal	
E 132	Fuel pressure in rail 2 not being monitored.	Short circuit to earth or cable break	Consult LIEBHERR customer service.
E 133		Short circuit + 24 V	
E 134		Incoherent signal	
E 135		Circuit 5 Volt - REF1	Consult LIEBHERR customer service.
E 136		Circuit 5 Volt - REF2	
E 137		Circuit 5 Volt - REF3	
E 138		Circuit 5 Volt - REF4	
E 139		Circuit 5 Volt - REF5	
E 140	Possible starting difficulties at low ambient temperatures	Left heater flange R51-1 is defective	Check, if necessary replace the heater flange R51-1 .
E 141		Right heater flange R52-1 is defective	Check, if necessary replace the heater flange R52-1 .
E 219	Possibly incorrect function of the travel pedals U22/U23	The sensors B40/B45 are active, even though the pedals U22/U23 are not actuated . Travel pedals U22/U23 wrong adjusted or defective	Check the travel pedals for proper function, if necessary readjust or replace pedals.
E 220	Possibly incorrect function of the pressureless lowering	Short circuit to ground or to +24V in the load circuit of Y401	Check, if necessary repair the commutation solenoid valve Y401 and its connecting circuit
E221 to E223	Possibly incorrect function of the servo control for additional movement	Short circuit to ground or to +24V in the load circuit of the commutation solenoid valve	Check, if necessary repair the commutation solenoid valve for additional movement and its connecting circuit
E 224 to E 227		Short circuit to ground or to +24V in the load circuit	Check, if necessary repair the load circuit

Error code	Effect	Cause	Measure / remedy
E 228	Possibly incorrect function of the servo control circuit	Short circuit to ground or to +24V in the load circuit of the commutation solenoid valve Y 369A	Check, if necessary repair the commutation solenoid valve Y369A and its connecting circuit
E 229	Possibly incorrect function of the servo control circuit	Short circuit to ground or to +24V in the load circuit of the commutation solenoid valve Y 370B	Check, if necessary repair the commutation solenoid valve Y370B and its connecting circuit
E230, E231 and E233	Possibly incorrect function of the servo control for additional movement	Short circuit to ground or to +24V in the load circuit	Check, if necessary repair the load circuit
E 232	Possibly incorrect function of the pressureless lowering	Short circuit to ground or to +24V in the load circuit Y109	Check, if necessary repair the commutation solenoid valve Y109 and its connecting circuit
E 234	Possibly incorrect function of the servo control for swing left	Short circuit to ground or to +24V in the load circuit Y150	Check, if necessary repair the commutation solenoid valve Y150 and its connecting circuit
E 235	Possibly incorrect function of the servo control for swing right	Short circuit to ground or to +24V in the load circuit Y151	Check, if necessary repair the commutation solenoid valve Y151 and its connecting circuit
E220 to E235 Simultaneously	No or incorrect function of the servo control	Missing 24V supply of the servo control plate U46/D	Check 24V supply circuit, r(epar as necessary (Fuse F153, connectors X830-1 & X830-3, .))
E 236	Possibly incorrect function of the servo control for lowering boom.	Short circuit to ground or to +24V in the load circuit Yr1-A1	Check, if necessary repair the regulation solenoid valve Yr1-A1 and its connecting circuit
E 237		Broken wire in the load circuit to regulation solenoid valve Yr1-A1	
E 238	Possibly incorrect function of the servo control for lifting boom.	Short circuit to ground or to +24V in the load circuit Yr1-B1	Check, if necessary repair the regulation solenoid valve Yr1-B1 and its connecting circuit
E 239		Broken wire in the load circuit to regulation solenoid valve Yr1-B1	
E 240	Possibly incorrect function of the servo control for bucket tilting out.	Short circuit to ground or to +24V in the load circuit Yr1-A2	Check, if necessary repair the regulation solenoid valve Yr1-A2 and its connecting circuit
E 241		Broken wire in the load circuit to regulation solenoid valve Yr1-A2	
E 242	Possibly incorrect function of the servo control for bucket tilting in.	Short circuit to ground or to +24V in the load circuit Yr1-B2	Check, if necessary repair the regulation solenoid valve Yr1-B2 and its connecting circuit
E 243		Broken wire in the load circuit to regulation solenoid valve Yr1-B2	
E 244	Possibly incorrect function of the servo control for travelling left backwards.	Short circuit to ground or to +24V in the load circuit Yr1-A3	Check, if necessary repair the regulation solenoid valve Yr1-A3 and its connecting circuit
E 245		Broken wire in the load circuit to regulation solenoid valve Yr1-A3	

Error code	Effect	Cause	Measure / remedy
E 246	Possibly incorrect function of the servo control for travelling left forward.	Short circuit to ground or to +24V in the load circuit Yr1-B3	Check, if necessary repair the regulation solenoid valve Yr1-B3 and its connecting circuit
E 247		Broken wire in the load circuit to regulation solenoid valve Yr1-B3	
E 248	Possibly incorrect function of the servo control for retracting or extending stick.	Short circuit to ground or to +24V in the load circuit Yr1-A4	Check, if necessary repair the regulation solenoid valve Yr1-A4 and its connecting circuit
E 249		Broken wire in the load circuit to regulation solenoid valve Yr1-A4	
E 250	Possibly incorrect function of the servo control for extending or retracting stick.	Short circuit to ground or to +24V in the load circuit Yr1-B4	Check, if necessary repair the regulation solenoid valve Yr1-B4 and its connecting circuit
E 251		Broken wire in the load circuit to regulation solenoid valve Yr1-B4	
E 236 to E 251 Simultaneously	No or incorrect function of the servo control	Missing 24V supply of the servo control plate U48-1/A , connector X840-3	Check 24V supply circuit, r(epar as necessary (Fuse F151, connector X840-3, .)
E 252	Possibly incorrect function of the servo control for travelling forward.	Short circuit to ground or to +24V in the load circuit Yr1-A5	Check, if necessary repair the regulation solenoid valve Yr1-A5 and its connecting circuit
E 253		Broken wire in the load circuit to regulation solenoid valve Yr1-A5	
E 254	Possibly incorrect function of the servo control for lifting boom.	Short circuit to ground or to +24V in the load circuit Yr1-B5	Check, if necessary repair the regulation solenoid valve Yr1-B5 and its connecting circuit
E 255		Broken wire in the load circuit to regulation solenoid valve Yr1-B5	
E 256	Possibly incorrect function of the servo control for travelling right backw. (R964 C) or bucket tilting out (R974 C).	Short circuit to ground or to +24V in the load circuit Yr1-A6	Check, if necessary repair the regulation solenoid valve Yr1-A6 and its connecting circuit
E 257		Broken wire in the load circuit to regulation solenoid valve Yr1-A6	
E 258	Possibly incorrect function of the servo control for travelling right forward (R964 C) or bucket tilting in (R974 C).	Short circuit to ground or to +24V in the load circuit Yr1-B6	Check, if necessary repair the regulation solenoid valve Yr1-B6 and its connecting circuit
E 259		Broken wire in load circuit to regulation solenoid valve Yr1-B6	
E 260	Possibly incorrect function of the servo control for travelling right backw. (R974 C) or bucket tilting out (R964 C).	Short circuit to ground or to +24V in the load circuit Yr1-A7	Check, if necessary repair the regulation solenoid valve Yr1-A7 and its connecting circuit
E 261		Broken wire in load circuit to regulation solenoid valve Yr1-A7	
E 262	Possibly incorrect function of the servo control for travelling right forward (R974 C) or bucket tilting in (R964 C).	Short circuit to ground or to +24V in the load circuit Yr1-B7	Check, if necessary repair the regulation solenoid valve Yr1-B7 and its connecting circuit
E 263		Broken wire in load circuit to regulation solenoid valve Yr1-B7	

LFR/en/Edition: 07 / 2011

Error code	Effect	Cause	Measure / remedy
E 264	Possibly incorrect function of the servo control for retracting stick (only R974C)	Short circuit to ground or to +24V in the load circuit Yr1-A8	Check, if necessary repair the regulation solenoid valve Yr1-A8 and its connecting circuit
E 265		Broken wire in load circuit to regulation solenoid valve Yr1-A8	
E 266	Possibly incorrect function of the servo control for extending stick (only R974C)	Short circuit to ground or to +24V in the load circuit Yr1-B8	Check, if necessary repair the regulation solenoid valve Yr1-B8 and its connecting circuit
E 267		Broken wire in load circuit to regulation solenoid valve Yr1-B8	
E252 to E267 Simultaneously	No or incorrect function of the servo control	Missing 24V supply of the servo control plate U48-1/A , connector X840-1	Check 24V supply circuit, r(epar as necessary (Fuse F151, connector X840-1, .)
E 268	Possibly incorrect function of the servo control for shovel flap opening. (only R964C)	Short circuit to ground or to +24V in the load circuit Yr2-A2	Check, if necessary repair the regulation solenoid valve Yr2-A2 and its connecting circuit
E 269		Broken wire in load circuit to regulation solenoid valve Yr2-A2	
E 270	Possibly incorrect function of the servo control for shovel flap closing (only R964C)	Short circuit to ground or to +24V in the load circuit Yr2-B2	Check, if necessary repair the regulation solenoid valve Yr2-B2 and its connecting circuit
E 271		Broken wire in load circuit to regulation solenoid valve Yr2-B2	
E 272	Possibly incorrect function of the servo control for shovel stick retraction (R964C) or shovel flap opening (R974C)	Short circuit to ground or to +24V in the load circuit Yr2-A1	Check, if necessary repair the regulation solenoid valve Yr2-A1 and its connecting circuit
E 273		Broken wire in load circuit to regulation solenoid valve Yr2-A1	
E 274	Possibly incorrect function of the servo control for shovel stick extension (R964C) or shovel flap closing (R974C)	Short circuit to ground or to +24V in the load circuit Yr2-B1	Check, if necessary repair the regulation solenoid valve Yr2-B1 and its connecting circuit
E 275		Broken wire in load circuit to regulation solenoid valve Yr2-B1	
E 276	Possibly incorrect function of the servo control for extension of additional cylinder	Short circuit to ground or to +24V in the load circuit Yr3-B1	Check, if necessary repair the regulation solenoid valve Yr3-B1 and its connecting circuit
E 277		Broken wire in load circuit to regulation solenoid valve Yr3-B1	
E 278	Possibly incorrect function of the servo control for retraction of additional cylinder	Short circuit to ground or to +24V in the load circuit Yr3-A1	Check, if necessary repair the regulation solenoid valve Yr3-A1 and its connecting circuit
E 279		Broken wire in load circuit to regulation solenoid valve Yr3-A1	
E 280	Possibly incorrect function of the servo control for swing left	Short circuit to ground or to +24V in the load circuit Yr150	Check, if necessary repair the regulation solenoid valve Yr150 and its connecting circuit
E 281		Broken wire in load circuit to regulation solenoid valve Yr150	
E 282	Possibly incorrect function of the servo control for swing right	Short circuit to ground or to +24V in the load circuit Yr151	Check, if necessary repair the regulation solenoid valve Yr151 and its connecting circuit
E 283		Broken wire in load circuit to regulation solenoid valve Yr151	
E 268 to E 283 Simultaneously	No or incorrect function of the servo control	Missing 24V supply of the servo control plate U48-2/A , connector X850-3	Check 24V supply circuit, r(epar as necessary (Fuse F152, connector X850-3, .)

Error code	Effect	Cause	Measure / remedy
E 284	Possibly incorrect function of the servo control for pressure-less lowering	Short circuit to ground or to +24V in the load circuit Yr401	Check, if necessary repair the regulation solenoid valve Yr401 and its connecting circuit
E 285		Broken wire in load circuit to regulation solenoid valve Yr401	
E286, 88, 90, to E298	Possibly incorrect function of the servo control for additional movement	Short circuit to ground or to +24V in the load circuit	Check, if necessary repair the regulation solenoid valve for additional movement and its connecting circuit
E287, 89, 91, to E299		Broken wire in load circuit to regulation solenoid valve	
E284 to E299 Simultaneously	No or incorrect function of the servo control	Missing 24V supply of the servo control plate U48-2/A , connector X850-1	Check 24V supply circuit, r(epar as necessary (Fuse F152, connector X850-1, .)
E 302	No entry possible using keypad	No coding plug	Consult LIEBHERR customer service.
E 303	Diesel engine speed cannot be adjusted using keypad, hydraulic power is reduced.	No CAN bus connection between keypad and BST plate (message also appears if bus arbiter not operating, e.g. if no power supply is present).	Switch to emergency control speed adjustment S71 and S72 and emergency operation work pumps Y50 , consult LIEBHERR customer service.
E 305	Malfunctions, e.g. swing gear brake, servo control	No CAN bus connection between keypad and ESP01 board (message also appears if ESP01 not operating).	Switch to emergency switching of servo pressure circuits S73 , consult LIEBHERR customer service.
E 307		No CAN bus connection between keypad and engine control system PLD	Switch to emergency control speed adjustment S71 and S72 and emergency operation work pumps Y50 , consult LIEBHERR customer service.
E 308	No display or incorrect display on screen	No connection keypad / screen or keypad not operating	Consult LIEBHERR customer service.
E 309		No Software compatibility between screen and keypad	
E 310		For boring excavators, Hardware coding and software coding are not in concordance.	Consult LIEBHERR customer service.
E 314		Time out for CAN bus connection between keypad and engine control system PLD	Consult LIEBHERR customer service.
E 318	The error codes of the UEC (platine A180) are not displayed on screen	No CAN bus connection between keypad and UEC (platine A180)	Consult LIEBHERR customer service.
E 319	Diesel engine speed cannot be adjusted using keypad, reduced hydraulic power.	Hardware coding not suited to software coding	Switch to emergency control speed adjustment S71 and S72 and emergency operation work pumps Y50 , consult LIEBHERR customer service.
E 321		Keypad has not received a recognised machine type.	
E 322		Unknown hardware coding	

LFR/en/Edition: 07 / 2011

Error code	Effect	Cause	Measure / remedy
E 323	Possibly incorrect function of the servo control circuit	Internal default of servo control plate U47	Consult LIEBHERR customer service.
E 324		Internal default of servo control plate U48-1	Consult LIEBHERR customer service.
E 325		Internal default of servo control plate U48-2	Consult LIEBHERR customer service.
E 326		Internal default of servo control plate U46	Consult LIEBHERR customer service.
E 327	Possibly incorrect function of the travel pedals U22/U23	Pedals U22/U23 actuated, even though B40/B45 not active Travel pedals U22/U23 wrong adjusted or defective	Check the pedals U22/U23 for proper function, if necessary readjust or replace pedals.
E 328	No or incorrect function of the electrical servo control system	No communication with the U101 coding unit	Consult LIEBHERR customer service.
E 329	No or incorrect function of the electrical servo control system	Incorrect CAN-Bus connection (Timeout) between control unit and servo control plate U47	Consult LIEBHERR customer service.
E 330	No or incorrect function of the electrical servo control system	Incorrect CAN-Bus connection between CAN 3-1 and CAN 3-2	Consult LIEBHERR customer service.
E 331		Incorrect CAN-Bus connection between CAN 4-1 and CAN 4-2	Consult LIEBHERR customer service.
E 332		Incorrect CAN-Bus connection between CAN 5-1 and CAN 5-2	Consult LIEBHERR customer service.
E 333	No or incorrect function of the electrical servo control system	Defective Bus CAN 3	Consult LIEBHERR customer service.
E 334		Defective Bus CAN 4	Consult LIEBHERR customer service.
E 335		Defective Bus CAN 5	Consult LIEBHERR customer service.
E 336	No or incorrect function of the electrical servo control system	Incorrect CAN-Bus connection between servo control plate U47 and LDC	Contactez votre Service Après Vente LIEBHERR.
E 337	No or incorrect function of the electrical servo control system	Incorrect CAN-Bus connection between servo control plate U47 and left joystick	Consult LIEBHERR customer service.
E 340		Incorrect CAN-Bus connection between servo control plate U47 and right joystick	Consult LIEBHERR customer service.
E 343	No or incorrect function of the electrical servo control system	Incorrect CAN-Bus connection between servo control plate U47 and left travel pedal U22	Consult LIEBHERR customer service.
E 345		Incorrect CAN-Bus connection between servo control plate U47 and right travel pedal U23	Consult LIEBHERR customer service.
E 347	No or incorrect function of the electrical servo control system	Incorrect CAN-Bus connection between servo control plate U47 and pedal for special attachments U24	Consult LIEBHERR customer service.

Error code	Effect	Cause	Measure / remedy
E 350	No or incorrect function of the electrical servo control system	Incorrect CAN-Bus connection between servo control plate U47 and brake pedal U26	Consult LIEBHERR customer service.
E 353	No or incorrect function of the electrical servo control system	Incorrect CAN-Bus connection between servo control plate U47 and pedal for special attachments U27	Consult LIEBHERR customer service.
E 355	No or incorrect function of the electrical servo control system	Unknown excavator coding in coding unit U101	Consult LIEBHERR customer service.
E 356	No or incorrect function of the electrical servo control system	Incorrect CAN-Bus communication between control plate U47 and U48-1	Consult LIEBHERR customer service.
E 357		Incorrect CAN-Bus communication between control plate U47 and U48-2	Consult LIEBHERR customer service.
E 358		Incorrect CAN-Bus communication between control plate U47 and U46	Consult LIEBHERR customer service.
E 413	Possibly incorrect function of the shock-absorber of the bucket cylinder.	Defective wire - connection to the transmitter B 351 Current < 3mA or > 21 mA	Check, if necessary repair the connecting circuit to the transmitter
E 429	Possibly incorrect function of the servo control for additional movement (AHS 11) .	Incorrect neutral position of the pedal 1 in the double pedal U24 is recognized	Check, if necessary repair the left double pedal U24 and its connecting circuit
E 431		Defective wire - connection to the pedal 1 in the double pedal U24 Current < 3mA or >21mA	
E 432	Possibly incorrect function of the servo control for additional movement (AHS 11) .	Incorrect neutral position of the pedal 2 in the double pedal U24 is recognized	Check, if necessary repair the left double pedal U24 and its connecting circuit
E 434		Defective wire - connection to the pedal 2 in the double pedal U24	
E 435	Possibly incorrect function of the servo control for additional movement (AHS 12) .	Incorrect neutral position of the pedal 1 in the double pedal U27 is recognized	Check, if necessary repair the right double pedal U27 and its connecting circuit
E 438		Defective wire - connection to the pedal 1 in the double pedal U27	
E 439	Possibly incorrect function of the servo control for additional movement (AHS 12) .	Incorrect neutral position of the pedal 2 in the double pedal U27 is recognized	Check, if necessary repair the right double pedal U27 and its connecting circuit
E 441		Defective wire - connection to the pedal 2 in the double pedal U27	
E 442	Automatic idling on left joystick does not function, i.e. the engine remains at low speed.	Short circuit + 24 V	Deactivate automatic idling S20 , consult LIEBHERR customer service.
E 443		Short circuit to earth or cable break	




Error code	Effect	Cause	Measure / remedy
E 445	Automatic idling on right joystick does not function, i.e. the engine remains at low speed.	Short circuit + 24 V	Deactivate automatic idling S20 , consult LIEBHERR customer service.
E 446		Short circuit to earth or cable break	
E 447	Possibly incorrect commutation for the variable flow travel motors	Defective wire - connection to the pressure transmitter B 144	Check, if necessary repair the connecting wire to the switch
E 449	Possibly incorrect commutation for the pressureless lowering function	Defective wire - connection to the pressure transmitter B 145	Check, if necessary repair the connecting wire to the switch
E 451	Possibly incorrect commutation for the pressureless lowering of crowd cylinder on shovel attachment	Defective wire - connection to the pressure transmitter B 167	Check, if necessary repair the connecting wire to the switch
E 452		Defective wire - connection to the pressure transmitter B 141	Check, if necessary repair the connecting wire to the switch
E 453		Defective wire - connection to the pressure transmitter B 149	Check, if necessary repair the connecting wire to the switch
E 454	The hydraulic power of the swing is no more controlled. Possible slappings in the valves	Short circuit + 24 V	Consult LIEBHERR customer service.
E 455		Short circuit to earth or cable break	
E 456	Incorrect fuel gauge.	Short circuit + 24 V	Check fuel level visually, consult LIEBHERR customer service.
E 458		Short circuit to earth or cable break	
E 529	Transmission problem with the modem (option).	Short circuit + 24 V in input X50.20 of the keypad	Consult LIEBHERR customer service.
E 601		Connection default for plate ESP01	Consult LIEBHERR customer service.
E 860		Cable break or short circuit of the transmitter of the X axle (signal 1) of the left joystick.	Consult LIEBHERR customer service.
E 861		Cable break or short circuit of the transmitter of the X axle (signal 2) of the left joystick.	Consult LIEBHERR customer service.
E 862		Cable break or short circuit of the transmitter of the Y axle (signal 1) of the left joystick.	Consult LIEBHERR customer service.
E 863		Cable break or short circuit of the transmitter of the Y axle (signal 2) of the left joystick.	Consult LIEBHERR customer service.
E 864		Cable break or short circuit of the transmitter of the X axle (signal 1) of the right joystick.	Consult LIEBHERR customer service.
E 865		Cable break or short circuit of the transmitter of the X axle (signal 2) of the right joystick.	Consult LIEBHERR customer service.
E 866		Cable break or short circuit of the transmitter of the Y axle (signal 1) of the right joystick.	Consult LIEBHERR customer service.




Error code	Effect	Cause	Measure / remedy
E 867		Cable break or short circuit of the transmitter of the Y axle (signal 2) of the right joystick.	Consult LIEBHERR customer service.
E 870		EEPROM memory contents are damaged.	Consult LIEBHERR customer service.
E 872	Signals of the X axle of the left joystick not logical	Contact problem or faulty transmitter	Consult LIEBHERR customer service.
E 873	Signals of the Y axle of the left joystick not logical	Contact problem or faulty transmitter	Consult LIEBHERR customer service.
E 874	Signals of the X axle of the right joystick not logical	Contact problem or faulty transmitter	Consult LIEBHERR customer service.
E 875	Signals of the Y axle of the right joystick not logical	Contact problem or faulty transmitter	Consult LIEBHERR customer service.
E 876	Faulty rotator turn A	Cable break of the valve on the PWM1 output.	Consult LIEBHERR customer service.
E 877	Faulty rotator turn B	Cable break of the valve on the PWM2 output.	Consult LIEBHERR customer service.
E 878	Faulty rotator swivel A	Cable break of the valve on the PWM3 output.	Consult LIEBHERR customer service.
E 879	Faulty rotator swivel B	Cable break of the valve on the PWM4 output.	Consult LIEBHERR customer service.
E 880	Faulty proportional grab	Cable break of the valve on the PWM5 output.	Consult LIEBHERR customer service.
E 881	Faulty additional and proportional attachment	Cable break of the valve on the PWM6 output.	Consult LIEBHERR customer service.
E 883	Faulty proportional adjustable boom	Cable break of the valve on the PWM8 output.	Consult LIEBHERR customer service.
E 884	Faulty adjustable boom A	Cable break of the valve on the PWM9 output.	Consult LIEBHERR customer service.
E 885	Faulty adjustable boom B	Cable break of the valve on the PWM10 output.	Consult LIEBHERR customer service.
E 886	Faulty grab rotation A	Cable break of the valve on the OUT11 output.	Consult LIEBHERR customer service.
E 887	Faulty grab rotation B	Cable break of the valve on the OUT12 output.	Consult LIEBHERR customer service.
E 888	Faulty additional attachment side A	Cable break of the valve on the OUT13 output.	Consult LIEBHERR customer service.
E 889	Faulty additional attachment side B	Cable break of the valve on the OUT14 output.	Consult LIEBHERR customer service.
E 890		Short circuit to earth of the transmitter supply	Consult LIEBHERR customer service.
E 891		Error on UB1 supply	Consult LIEBHERR customer service.
E 892		Error on UB2 supply	Consult LIEBHERR customer service.
E 893		Error on UB3 supply	Consult LIEBHERR customer service.

Error code	Effect	Cause	Measure / remedy
E 894		Error on UB4 supply	Consult LIEBHERR customer service.




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
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 white 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

 Fault / error	 Cause	 Solution
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	
Hydraulic oil temperature too high	Radiator cores dirty	Clean radiator cores	
	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	




LFR/en/Edition: 07 / 2011




 Fault / error	 Cause	 Solution
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 go 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

 Fault / error	 Cause	 Solution
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 Work equipment

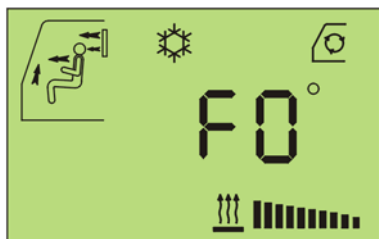
 Fault / error	 Cause	 Solution
Cylinder stretches when loaded	Piston seal in cylinder defective	Overhaul cylinder
Bearing clearance too high on equipment	Bearing points worn out	Replace bearing parts
Grab / bucket does not move	Valve block on tilting cylinder incorrectly switched	Switch over valve block
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

4.2.6 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

In addition, the troubleshooting in the heater and airconditioning circuit is facilitated

by the upcoming of error codes in the display area of the heater/airco operation unit. These error codes inform upon the possible troubles on given components in the operation and control circuits of the heater airco/plant. They are listed below:

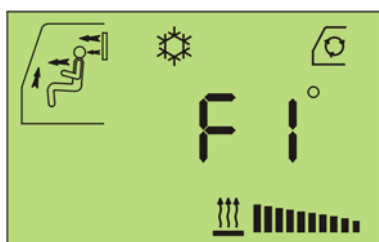


Error code “F0“ faulty room temperature gauge:

The control unit has recognised a faulty room temperature gauge, the regulation is no longer ready for operation.

Cause of gauge error: short-circuit or interruption of gauge power supply line, defective plug connection on gauge or on control unit, or temperature gauge faulty.

The heater / airco regulator is then only ready for operation again when the fault of the gauge has been remedied, the gauge error will then no longer be displayed! Should a gauge error occur, the regulator continues to operate to the setting which was valid before the fault was recognised.

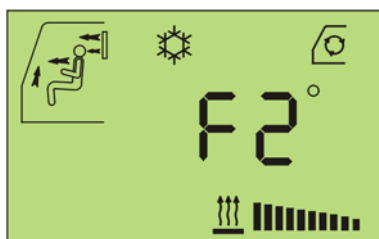


Error code “F1“ faulty blow-out temperature gauge:

The control unit has recognised a faulty blow-out temperature gauge, the regulation is no longer ready for operation.

Cause of gauge error: short-circuit or interruption of gauge power supply line, defective plug connection on gauge or on control unit, or temperature gauge faulty.

The heater / airco regulator is then only ready for operation again when the fault of the gauge has been remedied, the gauge error will then no longer be displayed! Should a gauge error occur, the regulator continues to operate to the setting which was valid before the fault was recognised.

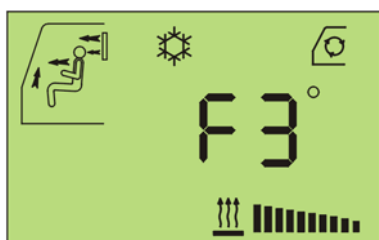


Error code “F2“ faulty reserve temperature gauge:

The control unit has recognised a faulty reserve temperature gauge, the regulation is no longer ready for operation.

Cause of gauge error: short-circuit or interruption of gauge power supply line, defective plug connection on gauge or on control unit, or temperature gauge faulty.

The heater / airco regulator is then only ready for operation again when the fault of the gauge has been remedied, the gauge error will then no longer be displayed! Should a gauge error occur, the regulator continues to operate to the setting which was valid before the fault was recognised.

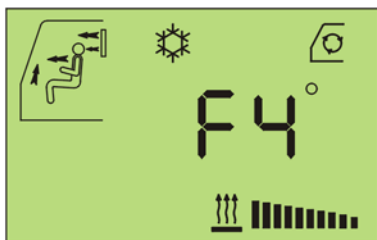


Error code “F3“ faulty vent flap foot room area and front window:

The control unit has recognised a faulty vent flap in the air duct to the front window and foot area, the regulation is once again ready for operation.

Cause of flap fault: short-circuit or interruption of the power supply line, defective plug connection on flap motor or on control unit, or flap motor faulty.

After remedying of the fault, the fault is no longer displayed. Should a flap error occur, the regulator carries on working as usual, only the middle position of the vent flap can no longer be started.



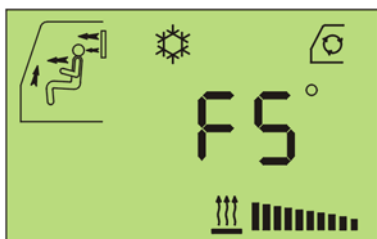
Error code “F4“ pressure fault and faulty magnetic coupling:

The control unit has recognised a faulty vent flap room area and front window, the regulation is once again ready for operation.

Cause of flap fault: short-circuit or interruption of the power supply line, plug connection on fan flap motor or control unit, flap motor faulty.

After remedying of the fault, the fault is no longer displayed!

Should a pressure fault or faulty magnetic coupling occur, the regulator carries on working as usual, only the magnetic coupling output is interrupted.



Error code “F5“ faulty data transmission operating feature / control unit:

Data transmission from the operating feature to the control unit is faulty.

Cause of the fault: short-circuit or interruption of the data line to control unit, plug connection on operating feature or control unit.

The operating feature continues to try to establish data connection to the control unit, if the connection is once again OK, “F5“ – fault will no longer be displayed. If the data transmission from the operating feature can not be established again, the ignition must be switched off, and RESET will be carried out following the restart.

4.2.7 LIEBHERR particles filter system

Chart of errors on particle filter control unit A175.

LCD display message	LED	Cause	Remedy
"Thermo element 1 (or 2) is defective" (or "Thermoelement 1 (oder 2) defekt") Buzzer (H) is activated.	orange + green	Defektive or interruption of a temperature sensor	Press key E : Deactivation of the acoustic alarm (buzzer). Check temperature sensor, connect or, if necessary, replace.
"ERROR idling / Temp. ignition block active" (or "Fehler Leerlauf / Temp. Zündungssperre aktiv") Buzzer (H) is activated.	orange + green	Too long operation with low exhaust gas temperature (low engine load)	Press key E : Deactivation of the acoustic alarm (buzzer). Increase engine load (full load operation)
		Idling operation too long	Operate machine with higher speed.
"Error interrupt. Terminal W" (or "Fehler Unterbr. Klemme W") Buzzer (H) is activated.	orange + green	Interruption of the of the speed logging.	Press key E : Deactivation of the acoustic alarm (buzzer). Check the circuit for speed logging and, if necessary, replace.
"Pre-loading pressure achieved" (or "Vorbeladedruck erreicht") Buzzer (H) is activated at interval	red (A) + green	Heavy loading of the particles filter through soot or ash particles.	Operate the excavator with full load until the back pressure decreases. If the back pressure doesn't decrease, carry out a filter cleaning
"Main load pressure achieved." (or "Hauptbeladedruck erreicht") Buzzer (H) is activated at interval	red (A) (blink) + green	Load on the particles filter is too high due to soot or ash particles collection.	Press key E : Deactivation of the acoustic alarm (buzzer). Clean the filter.

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LCD display message	LED	Cause	Remedy
"Filter breakage or pressure line clogged" (or "Filterbruch oder Druckleitung zu") Buzzer (H) is activated at interval	All LED-blink	Defective particle filter (By-Pass) or blocked pressure line or leak in the pressure line	Press key E : Deactivation of the acoustic alarm (buzzer). Check particle filter module, if necessary, or replace filter module, if necessary or eliminate blockage in the pressure line or eliminate leak in the pressure line
"Call service" (or "Service rufen")		The pre-set operating hours until the next service / cleaning of the filter module has expired	Press key E Set back the operating hours counter.

For Filter maintenance see the chapter 5 "Maintenance"

4.3 Fuses and relays

4.3.1 Electrical power box E50 with main fuses

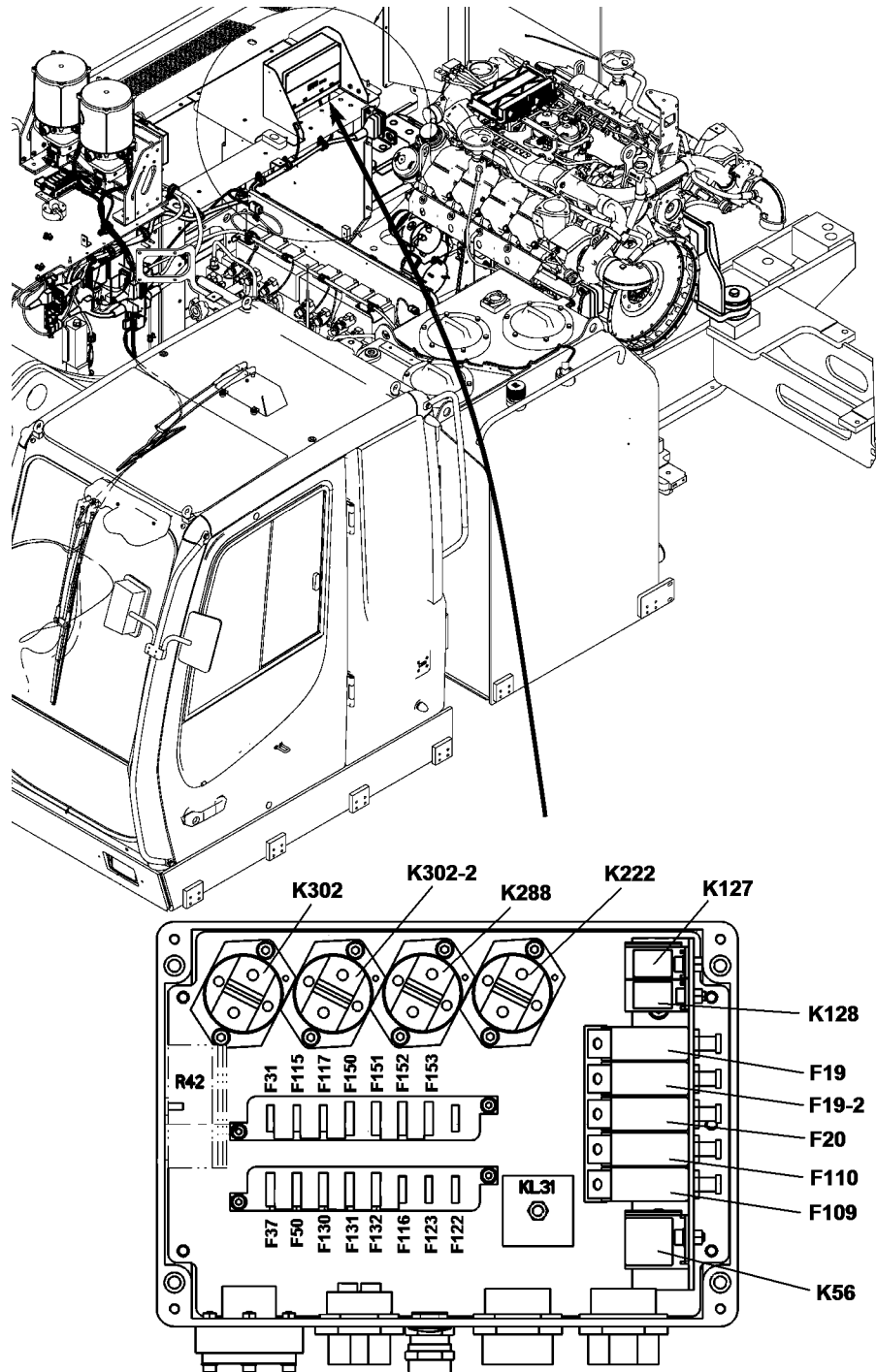


Fig. 4-2 Electrical power box E50

The power box E50 is mounted on the right side of the Diesel engine, between engine and batteries.

It is accessible from the standing space between engine and valve spool console.

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F19	100 A	Circuit breaker on terminal KI30 Heater flange I
F19-2	100 A	Circuit breaker on terminal KI30 Heater flange II
F20	80 A	Circuit breaker on terminal KI30 Main circuit
F31	7,5 A	Fuse on KI15 / heater and air conditioning unit, refueling pump
F37	20 A	Fuse on KI30 / heater and air conditioning unit
F50	15 A	Fuse on KI30 / Heating resistor in fuel prefilter
F109	50 A	Circuit breaker on terminal KI30 / special equipments and floodlights
F110	50 A	Circuit breaker on KI30 / power terminal of Electronic Diesel Control system
F115	7,5 A	Fuse on KI15 / Control circuit for heating resistor in fuel prefilter
F116	7,5 A	Fuse on KI30 / controller on Electronic Diesel Control system
F117	7,5 A	Fuse on KI15 / Electronic Diesel Control system
F122	7,5 A	Fuse on KI30 / Preglow signal to Electronic Diesel Control
F123	7,5 A	Fuse on KI30 / Preglow signal to Electronic Diesel Control
F130	15 A	Fuse on KI30 / Floodlights on attachment
F131	15 A	Fuse on KI30 / Horn
F132	15 A	Fuse on KI30 / Reserve
F150	15 A	Fuse on KI15 / Servo control system and servo control plates
F151	15 A	Fuse on KI30 / Servo control plate U48-1
F152	15 A	Fuse on KI30 / Servo control plate U48-2
F153	15 A	Fuse on KI30 / Servo control plate U46
K56		Relay / Heating resistor in fuel prefilter
K127		Relay / engine RPM adjustment in safety mode
K128		Relay / engine start in safety mode
K222		Relay / Servo control system on
K288		Main relay / Terminal 15
K302		Relay / Heater flange on intake air manifold I
K302-2		Relay / Heater flange on intake air manifold II

4.3.2 Control plate A1010 with fuses

The remaining fuses and circuit breakers are mounted to the printplate A1010, located in the electrical box of the left control console.



Danger

Incorrect or bypassed fuses do not offer the operator or the electrical system of the machine the required degree of protection..

- ▶ Only use original fuses.
- ▶ Never repair or bypass electrical fuses.

If required, order replacement fuses from LIEBHERR.

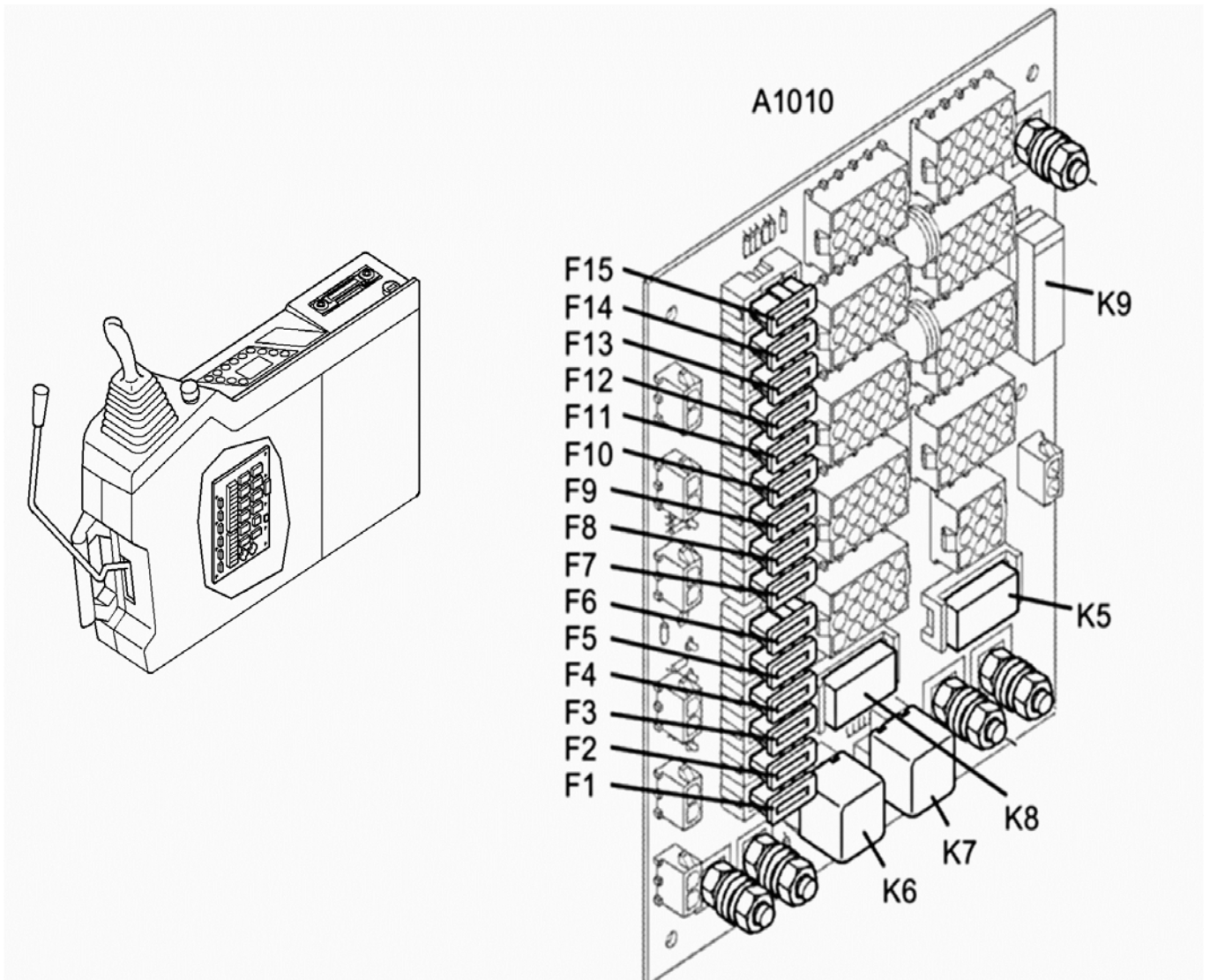


Fig. 4-3 Control plate A1010 with fuses and Relays

		Fuses on terminal 15 (KI15)
F1	15 A	Reserve
F2	15 A	Power circuit for additional floodlights
F3	15 A	Windshield wiper and washer on cab roof, central lubrication system
F4	15 A	Windshield washer, control circuit of windshield wiper, control circuit for emergency lowering, 24 Volt stabilized for transmitters and switches, min flow commutation, beacon*, solenoid valves of rotating device*
F5	7,5 A	Windshield wiper motor (power circuit)
F6	7,5 A	Engine RPM adjustment in mode „MANU“
F7	7,5 A	Control unit and monitoring display
F8	15 A	Safety lever, solenoid valve for servo control, swing brake, travel speed increase, pressure increase, float position of attachment
F9	15 A	Excavator control module "BSt"

Fuses on terminal 30 (KI30)

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F10	25 A	Floodlights on working attachment, uppercarriage and cab roof
F11	15 A	Reserve
F12	15 A	Control circuit for additional floodlights
F13	7,5 A	Ignition key, starting circuit, voltage transformer*, Radio*,
F14	15 A	Dome light, cigarette lighter, horn
F15	15 A	Solenoid valves for oversteering of pressure cut-off during travelling movements

Relays on printplate A1010

K5	Relay / engine stop (not used)
K6	Relay / horn
K7	Relay / additional floodlights on cab roof
K8	Relay / float position of boom

* optional equipment

5 Maintenance

5.1 Maintenance access doors

5.1.1 Overview of access doors

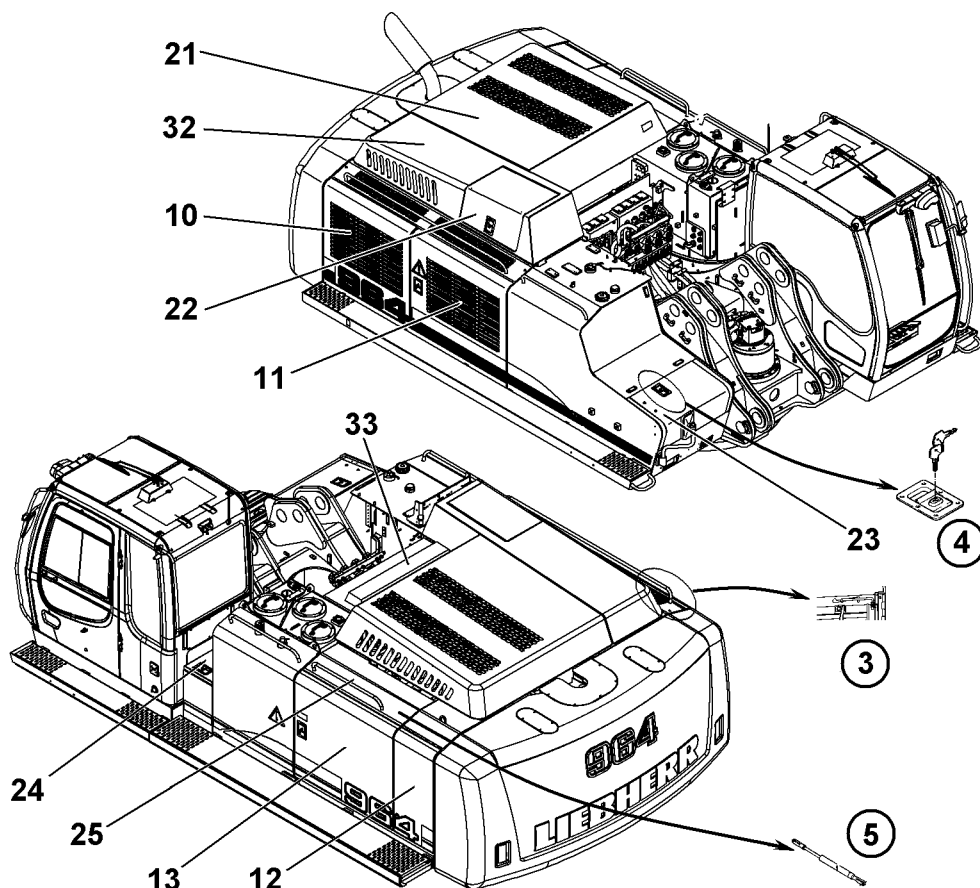


Fig. 5-1 Access doors for maintenance on the machine

Pos.	Denomination / location of the door	Locking device in opened position	Locking device in closed position
10	Side door right rear	Retaining rod 3	Lock up handle 4
11	Side door right front	Retaining rod 3	Lock up handle 4
12	Air filter door	Gas pressure spring 5	Door fixed by screws
13	Side door left	Retaining rod 3	Door fixed by screws
21	Engine hood	Mechanical retainer 2 + two gas pressure springs 5	Locking device 6. Access after opening hood 25

Tab. 5-1 Access doors

Pos.	Denomination / location of the door	Locking device in opened position	Locking device in closed position
22	Cooler cover	Gas pressure spring 5	Cover fixed by screws
23	Cover front right	Retaining rod 3	Lock up handle
24	Cover tool box	Gas pressure spring 5	Lock up handle 4
25	Hood left rear	Gas pressure spring 5	Locking device 6. Access after opening door 13

Tab. 5-1 Access doors

The machine has 9 access doors for maintenance. The doors and covers are partly fitted with lock up handles, partly secured by screws.

For safety reasons, the locks integrated in the handles **4** must be unlocked before starting to work with the machine.

The radiator hood **32** and the middle cover **33** are screwed parts whose opening is not necessary in the limits of usual maintenance works.

5.1.2 Door retaining rods



Caution!

Access doors can close accidentally and trap the operator or maintenance personnel.

- ▶ After you have opened the access doors, latch them using the retaining rods..

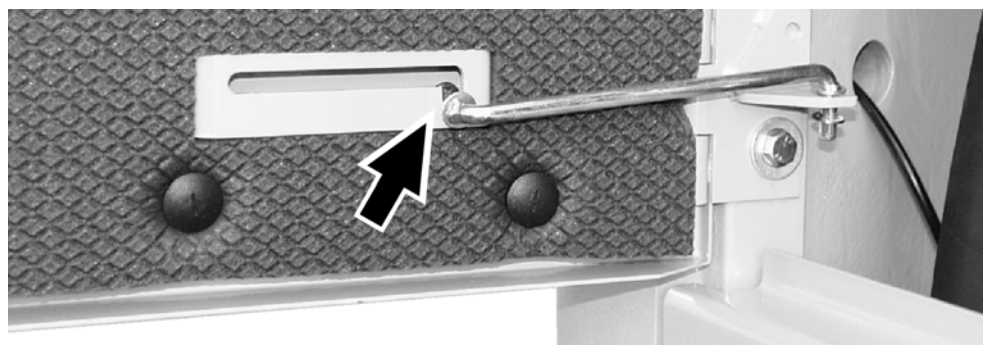


Fig. 5-2 Door retaining rod

- ▶ 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.

5.1.3 Opening, closing, locking the engine hood 21

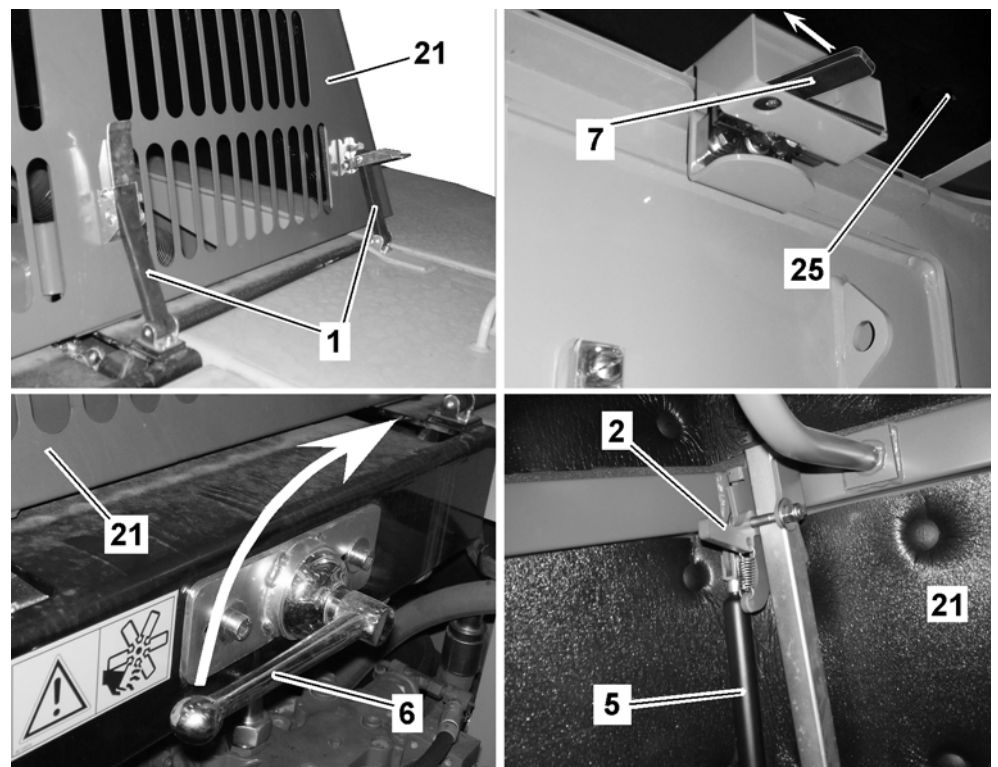


Fig. 5-3 Locking of engine hood in opened and closed position

- ▶ Unlock the door locks **1** of the engine hood **21**.
- ▶ Open the side door left **13**, unlatch the locking device **7** of the rear left cover **25** and tilt up the cover **25** all the way to the rear.
- ▶ Bring the handle of the locking device **6** of the engine hood **21** to the vertical.



Caution!

The engine hood moves with the assistance of two gas cylinders **5**. On older gas cylinders, the lifting force can drop, making the lifting and lowering of the engine hood more difficult.

- ▶ As soon as you notice a decrease of the efficiency of the gas cylinders **5**, make the necessary to have them replaced in the best delays.
- ▶ Wenn opening the engine hood **21**, make sure that in any case, even if the force of the gas cylinders is sufficient to maintain the hood, the mechanical retainer **2** engages so to prevent from unexpected lowering of the hood.

- ▶ Lift up the hood **21** so far the mechanical retainer **2** engages automatically

To close the engine hood **21**:

- ▶ Slightly lift up the hood **21** so to can disengage the mechanical retainer **2**.
- ▶ Close the hood **21** and secure it while closing the locking device **6** as well the door locks **1**.

5.2 Cleaning machine

The machine should be cleaned before carrying out any maintenance or repair work. In particular, the connections and screws should be cleaned of oil, fuel and residue of cleaning agents.



Note!

High-pressure water jet cleaners (steam cleaners) can damage the coating.

- ▶ Do not use high-pressure water jet cleaners during the first two months after commissioning (or after recoating).
 - ▶ Observe the prescribed safety distances.
-

Before cleaning the machine:

Before cleaning the machine with water or with a steam cleaner (high-pressure water jet cleaner), carry out the following tasks to protect the equipment against penetrating water.

- ▶ Lubricate all bearing points, bolt connections and the slewing ring; if necessary, use the central lubrication system to do this.
- ▶ Cover or seal all openings that must be protected against penetrating water for safety reasons (particularly at risk of damage are electric motors, electric components, switch cabinets, plug connections, measuring sensors and air filters).

Cleaning:

- ▶ Use flint-free cleaning cloths.
- ▶ Do not use aggressive detergents or flammable liquids.
- ▶ When cleaning the engine compartment, ensure that the temperature sensor of the fire alarm and extinguishing systems (if installed) are not accidentally brought into contact with the hot cleaning solution,

After cleaning:

- ▶ Remove all seals and covers.
- ▶ Check all fuel, engine oil and hydraulic lines for leakage, loose connections, chafing and damage.
- ▶ Repair any defects without delay.
- ▶ Lubricate all bearing points, pin connections and the slewing ring to remove any water that might have been penetrated.
- ▶ If required, renew the preservation layer (anti-corrosion protection) on components and surfaces.

5.3 Care for rubber components

The service life of rubber seals can be prolonged by treating them with a rubber care product.

Clean and regularly treat the rubber seals on doors and panelling elements with a care product. This helps prevent premature wear and protects the rubber seals du-

ring the cold season.

Recommended care products: Silicone, talcum powder, deer tallow

5.4 Lubricants and fluids

5.4.1 General information





Observe the instructions for lubricants and process chemicals. Lubricate the machine and change the oils at the prescribed intervals. For more information, see lubrication chart and inspection and maintenance schedule.

Keep workplaces for these activities clean. This enhances the service life and reliability of the machine.




- ▶ All work on the machine must be carried out while it is standing on firm and level ground.
- ▶ Switch off the diesel engine, remove the ignition key and set the battery main switch to position 0 (OFF).
- ▶ Clean lubricating nipples before adding grease.
- ▶ Clean all filling points and the area around them before opening the caps and screws.
- ▶ The oil should be changed while it is at operating temperature.
- ▶ After each oil change or refilling, check the fill level in the respective unit (the specified fill levels are guide values).
- ▶ Collect old oil and chemicals in suitable containers and dispose of them according to the applicable statutory regulations.

5.4.2 Filling quantities and lubricating chart

Recommended lubricants



Designation	Recommended lubricant	Symbol	Volume [litre]*
Diesel engine	Liebherr Motoroil 10W-40 Liebherr Motoroil 10W-40 low ash Liebherr Motoroil 5W-30		70
Hydraulic system (system capacity / oil change volume)	Liebherr Hydraulic Basic 68 Liebherr Hydraulic Basic 100 Liebherr Hydraulic HVI Liebherr Hydraulic Plus Liebherr Hydraulic Plus Arctic		1050 / 645
Slewing gear mechanism	Liebherr Gear Basic 90 LS		20
Travel gear mechanism	Liebherr Gear Basic 90 LS		2 x 12

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Designation	Recommended lubricant	Symbol	Volume [litre]*
Pump distributor gear	Liebherr Gear Basic 90 LS		10
Tracks and bearing of the equipment	Liebherr Universalfett 9900		-
Gearing of the slewing ring	Liebherr Pate Speciale CRL Liebherr Universalfett 9900		-
Hinges, joints, locks	Engine oil	-	-

* = guide values

Recommended fuels and chemicals

Designation	Recommended fuel	Symbol	Volume (litre)*
Fuel tank	Conventional diesel fuel		1251
Coolant	Liebherr Antifreeze Mix Liebherr Antifreeze Concentrate		96
Windscreen washer system	Conventional windscreen cleaning agent or denatured alcohol	-	5

* = guide values

Lubricating chart

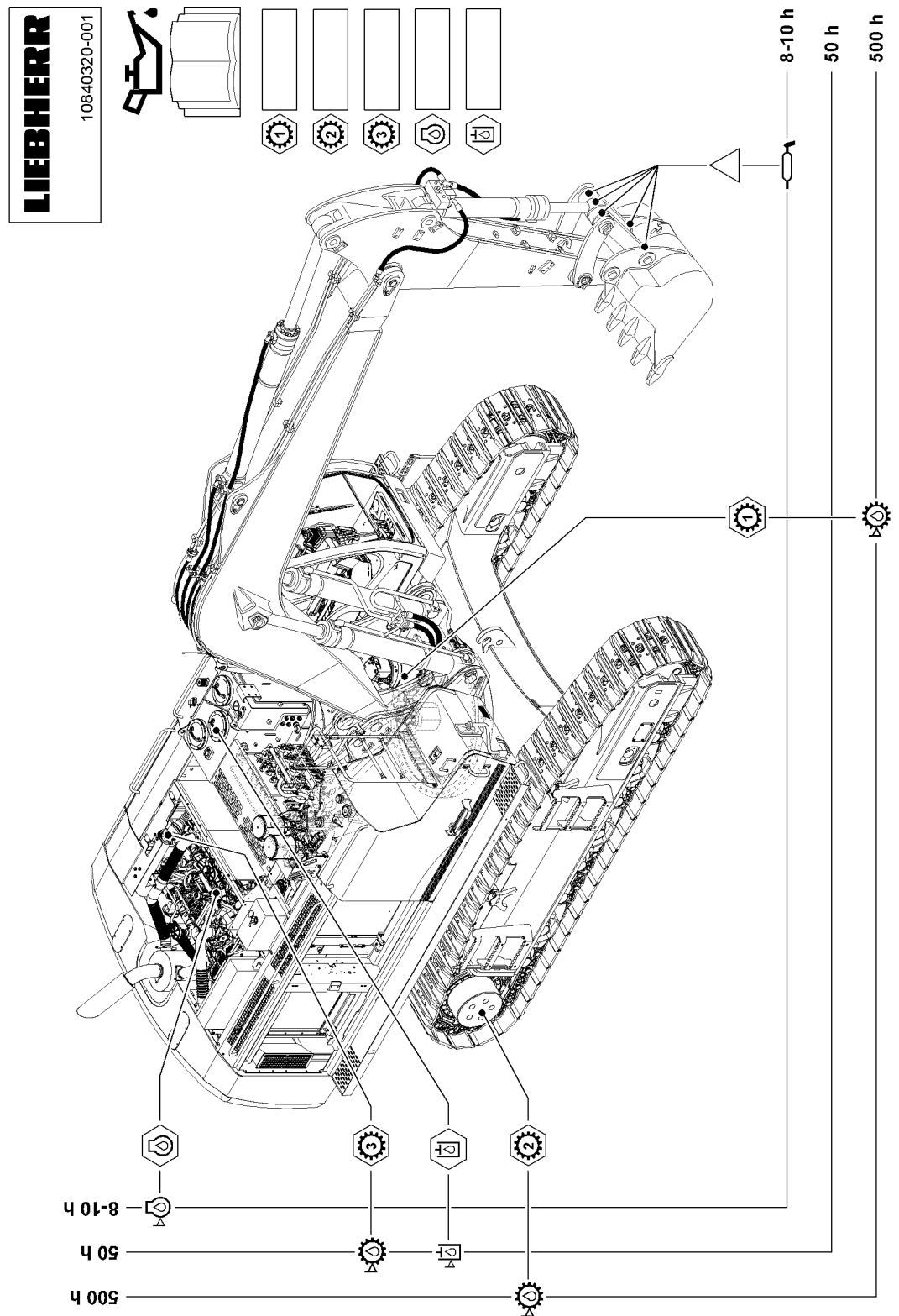












Fig. 5-4 Lubricating chart

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Symbol	Description
	For oil change intervals, observe the relevant instructions in the operating manual.
	Medium filling point
	Slewing gear mechanism
	Travel gear mechanism
	Pump distributor gear
	Gearbox or axle, check oil level
	Diesel engine, check oil level
	Hydraulic tank, check oil level
	Lube point
	Lubricate machine

Tab. 5-2 Key to lubricating chart

5.5 Lubricants and fluids specification

5.5.1 Diesel fuels

Specification



The diesel fuels must meet the minimum requirements of the fuel specifications outlined below.

Approved specifications:

- DIN EN 590
- ASTM D 975 (89a) - 1D and 2D

The fuel supplier must submit a fuel certificate (fuel specification, sulphur content, lubricity, cetane number)

Sulphur content, lubricity

The following restrictions apply:

- Do not use fuels with a sulphur content of more than 1 % (10,000 mg/kg).
- When using engine oils conforming to specification E6 and standard oil change intervals (every 500 operating hours): Do not use fuels with a sulphur content of more than 0.005 % (50 mg/kg).

- When using exhaust gas purification units (particle filters): Do not use fuels with a sulphur content of more than 0.005 % (50 mg/kg).
- Diesel engines with external exhaust gas return system: We recommend using fuels with a sulphur content of less than 0.005 % (50 mg/kg).

Additional information: see oil change intervals for operation under adverse conditions.

According to DIN EN 590, diesel fuels must have a lubricity determined by HFRR test (corrected wear scar diameter [wsd 1.4] at 60 °C) of maximum 460 µm

The ASTM D 975 fuel standard does not specify that the fuels must undergo a fuel lubricity test. The required additives should be added by the supplier, who is responsible for the quality of the fuel.

Cetane number

ASTM D 975 fuels must have a cetane number of minimum 45. A cetane number of more than 50 is preferable, especially at temperatures below 0 °C (32 °F).

Low temperature operation

At low temperatures, paraffin crystals are formed in the diesel fuel. They increase the flow stress in the fuel filter so that the diesel engine might not be supplied with sufficient fuel.



Caution!

The use of an unsuitable fuel can cause damage to the diesel engine. Adding petroleum, normal car petrol or other substances damages the injection system.

- ▶ Never add petroleum, car petrol or other additives to the diesel fuel.
- ▶ At ambient temperatures of below -20 °C: use start-up aid (e.g. fuel filter heater).
- ▶ For operation of the machine under arctic conditions: use special diesel fuels that offer adequate viscosity.

5.5.2 Lubricating oil for the diesel engine

Quality



Modern diesel engines must be lubricated with high-performance oils. They consist of a basic oil with special additives.

The lubricating oil requirements for LIEBHERR diesel engines are based on the following standards and regulations:

Designation	Specification
ACEA classification (Association des Constructeurs Européens d'Automobiles)	E4, E6, E7 Caution: particle filter only permitted with E6
API classification (American Petroleum Institute)	CH-4, CI-4 Caution: observe shorter oil change intervals

Tab. 5-3 Lubricating oil specifications

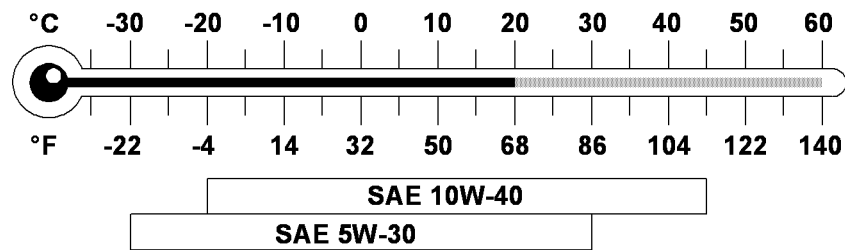
If LIEBHERR oils are not available locally, use an oil that conforms to the specifications (before choosing an oil, contact our customer service department).

Viscosity

The choice of the lubricating oil viscosity is based on the SAE classification (Society of Automotive Engineers). The SAE classification does not provide any indication as regards the quality of a lubricating oil. The relevant factor for the correct choice of SAE class is the ambient temperature.

Excessively high viscosity might lead to start-up problems. If the viscosity is too low, the oil's lubrication might not be sufficiently efficient.

The temperature ranges shown in the diagram are approximate ranges that might temporarily be exceeded.

**Fig. 5-5** Temperature-based selection of the SAE class

For ambient temperatures of -20 °C (-4 °F) to +45 °C (+113 °F), we recommend the following diesel engine oils:

Liebherr Motoroil 10W-40, specification ACEA E4

Liebherr Motoroil 10W-40 low ash, specification ACEA E6

For ambient temperatures of -30 °C (-22 °F) to +30 °C (+86 °F), we recommend the following diesel engine oils:

Liebherr Motoroil 10W-30, specification ACEA E4

Adverse operating conditions affecting the oil change intervals

Oil change intervals: see chapter "Inspection and maintenance schedule".

Subsequent oil changes depend on the climate, the sulphur content of the fuel and the oil grade. For details, see the table below.

If the specified operating hours (h) per year are not reached, the diesel engine oil and the filter must be changed at least once every year.

A number of **adverse factors** (unfavourable operating conditions) affect the length of the maintenance interval.

Possible adverse factors:

- Frequent cold starts
- Sulphur content of fuel
- Operating temperature

If such factors apply, the oil and filter must be changed according to the table below.

Adverse factor		Oil quality	
		CH-4, CI-4	E4 / E7*
Operating conditions	Sulphur content of fuel	Interval	
Normal climate, to -10 °C	to 0.5 %	250 h	500 h
	between 0.5 % and 1 %	125 h	250 h
below -10 °C	to 0.5 %	125 h	250 h
	between 0.5 % and 1 %	not permissible	125 h

Adverse factor		Oil quality
		E6
Operating conditions	Sulphur content of fuel	Interval
Normal climate, to -10 °C	to 0.005 %	500 h
	between 0.005 % and 0.05 %	250 h
	between 0.0501 % and 0.1 %	125 h
below -10 °C	to 0.005 %	250 h
	between 0.005 % and 0.05 %	125 h
	between 0.0501 % and 0.1 %	not permissible

h= operating hours

* TBN minimum 13 mg KOH/g

5.5.3 Coolants for diesel engine

General recommendations



The cooling system works only properly when pressurised. It is therefore imperative that it is kept clean and sealed at all times, that the radiator sealing and operating valves work properly and that the required coolant level is maintained.

Corrosion inhibitors/antifreeze agents approved by LIEBHERR ensure proper protection against frost, corrosion and cavitation without causing damage to seals and hoses and without foaming.

Coolants that contain unsuitable corrosion inhibitors or antifreeze agents or that have been prepared incorrectly might cause failure of assemblies and component parts in the coolant circuit due to cavitation or corrosion. Heat-insulating deposits on components that conduct heat might result in overheating and consequently failure of the engine.

Water (fresh water)

Clear and clean water free of particles that meets the following chemical requirements is suitable for use as a coolant.

Do not use sea water, brackish water, brine or industrial wastewater.

Designation	Value / unit
Total alkaline earth metals (water hardness)	0.6 to 3.6 mmol/l (4 to 25 °e)
pH at 20 °C	6.5 to 8.5
Chloride ion concentration	max. 80 mg/l
Sulphate ion concentration	max. 100 mg/l

Tab. 5-4 Fresh water quality

Designation	Value / unit
Total alkaline earth metals (water hardness)	0.6 to 2.7 mmol/l (4 to 19 °e)
pH at 20 °C	6.5 to 8.0
Chloride ion concentration	max. 80 mg/l
Sulphate ion concentration	max. 80 mg/l

Tab. 5-5 Fresh water quality with use of DCA 4*

* = Diesel Coolant Additives

Water analysis results are available from the local authorities.

Mixing ratio for coolant

The coolant must contain min. 50% corrosion inhibitor and antifreeze agent at **all times of the year**.

Outdoor temperature to	Mixing ratio	
	Water %	Corrosion inhibitor/antifreeze agent %
-37 °C	50 %	50 %
-50 °C	40 %	60 %

Tab. 5-6 Permissible mixing ratio (for all seasons)

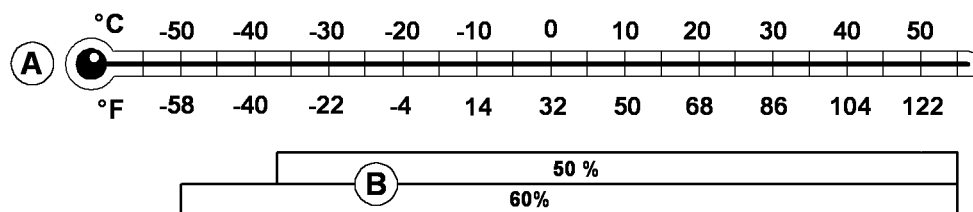


Fig. 5-6 Temperature-based mixing ratio of water + corrosion inhibitor / antifreeze agent

- A Ambient temperature
- B Corrosion inhibitor/antifreeze agent concentration in coolant

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Permissible corrosion inhibitors/antifreeze agent



Note!

Improper mixing of different products might negatively affect the properties of the coolant and cause damage to the cooling system.

- ▶ Use only approved products. Do not mix different products.
- ▶ Never mix products containing silicone with silicone-free products.
- ▶ If the recommended LIEBHERR product is not available locally:
Contact the LIEBHERR customer service department; choose product conforming to the "Coolant specifications for LIEBHERR diesel engines".

Concentrate	
Product name	Manufacturer
Liebherr Antifreeze Concentrate	Liebherr

Ready-mixed corrosion inhibitor/antifreeze agent (premix)	
Product name	Manufacturer
Liebherr Antifreeze Mix	Liebherr

Premix = ready-mixed product (50 % water and 50 % corrosion inhibitor/antifreeze agent)

Approved corrosion inhibitors without antifreeze agent



Note!

Improper mixing of different products might negatively affect the properties of the coolant and cause damage to the cooling system.

- ▶ Use only approved products. Do not mix different products.
- ▶ Never mix products containing silicone with silicone-free products.
- ▶ If the recommended LIEBHERR product is not available locally:
Contact the LIEBHERR customer service department; choose product conforming to the "Coolant specifications for LIEBHERR diesel engines".

In **exceptional circumstances** and at **ambient temperatures that are always above the freezing point**, e.g. during use in tropical regions where there are no corrosion inhibitors/antifreeze agents available, the following inhibitors must be added to the coolant:

- DCA 4 (Diesel Coolant Additives 4)
- Caltex / Chevron / Havoline / Total product

In this case, the coolant must be changed annually.

As part of routine maintenance work, check the concentration and correct it, if necessary.

Product name	Manufacturer
DCA 4 Diesel Coolant Additives	Fleetguard / Cummins Filtration
Caltex CL Corrosion Inhibitor Concentrate	Chevron Texaco

Product name	Manufacturer
Chevron Heavy Duty Extended Life Corrosion Inhibitor Nitrite Free (ELC)	Chevron Texaco
Havoline Extended Life Corrosion Inhibitor (XLI)	Chevron Texaco
Total WT Supra	Total, Paris

5.5.4 Hydraulic oil



Hydraulic oils must meet the requirements outlined below.

Maximum water content of hydraulic oil: < 0.1 %

Liebherr hydraulic oil

LIEBHERR recommends using the following hydraulic oils in its machines (depending on temperature range):

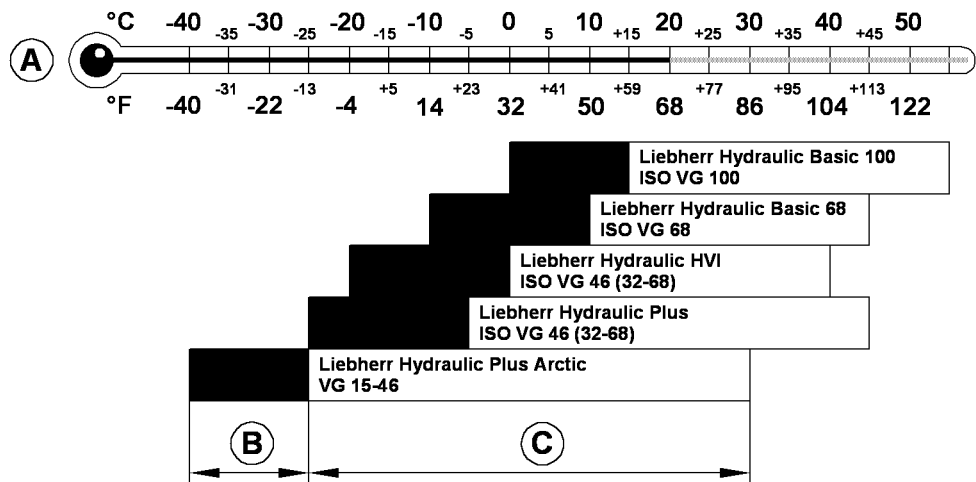


Fig. 5-7 Liebherr hydraulic oil, temperature ranges

- A Ambient temperature
- B Cold-start range with mandatory warm-up
- C Operating range

Liebherr Hydraulic Plus and **Liebherr Hydraulic Plus Arctic** are suitable for both long-term use and use in environmentally sensitive areas.

If LIEBHERR oils are not available locally, use one of the engine oils listed in section "Engine oils for use as hydraulic oils" (before choosing an oil, contact the respective customer service department).

Use only LIEBHERR hydraulic oils. The use of other oils is not permitted.

Engine oils for use as hydraulic oils

When using engine oils (third-party products) as hydraulic oils, we advise customers to request a certificate from the oil manufacturer, confirming that the product meets the following specifications.

Engine oils that are to be used as hydraulic oils must meet the following specifications:

Single grade engine oils (1):	API - CD / ACEA - E1 (MB 226.0 and 227.0)
Multigrade oils (2):	API - CD, CE, CF / ACEA - E2, E3, E4 (MB 227.5, 228.1, 228.3 and 228.5)

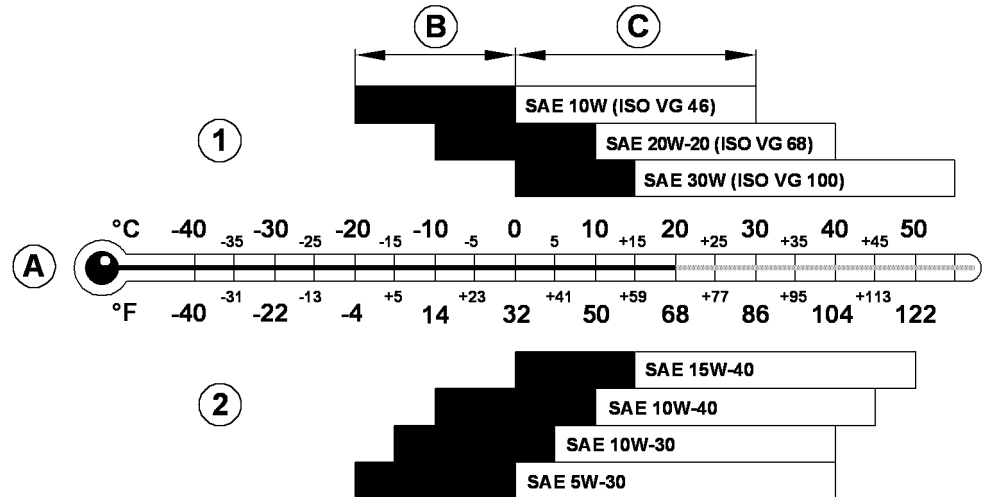


Fig. 5-8 Engine oil for use as hydraulic oil, temperature ranges (SAE classes)*

- A Ambient temperature
- B Cold-start range with mandatory warm-up
- C Operating range
- 1 Single grade engine oils
- 2 Multigrade oils

* For oils with deviating viscosity grade, consult LIEBHERR customer service.

Warm-up instruction

The black bar **B** indicates ambient temperatures that are up to 20 °C below the operating range **C**.

For cold starting at an ambient temperature below range **B**, the following warm-up instruction for the hydraulic oil applies:

- ▶ **1.** Start the diesel engine and set it to medium speed (not exceeding 50% of maximum speed).
- ▶ **2.** Carefully activate the working hydraulics. Operate the hydraulic cylinders and move them briefly to the stop.
- ▶ **3.** After approx. 5 minutes, actuate the travel hydraulics. Total warm-up time: approx. 10 minutes.

For cold starting at lower ambient temperatures, follow the warm-up instruction below: Before starting the engine, warm up the hydraulic oil tank. Then proceed according to the warm-up instruction in 1.

Biodegradable hydraulic oils



Caution!

Do not mix hydraulic oil products!

When mixing different ester-based biodegradable hydraulic oils or mixing such products with mineral oils, aggressive chemical reactions might occur, causing damage to the hydraulic system.

- ▶ Therefore never mix biodegradable hydraulic oils from different producers, and never mix bio hydraulic oils with mineral oils!

LIEBHERR recommends using the following hydraulic oils in its machines (depending on the temperature range):

Liebherr Hydraulic Plus or Liebherr Hydraulic Plus Arctic

These products are polyalphaolefins (HEPR) conforming to CEC-L-33-A-93, and are biodegradable.

When using these hydraulic oils, bypass filtration might be omitted.

If these oils are not available locally, use a fully saturated hydraulic environmental ester synthetic oil (HEES fluid) (before choosing an oil, contact the respective customer service department).



Caution!

The use of synthetic ester-based oils without bypass filter causes damage to the hydraulic system!

If synthetic ester-based oils are to be used, bypass filtration is mandatory, as the water concentration in the oil must be kept below 1000 ppm (0.1%).

- ▶ Always use a bypass filter (optional equipment).

For such oils, we recommend replacing the hydraulic hoses every 4000 operating hours or at least every 4 years.

Do not use vegetable oils, as they do not possess the necessary thermal stability.

The use of polyglycols is not permissible, as they cause damage to paintwork.

When using third-party products, we advise customers to request a certificate from the oil manufacturer, confirming that the product meets the above specifications.

Oil change, oil analysis and filter change

Oil change



Note!

Liebherr recommends carrying out regular oil analyses (see chapter "Oil analysis").

Oil type	Oil change		
	Not for use in environmentally sensitive areas		For use in environmentally sensitive areas (only permissible with oil analysis*)
	without oil analysis	with oil analysis* (optional)	
LIEBHERR mineral oil Liebherr Hydraulic HVI Liebherr Hydraulic Basic 68 Liebherr Hydraulic Basic 100	every 3000 h	every 6000 h	- ***
Liebherr-PAO** Liebherr Hydraulic Plus Liebherr Hydraulic Plus Arctic	every 4000 h	every 8000 h	every 8000 h
Third-party product - mineral oil	every 2000 h	every 2000 h	- ***
Third-party product - fully saturated synthetic ester	- ***	- ***	every 2000 h

Tab. 5-7 Oil change intervals

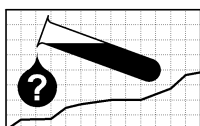
- * If the result of the oil analysis is satisfactory, you may continue using the oil for a longer period. If the result of the oil analysis is negative, change the oil immediately.
- ** PAO = polyalphaolefin
- *** Do not mix products

Use in environmentally sensitive areas

Machines operated in such areas must be filled with biodegradable hydraulic oil.

If the machine is operated for less than 1000 hours per year, an oil sample must be taken at least once a year. If a hydraulic oil is used for a prolonged time, it must be changed at least every 4 years (mineral oils and fully saturated synthetic esters) or every 6 years (Liebherr-Plus oils).

If the machine is not in use for a period of more than 6 months, carry out an oil analysis before restarting it.



Oil analyses

For regular oil analyses, LIEBHERR recommends contracting the specialist company OELCHECK and changing the oil when indicated by the test results in the lab report.

- Yellow kit for biodegradable hydraulic oils
- Green kit for mineral oils

See also customer service and product information.

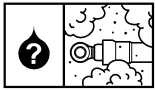
Reasons for regular oil analyses:

- Reduction of costs thanks to prolonged oil change intervals
- Detailed information regarding the hydraulic system, its component and the medium
- Better protection of resources and the environment

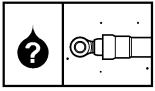
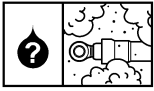
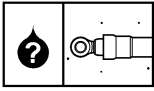
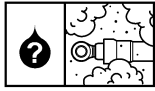
Oil sampling / operating conditions	
	Oil sampling in machines operated under normal operating conditions

Tab. 5-8 Symbols: Oil sampling depending on operating conditions

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Oil sampling / operating conditions	
	Oil sampling in machines operated under extremely dusty conditions
The oil sampling interval is determined by the actual operating conditions (for more information, see chapter "Dust-intensive applications, reduction of oil contamination")	

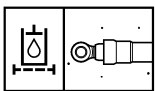
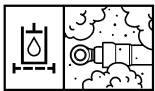
Tab. 5-8 Symbols: Oil sampling depending on operating conditions

Oil type	Oil sampling			
	No use in environmentally sensitive areas (oil analysis mandatory)		Use in environmentally sensitive areas (oil analysis mandatory)	
				
LIEBHERR mineral oil Liebherr Hydraulic HVI Liebherr Hydraulic Basic 68 Liebherr Hydraulic Basic 100	every 1000 h	every 250 h	- **	- **
Liebherr-PAO* Liebherr Hydraulic Plus Liebherr Hydraulic Plus Arctic	every 1000 h	every 250 h	first at 0 h, then every 1000 h	first at 0 h, then every 250 h
Third-party product - mineral oil	first after 1000 h, then every 500 h	every 250 h	- **	- **
Third-party product - fully saturated synthetic ester	- **	- **	first at 0 h, then every 500 h	first at 0 h, then every 250 h

Tab. 5-9 Oil sampling depending on operating conditions

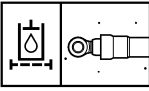
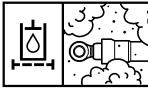
- * PAO = polyalphaolefin
- ** Do not mix products

Filter change

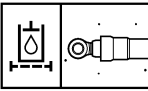
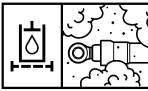
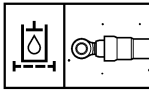
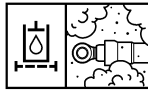
Filter change / operating conditions	
	Filter change in machines operated under normal operating conditions
	Filter change in machines operated under extremely dusty conditions
The filter change interval is determined by the actual operating conditions (for more information, see chapter "Dust-intensive applications, reduction of oil contamination")	

Tab. 5-10 Symbols: Filter change depending on operating conditions

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Change of return filter (use only LIEBHERR filters)	
	
every 1000 h	every 500 h

Tab. 5-11 Filter change depending on operating conditions

Change of bypass oil filter			
LIEBHERR filter		Filters from other manufacturers	
			
every 2000 h or as indicated		every 500 h	every 250 h

Tab. 5-12 Filter change depending on operating conditions

Dust-intensive applications, reduction of oil contamination

If the machine is normally operated with a hydraulic hammer or under similar conditions (considerable dust generation), the hydraulic oil might become more contaminated than under normal working conditions.

To prevent premature wear of the hydraulic components, the oil change and sampling intervals must be shorter.

- The filter cartridge(s) in the return filter must be replaced every 500 operating hours and after every hydraulic oil change.
- Use 10-µm filter cartridges instead of the standard 20 / 5-µm cartridges.
- The 2-µm breather filter must be replaced every 500 operating hours and at every hydraulic oil change.

Machines delivered with hydraulic hammer attachment and retrofitted hydraulic hammer kits are already fitted with 10-µm filter cartridges in the return filter. Please take this into account when ordering spare parts.

5.5.5 Lubricants for gearboxes

Quality



Recommended lubricant	Specification
Liebherr Gear Basic 90 LS	API: GL-5 MIL-L: 2105 D ZF: TE-ML 05C, 12C, 16E, 21C
Liebherr Gear Plus 20W-40	API: Niveau von GL4 ZF: TE-ML 05F, 06K, 17E
Liebherr Gear Hypoid 90 EP	API: GL 5 MIL-L: 2105 B, C, D ZF: TE-ML 05A, 12A, 16C, 17B, 19B



Recommended lubricant	Specification
Liebherr Hypoid 85W-140 EP	API: GL-5 MIL-L: 2105 D, PRF-2105 E ZF: TE-ML 05A, 07A, 16D, 21A
Liebherr Hydraulic-Gear ATF	GM: Dexron II D ZF: TE-ML 03D, 04D, 11A, 14A, 17C
Liebherr Syntogear Plus 75W-90	API: GL-4, GL-5, MT-1 MIL-L: 2105 D, PRF-2105 E ZF: TE-ML 02B, 05B, 07A, 12B, 16F, 17B, 19C, 21B

Tab. 5-13 Lubricating oil specifications

If LIEBHERR oils are not available locally, use an oil that conforms to the specifications (before choosing an oil, contact our customer service department).

Viscosity

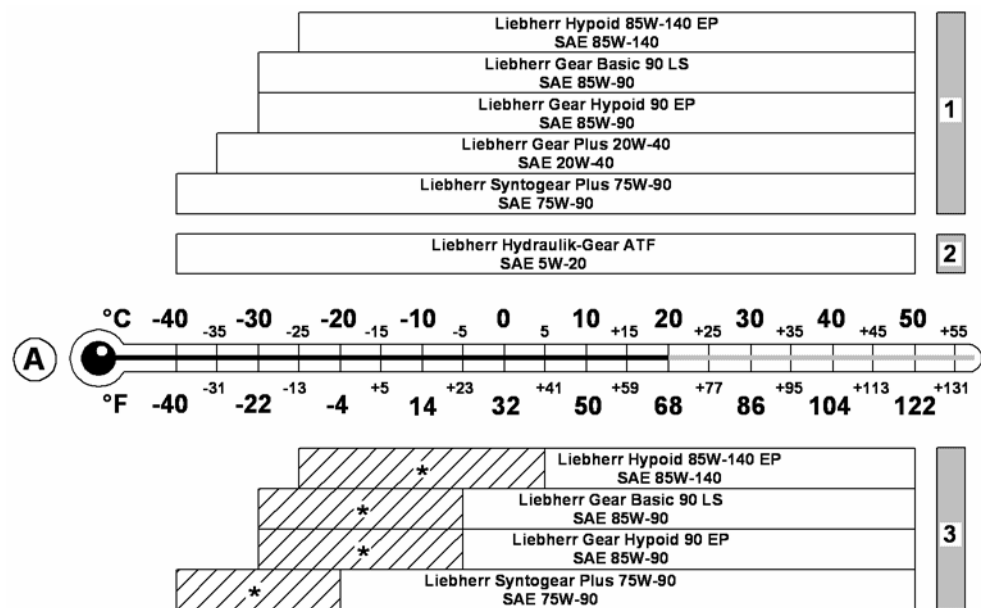


Fig. 5-9 Temperature-based selection of the SAE class

A Ambient temperature

1 Use in gearboxes

2 Use in automatic transmissions

3 Use in pump distributor gear systems

* If the pump distributor gear is equipped with an oil cooler, the oil is not suitable for the marked temperature range (shaded area).

The choice of the lubricating oil viscosity is based on the SAE classification (Society of Automotive Engineers). The SAE classification does not provide any indication as regards the quality of a lubricating oil. The relevant factor for the correct choice of SAE class is the ambient temperature. Incorrect viscosity can impair the operation of axles and gearboxes.

The temperature ranges shown in the diagram are approximate ranges that might temporarily be exceeded.

5.5.6 Grease

Quality



Recommended lubricant	Specification
Liebherr Universalfett 9900	Soap-base grease (lithium complex) KPF 2 N - 25 (DIN 51502) NLGI grade: 2 (DIN 51818) VKA welding force: > 6000 N (DIN 51350 / 4)
Liebherr Universalfett Arctic (for low-temperature operation)	Soap-base grease (lithium complex) KPFHC 1 N - 60 (DIN 51502) NLGI grade: 1 (DIN 51818) VKA welding force: > 5500 N (DIN 51350 / 4)
Liebherr Spezialpaste CRL*	NLGI grade: 2 (DIN 51818) VKA welding force: > 5500 N (ASTM D2596) water resistance: 1-90 (DIN 51807).

* Only use the Liebherr Spezialpaste CRL for the swing ring teeth

The grease is used for both automatic and manual machine lubrication. It is supplied by the central lubrication system or through lubrication nipples to the respective lube points.

Examples:

- Slewing ring bearings
- Crown gears, geared wheels
- Attachments

Operating temperature

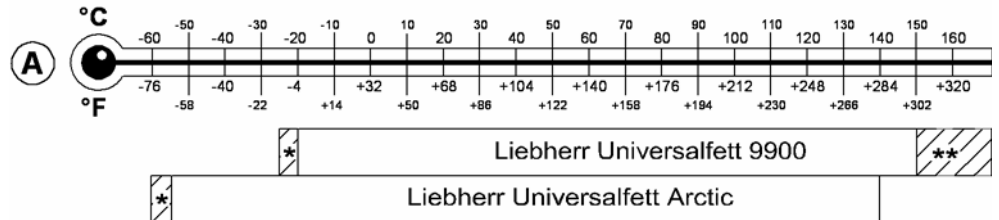


Fig. 5-10 Operating temperature for Liebherr greases

A Grease temperature

- * The grease is not suitable for the temperature range (shaded), if used in a central lubrication system.
- ** The grease may only be within the temperature range (shaded) for short periods of time. Peak temperatures of max. 200 °C (392 °F) are possible.

5.5.7 Lubricants and care products for electrical and mechanical components

Medium, purpose	Product (manufacturer)
Contact spray for slip rings	Cramolin
Lubricant for pistons, piston nuts and for the mounting of piston rod bearings at hydraulic cylinders	Gleitmo 800

Medium, purpose	Product (manufacturer)
Special corrosion inhibitor for mounting recesses of sealing elements at hydraulic cylinders	Rostilo Tarp CFX

5.6 Diesel engine



Danger !

Before carrying out diverse maintenance tasks, the Diesel engine, unless otherwise expressly specified in the descriptions, must be brought into the below described-maintenance position :

- the Diesel engine must be positioned horizontally,
- the Diesel engine must be turned off,
- the Diesel engine must be cooled off,
- the battery main switch must be switched off.

5.6.1 Checking the oil level in the Diesel engine



Danger!

Risk of burning.

The engine oil is hot when it is at or near operating temperature.

- ▶ Do not allow the hot oil or oil-bearing parts to touch the skin.

- The machine must be standing level.
- ▶ Turn the engine off.
- ▶ Wait a few moments for the oil to collect into the engine oil sump.

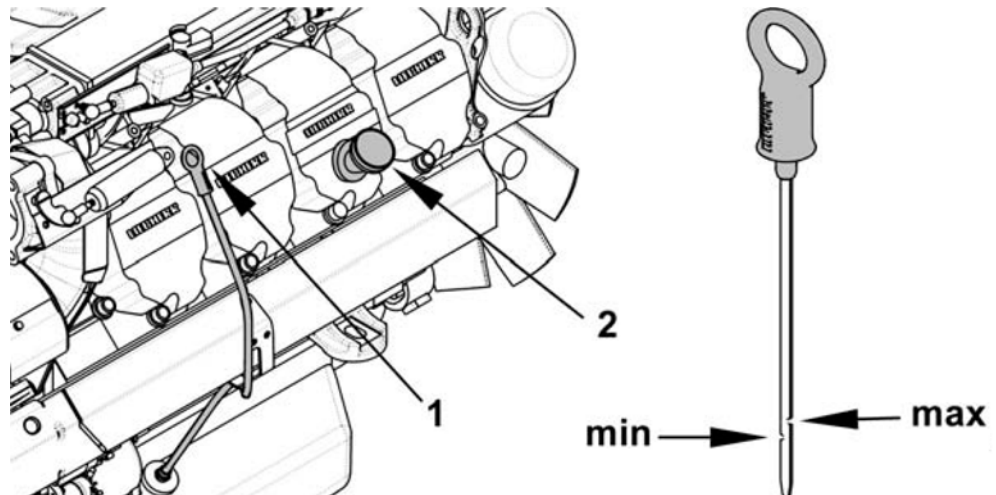


Fig. 5-11 Oil dipstick 1 and oil filler neck 2

- ▶ Pull out the dipstick 1, clean it and reinsert it into its orifice.
- ▶ Pull out the dipstick again and now notice the oil level.
- The oil level must be between the **min** and **max** marks of the dipstick 1.

- ▶ If necessary, add oil via the filler neck 2 until having the correct oil level.

5.6.2 Replacing the engine oil and the engine oil filter elements



Note!

- ▶ Only carry out the engine oil change when the oil is warm

To drain the oil:

The two engine oil filter units are mounted to the Diesel engine, on the cooler fan side.

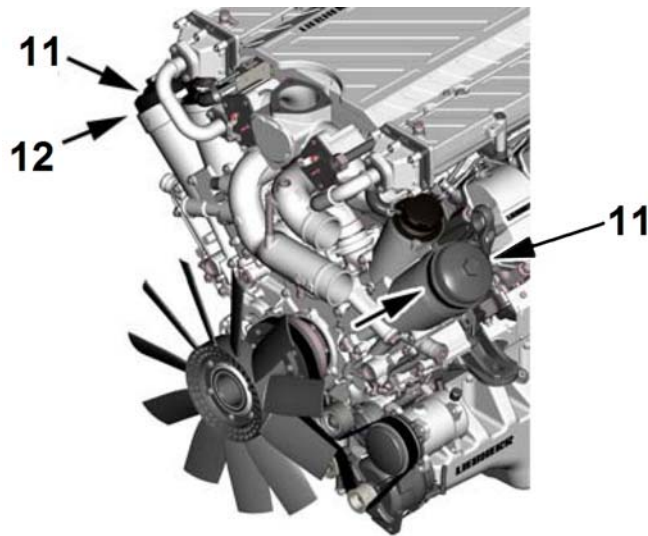


Fig. 5-12 Arrangement of the oil filter units

- ▶ Unscrew the both filter covers **11** until the upper O-ring **12** becomes visible.
 ↙ The engine oil contained in the filter units flows back into the engine oil sump.
- ▶ Unscrew the plug of the drain valve which is situated on the engine oil sump.

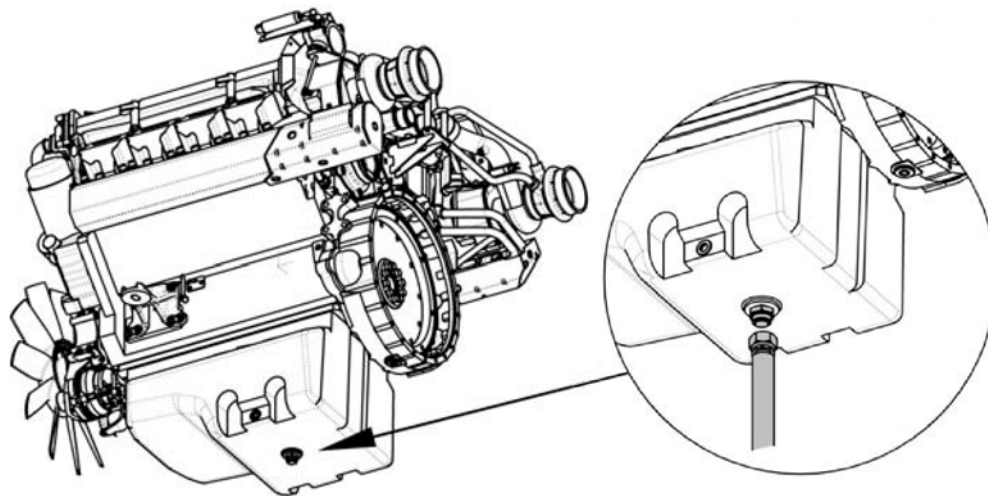


Fig. 5-13 Drain valve on the engine oil sump

- ▶ Connect the drain hose supplied with the machine to the drain valve on the sump.

- ▶ Collect the escaping oil into a suitable container.
- ▶ Remove the drain hose and reattach the plug of the drain valve.

Replacing the oil filter elements:



Danger!

- ▶ Be careful to avoid contact with hot oil when removing the filter cartridges **14**.

- ▶ Go on unscrewing the both filter covers **11** and remove them complete with the filter elements **14**.

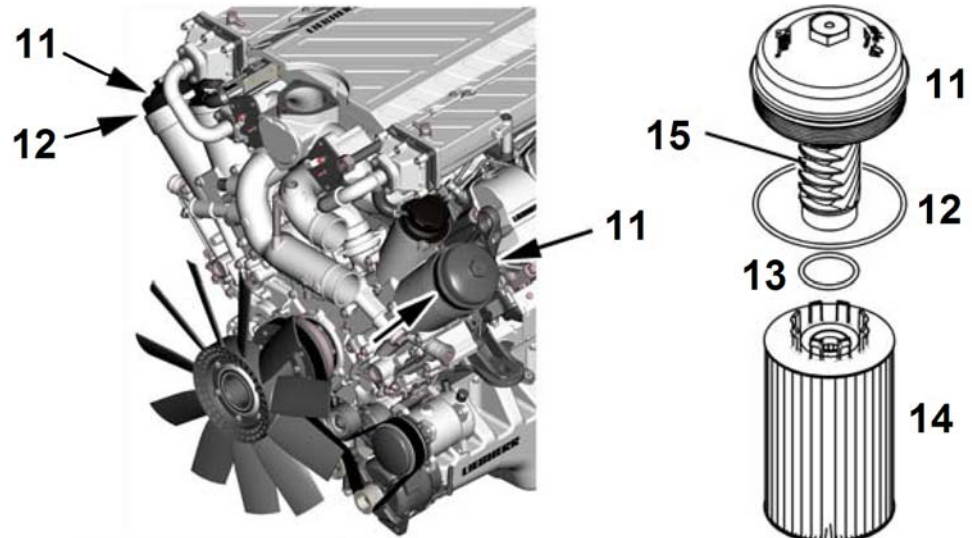


Fig. 5-14 Replacing the oil filter elements

- ▶ Draw the filter elements **14** away from the covers **11**.



Notice !

On the machines delivered before Mai 2010, the filter cover **11** and the guiding tube **15** consisted of two separable parts. These separable covers have been basically replaced at customers at the latest before end of December 2010 by covers in non separable monobloc execution.

- Should you, passed this date, notice during removal of a cover **11**, that the guiding tube **15** remains in the filter element **14**:
- ▶ Pull the guiding tube **15** out of the filter element **14** et reinsert it into the cover **11**.
- ▶ Immediately report this statement to the responsible for the machine maintenance in order to initiate as soon as possible the replacement by covers in monobloc execution (as per the Service Information LFR 04-53-13 / 10).

- ▶ Dispose of the old filter elements **14** for their elimination in conformity with the respect of the environment
- ▶ Slightly coat new O-rings **12** and **13** with oil and install them.
- ▶ Install the new filter elements **14** onto the covers **11**.
- ▶ Reinsert the oil filter covers **11** previously assembled with the elements **14** into their housings and retighten (tightening torque is 40^{+10} Nm - 30^{+7} ft.lbs).

Refilling the Diesel engine with oil:

- ▶ Add the oil via the filler neck **2** until the oil level is between the **min** and **max** marks

of the dipstick 1.

- ▶ Clean the filler plug and reinstall it to the filler neck 2.
- ▶ Start the Diesel engine.
- ▶ Check the oil pressure indication on the monitoring display of the machine and check the oil filter covers 11 for leaks.
- ▶ Turn the Diesel engine off.
- ▶ Wait for 2 or 3 minutes and check the oil level again.

For oil quantity and oil quality see the lubricants chart.

For the oil change interval, see the maintenance chart.

5.6.3 Polyvee belt for the airco compressor and alternator drive

The Diesel engine is fitted with a tensioning device for the belts. This device is self-tensioning and is therefore maintenance-free.

- ▶ Regularly check the belt for damage and wear and replaced it if necessary.

The following damages to the belt make its replacement necessary:

- Rib fractures
- Transversal fractures in several ribs
- Rubber nodules in between the ribs
- Deposition of dirt or stones
- Ribs becoming loosened at the base of the ribs
- Transversal fractures on the belt exterior

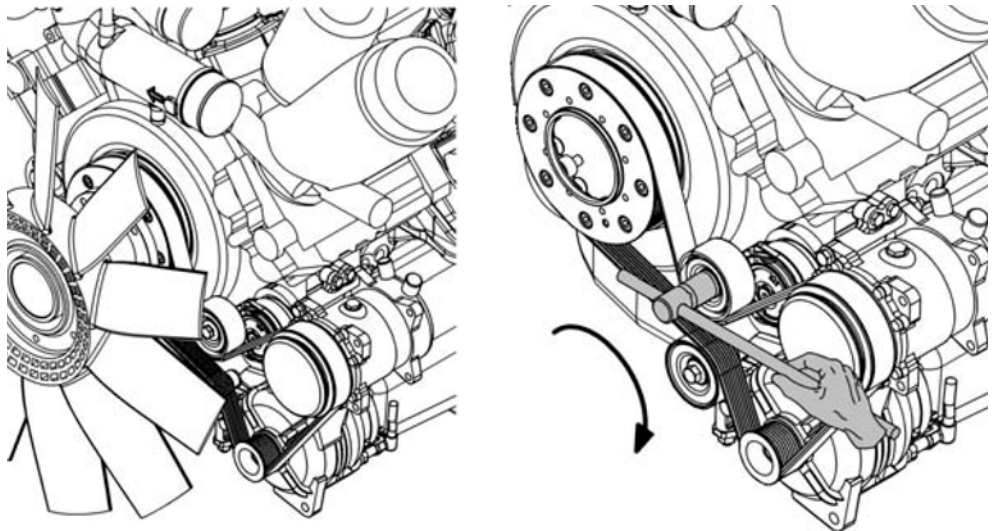


Fig. 5-15 Replacing the belt

To replace the belt:

- To replace the belt, you will need a spinner wrench with hexagon socket.
- ▶ Rotate the tensioning device back against the spring force clockwise as far as the stop.
- ▶ Remove the worn belt.
- ▶ Check tension pulley and belt pulley for sound condition (e.g. worn bearing of tension pulley, as well as wear of the belt pulley profile)

- ▶ If parts are damaged, replace the parts.
- ▶ With the tensioning device rotated back against the spring force, lay a new belt on the pulleys for the crankshaft, airco compressor, alternator and on tensioning and deflection pulleys.
- ▶ Swing the tensioning device back counterclockwise into the tensioning position.

5.6.4 Lubricating the starter ring gear

- ▶ Lubricate the teeth of the starter ring gear regularly at the intervalls indicated in the maintenance chart.

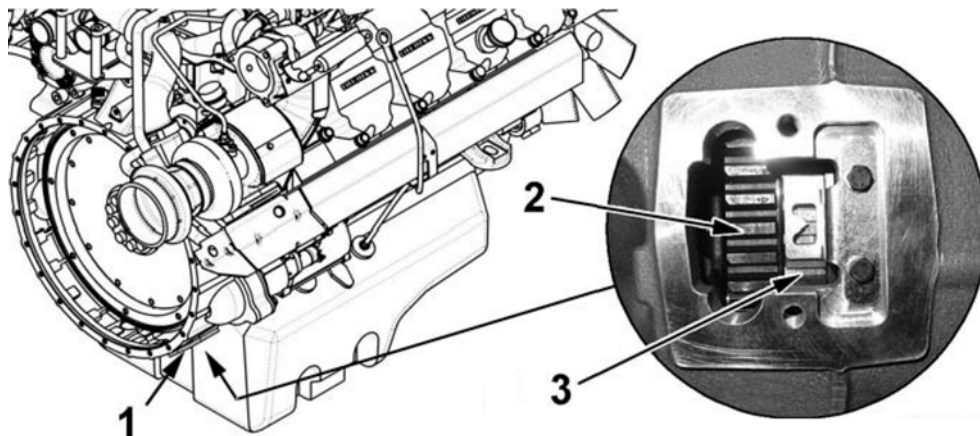


Fig. 5-16 Starter ring gear

1 Maintenance cover 2 Starter ring gear 3 Sensor ring gear

The maintenance cover 1 to the starter ring gear 2 is situated on the flywheel housing, at the lower right side of the engine.

- ☐ Make sure that the Diesel engine is in the maintenance position.
- ▶ Unscrew the maintenance cover 1 from the flywheel housing.
- ▶ Check the starter ring gear 2 and, if necessary, grease lightly with regular lubricating grease (as an example with the grease recommended for working attachment lubrication).



Note!

Only the starter ring gear 2 must be lightly lubricated, the sensor ring gear 3 is for the pulse counting by the engine RPM sensor and must remain free of grease.

- ▶ Reattach the maintenance cover 1 to the flywheel housing.

5.6.5 Checking mounting bolts

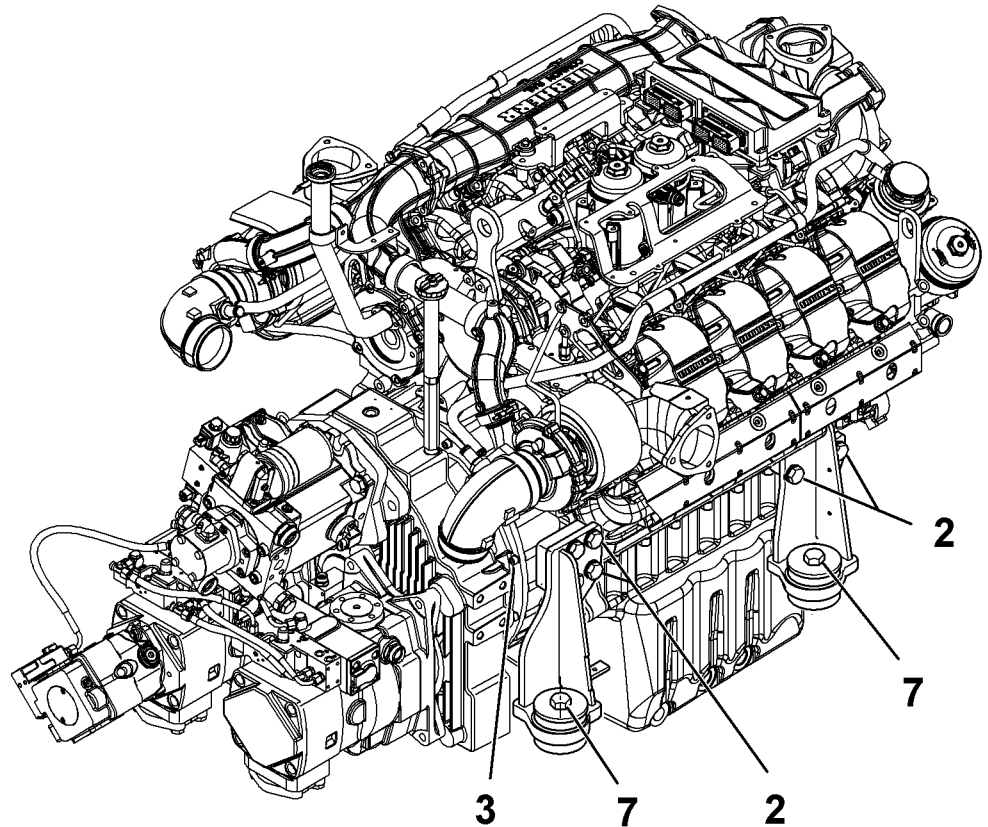


Fig. 5-17 Mounting bolts

- ▶ Check at regular intervals, as requested in the maintenance chart the correct mounting (tightening torques) of the thereafter listed bolts.
- ▶ Retighten the screws as necessary.

Pos.	Mounting screw	tightening torque in N.m (ft.lbs)
2	Consoles onto engine and pumps assembly	280 (207)
3	Pumps splitterbox onto Diesel engine	68 (50)
7	Engine and pumps assy onto upperstructure	960 (710)

5.6.6 Oil separator



Note!

Be sure that :

- The diesel engine is in maintenance position
- Both oil separators and their O-Rings are ready to use.

Disassembly the oil separator filter

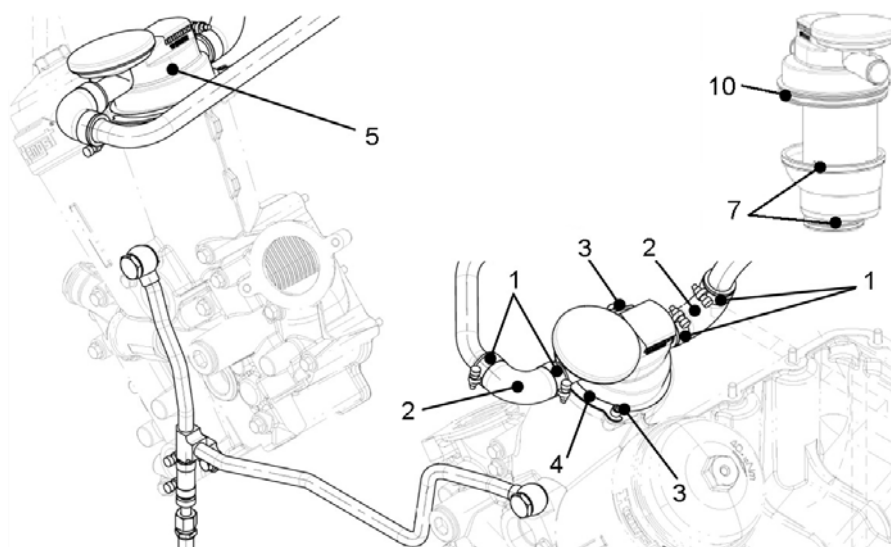


Fig. 5-18 Replacing the oil separator

- ▶ Loose the hose clamps 1 and draw the hose 2 off the regulating valve lid 5.
- ▶ Loose the screws 3 and open the bracket 4.

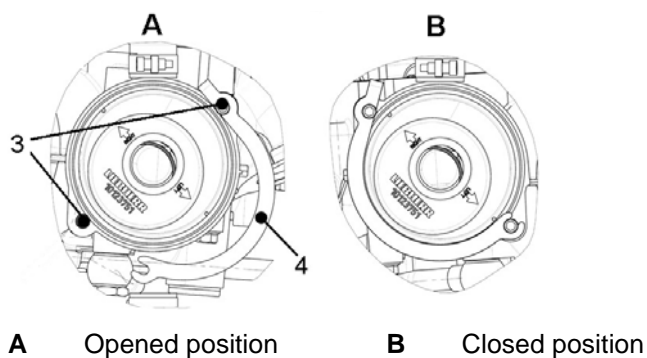


Fig. 5-19 Bracket positions

- ▶ Remove the lid of the regulating valve
- ▶ Remove the filter

Assembly the oil separator filter

- ▶ Lubricate the O-ring 7 of the new filter with clean fuel or oil.
- ▶ Insert the new filter.



Caution !

The arrows 8 on the filter have to be into line with the screws 3 !
LIEBHERR logo 9 has to be in the motor inside !

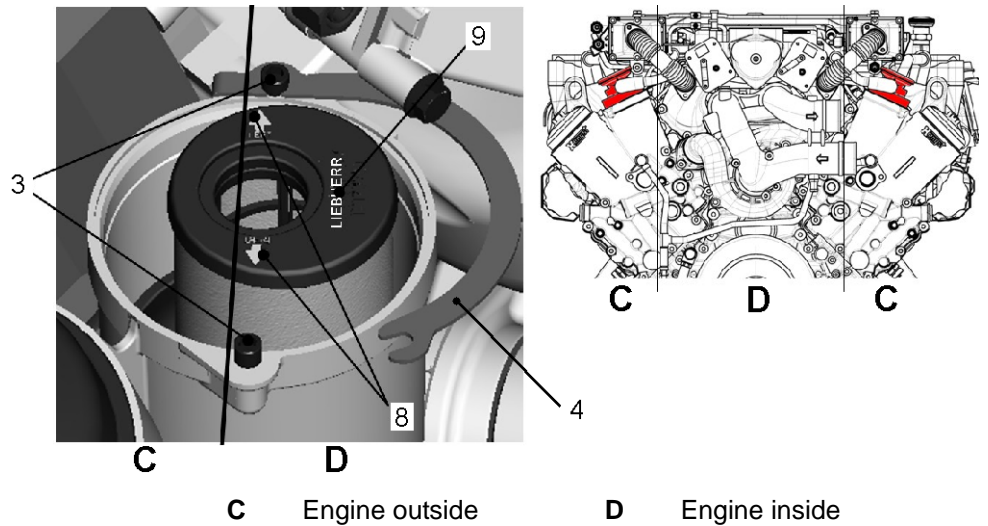


Fig. 5-20 Oil separator filter orientation

- ▶ Position the O-ring **10** on the regulation valve lid. Lubricate it with clean fuel or oil.
- ▶ Assemble the lid of the regulation valve, put it in the correct position (mind the current direction).
- ▶ Put the bracket **4** in closed position and screw **3**.
- ▶ Slip on the hose and retighten the hose clamps.

5.6.7 Heater flanges

An electrical heater flange is installed at the input of each intake air manifold, at the right side and at the left side of the Diesel engine.

The proper function of these heater flanges must be verified every year, at the beginning of the cold season.

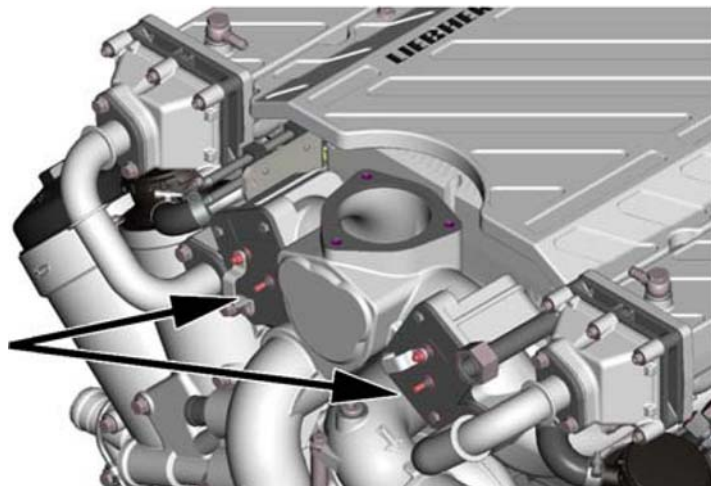


Fig. 5-21 Heater flanges

- ▶ Switch off the batteries main switch.
- ▶ Disconnect the electrical wires at the heater flanges.
- ▶ Connect an ohmmeter between the both terminals of each flange and measure the resistance.

↗ At a temperature of about 20°C the measured resistance value must be 250±10 mOhms, if this value is not reached, the heater flange must be replaced.

- ▶ Reconnect the electrical wires to the heater flanges and turn on the batteries main switch.

5.6.8 Checking and adjustment of valve clearance

Preparation

- It must be ensured that the Diesel engine is in the maintenance position and that new seals for all cylinder head covers are on-hand.



Note !

- The cylinder number 1 is always situated at the opposite of the flywheel side and at the right engine side when facing the flywheel.
- The sense of rotation of the engine is counterclockwise when facing the flywheel.
- The exhaust valves are on the flywheel side on cylinders 1 to 4 and on the fan side on cylinders 5 to 8.



Fig. 5-22 Arrangement of cylinders, intake and exhaust valves

A = Exhaust valves
E = Intake valves

- ▶ Dismount the cylinder head covers.
- ▶ Attach the manual engine slewing device to the stater gear ring, see also the paragraph "starter ring gear lubrication".
- ▶ Turn the engine in its sense of rotation until exhaust and intake valves overlap at the cylinder which is corresponding to the cylinder to be adjusted.

Sequence of valve clearance adjustments - 8 cylinders V-engine D9508								
Valves overlap at cylinder	1	5	7	2	6	3	4	8
Valves clearance adjusted at cylinder	6	3	4	8	1	5	7	2

Tab. 5-14 Correspondence between overlapping valves and valves to be adjusted

Checking and adjusting the valve clearance

- ▶ Insert feeler gauge between valve fitting and rocker arm and check the valve clearance.

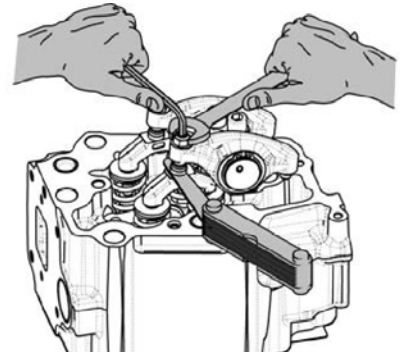
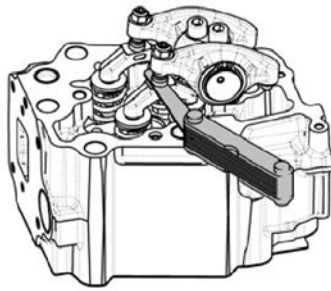


Fig. 5-23 Checking and adjusting intake valve clearance

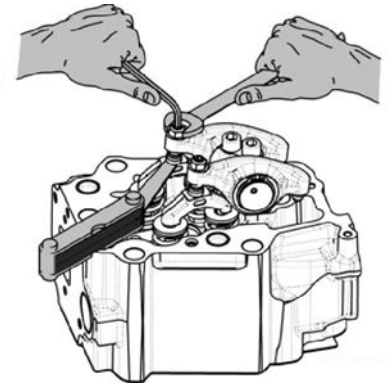
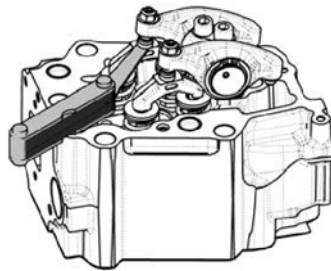


Fig. 5-24 Checking and adjusting exhaust valve clearance

- ❑ If the clearance does not correlate with the prescribed adjustment values:
 - ▶ Loosen the lock nut on the adjusting screw of the respective rocker arm and correct the setting.
 - ▶ Tighten lock nut with 45 Nm.
 - ▶ Check adjustment again.
- ❑ When all the intake and exhaust valves have been checked or adjusted:
 - ▶ fit cylinder head covers with new seals.
 - ▶ Remove the manual engine slewing device from the stater gear ring.

5.7 LIEBHERR particles filter (option)

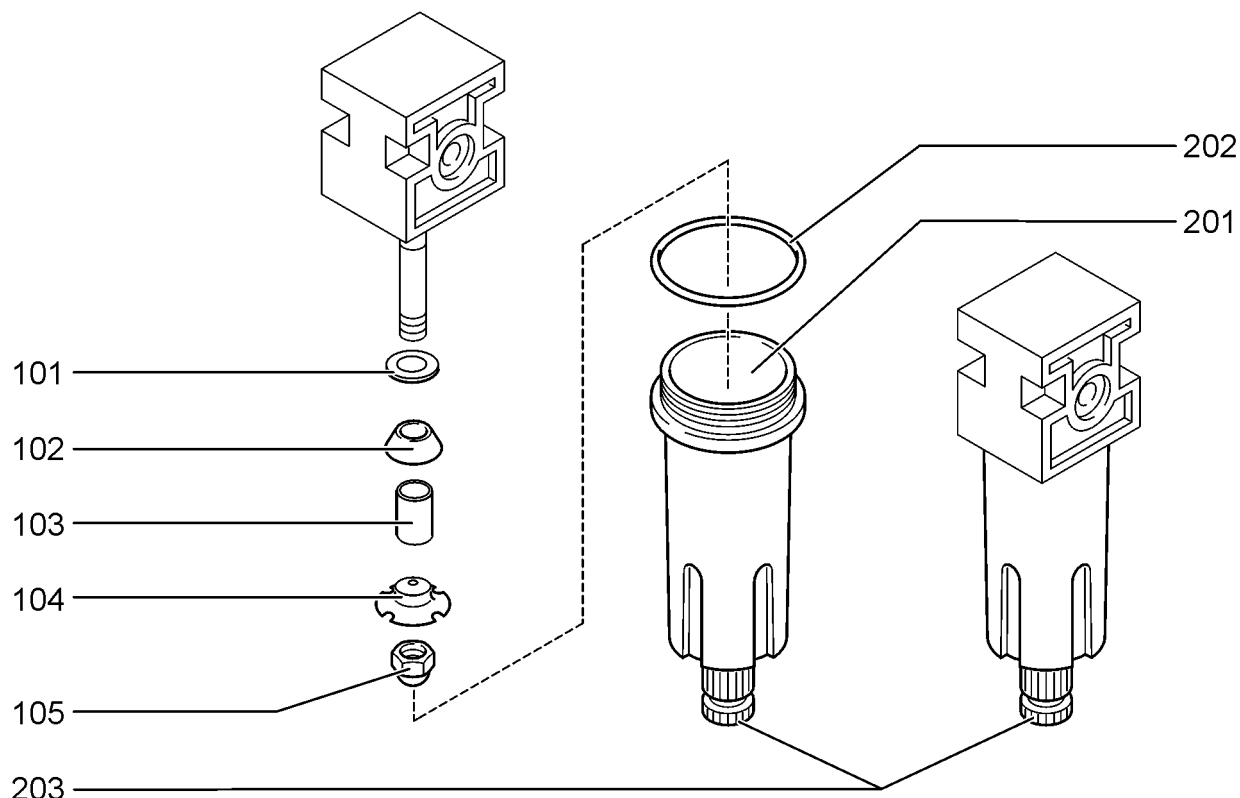


Fig. 5-25 Water separator

The exhaust back pressure is measured in the pressure line connecting the control unit A175 to the particles filter housing.

A water separator filter is integrated in this pressure line. The periodic maintenance works for the particles filter system are limited to this component.

5.7.1 Drain the condensation water

- ▶ The water separator must be drained regularly.
- ▶ Turn the screw **203** counterclockwise for 90° and collect the condensation water into an adapted container.
- ▶ Retighten the screw **203** by turning clockwise.

5.7.2 Water separator maintenance

- ▶ Drain the water separator.
- ▶ Unscrew and remove the filter housing **201**.
- ▶ Unscrew the nut **105**.



Notice!

The metallic screen **103** must be checked for good condition every 500 operating hours and cleaned if necessary. It must be changed every 1000 operating hours.

- ▶ Remove the filter components **101 to 104**, and wash or replace the metallic screen **130**.
- ▶ Reassemble the filter components **101 to 104** in the right sense and in the right order, reinstall and then retighten the nut **105**.
- ▶ Reinstall the filter housing **201** complete with the O-ring **202**.

For replacement, repair and other maintenance works on the particles filter, see the service manual or consult the LIEBHERR after sales service.

5.8 Cooling system

5.8.1 Checking and cleaning the cooling system

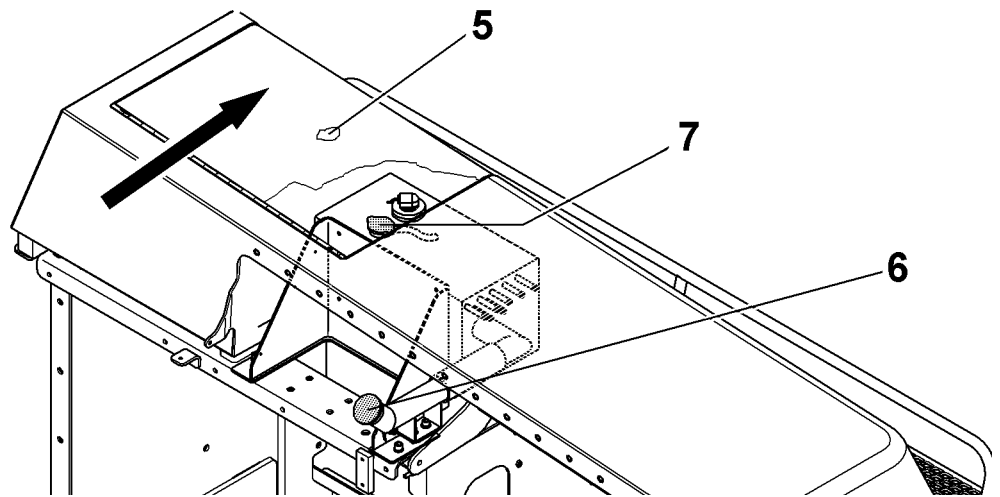


Fig. 5-26 Filler cap and pressure relief valve of the cooling system

The machine has a combined turbocharged air and water cooler unit.

Optimal cooling can only be achieved when the cooler is kept clean.

- ▶ Check the fan motor, the fan and the cooler core for damage and clean parts as necessary.
- ▶ If required, clean the cooling fins with compressed air or a steam jet (from inside out, see arrow).
- ▶ In case of leaks, change the coolant circuit pressure relief valve **7 mounted to the expansion reservoir** and/or the filler cap **6**.
- ▶ Regularly check the condition and seals on the connecting clips between the coolant cooler and engine as well as on the coolant hoses regularly.

5.8.2 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 cap **6** of the filler neck has cooled off sufficiently to touch.
- ▶ When the engine is very hot, preferably first let the pressure escape by slowly turning the pressure relief valve **7** accessible via the flap **5** in the cooler hood.

- ▶ Turn the cap **6** a half turn and let any pressure that may be present escape in this position.
- ▶ After balancing the pressure, slowly turn fully and remove the cap **6**.

When engine is cold, the coolant level must reach the top of the filler neck under the cap **6**.

- ▶ Add coolant if necessary.
- ▶ Close the cap **6**.

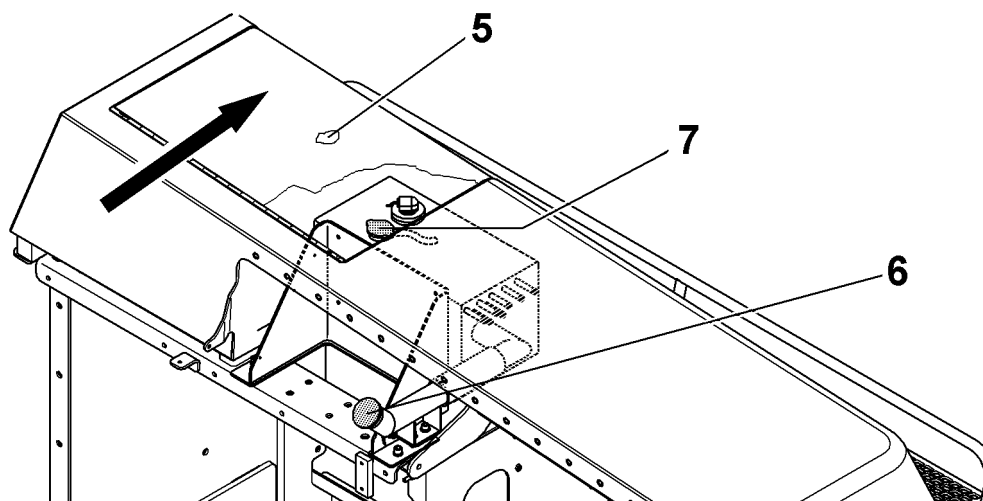


Fig. 5-27 Coolant filler cap 6 and pressure relief valve 7

- ▶ After adding coolant, allow the engine to run for a short time with the cab heating switched on and check the coolant level once again.

5.8.3 Changing the coolant



Danger!

Risk of burning due to hot coolant.

- ▶ Only change the coolant when the engine is cold.

The following points should be noted when changing the coolant:

- Change the coolant in the entire coolant circuit at least every two years.
- Always change the coolant with the shutoff valves for the cab heating circuit closed.

- Bleed the coolant circuit when refilled

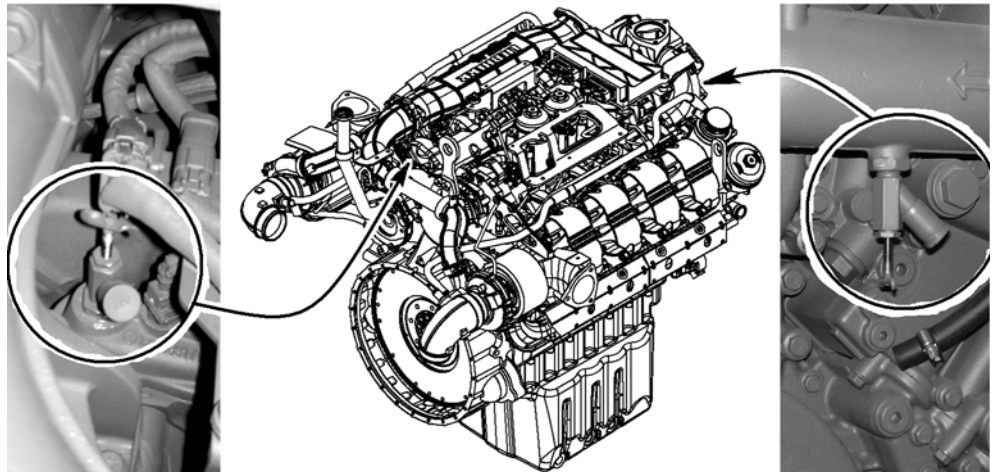


Fig. 5-28 Shutoff valves for cab heating circuit



Note!

If the coolant has been changed without closing the shutoff valves for the cab heating circuit, the heating circuit must be bled, see chapter "maintenance of heating circuit".

To be sure that the coolant flows through the heating system, the ignition key must be in contact position and the cab heater must be set manually to maximum heating power.

Draining the coolant

- Remove the filler cap 6 at the filler neck.

To drain the coolant at the Diesel engine:

- Unscrew the protection cap of the drain valve 1 on the front side of the engine, screw the supplied drain hose to the drain valve 1 and let the coolant drain into a suitable container.



Fig. 5-29 Coolant draining valve and screw on engine front side

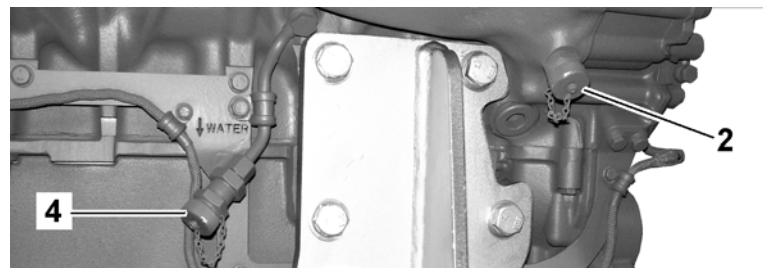


Fig. 5-30 Coolant draining valves on engine rear side

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- ▶ Unscrew the protection cap of the drain valve **2** on the rear side of the engine, screw the supplied drain hose to the drain valve **2** and let the coolant drain into a suitable container.
- ▶ Unscrew the protection cap of the drain valve **4** on the rear side of the engine, screw the drain hose to the drain valve **1** and let the coolant drain off.
- ▶ Remove the drain screw **3** on the front side of the engine housing and let the coolant drain into a suitable container.
- ▶ Reinstall and retighten the protection caps of the drain valves **1, 2, and 4** and the drain screw **3**.

To drain the coolant at the cooler:

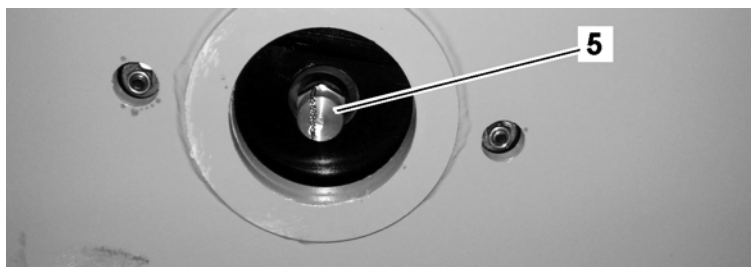


Fig. 5-31 Coolant draining valve on watercooler

- ▶ Unscrew the protection cap of the drain valve **5** at the bottom of the coolant cooler.
- ▶ Screw the supplied drain hose to the drain valve **5**.
- ▶ Let the coolant drain into a suitable container.
- ▶ Reinstall and retighten the protection cap of the drain valve **5**.

Refilling the coolant and bleeding the coolant circuit

- ▶ Add coolant via the cap **6** up to the upper edge of the filler neck of expansion reservoir.
- ▶ Close the cap **6** again.
- ▶ Open the shut-off valves for cab heating circuit and adjust the heating system to maximum heating power.
- ▶ Start the engine and let it run at low idle for approx. one minute.
- ▶ Open the cap **6** and add coolant up to the upper edge of the filler neck of expansion reservoir. Add coolant until the level does no longer drop.
It is not possible to overfill the coolant system when the pressure relief valve **7 is installed!**
- ▶ Close the cap **6** again.

If the coolant level sensor actuates during machine operation, check the coolant level and, if necessary, top up with coolant as described above.



Caution!

The engine could be damaged.

- ▶ If the indicator light for coolant overheat or the symbol for low coolant level lights up, bring the engine to low idle immediately.
- ▶ Switch off the engine after a few seconds.
- ▶ Check the coolant level and refill with coolant if necessary.

5.8.4 Checking coolant, adjusting mixing ratio

Coolant with corrosion inhibitor/antifreeze agent

The mixing ratio must at all times conform to a frost protection of -37 °C.

- ▶ Take a coolant sample and analyse it with a suitable method for the frost protection temperature.
- ▶ Adjust mixing ratio, if the frost protection is not sufficient.

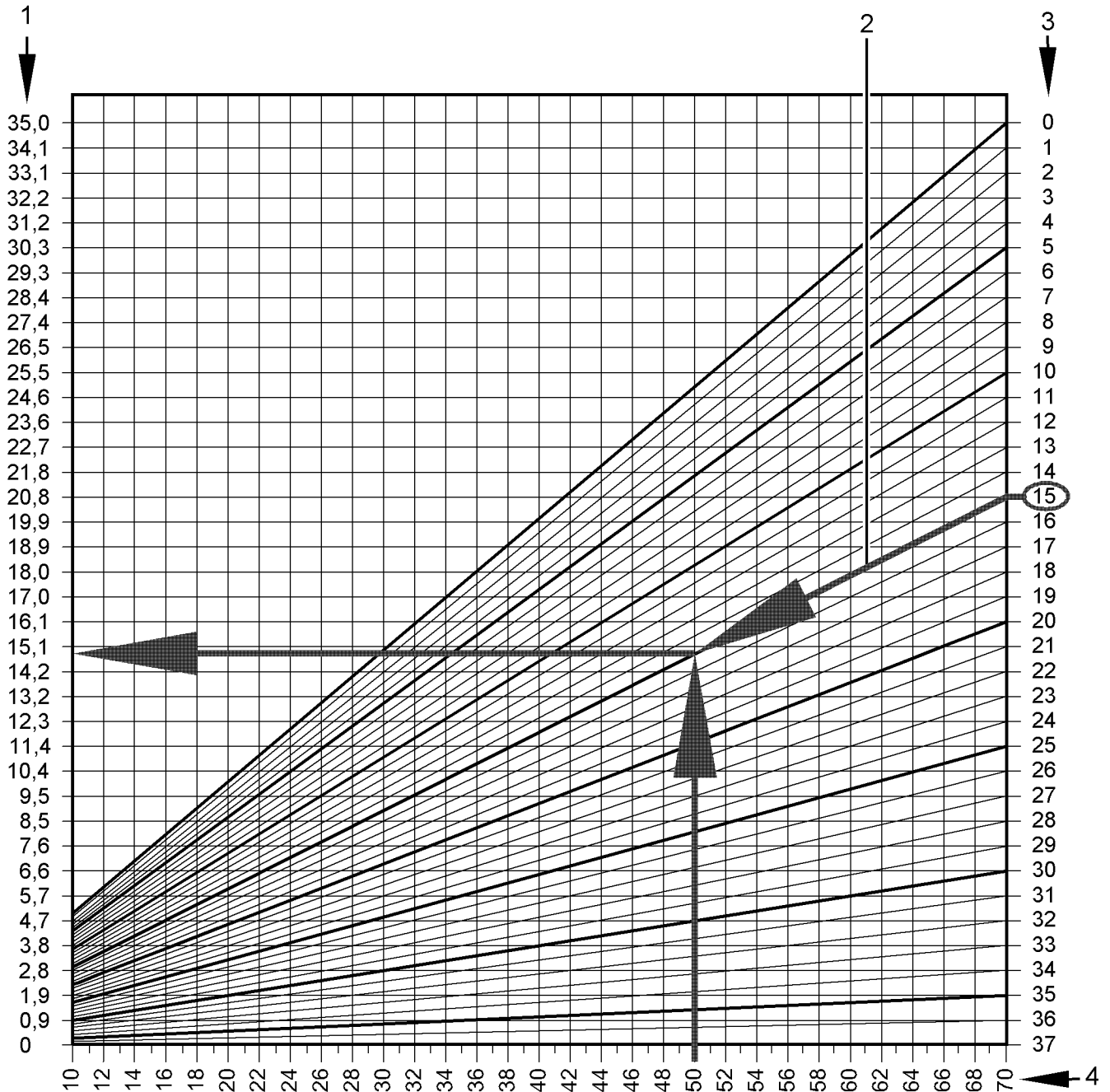


Fig. 5-32 Determining refill volume - example for -15 °C:

- 1** Corrosion inhibitor/antifreeze agent (concentrate), refill volume in litres
- 3** Max. frost protection temperature of the cooling system -°C

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2 Auxiliary line

4 Coolant volume in radiator in litres

Determining refill volume - example for -15 °C / 50 litres of coolant:

Based on the measured frost protection temperature (-15 °C) follow the auxiliary line 2 from the left bottom corner to the vertical line 4 (coolant volume – 50 litres) and from there horizontally to the left scale. The refill volume 1 is 14.8 litres.

This corresponds to the refill volume of corrosion inhibitor/antifreeze agent (concentrate) to be added in order to again achieve a frost protection temperature of -37 °C.

Correcting mixing ratio

- The necessary refill volume is known.
- ▶ To correct the mixing ratio, at least the (previously determined) volume must be drained from the cooling system.
- ▶ Add the determined volume of corrosion inhibitor/antifreeze agent (concentrate).
- ▶ To achieve the required coolant level, add some of the previously drained coolant.

Coolant with corrosion inhibitor (without antifreeze agent)**When using DCA 4:**

- ▶ Take a coolant sample and analyse the concentration using a Fleetguard CC 2602 M testing kit.
- ▶ If the concentration is incorrect, correct the mixing ratio (according to the values indicated by the test kit).

When using Caltex / Chevron / Havoline / Total:

The mixing ratio must always show a Brix value of $2.8_{-0.9}^{+0.9}$ % . This corresponds to 5 to 10 % of corrosion inhibitor and 90 to 95 % of water.

- ▶ Take a coolant sample and analyse with a Gefo refractometer.



Fig. 5-33 Gefo refractometer 2710

Refractometer:

- Adjusting screw for adjustment to 0-line (water line)
- Adjustment of acuity by turning the eyepiece
- Soft edge of eyepiece
- Sturdy metal housing
- Safe handling thanks to rubber jacket

Measuring procedure:

- ▶ Carefully clean the lid and prism.
- ▶ Apply 1 to 2 drops of sample liquid onto the prism.
- ▶ Close the lid.

↙ The liquid is distributed.

- ▶ Hold the device against a light-coloured background and look through the eyepiece.
- ▶ Adjust focus on scale and read the value at the blue separating line.

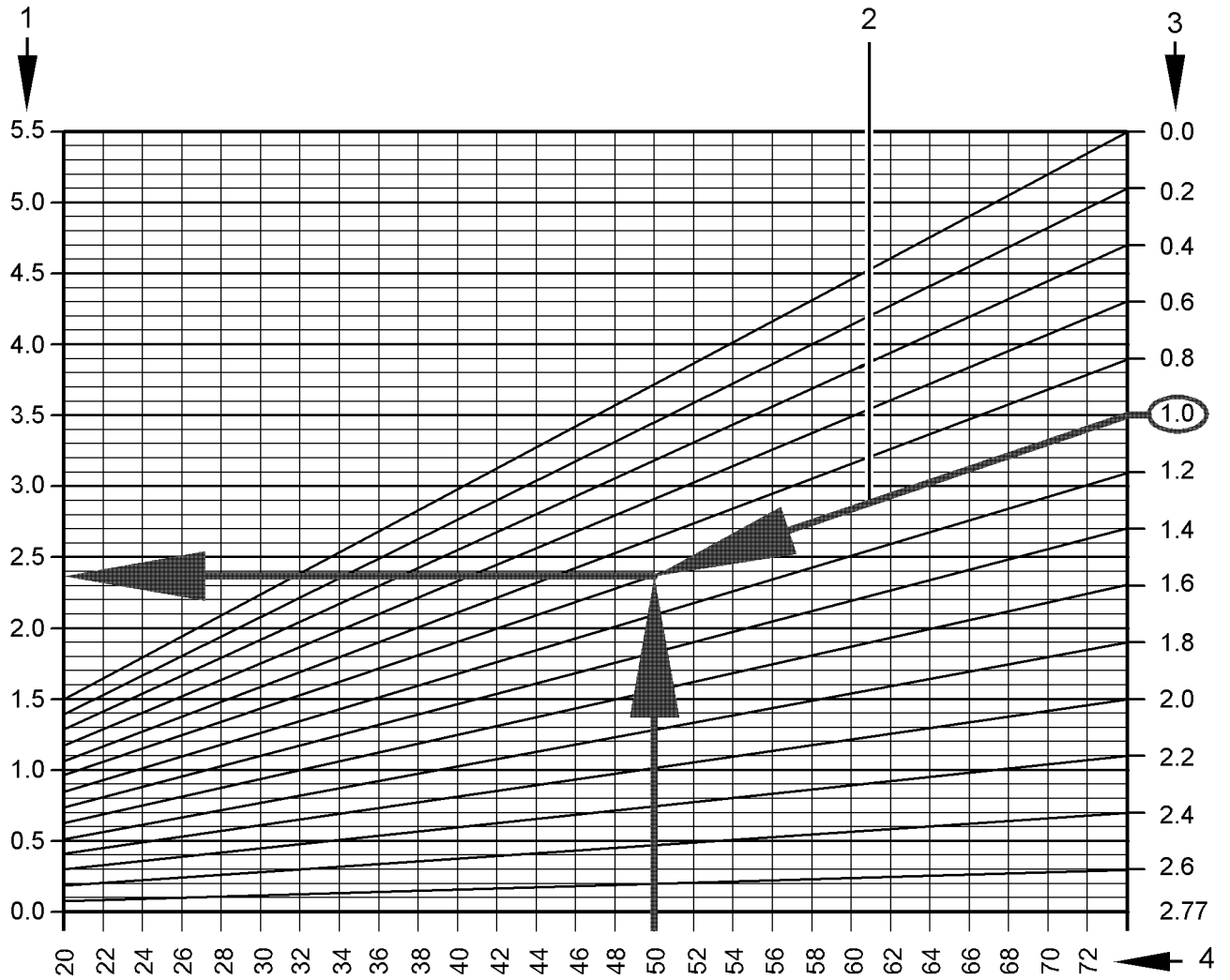


Fig. 5-34 Determining refill volume - example for 1 % Brix.

- | | |
|---|--|
| <p>1 Corrosion inhibitor, refill volume in litres</p> <p>2 Auxiliary line</p> | <p>3 Refractometer value in % Brix</p> <p>4 Coolant volume in radiator in litres</p> |
|---|--|

Determining refill volume - example for 1 % Brix / 50 litres of coolant:

Based on the measured value (1 % Brix), follow the auxiliary line **2** from the left bottom corner to the vertical line **4** (coolant volume – 50 litres) and from there horizontally to the left scale. The refill volume **1** is 2.4 litres.

This corresponds to the refill volume of corrosion inhibitor (concentrate) to be added in order to again achieve a value of 2.8 % Brix.

Correcting mixing ratio

- ☐ The necessary refill volume is known.

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- ▶ To correct the mixing ratio, at least the (previously determined) volume must be drained from the cooling system.
- ▶ Add the determined volume of corrosion inhibitor.
- ▶ To achieve the required coolant level, add some of the previously drained coolant.

5.9 Fuel system



Danger!

Risk of explosion!

- ▶ Avoid naked flame when working on the fuel system and when refuelling.
- ▶ Do not smoke.
- ▶ Only work on the diesel engine when it is switched off.

5.9.1 Refuelling

Fuel filler cap

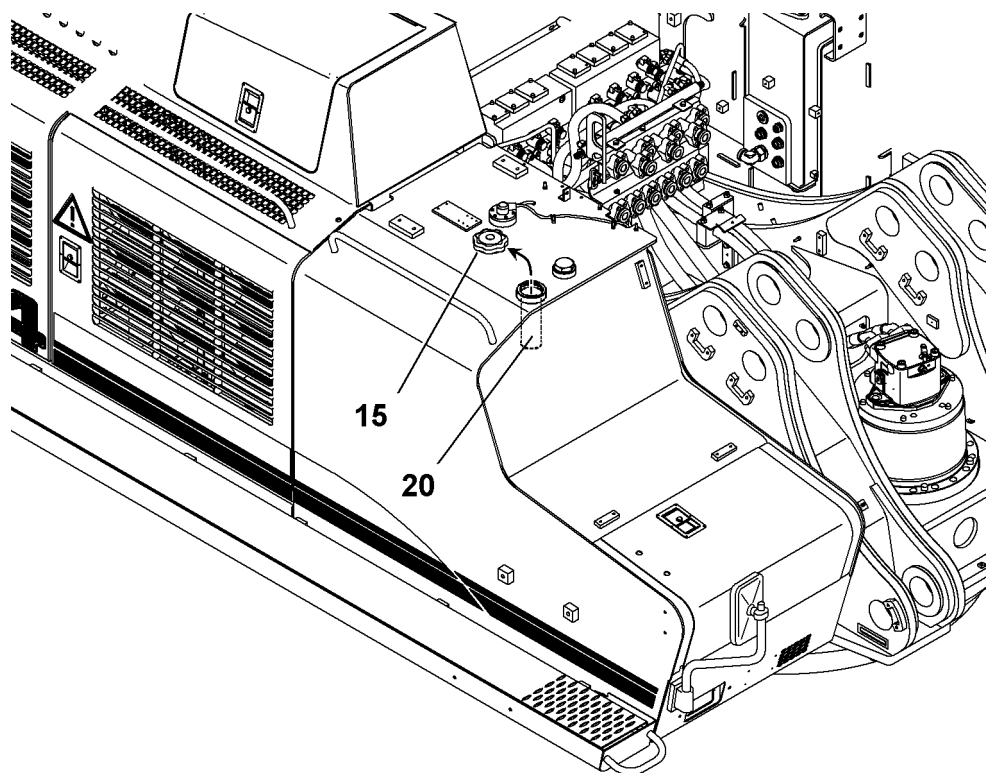


Fig. 5-35 Fuel filler cap

- ▶ Unscrew fuel tank cap 15.
- ▶ Add fuel via the filler sieve 20.

5.9.2 Electrical refuelling pump (optional extra)

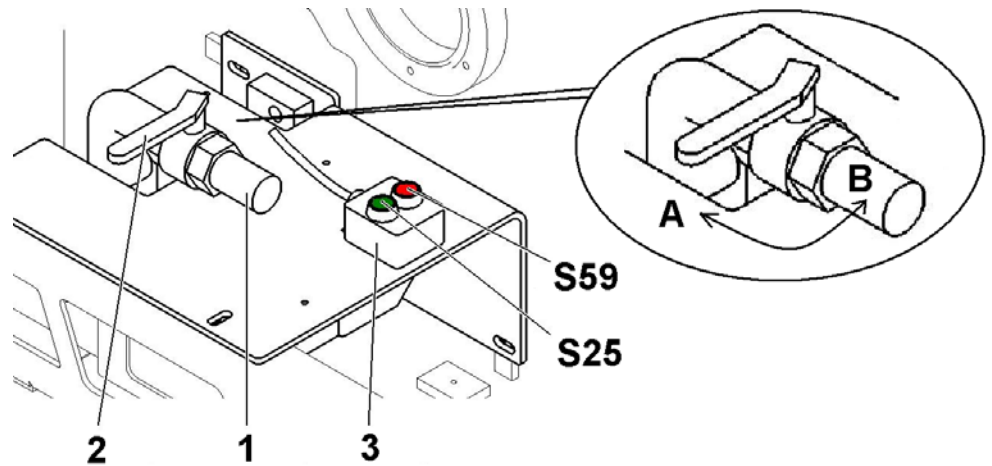


Fig. 5-36 Electrical refuelling pump

- | | | | |
|---|----------------|------------|------------|
| 1 | Intake hose | S25 | Button ON |
| 2 | Shut off valve | S59 | Button OFF |
| 3 | Operating unit | | |

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.

Refuelling pump data

Technical data	Value
Flowrate	100 L/min
Power	30 min
Max. delivery height	4 m

Refuelling pump start up

- ▶ Unscrew the fuel filler cap **15**.
- ▶ Insert the free end of the intake hose **1** in the fuel supply tank down to the bottom of the tank.
- ▶ Open the shut off valve **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).

**Caution !**

- ▶ Refuel only with clean diesel.
- ▶ Ensure that the filter (at the end of the intake hose) is not damaged or plugged in order to protect the pump against foreign bodies.
- ▶ 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.
 - ↪ Ensure that the valve **2** is open before the pump is working.
- ▶ Make sure refuelling is going smoothly.

Refuelling pump switch off and stowing the hoses

- ▶ The pump is stopped.
- ▶ 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.
- ▶ Screw the fuel filler cap **15**.

**Caution !**

- ▶ After a refuelling, the pump body has to stay full of gasoil to avoid the jamming of it.
- ▶ Only close the stop cock when the pump is stopped.
- ▶ Do not change intake hose's length or/and diameter.

**Note !**

- ▶ To avoid watercondensation in the tank, refuel at the end of the workingshift.

Filling a tank fitted with quick refuelling coupling (option)

At customer's wish the fuel tank can be equipped with a quick refuelling coupling, which allows an appreciable reduction of the refuelling time, (if the employed tank truck is fitted with the corresponding coupling system too) .

Depending on the execution of the machine and on customer's wish, this coupling can be installed at the front (2a) in the bottom sheet (2b) or in the side wall (2c) of the fuel tank.

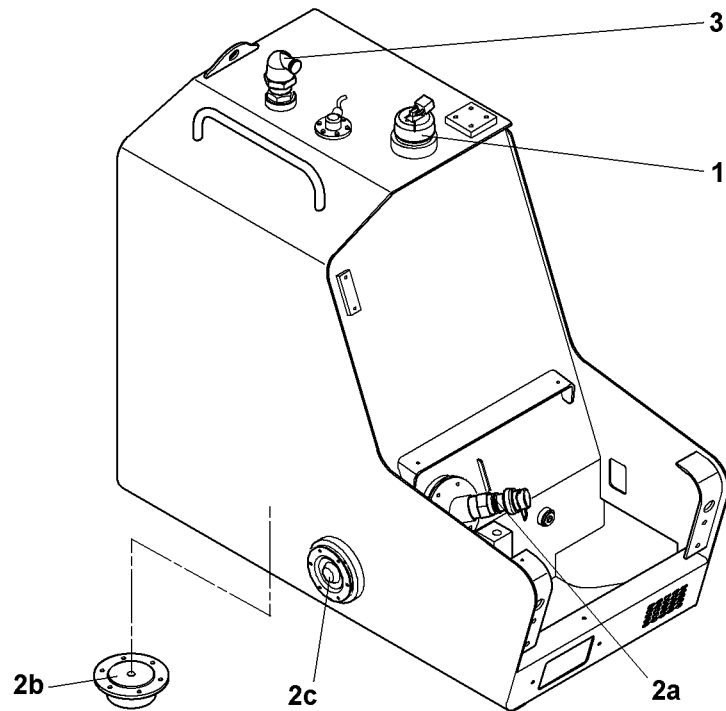


Fig. 5-37 Fuel tank equipped with quick refuelling coupling



Caution!

The fuel filler cap 1 must remain installed on the tank during refuelling via the quick refuelling coupling. Otherwise no automatic cut off of the fuel gun will happen and the tank will overflow.

- ▶ Remove the cap of the filler coupling 2.
- ▶ Connect the fuel gun to the coupling 2 and add fuel, until the tank is full.
- Once the tank is full:
 - ↳ the vent valve 3 closes, causing the counterpressure in the tank to increase and the fuel gun to stop refuelling automatically.
- ▶ Remove the grease gun from the coupling 2.
- ▶ Reattach the cap to the filler coupling 2.

5.9.3 Draining the fuel tank

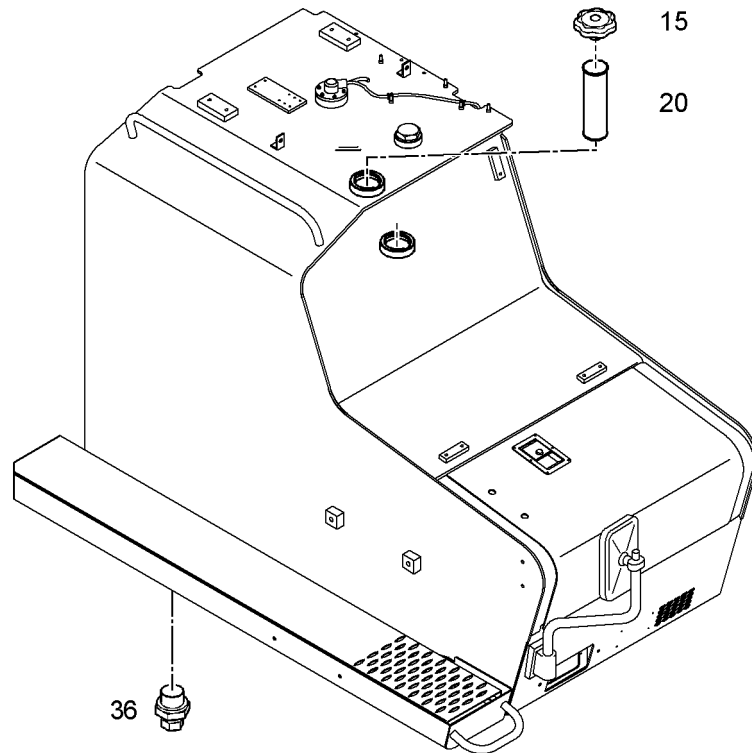


Fig. 5-38 Fuel tank

15 Filler cap

20 Filler sieve

36 Drain valve

To daily drain the fuel tank and the fuel system:

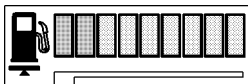
- ▶ Place a suitable container underneath.
- ▶ Unscrew the drain valve **36** mounted to the bottom sheet of the fuel tank.
- ▶ Drain off the water until water free fuel escapes.
- ▶ Close the drain valve **36** again.

If the operating conditions and the fuel quality allows, the water draining interval can be increased to once a week.



Note!

To reduce the formation of condensate in the tank, keep the fuel level as high as possible. Preferably refuel the tank at the end of the working day.



Display **P3** indicates the fuel level.

When the red bar **P3.1** illuminates, a low reserve quantity is still in the tank.

- ▶ In the event of a low fuel level, refill the tank before starting to work..

5.9.4 Emptying and cleaning the fuel tank

The bottom of the tank is fitted with a drain valve **36**.

- ▶ Place a suitable container underneath.
- ▶ To drain off the water, unscrew the drain plug on the drain valve **36** by two turns

and let the water flow out until water free fuel escapes.

- ▶ Retighten the plug of the drain valve **36**.
- ▶ To empty the fuel tank totally, remove both the fuel filler cap **15** and the drain valve **36** and collect the fuel in a suitable container.
- ▶ Check the fuel tank and filler sieve **20** regularly for contamination.
- ▶ If necessary, replace the filler sieve **20** and / or wash out the fuel tank.

5.9.5 Draining the fuel prefilter

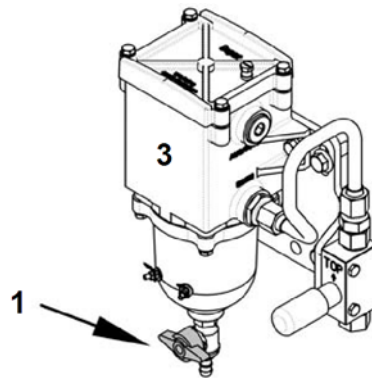


Fig. 5-39 Drain valve at fuel prefilter



The water separator of the fuel pre-filter must be drained on a daily basis and, if necessary, each time the symbol E528 appears at the display of the machine:

- ▶ Position a collecting container underneath.
- ▶ Press the drain valve **1** of the fuel prefilter **3** and then turn it clockwise to open.
- ▶ Let the water flow out until water free fuel escapes.
- ▶ Close the drain valve **1** again.

5.9.6 Replacing the fuel filter elements



Danger !

There is a risk of fire and explosion!

No smoking !

Avoid open flame !

Perform maintenance works only after the Diesel engine is shut down.

Replacing the fuel prefilter element

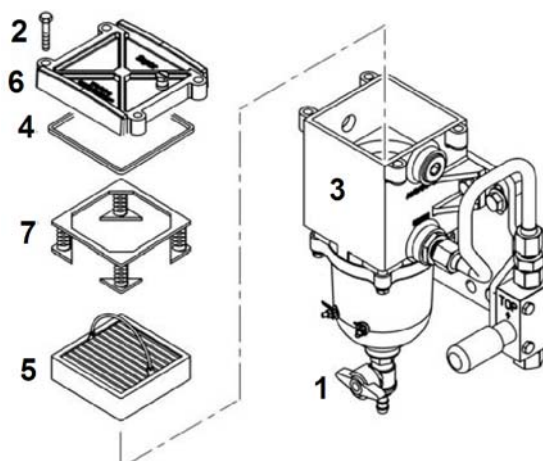


Fig. 5-40 Replacing the fuel prefilter element

- | | | | |
|---|----------------------|---|--------------|
| 1 | Water drain valve | 2 | Screw |
| 3 | Filter housing | 4 | Seal |
| 5 | Paper filter element | 6 | Filter cover |
| 7 | Spring holder plate | | |

- ▶ Position a collecting container under the fuel pre-filter **3**.
- ▶ Clean fuel pre-filter and the surrounding area thoroughly.
- ▶ Press the handle of the water drain valve **1** and turn it clockwise, let the fuel flow out of the filter housing.
- ▶ Loosen the screws **2** and **take off the cover 6** with the seal **4**.
- ▶ Take off the paper filter element **5** complete with the spring holder plate **7**.
- ▶ Dispose of the old paper filter element **5**.
- ▶ Install a new filter element **5**.
- ▶ Check the good condition of the seal **4** and replace seal as necessary.
- ▶ Reassemble the complete fuel prefilter.
- ▶ Bleed the fuel prefilter after replacement of its filter element.

Replacing the fuel fine filter elements

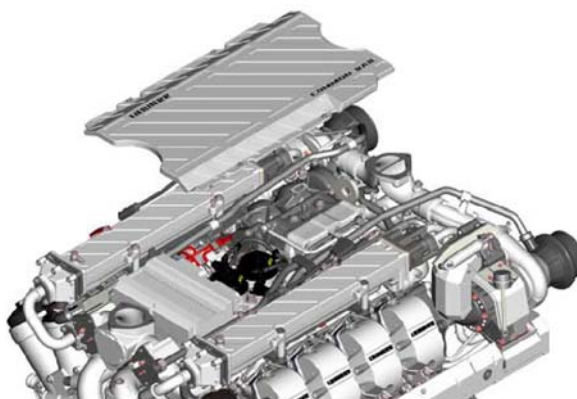


Fig. 5-41 Running plate at the top of Diesel engine

The fuel fine filters are situated under the protection running plate, in the V-area at the top of the engine.

- ▶ Remove the running plate.
- ▶ Clean fuel fine filters and the surrounding area thoroughly.

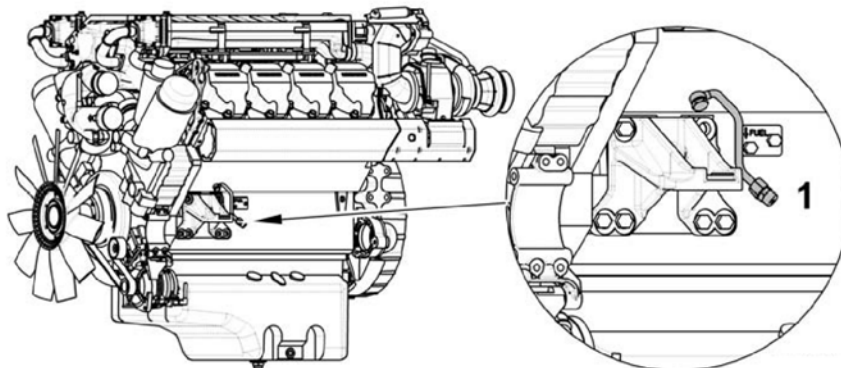


Fig. 5-42 Fuel draining pipe - fine filter assembly

- ▶ Position a collecting container under the fuel draining pipe.
- ▶ Unscrew the fitting 1 at the fuel draining pipe.

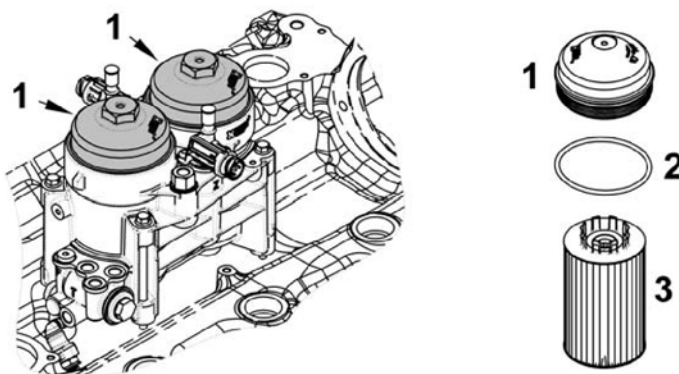


Fig. 5-43 Fuel fine filter - Replacement of filter elements

- ▶ Using a suitable tool loosen the both covers of the fine fuel filters. Unscrew the covers 1 until the breather holes under the o - rings 2 are free.
- ▶ Wait until all the fuel in the filter housing has drained off into the collecting container.
- ▶ Remove the both covers 1 complete with the fine filter elements 3.
- ▶ Pull the fuel fine filter elements 3 away from the covers 1.
- ▶ Dispose of the old filter elements 3.
- ▶ Replace the O - rings 2 and clean the covers 1 as necessary.



Caution!

Introduction of dirt can cause the destruction of the Common Rail system! It is essential that no contaminants attain the clean side of the filters.

- ▶ Leave the remaining fuel inside the filter housing. Do not attempt to sponge up the filter housing using a rag.

Never reuse an already used fuel filter element..

- ▶ Use only new original Liebherr fuel fine filter elements **3** .
- ▶ Reinstall the fuel fine filter elements **3** complete with the covers **1** and tighten to prescribed torque (20^{+5} Nm or 15^{+4} ft.lbs).
- ▶ Retighten the fitting **1** to close the fuel draining pipe.
- ▶ Refill the fuel system using the hand pump.
- ▶ Reinstall the protection running plate.

5.9.7 Bleeding the fuel system

A complete bleeding operation consists in bleeding first the fuel prefilter and then the low pressure fuel system.

The bleeding of the fuel system becomes necessary after replacement of the fuel filter elements, after running the fuel tank empty and at initial start up of the Diesel engine.



Note !

Impurities in the fuel system cause the the Common Rail system to disfunction. Injection lines must not be opened or loosened.

All works at the components of the Common Rail Systems are only to be performed by specially trained personnel.

The Diesel engine must be shut down for at least one Minute to allow the pressure in the rail to decrease before working in the high pressure system.

For all works and any parts of the fuel system, it is essential to respect absolute cleanliness (e.g. washing hands, wearing clean work dress). Humidity is to be avoided absolutely.

Bleeding the fuel prefilter:

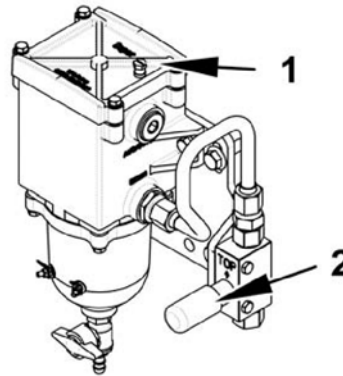
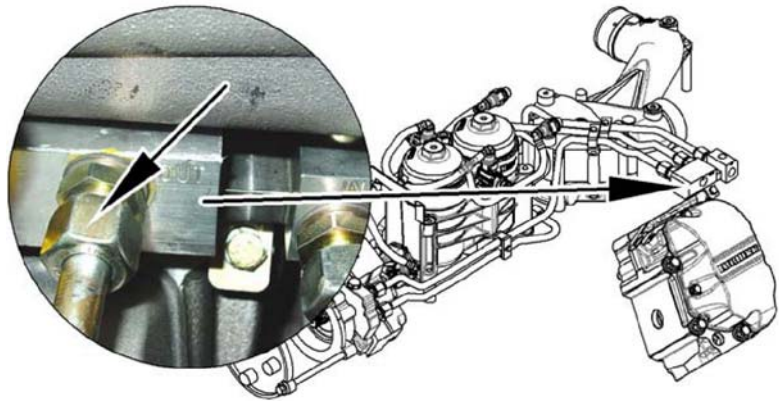


Fig. 5-44 Bleeding the fuel prefilter

1 Bleeder screw

2 Hand pump

- ▶ Unscrew the bleeder screw **1** at the filter head of the fuel prefilter by 2 or 3 turns.
- ▶ Actuate the hand pump **2**.
- ▶ Retighten the bleeder screw **1** as soon as bubble-free fuel escapes from bleeder screw.
- ▶ Continue actuating the hand pump **2** until you notice a more intense resistance.

Bleeding the low pressure fuel system:**Fig. 5-45** Fuel return pipe

- ▶ Loosen the fitting at the fuel return line (see arrow).
- ▶ Continue actuating the hand pump **2**.
- ▶ As soon as bubble-free fuel escapes, retighten the fitting at the fuel return line.
- ▶ Continue actuating the hand pump **2** until you notice a more intense resistance.
- ▶ Start the engine.

**Note !**

If the engine does not start after a 20 seconds cranking:

- ▶ respect a pause time of 1 minute,
- ▶ perform a new starting attempt (maximum duration of 20 seconds).

If the engine does not start after three starting attempts, repeat the bleeding procedure.

5.10 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.

The maintenance mainly consists in changing the filter elements **3** and **4**. For safety reasons it is not recommended that filter elements be washed out.

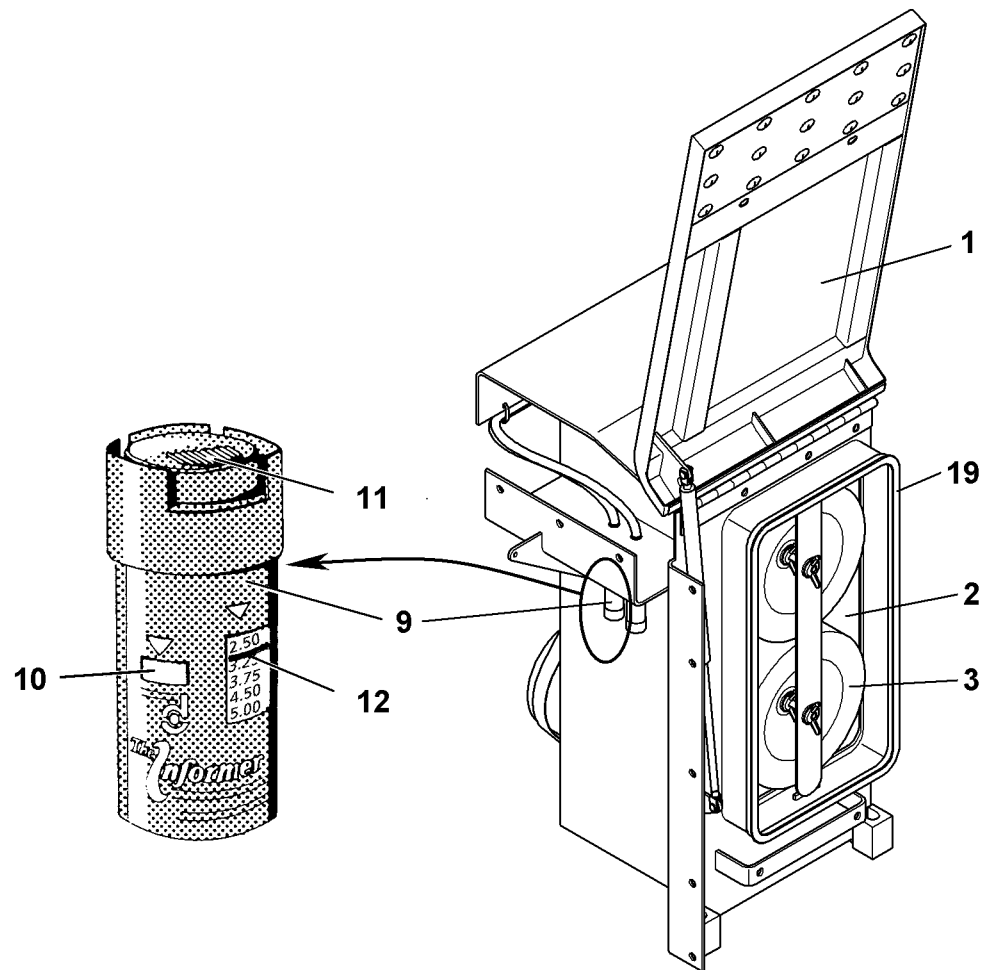


Fig. 5-46 Dry air filter

- | | | | |
|----|----------------|----|------------------------------|
| 1 | Filter cover | 12 | Depression indication stripe |
| 2 | Filter housing | 19 | Sealing |
| 3 | Main element | 20 | Engine air intake hose |
| 9 | Vacuum gauge | 21 | Tensioning clamp |
| 10 | Alarm window | 22 | Tensioning clamp |
| 11 | Reset button | | |

The maintenance indicators **9** store the maximum recorded intake air depression occurring at the filter outlets, during the Diesel engine operation.

The appearance of the red indication strip **12** in alarm window **10** indicates that the maximum permissible vacuum of 5 kPa (50 mbar) has been reached.

- ▶ At that time, replace the primary filter element **3**.
- ▶ Press the reset button **11** of the vacuum gauge **9** to clear the stored low pressure reading.

5.10.1 Changing the main element



Caution!

Only replace the main element **3** when the maximum permissible intake depression has been reached, or at least once a year.

Installing and removing the main element **3** too often could damage the seals between the filter element and the filter housing **2**.

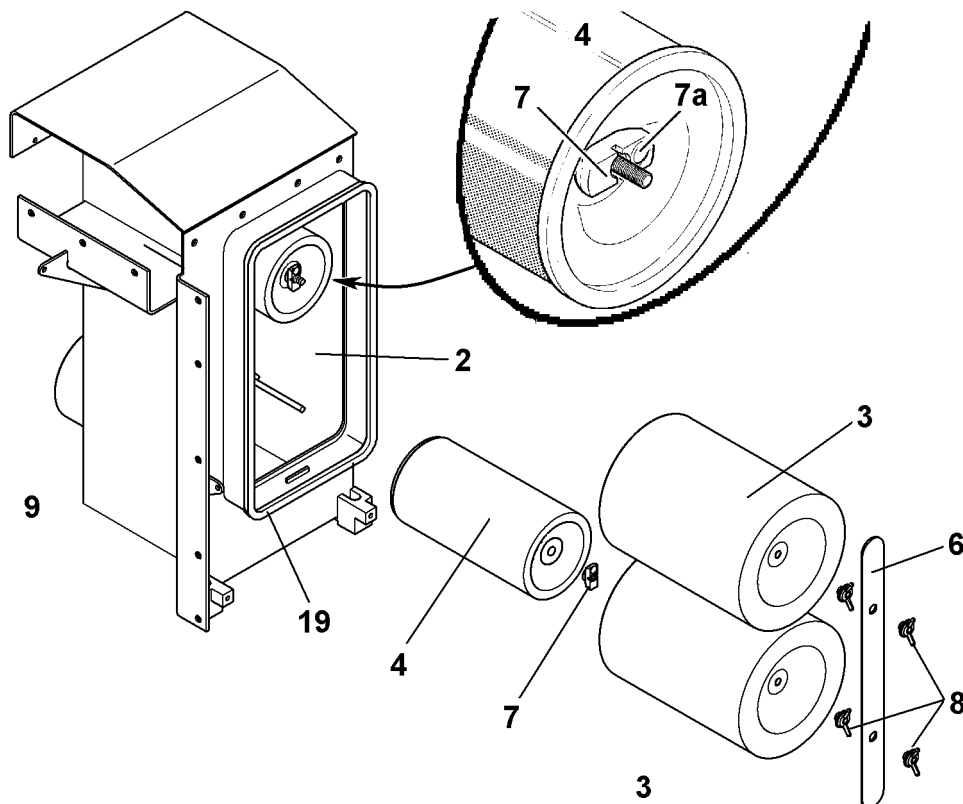


Fig. 5-47 Changing the filter elements

- | | |
|------------------|---------------------------------------|
| 1 Filter cover | 6 Retaining rod |
| 2 Filter housing | 7 Maintenance indicator (special nut) |
| 3 Main element | 8 Wing nuts |
| 4 Safety element | 9 Vacuum gauge |

- ▶ Swivel up the cover **1** with the engine switched off.
- ▶ Remove the retaining rod **6** and the wing nuts **8**
- ▶ Remove the contaminated main elements **3**.
- ▶ Clean the interior of the air filter housing **2** using a damp cloth.
- ▶ Insert the new main elements **3** and ensure that they are sealed and positioned correctly.
- ▶ Reinstall the wing nuts **8** and the retaining rod **6**.
- ▶ Close the cover **1** of the filter, taking care that the seal **19** is positioned correctly.

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5.10.2 Changing the safety element



Note!

Replace the safety elements **4** after replacing the main filter cartridges **3** three times or at least once a year.

In addition if, when changing the main elements **3**, you notice that the green dots **7a** on the special nuts **7** have turned red, you must replace the safety elements **4** immediately.

- ▶ Remove the main elements **3** as described above.
- ▶ Remove the special indicator nuts **7** and the safety elements **4**.
- ▶ Clean the interior of the air filter housing **2** carefully using a damp cloth.
- ▶ Clean the sealing surfaces in the housing **2** and inspect for any damage.



Caution!

Dirt could enter the engine air intake manifold!

- ▶ Do not clean the housing by blasting out with compressed air.
- ▶ Insert the new safety elements **4** carefully and secure using the special nuts **7**.
- ▶ Insert the main filter cartridges **3** as described above.
- ▶ Close the filter housing **2** with cover **1**.

5.10.3 Checking the intake air lines

- ▶ At each replacement of filter elements, check the filtered air line between the filter outlet, the turbocharger, the charged air aftercooler and the engine intake pipe (as an ex. the air hose **20**) for damage and leaks.
- ▶ If necessary, retighten the screws of the tensioning clamps **21** and **22**.

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.

However, the pipe and hose network must 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 filters
- for cleaning the oil cooler and
- for changing the oil must be adhered to.

5.11.1 Depressurizing the hydraulic system

Before any intervention on any hydraulic component, you have to depressurize the hydraulic system.



Danger!

Do not inspect leaks with bare hands.

A fine stream of liquid can penetrate the skin when under high pressure and cause serious injury.

Note the following points:

- ❑ The machine must stand level and the attachment must be laid down on even ground.

To relieve pressure in the high pressure circuits

- ▶ Switch off the engine.
- ▶ Briefly move the pilot control devices (joystick and pedals) in all directions (with the ignition key in the contact position).

To relieve pressure the servo oil circuits

- ▶ Move the pilot control devices (joystick and pedals) several times in all directions (with the ignition key in the contact position).

To depressurize the hydraulic tank

- ▶ Unscrew the vent filter **1** by a **maximum** of one turn.
↳ The hydraulic tank will depressurize.

The vent filter **1** can be turned manually if safety stud **2** is inserted. An open-ended spanner can be used if the filter does not open easily

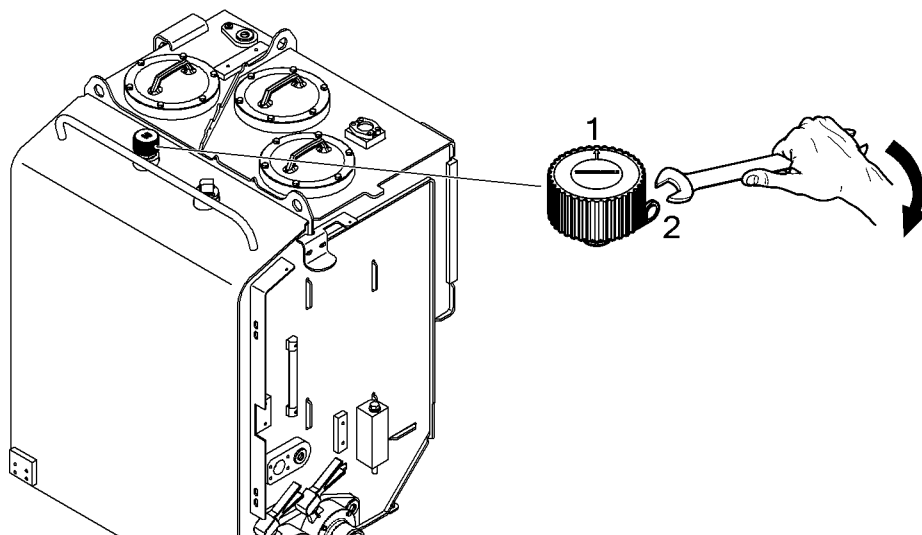


Fig. 5-48 Depressurizing the hydraulic tank



Note!

- ▶ The retaining pin **2** (or anti vandalism key) must be systematically removed from the vent filter **1** and hung with the ignition key.

**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.

5.11.2 Checking the oil level, emptying and refilling the hydraulic tank

Machine position

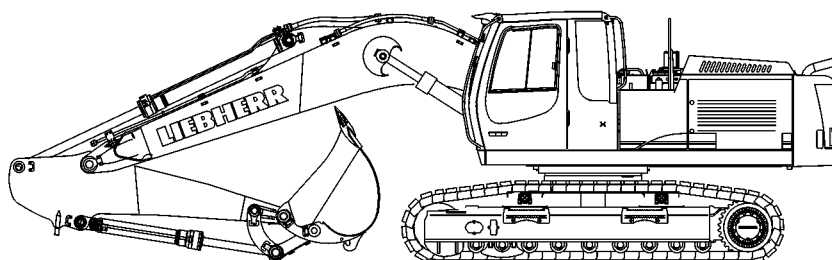


Fig. 5-49 Machine position for checking the oil level in the hydraulic tank

When checking the oil level or refilling the oil:

- the machine must stand on level floor,
- the attachment must be laid down on even ground with the stick and bucket cylinders fully extended (bucket and stick fully tilted in),
- the Diesel engine must be switched off.
- if applying the bottom dump bucket must be closed.

Checking the oil level in the hydraulic tank

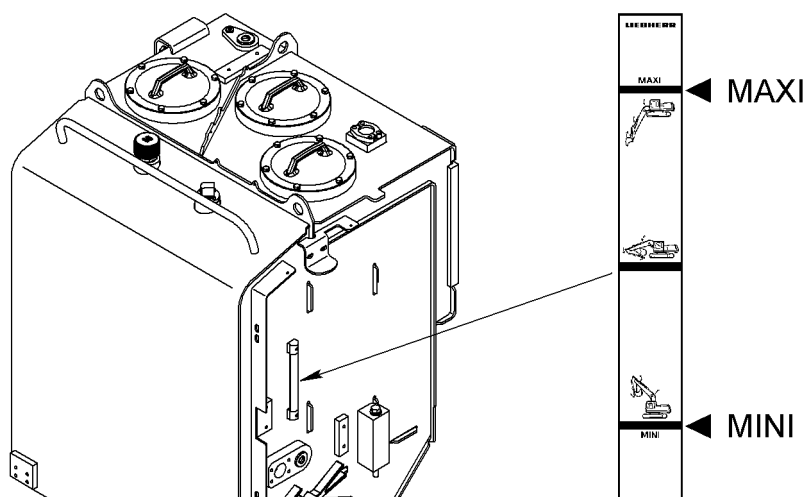


Fig. 5-50 Hydraulic tank oil level

When the machine is in the check position, the level must not be below the middle marking on the sight gauge.

- ▶ If this is not the case, fill oil through the return filter until the oil level reaches the middle marking.

The upper marking **MAXI** shows the maximum oil level when all cylinders are fully retracted.

The lower marking **MINI** shows the minimum oil level when all cylinders are fully extended.



If the oil level drops below the lower marking **MINI**, the symbol appears on screen when the lowest quantity is reached.

Emptying and refilling the hydraulic tank

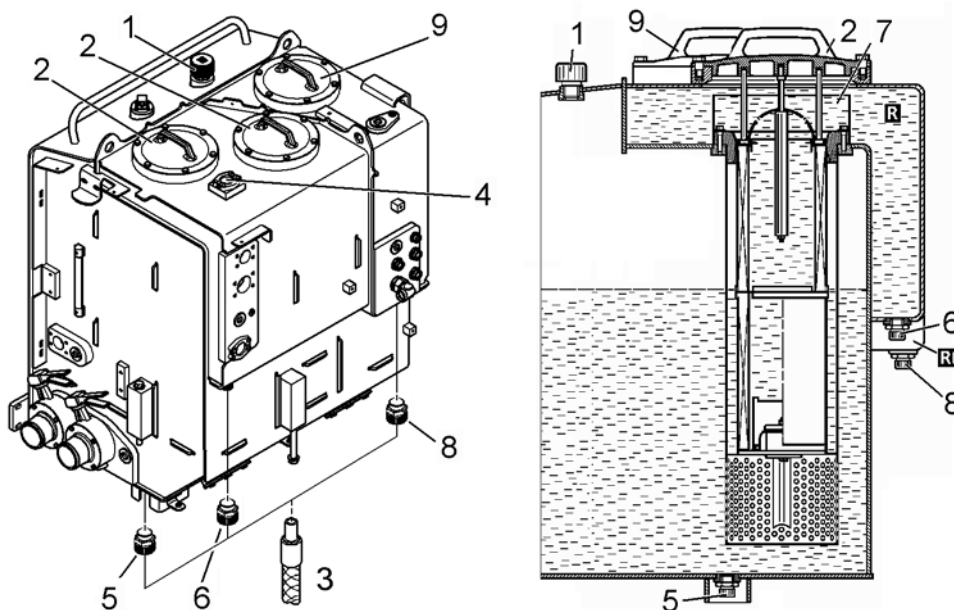


Fig. 5-51 Draining and refilling the hydraulic oil

- | | |
|---|---|
| 1 Breather filter | 2 Return filter cover |
| 3 Drain hose | 4 Flange on collecting compartment |
| 5 Drain valve on hydraulic tank | 6 Drain valve on collect. compartment |
| 7 Filter centering tube | 8 Drain valve on leakage oil collecting compartment |
| 9 Return filter (Main oil flow) | 10 Return filter (Leakage oil flow) |
| R collecting compartment for main oil flow) | RI collect. compartment for leakage oil flow |

► 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 **1** by a maximum of one turn.
↳ The hydraulic tank will depressurize.
- Remove the cover **2** of a return filter **9**.
- Screw the drain hose to the drain valve **5** at the bottom of the hydraulic tank.
- Let the oil flow out into a suitable container.
- Screw the drain hose to the drain valves **6** and **then 8** and let the oil flow out of the collecting compartments **R** and **RI** into the collecting container.

To refill the hydraulic oil:

- ▶ Unscrew the breather filter **1** by a maximum of one turn.
 - ↳ The hydraulic system will depressurize.
- ▶ Remove the cover **2** of one of the return filters **9**.
- ▶ Refill the oil through the removed filter cover **2** (or through the flange **4** on collecting compartment) until the level reaches precisely the central marking on the sight gauge.
- ▶ Retighten the breather filter **1**.
- ▶ Refill the tank up to the top. If refilling through the filter cover **2**, be sure to refill also completely the collecting compartment around the filter centering tube **7**.
- ▶ Screw on the cover **2** of return-line filter or the flange **4**.

**Caution!**

- ▶ After each hydraulic oil change, vent the hydraulic pumps.

To drain off condensation water

Drain off the condensation at the regular intervals specified in the maintenance chart.

- ▶ Place a suitable container underneath.
- ▶ Keep the drain hose on the drain valve **5** until water free oil flows out.

**Note!**

When using "environmentally friendly hydraulics fluids" and after machine down time (after about 24 hours), we recommend to drain off the condensation in the hydraulic tank before operating the machine.

5.11.3 Checking and cleaning the oil cooler system

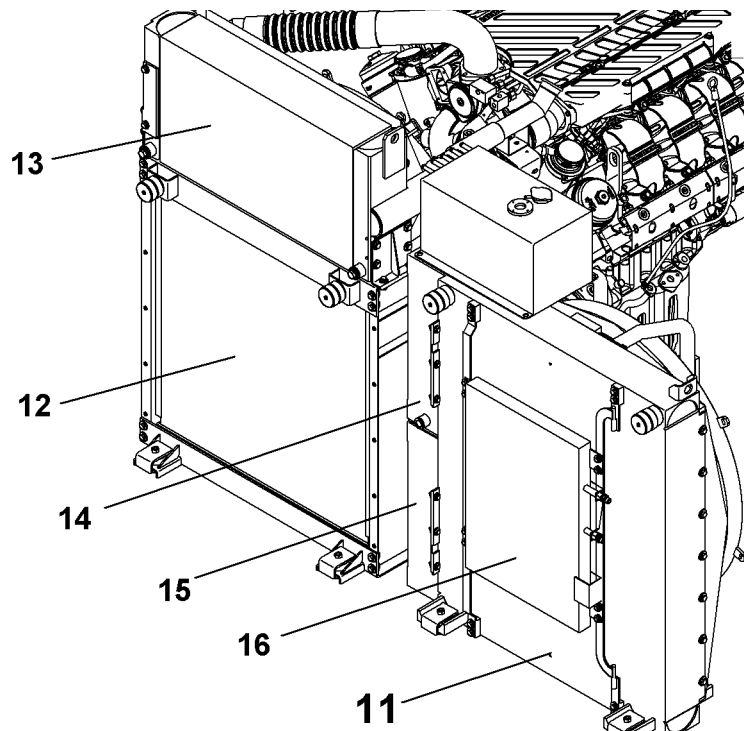


Fig. 5-52 Oil cooler

- | | |
|--|------------------------------------|
| 11 Hydraulic oil cooler | 12 Water cooler |
| 13 Charging air cooler | 14 Fuel cooler |
| 15 Pumps splitterbox oil cooler | 16 Condensor of airco plant |

The oil cooler is integrated in the coolers arrangement consisting of two combined cooler units.

Keeping the oil cooler in clean condition is prerequisite for an optimum hydraulic oil cooling.

- ▶ Check cooler and fan for damage and clean if necessary.
- ▶ Regularly clean the cooling fins with pressure air or steam jet from the inside out.

5.11.4 Return filter

The three return filters are located on the top of the hydraulic tank.

The both return filters 9 filter are for the main oil return flow of the hydraulic circuit. The leakage oil flows of the hydraulik pumps and motors are gathered in a separate return circuit streaming to the tank via the leakage oil return filter 10.

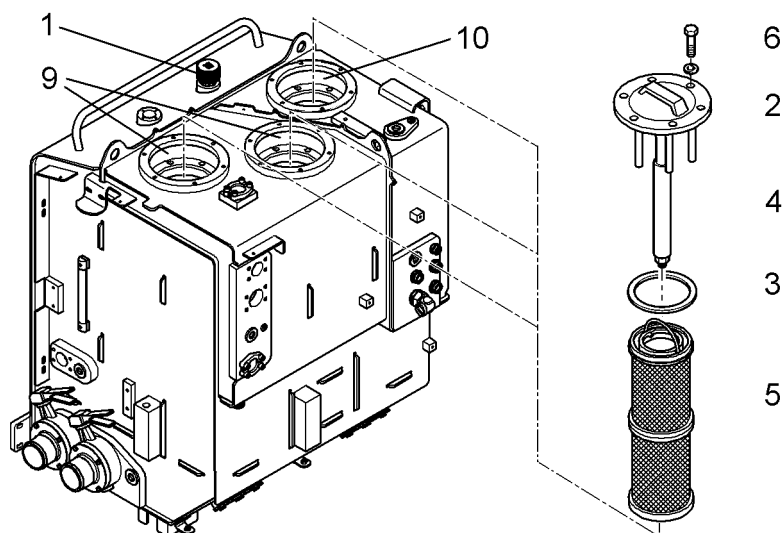


Fig. 5-53 Return filter

- | | |
|-----------------------|-----------------------------------|
| 1 Breather filter | 5 Filter element |
| 2 Return filter cover | 6 Screw |
| 3 Sealing | 9 Return filter for main oil flow |
| 4 Magnetic rod | 10 Return filter for leakage oil |

The magnetic rods **4** of all the three return filters **9** and **10** must be cleaned and the glass fibre filter elements **5** replaced at fixed intervals (see maintenance chart) .



Note

- ▶ When working in heavy dust conditions, please note the special regulations for changing the filter.

To clean a magnetic rod and replace a filter element:

- The hydraulic system must be depressurized.
- ▶ Unscrew screws **6** on the filter cover and lift out cover **2** with magnetic rod **4**.
- ▶ Carefully clean off any dirt sticking to the magnetic rod **4**.
- ▶ Remove the used filter cartridge **5** while lifting it at the clamp.
- ▶ Insert the new filter cartridge using the clamp 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 sealing faces on the filter element are not damaged.
- ▶ Position and center the cover unit **2** complete onto the filter element **5**. When doing this, ensure that the sealing **3** is positioned correctly and is in good condition.
- ▶ Retighten the screws **6**.
- ▶ Retighten the breather filter **1**.

5.11.5 Servofilter

The servo oil filter **11** is part of the control oil unit **1** which is located on the rear of the hydraulic tank.

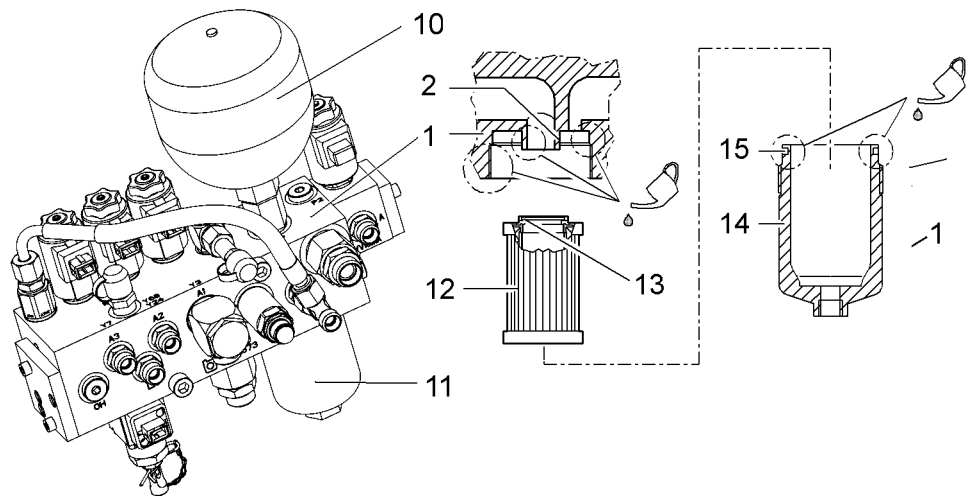


Fig. 5-54 Control oil unit with servo-filter

1	Control oil unit	12	Filter element
2	Centering pivot	13	Sealing ring
10	Servo pressure accumulator	14	Filter housing
11	Servo oil filter	15	Sealing ring



Note!

It is not permitted to clean the filter element **12**.

- ▶ Change the filter element each time you open the filter housing **14**.

To replace the filter element:

- The hydraulic system must be depressurized.
- ▶ Unscrew the filter housing **14** of the servo filter **11** and remove filter element **12**.
- ▶ Clean the filter housing **14**.
- ▶ Oil the threads 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** by hand to the stop and turn it back from a $1/4$ turn (approx. 90°).

5.11.6 Replenishing oil filter in swing circuit

The replenishing oil filter is mounted on the swing pump.

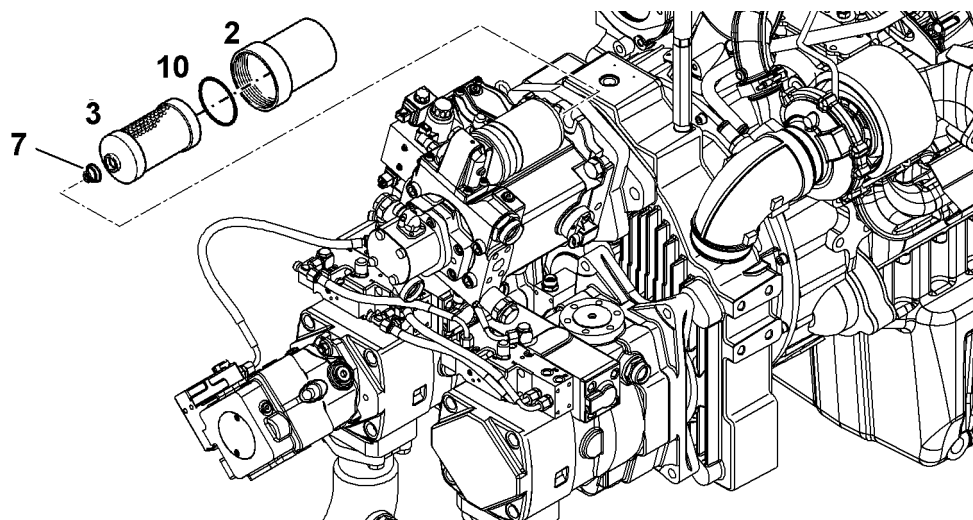


Fig. 5-55 Replenishing oil filter of swing circuit

2	Filter housing	7	Coil
3	Filter element	10	O-ring

- ▶ Unscrew filter housing **2** and remove filter element **3** and O-ring **10**.
- ▶ Clean the filter housing **2**.
- ▶ Oil the thread and sealing surfaces of filter housing **2** and of filter head on swing pump.
- ▶ Carefully install the coil **7** and the new filter element **3** with the a new O-ring **10**.
- ▶ Screw the filter housing **2**.

5.11.7 Servo control circuit

The control circuit does not require any special maintenance.

- ▶ Regularly inspect for leaks the pipe network and connections on all components (pressure accumulator, pressure limiting valve, pressure filter etc.) .



Danger!

The pressure accumulator **10** maintains the servo control circuit under pressure for a small number of actuations even after the Diesel engine shutdown.

Before working on the control circuit, relieve the servo pressure as follows:

- ▶ Lay the working attachment down to the ground.
- ▶ Switch the engine off.
- ▶ Actuate both joysticks several times (with the ignition key in contact position and the safety lever tilted down).

5.11.8 Air bleeding of the servo control chambers

With the time the air contained in the hydraulic fluid of the machine can collect in the servo control chambers of the control valves and form there air cushions.

This condition is generally noticed by the excavator driver when, during actuation,

one or several movements are reacting jerkily, lazy or time delayed.

- ▶ Bleed in this case, and in any case at the regular intervals indicated in the maintenance chart, the servo control chambers, using the push button S248 and according to the following procedure:



Notice!

- ❑ The electronics of the machine allow the starting of a bleeding procedure only if:
 - the hydraulic oil temperature is at least 20°C (70°F).
 - the working attachment of the machine is lowered down to the ground.

- ▶ Start the Diesel engine and bring it to high idle RPM,
- ▶ tilt the safety lever down:



- ↪ at the display, the symbol indicating insufficient servo oil pressure (symbol "PST") must go out.
(The servo pressure must be correct to ensure the effectiveness of the air bleeding procedure).

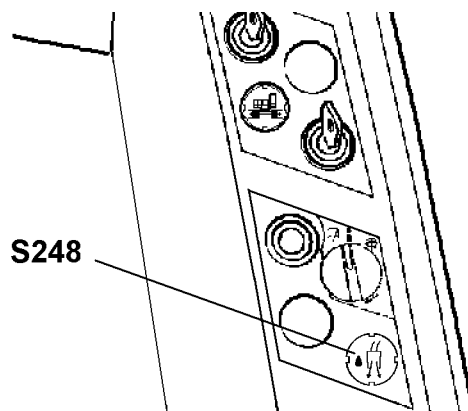
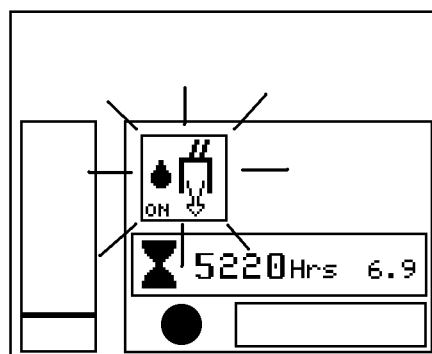


Fig. 5-56 Air bleeding of servo control chambers

- ▶ Depress the push button S248 at the rear control desk and keep it depressed for approx. 70 seconds.
 - ↪ the symbol air bleeding - "ON" appears on the monitoring display.
 - ↪ the servo control chambers of all of the main control valves installed on the machine are air bled progressively and one after the other.
- ▶ Release the push button S248 after approx. 70 seconds.
 - ↪ the symbol Air bleeding - "OFF" appears temporarily on the display.
 - ↪ the air bleeding procedure is over.

5.11.9 Bleeding the hydraulic pumps

After maintenance works on the pumps or after oil change in the hydraulic system, the hydraulic pumps must be bled.



Note!

To bleed the pumps, it is advised to use the special kit (order nb. 7408148) to get the hydraulic tank under pressure.

If the pumps are bled without employing the special kit or pressurizing the tank, the en-

gine must be run at low idle (800-900 RPM) for the whole duration of the bleeding procedure.

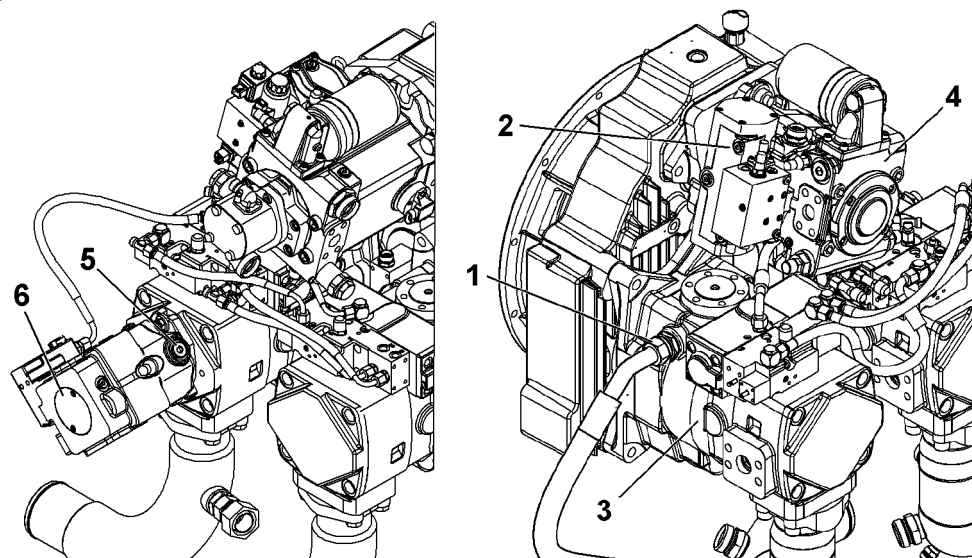


Fig. 5-57 Hydraulic pumps)

- | | |
|---|---------------------------------|
| 1 Fitting / bleeding of working pump | 2 Plug / bleeding of swing pump |
| 3 Working pump | 4 Swing pump |
| 5 Plug / bleeding of cooler fans driving pump | 6 Cooler fans driving pump |

- ▶ To bleed a working pump **3**, loosen the fitting **1** and let the air escape. As soon as oil free of air bubbles flows out, retighten the fitting **1**.
- ▶ To bleed the swing pump **4**, loosen the plug **2** and let the air escape. As soon as oil free of air bubbles flows out, retighten the plug **2**.
- ▶ To bleed the cooler fans driving pump **6**, loosen the plug **5** and let the air escape. As soon as oil free of air bubbles flows out, retighten the plug **5**.

The pump housings must be filled up with hydraulic oil via the above mentioned orifices before initial starting of the pump as well after repairing or replacing a pump.

5.11.10 Bleeding the hydraulic cylinders

A cylinder must be bled after cylinder replacement or after maintenance works on the cylinder (replacement of seals,...) or on its hydraulic circuit (replacement of a hose, ...).

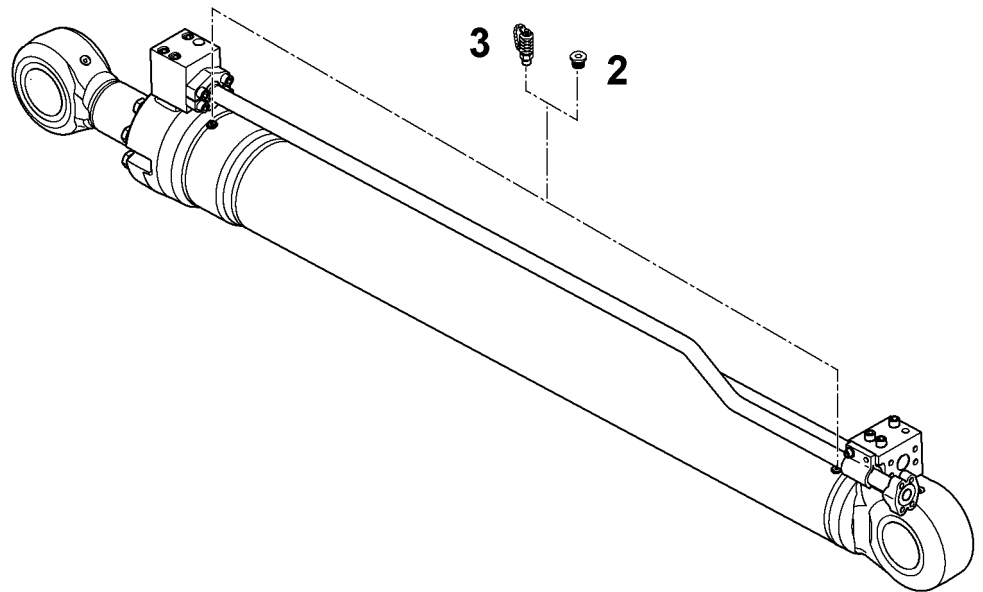


Fig. 5-58 Hydraulic cylinder bleeding

2 Bleeder plug

3 Gauge coupling

Hydraulic cylinders fitted with bleeder plugs **2** must be bled according to the procedure 1 below and hydraulic cylinders without these bleeder plugs according to the procedure 2.

Procedure 1

- ▶ Unscrew the bleeder plugs **2** on both sides of the cylinder.
- ▶ Screw in gauge couplings **3** into bleeder holes and fit each coupling with a test hose.
- ▶ Start the engine and keep it running at low idle (800-900 RPM).
- ▶ If possible, move the attachment in such a way the cylinder side to be bled is in the higher position.
- ▶ Carefully actuate the cylinder. It is recommended to bleed first the side, which does not necessitate a displacement of the cylinder (for example, if the cylinder is already retracted, first actuate the cylinder retraction in order to bleed the cylinder rod side).
Continue until oil free of air bubbles flows out of the test hose.
- ▶ Supply the other side of the cylinder and bleed it.
- ▶ Switch off the engine, remove the test hoses and replace the gauge couplings **3** by the bleeder plugs **2**.
- ▶ Perform the procedure 2.

Procedure 2

- ▶ Start the engine and keep it running at low idle (800-900 RPM).
- ▶ Slowly and regularly extend the cylinder until stop, then slowly and regularly retract it all the way to the stop. Repeat the operation 5 times. .



The incorrect bleeding can cause the appearance of gas bubbles (mixture of air and hydrocarbon) which could explode due to the high pressure in the cylinder (Diesel effect).

5.11.11 Removing the suction hose to the pumps

For maintenance reasons (change of a suction hose, removal of a pump), the suction hoses to the pumps can be isolated from the hydraulic tank thanks to shut off valves.

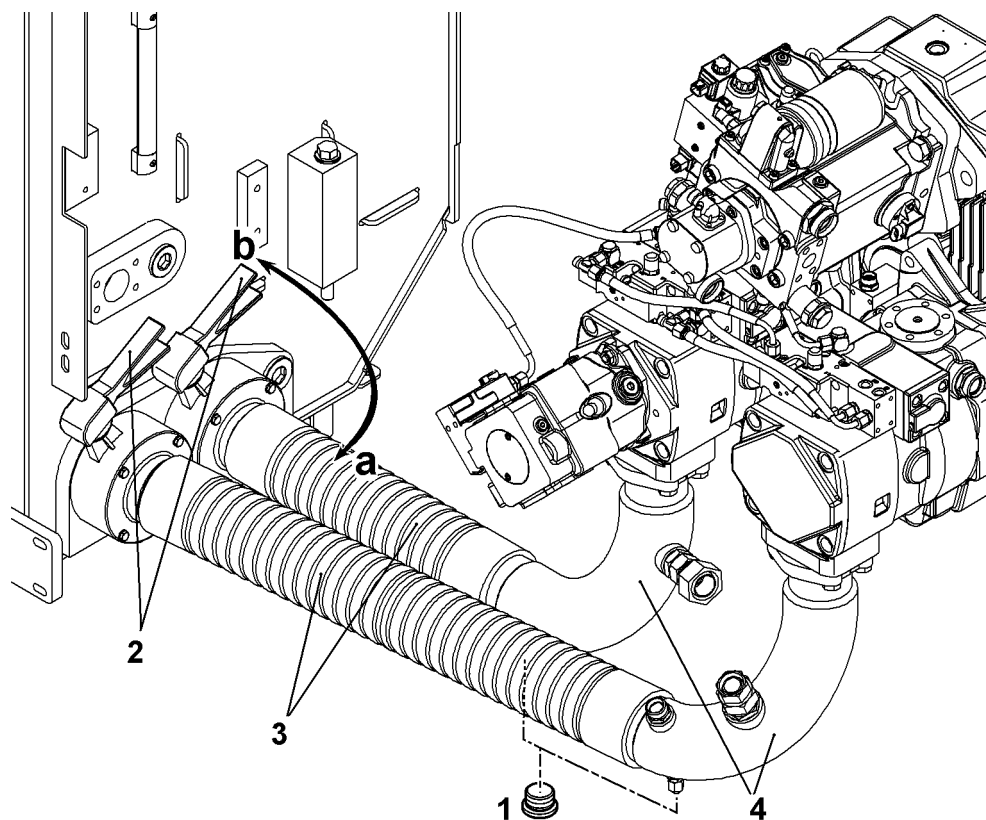


Fig. 5-59 Shut off valves and suction hoses to the hydraulic pumps

- | | | | |
|---|--------------|---|-------------------|
| 1 | Drain plug | 2 | Shut off valve |
| 3 | Suction hose | 4 | Pump suction neck |

The shut off valve on the hydraulic tank to the suction hose has two positions :

- **a** open
- **b** closed

- ▶ Depressurize the hydraulic system.
- ▶ Close the shut off valve on the hydraulic tank **b**.
- ▶ Unscrew the drain plug **1** in the pump suction neck.
- ▶ Drain the hydraulic oil out of the pump and suction hose.
- ▶ Once the repair work is completed, turn the shut off valve back to its initial position **a** and engage.
- ▶ Retighten the vent filter on the hydraulic tank.

5.11.12 Breather filter on the hydraulic tank

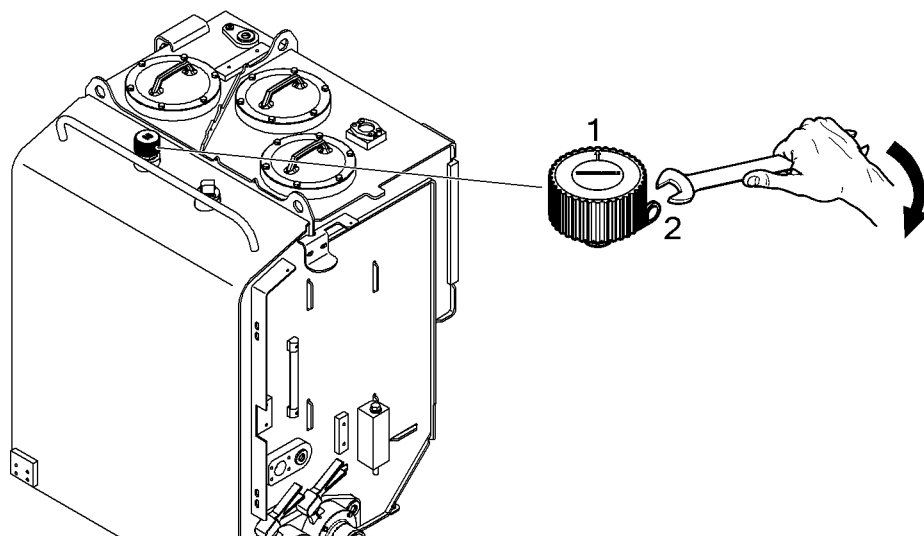


Fig. 5-60 Hydraulic tank breather filter

- ❑ The hydraulic system must be depressurized.
- ▶ Replace the breather filter **1** and the retaining pin **2** at the regular intervals indicated in the maintenance chart.



Note!

- ▶ When working in heavy dust conditions, please note the special regulations for changing the breather filter.
- ▶ The retaining pin **2** (or anti vandalism key) must be systematically removed from the breather filter **1** and hung with the ignition key.

5.11.13 Bypass oil filter for hydraulic system (option)

The purpose of the bypass oil filter is to eliminate the smallest impurities and the water contained in the hydraulic system.

The bypass oil filter is mounted to the front of the hydraulic tank, resp. in the hydraulic pumps compartment.

On machine model R964 C and above, two bypass oil filters are mounted in parallel due to the oil flow to be filtered.



Note!

LIEBHERR insistently recommends to fit with a bypass oil filter the excavators which are operated with environmentally friendly hydraulic fluids.

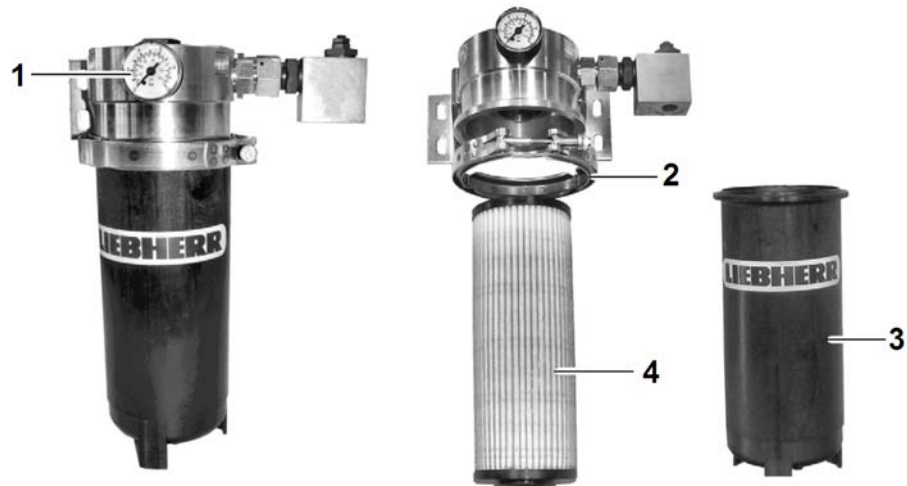


Fig. 5-61 Bypass oil filter for hydraulic system

- | | |
|------------------|--------------------|
| 1 Pressure gauge | 2 Tightening clamp |
| 3 Filter housing | 4 Filter element |

The more the oil is contaminated, the higher the pressure in the filter housing.

Depending on the machine applications and the dirt/water collection in the filter, the filter cartridge might need to be replaced before the standard change interval (2000 operating hours) is reached.

If the pressure gauge **1** indicates a value of more than 2.5 bar during operation, the filter element is too much contaminated to ensure sufficient filtering of the hydraulic oil.

Checking filter contamination:

The contamination grade of the bypass oil filter must be checked at the regular interval indicated in the maintenance chart

- When checking, the hydraulic oil must be at a temperature of at least 50 °C (operating temperature) and the engine must be running.
- ▶ Read the indication of the pressure gauge.
- ▶ If the pressure exceeds 2.5 bar, change or get changed the filter element at once.

Replacing filter element:

- ▶ Switch off the engine.
- ▶ Release the pressure in the hydraulic tank.
- ▶ Open and remove the tightening clamp **2**.
- ▶ Remove the old filter element **4** and collect the oil leaking from the filter in a suitable container.
- ▶ Check the inlet and outlet sections of the bypass oil filter and if necessary clean the inner side of the filter head.
- ▶ Insert a new filter element **4**.
- ▶ Replace the filter housing **3**, replace and tighten the clamp **2**.
- ▶ Start the machine and check the bypass oil filter for leakage.

5.11.14 High pressure filters in working circuit

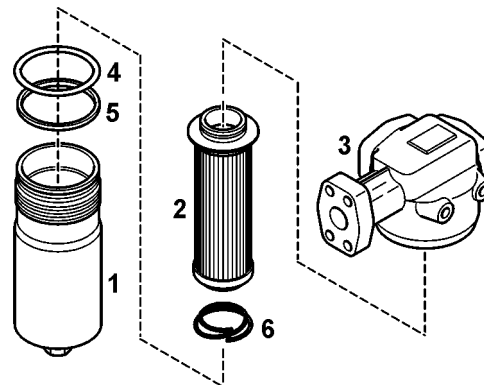


Fig. 5-62 High pressure filters

These filters are mounted between the working pumps and the inlets of the control valve blocks.

The filter elements must be checked and if necessary cleaned :

- regularly every 2000 operating hours,
- after each repair or replacement of a working pump.

To clean a filter element :

- ▶ relieve the tank pressure,
- ▶ remove the filter housing **1**,
- ▶ remove the O-ring **4**,
- ▶ remove the filter element **2**, clean it in gasoline or replace it,
- ▶ clean the filter housing **1** and the filter head **3**,
- ▶ reinstall all parts (Replace the O-ring **4** by a new one and make sure the O-ring **4**, the supporting ring **5** and the spring **6** are seated correctly),
- ▶ retighten the breather filter on the hydraulic tank.



Note!

Anytime after cleaning or replacing the filter element, check the high pressure filter 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 head **3**.

5.11.15 Servicing the hydraulic cylinder

Checking the condition of the piston rod mount

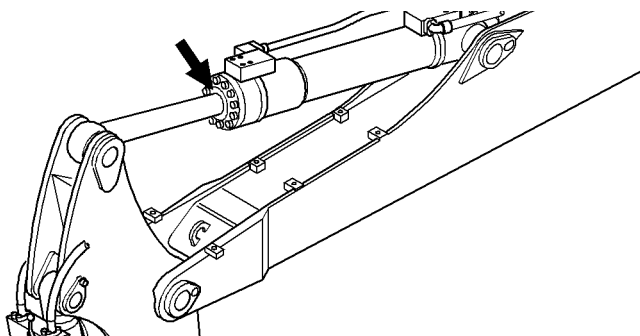


Fig. 5-63 Piston rod mount



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.

Protecting the piston rods

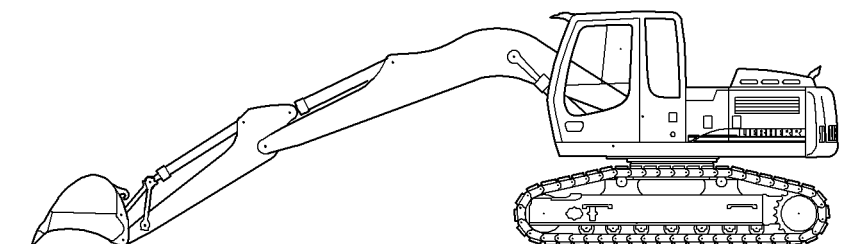


Fig. 5-64 Machine with piston rods drawn in

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.

5.11.16 Replacing hydraulic hoses

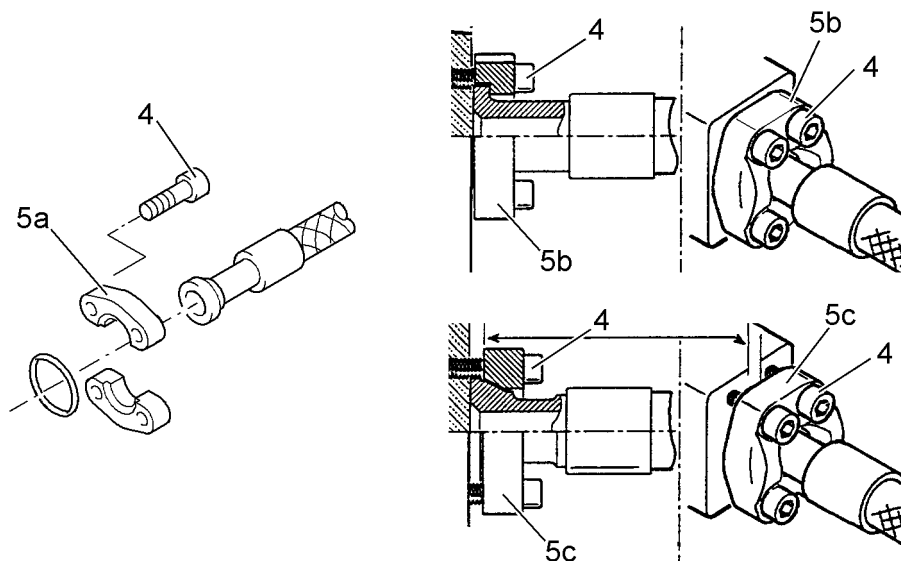


Fig. 5-65 High pressure hose with SAE fitting



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, 25, 32 or 40 (5/8", 3/4", 1", 1"1/4, or 1"1/2).

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

Tab. 5-15 Tightening torques for SAE fittings - Quality 10.9

Size of screw 4	Torque value in Nm - Quality 8.8
	Half flanges 5a
M8	22

Tab. 5-16 Tightening torques for SAE fittings - Quality 8.8

LFR/en/Edition: 07 / 2011

Size of screw 4	Torque value in Nm - Quality 8.8
	Half flanges 5a
M10	44
M12	76
M14	122
M16	187

Tab. 5-16 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 level check and oil change

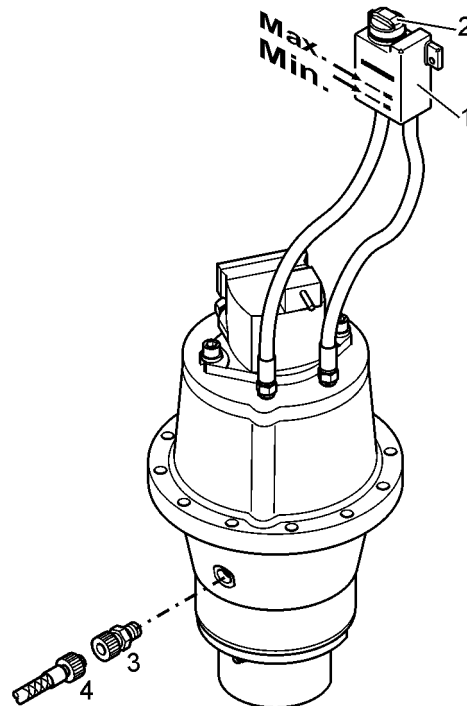


Fig. 5-66 Checking oil level and changing oil in swing gear

- | | | | |
|---|---------------|---|-------------|
| 1 | Oil reservoir | 3 | Drain valve |
| 2 | Cover | 4 | Drain hose |

To check the oil level:

When the gear oil is cold, the level in the expansion reservoir **1** should not be below the marking **Min.**

- ▶ Otherwise add oil until the level reaches the marking **Max.**

To drain the oil:

- ▶ Remove the cover **2**.
- ▶ Unscrew the cover of the drain valve **3** via the opening on the upperdeck.
- ▶ Screw the drain hose provided **4** to the drain valve **3** and let the oil flow out into a suitable container.
- ▶ Remove the hose **4**.
- ▶ Screw the cover of the drain valve **3** back on.

To add the oil:

- ▶ Add the oil in the reservoir until the level reaches the **Max.** marking.
- ▶ Screw the cover **2** back on.

5.12.3 Travel gear oil change

Perform the oil change at the intervals indicated in the maintenance chart.

- Before draining or adding oil, actuate the travel drive until the plug 2 for oil drain-

ing is situated straight below the central axle of the gear.
Preferably drain the oil when it is at operating temperature.

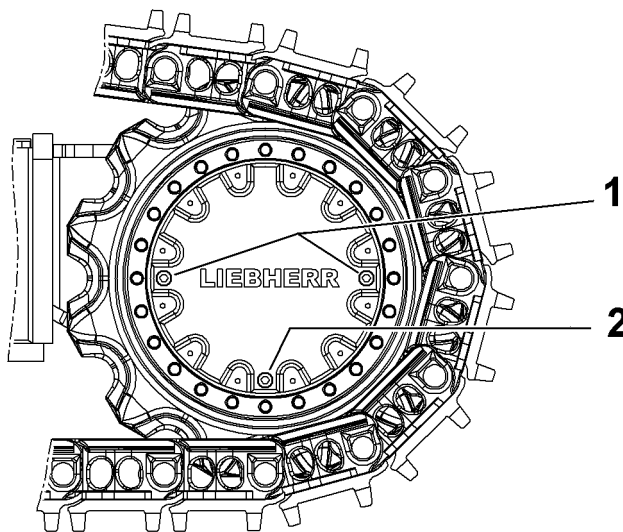


Fig. 5-67 Travel gear - Oil level plugs 1 and oil drain plug 2

To drain the oil:

- ❑ Ensure that you have a suitable oil drainage container to hand.
- ▶ Place the container beneath the travel gear.
- ▶ Remove one oil level plug 1.
- ▶ Remove the oil drain plug 2.
 - ↪ The oil drains into the container.

To add the oil:

- ▶ Screw in the oil drain plug 2.
- ▶ Fill in oil until the level reaches the bore hole 1.
- ▶ Screw in the oil level plug 1.



Note!

The track components of the machines working with their undercarriage the most of time underwater, are exposed to increased rust and premature wear.

On these machines the oil in the travel gears must be changed every 100 working hours and an oil analysis (water content of the oil) must be performed weekly.

5.12.4 Splitterbox - Oil change

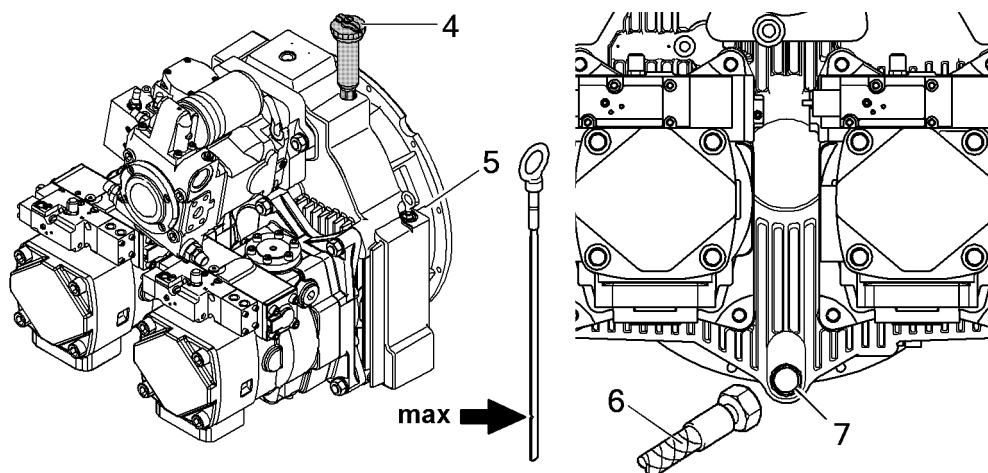


Fig. 5-68 Changing the oil in the splitterbox

- | | | | |
|---|------------|---|-------------|
| 4 | Cover | 5 | Dipstick |
| 6 | Drain hose | 7 | Drain valve |

To check the oil level:

- ▶ Check the oil level at the dipstick **5**, a few minutes after turning off the engine, to allow the oil to collect in the sump of the splitterbox.

To drain the oil:

- ▶ Remove the cover **4**.
- ▶ Screw the drain hose provided **6** to the drain valve **7** and let the oil flow out into a suitable container.
- ▶ Remove the hose **6**.
- ▶ Screw the cover of the drain valve **7** back on.

To add the oil:

- ▶ Add the oil via the filler tube under the cover **4** until the level reaches the marking "Max" on the dipstick **5**.
- ▶ Screw the cover **4** back on.
- ▶ Run the engine for a few minutes, stop it and recheck the oil level after a short time.

5.13 The track components

The maintenance works necessitated by the tracks assemblies mainly consist of the replacement of the worn components once they have reached their wear limits.

The sealing of the carrier rollers, track rollers and idlers via slipping seals provides an increased durability to the track assemblies while making these parts widely insensitive to any intrusion of dirt or water.

5.13.1 Checking the mounting screws of the track components

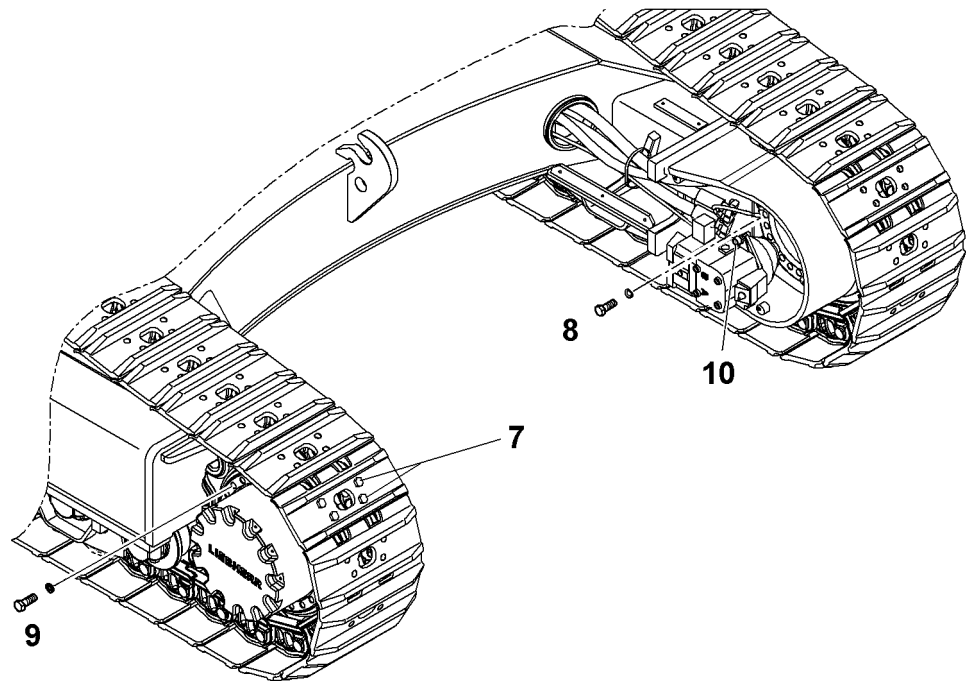


Fig. 5-69 Track components mounting screws

- ▶ Regularly carry out a visual inspection for loose mounting screws on the track pads and travel drives.
- ▶ Regularly check the tightening torques of some screws (take a random sample of about ten screws regularly distributed on the upper side of each chain) and retighten all the screws if you notice that at least one screw has loosened.
 - The track pads mounting screws **7** must be torqued to:
 - For tracks D8K, (Screws - 1" - 14UNS - 12.9) : **1560 Nm (1150 ft.lbs)**
 - For tracks B9S, (Screws - 1" 1/8 - 12 UNF - 12.9) : **2100 Nm (1550 ft.lbs)**
 - The mounting screws **8** of the travel gears to the side frames must be torqued to:
 - For machine types 448 und 1008, (Screws - M24 - 10.9) : **960 Nm (710 ft.lbs)**
 - For machine types 1009 (Scr. - M24 - 12.9) : **1120 Nm (830 ft.lbs)**
 - The mounting screws **9** of the sprocket wheels must be torqued to:
 - For machine types 448 und 1008, (Screws - M24 - 10.9) : **960 Nm (710 ft.lbs)**
 - For machine types 1009 (Scr. - M24 - 12.9) : **1120 Nm (830 ft.lbs)**
 - The mounting screws **10** of hydraulic motors to travel gears must be torqued to:
 - For all machine types , (Screws - M24 - 10.9) : **960 Nm (710 ft.lbs)**

5.13.2 Checking the track chains tension

Due to normal wear of the tracks, the chain tension needs to be checked regularly, and, if necessary, the chains must be tightened.

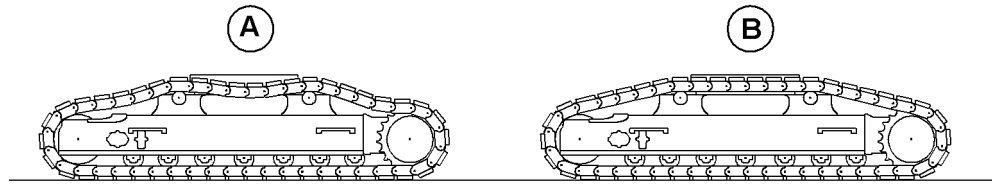


Fig. 5-70 Track insufficiently (A) and properly (B) tightened

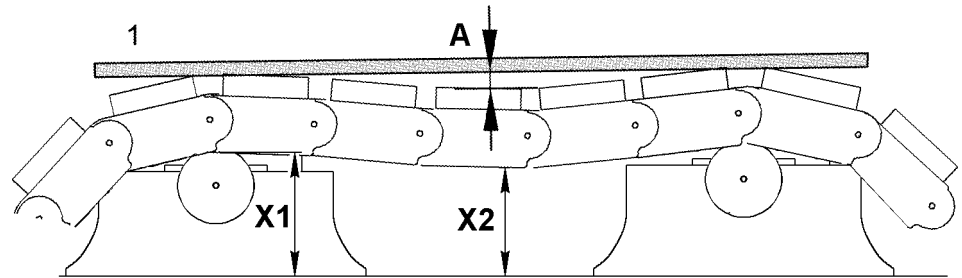


Fig. 5-71 Monitoring the track tension

- ▶ Relieve the track by driving the machine forwards and backwards.
- ▶ Place the measuring rod **1** in the area above the carrier rollers.
- ▶ Measure distance **A** between the measuring rod lower edge and the top of the track pads.
 - ↳ On machines with two carrier rollers per side, the track should, under operating conditions, sag **20 to 30 mm** between the carrier rollers.
 - ↳ On machines with three carrier rollers per side, the track should, under operating conditions, sag **15 to 20 mm** between two consecutive carrier rollers..



Note!

As an alternative, or if no correct measuring rod is available, it is possible to determine the sag **A** as the difference between **X1** and **X2** ($A = X1 - X2$).

X1 is the distance between lower face of a chain link and the cover sheet of the side frame measured at a carrier roller, **X2** the same distance measured in the middle between two carrier rollers.

- ▶ Retension the track if necessary.

5.13.3 Retensioning the track

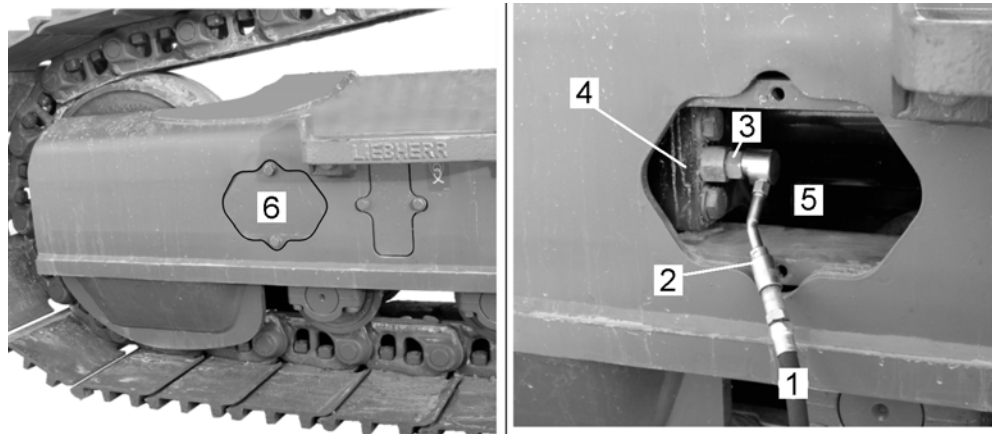


Fig. 5-72 Retensioning the track

- ▶ Remove the cover **6** on the side frame of the undercarriage.
- ▶ Screw high pressure hose **2** onto the manual grease gun **1**.
- ▶ Through the opening in then side frame, connect the high pressure hose **2** to the lubricating nipple **3** of the grease tensioner **4**.
- ▶ Inject grease until the track is sufficiently tensioned.
- ▶ Check the track tension as described above.
- ▶ Remove the grease gun **1**, the pressure hose **2** and reattach the cover **6**.

5.13.4 Releasing the track chain tension



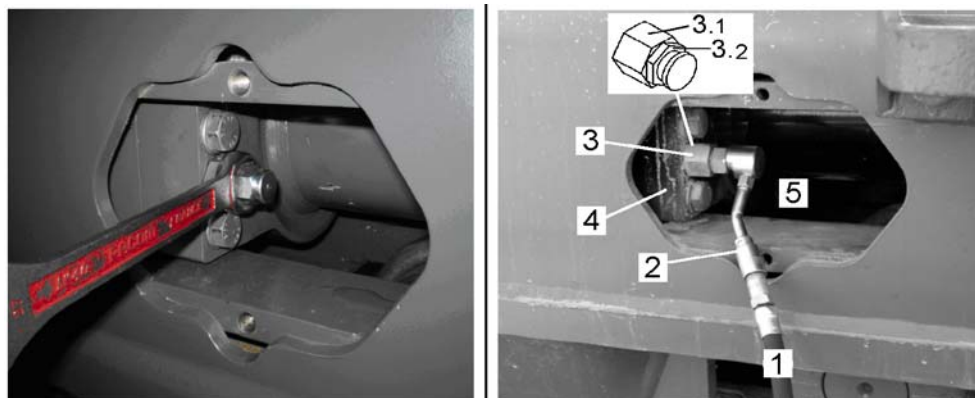
Danger!

Risk of injury due to sudden dropping of the crawler or to a jet of grease under high pressure.

- ▶ Because of the risk of grease jet, always wear protective gloves and glasses when releasing the chain tension
 - ▶ When releasing the tension of the chain, keep your head away from the opening **5** in the track side frame. Never touch the grease nipple **3** with your hand but always use an appropriate tool to unscrew or screw it in.
-
- ▶ Before attempting to release the chain tension, loosen and remove every item which may be stucked in the chain while driving forward and backward or doing as described in the section "Cleaning the track components" thereafter.
 - ▶ Carefully unscrew lubricating nipple **3** (see Fig. 5-72) by several thread pitches until the grease escapes out of the releasing groove of the nipple.

**Danger!**

- ❑ Machines delivered up to september 2008 are possibly fitted with a lubricating nipple **3** showing two distinct hexagonal bearing areas.



- ▶ To screw the grease nipple **3** in or out, always catch it at its rear part **3.1** (use a **27 mm** wrench) and never at its front part **3.2**.
Loosening the nipple at its front hexagonal bearing area could cause the front part **3.2**, to loosen and to be powerfully thrown out.
- ▶ Tighten lubricating nipple **3** as soon as the desired track tension is obtained.
- ▶ After the adjustment procedure, drive the machine forwards and backwards and check the track tension again as described above.

5.13.5 Cleaning the track components

Before working

Do not operate the machine if larger stones, pieces of wood or metal, wires or cables are wedged into the track components.

Dried or frozen mud and stones or other foreign bodies in track 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 wooden planks or logs to prevent the tracks becoming frozen to the ground.

**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 track pads.

At the end of a workday

- ▶ Always clean the track components from dirt accumulation before stopping the machine.
- ▶ Clean the gliding surfaces of the tension units from clinging dirt or sand and apply grease.

The machine can be supported and lifted slightly on each side with the attachment, so the tracks can be cleaned.

Keep the bucket stick as vertical as possible when lifting one machine side.

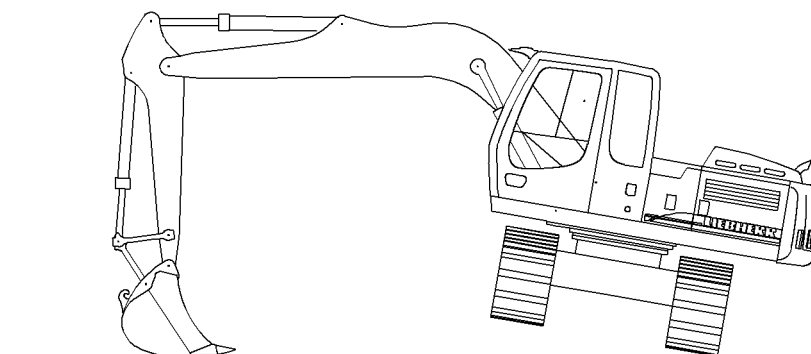


Fig. 5-73 Raising the machine on one side



Danger!

Never work from underneath on track components of the raised machine unless the track is securely blocked and supported with wooden beams. On a hard or flat soil the machine can slide away.

5.14 24 V circuit

To insure trouble free operation of your excavator, the electrical system must be in good condition.

Its therefore important to inspect regularly the correct functioning and the good condition of the electrical system and to perform the following checks at the intervals given in the maintenance chart at the end of this manual.

5.14.1 General checks on the 24 V electrical system

- ▶ Check the correct function of the gauges and indicator lights daily, when starting the machine.
- ▶ Always replace burnt-out fuses and bulbs immediately once the cause of the defect has been rectified.
It is forbidden to repair burn-out fuses, which must exclusively be replaced by original spare fuses with the same amperage.
- ▶ Check for bare and damaged wires, which could cause damage to the electrical system or a fire. Check for loose, dirty or corroded connections. Immediately rectify defects such as loose connections, abraded cables or badly fastened clamps

5.14.2 Batteries care

**Danger!**

Risk of injury due to formation of sparks.

- ▶ When disconnecting batteries, always branch off the negative terminal (-) first and reconnect it last.
- ▶ Avoid sparks and naked flame when charging batteries or working on the batteries.
- ▶ Always wear protective goggles and gloves.

The batteries must always be kept clean to ensure that they are 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.

**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.

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.

- ▶ From time to time, measure the acid concentration using an acid tester. **C**

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 more or less unloaded and should be charged if necessary.

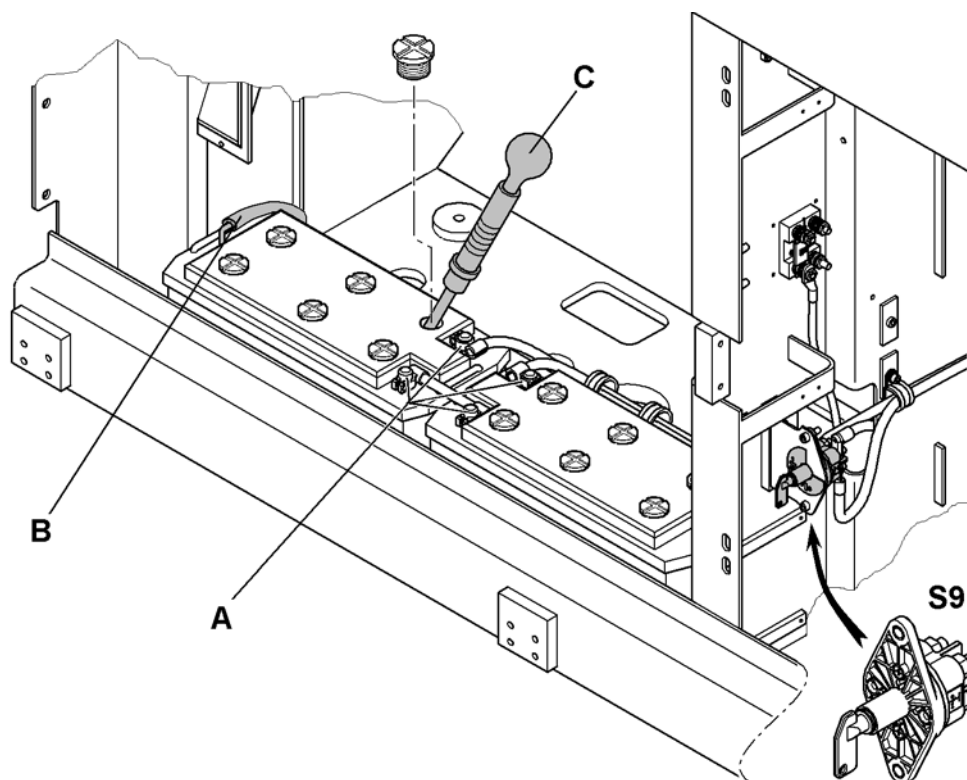


Fig. 5-74 Batteries care - batteries switch

5.14.3 Batteries switch

- ▶ Before starting any work on the electrical system, or before any welding work on the machine, switch the batteries switch to position **0**.



Caution!

Take particular care with machines with built-in standstill heater.

- ▶ Only switch off the batteries switch when the standstill heater's run-on is over.



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 batteries switch to position **0** (off).

5.14.4 Protection of the 24 V circuit during maintenance works

- ▶ Disconnect the batteries when working on the electrical system or when carrying out electric arc welding on the machine.
- ▶ When washing the machine, cover the electrical units (particularly the alternator, generator, cabling, electronic components and transmitters) to prevent water penetrating.
- ▶ When cleaning the engine with a water / steam jet, do not subject transmitters such as oil pressure sensors to any direct jets.
 - ↳ If this happens, moisture could penetrate and lead to contact corrosion and the

- failure of the measuring function.
- ↪ Oil pressure sensors are not watertight due to the necessary presence of membrane ventilation.

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

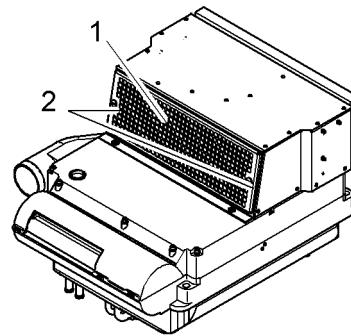


Fig. 5-75 Recirculated air filter

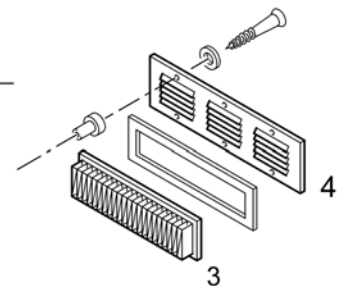


Fig. 5-76 Fresh air filter

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 (see Fig. 5-77).

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 luke-warm water.

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.

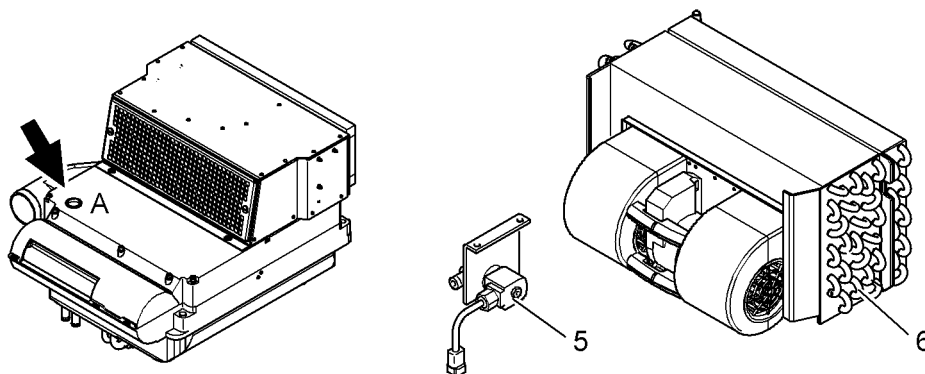


Fig. 5-77 Heating unit with solenoid valve

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.

5.15.3 Air-conditioning system

Switch on the air-conditioning system for approx. 10 minutes every 2 or 3 weeks, re-

ardless of the season.

During the operating period, the following maintenance work is to be carried out every 500 operating hours:

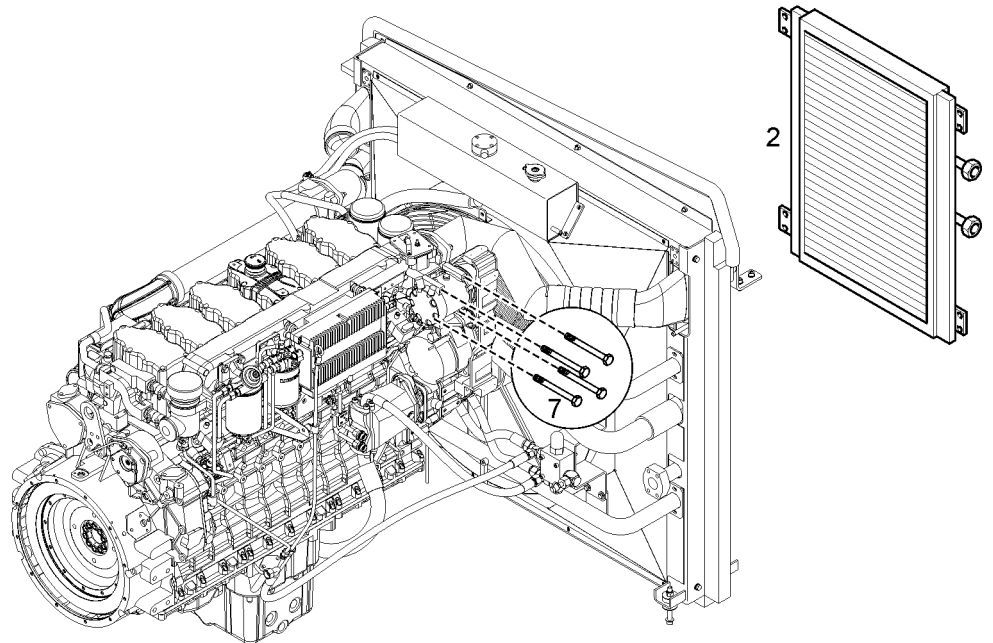


Fig. 5-78 A/C compressor and condensor

2 Condensor 7 Mounting screws of the compressor

To check the condensor:

- ▶ Check the condensor **2** for contamination.
- ▶ If necessary, fold down the condensor **2** and blow out with compressed air from the inside (blower end) out.
- ▶ Ensure that the condensor plates are clean.

If heavily contaminated, overpressure forms in the chiller circuit and the air-conditioning system switches off automatically.

To check the A/C compressor:

- ▶ Tighten the mounting screws **7** on the A/C compressor and the bracket on the engine.

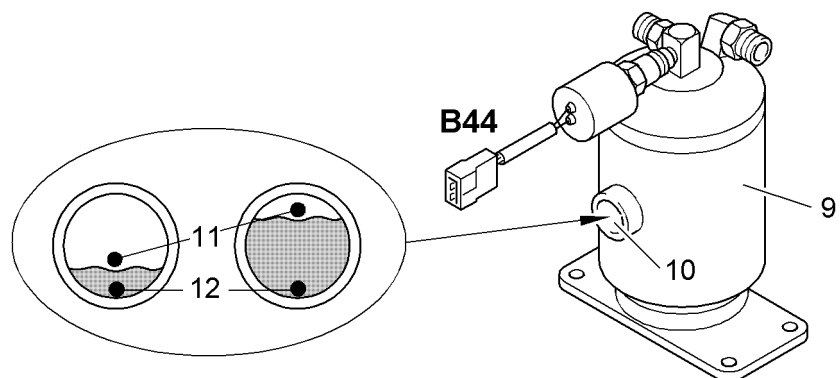


Fig. 5-79 Dryer-accumulator unit

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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.

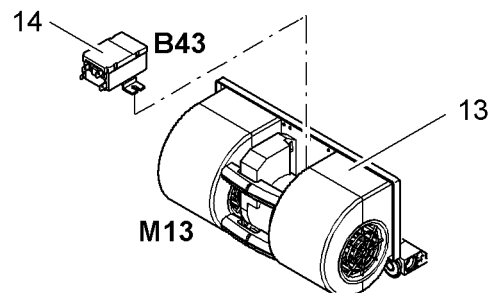


Fig. 5-80 Fan motor on the heating/air-conditioning device

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** (see Fig. 5-79).

5.16 Greasing the machine

5.16.1 The centralized lubrication system

The machine is serially fitted with a centralized lubrication system.

With this system all or nearly all of the lube points of the machine which require at least daily lubrication are lubricated via an electrical driven grease pump which is turned on during machine operation.

Construction and operation of the centralized lubrication system.

The centralized lubrication comprises two lubrication plants, U4-1 and U4-2, mounted at the top of the fuel tank.

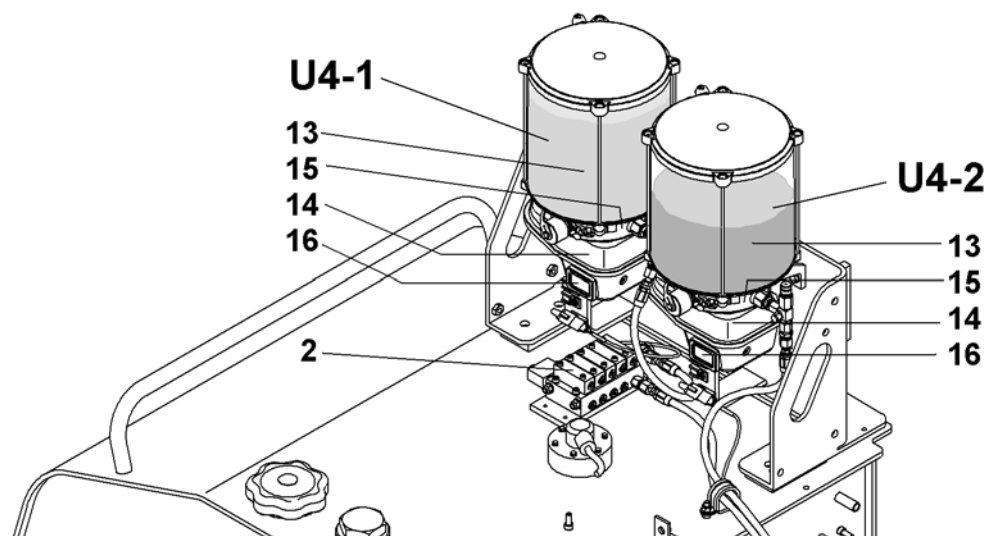


Fig. 5-81 Lubrication plants of the centralized lube system

U4-1 Lubrication plant for general lube points

U4-2 Lubrication plant for swing ring teeth

Each lubrication plant complete **U4** mainly consists of a transparent grease container **13**, and an electric motor **14** with control unit **16** and which drives a lube pump **15**.

The grease delivered by the pump **U4-1** is distributed to the different lubrication points LP in metered quantities, first via the main distributor **2** and further via the secondary distributors **3, 4, 5, ...** mounted to the front of the upper carriage and to the working attachment.

During a lubricating procedure, all of the lube points connected to the system are lubricated one after the other in a predetermined sequence (progressive system).

The flow sequence and amount of lubricant for each lubrication point depend on the combination of the distributors and lubrication lines and on the piston sizes of the different distribution elements.

The pump **U4-2** delivers the special grease for swing ring teeth lubrication. The grease quantity is metered in the distributor 9.

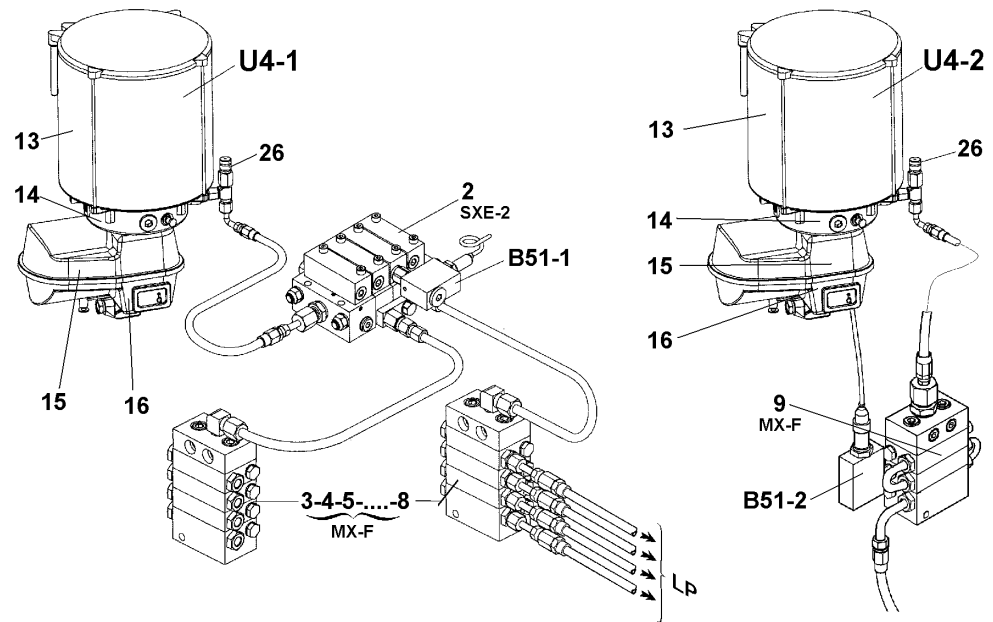


Fig. 5-82 Centralized lubrication system

2	Main distributor	3	Secrond. distrib. on uppercarriage
4	Sercondary distributor on boom	5	Sercondary distributor on stick
9	Distributor for swing ring teeth	13	Grease container
14	Electric motor	15	Grease pump
16	Control unit	26	Pressure relief valve
B51-1	Proximity switch for U4-1	B52-1	Proximity switch for U4-2
U4-1	Lubrication pump 1 complete	U4-2	Lubrication pump 2 complete
LP	Lubrication points		

Lube points connected to the lubrication plant U4-1:

- the ball bearing races of the swing ring,
- all (or the most of) the lubrication points of standard working attachments.
- the seat of the swing gear inside the uppercarriage structure.
- the roller bearing of the output shaft of the swing gear.

Lube points connected to the lubrication plant U4-2:

- the housing around the output pinion of the swing ring, which contains the grease reserves for the swing ring teeth lubrication,

Lube points which are not connected to the central lubrication system:



Caution!

When operating a machine and especially if it is fitted with a special working attachment, make sure to lubricate daily all the lubrication points which may be installed separately, i. e. which are not connected to the central lubrication system.

- On some backhoe attachments, some grease fittings may be installed separately in the area of the connector bracket and shifting lever for the digging tool.
- With special attachments (telescopic stick, hydraulic offset boom, ...) some bearing points at the attachment or at the working tool are possibly not connected to the central lubrication system.

- ▶ This bearing points have to be lubricated daily via separately mounted, red marked lubricating nipples and using a grease gun or a manual grease pump.



Notice!

The standard undercarriages of crawler excavators do not require daily lubrication. On undercarriages with special design necessitating regular lubrication (undercarriages with adjustable track width, ...) the lubrication points are not connected to the centralized lubrication. For description of the corresponding lubrication works, see the subgroups related to the special maintenance for these undercarriages.

5.16.2 Operation of the full automatic system

Function of the automatic lubrication plants

After turning on the excavator the control light inside the touch **S84-1** (resp. **S84-2**) and the green LED **17** of the integrated control unit **16** light up for approx. 1,5 sec. to show that the corresponding electric pump is operative.

.In each plant a lubrication procedure will begin automatically after a "cycle time" is over.

During lubrication, at each stroke of the dosing piston in the main distributor, the proximity switch **B51** gives a pulse signal to the control unit **16**, which stops the lubricating procedure as soon as the preadjusted number of strokes has been reached.

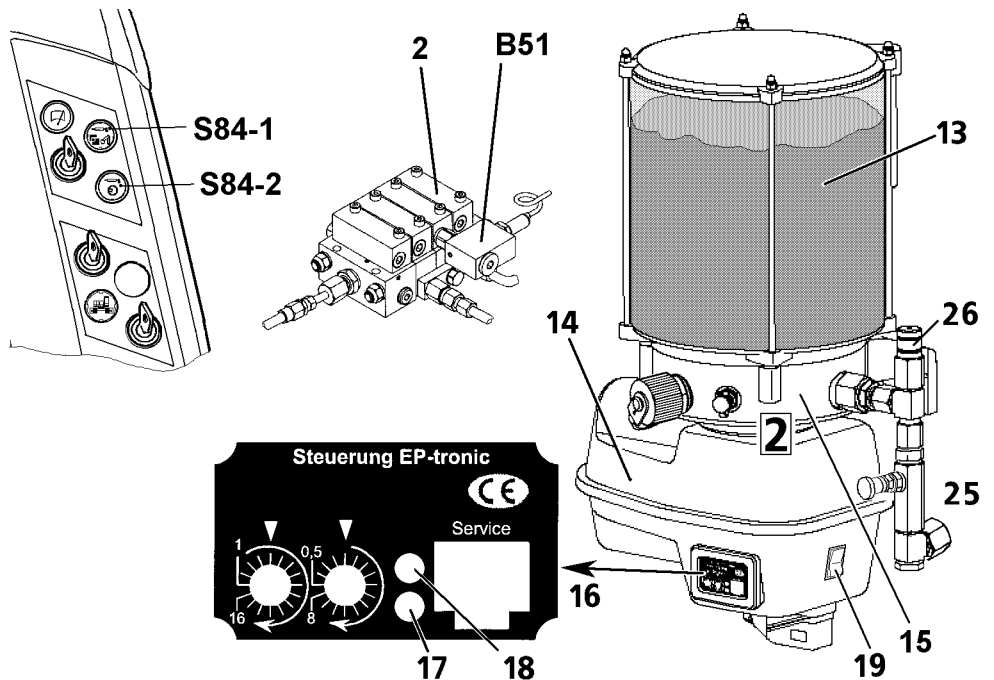


Fig. 5-83 Full automatic lubrication system

- | | | | |
|------------|--------------------------------|-----------|-------------------------|
| 2 | Main distributor | 14 | Electric motor |
| 13 | Grease container | 16 | Electronic control unit |
| 15 | Grease pump | 18 | LED red - failure |
| 17 | LED green - in operation | 26 | Pressure relief valve |
| 19 | Touch - additional lubrication | | |
| B51 | Proximity switch | | |

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S84 Push button - additional lubrication **U4** Lubrication pump complete

Starting an additional lubrication procedure

If the lubrication plant **U4-1** (resp. **U4-2**) is in working order, an additional lubricating procedure of the lube unit can be started any time by depressing either the push button **S84-1** (resp. **S84-2**) on the rear control desk or the touch **19** on the respective motor housing.

Monitoring of the automatic lubrication system

During a lubrication procedure of the lubrication plant **U4-1** (resp. **U4-2**), the control light inside the push button **S84-1** (resp. **S84-2**) and the green LED **17** at the control unit are on continuously.

In case of a failure in a lubrication plant (no stroke signal delivered by the proximity switch **B51** about 20 minutes after begin of a lubrication procedure) both LEDs **17** and **18** of the unit and the control light inside **S84** will start blinking simultaneously.

The possible causes are:

- a plugged or kinked lubrication line, (in this case the grease will flow out of the relief valve **26**),
 - a failure of the switch **B51** or of its connecting wire,
 - the use of too viscous grease at very low temperatures,
 - not enough grease in the grease tank **13**,
 - a problem in the 24 V electrical circuit for the motor **14**.
- ▶ Immediately locate and remedy the cause of the trouble.

5.16.3 Emergency lubrication with defective lubrication system

- In case the lubrication pump **15** does not work, all lubrication points connected to the centralized system may be lubricated via the lube fitting **25** using a lubrication gun.
- ▶ For lubrication plant **U4-1**, press daily or per working shift approx. 250 cm³ grease into the fitting **25**.
- ▶ For lubrication plant **U4-2**, press daily or per working shift approx. 120 cm³ grease into the fitting **25**.

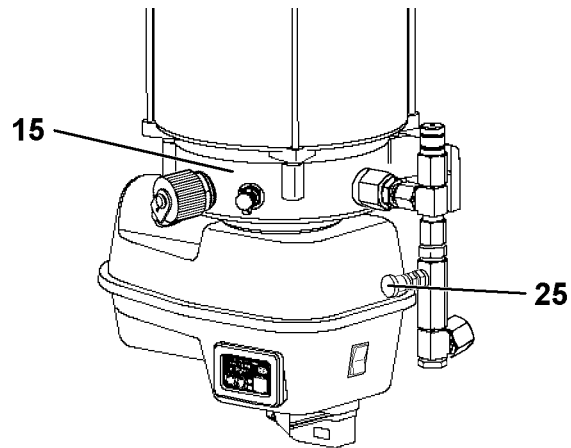


Fig. 5-84 Emergency lubrication

15 Grease pump

25 Emergency lube fitting



Caution!

For emergency lubrication via the lube fitting 25, it is imperative to have regard for the specific grease quality which is necessary for each lubrication plant.

5.16.4 To refill a grease container

The grease level in the container 13 of the pump must be checked weekly, and if necessary, the container refilled.



Caution!

Since the both pumps deliver grease according to different specifications, it is essential to notice, for refilling, that the outer pump U4-2 is for swing ring teeth lubrication and that the pump U4-1 situated most inside is for the attachment bearings .

See the lubricant chart for grease specifications.

► The refilling of the grease container should only be done via the special fitting 21.



Note!

Avoid refilling the container 13 via the upper cover 23, since it could create an air pocket in the container and cause the pump 15 to run dry.

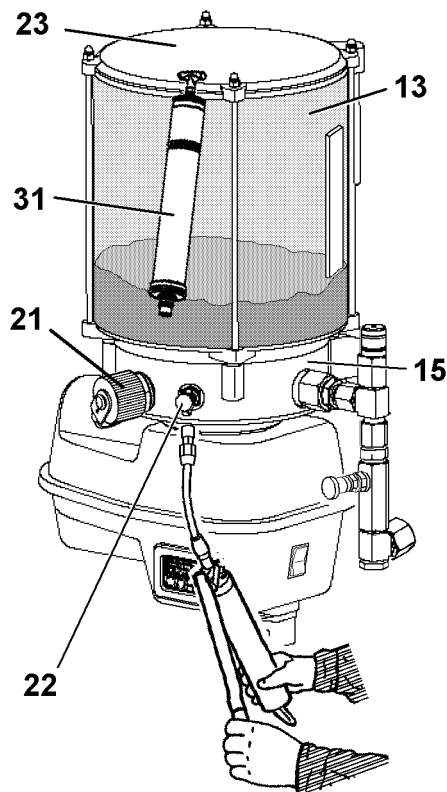


Fig. 5-85 Refilling the grease container

13	Grease container	15	Grease pump
21	Fitting for filling pump	22	Grease fitting
23	Cover	31	Filling pump

- ▶ Insert a grease cartridge in the special filling pump **31** (Id. No. 10009239).



Note!

The attached filling pump **31** for the lubrication plant **U4-2** is marked with a label for gear teeth. When refilling, be careful of employing always the correct filling pump, destined either for lubrication plant U4-1 or for lubrication plant U4-2.

- ▶ Connect the pump to the fitting **21**
- ▶ push the whole content of the cartridge into the container **13**.

For indication of ordering number of grease cartridges, refer to subgroup "lubricants specifications".

- If the special filling pumps **31** or the grease cartridges are not available:
- ▶ refill the container **13** through the grease fitting **22**, using a grease gun.

5.16.5 Changes in the lubrication circuit

Before you make any changes to the lubrication system (for example when changing the attachment configuration), always check with a LIEBHERR mechanic first.

Never remove a line and close off an outlet, which is not being used, or the whole lubrication system would be blocked.

Only plug an outlet after the line has been removed from the distributor and the necessary changes have been achieved at the corresponding distribution elements.

This applies as well for main distributor 4 as for secondary distributors 5.

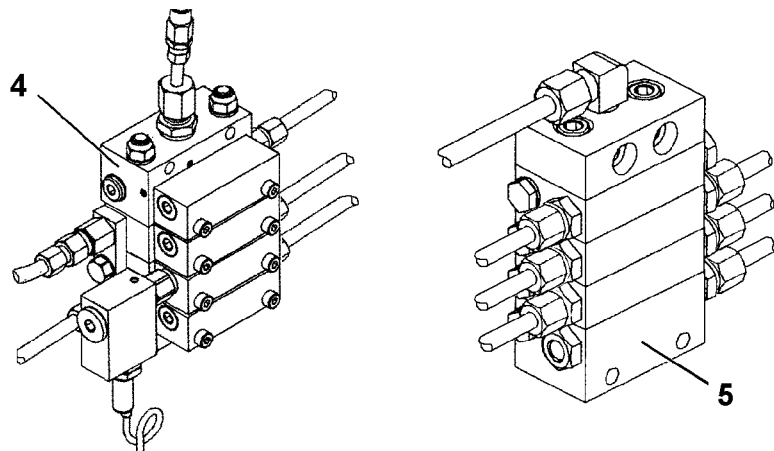


Fig. 5-86 Main and secondary distributor

5.16.6 Greasing the grab (optional extra)

The grab is not lubricated via the central greasing system. It must be regularly greased manually. The relevant oiling points are marked in red.

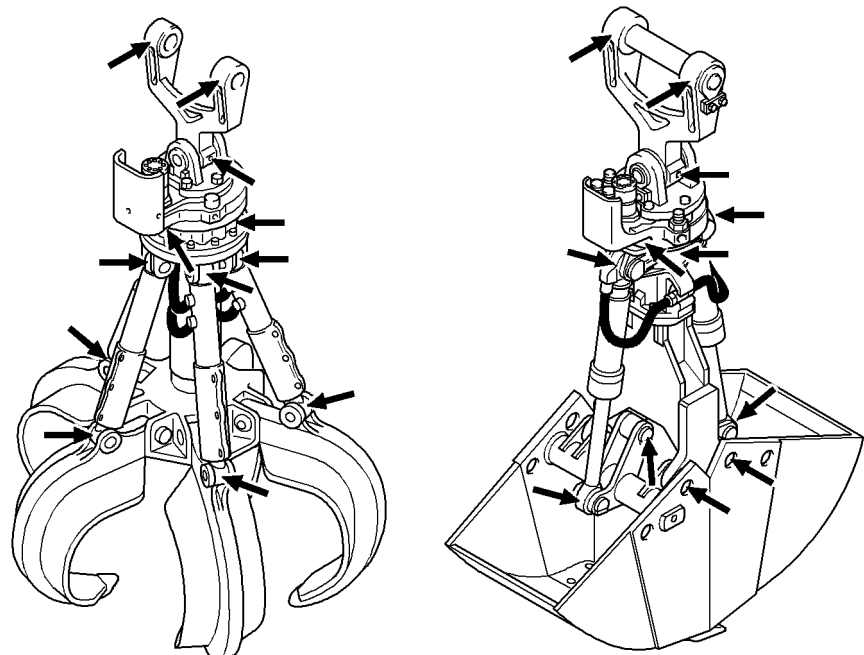


Fig. 5-87 Greasing the grab

In normal use, each oiling point must be greased daily or per shift until clean grease flows out at the relevant bearing point.

When the machine is working hard, the greasing interval should be shortened accordingly.

Grease quality: see lubrication chart

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5.17 Quick-change systems

5.17.1 Greasing the mechanical quick-change adapter (option)

The mechanical quick-change adapter is not lubricated via the central greasing system. The bearing points must be greased using the grease gun.

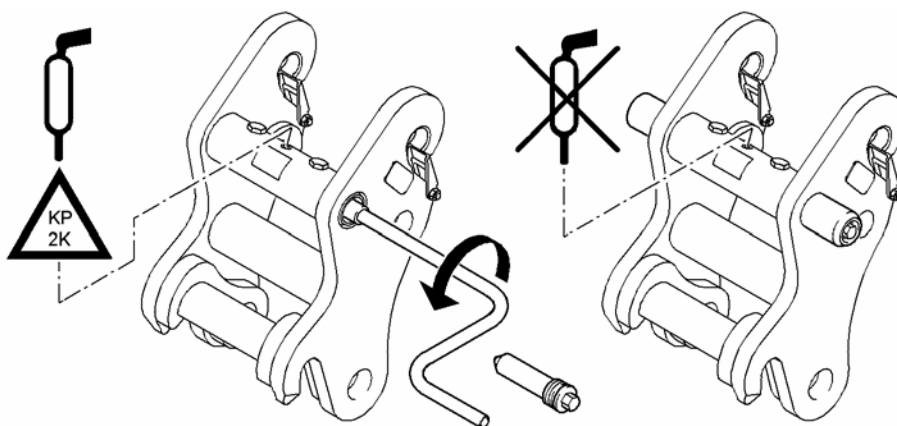


Fig. 5-88 Greasing the mechanical quick-change adapter

- ▶ 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 (option)

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.

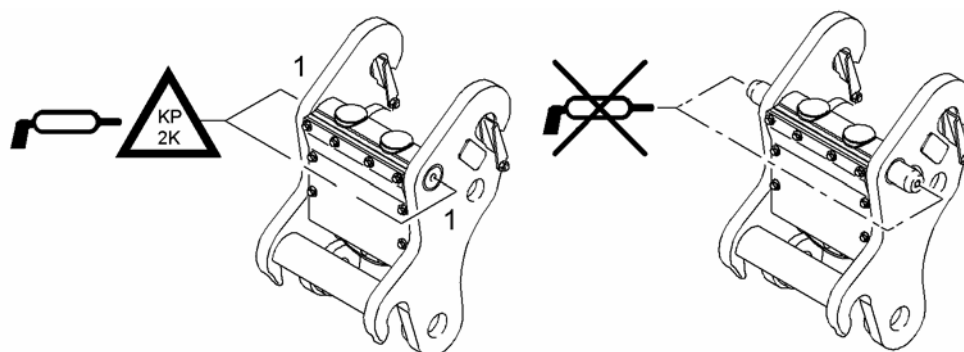


Fig. 5-89 Greasing the quick-change adapter

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- ▶ 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.

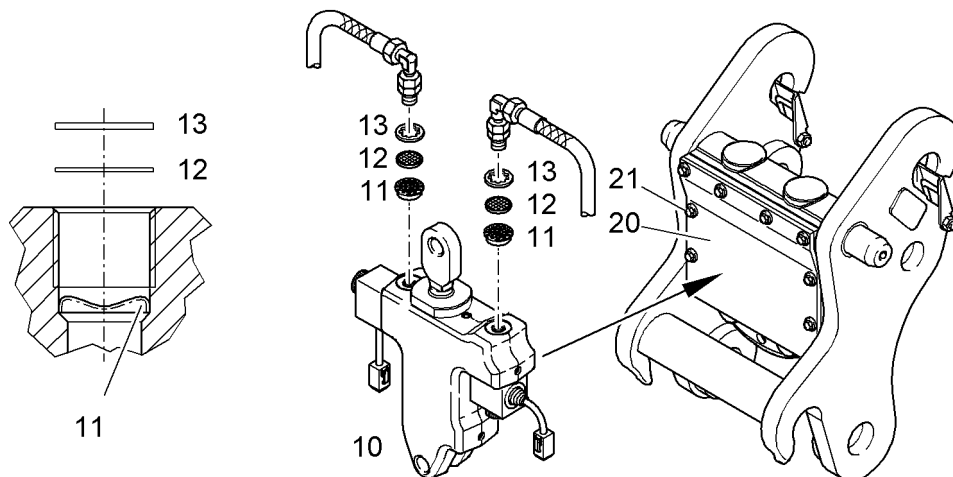
Cleaning the sieve filter

Fig. 5-90 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.

5.17.3 LIKUFIX (option)**Cleaning LIKUFIX**

The LIKUFIX hydraulic coupling system is mostly maintenance-free.

It is recommended that the system is cleaned at regular intervals and sprayed with lubricating varnish (see Workshop manual). This will prevent dirt adhering and icing up.

If the system is kept properly clean, the seals are very durable.

Check mounting bolts for tightness

Replacing the sealing ring

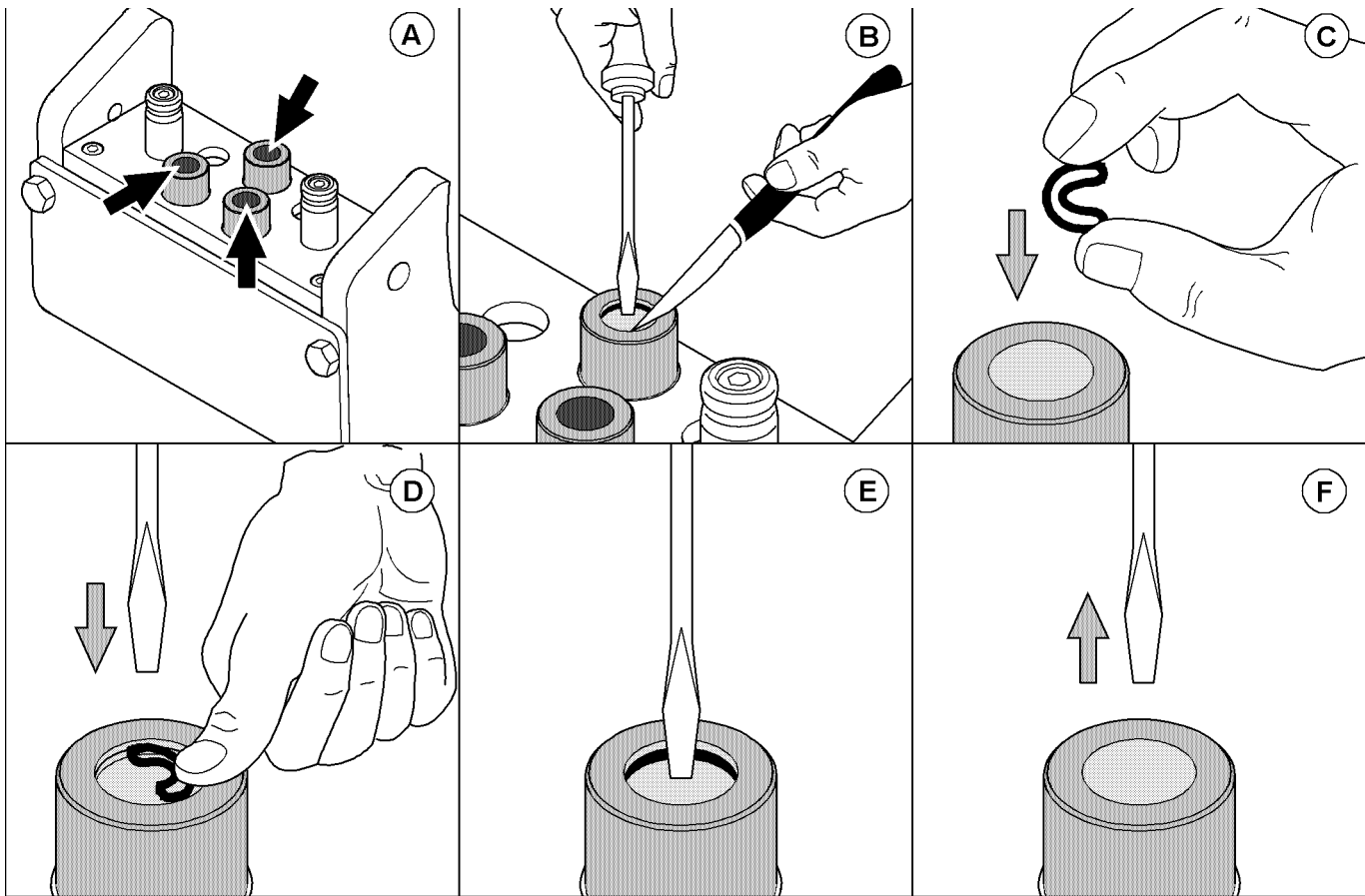


Fig. 5-91 Replacing the sealing ring

If leaks occur at the coupler plugs (A , see arrows), the sealing rings should be replaced.

- ▶ Use a screwdriver to push down the sealing washer and lever out the defective sealing ring using a pointed object (B).
- ▶ Press the new sealing ring together and place it on the sealing washer with the open side down (C).
- ▶ Press down the washer as far as the groove, place the screwdriver in the middle of the sealing ring and move your hand away (D).
- ▶ Allow the sealing ring to jump into the groove (E).
- ▶ Remove the screwdriver (F).
 - ↪ The sealing washer must move upwards. If necessary, press the sealingring again until the sealing washer is flexible.

5.18 Check mounting bolts for tightness

The mounting bolts listed below must be regularly checked and retighten if necessary. See maintenance chart for the checks intervals.

**Caution!**

The mounting bolts for all the main components (especially those listed below), and for the hydraulic hoses and pipes must be replaced after every removal.

Notice : when installing bolts of size bigger than M40 the thread of the screw must be slightly coated with a MoS2 based grease. For these bolt sizes also grease the supporting surface of the bolt head, unless hereafter otherwise specified.

5.18.1 Mounting bolts of the counterweight

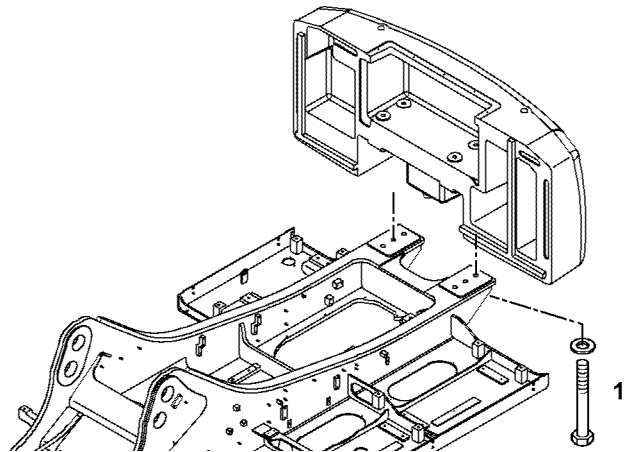


Fig. 5-92 Counterweight mounting bolts

The mounting bolts 1 (M42 - 10.9) must be torqued to 4940 Nm (3640 ft.lbs).

5.18.2 Mounting screws of the swing ring

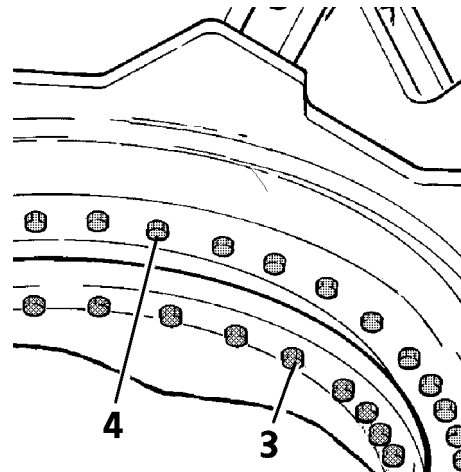


Fig. 5-93 Swing ring mounting bolts

The mounting screws 3 (M27 - 10.9) swing ring to undercarriage must be torqued to 1400 Nm (1030 ft.lbs.).

The mounting screws 4 (M27 - 10.9) swing ring to uppercarriage must be torqued to 1400 Nm (1030 ft.lbs.).

Check mounting bolts for tightness

5.18.3 Mounting screws of the hydraulic oil and fuel tank

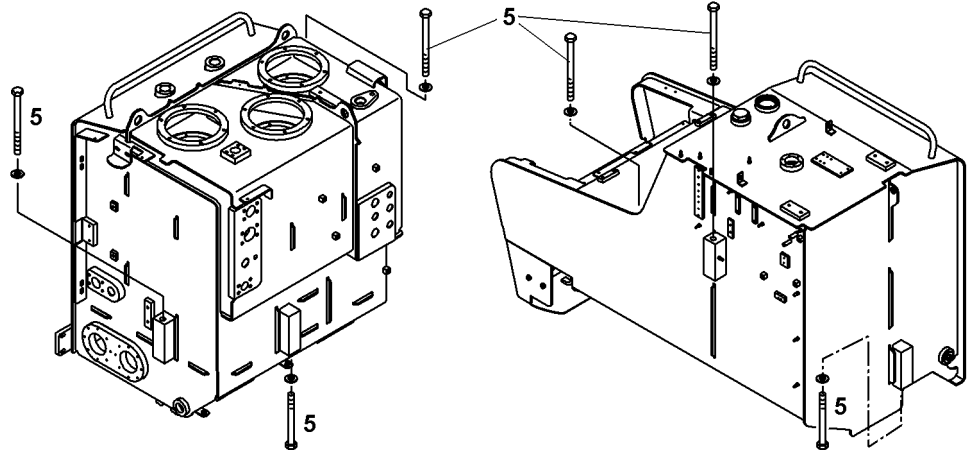


Fig. 5-94 Hydraulic oil tank and fuel tank mounting bolts

The mounting screws **5** (M20 - 10.9) must be torqued to 560 Nm (410 ft.lbs.)

5.18.4 Mounting bolts of the swing gear and motor

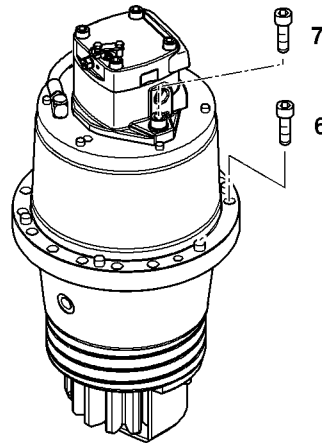


Fig. 5-95 Swing gear and swing motor mounting bolts

The mounting bolts **6** (M24 - 10.9) of the swing gear must be torqued to 960 Nm (710 ft.lbs).

Torque mounting bolts **7** (M24 - 10.9) of the swing motor on machines R974C to 960 Nm (710 ft.lbs).

Torque mounting bolts **7** (M20 - 10.9) of the swing motor on machines R964C to 560 Nm (410 ft.lbs).

5.18.5 Mounting bolts central piece to side frames (option "removable side frames")

The bolts must be checked every 500 working hours, and if necessary retightened.

The lower bolts M42 must be torqued to 4940 Nm (4380 ft.lbs).

The upper bolts M30 must be torqued to 1900 Nm (1400 ft.lbs).

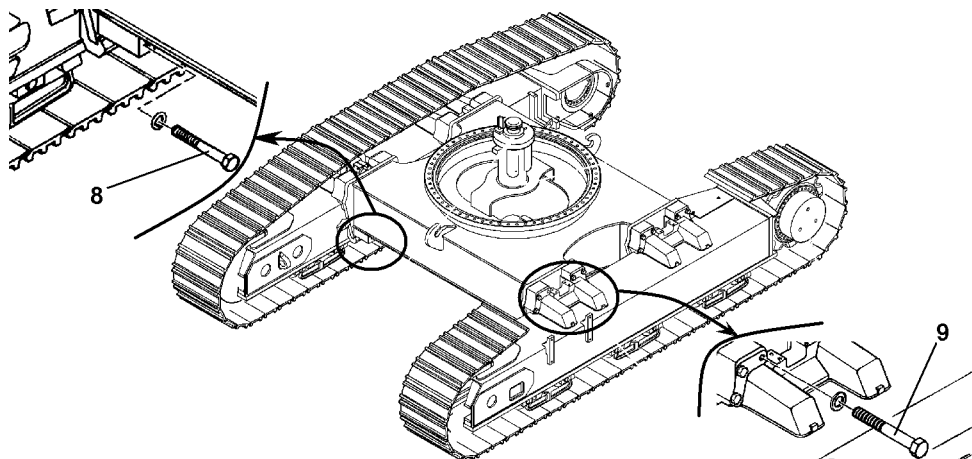


Fig. 5-96 Side frame mounting bolts

5.19 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.

5.20 General maintenance points

5.20.1 Replacing working parts

In addition to the normal maintenance and repair work that is to be carried out at the given intervals, the machine operator and maintenance personnel can also carry out the repairs referred to below:

- Replacing worn teeth on the bucket.
- Replacing defective sealing material on the pipe and hose system and on the hydraulic unit connections (not, however, on pressure relief valves which are lead sealed at the works).
- In addition, high pressure hoses, hydraulic lines and bolt connections on the hydraulic system can be replaced.

It should be noted that only original LIEBHERR replacement parts are to be used.

This is particularly relevant for hoses and hydraulic lines, which must be preassembled at the works. For all other repairs, particularly when dismantling the ballast weight, works and dealership fitters are to be consulted.

5.20.2 Checking or replacing the teeth on the bucket



Note!

Do not work with the machine if teeth on the bucket are missing or are heavily worn. With heavily worn teeth, considerably greater force will be required when using the bucket to penetrate the material to be excavated.

- ▶ Determine the degree of wear of the teeth visually and at regular intervals (For interval, refer to the maintenance chart).
- ▶ Make the necessary to have heavily worn teeth replaced in good time, in any case early enough to prevent any damage occurring to the tooth fitting piece.

To attach and dismantle the teeth:

Liebherr teeth system with flat locking wedge:

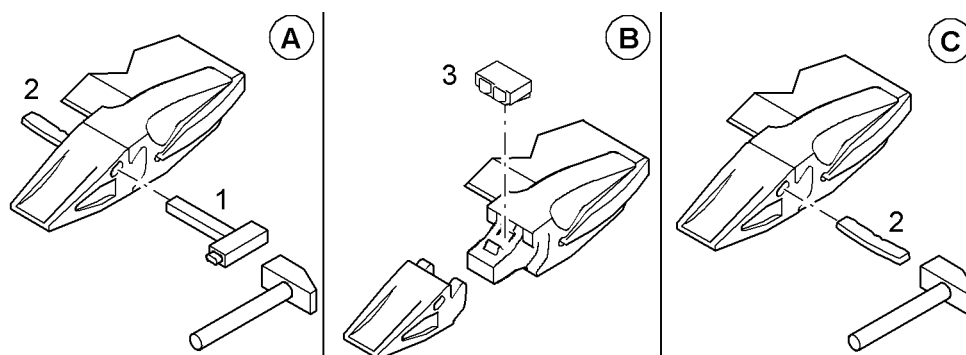
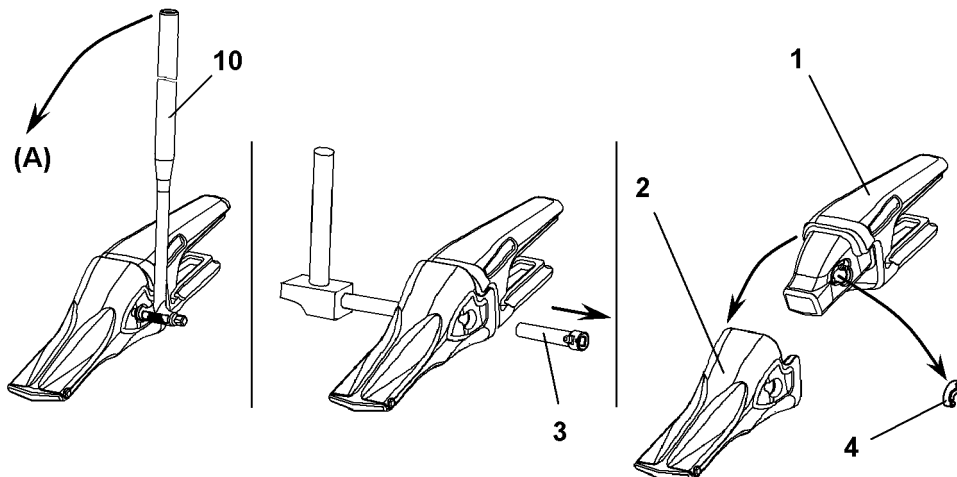


Fig. 5-97 Replacing the teeth

- ▶ Use a hammer and ejector drift **1** to knock out the wedge **2** (A).
- ▶ Remove the old tooth.
- ▶ Place a new rubber wedge holder **3** onto the tooth holder (B).
- ▶ Push the new tooth onto the fitting piece.
- ▶ Use the hammer to knock in the wedge **2** (C).

(New) Liebherr teeth system with tooth locking bolt round:

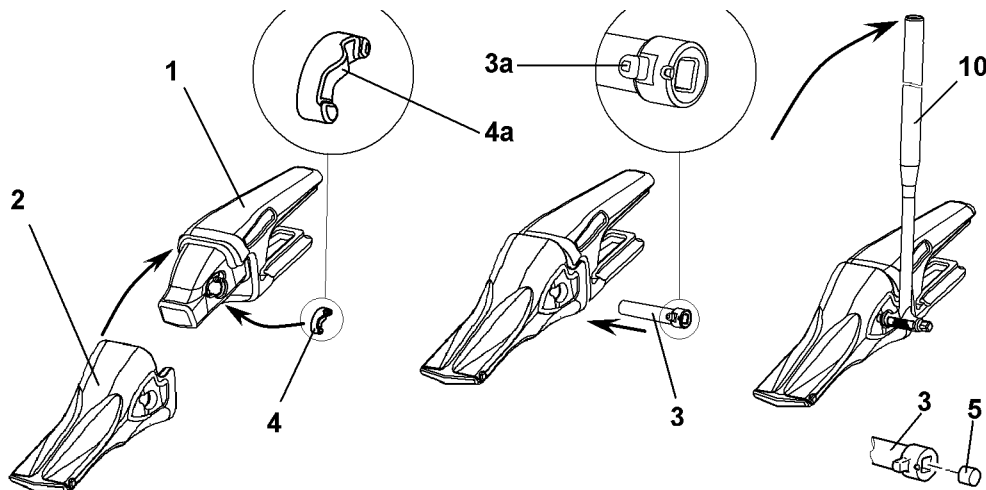
To remove an old tooth



- | | | | |
|----------|----------------------|-----------|----------------------|
| 1 | Tooth fitting | 2 | Tooth |
| 3 | Tooth locking bolt | 4 | Latch |
| 5 | Expanded foam plug | 10 | Bolt blocking wrench |

- ▶ Take away the expanded foam plug **5** or the ground out of the square hole in the middle of the locking bolt **3**.
- ▶ Set the bolt blocking wrench **10** (special tool Id. Nb. 10451202) onto the bolt **3** and turn counterclockwise to the stop (movement **A** - turn by approx. 30°).
- ▶ Knock out the bolt **3** from the opposite side.
- ▶ Take the tooth **2** off from the fitting **1** and remove the latching piece **4**.

To install a new tooth



Note!

Check the tooth locking bolt **3** and the latch **4** for good condition before reuse when installing a new tooth. Should this parts be distorted or strongly corroded, so they must be replaced by new ones.

- ▶ Set the latch **4** in the hollow part of the tooth fitting **1** so that the flat side of the latch pushes against the fitting and slide the new tooth **2** over the tooth fitting **1**.
- ▶ Push the tooth locking bolt **3** all the way in.

- ▶ Engage the bolt blocking wrench **10** into the square hollow in the middle of the bolt **3** and lock the bolt by turning the wrench clockwise by approx. 30° (when turning, the nose **3a** of the bolt is enforced over the protrusion **4a** of the latch).
- ▶ Take the blocking wrench away and press a new expanded foam plug **5** into the middle of the locking bolt **3**.

5.20.3 Welding work on the machine

Welding work on all main components or structural parts serving the power transmission (such as the undercarriage, uppercarriage, attachment parts etc.) may only be carried out by the manufacturer or by an authorized workshop.



Caution!

If high currents flow through the bearings or sealing elements, these could be damaged.

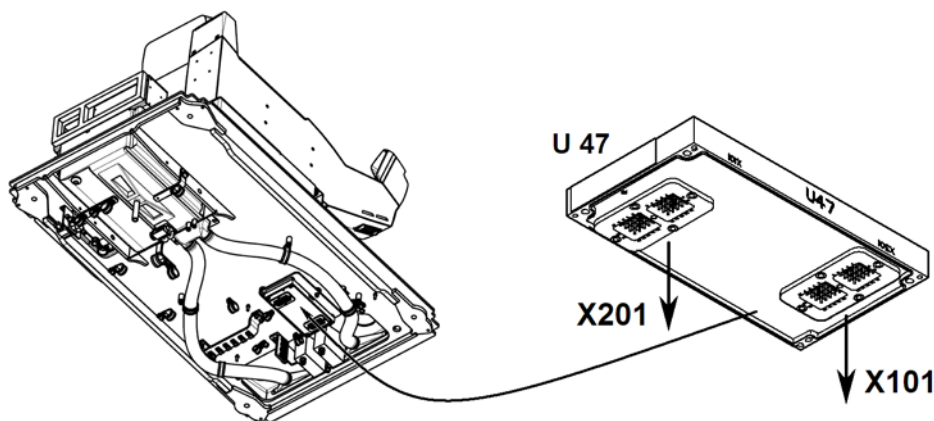
- ▶ When electric arc welding, attach the earthing cable of the welding tool as close as possible to the welding area, so that the welding current cannot flow over parts like the swing ring, articulations, bearings, bushings, rubber elements or seals.
-
- ▶ Disconnect the batteries before starting any electric arc welding work on the machine.
 - ▶ Always disconnect the negative terminal (-) first and reconnect it last.
 - ▶ Switch off the main battery switch!
 - ▶ On this machine fitted with electronic control system, you must also disconnect the components of the servo control circuit which are listed below.



Caution!

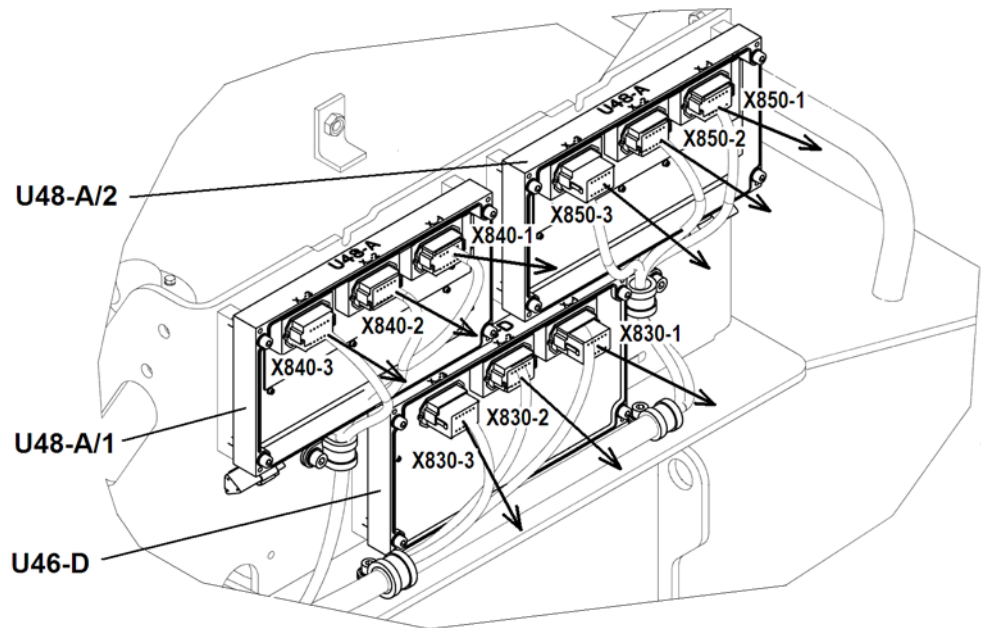
Electric arc welding on the machine can cause the destruction of not disconnected printing plates, this leading to a complete shutdown of the machine.

- disconnect the main control card U47 of the electronic servo control system situated below the driver's cab..
 - Remove the cover under the cab.

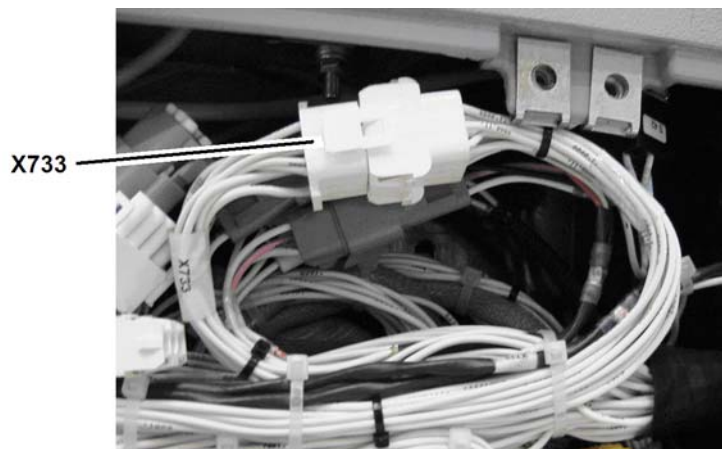


- unplug both connectors X101 and X201.
- disconnect the control cards U46-D, U48-1 and U48-2 at the top of the hydraulic tank.
 - Remove the protection hood at the upper side of the hydraulic tank.

- Unplug all the connectors X830, X840 and X850. Notice that the connectors are correctly identified, if necessary mark the connectors.



- disconnect the joystick units U20, U21 and the codage module U101 in the left control console. These 3 components can be disconnected at the same time while unplugging the connector X733.
 - remove the cover of the left control console.



- disconnect the connector X733.

- ▶ After completion of the welding works, carefully reconnect the different components.



Note !

If electric arc welding is necessary on smaller and easily removable parts, preferably remove these parts from the machine to perform the welding works, seeing the expenditure of the disconnections of the different electronic boards..

5.21 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 of the driver include the check of the proper function of hydraulic, electric and brake system before starting operation.

He must also daily perform a visual check for leaks on the engine, hydraulic system, gears and track parts.

Maintenance / inspection at operating hours							WORK TO BE CARRIED OUT R 964 C		
At delivery	Every 8 - 10	Every 10 - 50	At 500, 1500	At 1000, 3000	At 2000, 4000	By maintenance personnel (machine owner)	By authorized specialist personnel	Note	
						■ First and only interval ● Repeat interval ◆ Special interval every 250 hours	<input type="checkbox"/> First and only interval <input type="radio"/> Repeat interval		
DIESEL ENGINE AND SPLITTERBOX									
<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check oil level in engine			
<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check oil pressure and coolant temperature during operation			
<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check air filter contamination on maintenance indicator (vacuum gauge)			
	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check and drain water separator on fuel filter (or when the corresponding symbol appears on the display)			
	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	If mounted, drain the condensation of the water separator of the particles filter system			
<input type="radio"/>		<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check coolant level			
		<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Drain off water and sediment at fuel tank			
		<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check oil level in splitterbox			
			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check and clean watercooler and ventilator fan			
			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check condition of belt for A/C compressor and alternator installation			
			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Replace lubricating oil filter cartridge (at least 1 x yearly)			
			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Replace engine oil (at least 1 x yearly)		1)	
			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Replace splitterbox oil			
			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check oil, cooling and fuel systems for leaks and condition			
			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check anti-corrosion fluid / antifreeze in coolant, if necessary rectify the mixture concentration			

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Maintenance / inspection at operating hours						WORK TO BE CARRIED OUT R 964 C		
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					○ ○	Check / adjust valve clearance		
				○ ○	○ ○	Check mounting of engine control unit for good condition		
				○ ○	○ ○	Check detectors, transmitters and cable connectors for sound condition		
				○ ○	○ ○	Check the flap of the engine brake, grease the joints of the actuating cylinder		
				○ ○	○ ○	Check the shutting flap of the exhaust gas recirculation system		
				○ ○	○ ○	If mounted, carry out the maintenance of the water separator of the particles filter system		
				○ ○	○ ○	Replace fuel fine filter cartridge (or if power loss)		2)
				○ ○	○ ○	Replace fuel preliminary filter cartridge (or if power loss)		2)
				□ ○	○ ○	Check intake and exhaust systems for leaks and condition (first time at 500 op. hours)		
					○ ○	Check mounting screws of engine console, oil sump and splitterbox		
					○ ○	Grease flywheel teeth		
						Check heater flange at intake manifold (yearly at begin of cold season)		
						Replace air filter main element (according to maintenance indicator / at least once a year)		
						Replace air filter safety element (every third change of main element / 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 or every 3000 hours, what first happens) (only for authorized specialist personnel)		
					○ ○	Replace oil separator (every 1000 hours or at least once a year)		
HYDRAULIC SYSTEM								
	○ ●	● ○	○ ○	○ ○	○ ○	Check oil level in hydraulic tank		
	○ ■	● ○	○ ○	○ ○	○ ○	Clean magnetic rods in return filters (daily during first 300. hours)		
				○ ○	○ ○	Replace servo filter element on control oil unit		
				○ ○	○ ○	Replace replenishing oil filter on swing pump		
				○ ○	○ ○	Check mounting screws of components		
				○ ○	○ ○	Check and clean hydraulic oil cooler and ventilator fan		2)

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Maintenance / inspection at operating hours						WORK TO BE CARRIED OUT R 964 C		
At delivery	Every 8 - 10	Every 10 - 50	At 500, 1500	At 1000, 3000	At 2000, 4000	By maintenance personnel (machine owner)	By authorized specialist personnel	Note
			○	○	○	<ul style="list-style-type: none"> ■ First and only interval ● Repeat interval ◆ Special interval every 250 hours 	<ul style="list-style-type: none"> □ First and only interval ○ Repeat interval 	
			○	○	○	Drain off water in hydraulic tank (when using environmentally friendly fluids, max. permissible water content is 0.1 % , fit hydraulic system with bypass oil filter and take oil samples)		
			○	○	○	If mounted check return filter for hydraulic hammer for cleanliness, replace element if necessary		
			○	○	○	Perform an air bleeding procedure of the servo control chambers via the touch S248 (every 500 working hours and each time when necessary)		
			□	○	○	Replace filter elements in return filter (first time at 500 hours) 2)		
			□	○	○	Clean or replace filter element of leak oil filter (first time at 500 hours) Replacement necessary after max. 3 cleanings 2)		
		●	○	○	○	Check the degree of contamination of the bypass oil filter (optional equipment); if required, change the filter cartridge.		
				○	○	Check hydraulic system for leaks and function		
				○	○	Check / adjust servo, primary and secondary pressures		
						If required, change the oil in the hydraulic system (to be carried out by specialist technical personnel; add oil through filter). For oil grades and change intervals, see fuels and lubricants, "Hydraulic oil".		
					○	Bleed servo system and hydraulic pumps (after replacing oil)		
					○	Replace breather filter on hydraulic tank 2)		
					○	Check the 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 batteries terminals		
			○	○	○	Check the central vent tubes of the batteries for proper installation and damage.		
			○	○	○	Spray slip rings of electrical rotary connection (if mounted) with Cramolin contact spray		
○				○	○	Check system and components for function		
SWING GEAR								
○			○	○	○	Check oil level and for leaks		

Maintenance / inspection at operating hours						WORK TO BE CARRIED OUT R 964 C			
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			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Replace gear oil (first at 500 hours)	
				<input type="checkbox"/>	<input type="checkbox"/>			Check function and operation of swing brake	
				<input type="checkbox"/>	<input type="checkbox"/>			Check mounting of swing gear and oil motor	
SWING RING									
				<input type="checkbox"/>	<input type="checkbox"/>			Check, if necessary retighten mounting screws	
				<input type="checkbox"/>	<input type="checkbox"/>			Check pinion gear mesh	
TRAVEL GEARS									
<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check for leaks	
				<input type="checkbox"/>	<input type="checkbox"/>			Check mounting of travel gears and oil motors	
			<input type="checkbox"/>		<input type="checkbox"/>			Replace gear oil (first at 500 hours)	
TRACKS									
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Visually check the track chains tension, retighten if necessary	
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>						Clean tracks (at the end of working day)	
		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check and tighten mounting screws of track pads and sprocket wheels	
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Clean and grease sliding surfaces of chain tensioners	
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check idler wheels, carrier rollers and track rollers for leaks	
CAB AND HEATER									
		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check level in reservoir for windshield washer, refill if necessary	
<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>			Check function of heater (before start of cold season)	
				<input type="checkbox"/>	<input type="checkbox"/>			Check heating system for leaks	
				<input type="checkbox"/>	<input type="checkbox"/>			Check and grease locks and hinges on doors and windows	
					<input type="checkbox"/>			Check the warm water solenoid valve for function and chocking, clean it as necessary	
AIR-CONDITIONING SYSTEM									
		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Switch on air-conditioning system regularly (at least 1 x every 14 days)	
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check the condensor for contamination, blow it out if necessary	
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Clean, if necessary replace both recirculated and fresh air filters in airco unit, reduce maintenance interval in very dusty conditions	

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Maintenance / inspection at operating hours						WORK TO BE CARRIED OUT R 964 C		
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			○	○	○			Check mounting screws and compressor drive belt
			○	○	○			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 the 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.
UNDER / UPPERCARRIAGE, & ATTACHMENTS								
		●	○	○	○			Grease all lubrication points connected to the centralized lube system (actuate switch in cab with semi-automatic system or no action required with fully automatic system)
		●	○	○	○			Manually grease all lubrication points not connected to the centralized lube system (as in digging bucket area if necessary, on special attachments or on special undercarriage)
		●	○	○	○			Check bucket teeth visually for wear
		◆	○	○	○			Check all parts for cracks
		◆	○	○	○			Check mounting screws of counterweight and tanks for tightness
			○	○	○			Check the screws of connections and the fittings on hydraulic hoses and pipes
				○	○			Check and lubricate cover hinges and locks, check mounting and efficiency of cover lifting cylinders, replace as necessary
○					○			Check the lowering speed of the attachment
○								Explain proper use and maintenance of the attachments to the operator
○								Ask the operator to lubricate the machine using the lubrication chart, explain defects and deficiencies
HYDRAULIC QUICK-CHANGE ADAPTER								
○	●	●	○	○	○			Check function of optical and acoustic warning devices
	●	●	○	○	○			Visually check drawn out position of locking pins

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	●	●	○	○	○	■ First and only interval ● Repeat interval ◆ Special interval every 250 hours	<input type="checkbox"/> First and only interval <input type="checkbox"/> Repeat interval	
	●	●	○	○	○	Check the hydraulic hoses, the cable tree and the safety latches on the load hooks of the quick change adapter for good condition		
		●	○	○	○	Lubricate locking pins		
					○	Clean the sieve filter in the fittings of the hydraulic hoses		
MECHANICAL QUICK-CHANGE ADAPTER								
	●	●	○	○	○	Visually check drawn out position of locking pins		
		●	○	○	○	Lubricate locking pins		

Tab. 5-17 Maintenance chart

- 1 Depending on ambient temperature, fuel and oil qualities, the intervals for engine lube oil changes may be reduced.
- 2 Shorten the maintenance interval dependent on conditions of use (eg. working in dusty conditions, barrel refuelling).

