en

Operating instructions

Hydraulic excavator / Material handler
R 924 B Li. Compact

from serial number 14749

Document identification

Order number: 10286595

edition: 05 / 2006

Valid for: R 924 B Li. Compact from serial number 14749

Author: LFR - Technical documentation department

Product identification

Manufacturer: LIEBHERR France SAS.

Type: R 924 B Li. Compact

Type no.: 911 / 198

Conformity: CE

Address

Liebherr France SAS.

2 avenue Joseph Rey, B.P 90287 F - 68005 Colmar Cedex

LFR/en/edition: 05 / 2006

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:

. . / . . / . .

LFR/en/edition: 05 / 2006

Preface

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

They contain:

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

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

Work with or on the machine includes, for example:

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

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

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

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

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

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

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

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

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

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able for your convenience.

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

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

Modifications, conditions, copyright

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

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Content

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1 Product description

1.1 Assembly - overview

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

1.1.1 Machine and construction equipment

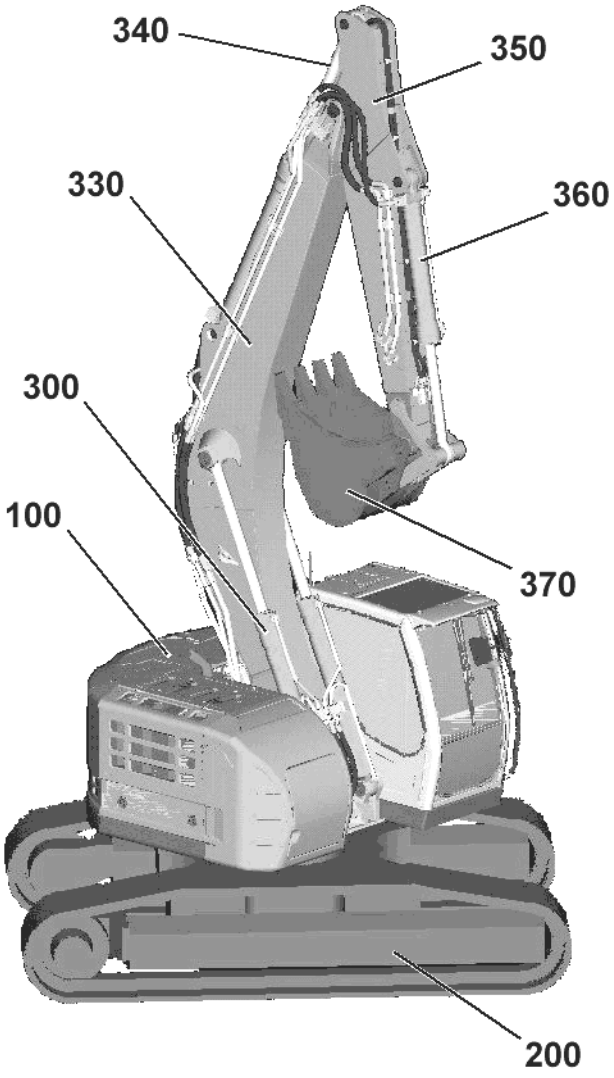

Fig. 1-1 *Machine with construction equipment*

100	Upper carriage	**320**	Adjusting cylinder	**360**	Tilt cylinder
200	Chassis	**330**	Boom	**370**	Bucket
300	Hydraulic jack	**340**	Stanchion cylinder		
310	Slewing arm	**350**	Shovel arm		

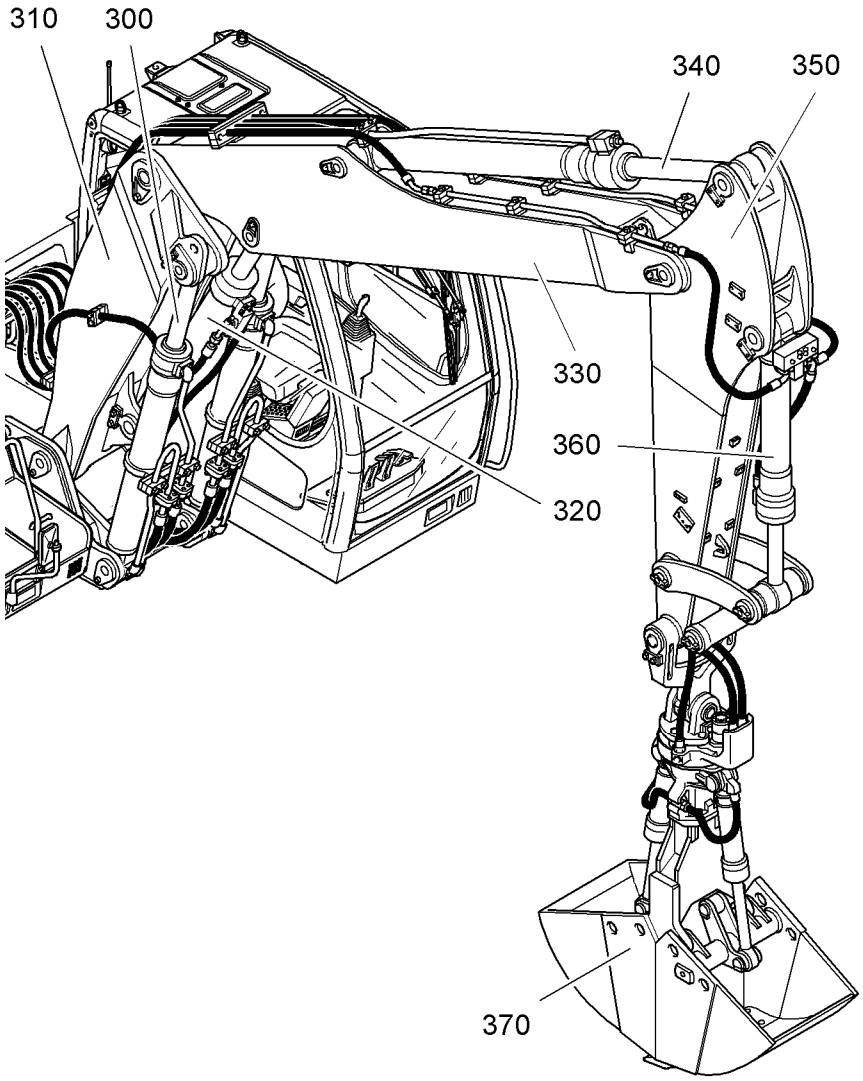

Fig. 1-2 *Machine with construction equipment*

300	Hydraulic jack	**330**	Boom	**360**	Tilt cylinder
310	Slewing arm	**340**	Stanchion cylinder	**370**	Bucket
320	Adjusting cylinder	**350**	Shovel arm		

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1.1.2 Machine for transferring material

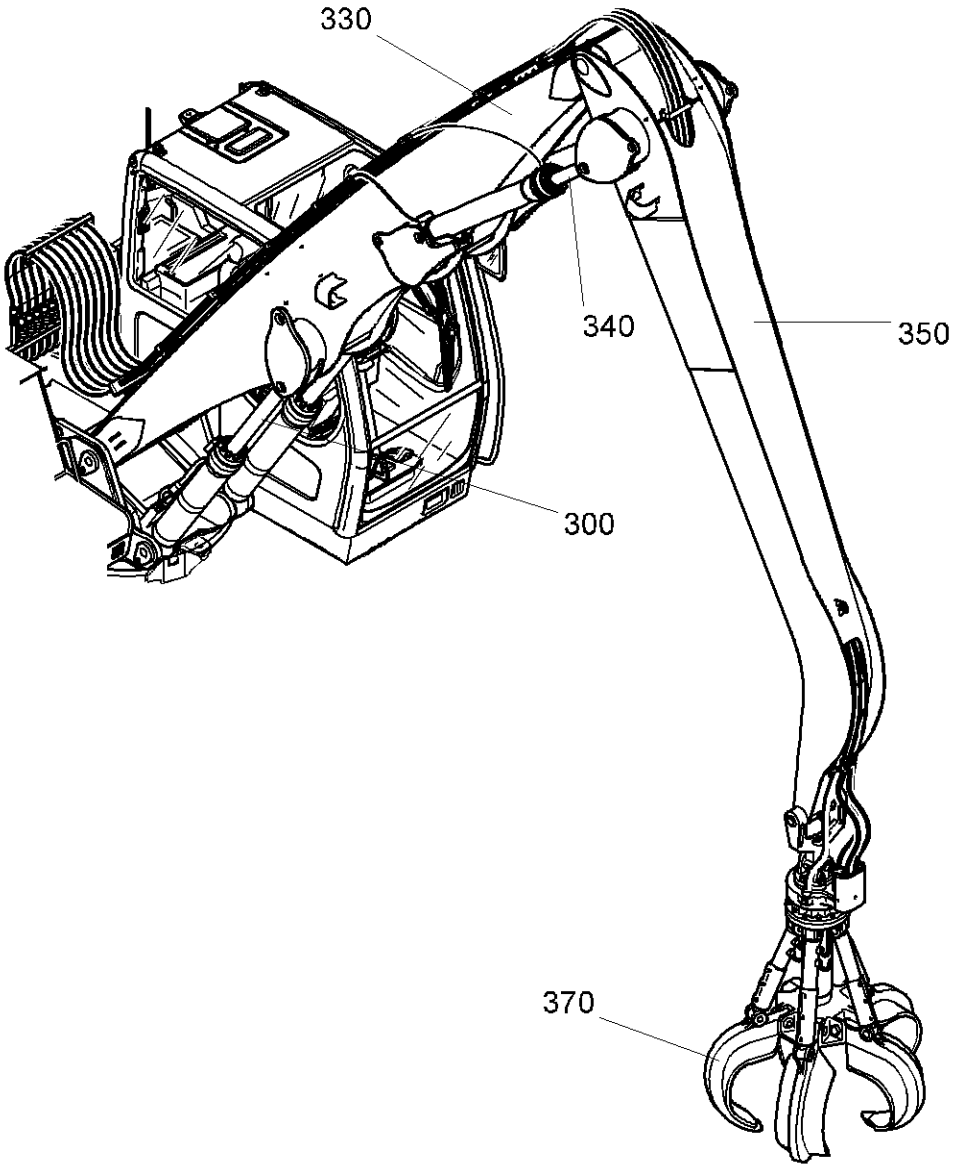

Fig. 1-3 *Machine for transferring material*

300	Hydraulic jack	**340**	Stanchion cylinder	**370**	Grab
330	Industrial boom	**350**	Industrial stanchion		

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1.1.3 Upper carriage

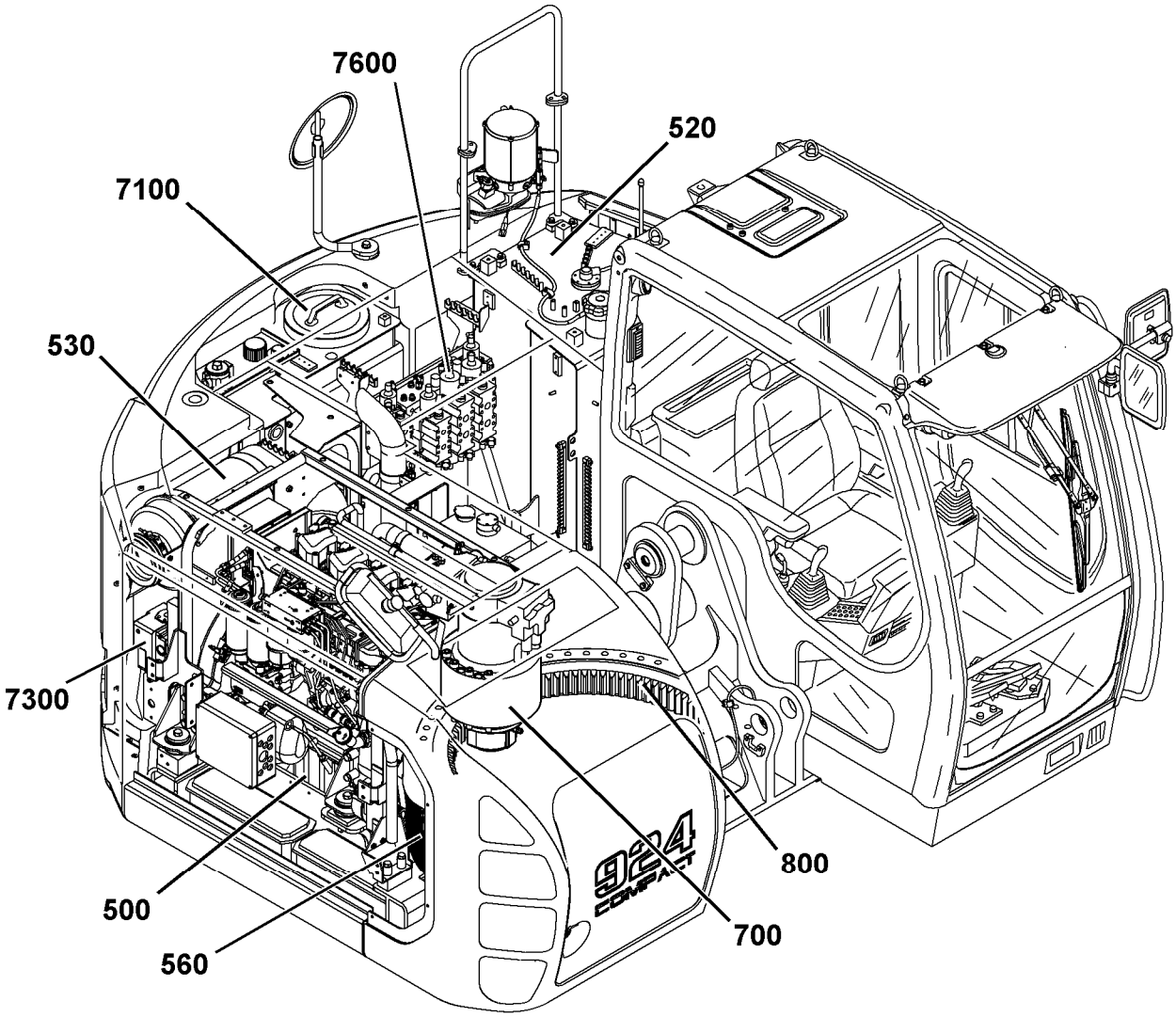

Fig. 1-4 *Upper carriage*

500 Diesel engine
520 Fuel tank
530 Dry air filter
560 Radiator
700 Slewing gear transmission
800 Swing ring
7100 Hydraulic fluid tank
7300 Hydraulic pump
7600 Distributing regulator

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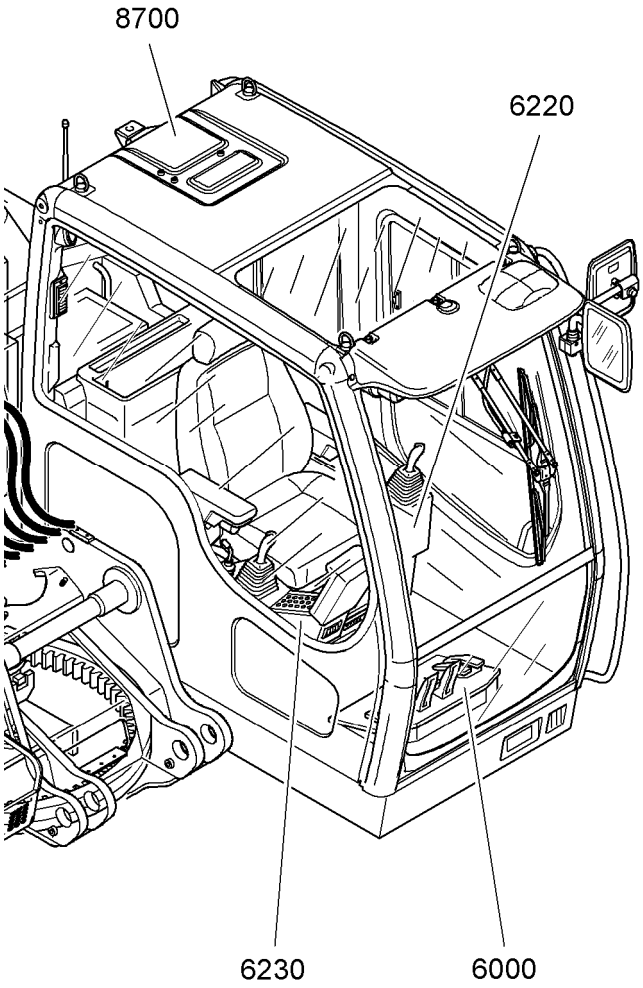

Fig. 1-5 *Upper carriage - cabine*

6000 Operator's standing position
6220 Control panel, left
6230 Control panel, right
8700 Cab

1.1.4 Chassis

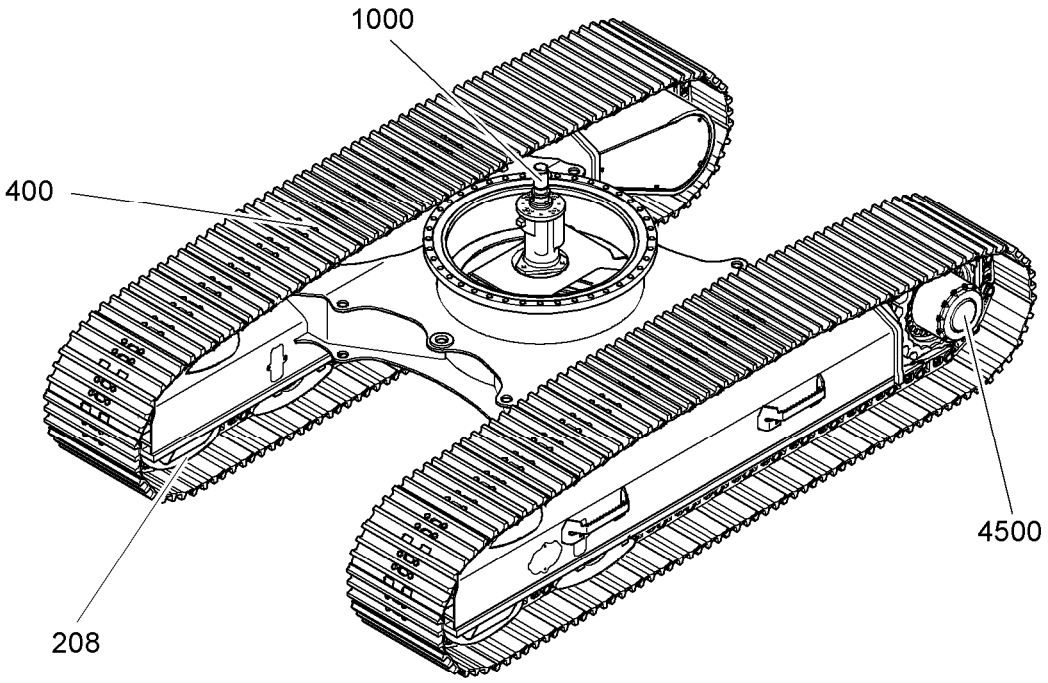

Fig. 1-6 *Chassis*

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

1.2 Technical data

This should be taken from the accompanying technical description.

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The crawler excavator. R 924 COMPACT

Operating Weight: 23,900 - 26,600 kg
Engine Output: 121 kW / 164 HP
Bucket Capacity: 0.35 - 1.20 m³

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R 924 COMPACT

Operating Weight:	23,900 - 26,600 kg
Engine Output:	121 kW / 164 HP
Bucket Capacity:	0.35 - 1.20 m³

Performance

The Liebherr R 924 Compact is the combination of the excellent performance characteristics of a standard excavator and the reduced dimensioning of a compact machine. Even when operational in areas where space is limited the R 924 Compact copes with the highest demands in regard to excavation and load performance.

Reliability

The high demand for performance and quality is consequently converted into landmark solutions to achieve the highest level of dependability and availability. Liebherr has 50 years experience in the production of hydraulic excavators and has an unparalleled competence in design and know-how.

Comfort

A concept focussed specifically on operator comfort has resulted in the largest driver's cab in its class as well as perfect accessibility of all service points.

Economy

The R 924 Compact is synonymous with multi-functionality, performance and maximum possible productivity. Innovative features such as the modular quick-change system and the central lubrication system, fitted as standard, shorten tooling and servicing times.

Multi-function tool carrier

- For every material and application the correct digging tool
- Change-over of mechanical and hydraulic tool in a matter of seconds due to a modular quick coupler system designed and manufactured by Liebherr
- Likufix for the change-over of all hydraulic and mechanical tools from the dash board in the operator station

Performance

The Liebherr R 924 Compact is the combination of the excellent performance characteristics of a standard excavator and the reduced dimensioning of a compact machine. It is synonymous with multi-functionality, performance and maximum possible productivity. Innovative features such as the modular quick-change system and the central lubrication system, fitted as standard, shorten tooling and servicing times.

Outstanding Productivity

Outstanding Lift Capacities

The low center of gravity and the well thought-out attachment geometry are the reasons for impressive lift capabilities. The R 924 Compact delivers the best lifting capability in its class.

High excavation and load performance

The R 924 Compact is ideally suitable for use under the most confined conditions due to a reduced tail swing of 1.69 m and impresses with an outstanding stability. Combined with a high hydraulic performance – typical for Liebherr hydraulic excavators – the results are short cycle times and high digging- and loading performances.

Liebherr diesel power

The four cylinder diesel engine designed and manufactured by Liebherr especially for construction machinery, guarantees huge capacity and long operational life. The aggregate exhibits its full performance even in the low rpm range, contributing significantly to the economic operation of the machine as a whole. At the same time, the R 924 Compact with this engine power is the most powerful excavator in its class. Unique for a compact excavator is the crafty solution for the longitudinal mounting of the powerpack.

Solid footing

Stability

The weight concentration in the undercarriage contributes to an effective utilization of the digging forces and an excellent stability under all ground conditions.

Large ground clearance

The large ground clearance under the carbody assures an extensive protection of the undercarriage components as well as easy traveling even under difficult ground conditions.

Key technologies made by Liebherr

- Power train optimised perfectly to the construction of the short-tail excavator
- Outstanding performance characteristics for productivity unique in its class
- In-house production of engines, hydraulic pumps, transfer gears, traction drives and electronic components

Sturdy Undercarriage

- The combination of high tensile strength steel plates and steel castings in order to minimize stress tension
- A dozer blade, e.g. for grading jobs, is optional available

Robust equipment design

- Unique hoist assembly positioning design: The R 924 Compact is the only machine in its class fitted with two separate bolts
- High-strength design with cast sockets
- Long-term benefit: Cast steel components at the pivot points

Reliability

The high demand for performance and quality is consequently converted into landmark solutions to achieve the highest level of dependability and availability. Liebherr has 50 years experience in the production of hydraulic excavators and has an unparalleled competence in design and know-how.

Technology with prospects

Perfect optimisation

Individual components of the drive train, manufactured in-house, such as diesel engine, traction drive, rotary actuators, operating pump and hydraulic cylinder are perfectly optimised with one another. As components of a total system designed for long operational life, they guarantee maximum possible reliability.

Quality right down to the last detail

The clear lay out of hydraulic, lubrication and electrical conduits ensures ideal operational reliability and maximum machine availability. Undercoating and surface-treating of components provide ideal corrosion protection.

Safety of functionality

Automatic control of functionality

The operator can entirely focus on his job, because the integrated on-board electronic continuously performs a comparison with pre-determined target data. Eventual deviations from the target parameters are shown on the display.

Data storage

The on-board computer stores eventual abnormalities from the rated data. The data can be readily recalled and transferred by radio transmission to a service center.

Liebherr hydraulic cylinders

- Cylinder sizes matched to each model
- High-quality coating of piston rod
- Special gasket packages for piston rod and piston
- Sealed special bushings for pin mountings
- End-cushion at each end

Cleanly arranged upper

- Clearly arranged hose routing is designed to achieve longevity
- Transverse-mounted control valve for optimal accessibility
- Secure hose routing within the upper structure

Intelligent detailed solutions

- The radiators are well accessible from the ground level for cleaning
- Easy cleaning of the foldable climate condenser
- Laterally positioned intake slots to increase radiator longevity

Comfort

A concept focussed specifically on operator comfort has resulted in the largest driver's cab in its class as well as perfect accessibility of all service points.

The operator takes centre stage

Workspace with free room

In terms of the personal space requirements, the operator of the R 924 Compact has almost unlimited room. The spacious and comfortable cab provides all operators with generous room for climbing in, generous leg and elbow room and lots of storage space for cool box and other personal items.

Air-conditioning as standard

The air-conditioning sensors constantly monitor the temperature settings. The ventilation flaps can be open and closed electronically at the press of a button. The re-heat function dehumidifies the cab in seconds.

Ergonomics for an effective work effort

Straightforward arrangements

Design and positioning of seat, consoles and information display are perfectly coordinated within an ergonomically total concept. The operator seat with shock absorber is adjustable to fit individual needs. The oversized cab windows provide optimal visibility to the entire working- and surrounding area.

Intelligent joystick controls

The ergonomically optimized joysticks provide relaxed working conditions. The travel function of the excavator is easy and precise due to hydraulically cushioned foot pedals.

Everything in its right place

- Comfortable climb with ergonomically positioned hand grips
- Large platform, treated with anti-slip coating
- Optimal arrangement of mirrors for unobstructed view of the surrounding area

Maintenance benefits as standard

- All service points are centrally integrated and easily accessible via service flap
- All routine servicing work possible from ground
- Routine cleaning of the most accessible coolers can easily be performed by opening out the individual cooling elements

Liebherr Tool-Control

- Immediately after change of the hydraulic tool, the programmed pressure settings and oil flow volumes are available
- Stores up to 10 accessory tool settings (pressure and oil flow)
- Displays the type of accessory tool

Economy

The R 924 Compact is synonymous with multi-functionality, performance and maximum possible productivity. Innovative features such as the modular quick-change system and the central lubrication system, fitted as standard, shorten tooling and servicing times.

One excavator – unlimited application areas

Multi-purpose machine

The R 924 Compact is a multi-purpose machine, which can be utilized in a variety of ways. It is ideally suitable at jobsites with tight space conditions such as inner cities and narrow forest roads due to its compact design. Naturally, it can perform all classical jobs of a standard excavator as well, such as digging- and utility construction, demolition- and material handling work.

Compact attachment dimensions

The attachment geometry, especially developed for the R 924 Compact, allows due to the boom pivot point located behind the operator station, an effective operation at loading height as well. The total clearance circle is less than 1.90 m.

Top technology for top profitability

Well oiled

Regular greasing on the Liebherr R 924 Compact is performed by the semi-automatic central lubrication system, fitted as standard. The Liebherr central lubrication system ensures a marked reduction in servicing times as well as maximum operational reliability even in aggressive environmental conditions. Resulting in a real-term reduction in bearing wear and subsequent repair work.

Electronic engine speed sensing

This regulating system provides an efficient conversion of the engine power into hydraulic performance – which ends up in an optimal utilization of the pump capacity. The result: increase in output, decrease in fuel consumption, and protection of the diesel engine.

Hydrostatic fan drive

- Thermostatically regulated fan speed via engine oil and coolant temperature
- Accelerated warm-up period
- Assurance of steady fluid quality due to constant temperature
- Increased longevity of drive components
- Fan only takes-off the needed power, reducing fuel consumption

Quick spare parts service

- Over 80,000 line items are ready for the global spare part requirements
- Emergency spare parts requirements are available within 24 hours

Technical Data

Engine

Rating per ISO 9249	121 kW (164 HP) at 1800 RPM
Model	Liebherr D 924 TI-E
Type	4 cylinder in-line
Bore/Stroke	122/142 mm
Displacement	6,6 l
Engine operation	4-stroke diesel direct injection turbo-charged after-cooled reduced emissions
Cooling	water-cooled and integrated motor oil cooler
Air cleaner	dry-type air cleaner with pre-cleaner, primary and safety elements
Fuel tank	360 l
Standard	sensor controlled engine idling
Electrical system	
Voltage	24 V
Batteries	2 x 110 Ah/12 V
Starter	three phase current 24 V/5,4 kW
Alternator	24 V/80 A

Hydraulic System

Hydraulic pump	LSC control system (Liebherr-Synchron-Comfort), regulation with Liebherr variable flow, swash plate double pump
Max. flow	2 x 214 l/min.
Max. pressure	350 bar
Pump regulation	electro-hydraulic with electronic engine speed sensing regulation, pressure compensation, flow compensation, automatic oil flow optimizer, swing circuit with priority and torque control
Hydraulic tank	140 l
Hydraulic system	max. 350 l
Hydraulic oil filter	1 full flow filter in return line with integrated fine filter area (5 µm) and an additional leakage filter
Hydraulic oil cooler	compact cooler, consisting of a water cooler, sandwiched with hydraulic oil cooler and after-cooler cores and hydrostatically driven fan
MODE selection	adjustment of machine performance and the hydraulics via a mode selector to match application
ECO	for especially economical and environmentally friendly operation
POWER	for maximum digging power and heavy duty jobs
LIFT	for lifting
FINE	for precision work and lifting through very sensitive movements
Super-Finish	adjustable working speed for grading
R.P.M. adjustment	stepless adjustment of engine output via the r.p.m. at each selected mode
Liebherr Tool Control	ten preadjustable pump flows and pressures for add on tools

Hydraulic Controls

Power distribution	via control valve with integrated safety valves, simultaneous and independent operation of travel drive, swing drive and work attachment
Servo circuit	
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 control valve and torque control
Transmission	compact planetary reduction gear
Swing ring	Liebherr, sealed single race ball bearing swing ring, internal teeth
Swing speed	0–9 RPM stepless
Swing torque	74 kNm
Holding brake	wet multi-disc (spring applied, pressure released)
Option	pedal controlled positioning brake

Operator's Cab

Cab	built from deep drawn components, resiliently mounted, sound insulated, tinted windows, front window stores overhead, 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 air conditioning, combined cooler/heater, additional dust filter in fresh air/recirculated
Noise emission	
ISO 6396	L_{pA} (inside cab) = 74 dB(A)
2000/14/EC	L_{WA} (surround noise) = 102 dB(A)

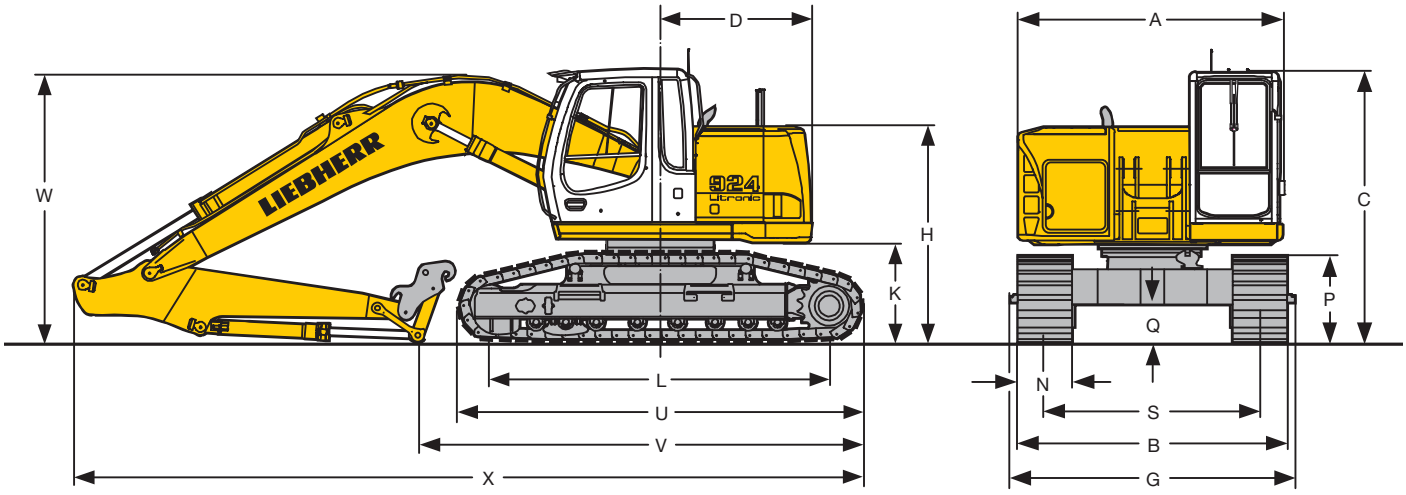
Undercarriage

HD-SL	heavy duty, wide gauge
Drive	Liebherr swash plate motors with integrated brake valves on both sides
Transmission	Liebherr planetary reduction gears
Travel speed	low range –3,1 km/h high range –5,2 km/h
Drawbar pull max.	264 kN
Track components	B 60, maintenance-free
Track rollers/ Carrier rollers	8/2
Tracks	sealed and greased
Track pads	triple grouser
Digging locks	wet multi-discs (spring applied, pressure released)
Brake valves	integrated into travel motor
Option	blade

Attachment

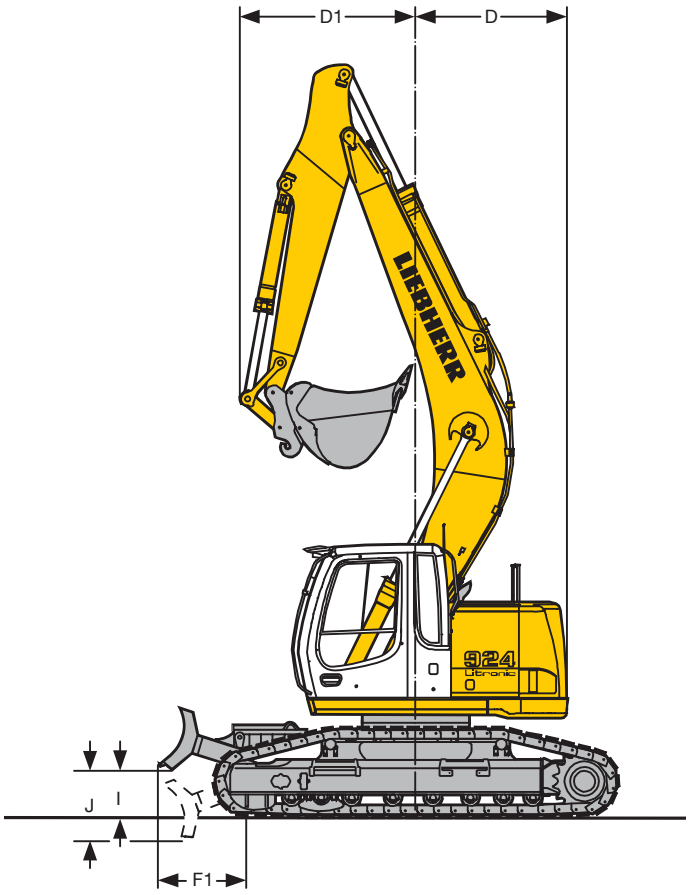
Type	combination of resistant steel plates and cast steel components
Hydraulic cylinders	Liebherr cylinders with special seal-system, shock absorbed
Pivots	sealed, low maintenance
Lubrication	lubrication semi automatic
Hydraulic connections	pipes and hoses equipped with SAE split-flange connections
Bucket	standard equipped with 12 t safety hook for lifting

Dimensions



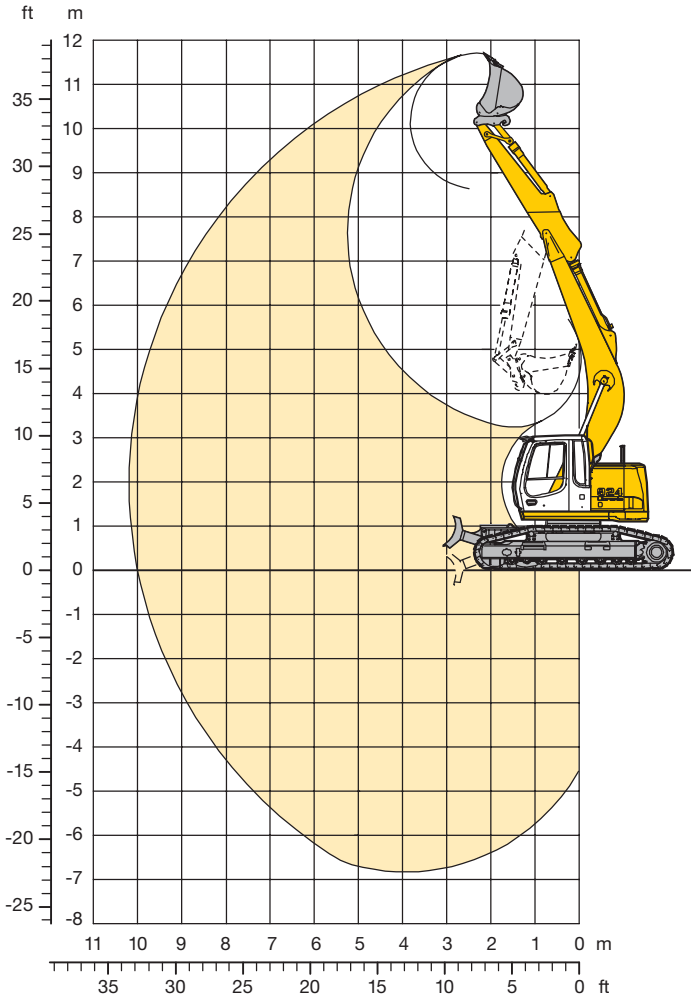
		mm
A		2970
C		3060
C	with protective grid up FOPS	3255
D		1690
D1	without quick change adapter with bucket	1900
D1	with quick change adapter and bucket	1950
F1		975
H		2430
I		535
J		800
K		1110
L		3748
P		995
Q		470
S		2400
U		4555
U1		5040
N		600 750
B		3000 3150
G		3160 3160

Gooseneck Boom 5,70 m			
Stick Length		m	2,95
V		mm	5000
W		mm	3060
X		mm	8900



Backhoe Attachment

with Gooseneck Boom 5,70 m



Digging Envelope
with Quick Change Adapter

Stick length	m	2,95
Max. digging depth	m	6,80
Max. reach at ground level	m	10,00
Max. dump height	m	8,65
Max. dump height	m	11,70

Digging Forces
without Quick Change Adapter

Digging force ISO	kN	103
	t	10,5
Breakout force ISO	kN	141
	t	14,4

with Quick Change Adapter

Digging force ISO	kN	97
	t	9,9
Breakout force ISO	kN	117
	t	11,9

Max. breakout force
without quick change adapter with ripper bucket 158 kN (16,1 t)

Operating Weight and Ground Pressure

Operating weight includes basic machine with gooseneck boom 5,70 m, stick 2,95 m, quick change adapter 48 and bucket 0,70 m³.

Undercarriage HD-SL		without blade			with blade		
Pad width	mm	500	600	750	500	600	750
Weight	kg	24225	24500	24915	25915	26190	26605
Ground pressure	kg/cm²	0,60	0,51	0,41	0,64	0,54	0,44

Buckets

		without Quick Change Adapter					with Quick Change Adapter			
Cutting width SAE	mm	600[1]	1050	1250	1400	1400	1050	1250	1400	1400
Capacity ISO 7451	m³	0,35	0,70	0,90	1,05	1,20	0,70	0,90	1,00	1,20
Max. possible material weight	t/m³	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,8	1,5
Weight with Liebherr teeth Z 13[2]	kg	700	595	685	730	810	615	700	715	845

[1] Ripper bucket with teeth size Z 16 P
[2] Bucket with Liebherr teeth Z 13 (for applications up to surface class 5, heavy soils)

Lift Capacities

with Gooseneck Boom 5,70 m

Stick 2,95 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m) 3,0	4,5	6,0	7,5
9,0	without blade		4,3# (4,3#)		
	with blade		4,3# (4,3#)		
7,5	without blade		5,0# (5,0#)	4,3# (4,3#)	
	with blade		5,0# (5,0#)	4,3# (4,3#)	
6,0	without blade		5,4# (5,4#)	5,1 (5,1#)	3,4 (3,6#)
	with blade		5,4# (5,4#)	5,1# (5,1#)	3,6# (3,6#)
4,5	without blade	7,4# (7,4#)	6,6# (6,6#)	4,8 (5,7#)	3,4 (5,0#)
	with blade	7,4# (7,4#)	6,6# (6,6#)	5,2 (5,7#)	3,6 (5,0#)
3,0	without blade	13,0# (13,0#)	7,1 (8,3#)	4,6 (6,5#)	3,2 (5,4)
	with blade	13,0# (13,0#)	7,6 (8,3#)	4,9 (6,5#)	3,5 (5,5#)
1,5	without blade	6,6# (6,6#)	6,5 (9,8#)	4,3 (7,2#)	3,1 (5,2)
	with blade	6,6# (6,6#)	7,0 (9,8#)	4,6 (7,2#)	3,3 (5,6)
0	without blade	7,4# (7,4#)	6,1 (10,5#)	4,1 (7,1)	3,0 (5,1)
	with blade	7,4# (7,4#)	6,6 (10,5#)	4,4 (7,6#)	3,2 (5,5)
- 1,5	without blade	10,1# (10,1#)	6,0 (10,2#)	3,9 (7,0)	2,9 (5,0)
	with blade	10,1# (10,1#)	6,5 (10,2#)	4,3 (7,5)	3,2 (5,4)
- 3,0	without blade	11,7 (12,9#)	6,0 (9,2#)	3,9 (6,8#)	
	with blade	12,7 (12,9#)	6,5 (9,2#)	4,3 (6,8#)	
- 4,5	without blade	9,6# (9,6#)	6,2 (7,1#)	4,1 (4,9#)	
	with blade	9,6# (9,6#)	6,7 (7,1#)	4,4 (4,9#)	

The lift capacities on the load hook of the Liebherr quick change adapter 48 without attachment are stated in metric tonnes (t), and can be lifted 360° on firm, level supporting surface. Values quoted in brackets are valid for the undercarriage when in longitudinal position. Capacities are valid for 600 mm wide triple 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 quick change adapter's load hook is 12 t. Without quick change adapter the lift capacities will increase by 235 kg, without bucket cylinder, link and lever they increase by an additional 275 kg. Lifting capacity of the excavator is limited by machine stability, hydraulic capacity and maximum permissible load of the load hook.
When lifting loads, the hydraulic excavator must be equipped with automatic check valve on its hoist cylinders and overload warning device according to European Standard, EN 474-5.

Equipment

Undercarriage

	s	o
Pads 600 mm	•	
Track chain tensioner (grease/hydraulic)	•	
Two-stage travel motors	•	
Idler protection	•	
Lifetime lubricated track rollers	•	
Track guide at each track frame	•	
Tracks sealed and greased	•	
Pads 500 mm		•
Pads 750 mm		•
Track guides at sprocket and in center		•
Track guide continuous		•
Sprocket with dirt ejector		•
Reinforced base-plate center-piece		•

Uppercarriage

	s	o
Maintenance free swing brake lock	•	
Non slip surfaces	•	
Handrails	•	
Main switch for electric circuit	•	
Engine hood with lift help	•	
Sound insulation	•	
Maintenance-free HD-batteries	•	
Tool kit	•	
Counterweight	•	
Rear view mirror on counterweight	•	
Rear view mirror right	•	
Dust protective net for radiator and oil cooler	•	
Radiator guard for cooling fan	•	
Electric fuel tank filler pump		•
Foot pedal swing positioning brake		•
Customized colors		•

Hydraulics

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

Engine

	s	o
Turbo charger	•	
Direct injection	•	
After-cooled	•	
Sensor controlled engine idling	•	
Air filter with pre-cleaner main- and safety element	•	
Fuel water separator	•	
Laminated radiator	•	
Cold starting aid		•

Operator's Cab

	s	o
All tinted windows	•	
Roof hatch	•	
Door with sliding window	•	
Rain hood over front window opening	•	
Wiper/washer	•	
6-way adjustable seat	•	
Seat and consoles independently adjustable	•	
Storage tray	•	
Dome light	•	
Inside rear mirror	•	
Cloth hook	•	
Cigarette lighter and ashtray	•	
Displays for engine operating condition	•	
Mechanical hour meters, readable from outside the cab	•	
Outside rear mirror	•	
Sun roller blind	•	
Removable customized floor mat	•	
Air conditioning	•	
Hydraulic joystick	•	
Preparation for radio installation	•	
Seat belt	•	
Safety lever for hydraulic disconnect	•	
Emergency exit rear window	•	
2 front headlights	•	
Air pressure operator seat with heating and head-rest		•
Extinguisher		•
Roof window wiper		•
Electric cool box		•
Bullet proof window (fixed installation – can not be opened)		•
Stereo radio		•
Beacon		•
Auxiliary heating		•
Socket 12 V		•
FOPS protection		•
Electronic drive away lock		•
Additional flood lights rear		•

Attachment

	s	o
Flood lights on boom right	•	
Sealed pivots	•	
Safety lift hook on buckets	•	
SAE-dbl flange connection for all hi-pressure lines	•	
Lubrication semi automatic for attachment and swing ring	•	
Cylinders with shock absorber	•	
Hydraulic rotor protection	•	
2nd flood lights on boom left		•
Liebherr automatic lubrication system for attachment and swing ring		•
Hydr. lines for clam operation on stick		•
Liebherr line of clams		•
Likufix		•
Safety check valves on hoist cylinder		•
Safety check valves on stick cylinder		•
Hose quick connection		•
Manual quick change tool adapter		•
Hydraulic quick change tool adapter		•
Customized colors		•
Special buckets and other tools		•
Overload warning device		•
Two way valves for bucket/clam use		•
Locking of connections for clam operation		•
Extra hydraulic controls including piping		•

S = Standard, O = 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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2 Safety information, signs

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

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

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

2.1 Symbols in the operating instructions

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

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

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

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

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

– This symbol identifies a listing.
  • This symbol identifies a sub-listing.

❑ This symbol signifies the following: “The precondition must be fulfilled”.
The machine operator or the maintenance personnel must first fulfil the precondition described, i e. the machine must be brought into a particular work position in order to be able to carry out the actions subsequently described.

▶ This symbol identifies an action.
The machine operator or the maintenance personnel should be active at this location and carry out the action described.

↳ This symbol means “Carry out an activity".
If the machine operator or maintenance personnel have carried out the activities described in an action, the result of this action will be described here.

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

Additional points that should be noted are:

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

2.2 Use in accordance with the regulations

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

2.3 Safety instructions

2.3.1 General safety instructions

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

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perienced member of staff.

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

2.3.2 Avoidance of crushing and burns

- Do not work beneath the equipment if it is not safely positioned on the ground or supported.

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

2.3.3 Avoidance of fire and explosions

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

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2.4 Signs on the machine

2.4.1 Introduction

The machine displays several types of signs:

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

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

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

▶ Replace missing or illegible safety plates immediately.

2.4.2 Arrangement of signage

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

4 Nameplate
15 Lubrication chart
20 Prohibiting sign
22 Operating symbols plate
24 Plan number plate
30 Lubrication chart, engine
35 Information plate, load and anchoring points
40 Information plate, lashing points
45 Information plate, stop-lift point
47 Safety plate, external start
50 Obstruction safety plate
52 Engine-off safety plate
60 Information plate – sound / power level [truck]
65 Load chart
66, part 1 Accident prevention safety plate
66, part 2 Safety lever
66, part 3 Safety plate work equipment
80 Information plate, safety belt
250 Information plate, rear window

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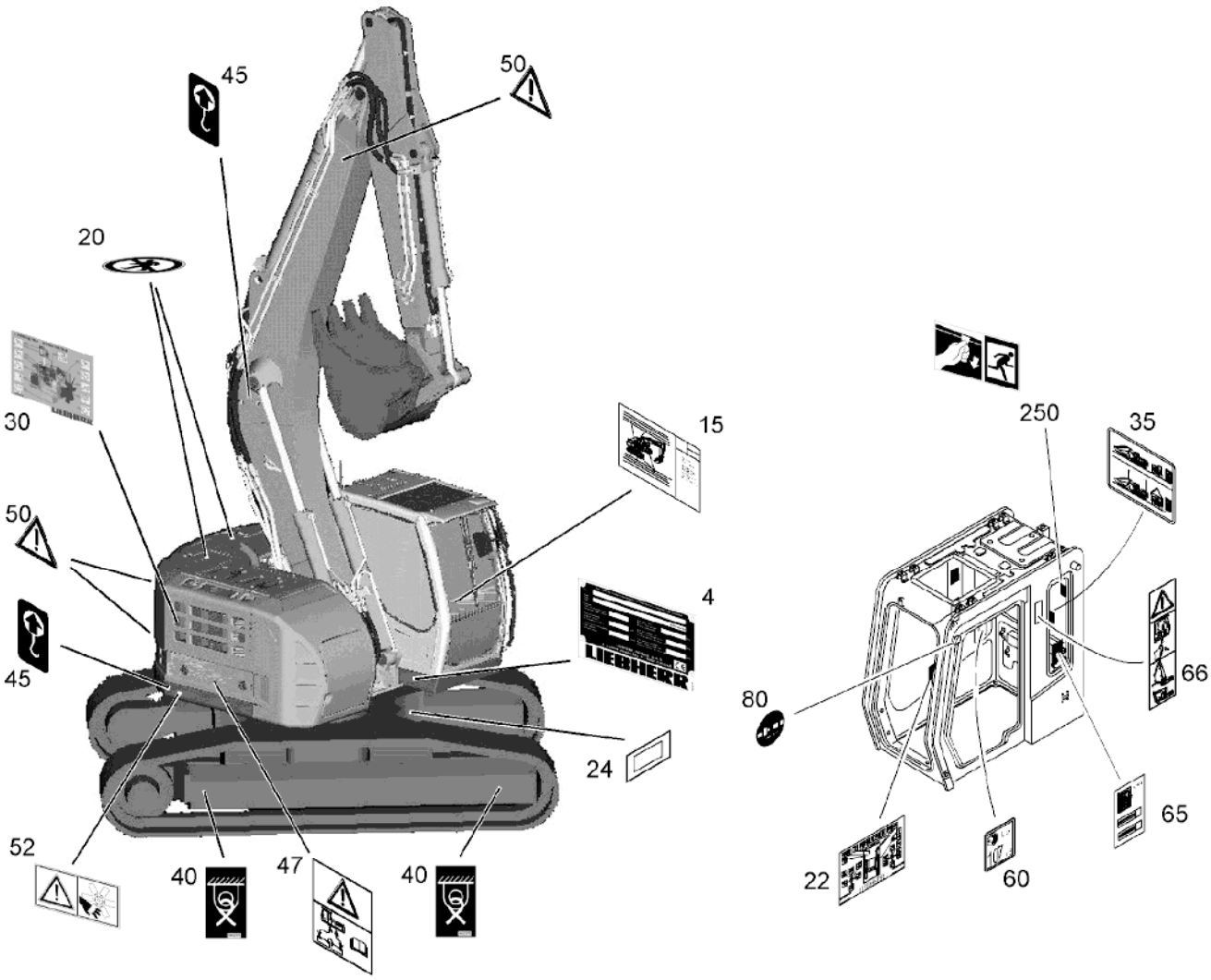

2.4.3 Explanation of signage

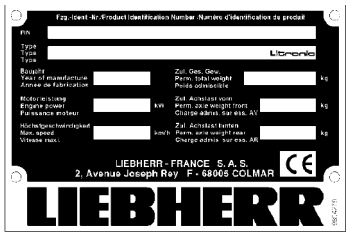

Plate 4: Machine nameplate

The nameplate displays the following information:

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

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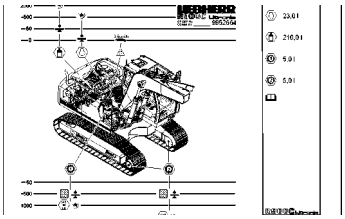


Plate 15: Lubrication chart

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

Plate 20: Prohibiting sign

Entering the marked area is forbidden.

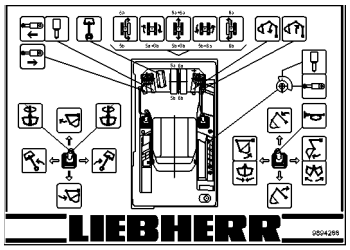
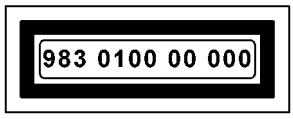


Plate 22: Operating symbols

Describes the functions of the operating devices which are not labelled.



Schild 24: Plan number

Indicates the plan number.

Plate 30: Lubrication chart, engine

Indicates the maintenance intervals for the diesel engine.

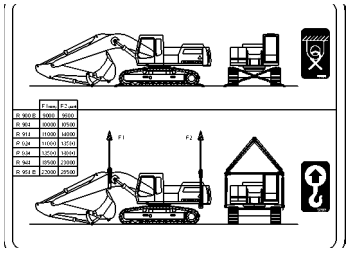


Plate 35: Loading and anchoring points

Identifies the positions of the loading and anchoring points, as well as the relevant weight of the machine.

Plate 40: Lashing point

Indicates the machine's lashing points.

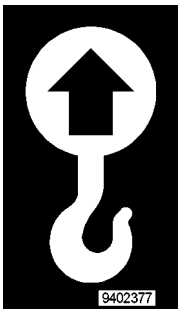


Plate 45: Stop-lift point

Indicates the machine's stop-lift points.

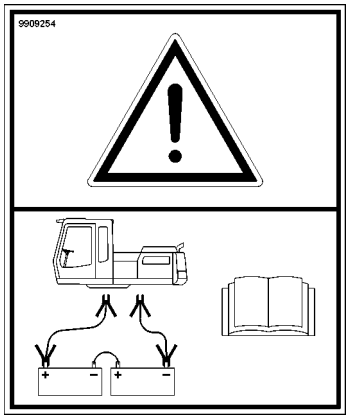


Plate 47: External starting

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

Plate 50: Obstruction

It is forbidden to stand in the danger zone.

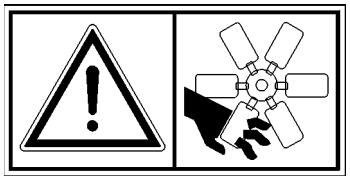


Plate 52: Engine-off

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

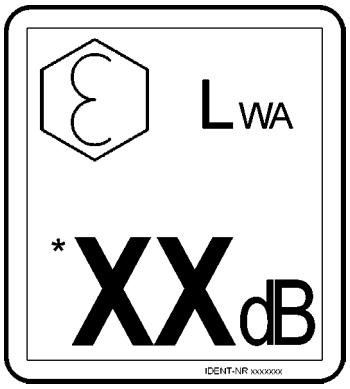


Plate 60: Sound/power level [truck]

Indicates the sound/power level of the machine to the environment in dB(A).

***XX** = The applicable weight for the machine is provided on the operator's cab.

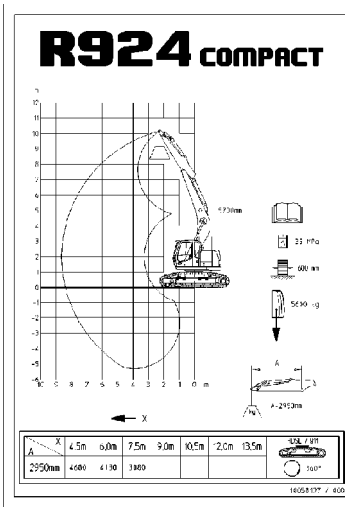


Plate 65: Load chart

Shows the permissible loads dependent on the working radius.

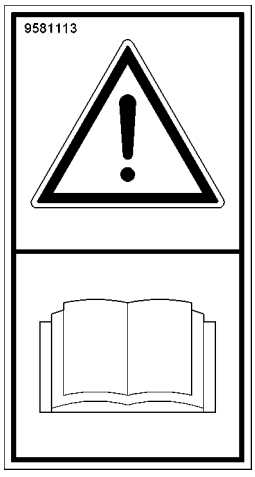


Plate 66, Part 1: Accident prevention

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

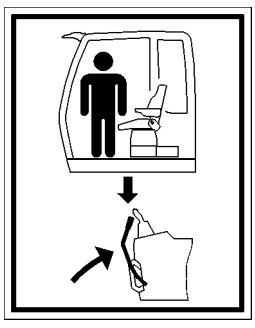


Plate 66, Part 2: Safety lever

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

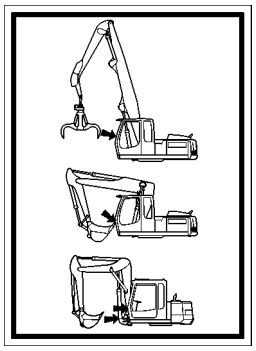


Plate 66, Part 3: Equipment

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

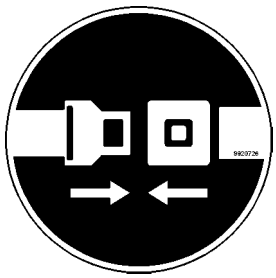


Plate 80: Safety belt

The safety belt must be fastened before starting the machine.

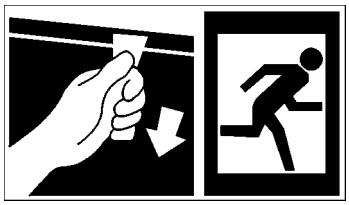


Plate 250: Emergency exit – rear window

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.

2.5 Nameplates on the machine

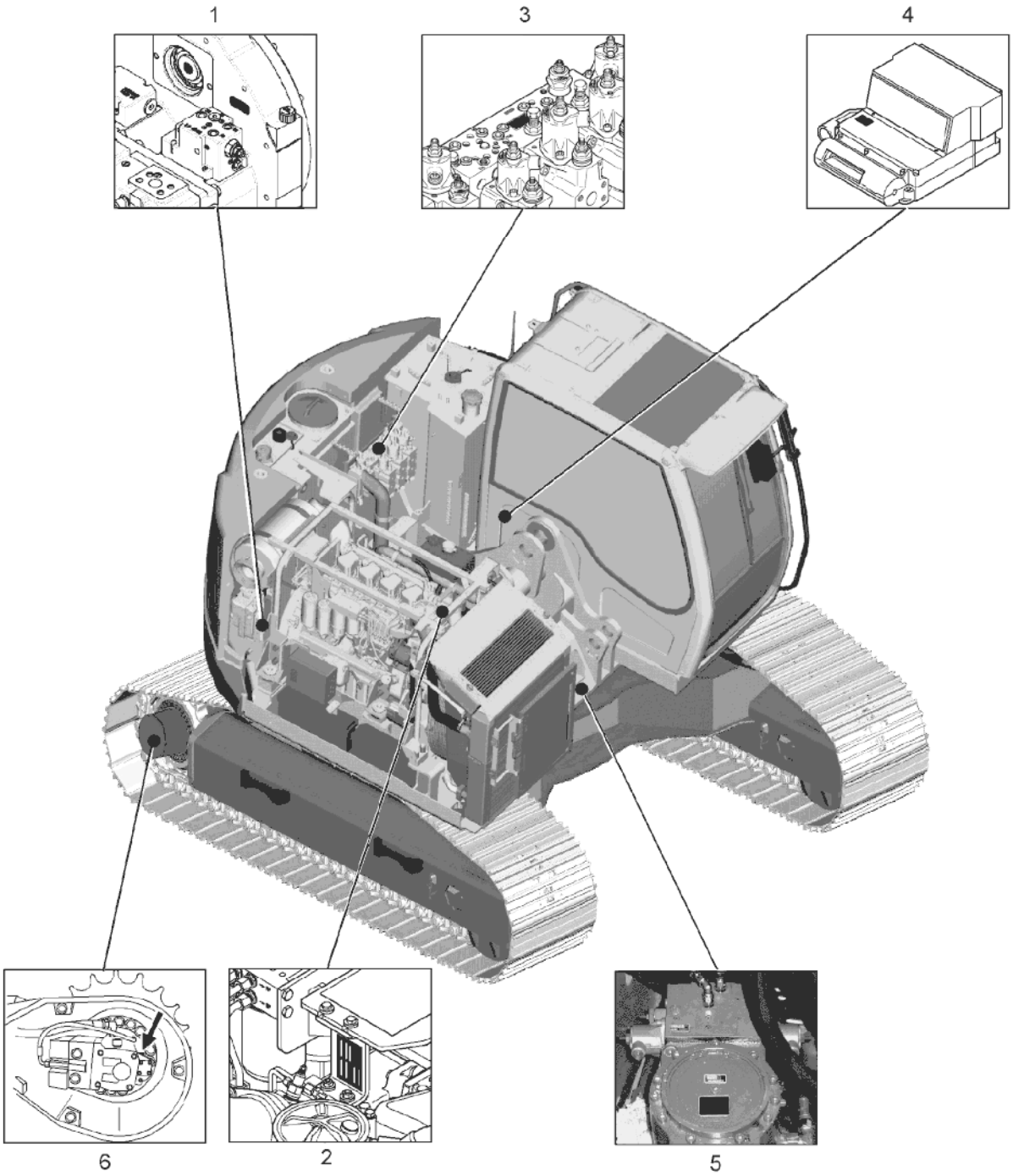


Fig. 2-2 *Important nameplates on the machine*

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

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3 Control and operation

3.1 Operating and control elements

3.1.1 Overview of the operator's standing position

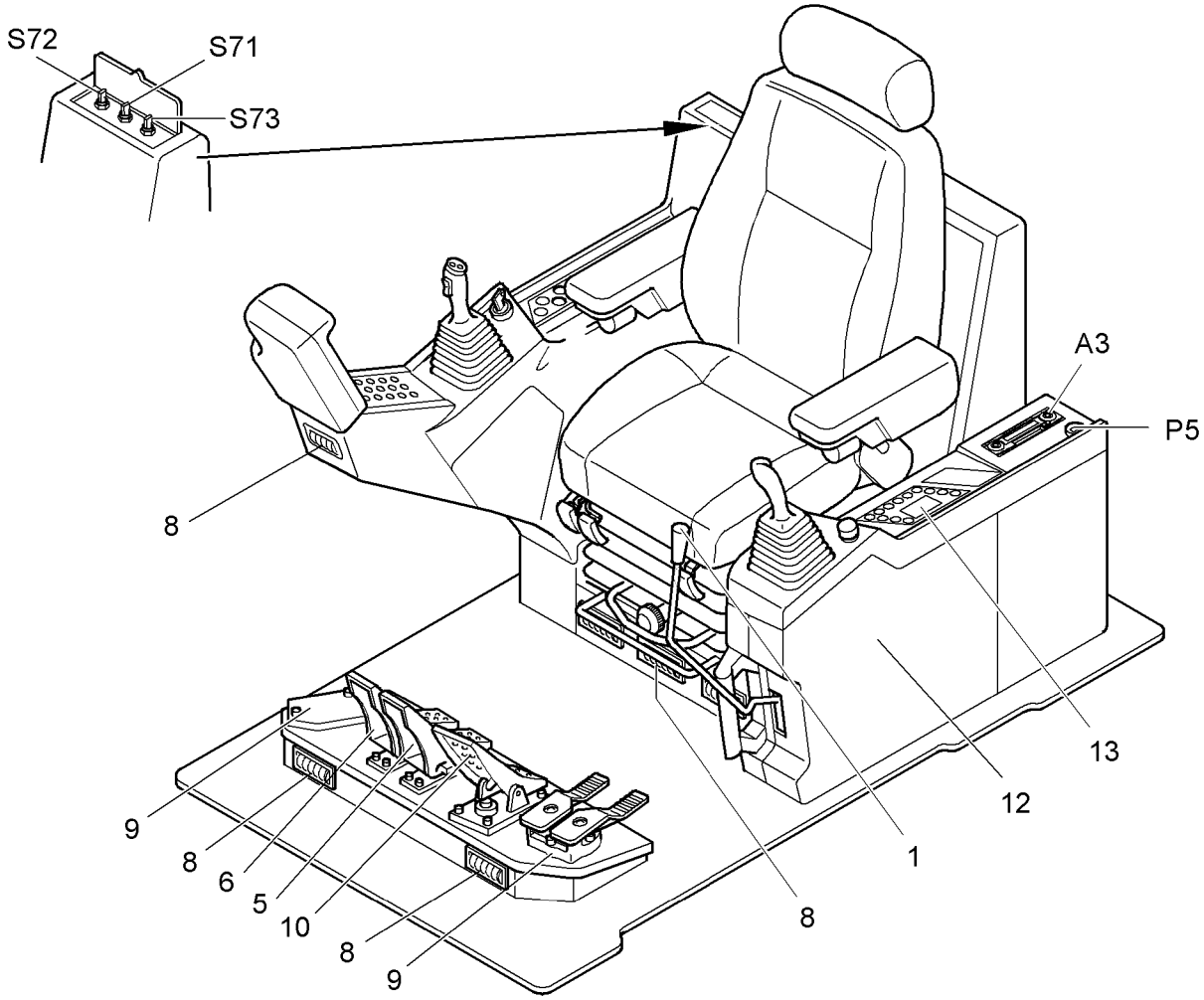

Fig. 3-1 *Operator's standing position*

1	Servo control safety lever	**13**	Heating/air-conditioning system
5	Pedal for left drive unit	**A3**	Radio (optional extras)
6	Pedal for right drive unit	**P5**	Operating hours counter
8	Air vent, heating	**S71**	Automatic / manual speed adjustment switch
9	Equipment operation (optional extras)	**S72**	+ / - speed switch
10	Positioning swing brake (optional extras)	**S73**	Emergency operation switch
12	Fuse box		

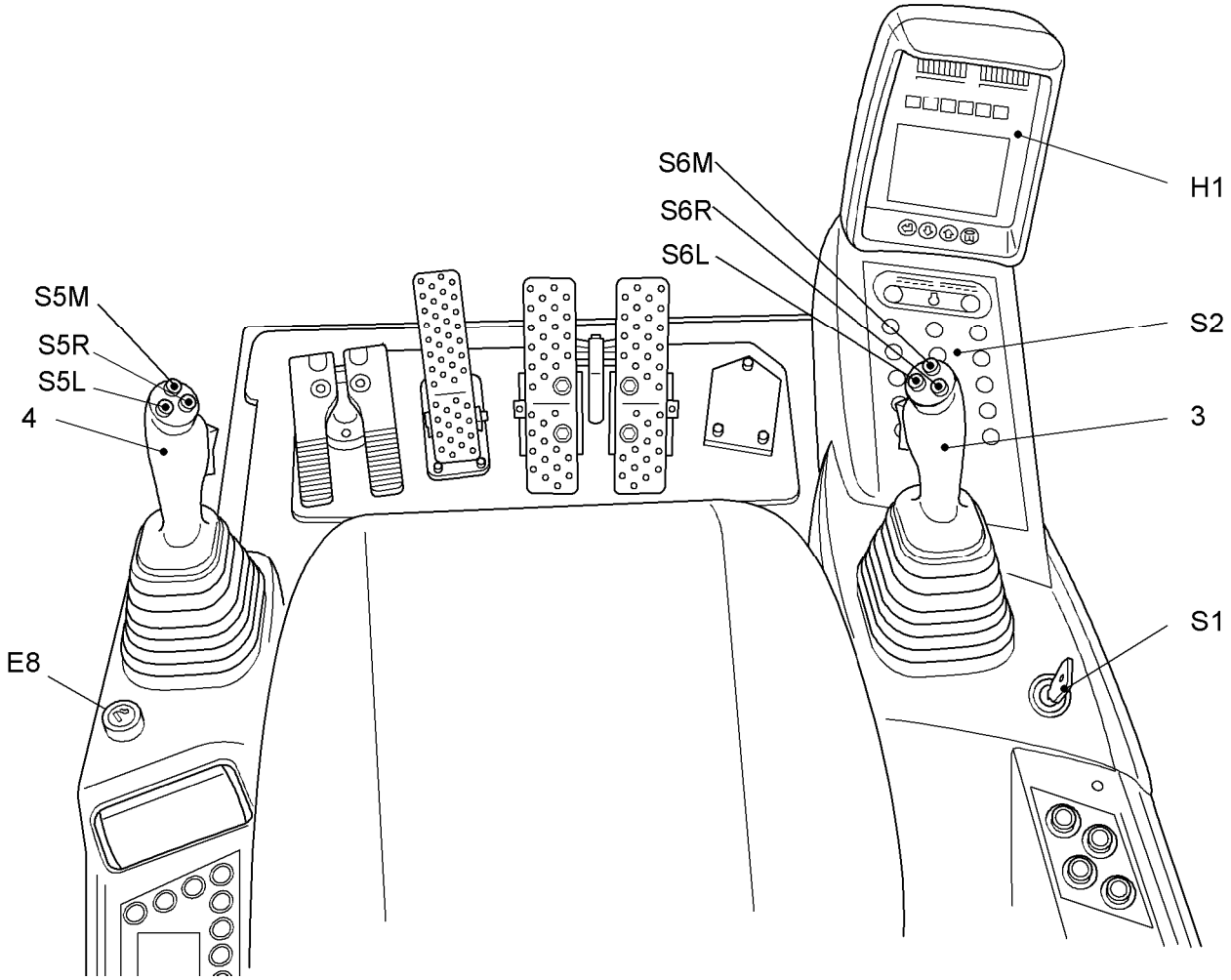

Fig. 3-2 *Operator's standing position, seen from the operator's point of view*

3	Joystick, right	**S5L**	Turn grab left pushbutton
4	Joystick, left	**S5R**	Turn grab right pushbutton
E8	Cigarette lighter	**S5M**	Horn
H1	Monitoring screen	**S6L**	Magnetic system (option)
S1	Ignition switch	**S6R**	Drive warning device (option)
S2	Keypad	**S6M**	Floating position (option)

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3.1.2 Arrangement of joystick

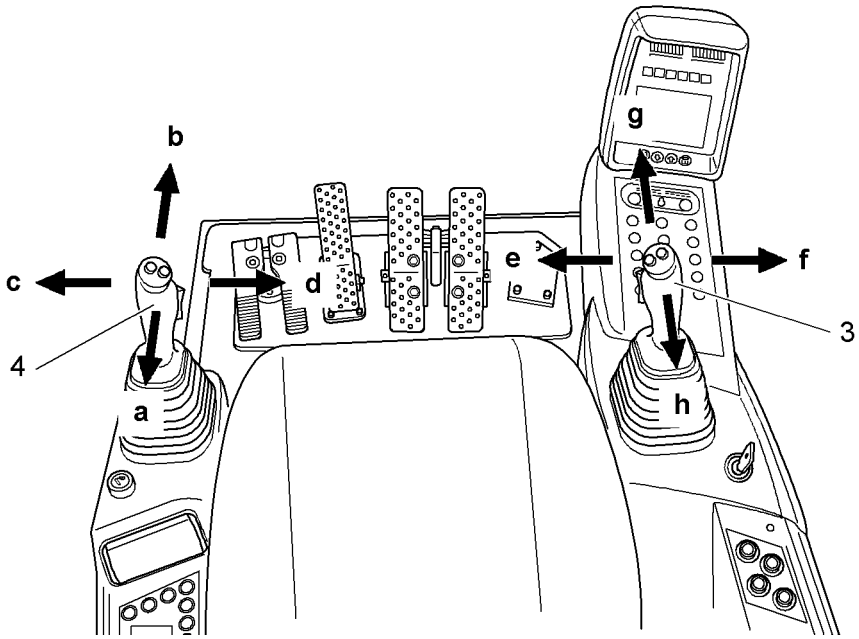

Fig. 3-3 *Joystick, right (**3**) and left (**4**)*

Standard control

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

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

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

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

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

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3.1.3 Keypad

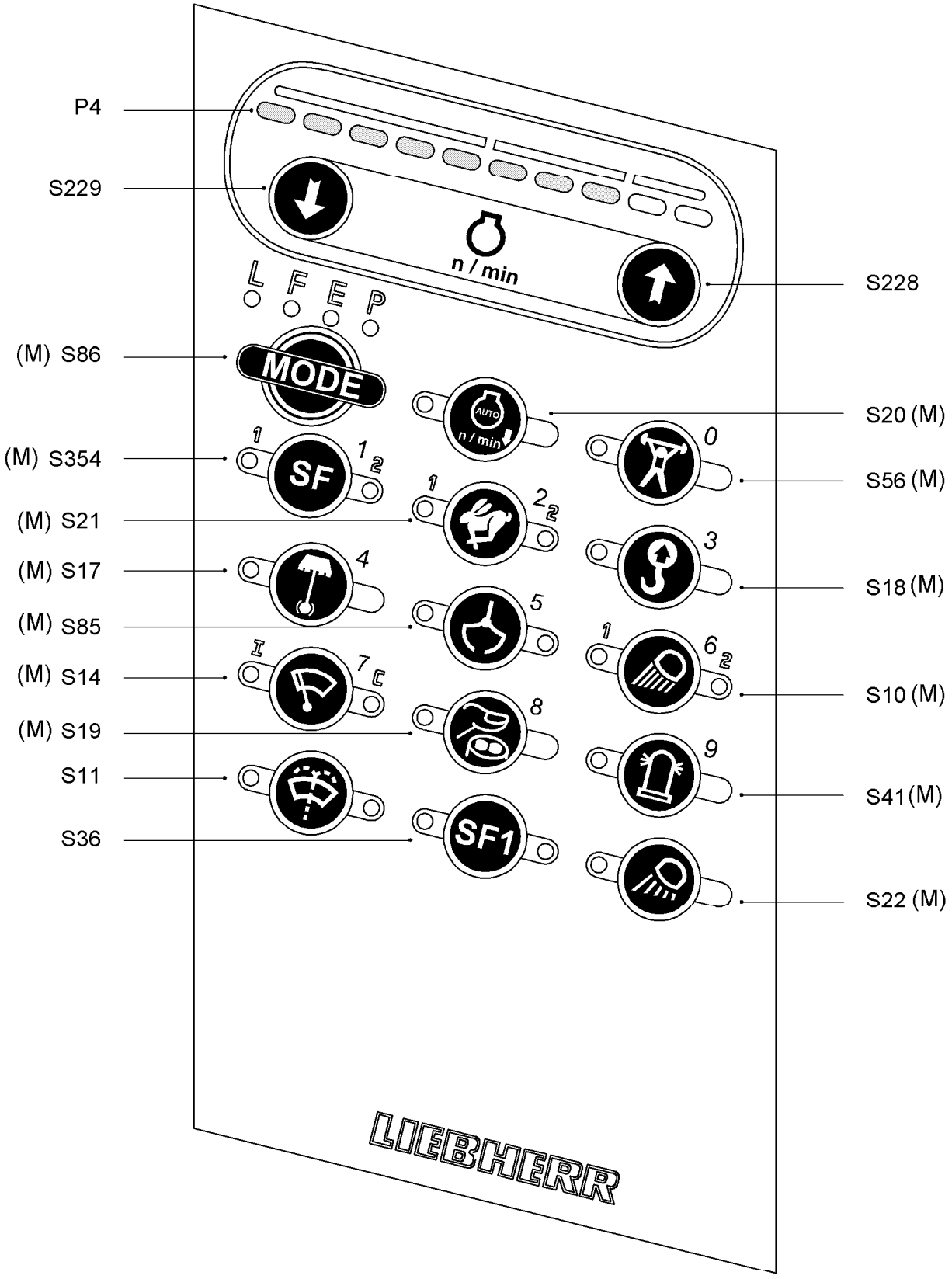

Fig. 3-4 *Excavator keypad*

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Note !

The function of the push buttons market with (M) are memorized when stopping the excavator. This means that the controled function recovers the previous state (on, off, 1/2, L/H,...) before the machine had been turned off

S10 - **Driving light** / **Equipment headlight**

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

S11 – **Windscreen washing unit**

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

S14 – **Windscreen washer**

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

S17 – **Slewing gear brake**

- ▶ Press switch.
  - ↳ Slewing gear brake is engaged.
  - ↳ Upper carriage is locked.
  - ↳ LED in the switch illuminates.
- ▶ Press switch again.
  - ↳ Slewing gear brake is released.
  - ↳ LED in the switch goes out.

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S18 – Overload warning device (optional)

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

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

❑ No overload warning device is built in.

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

  ↳ LED in the switch illuminates.

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

S19 – Additional function release (optional)

▶ Press switch.
  ↳ Additional function (eg. rotating grab) is activated.
  ↳ LED in the switch illuminates.

▶ Press switch again.
  ↳ Additional function is deactivated.
  ↳ LED in the switch goes out.

S20 – Automatic idling

▶ Press switch.
  ↳ Automatic idling is activated.
  ↳ LED in the switch illuminates.

▶ Press switch again.
  ↳ Automatic idling is deactivated.
  ↳ LED in the switch goes out.

S21 - High speed gear

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

While driving, the machine will automatically transfer from normal drive to fast drive. LED 2 illuminates after transfer to fast drive.

▶ Press switch again.
  ↳ Transfer from normal drive to fast drive is deactivated.
  ↳ LED 1 in the switch goes out.

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S22 - Additional headlight (optional)

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

S36 – Special function 1 (optional)

Configuration and activation according to kit.

S41 – Rotating beacon (optional)

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

S56– Primary pressure increase (optional)

- ▶ Press switch.
  - ↳ The opening pressure of the primary relief valve is higher.
  - ↳ The force on the working attachment is increased and simultaneously, the movements of the machine become slow.
  - ↳ LED in the switch illuminates.
- ▶ Press switch again.
  - ↳ The opening pressure of the primary relief valve is set back at its initial value.
  - ↳ LED in the switch goes out.

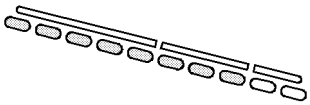
S85 – Grapple operation (optional)

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

S86– Mode selection, speed adjustment

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

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



P4– Engine speed display

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

S228 – Increase speed

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

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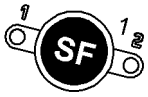
S229 – Decrease speed

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



S354– Super Finish (quantity reduction)

▶ Press switch.
  ↳ The quantity reduction set using the operator's menu is active.
  ↳ LED 1 in the switch illuminates.
  ↳ The symbol ® appears in the TI field, if quantity reduction <= 99%

▶ Press switch again.
  ↳ Quantity reduction is deactivated.
  ↳ LED 1 in the switch goes out.
  ↳ If the symbol turns black 🗁 = 100%

3.1.4 Monitoring display

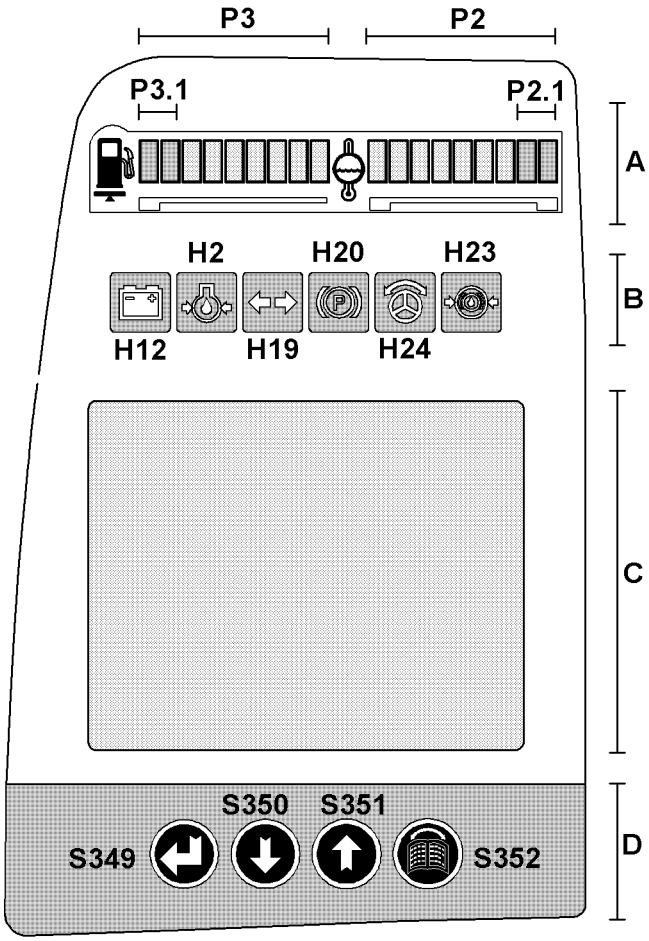


Fig. 3-5 *Monitoring display*

A Analog-value display
B Indicator lights
H24 Telltale light steering
P2 Coolant temperature display

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C	LCD screen	**P2.1**	Coolant temperature display red area
D	Menu control buttons	**P3**	Fuel level display
H2	Telltale light, engine oil pressure	**P3.1**	Fuel level display red area
H12	Telltale light, battery	**S349**	Back button
H19	Telltale light indicator	**S350**	Down button
H20	Telltale light parking brake	**S351**	Up button
H23	Telltale light service brake accumulator pressure	**S352**	Menu button

Area A : Analog-value display

P2 –Diesel engine coolant temperature display

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

In the event of overheating (over 100 ºC during more as 3 seconds), the red LEDs **P2.1** at the end of indicator **P2** light up.

Simultaneously, the buzzer in the cab also sounds and the error will be saved as error code **E 503**.

The engine power is automatically reduced.

▶ Stop working as soon as possible.

▶ Allow the engine to continue to idle high.

❑ If the alarm warning exceeds 60 seconds.

▶ Allow the engine to low idle for another 3 to 5 minutes.

▶ Switch off the engine.

▶ Find and correct the cause of the problem.

❑ If the overheating is stronger (over 104 ºC during more as 7 seconds), the corresponding symbol is displayed on the main screen and the error will be saved as error code **E 523**.

▶ Switch off the engine immediately.

P3 – Fuel level display

The display's illuminating LEDs indicate the amount of fuel remaining in the tank.

When the red LEDs **P3.1** illuminate, a reserve quantity of 10-20% is still in the tank, depending on the type of machine.

Area B :Indicator lights

H2 – Indicator light, low engine oil pressure

The indicator light illuminates if the engine oil pressure drops below a given value during more than 3 seconds when the machine is operating.

The buzzer in the cab also sounds.

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

▶ Bring the engine to a low idle immediately.

▶ Switch off the engine immediately.

❑ If the pressure remains too low for 5 other seconds, the corresponding symbol is displayed on the main screen and the error will be saved as error code **E 522**.

▶ Find and correct the cause of the problem.

H12 –Indicator light, battery charge

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

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

When the machine is operating, this indicator light illuminates if the alternator belt or the electrical charging system are defective.

▶ Bring the engine to a low idle immediately.

▶ Allow the engine to idle for approximately 5 seconds.

▶ Switch off the engine.

▶ Find and correct the cause of the problem.

H19 – No function

H20 –No function

H23 – No function

H24 – No function

Area B : Menu control buttons

Fig. 3-6 *Menu control buttons*

The screen can be operated using the following 4 buttons:

– **S349**: **Back** button

– **S350**: **Down** button

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– **S351**: **Up** button
– **S352**: **Menu*** button
* = Change from main to submenus

These buttons can be used to jump from the main menu to the submenus or to move from page to page.

Area C: LCD Screen

To change the screen contrast:

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

To alter the brightness of the main screen:

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

Note!
A light sensor built in to the top left of the monitoring screen adapts the illumination on the main screen to the brightness of the environment. The adaptation is done from saved set 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** buttons simultaneously.

▶ Turn on the ignition again.

▶ Release the buttons once the automatic check is completed.

3.1.5 Main screen (Software R5.6 V4.0)

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

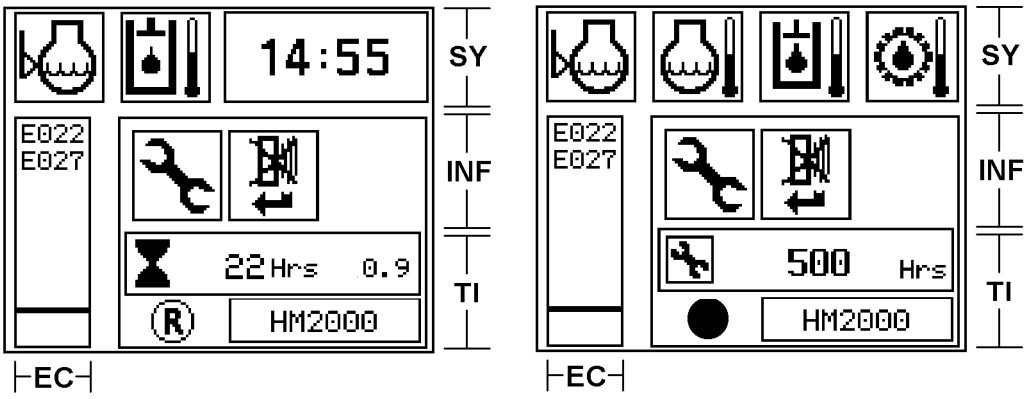

Fig. 3-7 *Main screen*

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

Main screen design

SY field

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

If more than 4 symbols must be shown, then every 10 seconds, the symbols move to the left by one symbol. (siehe Kap. , "Warning symbols in the SY field" auf Seite 13).

EC field

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

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

INF field

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

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

The information is displayed in graphic or text form and indicates specific operating states on the machine. (siehe Kap. , "Information symbols in the INF field" auf Seite 15).

TI field

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

The symbol ® is displayed when an external flow limitation (function "set option") is activated (siehe "Status of hydraulic pumps and electrical inputs and outputs menu" auf Seite 22).

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

After having selected a tool (siehe Kap. , "Menu "Tool Control"" auf Seite 19), the name of the tool is displayed (for example HM200).

Menu navigation in the event of an error display

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

Depending on the error (level of urgency), the buzzer will sound either continuously

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or in short consecutive bursts. This symbol will be displayed in the INF field.

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

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

Warning symbols in the SY field

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

Code - Designation - Consequences - Intervention	Code origine	Sensor
E 501 – Diesel engine oil to low - Warning stage The buzzer sounds after 2 sec. ▶ Engine is stopped after the next 5 sec. ▶ Localise the leak and carry out repairs.	**EDC 3031**	**B5**
E 502 – Coolant low The buzzer sounds simultaneously. ▶ Engine is stopped automaticaly after 5 sec. ▶ Localise the leak and carry out repairs.	**EDC 3032**	**B3**
Caution! This monitoring device acts as an increased level of security in case of larger amounts of water loss (e.g. hose rupture). It does not relieve the operator or maintenance personnel from the responsibility of regularly checking the coolant level in the equalizing reservoir.		
E 503 – Coolant overheat - Warning stage This symbol appears simultaneously with the **P2** coolant temperature display. The buzzer sounds simultaneously. ▶ the engine idle is lowered after 3 sec. ▶ Pump rocks into Qmin ▶ Localise the leak and carry out repairs.	**EDC 3038**	**B2**

E 504–Hydraulic oil level low

The buzzer sounds simultaneously.

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

BST **B14**

E 505 –Hydraulic oil overheat

This symbol appears if the hydraulic oil temperature in the tank exceeds 98 °C.

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

BST **B8**

E 506 – Splitterbox oil overheat

This symbol appears if the oil temperature in the splitter-box exceeds 100 °C.

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

BST **B15**

E 511 – Over voltage for the BBT

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

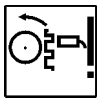
BBT

E 520 – Overspeed of diesel engine - Safety stage

This symbol appears if the RPM **diesel** engine is too high.

- ▶ The engine shut off automatically.
- ▶ Localise and rectify the error (Customer Service)

EDC 3004 **B12-1** **B12-2**



E 521 – Defect of both engine RPM sensors

This symbol appears if **both engine RPM sensors are simultaneously defective**.

- ▶ The engine shut off automatically.
- ▶ Remplace the **RPM sensor** (Custoner Service)

EDC 3001 + EDC 3002 **B12-1** **B12-2**

if one of the both sensor is defective

- ▶ the engine does not shut off.
- ▶ Remplace the **RPM sensor** (Custoner Service)

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E 522 – Low engine oil pressure - Safety stage

The buzzer sounds simultaneously.

▶ The engine shut off automatically after 7 sec.

▶ Localise and rectify the error (refill the hydraulic oil,...)

EDC 3041 **B5**

E 523 – Coolant overheat - Safety stage

The buzzer sounds simultaneously.

▶ The engine shut off automatically after 7 sec.

▶ Localise and rectify the error (refill the hydraulic oil,...)

EDC 3048 **B2**

E 524 – Boost air overheat - Safety stage

The buzzer sounds simultaneously.

▶ The engine shut off automatically after 7 sec.

▶ Localise and rectify the error (refill the hydraulic oil,...)

EDC 3049 **B98**

E 525 – Engine in safety mode

This symbol appears if the engine is in safety mode control and simultaneously with one of the following engine error E501, E503, E522, E523, E524 or E597.

The buzzer sounds, H60 lamp lights on

▶ The engine shut off automatically after 7 sec.

▶ Localise and rectify the error (refill the hydraulic oil,...)

BBT **B2 B5 B98**

E 597 – Boost air overheat - Warning stage

The buzzer sounds simultaneously.

▶ the engine power is reduced after 3 sec.

▶ Localise and rectify the error (refill the hydraulic oil,...)

EDC 3039 **B98**

Quick change adapter (optional extra)

This symbol appears during the unlocking process or when the locking pins are retracted. No error codes are displayed.

Information symbols in the INF field

Preheating on

This symbol appears while preheating is taking place.

Preheating off

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

Manual diesel speed adjustment

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

Service due

This symbol appears if a service interval is due.

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

Acknowledge error

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

Parking brake and swing gear brake operation changed.

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

“Increased care required” note: Operation changed

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

Servo control operation changed

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

Overload warning device (optional extra)

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

No overload warning device present

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

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

Main screen menu selection

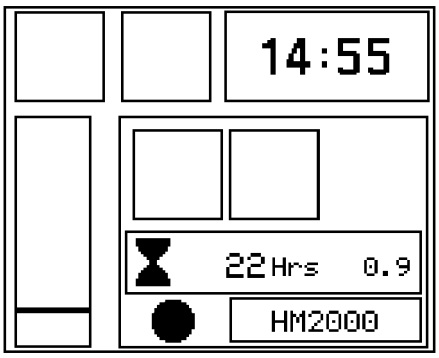


Fig. 3-8 *Main screen*

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

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

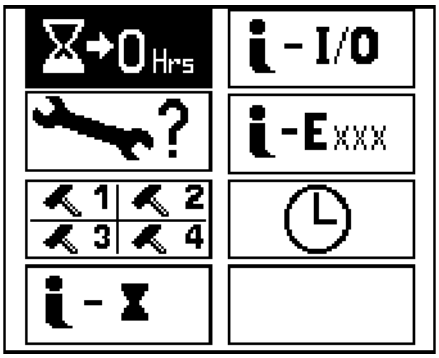


Fig. 3-9 *Menu selection in the operator's menu.*

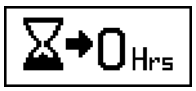
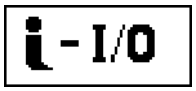
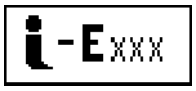
To select the operator's menu:

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

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

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

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

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

Tab. 3-1

Tab. 3-2 *Overview of menu options*

Reset daily operating hours counter menu

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

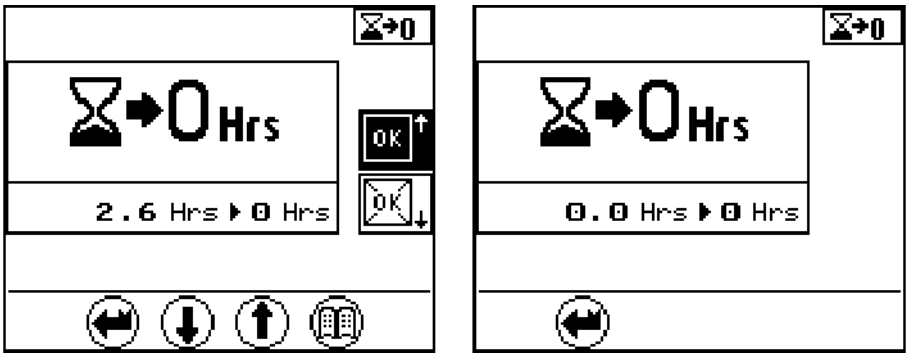


Fig. 3-10 *Resetting the daily operating hours counter*

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

▶ Press the **Menu*** button.
  ↳ The operating hours will be reset to 0.
  ↳ The arrow key symbols **Up** and **Down** and the **Menu** symbol will no longer be displayed.

To exit the menu:

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

Change work speed to SF mode menu

The work speed of the excavator equipment can be set using this menu.

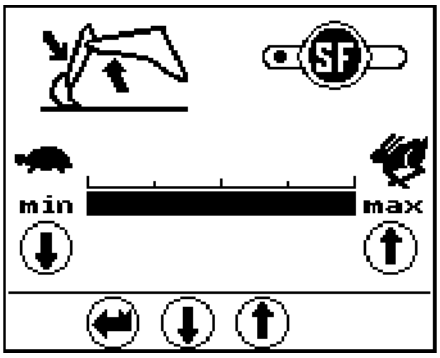


Fig. 3-11 *Work speed to SF mode menu*

As soon as this menu is visible on the main screen:
– Switch **S354 (Super Finish)** is activated.
– The work speed can be tested immediately using the joystick.

To set the work speed:

❑ Press switch **S354**.

▶ Press the **Up** or **Down** arrow key.
  ↳ Set the desired work speed. The quantity can be limited to up to 50 % of the maximum capacity.

▶ Press the **Back** button.

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- ↳ The submenu will be aborted.
- ↳ The selected work speed is activated.
- ↳ LED 1 in switch **S354** illuminates.
- ↳ The symbol ® appears in the S1 field on the main screen (siehe Fig. 3-8)

▶ Press switch **S354**.
- ↳ Quantity reduction is deactivated.
- ↳ LED 1 in the switch goes out.
- ↳ The symbol turns black ● = 100%

Confirm service interval menu

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

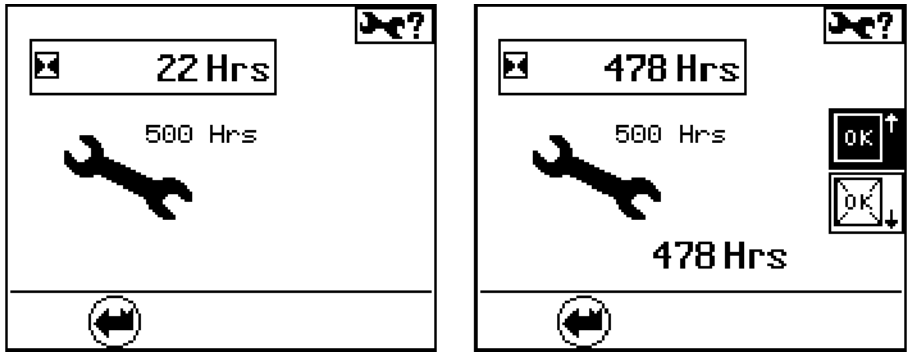

Fig. 3-12 *Service intervals menu*

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

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

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

❑ Service work carried out.

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

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

❑ Service work not carried out.

▶ Press the **Back** button.

The sub-menu will be aborted.

Menu "Tool Control"

Allocation of flow and pressure limitation options to external input I1

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

ample).

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

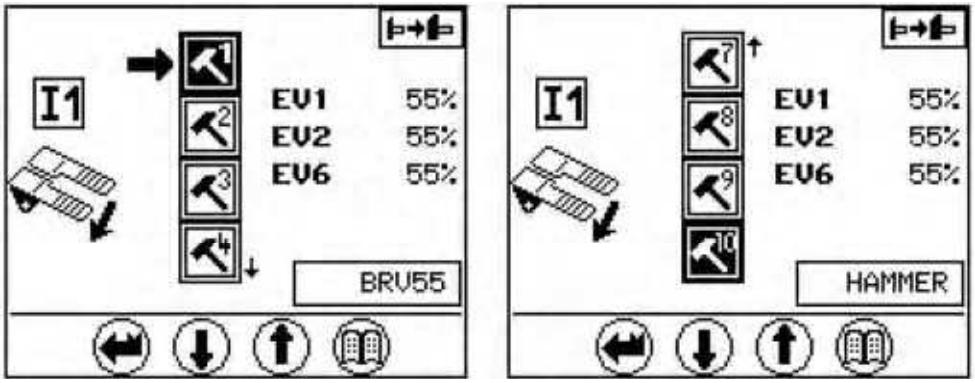

Fig. 3-13 *Menu "Tool Control"*

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

The black field represents the active option.

- ▶ Press the **Up** or **Down** arrow key.
  - ↳ A different, predefined option displayed with the arrow (1-10) can be assigned (e g. when work equipment is changed).
- ▶ Press the **Menu** button.
  - ↳ The selection is confirmed. The active option field is black (in this example Option 1 "HM2000").

To exit the menu:

- ▶ Press the **Back** button.
  - ↳ The sub-menu will be aborted.
  - ↳ In the main screen the name of the chosen option (HM2000) is displayed.
  - ↳ The tool will be supplied with the reduced pressure and the reduced flow predefined for the option 1.

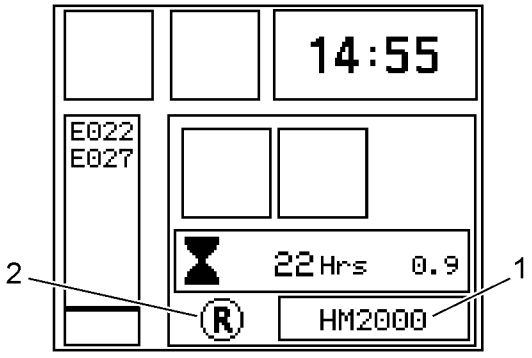

Fig. 3-14 *Main screen, The chosen option is displayed*

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1 Chosen option (tool)

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

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

Operating hours menu

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

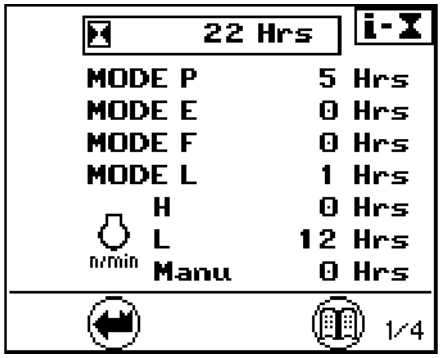

Fig. 3-15 *Engine service life menu (example)*

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

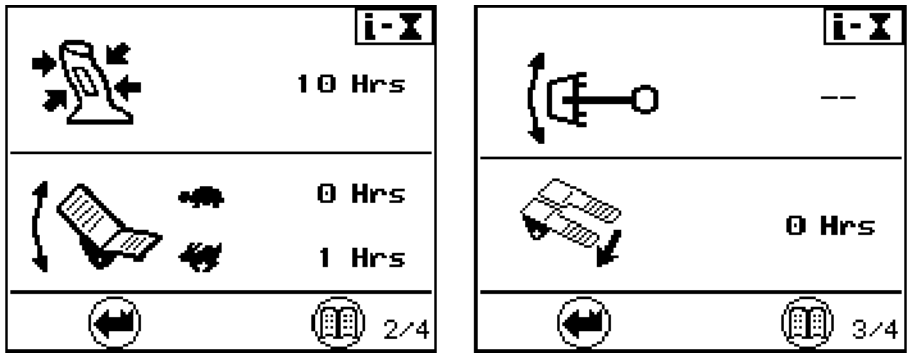

Fig. 3-16 *Service life for travelling motion menu*

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

Page 2 provides the service life in hours for:
– Equipment movements using the joystick
– Travelling motion using the accelerator pedal in crawling and fast modes

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

Page 3 provides the service life in hours for:

– Swing movements of the swing gear (no activation from device type A 934).
– Additional attached equipment operated via the foot pedals

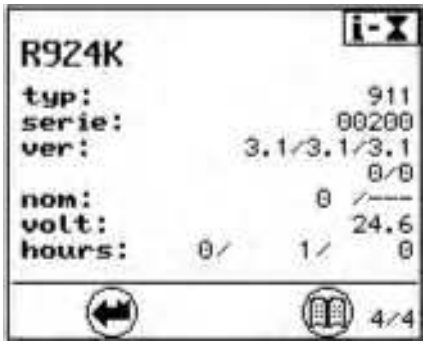

Fig. 3-17 *Technical data*

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

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

– The excavator type, including type and serial number (type, series)
– The design condition of the control which is currently built in (ver)
– The rated speed and the number of teeth on the starter crown (nom)
– The current operating voltage (volt)
– The operating hours for electrical inputs (not used for this machine)

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

To exit the menu:

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

i-I/O

Status of hydraulic pumps and electrical inputs and outputs menu

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

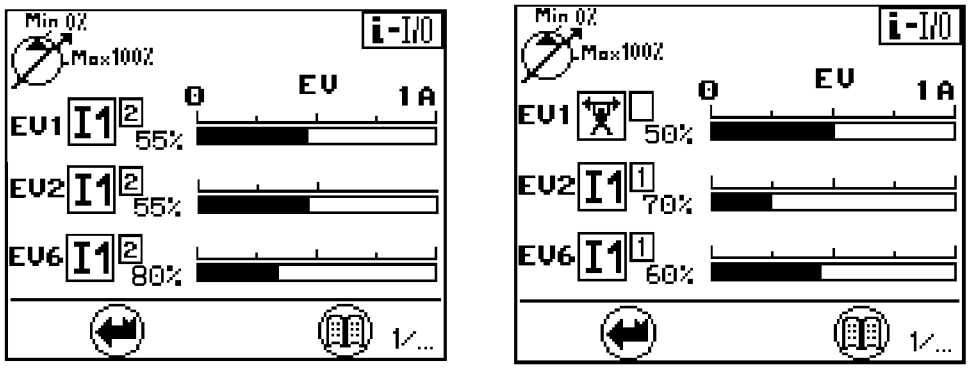

Fig. 3-18 *Flow and pressure limitation menu*

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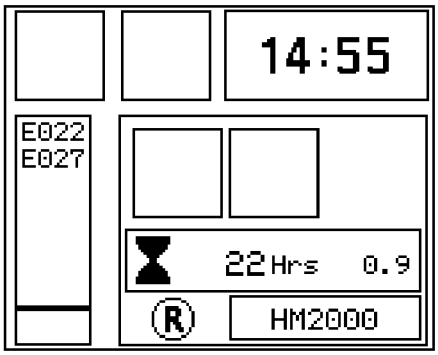

Fig. 3-19 *Main screen when an external limitation is active*

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

– On the left picture, an external limitation (Hardware input I1, option1) is activated (siehe Fig. 3-18 auf Seite 22). The current supplying the solenoid valves is limited at 55% of its maximal value. When an external limitation is activated, the symbol "R" is displayed in the TI field of the main screen, (siehe Fig. 3-19 auf Seite 23).

– On the right picture, an internal limitation (Pressure increase) and an external limitation (Hardware input I1, option1) are simultaneously activated. When several flow limitations are activated at the same time, the one with the smallest value is decisive for the hydraulic pump. In this case, the symbol "R" is displayed in TI field of the main screen. If just internal limitation are activated, the symbol "R" will be changed in "●". The choosen tool is shown on the main menu (for ex. "HM2000")

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

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

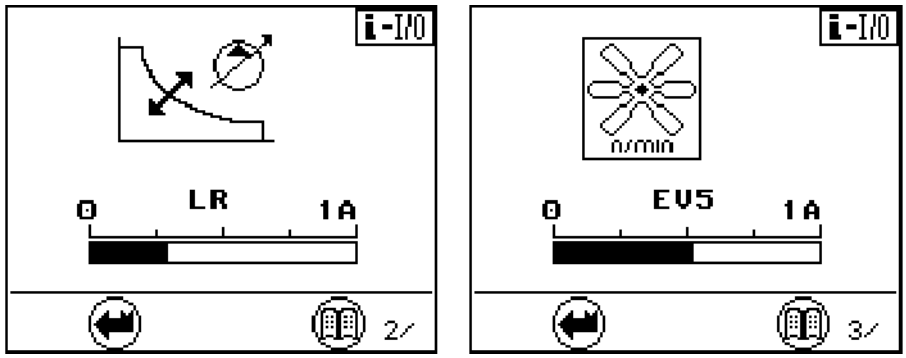

Fig. 3-20 *LR magnet and fan speed current values menu*

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

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

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

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

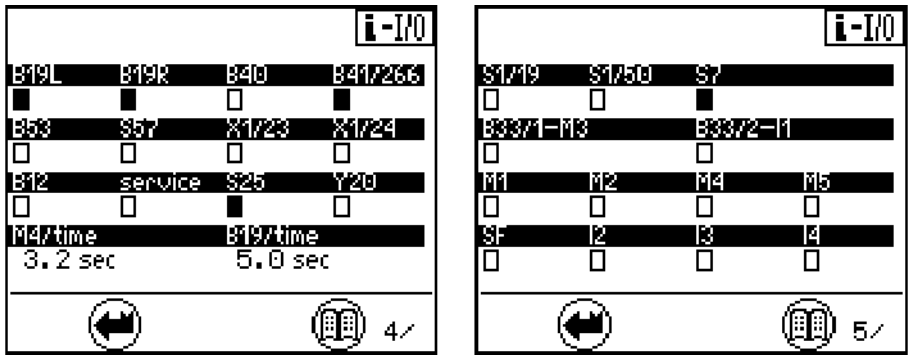

Fig. 3-21 *Electrical inputs*

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

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

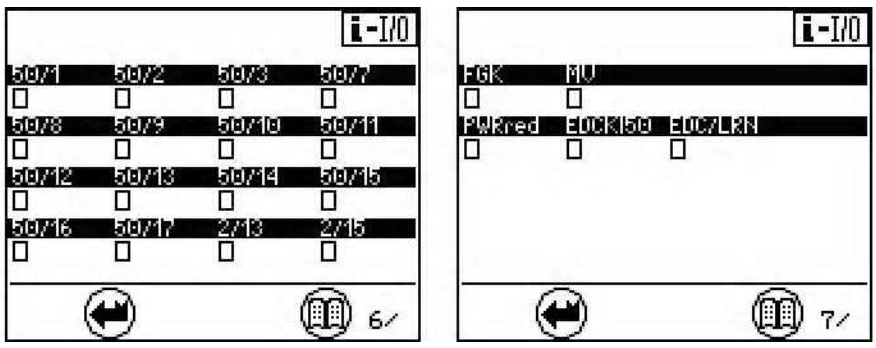

Fig. 3-22 *Electrical inputs*

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

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

Pages 4 to 7 provides an overview of the status of different electrical inputs.

A "□" means "Input not active".

A "■"means "Input active".

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

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

The screen 7 gives information about the EDC control system :

FGK : state of preheat plug.

MV : state of electrovalve.

PWRred : state of RPM engine reduction.

EDCK150 : state of starter.

EDC/LRN : state of pump regulation.

To exit the menu:

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

Error menu (operating errors and electrical system errors)

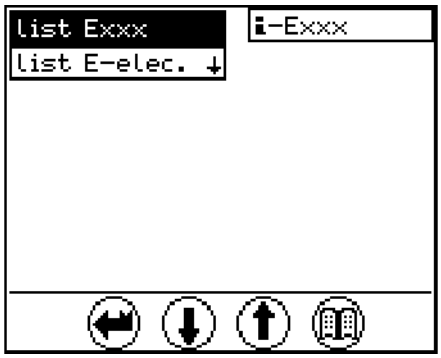

Fig. 3-23 *Recorded errors menu*

There are 3 selection options in this menu:
– By selecting **list Exxx**, machine errors recorded by the sensors are listed.
– By selecting **list E-elec**, all main screen cable errors stored when operating are listed.
– By selecting **list S-Exxx**, all errors which appeared when the service connector was connected are listed.

To select the desired error type:

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

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

Machine error list Exxx:

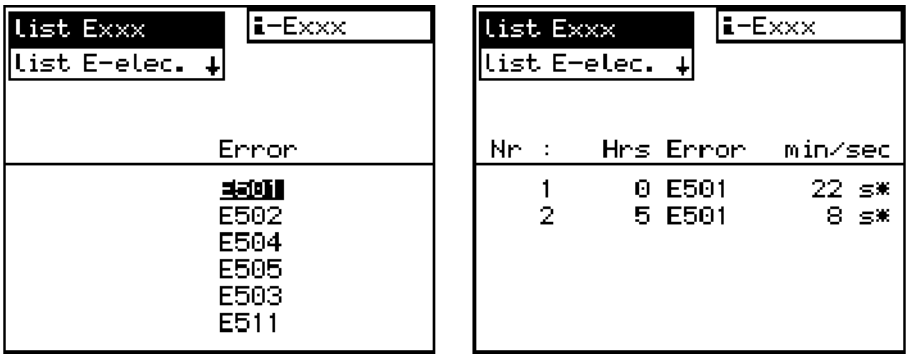

Fig. 3-24 *Error list (Fig. left) and Error occurrence (Fig. right) menu*

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

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

- Use the **Down** or **Up** arrow key to select the error code desired.
- Press the **Menu** button again.
  The second page of the sub-menu appears.

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

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

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

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

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

Cable error list E-elec.:

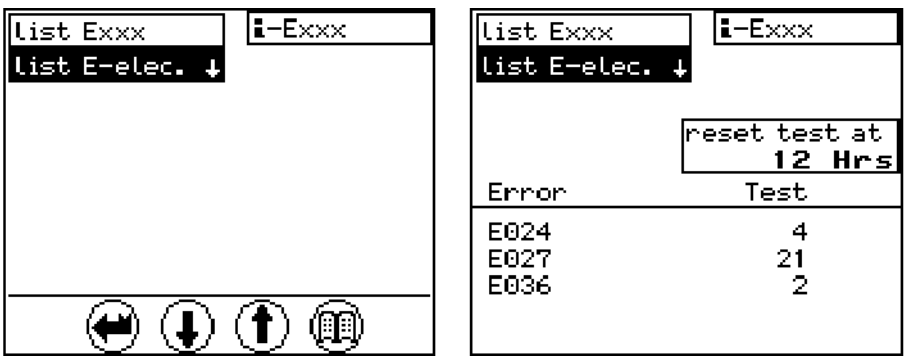

Fig. 3-25 *Occurrence of electrical error (Fig. left) and Error statistics (Fig. right)*

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

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

All electrical errors and their error code are listed.

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

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

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

Other errors list S-Exxx:

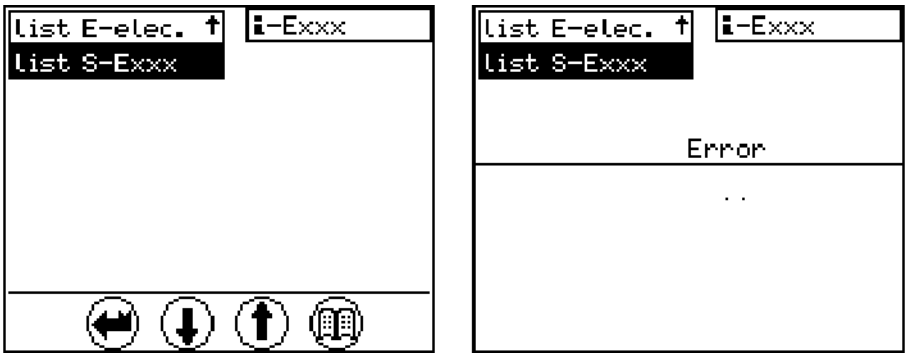

Fig. 3-26 *Call up service operation error list menu*

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

Set time menu

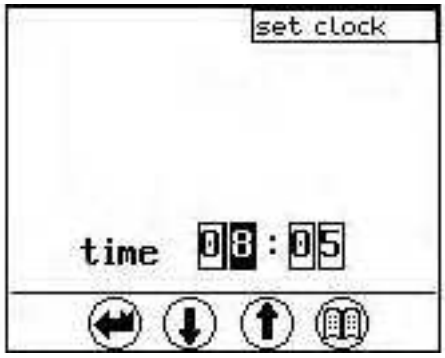

Fig. 3-27 *Clock setting*

▶ After selection of the function the digit completely right is inversely displayed.

▶ Press key **UP** or **DOWN** to adjust the selected digit.

▶ Press **MENU key to select the next digit.**

▶ Press the **Enter** key to store the set number.
↳ on screen appears shortly to confirm "update xx: xx".

3.2 Access and equipment of the cab

3.2.1 Safely getting up.

- Proceed with the the same precautions to climb up or down onto the machine, as to instal yourself.
- When getting up or down, position the machine on even, horizontal ground. The upper structure should be positioned with the chassis in such a way that the steps and ladders are aligned with each other.
- Ensure that steps, ladders and hand-rails (grips) are in good condition. In particular, you should ensure that they are free of dirt, oil, ice and snow.
  NOTE: To ensure that the doors open properly in all weather conditions, the door seals must be dusted with talc or silicon at least every two months or more often if required. The door hinges and locks should be greased regularly.
- Face the machine when getting in or out and always use three-point support, i.e. two hands and one foot or two feet and one hand must always be in contact with the access system at the same time.
- If you are able to reach the door handle with your free hand, open the doors before you climb any higher. External influences, such as wind, can make it more difficult to open doors. Because of this, always use your hand for control when opening doors. Ensure that the door is latched open to prevent it slamming open and shut.
- In case of bad weather conditions, be particulary vigilant to realise the climbing and descent from the cab with the best safety conditions, and do or give the instuctions to the execution of prior preparations to be accomplished, as enunciated above, in order to displace yourself safely.
- Be particulary vigilant with those prerequisites conditions.
- 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 doors and fasten the safety belt (if available), unlock the door, using the planned lever, and close it immediately using the door handle, befor tilting down the safety lever, and start the machine.
- If you wish to work with the door open, it is necessary to fasten your safety belt. If unavailable, let it be instaled before working with the door open.

3.2.2 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 chassis 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.

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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.

3.2.3 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:

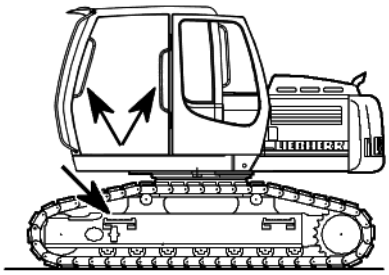

Fig. 3-28 *Climb up using the handholds*

Getting in

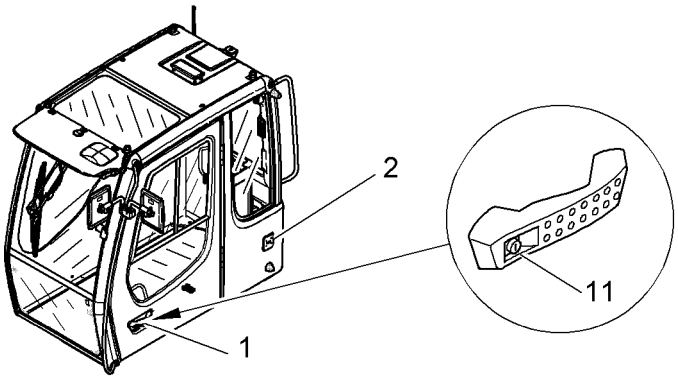

Fig. 3-29 *Door - exterior*

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.

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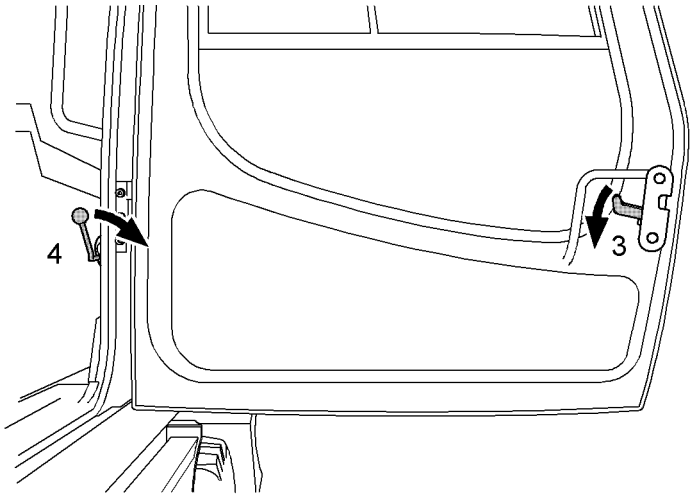

Fig. 3-30 *Door - interior*

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.

3.2.4 Safety lever

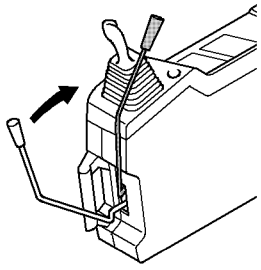

Fig. 3-31 *Safety lever*

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

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

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

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

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

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

3.2.5 Operator's seat

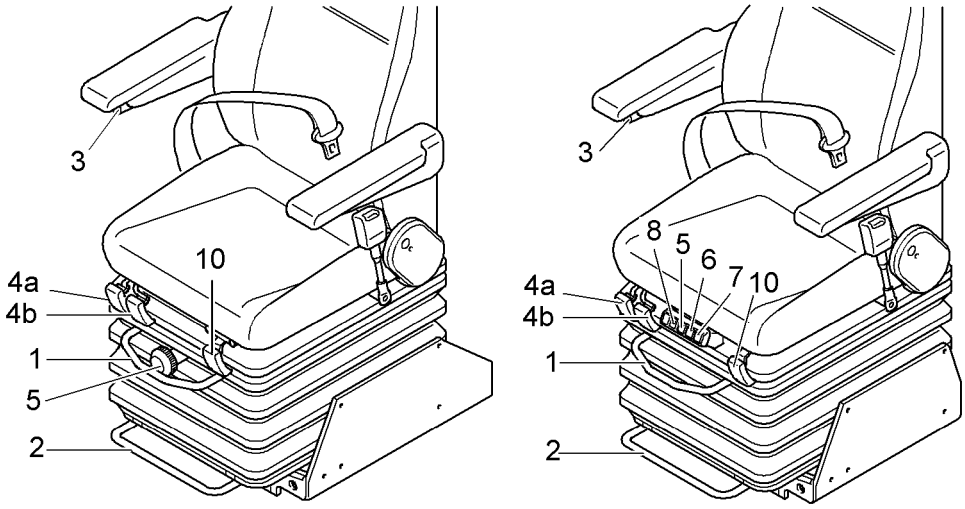

Fig. 3-32 *Standard operator' seat (Fig. left) and air-cushioned (Fig. right, optional extra)*

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

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

– The diesel engine may not be started.
– The safety lever must be pushed up.

This will avoid unexpected movement of the machine.

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Setting the armrests

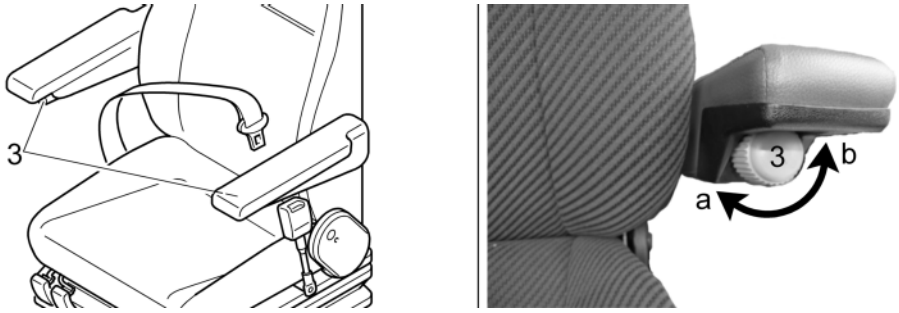

Fig. 3-33 *Setting the armrests*

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

Setting the seat and backrest

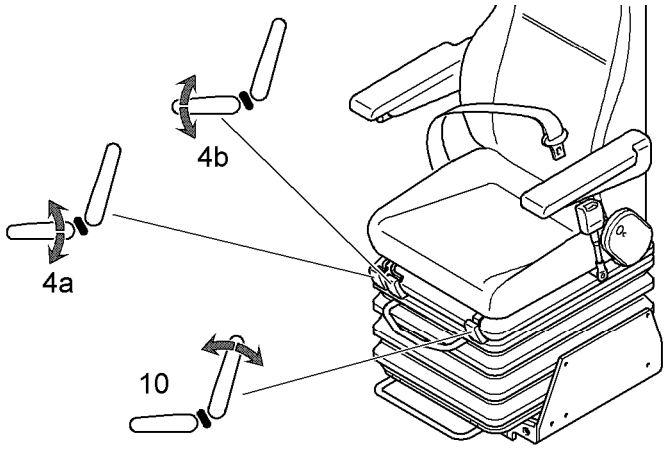

Fig. 3-34 *Setting the seat and backrest*

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

Setting the horizontal seat position

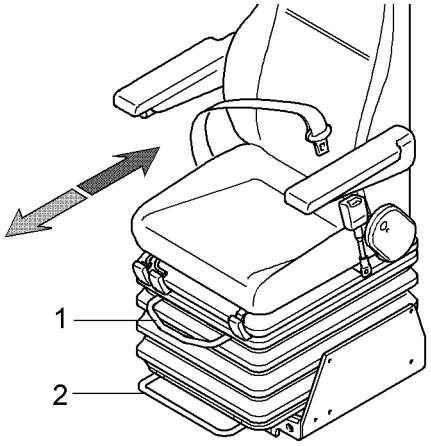

Fig. 3-35 *Setting the horizontal*

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

Setting the seat springs

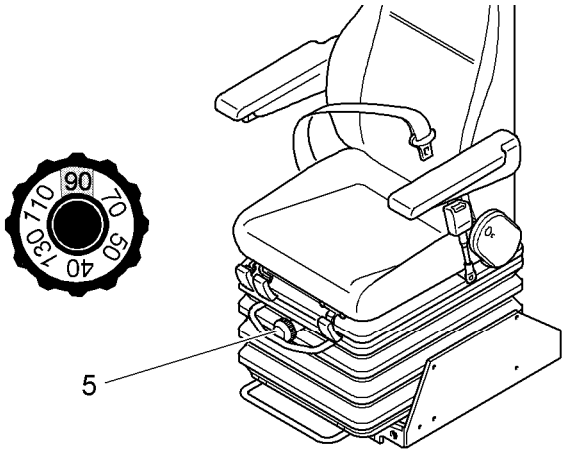

Fig. 3-36 *Setting the seat springs*

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

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Options setting (optional extras)

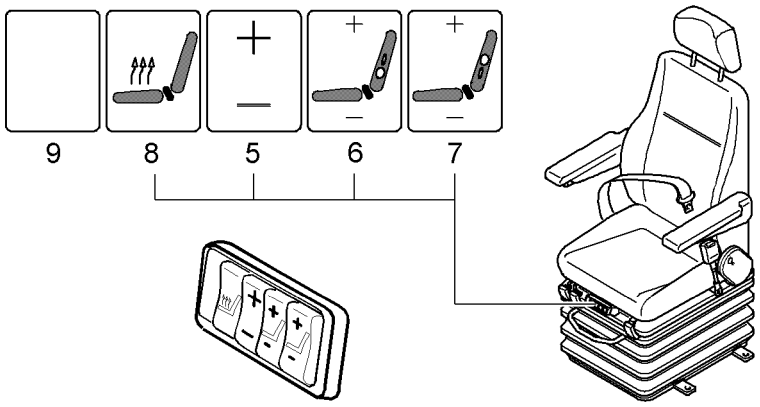

Fig. 3-37 *Switch bar on the air-cushioned operator's seat*

To set the vibration damping:

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

To set the lumbar support:

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

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

To set the seat heating:

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

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

Putting on / releasing the safety belt

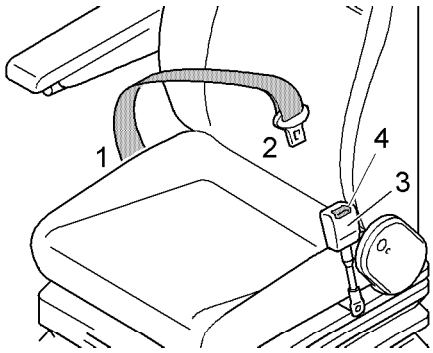

Fig. 3-38 *Safety belt*

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

▶ Pull the belt and buckle **2** out of the roller mount **1**.
  ⇘ If pulled out of the roller mount sharply, the belt may lock.

▶ Push the buckle into the belt lock **3** until it fastens.

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

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

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

Vibration damping

The seat complies with ISO 7096.

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

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

3.2.6 Windscreen

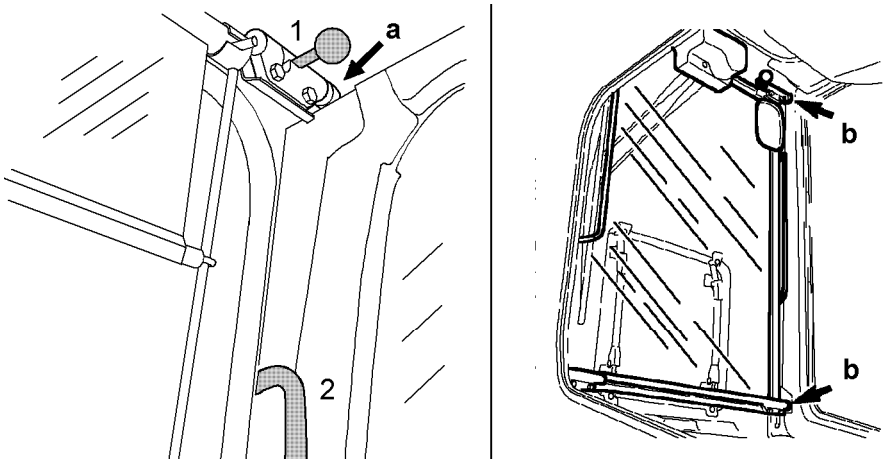

Fig. 3-39 *Windscreen*

The windscreen can be positioned in two ways.

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

- ▶ Pull bar **1** in and down.
  ↳ The window is unlocked.
- ▶ Move the windscreen with the bracket **2**, secure in one of the two window positions (**a** or **b**) and relock using bar **1**.

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3.2.7 Sunshade

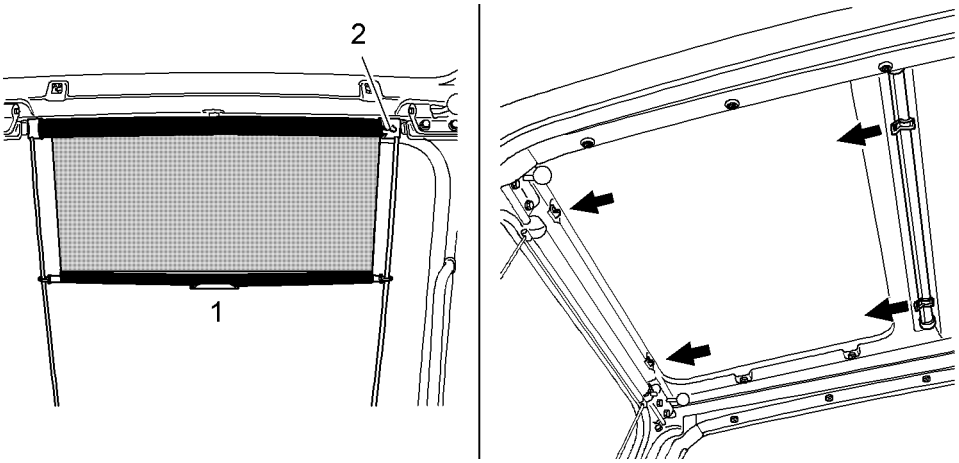

Fig. 3-40 *Windscreen and cab roof sunshade*

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

Windscreen

- ▶ Pull the sunshade down using the cross strut **1**.
  ↳ The sunshade can be set for individual use.
- ▶ Press button **2** (red).
  ↳ The sunshade rolls itself up.

Cab roof

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

3.2.8 Emergency exit – rear window

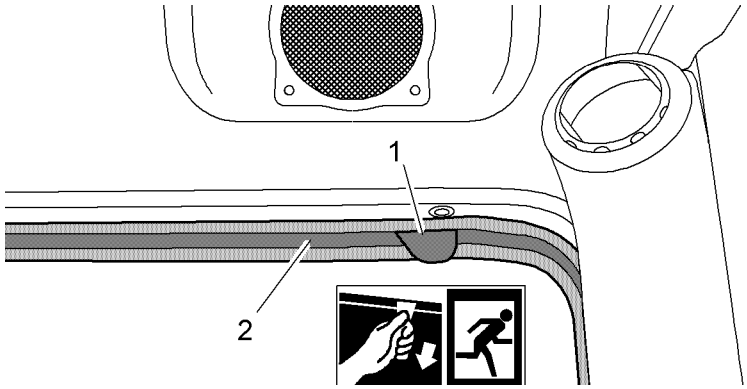

Fig. 3-41 *Emergency exit – rear window*

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

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

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3.2.9 Interior lighting

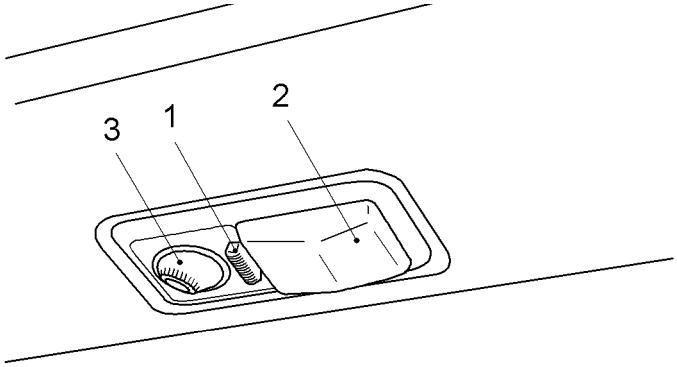


Fig. 3-42 *Interior lighting*

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

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

3.2.10 Fire extinguisher*

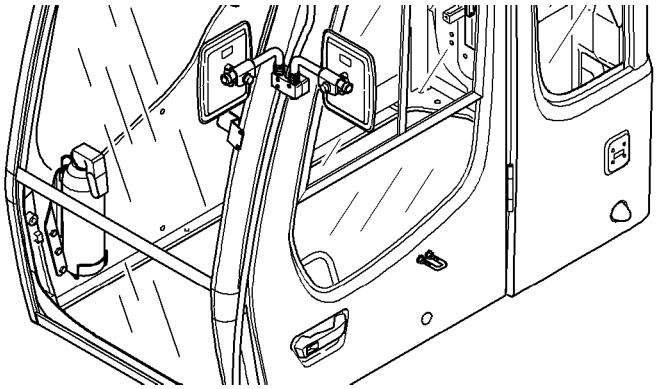


Fig. 3-43 *Fire extinguisher / First-aid box*

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

*Owner regulations

3.2.11 Windscreen wiper

Windscreen wiper

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

- ▶ Press switch.

↳ Intermittent switching
↳ LED I in the switch illuminates.

▶ Press switch again.
↳ Continuous operation.
↳ LED C in the switch illuminates.
↳ LED I in the switch goes out.

▶ Press switch again.
↳ Windscreen wiper is switched off.
↳ LED C in the switch goes out.

Setting the interval time for the intermittent switching

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

❑ Press the switch until the windscreen wiper is switched off (LED I in switch goes out)

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

▶ Release the switch when the desired interval time has been reached.
↳ The interval time can be set to between 2 and 10 seconds.

Windscreen washing system

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

▶ Press and hold button.
↳ Washing water will be sprayed onto the windscreen through the outlet nozzles.
↳ The windscreen washer runs continuously.

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

Windscreen washing fluid container

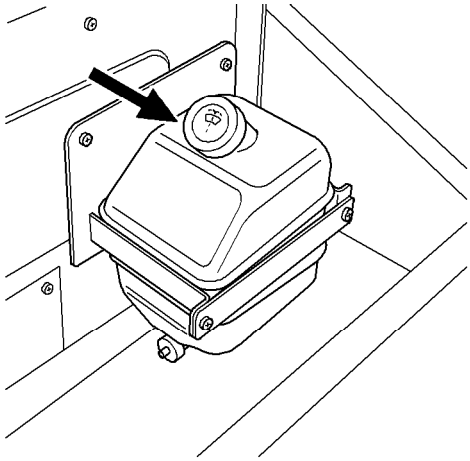


Fig. 3-44 *Windscreen washing fluid container*

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

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

Volume: see lubricant chart

Window washer on the cab roof (optional extra)

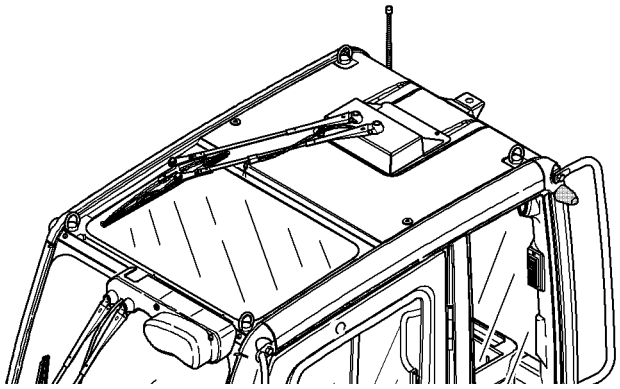
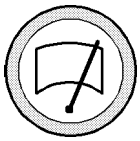


Fig. 3-45 *Window washer on cab roof*

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

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

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



3.2.12 Lighting

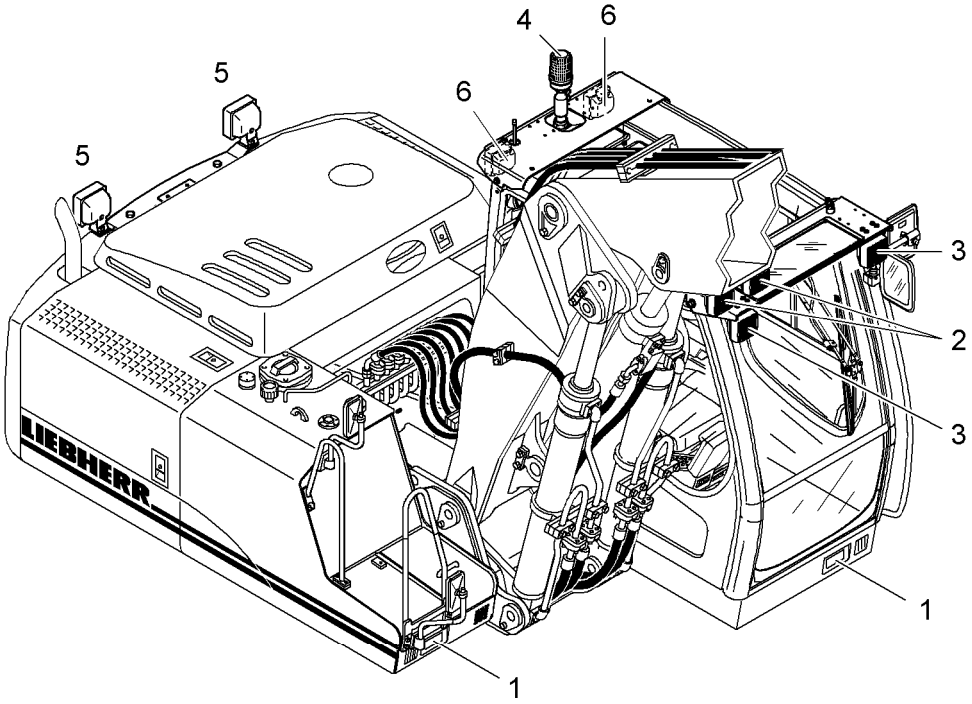


Fig. 3-46 *Arrangement of lighting*

1 Driving light
2 Equipment headlights
3 Front roof headlight (optional extra)
4 Rotating beacon (optional extra)
5 Headlights on ballast weight (optional extras)
6 Roof headlights, rear (optional extra)

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Driving light, equipment headlight

The driving light and the equipment headlight are switched on by pressing switch **S10**.

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

Additional headlight (optional extra)

Pressing switch **S22** when the ignition is on switches on the additional headlights.

- ▶ Press the switch.
  - ↳ Additional headlights are switched on.
  - ↳ LED in switch illuminates.
- ▶ Press switch again.
  - ↳ Additional headlights are switched off.
  - ↳ LED in the switch goes out.

Rotating beacon (optional extras)

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

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

Roof headlights, rear (optional extras)

Pressing switch **S275** on the right control panel switches on the roof headlights at the rear on the cab.

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

3.2.13 Heating and Air conditioning system

Overview

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.

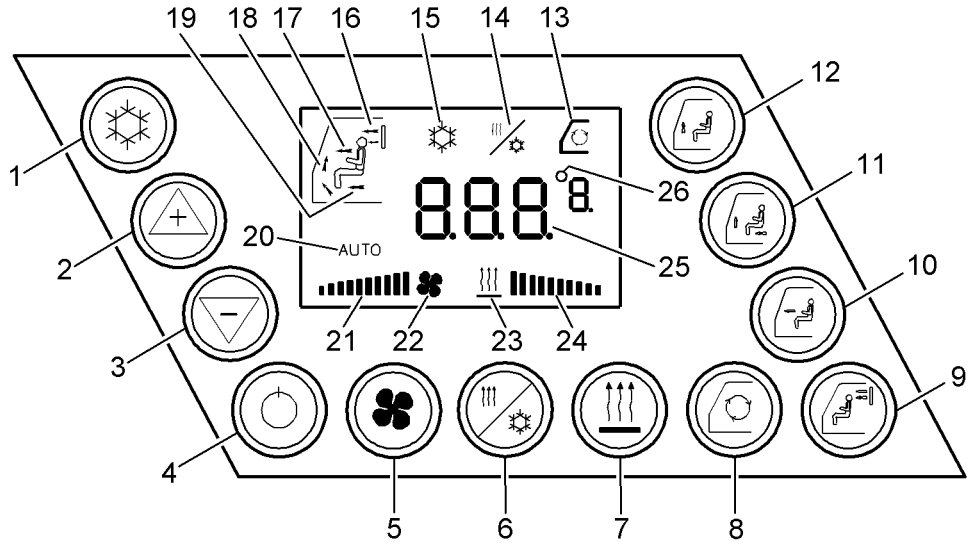

Fig. 3-47 *Control panel of Air conditioning system*

Control buttons

1 – Air conditioning (cooling)
2 – Increase cab temperature
3 – Decrease cab temperature
4 – Control ON / OFF
5 – Evaporator fan speed – manual / automatic
6 – REHEAT operation
7 – Heating – manual / automatic
8 – Fresh air / air circulation
9 – Rear wall vent OPEN / CLOSED
10 – Vent, right control panel (8b) OPEN / CLOSED
11 – Vent, front window, legroom CENTER / CLOSED
12 – Vent, front windshield, legroom CENTER / OPEN

Main screen displays

13 – Air circulation
14 – REHEAT operation
15 – Air conditioning (cooling)
16 – Vent, rear wall OPEN
17 – Vent, right control panel (8b) OPEN
18 – Vent, front windshield, legroom CENTER
19 – Vent, front windshield, legroom OPEN
20 – Automatic operation
21 – Indicator, fan speed in manual operation
22 – Symbol, fan speed in manual operation
23 – Symbol, heater operation in manual operation
24 – Indicator, heat output in manual operation
25 – Nominal value / error code
26 – Temperature unit (°)

If the control panel identifies an error, a blinking error number **F1 – F5** will be display-

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ed.

Note!

▶ In the event of an error, please contact LIEBHERR Service.

Turning the control panel on

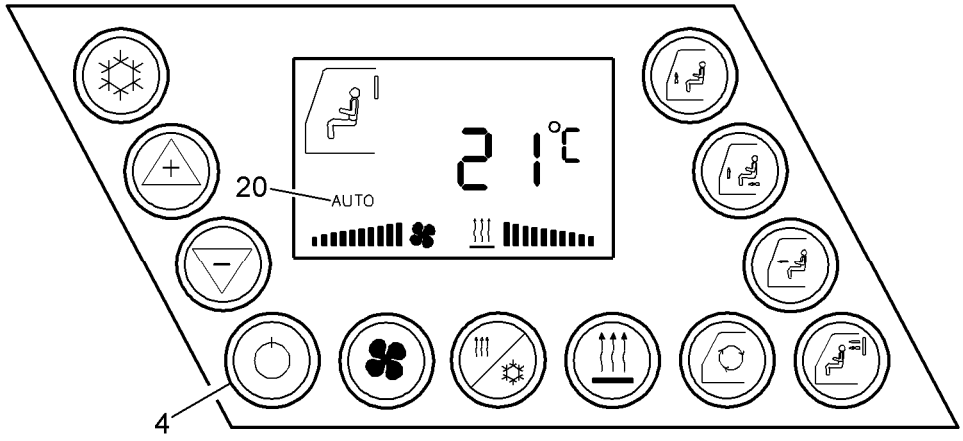

Fig. 3-48 *Turning the control panel on*

▶ Turn the system on using button **4**.
  ⇩ The software version will be displayed for approx. 12 seconds while the control panel carries out a self test.

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

Setting the desired cab temperature

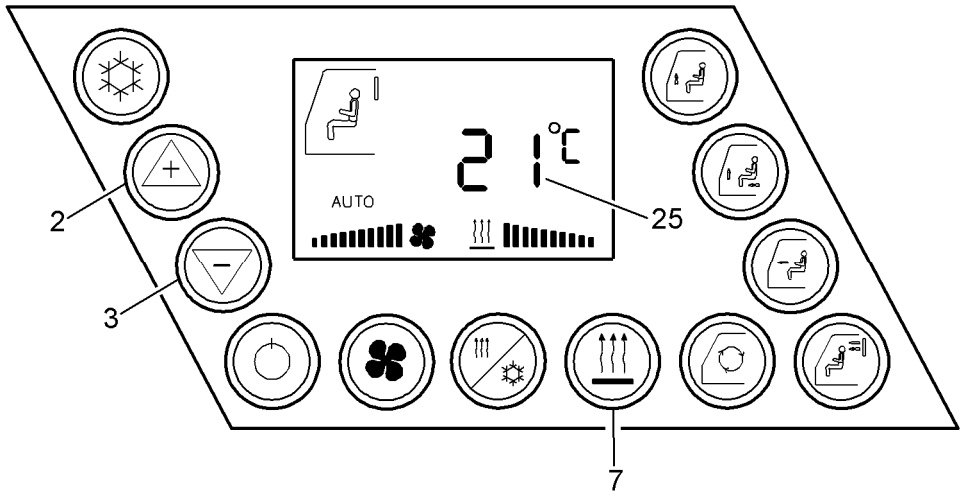

Fig. 3-49 *Setting the desired cab temperature*

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

- ▶ Use button **2** to increase the temperature.
- ▶ Use button **3** to reduce the temperature.

The adjusted temperature will remain until the next change is made.

Turn on the air conditioner to cool the cab.

- ▶ Press button **7** to adjust the heat output manually.
  - ↳ The heater symbol will blink for 5 seconds.
- ▶ As long as the heater symbol is blinking, use button **2** or **3** to increase or decrease the heat output manually.
- ▶ Press button **7** to return to automatic operation.

Air conditioning

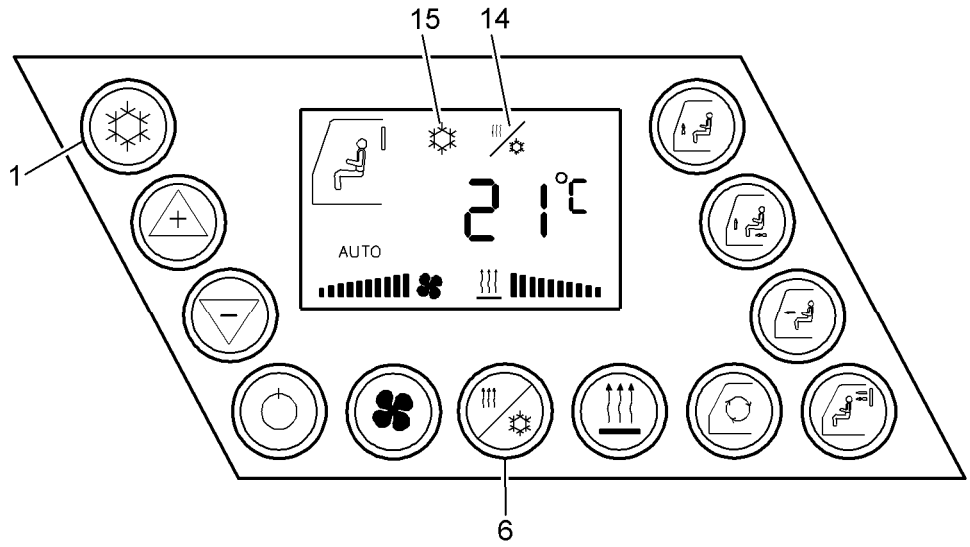

Fig. 3-50 *Air conditioning*

- ▶ Turn on the air conditioner using button **1**.
  - ↳ The symbol **15** will be activated.
  - ↳ The compressor will now be turned on by the control unit, if required, and automatically controls the heater and air conditioner RPM.
- ▶ To dehumidify the cab, turn on the air conditioning system when heating the cab.
- ▶ Press the REHEAT button **6**.
  - ↳ Symbol **14** is activated.
- ▶ In this case, turn on the air conditioner until the windows are no longer fogged.

After 10 minutes, the REHEAT function turns off automatically.

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Air circulation and fresh air

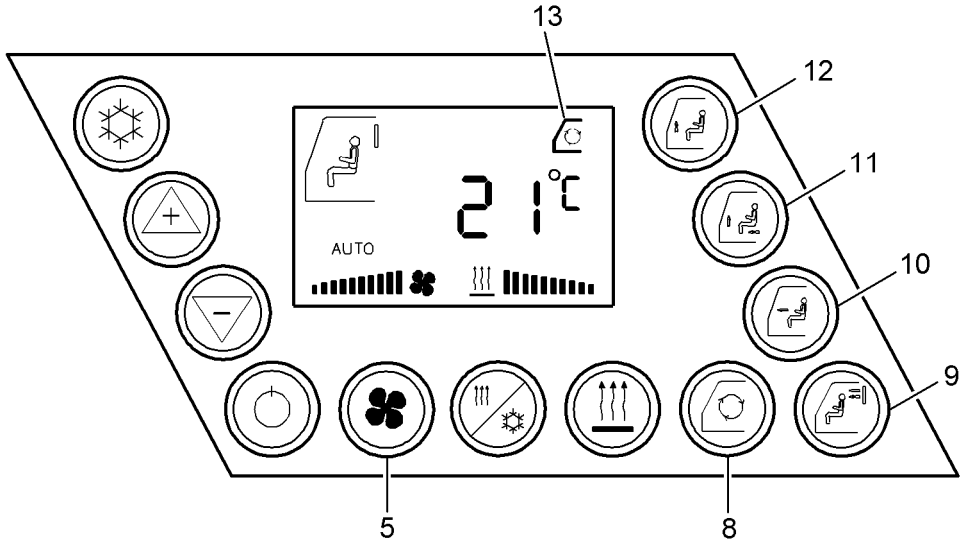

Fig. 3-51 *Air circulation and fresh air*

The heating and air conditioning system can be switched on to air circulation or fresh air operation.

- ▶ Press button **8** to open / close the fresh air vent.
  - ↳ Symbol **13** indicates that the fresh air vent is closed.
- ▶ Press button **5** to set the fan speed manually.
  - ↳ The fan symbol blinks for 5 seconds.
- ▶ As long as the fan symbol is blinking, use button **2** or **3** to increase or decrease the fan output manually.
- ▶ Press button **5** to return to automatic operation.

Air duct

Regulation of the air flow is made by using buttons **9** - **12** (siehe Fig. 3-51) and via rotating and closable air vents.

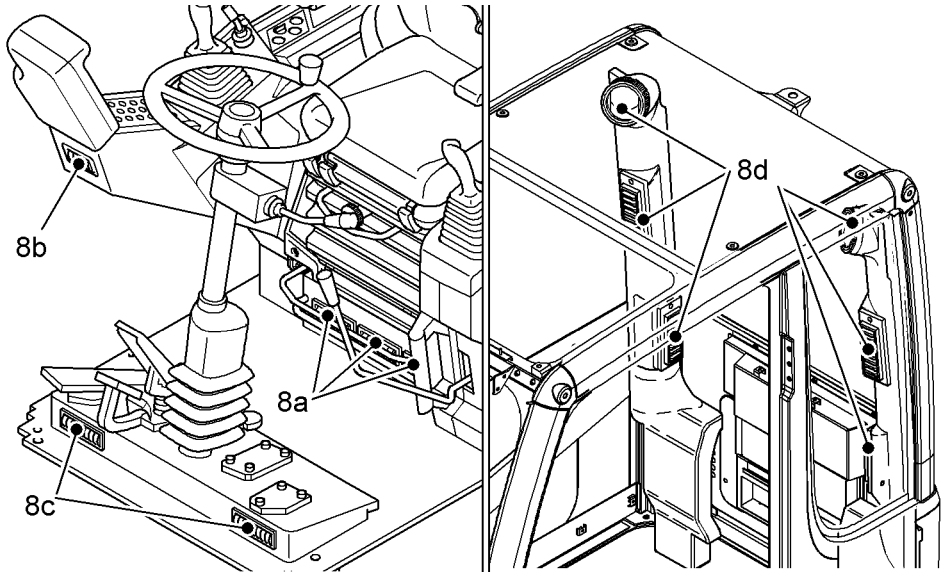

Fig. 3-52 *Position of front air vents (left view) and vents on the rear cab wall (right*

view)

The air vents are located on the seat console **8a**, on the right control panel **8b**, on the front windshield **8c** and on the rear wall of the cab **8d**. The open position of the corresponding vent is shown by an arrow in the display.

To obtain optimal comfort:

- In **heater operation**, open the air vents in the legroom area **8a**, the right control panel **8b** and possibly the front windshield **8c**.
- In **air conditioner operation**, open the air vents in the rear wall of the cab **8d** and the right control panel **8b**.

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

Note!
To prevent the starter motor and the battery from overloading, turn on the air conditioner only after the Diesel engine is running.

- If the machine is used for a longer period of time without using the air conditioner, operate the compressor every 2 weeks by pressing the REHEAT button **6** (siehe Fig. 3-50) .

Operation with auxiliary heater (option)

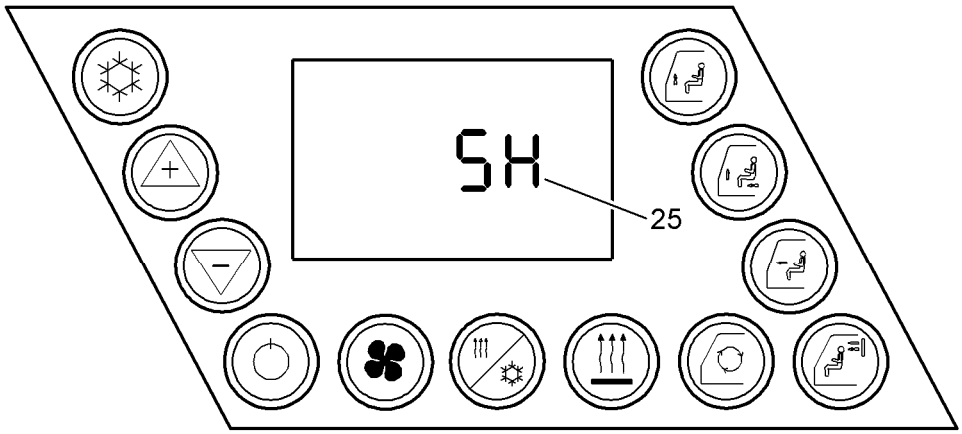

Fig. 3-53 *Operation with auxiliary heater*

Note!
The auxiliary heater can only be operated when the ignition is turned off.
It is not possible to make manual adjustments in auxiliary heater operation.

- Turn on the auxiliary heater.

When the Diesel engine is running, the auxiliary heater is turned off automatically.

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3.3 Operation

3.3.1 Safety instructions

Bringing the machine safely into service

- Carry out a careful inspection tour around the machine each time before starting it.
- Check the machine for loose bolts, cracks, wear, leakage and damage.
- Never attempt to operate a damaged machine.
- Ensure that any damage is immediately rectified.
- 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.
- Before starting the machine, adjust the seat, mirrors, armrests and operator's controls in such a way that you are able to work comfortably and safely.
- Acoustic insulation devices on the machine must be set to the insulation position throughout operation.
- Only operate combustion engines and fuel-operated heaters in adequately ventilated spaces. Before starting in closed areas, ensure adequate ventilation. Follow the regulations which apply for the particular area of use.

Starting the machine safely

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

3.3.2 Stopping the machine safely

- Only stop the machine on level, firm ground.
- If the machine has to be stopped on an incline, chocks should be used to secure it from rolling away.

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- Use the stop bolts to secure the upper structure facing the chassis, 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 covers, and remove all keys and secure it against unauthorized use.

Towing the machine safely

- Always follow the correct procedure: see chapter “Towing the machine” in these operating instructions.
- The machine may only be towed in exceptional circumstances, e.g. in order to move the machine away from an area where it is at risk.
- Before towing, check all attachments and towing devices for safety and stability.
- Towing devices such as bars must have adequate tensile strength and should be secured around the undercarriage tower or the towing hook provided on the undercarriage chassis.
  Any damage or accidents which occur while towing the machine are not covered by the manufacturer’s guarantee.
- Ensure that there is no one in the vicinity of the towing devices when towing.
- Stretch safely and hold the towing devices. Avoid kinks on cables or ropes.
- When towing, maintain the correct transport position, permitted speed and route, and avoid yanks.
- After towing, return the machine to correct operational status.
- When restarting the machine, be sure only to proceed in accordance with the operating instructions.

3.3.3 Starting / stopping the machine

General information

Note!
When using the machine at a specific height above sea level and in connection with coolant and boost air 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.

The power electronic regulator **LIDEC DC 5-00** is used for regulation, surveillance and protection of LIEBHERR diesel engines.

In the following environmental conditions (sea level and athmospheric pressure) the engine power is automaticaly reduced :

- 4.850 m and an atmospheric pressure up to 550 mbar
- 3.950 m and an atmospheric pressure up to 620 mbar
- 3.100 m and an atmospheric pressure up to 690 mbar
- 2.250 m and an atmospheric pressure up to 770 mbar
- 1.550 m and an atmospheric pressure up to 840 mbar

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

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Two advertising stages are present for the coolant and boost air temperatures (see chapter "Warning symbols in the SY field".

– The first stage, as warning, the engine power is reduced and an acoustic signal sounds.
– The second stage, as safety, stops the engine automaticaly and an acoustic signal sounds.

Attention !
In the time between warning and safety stage, a potential engine damage is possible. For that reason from first signal of warning stage :

▶ Stop the engine, localise and rectify the error immediately.

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.

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Starting the diesel engine

Ignition key switching positions

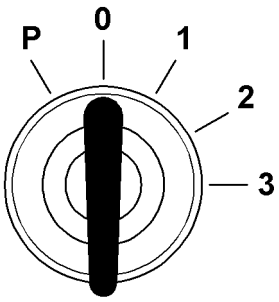
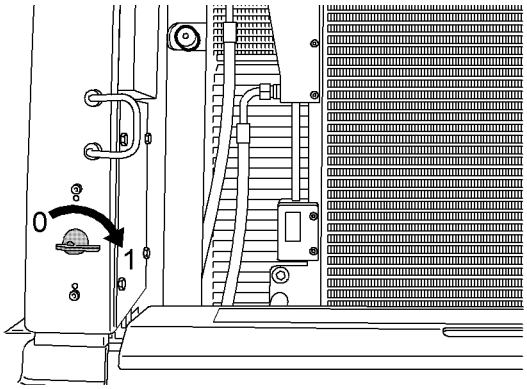


Fig. 3-54 *Ignition switch*

0	Neutral	**2**	Position 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** (one).

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

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

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

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Service interval display

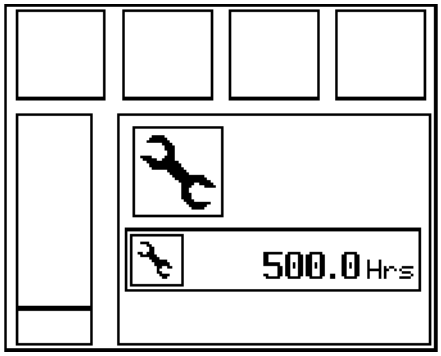

Fig. 3-55 *Service interval request*

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

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

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

Electronic immobilizer (optional extra)

In addition to the standard immobilizer, the machine can be fitted with an electronic immobilizer. The electronic immobilizer acts as an anti-theft device.

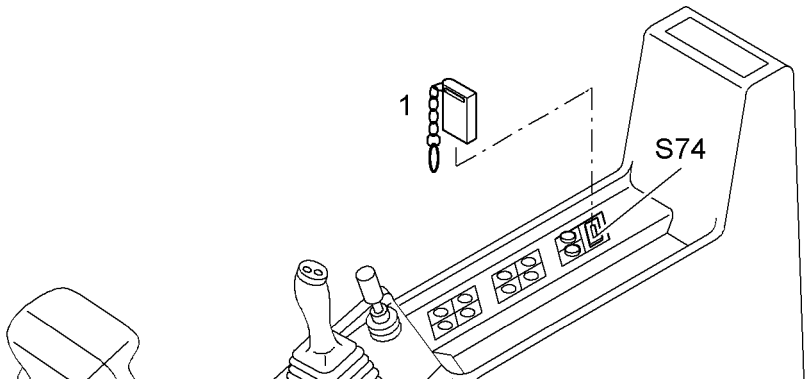

Fig. 3-56 *Electronic immobilizer*

- ▶ Insert the code key **1** in the code lock **S74** and then remove.
  - ↳ The LED goes out.
  - ↳ A signal tone sounds.
- ▶ Switch on the electrical system.
- ▶ Use the ignition key to start the electrical system within 9 seconds.

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

When the ignition is switched off, the immobilizer activates itself automatically after 30 seconds.

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

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Starting the engine

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

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

Starting procedure when the coolant temperature is above 10 °C.

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

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

Starting procedure when the coolant temperature is below 10 °C.

In case of low coolant température , a preheating improves the starting procedure of the diesel engine.

While powering the preheat plug thes ymbol Preheating ON appears on screen.

- ▶ After approx. 20 seconds (depends of coolant temperature) the symbol Preheating END starts to blink on main screen. Turn the ignition key to start position **3**.
- ▶ Release the ignition key as soon as the engine is running.

If the erngine should not start, the starting procedure is atomaticaly interrupted after a predefined time lapse.

- ▶ In that case, turn the ignition key first into **0** then into contact position **1**.
  - ↳ A new preheating and starting procedure can be started.

Note!
A starting procedure can be started at every time, even while preheating.

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

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

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

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Speed adjustment and mode functions

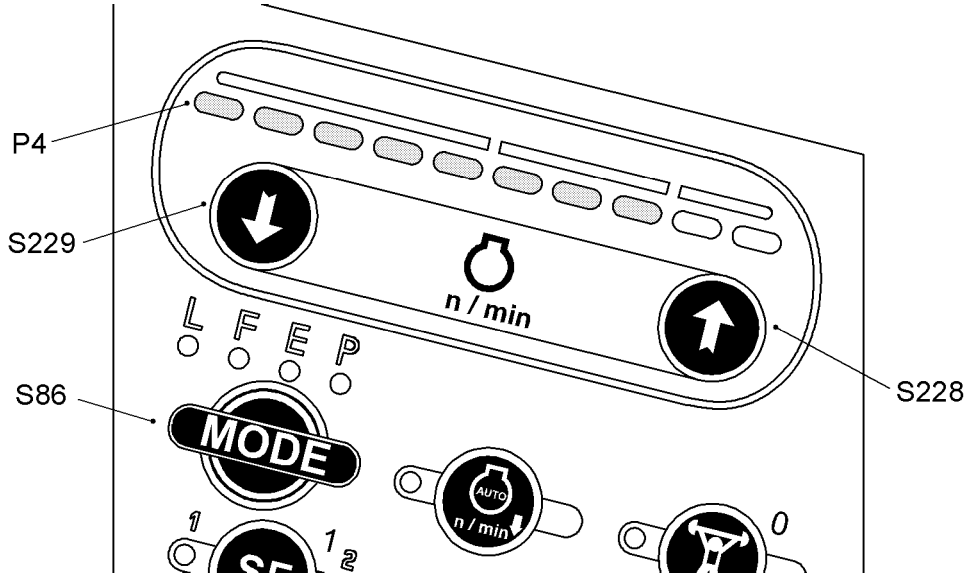


Fig. 3-57 *Speed adjustment and mode functions*

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

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

Performance selection (adjustment) using the mode button

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

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

Using the arrow keys to adjust speed

To increase the speed:

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

To reduce the speed:

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

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

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

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

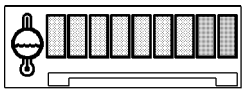
diesel engine.

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

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

Warm-up phase for diesel engine and hydraulic circuit

Diesel engine



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

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

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

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

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

Hydraulic oil

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

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

Notes after starting the engine

Danger!
Danger of suffocation.

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

Caution!

- Bring the engine and hydraulic oil up to operating temperature. The controls operate sluggishly at low oil temperatures.
- Move the machine carefully in an open space to test the function of the chassis and slewing gear brakes.
- Check that the equipment is operating perfectly.

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Switching off the diesel engine

Caution!
The engine could be damaged.

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

▶ First use arrow key **S229** to set the engine speed to low idle.
↳ Only the LED on the furthest left is now lit on display **P4** (engine speed).

▶ Allow the diesel engine to run continuously in low idle for another 2-3 minutes.

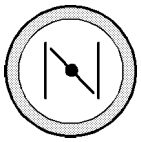
▶ Now turn the ignition key to position **0** in order to switch off the engine.

▶ Remove the ignition key.

3.3.4 indicatorStarting aids

Cold start device (optional extra)

The cold start device supports the cold starting procedure at temperatures below -18 °C.



▶ When starting, press and hold switch **S210** in the right control panel.
↳ A gas which aids the cold starting procedure will be injected into the intake pipe.
↳ The light in the switch remains on while the gas is injected.
↳ As soon as the diesel engine is running, the gas supply will be interrupted.
↳ No gas will be injected if the diesel engine is warm.

Fuel preheating S26 (optional extra)

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 (optional extra)

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.

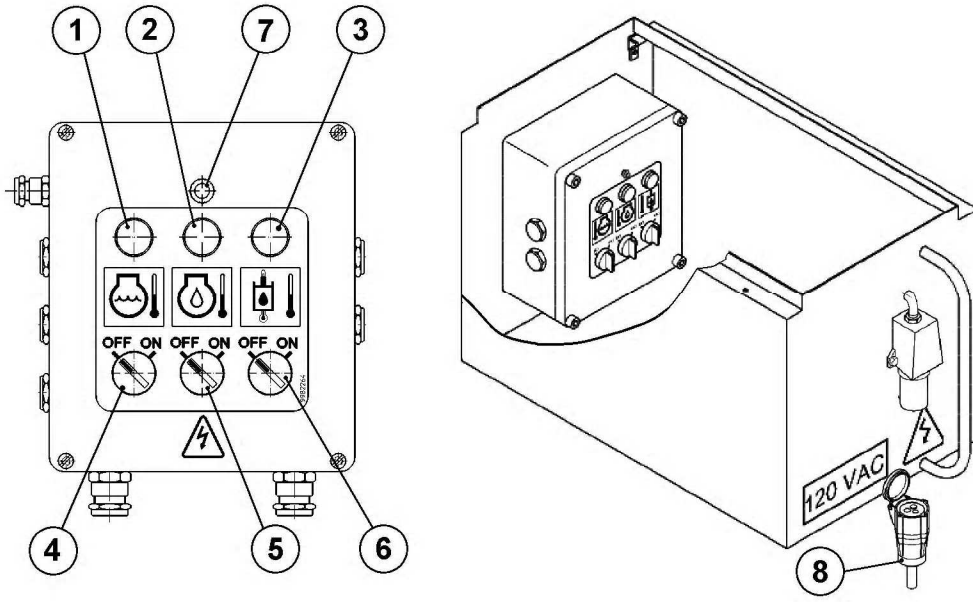


Fig. 3-58 *Coolant / motor oil / hydraulic oil preheating*

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.

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3.3.5 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”.

3.3.6 Emergency operations

Emergency control speed adjustment

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

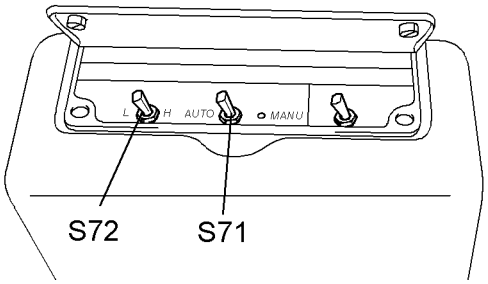

Fig. 3-59 *Emergency control speed adjustment*

This automatic system can be switched off in problem cases.

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

▶ Control the speed manually.

The speed will be controlled using toggle switch **S72**:

– Pos. **L** signifies: Speed reduction
– Pos. **H** signifies: Speed increase

Emergency operation

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

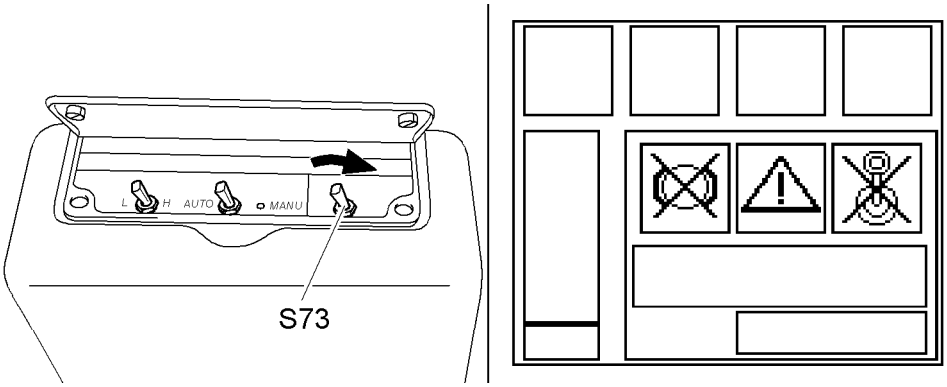

Fig. 3-60 *Emergency operation (Fig. left) and emergency switching screen display (Fig. right)*

▶ Push the safety lever down.

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

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

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

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

Emergency operation of operating pumps

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

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

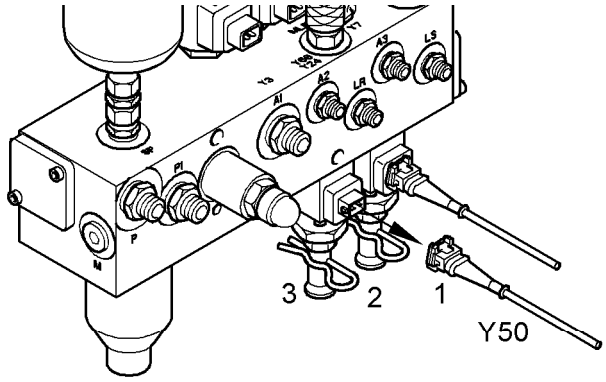

Fig. 3-61 *Preparing emergency operation of operating pumps*

- ❑ Toggle the lever **3** on the control oil unit on the back of the hydraulic tank and:
- ▶ pull out the plug connector **1 (Y50)**.
- ▶ pull out the cotter pin **2**.
- ▶ toggle the lever **3** to a horizontal position (emergency position).
  ↳ Emergency operation is prepared.

3.3.7 Driving

Driving straight ahead

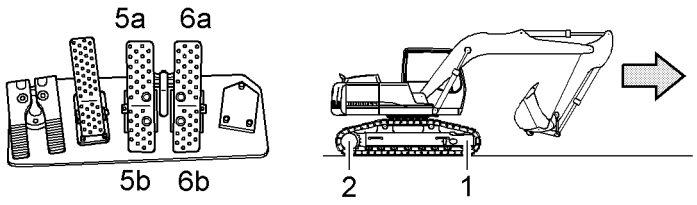

Fig. 3-62 *Driving straight ahead*

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

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

Driving forwards:

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

Reversing:

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

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

Turning on the spot

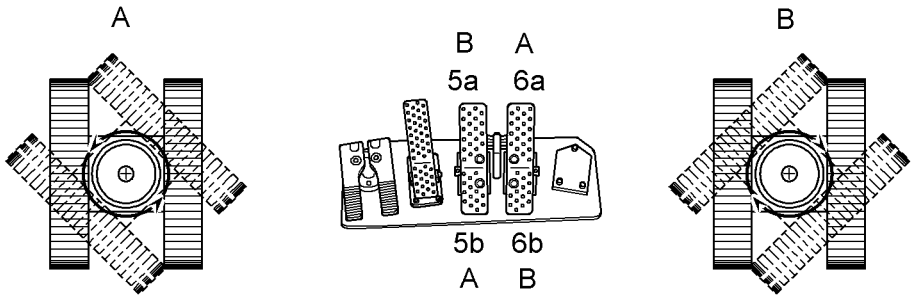

Fig. 3-63 *Turning on the spot*

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Turning left (A):

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

Turning right (B):

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

Turning with a crawler

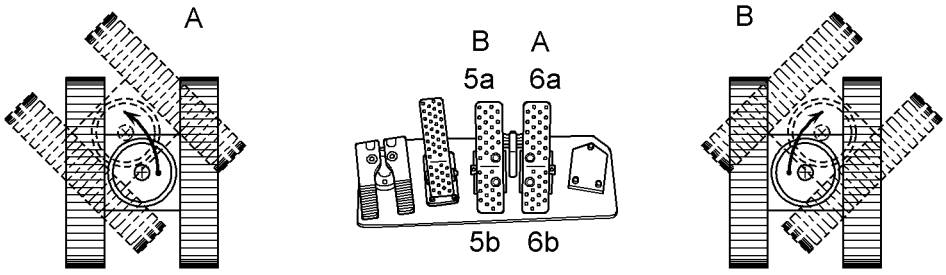

Fig. 3-64 *Turning with a crawler*

Turning to the left (A):

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

Turning to the right (B):

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

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

Controlling the drive unit manually

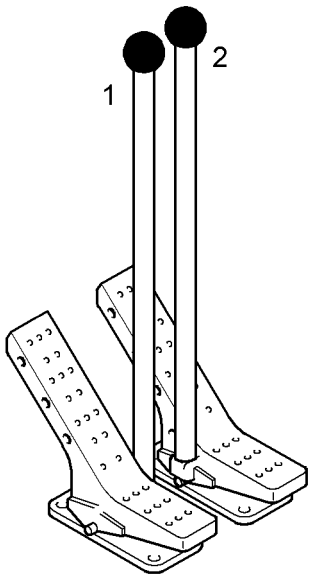

Fig. 3-65 *Manual drive unit control*

❑ Particularly careful driving is required here.

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

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

Controlling the speed

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

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

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

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

▶ Press switch **S21**.
  ↳ Transfer from normal drive to fast drive is deactivated.
  ↳ LED 1 in the switch goes out.

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

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Braking the machine

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

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

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

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

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

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

3.3.8 Drive warning device (optional extra)

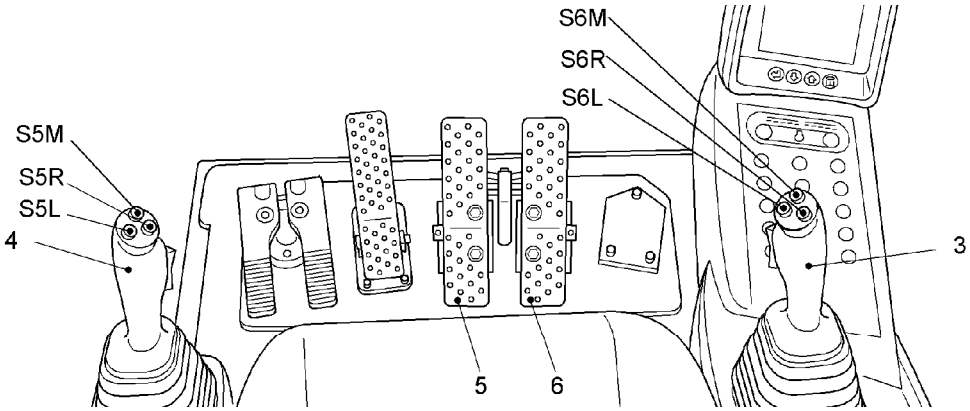

Fig. 3-66 *Drive warning device*

▶ Press accelerator 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 button **S6R** on right-hand joystick **3**.
  ↳ The drive warning device will switch off.

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

3.4 Working with the machine

3.4.1 Safely getting up or down.

– When getting up or down, position the machine on even, horizontal ground. The upper structure should be positioned with the chassis in such a way that the steps and ladders are aligned with each other.
– Ensure that steps, ladders and hand-rails (grips) are in good condition. In particular, you should ensure that they are free of dirt, oil, ice and snow.
NOTE: To ensure that the doors open properly in all weather conditions, the door seals must be dusted with talc or silicon at least every two months or more often if required. The door hinges and locks should be greased regularly.
– Face the machine when getting in or out and always use three-point support, i.e. two hands and one foot or two feet and one hand must always be in contact with the access system at the same time.
– If you are able to reach the door handle with your free hand, open the doors before you climb any higher. External influences, such as wind, can make it more difficult to open doors. Because of this, always use your hand for control when opening doors. Ensure that the door is latched open to prevent it slamming open and shut.
– Now continue to climb up and sit down in the operator's seat as soon as you enter the cab. Close the doors and fasten the safety belt.
– When getting out of the machine, proceed as carefully as when you climbed into the machine.
– Stop the machine on level, horizontal ground. The upper structure should be positioned with the chassis in such a way that the steps and ladders are aligned with each other.
– Unfasten the safety belt. Position yourself with your face toward the machine when getting out and use three-point support. Climb down until you can close the doors safely. Always use your hand for control when closing the doors.
– Now climb down to the ground.

3.4.2 Working safely with the machine

– Before you start working, acquaint yourself with the special features of the job site and any special precautions and warning signals. Examples of particular work environments would be on-site or traffic obstructions, the load-carrying capacity of the ground and any requirements to make the job site safe from public use.
– Always maintain a safe distance from overhangs, edges, slopes and unsafe ground.
– Be particularly careful in conditions of reduced visibility and changeable ground conditions.
– Familiarize yourself with the location of power lines on the job site and take 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,

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- warn any personnel in the vicinity not to come close to the excavator and not to touch it,
- instruct or initiate that someone turns off the voltage.
- move the machine, if possible, from the danger zone to a sufficient distance,
- Do not leave the machine until you are absolutely sure that voltage in the line, which had been touched or damaged, has been turned off !

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

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

Safe use white a hydraulic hammer

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

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

– According to use, it can be necessary when working with a grab to move with the equipment raised and the load lifted up; this applies, for example, when loading and unloading wood.

– Here, the centre of gravity of the machine will be displaced upwards in the vertical direction. The driving characteristics of the machine will thus be influenced persistently, e.g. through reduction of the dynamic stability.
The following instructions are therefore to be observed at all times:
  • Adjust vehicle handling to suit the altered machine characteristics and environmental conditions.
  • Reduce your speed to prevent the need for sudden braking and steering manoeuvres.
  • Avoid sudden speed changes, such as braking, accelerating and changing direction.
  • Only rotate the upper structure when the chassis is stationary.
  • Only rotate the upper structure after you have picked up the load.
  • Only move the machine when you have picked up and lifted the load and rotated the upper structure to the driving position.
  • There is a danger of possible swinging movement and dropping of the load when the equipment is raised.
  • A protective grid (FOPS) in accordance with ISO 10262 must be attached to the cab.
  • A protective roof (FOPS) in accordance with ISO 10262 must be attached if there is a risk of objects falling from above.
  • Only the maximum permissible load may be taken up using the grab.

– NOTE: The weight of absorbent materials, such as logs, is dependent on length, diameter and specific weight. The influencing variables present in a natural product, such as moisture, must be noted.

– Working procedures when using machines with grabs require the machine operator to receive special instruction and training.

– Use as part of the work process is only permitted when the machine operator has sufficient training and practical experience.

Safe use of machines with tower elevation

– Due to the tower elevation, the centre of gravity of the machine will be displaced upwards in the vertical direction. The driving and work characteristics of the machine will thus be influenced persistently, e.g. through reduction of the dynamic stability.

– Due to the heightened centre of gravity, the machine must be aligned horizontally before use. In horizontal alignment, the centre of gravity of the upper structure is over the centre of the chassis, which reduces the risk of tilting.

– The machine can still sway and tilt despite being aligned!
The following instructions are therefore to be observed at all times:

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

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- Reduce your speed to prevent the need for sudden braking and steering manoeuvres.
- Avoid sudden speed changes, such as braking, accelerating and changing direction.
- Ascending gradients and obstacles may only be approached in the longitudinal direction in order to prevent unacceptable banking of the machine.
- Special care should be taken when driving through narrow passages - drive slowly!

When loading and unloading:

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

Protection from vibration

– Vibrational loads on mobile building machinery are mainly the result of the type and method of use. The following parameters in particular are decisive influences:
  - Terrain conditions: Uneven areas and potholes;
  - Operational techniques: Speed, steering, brakes, controlling the machine's control elements when driving and working.

– To a large extent, the machine operator determines the vibrational loads since he selects the speed, gearbox ratio, working method and route himself.
  This means that there is a wide range of different vibrational loads for the same machine type.

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

– Select suitable machines, equipment parts and auxiliary devices for each part of the job.

– Use a machine that has a suitable seat (i.e. for earth-moving machinery such as hydraulic excavators, this should be a seat which corresponds with EN ISO 7096).

– Keep the seat in good condition and adjust it as follows:
  - The seat and its damping action should be adjusted depending on the weight and height of the operator.
  - Check the seat's damping action and adjustment mechanisms regularly and ensure that these seat characteristics remain as per the seat manufacturer's instructions.

– Check the maintenance status of the machine, particularly with respect to: tyre pressure, brakes, steering, mechanical connections etc.

– 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;

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- Fill in ruts and holes;
- Have machines ready to prepare and maintain suitable ground conditions and calculate in sufficient time to carry out any work required.

– Drive longer distances (e.g. on public roads) at an appropriate (medium) speed.

– Use special auxiliary systems (if available) which reduce vibration for machines that are driven frequently.
If such auxiliary systems are not available, regulate speed to avoid "oscillating" the machine.

3.4.3 Low idle automatic

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

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

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

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

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

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

❑ Desired time span is reached.

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

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

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

3.4.4 Operating the swing gear

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

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

Rotating the uppercarriage

The uppercarriage is rotated using the left joystick.

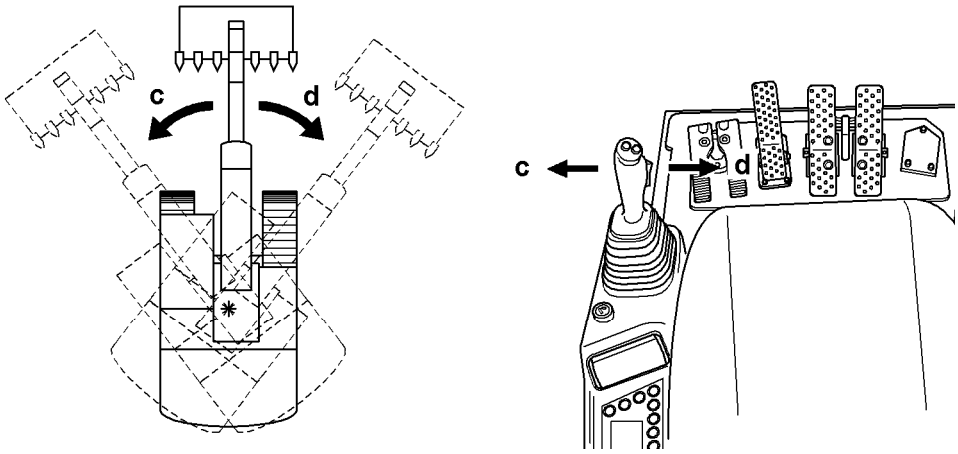


Fig. 3-67 *Rotating the uppercarriage*

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

Braking the uppercarriage

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

Hydraulic swing gear brake

- ▶ Move the left joystick **4** to neutral.
  - ↳ Uppercarriage will be adequately hydraulically braked.
- ▶ Move the left joystick **4** in the opposite direction.
  - ↳ Maximum hydraulic braking action of the uppercarriage is achieved.

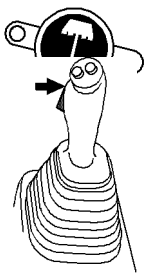
Mechanical swing gear brake

The uppercarriage can be locked in any position using this brake

The brake is negatively acting, hydraulically actuated and serves as a holding or parking brake.

Caution!
Damage to the machine.

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



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

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

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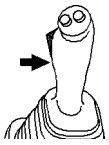

lower than a limit value.

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

Note!
The red control light in the button S17 lights up each time the brake is applied.
If this light does not go out when the rocker switch S57 is tilted up, the button S17 must first be pushed to pre-select the semi-automatic mode.

Caution!
The brake only applies when the uppercarriage is near standstill and if no swing motion is actuated via the joystick!
In order to stop the uppercarriage when working on a slope, tilt the switch S57 down and reduce the uppercarriage speed by braking with joystick 4.
Move the joystick 4 back to «0» position only when the uppercarriage is quite immobile, the brake will apply.

Ermergency stop of the uppercarriage swing motion

The swing brake can be applied independently of the uppercarriage RPM by switching the button S17 from position «semi-automatic» into position «applied».

Caution
Perform this braking via button S17 only in emergency cases, since it causes fast abrasion of the brake discs.

To check the mechanical swing gear brake:

❑ Upper carriage must be stationary.

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

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

Positioning swing brake (optional extras)

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

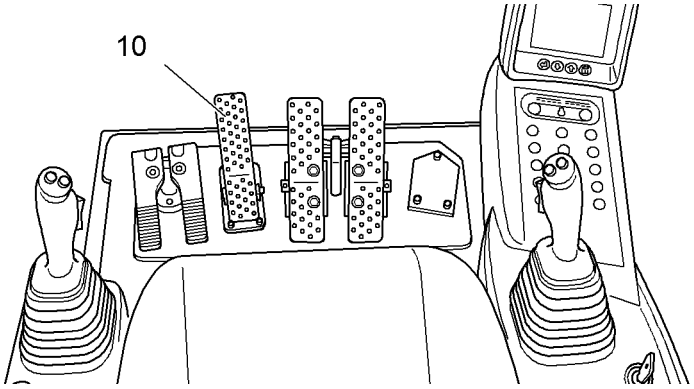

Fig. 3-68 *Positioning swing brake*

Note!
Increased wear.

- ▶ Do not use the positioning swing brake purely as a service brake, but only as a stop and parking brake for the swing gear.
- ▶ Brake the upper carriage hydraulically for preference (by countering).

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

3.4.5 Working position

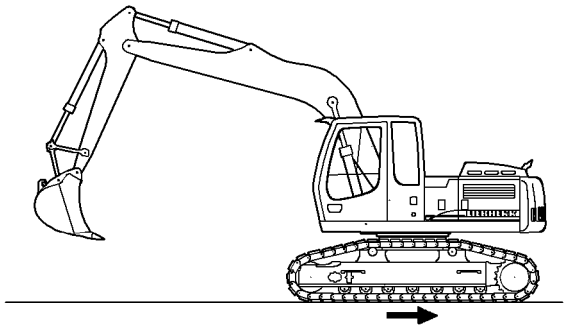

Fig. 3-69 *Working position – machine*

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

Note

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

3.4.6 Joystick functions when setting up the machine

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

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

Operating the stanchion cylinder

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

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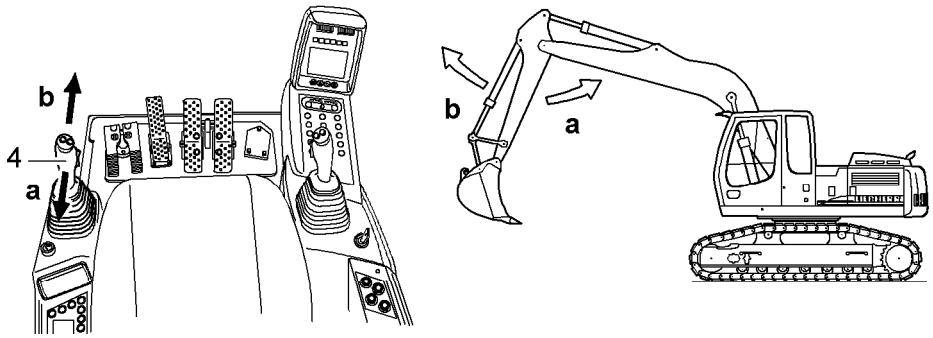

Fig. 3-70 *Operating the stanchion cylinder*

- ▶ Push the joystick back **a**.
  ↳ Stanchion will be drawn in.
- ▶ Push the joystick forwards **b**.
  ↳ Stanchion will be extended.

Operating the boom cylinder

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

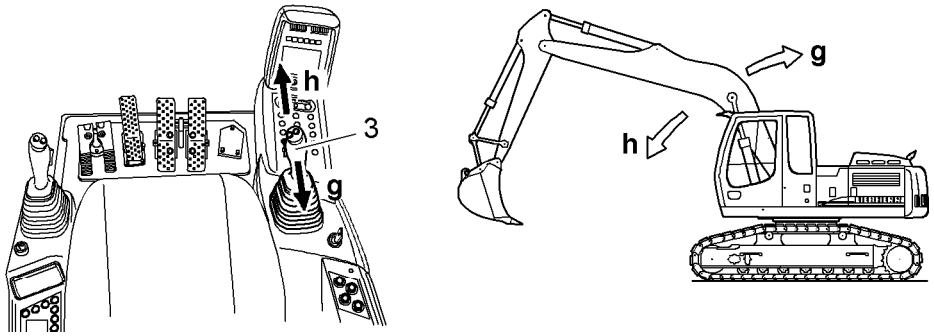

Fig. 3-71 *Operating the boom cylinder*

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

Operating the shovel cylinder

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

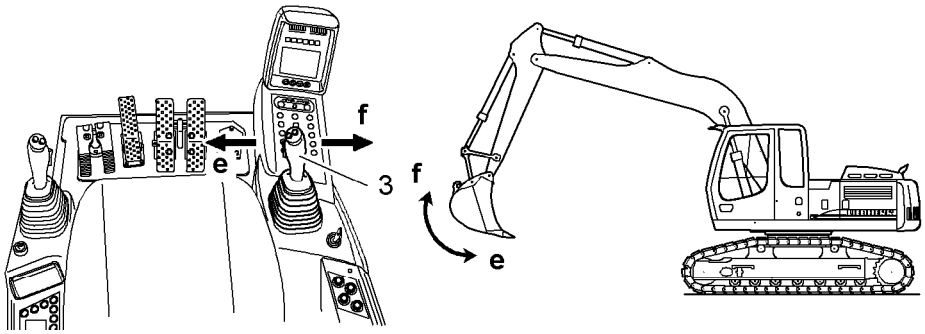

Fig. 3-72 *Operating the shovel cylinder*

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

Operating the grab cylinder

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

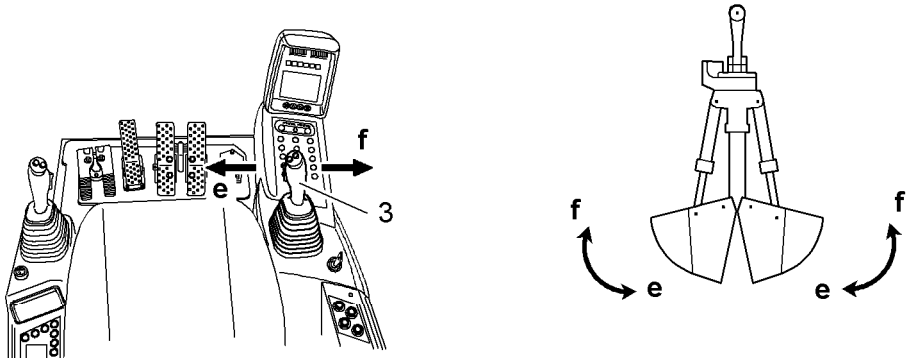

Fig. 3-73 *Operating the grab cylinder*

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

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

Combined movements

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

3.4.7 Lowering the work equipment when the engine is not run-

ning

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

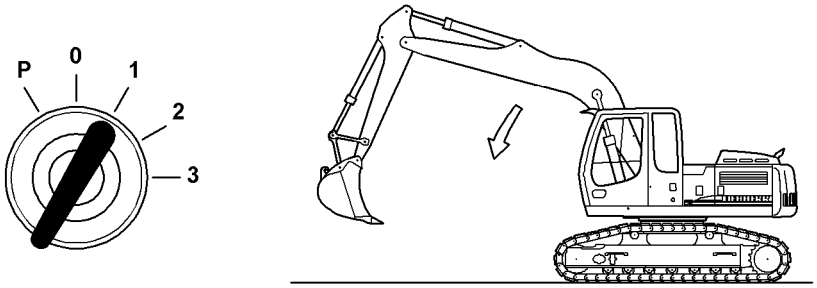

Fig. 3-74 *Lowering the equipment when engine is not running*

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

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

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

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

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

Switch **S19** is used to activate an additional function:
– rotating grab (A)
– slewing ditcher bucket (B)
– locking pin of a hydraulic quick change adapter (C)

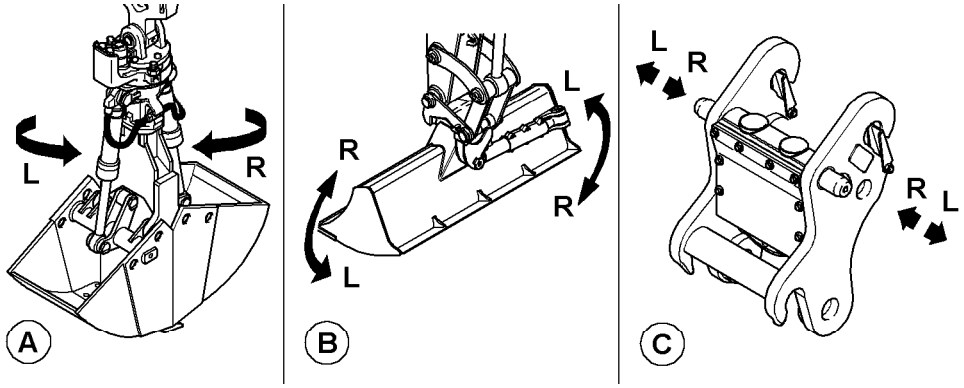

Fig. 3-75 *Add-on units example*

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

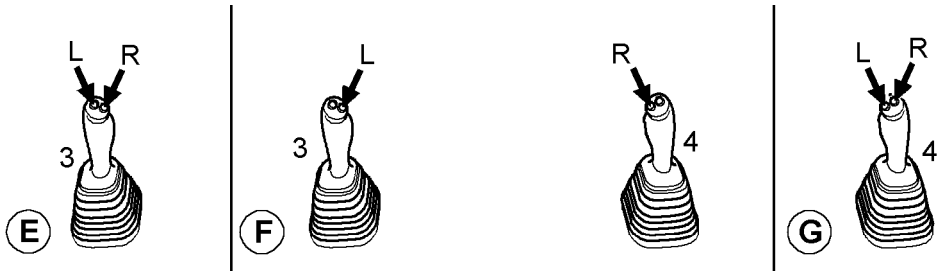

Fig. 3-76 *Pushbutton on the joystick*

E Operation with left joystick (optional extras)

F Operation with left and right joystick (optional extras)

G Operation with right joystick (standard)

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

- ▶ Press switch **S19**.
  - ↳ Additional function (eg. rotating grab) is activated.
- ▶ LED in switch illuminates.
- ▶ Press and hold left pushbutton **L**.
  - ↳ Grab will rotate left (anticlockwise).
  - **- or -**
  - ↳ Slewing bucket will slew left (anticlockwise), i e. it moves down to the left.
  - **- or -**
  - ↳ Locking pins will be drawn out.
- ▶ Press and hold right pushbutton **R**.
  - ↳ Grab will rotate right (clockwise).
  - **- or -**
  - ↳ Slewing bucket will slew right (clockwise), i e. it moves down to the right.
  - **- or -**
  - ↳ Locking pins will be inserted.

3.4.9 Magnetic system (special equipment)

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

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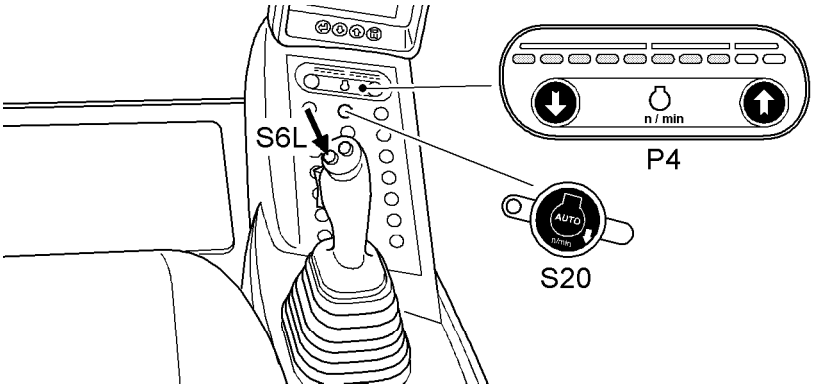

Fig. 3-77 *Activating the magnetic system*

- ▶ Press switch **S46**.
  - ↳ The magnetic system starts to function.
  - ↳ The engine speed **P4** increases to level 8.
  - ↳ Low idle automatic **S20** no longer functions.

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

- ▶ Always ensure that noone is standing beneath the load.
- ▶ Do not press pushbutton **S6L** unintentionally.

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

3.4.10 Add-on kits Tool Control AHS 1, AHS 11 and AHS 12 (optional extra)

Using add-on kits AHS 1, AHS 11 and AHS 12, additional loads can also be operated with different pressure and quantity settings.

Caution!
Incorrect preselection of the pressure and quantity setting can result in damage to the work tool (eg. hydraulic hammer) or to limited function (eg. boom adjustment cylinder).

Danger!
If a large or wide work tool (eg. grab) is made to vibrate in the vicinity of the cab, the cab could be knocked or buckled, which would expose the operator of the machine to danger.

Note!
If the machine is generally being used for hammer work, there is a risk that the hydraulic oil may be dirtier than usual.

- ▶ Adjust maintenance intervals for hydraulic oil and filter cartridge changes to suit heavy dust usage.

The add-on kit is activated using two foot pedals and also using switch **S36** (only on AHS 12).

Add-on kit AHS 1 (Tool Control)

Add-on kit AHS 1 is used to operate the boom adjustment cylinder for a hydraulic boom adjustment or for a side adjustable gooseneck boom.

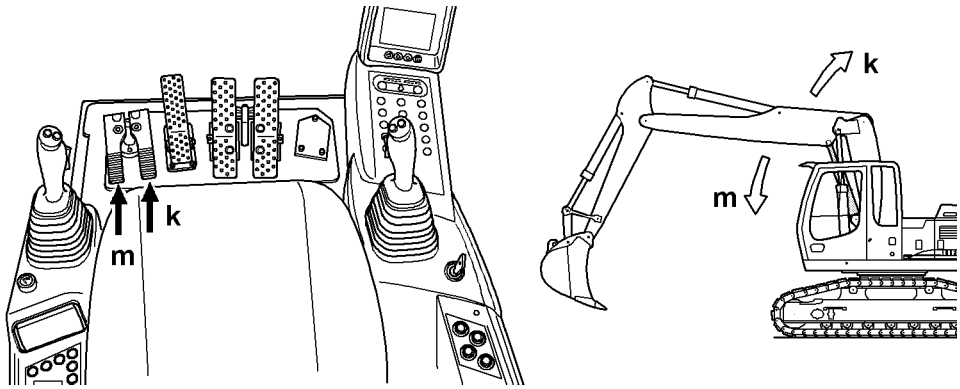

Fig. 3-78 *Add-on kit AHS 1*

To operate the boom adjustment cylinder:

- ▶ Push down foot pedal **k**.
  ↳ Boom adjustment cylinder will be extended, ie. the equipment moves up.
- ▶ Push down foot pedal **m**.
  ↳ Boom adjustment cylinder will be drawn in, ie. the equipment moves down.

Add-on kit AHS 11 (Tool Control)

Using add-on kit AHS 11, only **one** additional load can be operated, i e. one work tool (eg. hydraulic hammer) can be operated for the gooseneck boom.

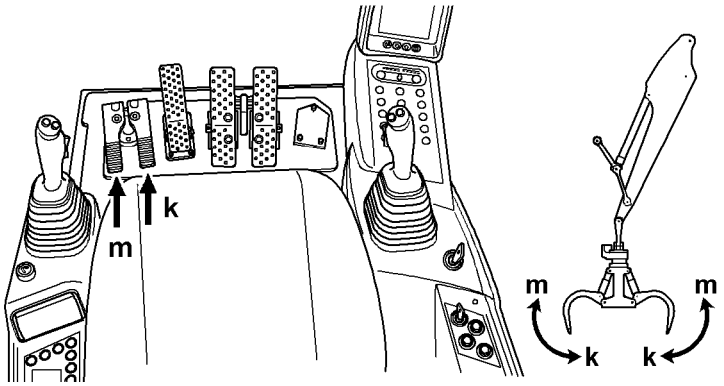

Fig. 3-79 *Add-on kit AHS 11*

To operate a work tool :

- ▶ Choose the predefined pressure and flow limitations assigned to the work tool in the operator's menu (see chapter "Tool Control")

Example: Hydraulic hammer

- ▶ Push down foot pedal **k**.
  ↳ Hydraulic hammer is activated.

Example: Scrap cutter

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▶ Turn the key switch to the **Cylinder** position.

▶ Push down foot pedal **k**.
↳ Cylinder will be extended, i e. the scrap cutter will close.

▶ Push down foot pedal **m**.
↳ Cylinder will be drawn in, i e. the scrap cutter will open.

Add-on kit AHS 12 (Tool Control)

Using add-on kit AHS 12, **two** additional loads can be operated, i e. the boom adjustment cylinder and one work tool (eg. hydraulic hammer) can be operated.

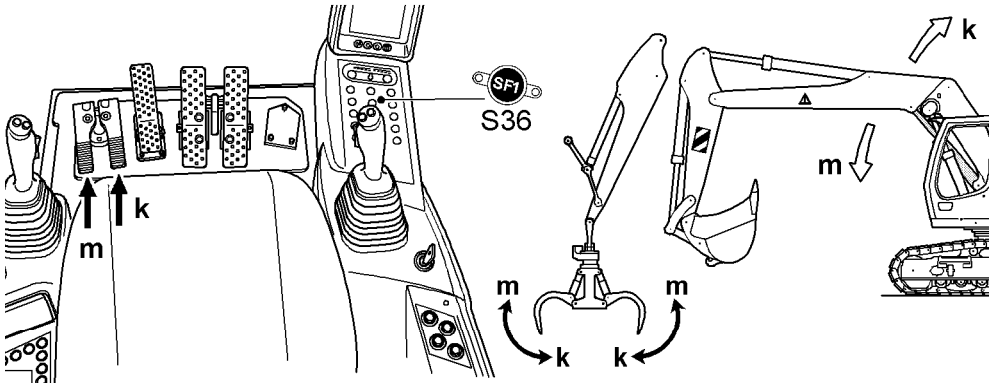


Fig. 3-80 *Multi-function kit AHS 12*

❑ Switch S36 is not activated
↳ LED into the switch does not lights on

▶ Push down foot pedal k.
↳ Boom adjustment cylinder will be extended, ie. the equipment moves up.

▶ Push down foot pedal m.
↳ Boom adjustment cylinder will be drawn in, ie. the equipment moves down.

To operate a work tool :

▶ Choose the predefined pressure and flow limitations assigned to the work tool in the operator's menu (see chapter "Tool Control")

Example: Hydraulic hammer

▶ Press Switch S36
↳ LED into the switch lights on.

▶ Push down foot pedal **k**.
↳ Hydraulic hammer is activated.

Example: Scrap cutter

▶ Press Switch S36
↳ LED into the switch lights on.

▶ Push down foot pedal **k**.
↳ Cylinder will be extended, i e. the scrap cutter will close.

▶ Push down foot pedal **m**.
↳ Cylinder will be drawn in, i e. the scrap cutter will open.

3.4.11 Foot pedals travel control with add on kits AHS (optional ex-

tra)

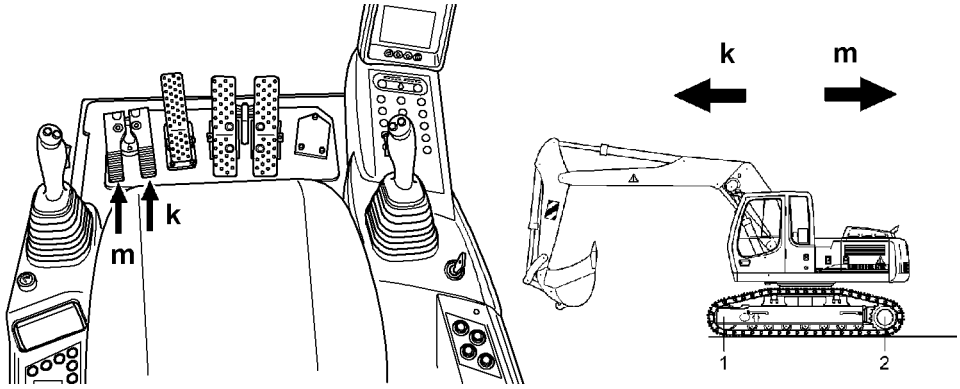
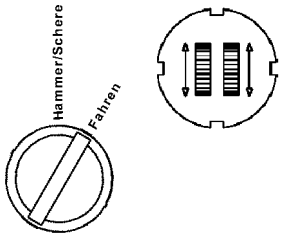


Fig. 3-81 *travel control with foot pedals*

On request, the machine can be equipped with the option "Foot pedals travel control". With it, it is possible to switch between the optional load AHS control **m** and **k** and the travel movement direction function **m** and **k**.

The control ist switched using switch **S159** into the right control bracket.



- ▶ Turn switch **S159** into position **Travel**.
  - ⇘ Control light **H66** into right control bracket lights on.
  - ⇘ Control functions are switched.
  - ⇘ Using foot pedal **m** allows to drive back,
  - ⇘ Using foot pedal **k** allows to drive up.

3.4.12 Adjust boom to side

Height and laterally adjustable gooseneck boom

The height and laterally adjustable gooseneck boom is operated using the two foot pedals of the AHS add-on kit.

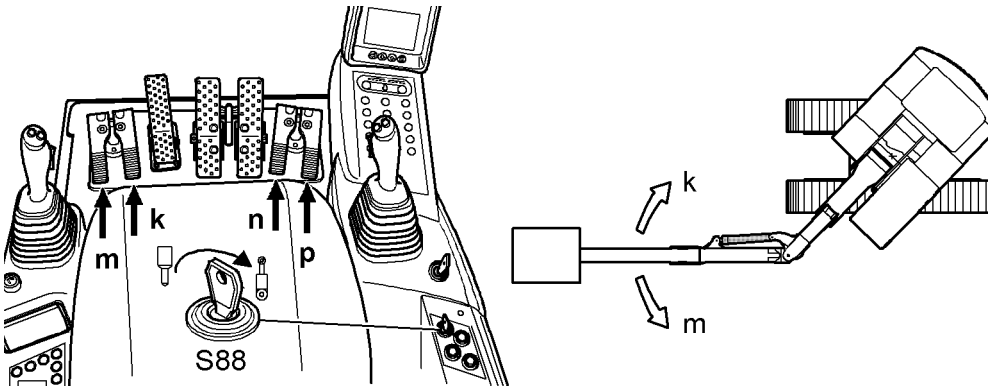


Fig. 3-82 *Adjust the height and laterally adjustable gooseneck boom.*

Add-on kit AHS 1 available:

- ▶ Push down foot pedal **k**.
  - ⇘ Boom will be slewed to the right.
- ▶ Push down foot pedal **m**.
  - ⇘ Boom will be slewed to the left.

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Add-on kit AHS 12 available:

- ▶ Turn the key switch to the **Cylinder** position.
- ▶ Push down foot pedal **k**.
  ↳ Boom will be slewed to the right.
- ▶ Push down foot pedal **m**.
  ↳ Boom will be slewed to the left.

Height and laterally adjustable boom

The height and laterally adjustable boom is operated using the two foot pedals of the AHS add-on kit.

Add-on kit AHS 12 available

This variation is only possible if no add-on unit, such as a hydraulic hammer or scrap cutter, is attached.

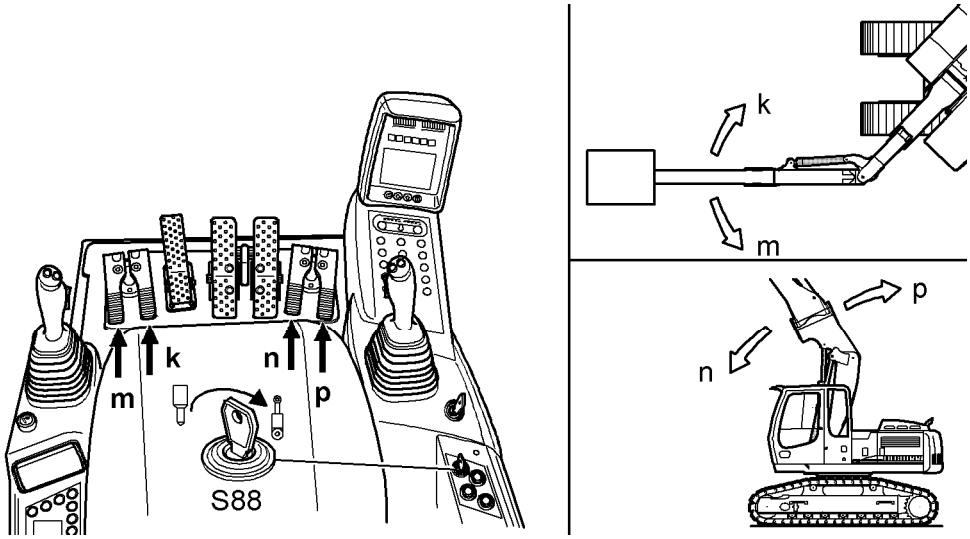


Fig. 3-83 *Adjust the height and laterally adjustable adjusting equipment.*

To adjust the height of the boom:

- ▶ Turn the key switch to the **Cylinder** position.
- ▶ Push down foot pedal **n**.
  ↳ Boom adjustment cylinder will be extended, ie. the equipment moves up.
- ▶ Push down foot pedal **p**.
  ↳ Boom adjustment cylinder will be drawn in, ie. the equipment moves down.

To adjust boom to side:

- ▶ Turn the key switch **S88** to the **Cylinder** position.
- ▶ Push down foot pedal **k**.
  ↳ Boom will be slewed to the right.
- ▶ Push down foot pedal **m**.
  ↳ Boom will be slewed to the left.

Add-on kit AHS 12 and changeover slide available

This variation is required if an add-on unit such as a hydraulic hammer or a scrap cutter is to be operated in addition to adjusting the boom.

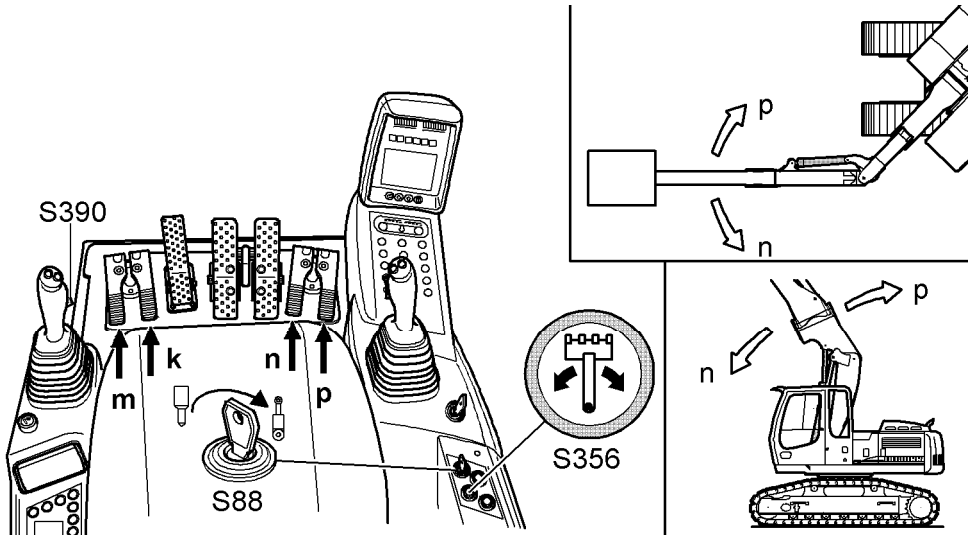
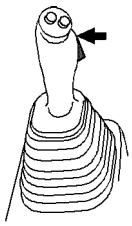


Fig. 3-84 *Adjust the height and laterally adjustable adjusting equipment.*

To adjust the height of the boom:

- ▶ Turn the key switch to the **Cylinder** position.

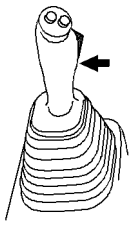
- ▶ Press switch **S356**.
  - ↳ Telltale light in the switch illuminates.
- ▶ Press up switch **S390**.
  - ↳ Boom adjusting cylinder is activated.



- ▶ Push down foot pedal **n**.
  - ↳ Boom adjustment cylinder will be extended, ie. the equipment moves up.
- ▶ Push down foot pedal **p**.
  - ↳ Boom adjustment cylinder will be drawn in, ie. the equipment moves down.

To adjust boom to side:

- ▶ Turn the key switch to the **Cylinder** position.
- ▶ Press switch **S356**.
  - ↳ Telltale light in the switch illuminates.



- ▶ Press switch **S390** down.
  - ↳ Lateral adjustment is activated.
- ▶ Push down foot pedal **n**.
  - ↳ Boom will be slewed to the right.
- ▶ Push down foot pedal **p**.
  - ↳ Boom will be slewed to the left.

3.4.13 Adjust boom to side (Tool Control)

Height and laterally adjustable gooseneck boom

The height and laterally adjustable gooseneck boom is operated using the two foot pedals of the AHS add-on kit.

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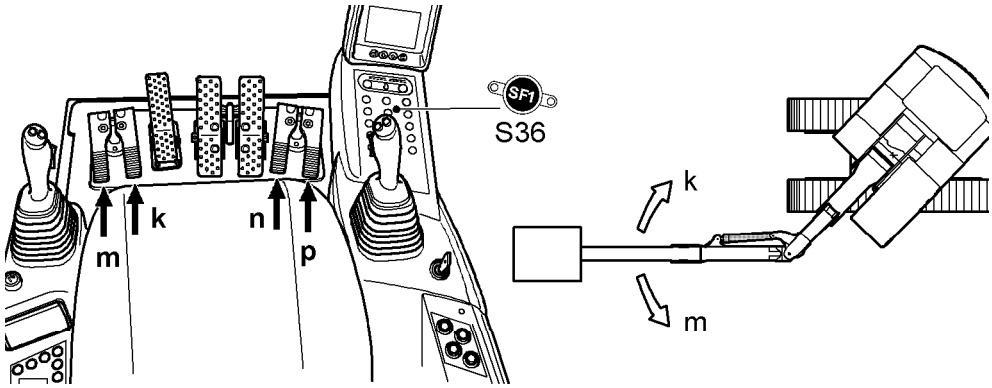

Fig. 3-85 *Adjust the height and laterally adjustable gooseneck boom.*

Add-on kit AHS 1 available:

▶ Push down foot pedal **k**.
↳ Boom will be slewed to the right.

▶ Push down foot pedal **m**.
↳ Boom will be slewed to the left.

Add-on kit AHS 12 available:

❑ Switch S36 is not activated
↳ LED into the switch does not lights on

▶ Push down foot pedal **k**.
↳ Boom will be slewed to the right.

▶ Push down foot pedal **m**.
↳ Boom will be slewed to the left.

Height and laterally adjustable boom

The height and laterally adjustable boom is operated using the two foot pedals of the AHS add-on kit.

Add-on kit AHS 12 available

This variation is only possible if no add-on unit, such as a hydraulic hammer or scrap cutter, is attached.

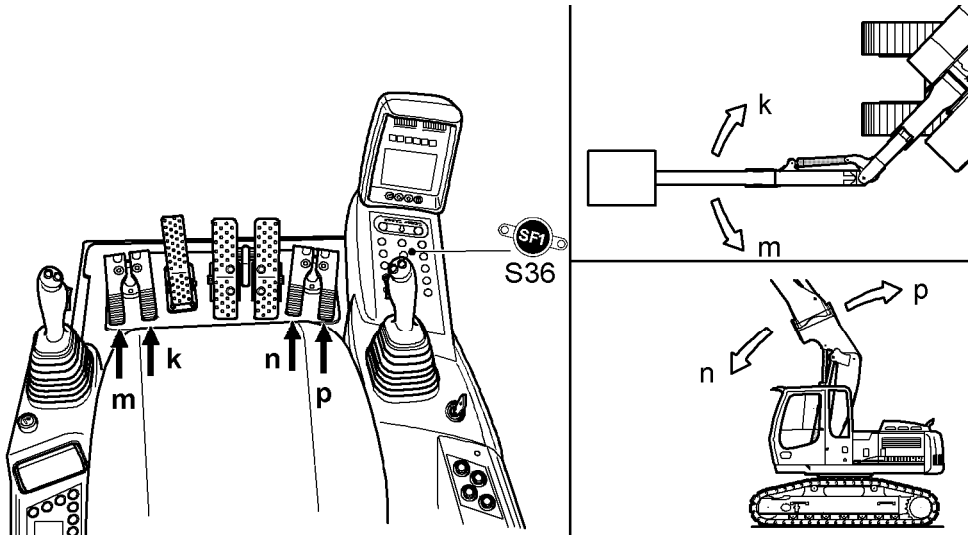

Fig. 3-86 *Adjust the height and laterally adjustable adjusting equipment.*

To adjust the height of the boom:

- ❑ Switch S36 is not activated
  - ↳ LED into the switch does not lights on
- ▶ Push down foot pedal **p**.
  - ↳ Boom adjustment cylinder will be extended, ie. the equipment moves up.
- ▶ Push down foot pedal **n**.
  - ↳ Boom adjustment cylinder will be drawn in, ie. the equipment moves down.

To adjust boom to side:

- ▶ Press Switch S36
  - ↳ LED into the switch lights on.
- ▶ Push down foot pedal **k**.
  - ↳ Boom will be slewed to the right.
- ▶ Push down foot pedal **m**.
  - ↳ Boom will be slewed to the left.

Add-on kit AHS 12 and changeover slide available

This variation is required if an add-on unit such as a hydraulic hammer or a scrap cutter is to be operated in addition to adjusting the boom.

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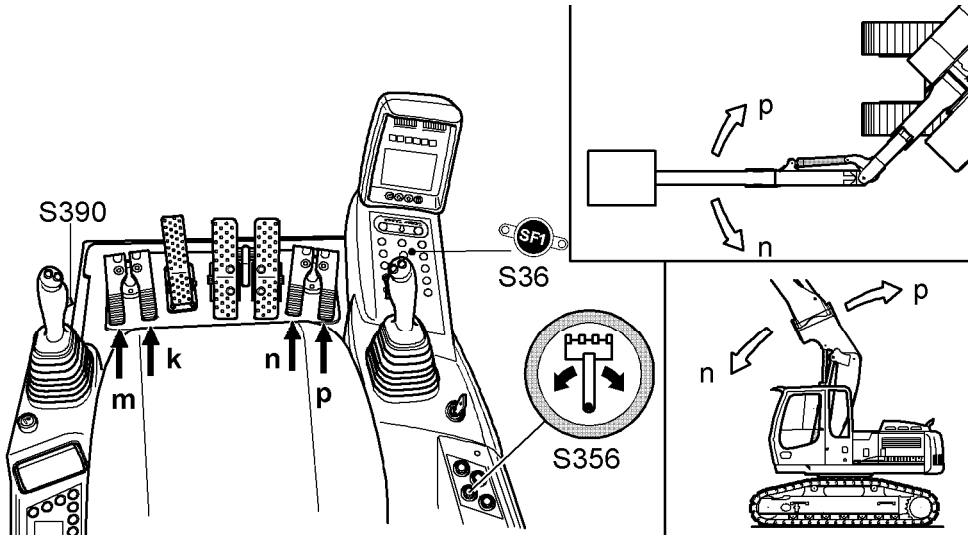
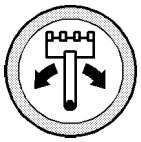


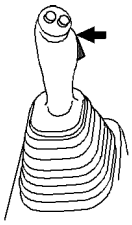
Fig. 3-87 *Adjust the height and laterally adjustable adjusting equipment.*

To adjust the height of the boom:

- ❑ Switch S36 is not activated
  - ↳ LED into the switch does not lights on
- ▶ Press switch **S356**.
  - ↳ LED in the switch lights on.



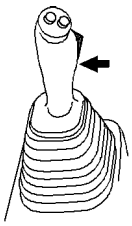
- ▶ Press up switch **S390**.
  - ↳ Boom adjusting cylinder is activated.
- ▶ Push down foot pedal **p**.
  - ↳ Boom adjustment cylinder will be extended, ie. the equipment moves up.



- ▶ Push down foot pedal **n**.
  - ↳ Boom adjustment cylinder will be drawn in, ie. the equipment moves down.

To adjust boom to side:

- ❑ Switch S36 is not activated
  - ↳ LED into the switch does not lights on
- ▶ Press switch **S356**.
  - ↳ LED in the switch lights on.



- ▶ Press switch **S390** down.
  - ↳ Lateral adjustment is activated.
- ▶ Push down foot pedal **p**.
  - ↳ Boom will be slewed to the right.
- ▶ Push down foot pedal **n**.
  - ↳ Boom will be slewed to the left.

3.4.14 Transferring controls PCSA - LH (optional extra)

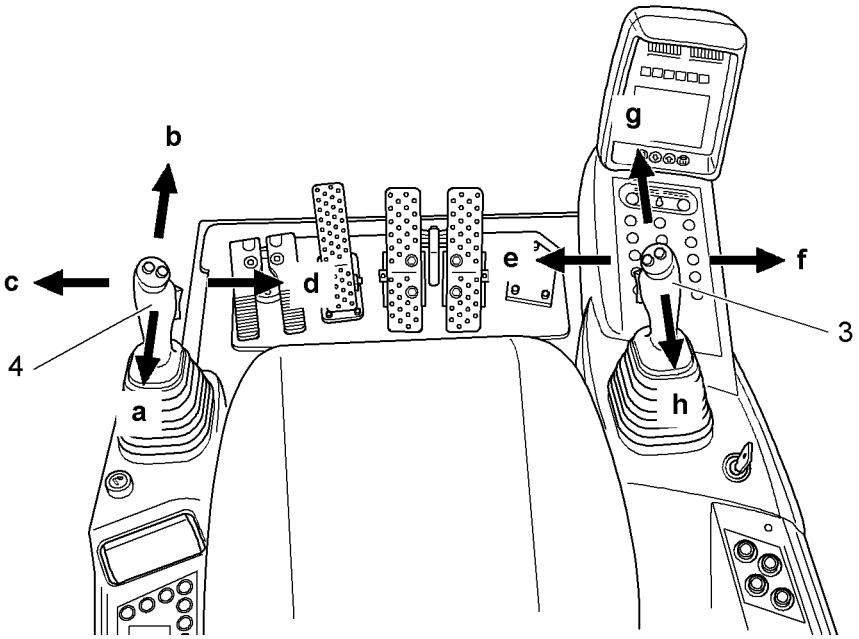
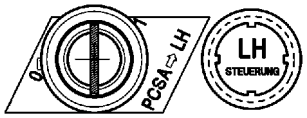


Fig. 3-88 *Transferring controls between joystick right (**3**) and left (**4**)*

On request, the machine can be equipped with the “Transfer controls” kit. This enables the operator to transfer the functions of the right joystick **3** and the left joystick **4**

Control is transferred using key switch **S247** on the right control panel.



▶ Turn the key switch **S247** to position 1.
  ⇩ Telltale light **H292** on the right control panel illuminates.
  ⇩ The control functions are transferred.

The left joystick (**3**) controls the stanchion and slewing movements.

– Direction of movement **h** and **g**: Stanchion is drawn in or out.
– Direction of movement **e** and **f**: Upper carriage is rotated to the left or to the right.

The right joystick (**4**) controls the boom or bucket and grab movements.

– Direction of movement **c** and **d**: Bucket will be tilted up or down, grab will close or open.
– Direction of movement **a** and **b**: Boom will be raised or lowered.

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

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3.4.15 Transferring AHS controls (optional extra)

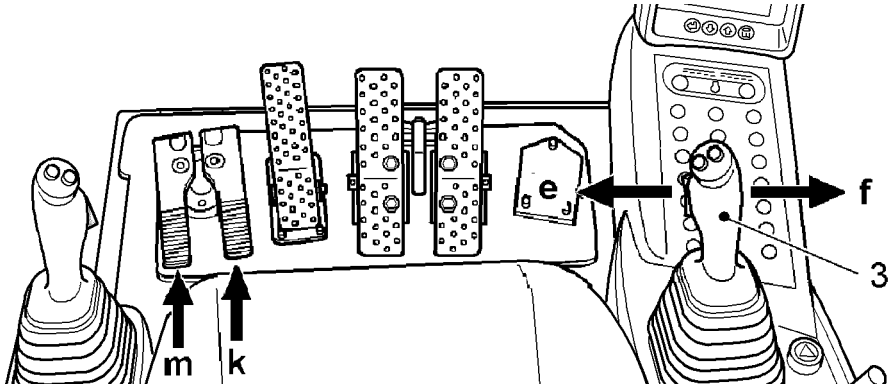

Fig. 3-89 *Transferring AHS controls*

On request, the machine can be equipped with the “Transfer controls” kit. This enables the operator to transfer the function “Tilt bucket” (directions of movement **e** and **f**) on the right joystick **3** to the additional load’s operation **m** and **k**.

Note
Requisite : Option AHS 1, AHS11 or AHS12 must be available, and being adjustate. See corresponding chapter.

Caution!
Additional equipment can have several functions. Always check out its functions on each machine starting
Incorrect preselection of the pressure and quantity setting can result in damage to the work tool (eg. hydraulic hammer) or to limited function (eg. boom adjustment cylinder).

Control is transferred using key switch **S114** on the right control panel.

- ▶ Turn the key switch **S114** to **position foot pedal**.
- ▶ Operate foot pedal **k**.
  - ↳ The additional equipment / cylinder will be extended.
- ▶ Operate foot pedal **m**.
  - ↳ The additional equipment / cylinder will be drawn in.
- ▶ Turn the key switch **S114** to **position joystick**.
- ▶ Push the right joystick **3** to the left **e**.
  - ↳ The same function will be carried out as if the right foot pedal **k** were being operated.
- ▶ Push the right joystick **3** to the right **f**.
  - ↳ The same function will be carried out as if the left foot pedal **m** were being operated.

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3.4.16 Special control (option)

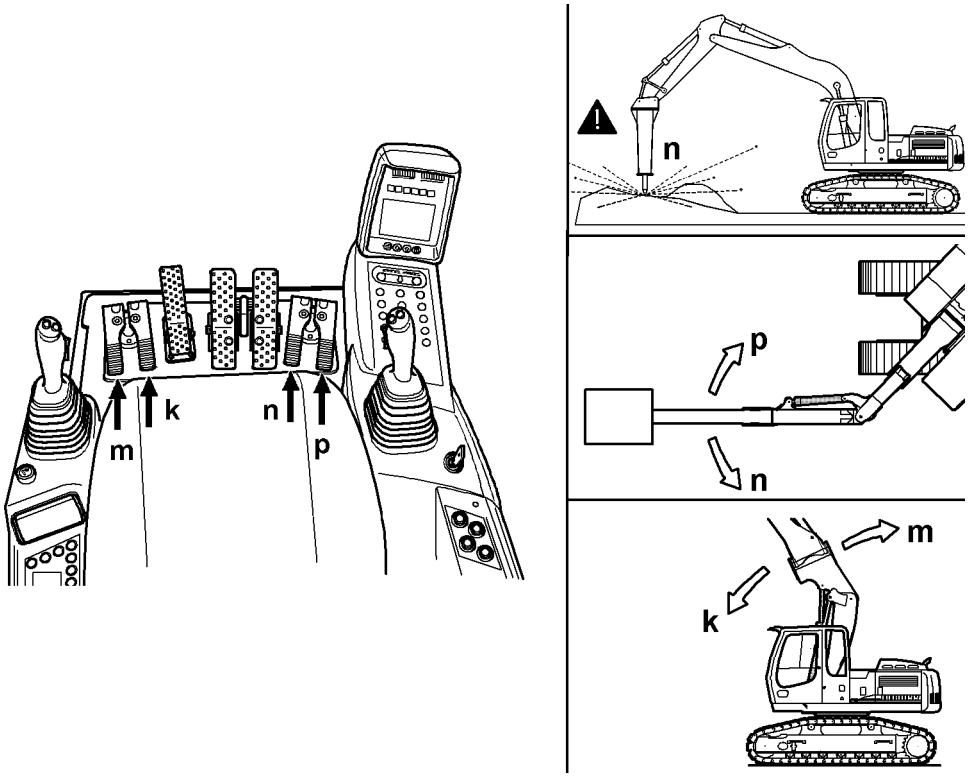

Fig. 3-90 *Special control*

On request, the machine can be equipped with the “Special control” kit. This declare the function “Hydraulic adjusted boom ” to the additional load’s operation **m** and **k**, and the function "Activating additional equipment" to the additional load’s operation **n** and **p**.

The function "Activating hydraulic hammer" is activated using foot pedale **n**.

Note
Requisite : Option AHS12 must be available, and being adjustate. See corresponding chapter.

Caution!
Additional equipment can have several functions. Always check out its functions on each machine starting
Incorrect preselection of the pressure and quantity setting can result in damage to the work tool (eg. hydraulic hammer) or to limited function (eg. boom adjustment cylinder).

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3.4.17 Dozer blade (option or serial according to machine type)

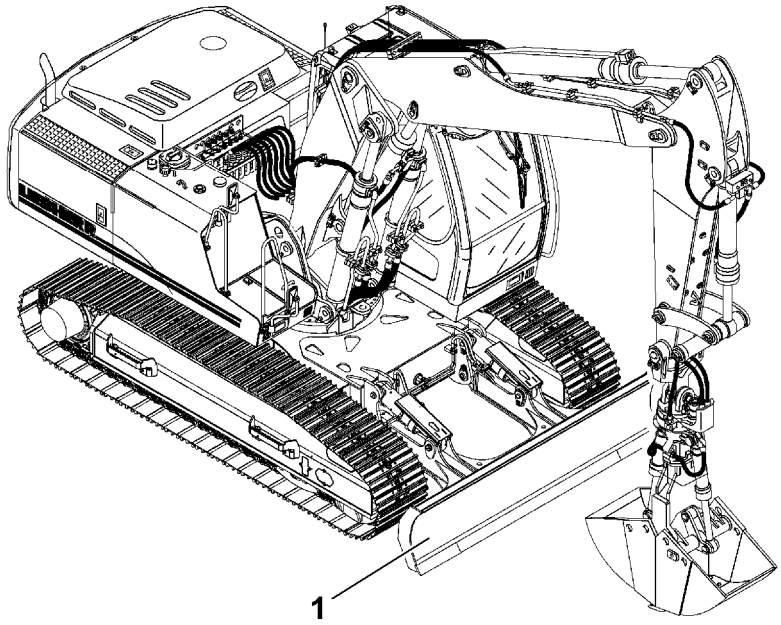


Fig. 3-91 *Dozer blade*

The machine can be equiped with a dozer blade :

– **1** Dozer blade

The dozer blade can only be monted on the front side.

Danger !
A dozer blade is not destinated for machine shoring. It's lowering does not cause any elevation of the immobilization point, and so any elevation of the admissible charge values.
The dozer blade has to be used exclusively for levelling tasks and **not** to shore the machine.

Activating the dozer blade

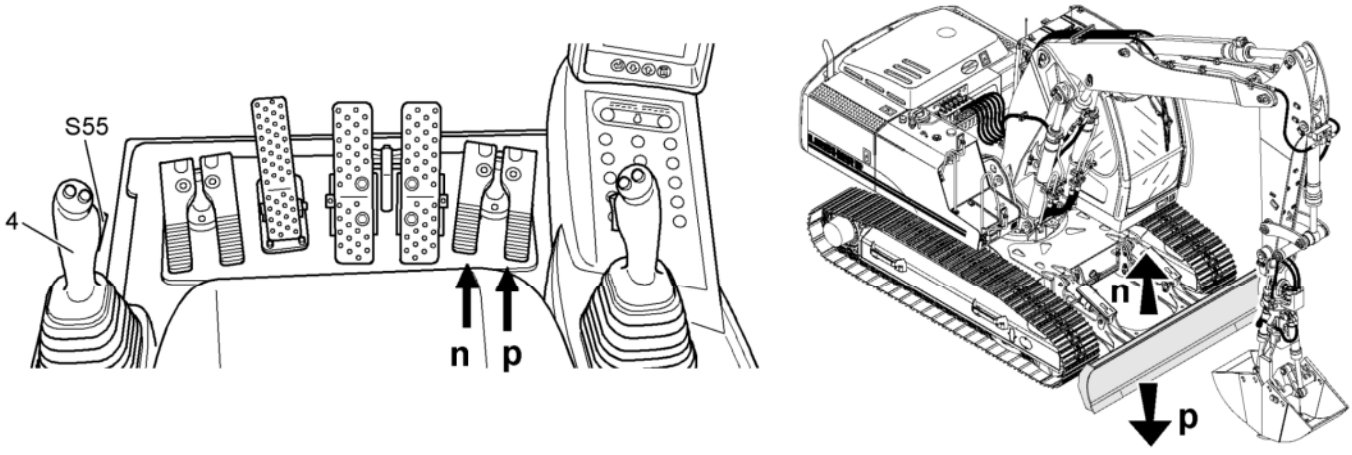
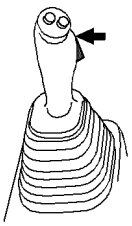


Fig. 3-92 *Dozer blade use*



Dozer blade height regulation :

- ▶ Tilt up the **S55** button.
  - ↳ The dozer blade regulation cylinder is activ.
- ▶ Press on **p** pedal.
  - ↳ The dozer blade regulation cylinder extends, the equipment is lowered.
- ▶ Press on **n** pedal.
  - ↳ The dozer blade regulation cylinder shortens, the equipment is moved up.

3.4.18 Mechanical stanchion cylinder shut-down (option)

Mode of operation

The movements of an industrial boom cover considerable heights and breadths.

When moving the industrial stanchion, both the stanchion and its suspended load can come close to the cab or an object in the vicinity.

If the operator does not take due care, this could be dangerous for the operator himself, the cab, the surrounding area and for the equipment and the suspended load.

To prevent this happening, the movement area of the industrial stanchion is limited on its minimum angle by the stanchion cylinder shut-down using an inductive sensor.

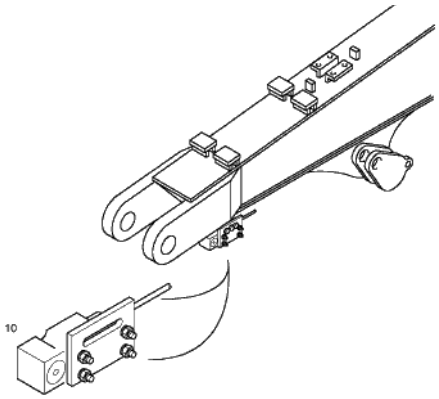


Fig. 3-93 *Sensor stanchion cylinder shut-down*

Danger!
Electronic stanchion cylinder shut-down is **not** a safety device. The shut-down is only intended as an aid to the operator of the machine!

Danger!
There is a risk that the equipment may come too close to the cab due to:

– A work tool shifting (eg. grab) and due to different dimensions of the work tool when opened and closed.
– A delay in the shut-down process. The shut-down route can, depending on oil temperature and equipment type, be extended by up to 0.5 m and dependent on speed of inward travel and grab contents by up to 1.0 m.

A minimum safety distance of at least 1.5 m to the danger object should be maintained. The machine operator is responsible for entering the correct settings!

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Caution !
Risk of damage! The machine could rock!
Avoid moving the industrial stanchion quickly when moving it in the vicinity of the shut-down points.

The stanchion cylinder shut-down point

The stanchion cylinder shut-down has one shut-down point:

– Drawing in shut-down point (**min. limit**)

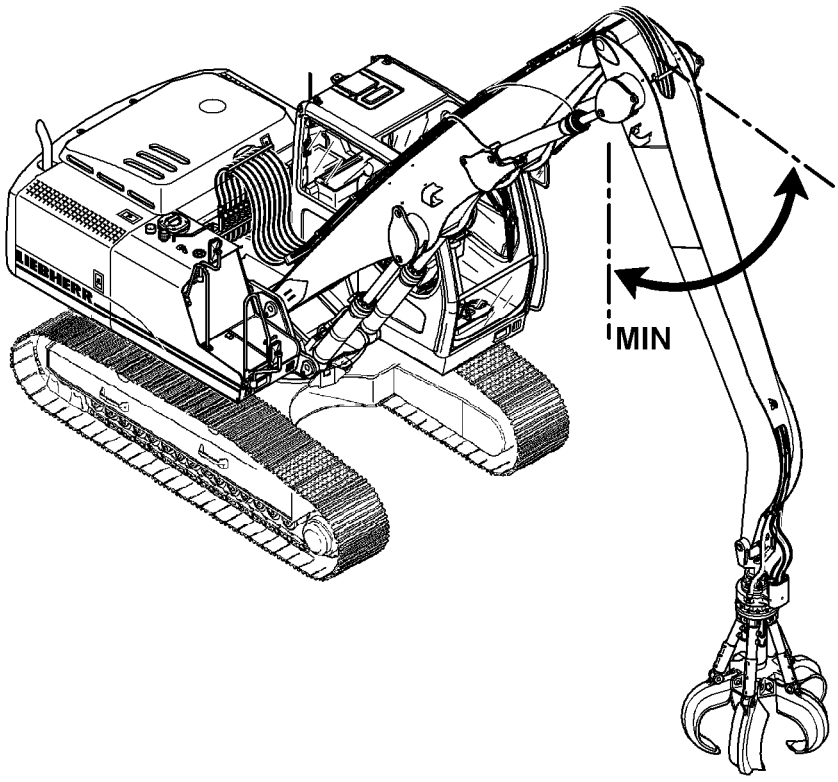


Fig. 3-94 *Stanchion cylinder shut-down - shut-down point*

Bypassing stanchion cylinder shut-down

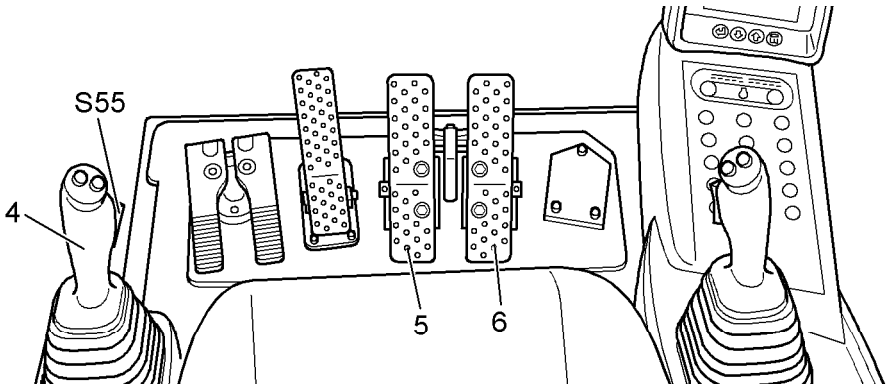
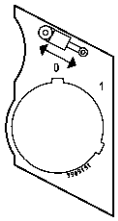


Fig. 3-95 *Kippschalter am Linken Handgriff*

f the industrial stanchion is to be moved beyond a shut-down point, the stanchion cylinder shut-down can be bypassed.

- ❑ Bypassing can only be activated if the movement of the industrial stanchion has already been shut down using the stanchion cylinder shut-down.

Danger!
Risk of injury and of damage!
When switch **S54** is being pressed, there is a risk that the equipment may come either too close to the cab or, if it has been extended too far, cause injury to other people or damage objects.



Pressing switch **S54** on the right control panel allows to bypass the stanchion cylinder shut-down.

- ▶ Turn the key-switch **S54** to the right (Position **I**).
  - ↳ Using the flip-switch **S55**, integrated on side of the left grip, up or down, bypasses the stanchion cylinder shut-down.
- ▶ Turn the key-switch **S54** into neutral position (Position **0**).
  - ↳ No bypass of the stanchion cylinder shut-down can be allowed true flip switch **S55**.

3.4.19 Overload warning device

General

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

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

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

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

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

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

For hoe type bucket equipment (including shovel cylinder, reversing lever and connecting clip) the values on the stanchion tip apply. The machine can be rotated 360° on solid, level subsoil when the full floating axle is engaged. If the shovel cylinder, reversing lever and connecting clip are dismounted, the values increase by an additional 300 kg. If a quick-change adapter is used, the values are reduced by 235 kg (QCA 48).

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

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“Simple” 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 hydraulic jack.

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

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

Starting

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

▶ Have the overload warning device repaired by a professional.

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

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

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

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

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

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

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

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3.5 Attaching and dismounting equipment parts

3.5.1 Attaching and removing equipment parts safely

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

3.5.2 Removing and installing equipment bolts safely

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

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3.5.3 Attaching and dismounting the bucket

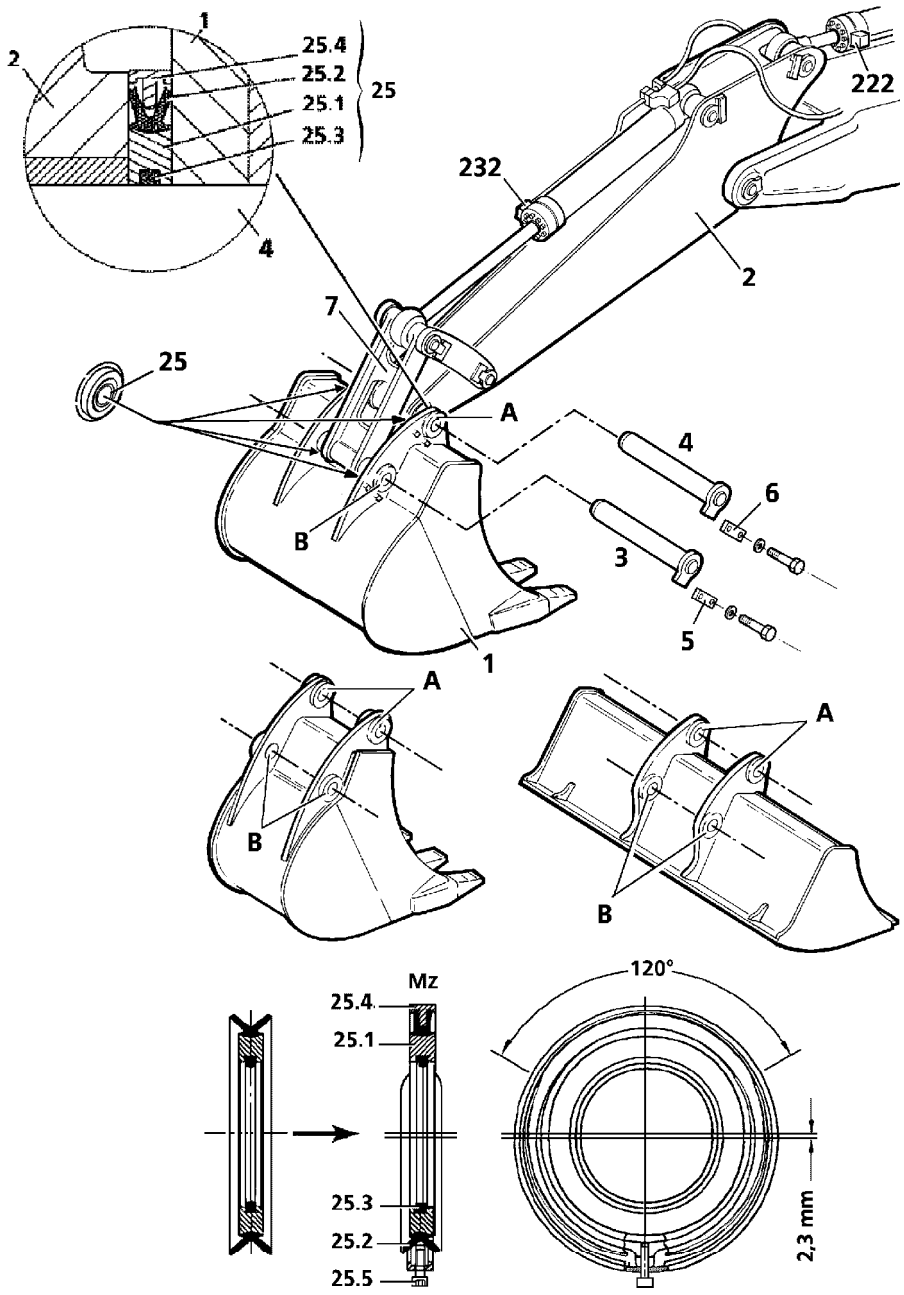

Fig. 3-96 *Attaching and dismounting the bucket*

1	Digging bucket	**25**	Complete pin bearing sealing
2	Stick	**25.1**	Sealing ring
3-4	Pin	**25.2**	Lip seal ring
5-6	Locking plate	**25.3**	O-Ring
7	Connecting link	**25.4**	Protection and installatio ring
222	Restrictor check valve	**25.5**	Assembly screw
232	Restrictor check valve		

The following is a description of how to attach and dismount buckets. Buckets are,

for example, hoe type buckets, ditcher buckets or breaker teeth.

Dismounting 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.

Attaching 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 bearing sealing rings **25** with protection ring, between bucket and stick while pressing in the pin.
- ▶ 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 bearing sealing rings **25** with protection ring, between bucket and stick while pressing in the pin.
- ▶ 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.

Description and installation of a pin bearing sealing

Function description

A pin bearing sealing **25** is loosely mounted on each side between the bearing limbs of the digging bucket **1**, facing the stick **2** and the connecting link **7**, in such a way that an axial play is produced.

The pin bearing sealings **25** are held in place by the bearing pins **3** and **4**.

The pin bearing sealing **25** protects the bearing from the penetration of dirt, water

and corrosive media.

The pin bearing sealing **25** is a pre-assembled delivery component.

The lip seal ring **25.2** is vulcanised onto the sealing ring **25.1**.

The sealing lips on the lip seal ring **25.2** have a V-form profile.

The lip seal ring **25.2** is housed in a protection and installation ring **25.4**.

The protection and installation ring, which houses the sealing lips radially, is made of plastic and protects the sealing lips from external mechanical damage.

The metallic sealing ring **25.1** is able to absorb the forces acting on the rotating part, so that these cannot destroy the lip seal ring.

Installation of a pin bearing sealing

- ▶ The inner face of the protection and installation ring **25.4** comprises two circular

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grooves which allow the installation of the pin bearing sealing.

- ▶ Before insertion of the complete pin bearing sealing **25** between the facing bearing limbs, the lips of the seal ring **25.2** must be fold together and inserted in the grooves of the installation ring in an angular sector of approx. 120°.
- ▶ Fill the interspace between installation ring and lips with grease before installation.
- ▶ The assembly screw **25.5** is only designed to hold the sealing lips together on the lip seal ring during basic assembly of the pin bearing sealing.
- ▶ The assembly screw must be removed after assembly.

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.

3.5.4 Attaching and dismounting the bucket with improved

sealing

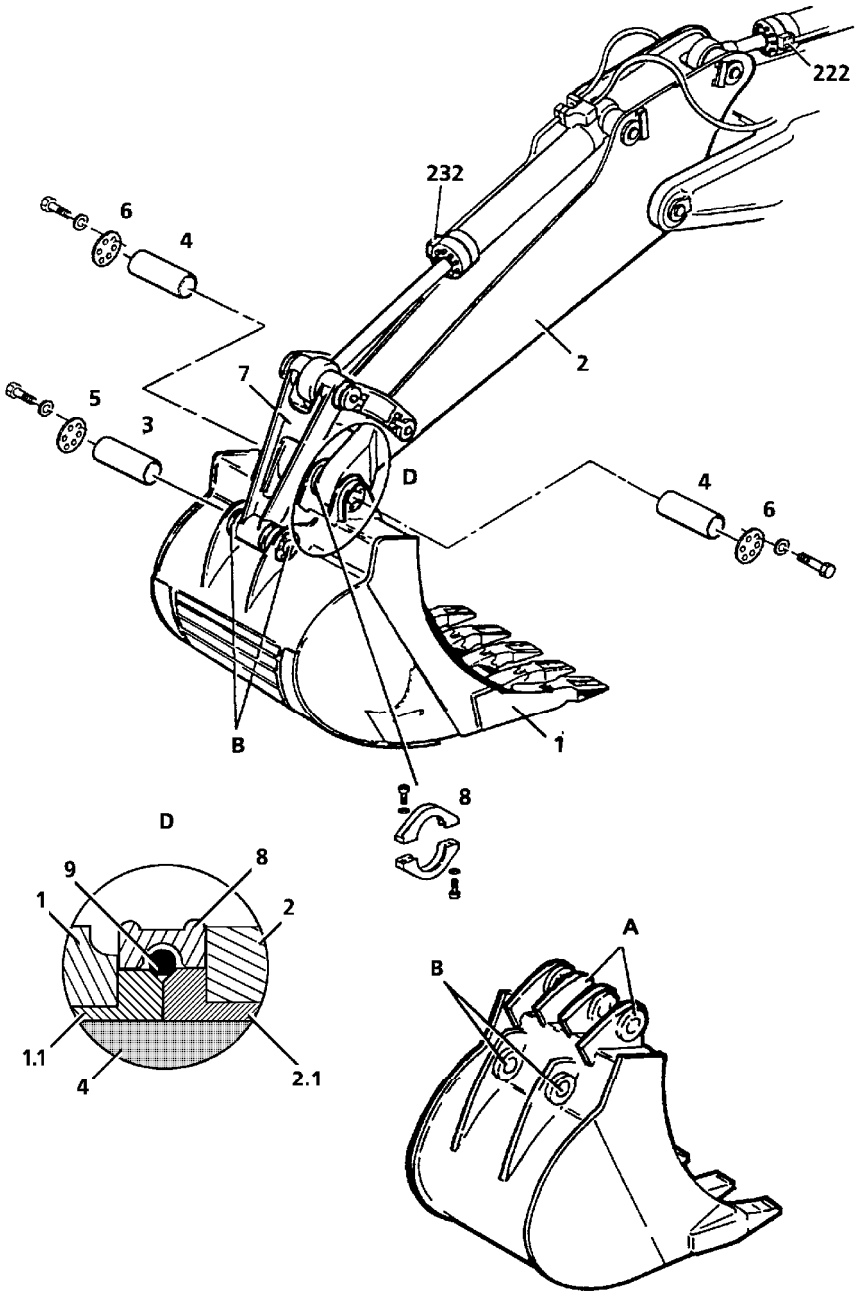

Fig. 3-97 *Attaching and dismounting the bucket*

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 dismount buckets with improved sealing.

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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.

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3.5.5 Attaching and dismounting the grab on stick

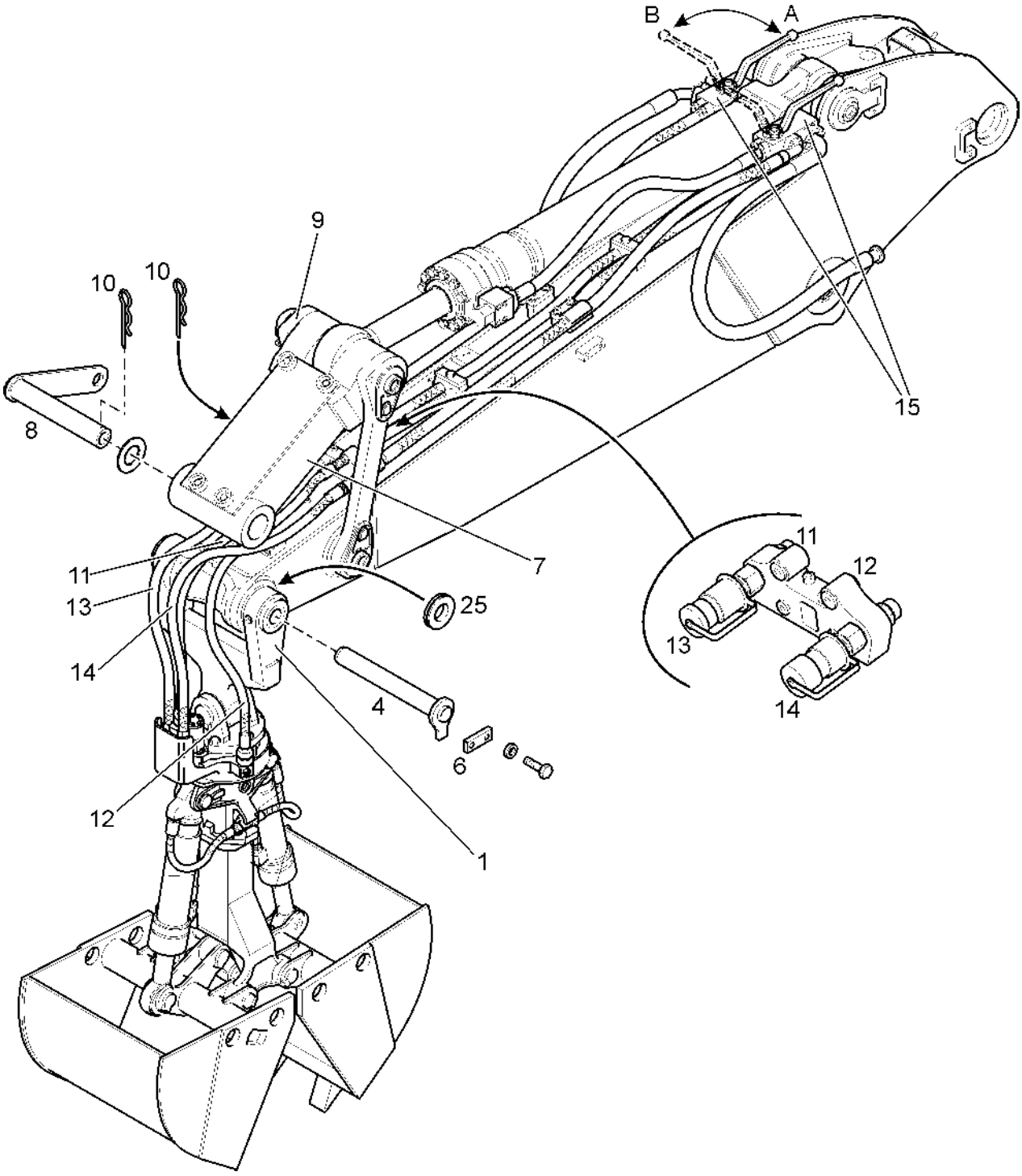

Fig. 3-98 *Attaching and dismounting the grab on the stick*

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		

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- ❑ Before attaching a clamshell bucket or grapple, ensure that the required hydraulic lines for operating the grab are built into the stick.
- ❑ Attaching and dismounting 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, dismount 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 (see also the corresponding section on page "Installation of a digging tool").
- ▶ 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.

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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**.

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3.5.6 Attaching and dismounting the grab on stick

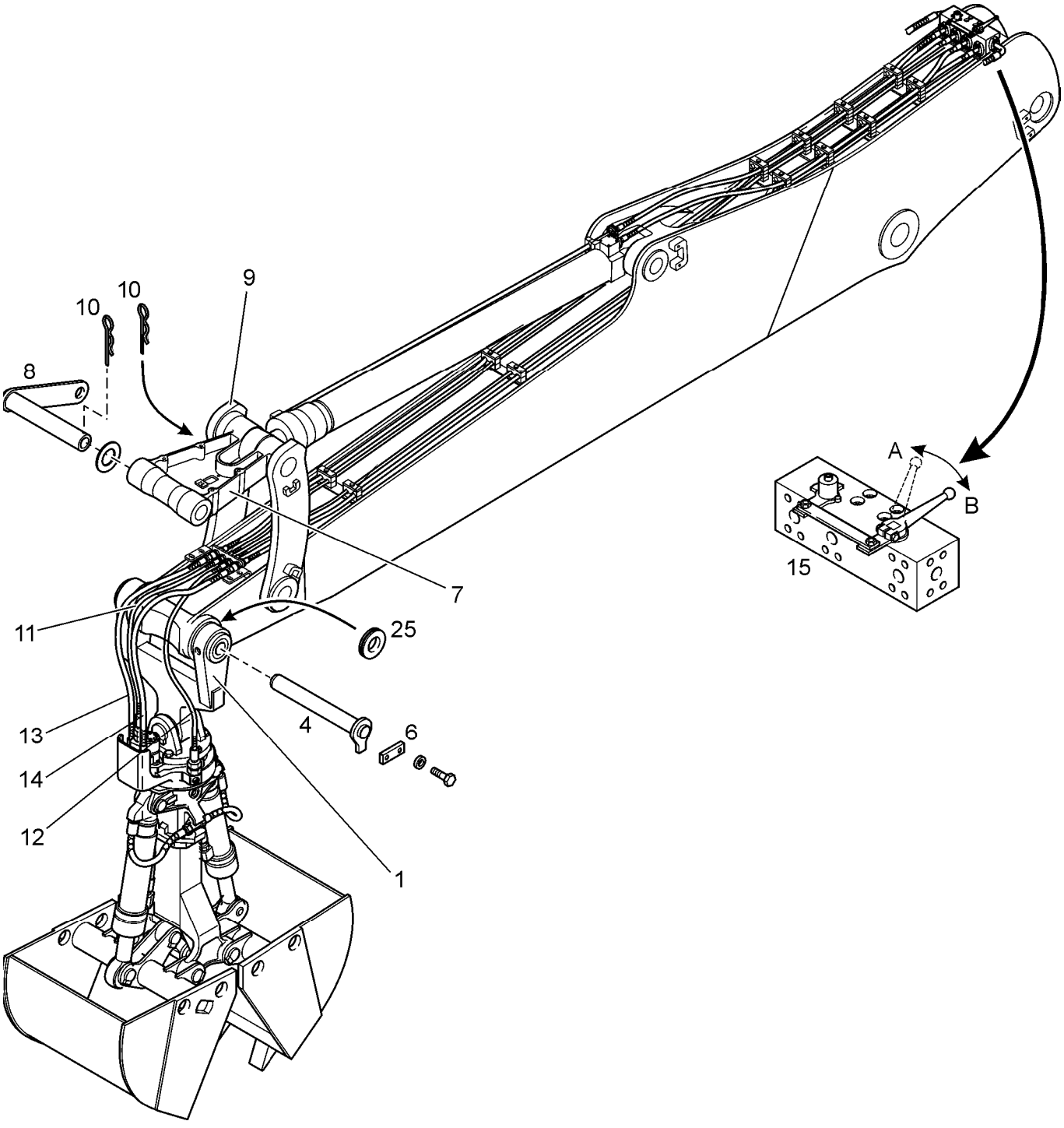

Fig. 3-99 *Attaching and dismounting the grab on the stick*

1	Grab mounting	**11**	Hose
4	Pin	**12**	Hose
6	Locking plate	**13**	Hose
7	Connecting link	**14**	Hose
8	Carrier bracket	**15**	Valve block
9	Reversing lever	**25**	Pin bearing sealing
10	Cotter pin		

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- ❑ Before attaching a clamshell bucket or grapple, ensure that the required hydraulic lines for operating the grab are built into the shovel arm.
- ❑ Attaching and dismounting 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, dismount 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 (see also the corresponding section on page "Installation of a digging tool").
- ▶ 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 a valve block **15**:

– **A** - Tilting cylinder operation (for buckets)
– **B** - grab operation (for grab, scrap cutter etc.)

- ▶ Turn the lever of the valve block **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.

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- ▶ 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**.

3.5.7 Attaching and dismounting the grab on the industrial stan-

chion

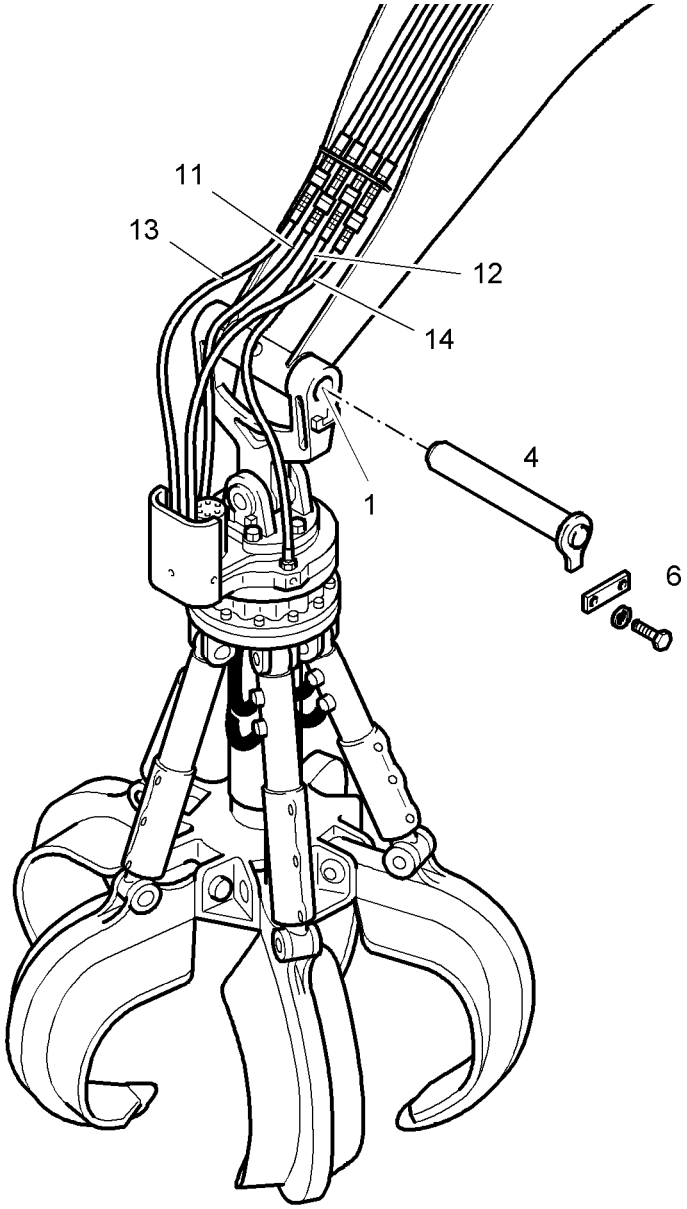

Fig. 3-100 *Attaching and dismounting the grab on the industrial stanchion*

- ❑ 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 dismounting 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**.

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- ▶ 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.

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3.5.8 Attaching and dismounting the stick to the boom

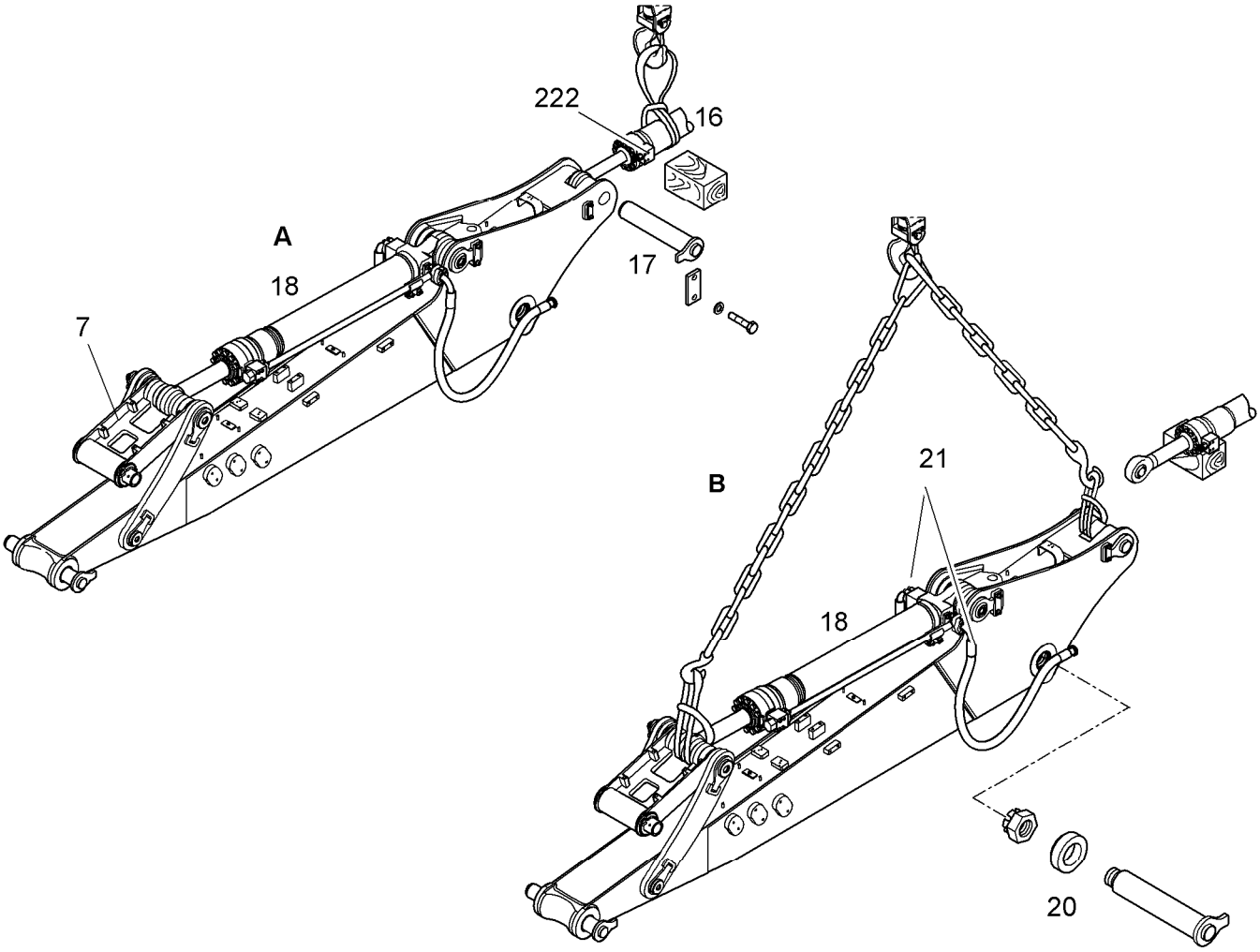

Fig. 3-101 *Attaching and dismounting the stick to the boom*

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

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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.

- 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.

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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.

3.5.9 Mechanical quick-change adapter (optional extra)

Safety information

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

Overview

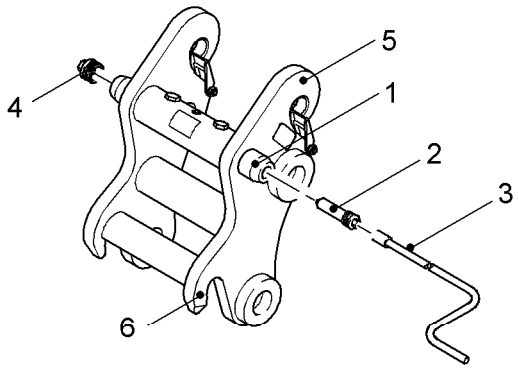

Fig. 3-102 *Mechanical quick-change adapter*

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

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Attaching the work tool

To move the equipment into position:

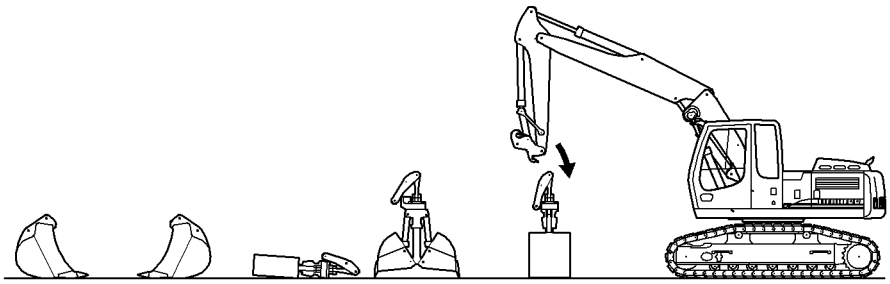

Fig. 3-103 *Positioning the equipment*

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

To unlock the quick-change adapter:

Danger!
Risk of injury.

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

- ▶ Approach the quick-change adapter from the side and unscrew the locking screw **2** using the crank **3** from the locking pin **1** (siehe Fig. 3-102).
- ▶ 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:

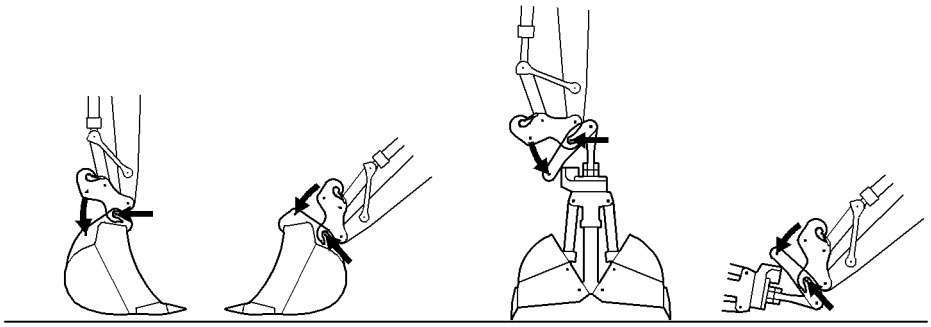

Fig. 3-104 *Taking up the work tool*

- ▶ 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:

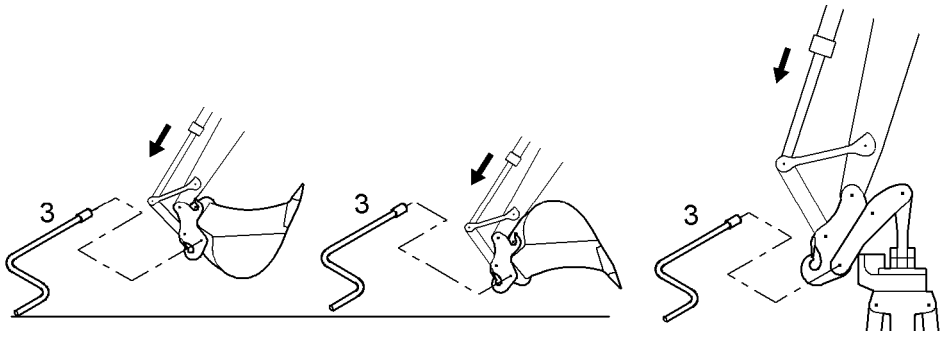

Fig. 3-105 *Locking the quick-change adapter*

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 diesel engine, turn the ignition key into the contact position, operate the joystick).

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

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Detaching a work tool

To move the equipment into position:

Caution!
Hydraulic lines are pressurized!

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

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

To unlock the quick-change adapter:

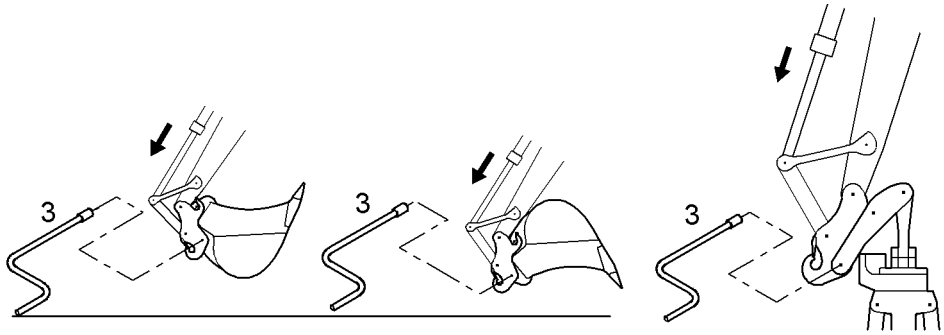

Fig. 3-106 *Unlocking the quick-change adapter*

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:

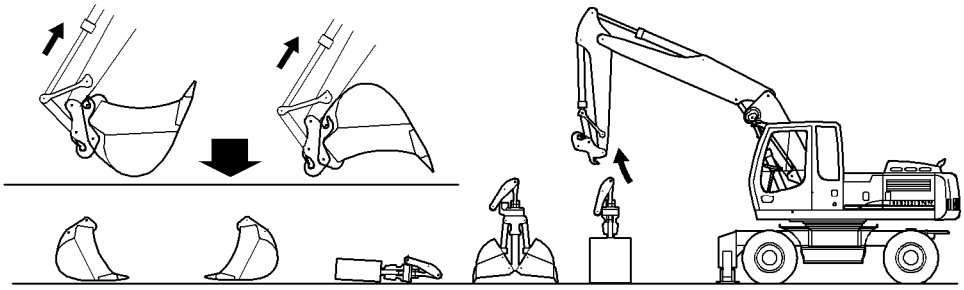

Fig. 3-107 *Putting down the work tool*

- ▶ 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

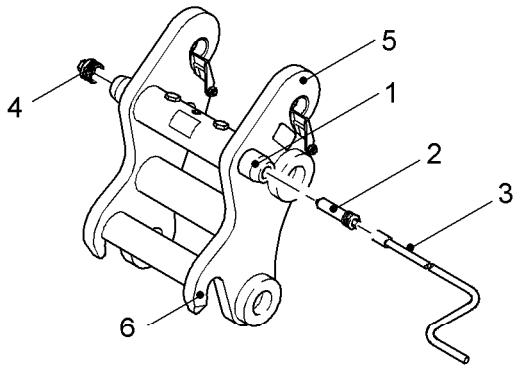

Fig. 3-108 *Mechanical quick-change adapter*

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

Danger!

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

- ▶ Fasten the load on the lifting hook as described in the chapter "Hoisting work".

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3.5.10 Hydraulic quick-change adapter (optional extra)

Safety information

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

Overview

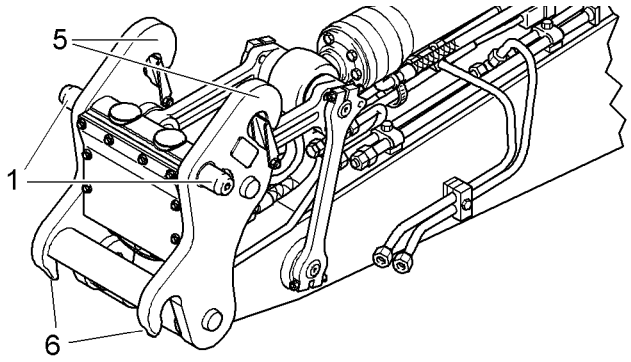


Fig. 3-109 *Hydraulic quick-change adapter*

1 Locking pin (removed) **5** Lifting hook **6** Take-up hook for work tool

Operating elements

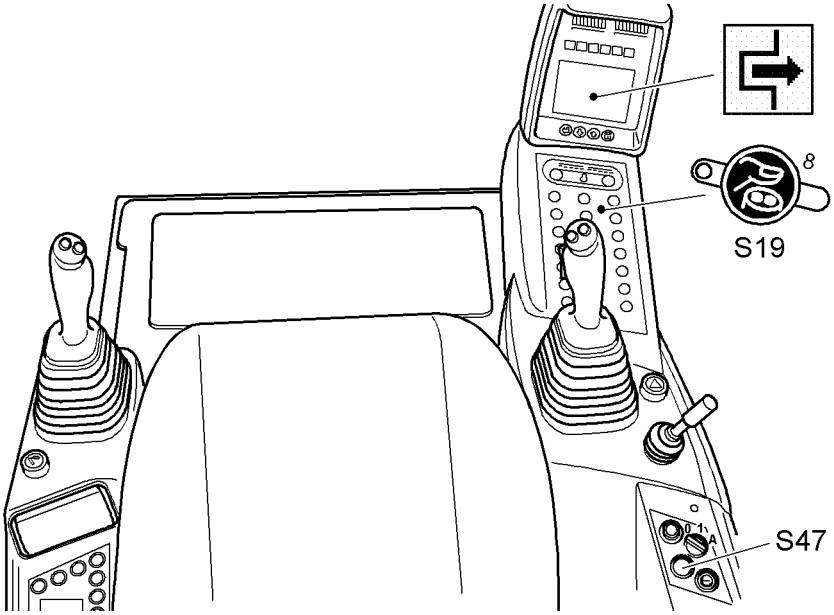


Fig. 3-110 *Operating elements for the hydraulic quick-change adapter*

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.

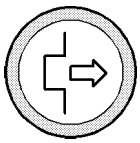
Button S47 (2 versions)

Key switch S47 (old version):

Key switch **S47** has two positions:

– Position **0**: It is not possible to operate the locking pins.

– Position **1**: The key switch can be pressed down. This activates the quick-change adapter – it is possible to operate the locking pins.



Key switch S47 (new version):

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

Pushbuttons L and R

Pushbutton **L** = remove locking pin (lock)
Pushbutton **R** = insert locking pin (unlock)

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

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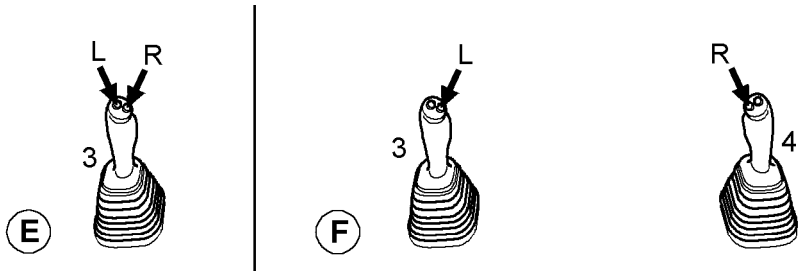

Fig. 3-111 *Pushbutton on the joystick*

E Operation with left joystick (standard)

F Operation with left and right joystick (optional extras)

Bildschirmsymbol "Schnellwechsler"

Das Symbol erscheint:

– während des Entriegelungsvorgangs oder

– bei zurückgefahrenen Verriegelungsbolzen.

Two-hand operation

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

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

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

Attaching the work tool

To move the equipment into position:

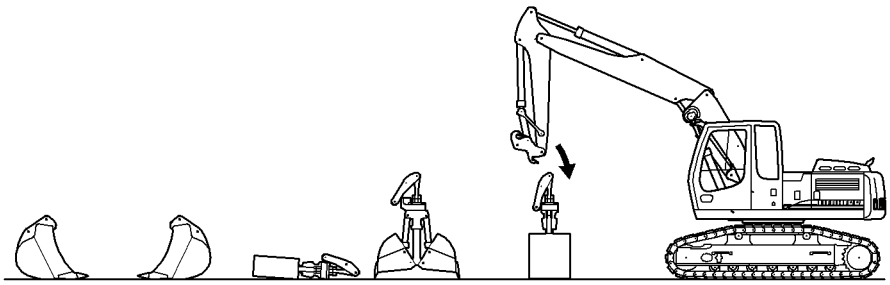

Fig. 3-112 *Positioning the equipment*

❑ 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:

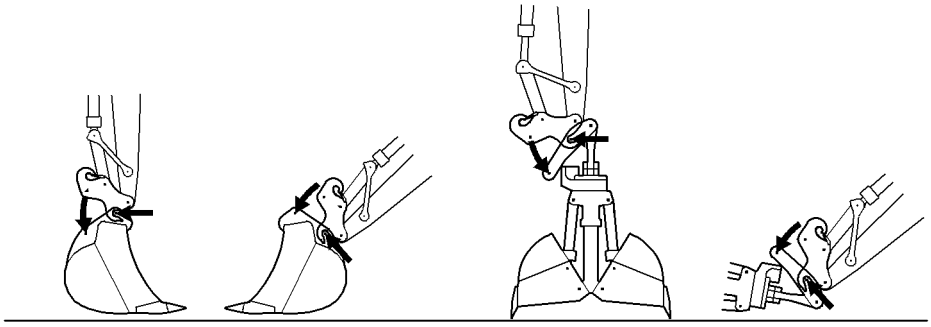

Fig. 3-113 *Taking up the work tool*

▶ Move the quick-change adapter into a position that allows the work tool to be picked up using the take-up hook.

▶ Raise the work tool from the ground and extend the shovel tilting cylinder fully until the bearing panel for the work tool is laying on the quick-change adapter stop.
↳ The bore holes of the work tool and the locking pins of the quick-change adapter must align.

To lock the quick-change adapter:

▶ Press switch **S19**.
↳ Quick-change adapter is activated.
↳ LED in switch illuminates.

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

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

▶ Release button **S47**.

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

Caution!
Hydraulic lines are pressurized!

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

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

grab).

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

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

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

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

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

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

▶ Performing the working cycle

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

Detaching a work tool

To move the equipment into position:

AchtCaution!
Hydraulic lines are pressurized!

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

▶ Disconnect hydraulic lines or electrical lines, if necessary (eg. when dismounting a grab).

▶ Extend the shovel tilting cylinder fully.

To unlock the quick-change adapter:

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

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

▶ Press switch **S19**.
↳ Quick-change adapter is activated.
↳ LED in switch illuminates.

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

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

To put down the work tool:

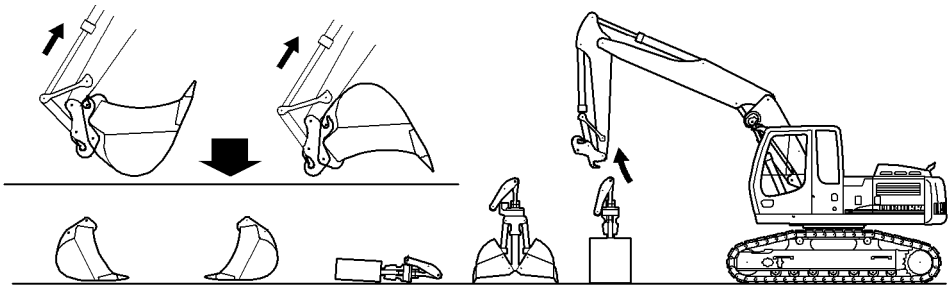

Fig. 3-114 *Putting down the work tool*

▶ 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

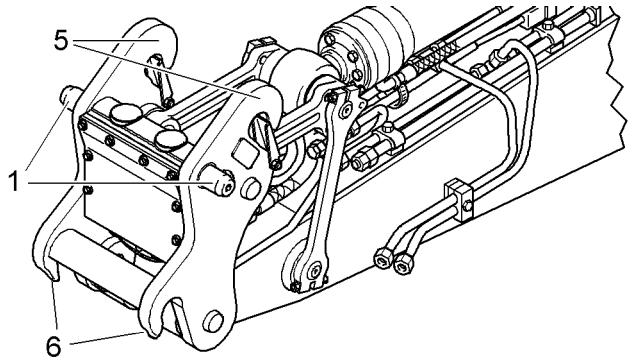

Fig. 3-115 *Hydraulic quick-change adapter*

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

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

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

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

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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.

3.5.11 LIKUFIX – hydraulic coupling system (optional extra)

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

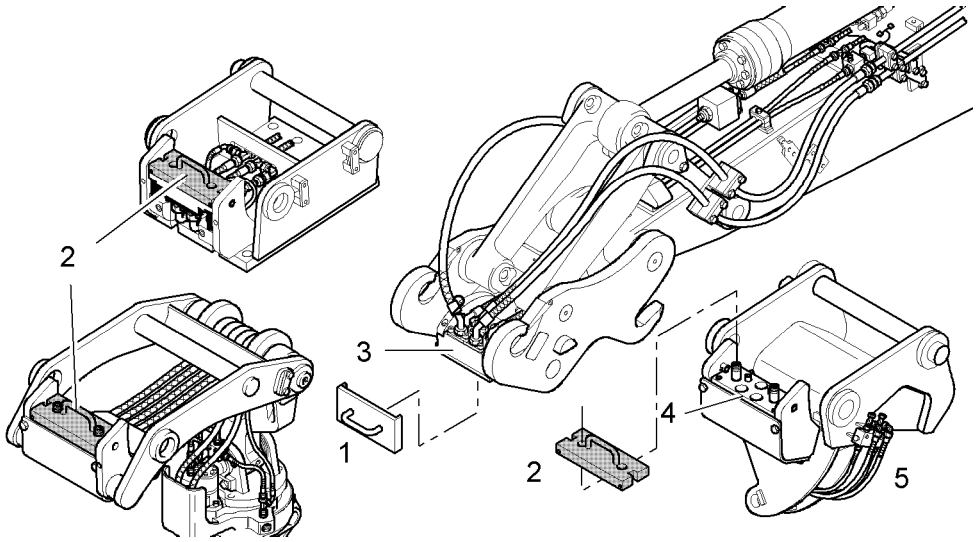

Fig. 3-116 *LIKUFIX*

1 Protective cover on quick-change adapter

2 Protective covering on work tool

3 LIKUFIX hydraulic coupling on quick-change adapter

4 LIKUFIX hydraulic coupling on work tool

5 Alternative hydraulic coupling on work tool

Attaching and dismounting work tools

Attaching and dismounting is carried out as described in the chapter “Hydraulic quick-change adapter”.

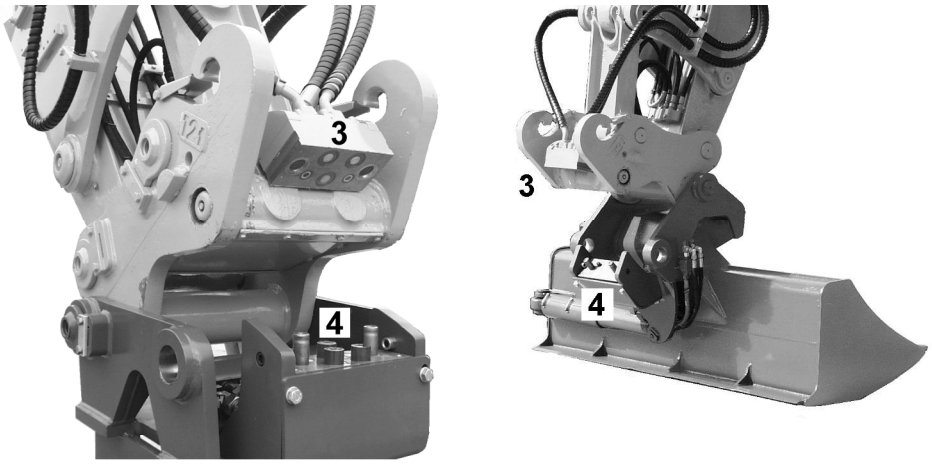

Fig. 3-117 *Connecting LIKUFIX*

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.

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- ▶ 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.

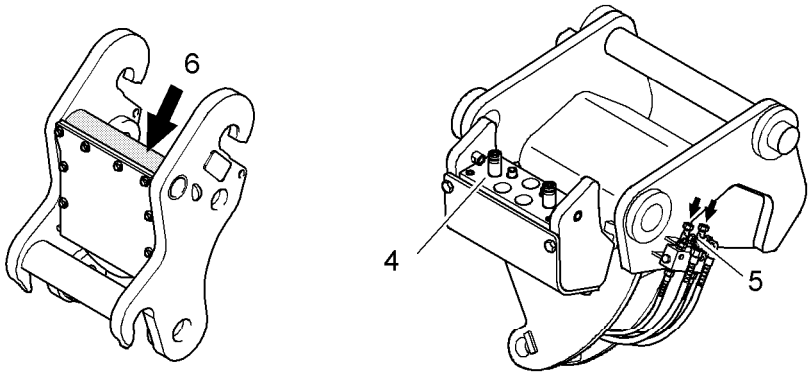

Fig. 3-118 *LIKUFIX work tool on quick-change adapter without LIKUFIX*

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**.

3.6 General working methods

3.6.1 Minimum impact working methods for your machine

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

– Do not stop the rotary motion of the upper carriage when slewing into a ditch by stopping the equipment on the walls of the ditch.
– Using the machine for applications where the equipment is knocked against the material to be removed, in the longitudinal direction too, is not permitted. Repeatedly hitting the work equipment against rock or other hard material will damage steel parts and machine components.
– With specific combinations of boom, 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.

3.6.2 Preparatory activities

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

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

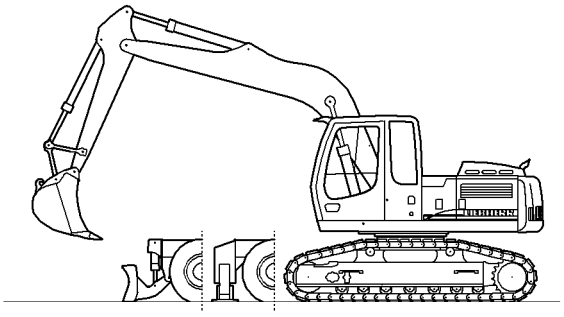

Fig. 3-119 *Working position – machine*

▶ Position the machine so that the load or grab material can be taken up above the rigid axle or the leading wheel.

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▶ 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.

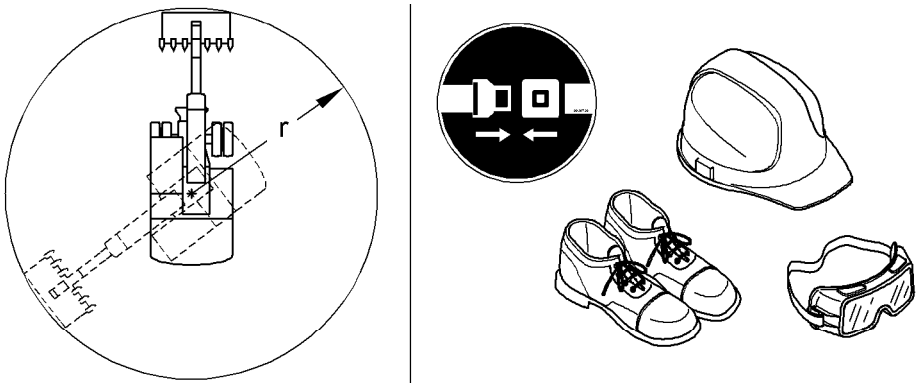

Fig. 3-120 *Safe working*

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

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

Caution!
Risk of injury when working.

▶ Always wear safety shoes and, particularly when leaving the cab when demolition work is going on, a protective helmet and goggles.

▶ Always wear the seat belt.

▶ Use the horn to give a short warning signal before starting work.

3.6.3 Working with the 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.

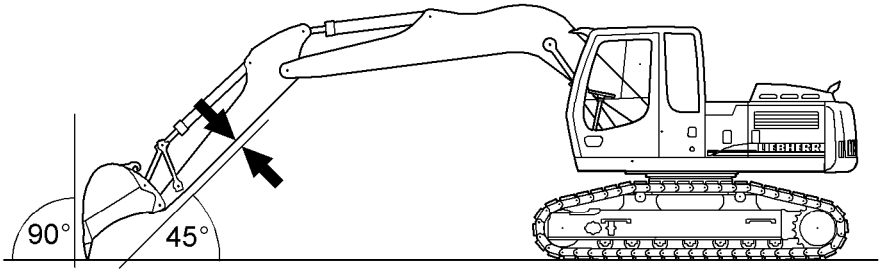

Fig. 3-121 *Aligning the stick and backhoe bucket*

- Align the stick in such a way that its underside is at an angle of approx. 45° to the ground.
- Align the backhoe backhoebucket in such a way that its ground side can enter the ground at an angle of approx. 90°.

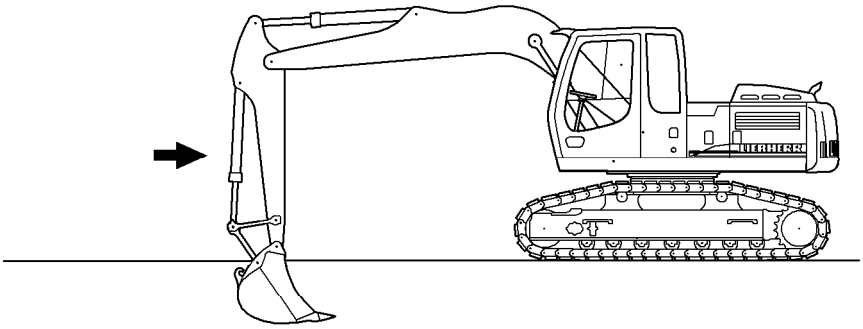

Fig. 3-122 *Taking up grab material*

- 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.

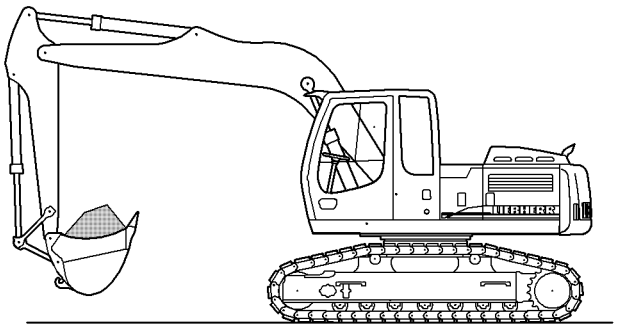

Fig. 3-123 *Raising grab material*

- 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.

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3.6.4 Loading the transport vehicle

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

- ▶ Do not load the transport vehicle so high that the grab material could drop out over the walls of the vehicle.
- ▶ Ensure that nobody is standing in the danger area or in the transport vehicle when loading.
- ▶ Do not slew the equipment over the driver's cab.

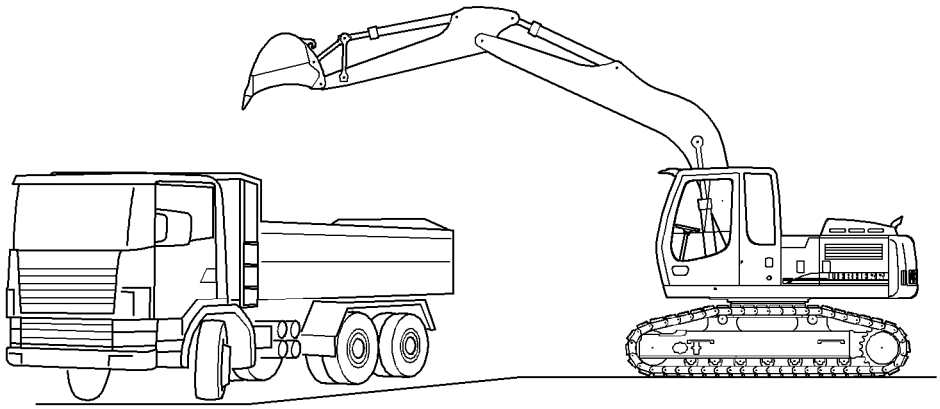

Fig. 3-124 *Emptying grab material*

- ❑ 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.

3.6.5 Working with the clamshell bucket (construction equipment)

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

- ▶ Ensure that the shell type bucket does not swing too close to the cab.
  - ↳ The shell type bucket could damage the cab when swinging and injure the machine's operator.
- ▶ Ensure that the shell type bucket does not swing towards anyone in the working area.
  - ↳ The shell type bucket could injure people standing in the vicinity when swinging.
- ▶ Move the joystick slowly and evenly to prevent the shell type bucket swinging.
- ▶ Hold the 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.

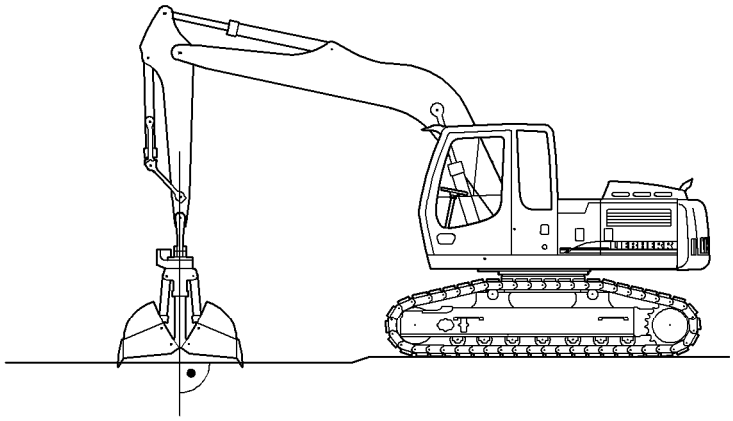

Fig. 3-125 *Straightening the stick*

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

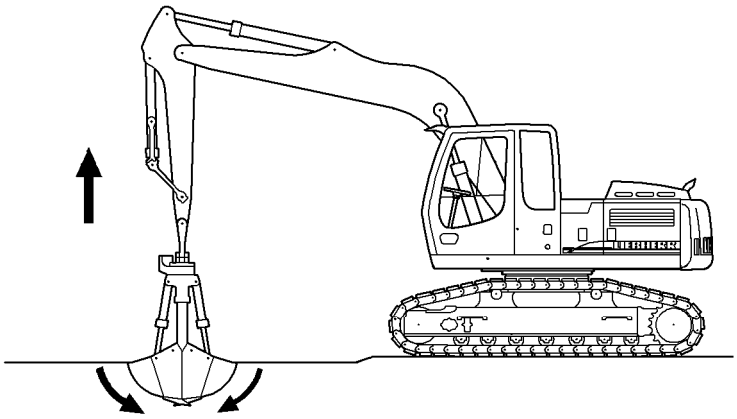

Fig. 3-126 *Closing the grab shells*

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- ▶ 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.

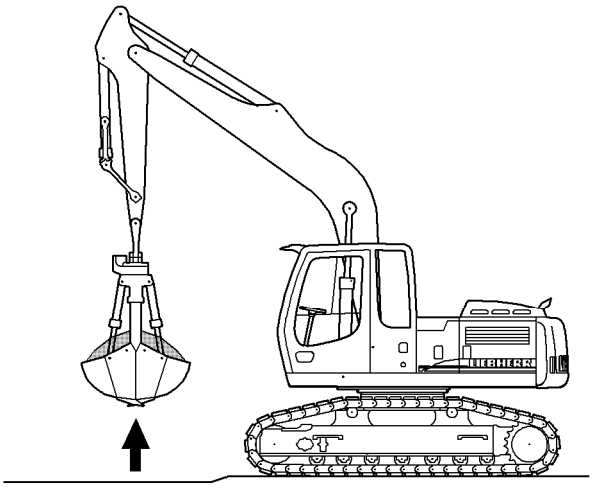

Fig. 3-127 *Raising grab material*

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

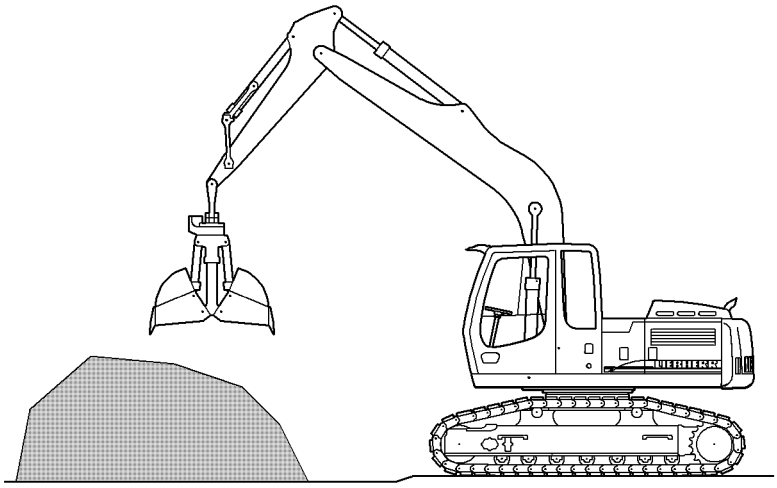

Fig. 3-128 *Emptying grab material*

- ▶ 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.

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3.6.6 Hoisting work

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

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

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

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

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

3.6.7 Working with the hydraulic hammer

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

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

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

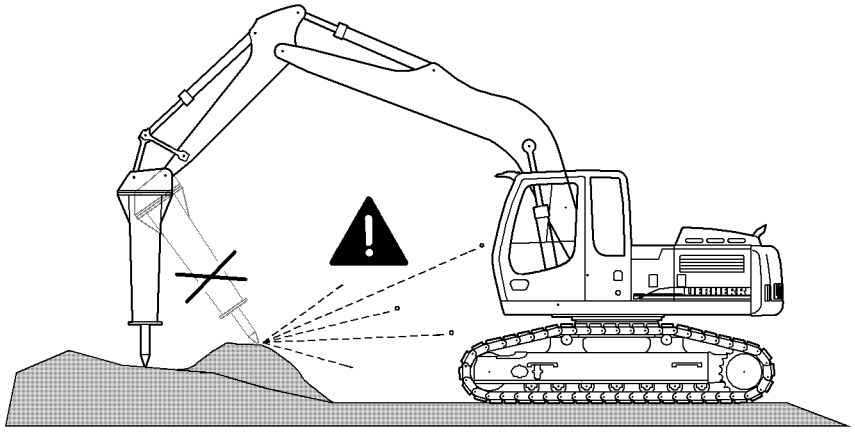

Fig. 3-129 *Hydraulic hammer*

- ❑ 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.

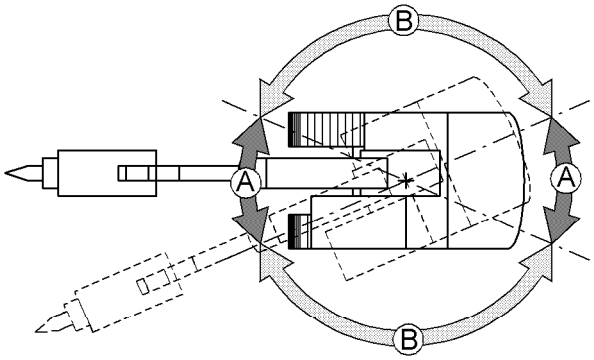

Fig. 3-130 *Permissible **A** and not permissible **B** work areas of the machine with hydraulic hammer*

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

3.6.8 Working with the grapple (industrial equipment)

❑ The machine must be in the working position.

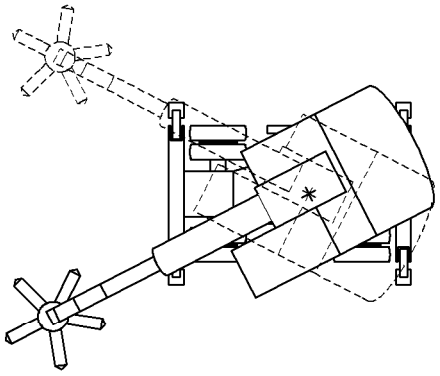

Fig. 3-131 *Taking up the load*

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

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

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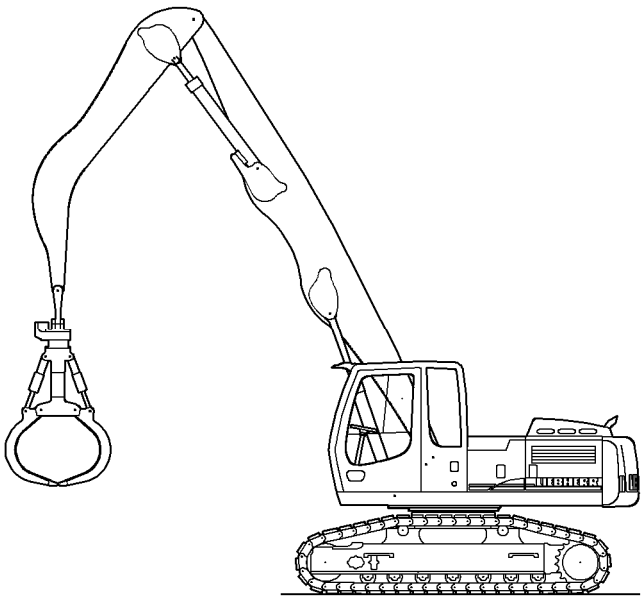

Fig. 3-132 *Transporting a load*

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

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

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

3.6.9 Skimming

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

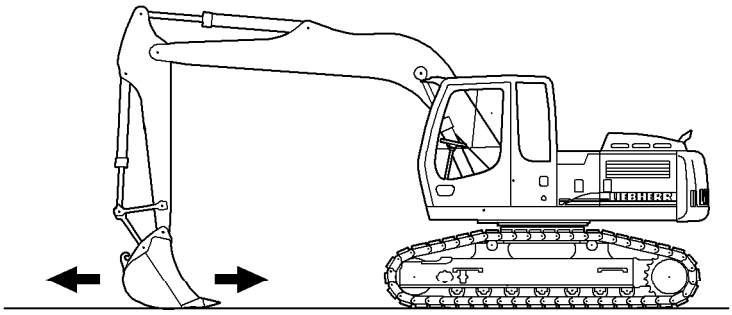

Fig. 3-133 *Skimming*

❑ 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 backhoestick bucket, lay this on the ground (siehe Fig. 3-133) 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.

3.7 Transport

3.7.1 Transporting the machine safely

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

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

3.7.2 Transporting the machine on a low loader

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

Preparatory activities

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

Fig. 3-134 *Loading ramp*

- ❑ The ramp inclination must be flatter than the machine's given hill climbing ability. Ramp inclination angle **W** < = 30°.
- ❑ Have the chocks ready.
- ▶ Lay down and secure wooden planks carefully on the steel surface of the ramp.
- ▶ Clean any ice, snow or mud off the crawlers before starting to drive up the ramp.

Loading the machine onto the low loader

To drive the machine up onto the low loader:

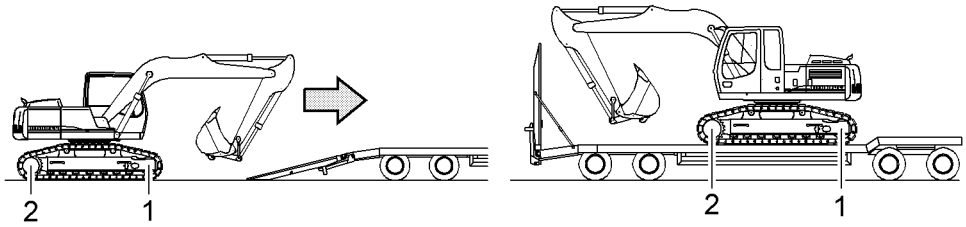

Fig. 3-135 *Driving up onto the low loader*

1 Leading wheel **2** Tumbler wheel

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

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

▶ Drive and steer with increased caution.

▶ For sensitive driving, insert the lever which is found in the tool kit into the pedals for the drive units.

▶ Align the machine precisely to the loading ramp.

▶ Drive the machine onto the low loader.

Note

Note
Have a signaller provide the necessary signs.

▶ Rotate the upper carriage carefully 180° (direction of travel over leading wheel) and lower the equipment (siehe Fig. 3-136).

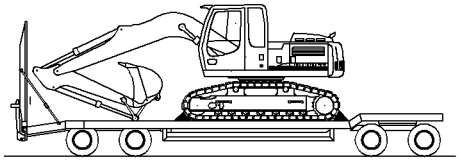

Fig. 3-136 *Transport position - machine*

▶ Switch off the engine.

▶ Turn the ignition key to the contact position and relieve pressure lines by moving the joystick carefully several times.

▶ Remove the ignition key and push the safety lever up.

▶ Close and lock all doors, covers and panels on the machine.

To secure the machine:

The machine must be secured against slipping before starting the journey.

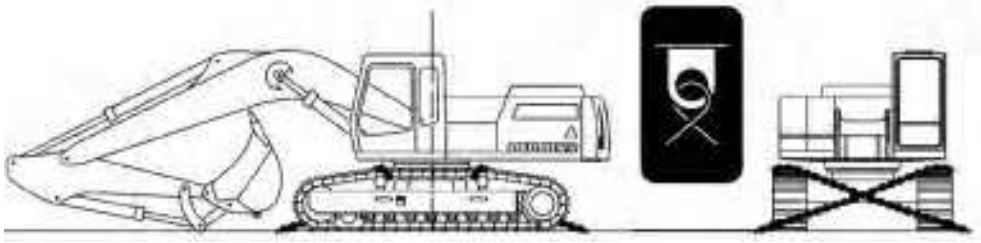

Fig. 3-137 *To secure the machine*

Danger!
Serious accidents can happen if the machine is allowed to slip on the loading ramp.

▶ Secure the machine against slipping.

▶ To do this, use chocks and a tension cable or tension chains.

▶ Secure the machine at the points provided for the purpose using tension cables or tension chains (siehe Fig. 3-137). The loading points are identified on plate 45

on the chassis.

▶ Secure tension cables and tension chains on the low loader according to type.

Transport route

Danger

Danger!
Driving beneath obstacles which are too low can cause serious accidents.

▶ Drive under obstacles, particularly electrical lines, with increased caution.

▶ Find out about the route to be travelled before starting the journey.

3.7.3 Loading the machine with a crane

If the machine is to be loaded using a crane (eg. onto ships or rail freight cars), the type of suspension should be selected according to the equipment.

Danger!
The load could slip or fall if incorrectly loaded.

▶ Only permit experienced personnel to secure loads and signal the crane driver.

▶ The signaller must position himself within the view of the operator or be in voice contact with him.

▶ Ensure that the length of the suspension gear is sufficient.

Loading a machine with a gooseneck boom:

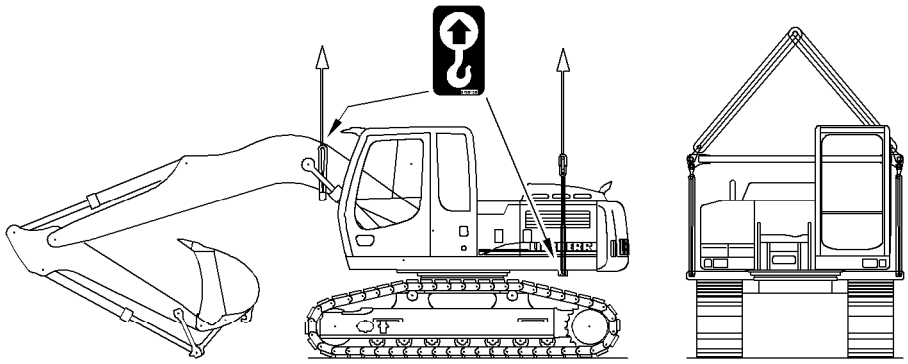

Fig. 3-138 *Suspending the machine with gooseneck boom*

❑ Only use cargo handling gear which is sufficiently dimensioned or which has been specially developed by LIEBHERR for this purpose.

▶ Lower the equipment, draw in the stanchion and tip the bucket as far as the stop.

▶ Switch off the engine.

▶ Turn the ignition key to the contact position and relieve pressure lines by moving the joystick carefully several times.

▶ Remove the ignition key and push the safety lever up.

▶ Close and lock all doors, covers and panels on the machine.

▶ Attach the cargo handling gear to the points provided for the purpose.

Danger!
Standing under the raised machine is not permitted!

- ▶ Raise the machine carefully with the crane and load.
- ▶ When restarting the machine, proceed only in accordance with the operating and maintenance instructions.

Loading a machine with adjusting equipment:

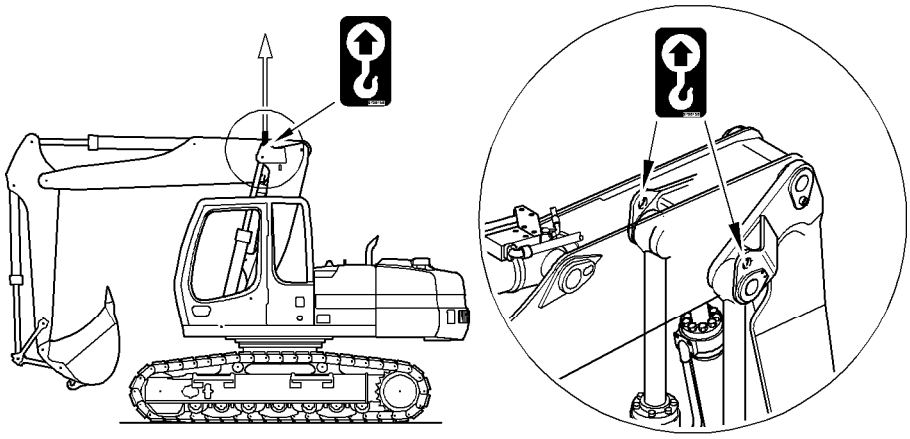

Fig. 3-139 *Loading a machine with adjusting equipment*

- ❑ Only use cargo handling gear which is sufficiently dimensioned or which has been specially developed by LIEBHERR for this purpose.
- ▶ Extend the hydraulic jack, draw the boom adjusting cylinder in and position the shovel arm more or less vertically.
- ▶ Switch off the engine.
- ▶ Turn the ignition key to the contact position and relieve pressure lines by moving the joystick carefully several times.
- ▶ Remove the ignition key and push the safety lever up.
- ▶ Close and lock all doors, covers and panels on the machine.
- ▶ Attach the cargo handling gear to the points provided for the purpose.
- ❑ The machine must be suspended in as horizontal a position as possible on the crane.

Danger!
Standing under the raised machine is not permitted!

- ▶ Raise the machine carefully with the crane and load.
- ▶ When restarting the machine, proceed only in accordance with the operating and maintenance instructions.

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4 Malfunctions

Warning messages and fault messages:

– Various faults are displayed on screen in the form of indicator lights or symbols (see chapter “Control and operating elements”).
– Warning functions can also be supported acoustically (buzzer).

Identifying and rectifying faults and errors:

– Faults can very often be traced back to incorrect operating or maintenance of the machine.
For each fault, therefore, read the relevant chapter in the operating instructions carefully once more.
– Analyse the cause of the fault and rectify it immediately.
– Describe the fault and all accompanying circumstances as precisely as possible if you contact LIEBHERR customer service.
Precise information makes it possible to find and rectify the cause of the fault quickly. Additionally, therefore, precise information on the type and serial number of the machine is also required.
– Do not carry out any work which you have not been trained to do.

Fig. 4-1 *LIEBHERR service*

If the cause of the fault cannot be recognised or rectified using the error codes and fault charts, please consult LIEBHERR customer service.

4.1 Error code charts

Danger!
When switching over to emergency operation, the speed can no longer be changed using the arrow keys on the monitoring screen. The servo control, parking brake and slewing gear brake can no longer be activated.

▶ Please also note the subheading “Emergency operations” in the chapter “Operating the machine” in this regard.

4.1.1 Sensors

Error code	EDC code	Effects	Causes	Measures / Solutions
E 001	3011	Engine oil pessure signal to high.	Oil level Oil pump state Oil viscosity Defective sensor cabling Programmed characterisitic	Check engine oil level, consult LIEBHERR customer service.
E 003	3021	Engine oil pessure signal to low.		
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 009	3018	Coolant temperature not being monitored.	Temperature sensor of Defective sensor cabling	Check radiator encrustation, consult LIEBHERR customer service.
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 coolant for contamination, consult LIEBHERR customer service.
E 014			Short circuit + 24 V	
E 015			Cable break	
E 016		Transmission 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	

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4.1.2 Regulating circuit

Error code	EDC code	Effects	Causes	Measures / Solutions
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 030		Quantity reduction for hydraulic add-on units not being carried out. (for Linde only)	EV 4 cable error at the output stage for quantity regulation of hydraulic pump	Do not operate quantity reduced add-on units, consult LIEBHERR customer service
E 033	3009	Maximum fan speed	EV 5 cable error at output stage of electric valve for hydraulic fan control	Consult LIEBHERR customer service.
E 036		Quantity reduction for hydraulic add-on units not being carried out.	EV 1 cable error at the output stage for quantity regulation of hydraulic pump	Do not operate quantity reduced add-on units, consult LIEBHERR customer service.
E 039		Quantity reduction for hydraulic add-on units not being carried out. (only A954, optional extra)	EV 2 cable error at the output stage for quantity regulation of second hydraulic pump	Do not operate quantity reduced add-on units, consult LIEBHERR customer service.
E 042		Quantity reduction for hydraulic add-on units not being carried out.	EV 3 cable error at output stage of fan shift valve	Do not operate quantity reduced add-on units, consult LIEBHERR customer service.
E 045		Diesel engine speed cannot be adjusted using keypad	Diesel engine speed servomotor faulty.	Switch to emergency control speed adjustment **S71** and **S72** and emergency operation work pumps **Y50**, consult LIEBHERR customer service.
E 046		SWF engine defective	SWF motor cable faulty.	Check out cable, consult LIEBHERR customer service.
E 063 E 065	3019 3029	Temperature sensor - air admission not being carried out	Short circuit to earth / cable break	Check out cable, consult LIEBHERR customer service.
			Short circuit + 24 V	
E 071 E 073	3012 3022	Pressure sensor - air admission not being carried out	Short circuit to earth / cable break	Check out cable, consult LIEBHERR customer service.
			Short circuit + 24 V	
E 074	3008	Motor starter hesitate	ignition time too long	Consult LIEBHERR customer service.
E 075			Defective starter	
E 076	3059	Motor perturbation due to regulator of injection pump	ajustement of positioning part error	Consult LIEBHERR customer service.
E 077	3058		EDC Regulator circuit - regulztor defective	
E 078		EDC motor regulator	Hardware error	Consult LIEBHERR customer service.
E 079			Software error	

Error code	EDC code	Effects	Causes	Measures / Solutions
E 080	3053	Motor perturbation due to regulator of injection pump	Difference between thorical and mesured values of regulator stroke	Consult LIEBHERR customer service.
E 081	3001	Wrong display of diesel engine RPM value	Tachometer B12-1 defective	Check out cable, consult LIEBHERR customer service
E 082	3002		Tachometer B12-2 defective	
E 083	3050 3056	Motor perturbation due to regulator of injection pump	Dysfonction au retour du régulateur.	Consult LIEBHERR customer service.
E 084	3006	Preheat perturbation of diesel engine	Tension du préchauffage faible	Consult LIEBHERR customer service.
E 085	3006		Ampérage du préchauffage faible	
E 086	3007	Perturbation moteur dû à l'électrovanne du carburant	Connection ou électrovanne défectueux	Check out cable, consult LIEBHERR customer service
E 087	3003	Affichage érroné de la valeur du régime moteur diesel	Différence régime B12-1 / B12-2	Consult LIEBHERR customer service.
E 088	3069	Dysfonction du capteur du régulateur moteur	Pression sous le seuil de tolérance inférieur	Consult LIEBHERR customer service.
	3089		Pression supérieur au seuil de tolérance supérieur	

4.1.3 Keypad

Error codes	Effects	Causes	Measures / Solutions
E 302	No entry possible using keypad	No coding plug	Consult LIEBHERR customer service.
E 303	Diesel engine RPM cannot be regulated using keypad, hydraulic power reduced.	No CAN 1 bus connection between keypad and bus arbiter board (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. slewing gear brake, servo control	No CAN 2 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 306	Malfunctions, e g. secondary valve, transmission shifting, add-on kits	No CAN 2 bus connection between keypad and ESP02 board (message also appears if ESP02 not operating).	Consult LIEBHERR customer service.
E 307	Malfunctions , e g. diesel engine functioning	No communication with EDC.	Consult LIEBHERR customer service.

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4.1.4 Display

Error codes	Effects	Causes	Measures / Solutions
E 308	No display or incorrect display on screen	No connection keypad / screen or keypad not operating	Consult LIEBHERR customer service.
E 601	Functioning default, e g. slewing gear brake, servo contro	ESP01 board defective	Consult LIEBHERR customer service.

4.1.5 Coding error

Error codes	Effects	Causes	Measures / Solutions
E 309	No display or incorrect display on screen	Hardaware / Software encoding incompatiblity	Consult LIEBHERR customer service.
E 310	No display or incorrect display on screen	Hardaware / Software encoding incompatiblity on undercarriage	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	

4.1.6 Other errors

Error codes	Effects	Causes	Measures / Solutions
E 442	Automatic idling on left joystick does not function, ie. 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	
E 445	Automatic idling on right joystick does not function, ie. 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 454	Rotation use cannot be recorded.	Short circuit + 24 V	consult LIEBHERR customer service.
E 455		Short circuit to earth or cable break	
E 456	Incorrect fuel gauge display.	Short circuit + 24 V	Check out visually the fuel gauge, consult LIEBHERR customer service.
E 458		Short circuit to earth or cable break	

4.1.7 Error due to warning symbols in SY field

These error codes will not be displayed in the EC field of the operator's menu. They

can only be read off the S-Exxx menu list.

Error codes	Effects	Causes	Measures / Solutions
E 501	Symbol appears (see description)	Diesel engine pressure too low - warning level	On diesel engine check out : – oil level. – greasing oil pump state Check out : – Pressure sensor B5 – sensor cabling – programed characteristic minimal oil pressure / RPM.
E 522		Diesel engine pressure too low - safety level	
E 502	Symbol appears (see description)	Coolant level low	Check out : – Coolant level – for leaks and repair them – level sensor B3 – sensor cabling
E 503	Symbol appears (see description)	Coolant overheating - warning level	Check out : – Coolant temperature – radiator state – fan state – sensor B2 – sensor cabling – Warning and engine stop programed
E 523		Coolant overheating - safety level	
E 504	Symbol appears (see description)	Hydraulic oil level low	Check out : – hydraulic oil level – for leaks and repair them – sensor B14 – sensor cabling
E 505	Symbol appears (see description)	Hydraulic oil overheating	Check out : – temperature hydraulic system – radiator state – fan state – temperature sensor B8 – sensor cabling – programmed warning levels
E 506	Symbol appears (see description)	Transfer box oil temperature too high	Check out : – hydraulic system temperature of gear box – radiator state – suply pump state – temperature sensor B15 – sensor cabling
E 511	Symbol appears (see description)	Overvoltage	Check out : – alternator state

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Error codes	Effects	Causes	Measures / Solutions
E 520	Symbol appears (see description)	Diesel engine over rating	Check out : – Programmed overrating levels. – Programmed number of flywheel tooths. – Diesel rating regulation – injection pump regulator cabling – injection pump assembly – if necessary, remplace the injection pump regulator.
E 521	Symbol appears (see description)	One or two tachometer of diesel engine are defective.	Check out : – Distance sensor / gear – Indicated direction of impulsions recorder – both impulsions sensors – sensor cabling
E 524	Symbol appears (see description)	Admission overheating - safety level	Check out : – temperature admission – radiator admission state – temperature sensor B98 – sensor cabling – programmed levels of warning and engine stop.
E 597		Admission overheating - warning level	
E 525	Symbol appears (see description)	Engine dysfunction into emergengy mode	Execute each recommanded measure above for the repectives codes (E501, E503, E597, E522, E523, E524).

4.2 Faults and remedies

4.2.1 Diesel engine and fuel system

Fault / error	Cause	Solution
Diesel engine does not start	Fuel tank almost or completely empty	Fill tank and vent fuel system
	Low pressure in tank	Remove fuel filler cap
	Fuel filter dirty	Clean or change filter and vent fuel system, drain fuel / clean tank
	Outside temperature below 0°C	For operation under specific climatic conditions, see operating instructions
	Starter motor not drawing through	Check line connections, overhaul starter motor
	Batteries have no power	Charge / replace

Fault / error	Cause	Solution
Engine starts but stops immediately after or runs irregularly	Fuel tank empty (low pressure in tank)	Fill tank and vent fuel system
	Fuel filter dirty	Clean or change filter and vent fuel system (tank)
	Particularly in winter: too viscous engine oil used	Use engine oil suitable for the outside temperature
	Dry-air filter dirty	Clean or change main filter element
	Air in fuel system	Vent fuel system
	Ventilation in fuel tank obstructed	Clean
	Fuel line bent	Check line and repair if required
Diesel engine emitting grey or black smoke	Dry-air filter dirty	Clean or change filter
Diesel engine continually emitting while smoke (steam)	Water in combustion chamber	Consult customer service
Diesel engine does not reach full speed	Speed adjustment not set to maximum value	Set speed adjustment to maximum value
	Injection system is set incorrectly	Consult customer service
	Dry-air filter dirty	Clean or replace filter
	Bad fuel supply	Clean or change fuel filter, check lines, drain water from tank
Diesel engine becomes too hot	Too little coolant	Fill coolant, check for leaks
	Water pump defective	Repair
	Thermostats do not work	Change thermostats
	Coolant contaminated	Clean coolant
Diesel engine has insufficient oil pressure **Note!** Switch off diesel engine immediately	Oil level too low	Correct oil level
	Oil pressure display faulty	Change oil pressure switch
Diesel engine consumes too much oil	External leak on diesel engine	Retighten screws, replace seals if required
Oil in coolant or coolant in oil		Consult customer service
Unusual noise / sounddevelopment on exhaust side	Exhaust system leaking	Check exhaust system / repair

4.2.2 Hydraulic system

Fault / error	Cause	Solution
Unusual noise / sounddevelopment at hydraulic pumps **Note!** Switch off diesel engine immediately	Shutoff valve on hydraulic tank closed	Open stop cock
	Hydraulic pumps taking in air	Check oil level in hydraulic tank, check intake lines for leaks
Modes E and P showing lack of power	No power adjustment via proportional solenoid valve Y50	Unplug cable of Y50 connection, remove safety cotter pin, move lever to emergency setting

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Fault / error	Cause	Solution
Hydraulic oil temperature too high	Coolant contaminated	Clean coolant
	Fan or fan control defective	Rectify error / consult customer service
Hydraulic oil level too low	Oil loss	Repair leaks, exchange hoses, refill oil via return-line filter
Cannot drive	Push the safety lever up	Push the safety lever down
	No direction of travel preselected	Use drive selection switch in right joystick to determine direction of travel
	Parking brake pressure switch defective	Consult customer service
	Parking brake not released	Release parking brake using switch
	Parking brake will not release despite switch being operated	Servo pressure present: Operate emergency function Y6
		Servo pressure not present: Consult customer service
	Service brake engaged	Release service brake
Slewing gear not functioning	No servo control	Push the safety lever down
		Switch on servo control
	Slewing gear brake activated	Push the safety lever down
		Release slewing gear brake
No working movement	No servo control	Push the safety lever down
		Switch on servo control
	No servo pressure present	Consult customer service
	No pump high pressure present	Consult customer service

4.2.3 Transmission

Fault / error	Cause	Solution
Oil flowing out on track rollers, support rollers or leading wheel	Seal defective	Replace seal
Insufficient crawler tracking on leading wheel	Leading wheel tracking on track roller mounting has too much play	Adjust the leading wheel tracking play
Crawler jumps off or over	Crawler tension too low / crawler wheel worn	Adjust crawler tension
Correctly tensioned crawler losing tension quickly during use	Crawler tensioning cylinder defective	Check crawler tensioning cylinder, change if required or seal (only authorized specialist personnel)
Track roller or support roller sticking	Running gear extremely dirty	Clean running gear

4.2.4 Electrical system

Fault / error	Cause	Solution
Battery charge telltale light does not goes out	Drive belt for alternator loose or torn	Tension or replace drive belt
	Alternator defective	Replace alternator
Batteries do not charge or charge poorly	Batteries defective	Replace batteries
	Battery connections dirty / oxidised	Clean battery connections
	Cable loose or damaged	Connect or replace cable
Telltale light or display instrument not functioning or functioning incorrectly	Bulb burnt out, display instrument defective	Replace defective part
Some or all functions on instrument panel drop out	Plug connector separated or damaged, earth lead interrupted, short circuit fuse defective	Mount plug connector correctly or change, rectify short circuit, replace fuse or activate overload cut-outs
Diesel speed adjustment via operating keypad (mode and arrow keys) not functioning	Automatic idling switch S20 is activated	Touch the joystick or deactivate automatic idling switch S20.
	Excavator speed adjustment electronics do not function	Switch the emergency function over from “AUTO” to “MANU” using switch S71 in the right control panel. Set speed using switch S72. Emergency function display appears on monitoring screen. Consult customer service.
	No signal emits from speed sensor B12	
Automatic idling not functioning, speed does not reduce	Permanent sensor signal	Consult customer service
	Switch S20 is deactivated	Activate switch S20
Servo control cannot be activated using switch	Excavator electrics faulty	Switch on emergency function using switch S73 in the right control panel Caution: Servo circuit and brake circuit can only be switched off using the safety lever. Keypad not functioning. Consult customer service.
Parking brake cannot be released using switch		
Slewing gear brake cannot be released using switch		

4.2.5 Heating/air-conditioning system

Fault / error	Cause	Solution
Heating not giving out warm air	Shutoff valves for coolant line on diesel engine closed	Open shutoff valve
	Engine not at operating temperature	Bring engine to operating temperature
Heating fan does not operate	No power supply	Check fuse and wiring / repair
	Fan motor defective	Change fan motor
Only low air flow in cab	Outside air filter / recirculated air filter dirty	Clean air intake opening, replace outside air filter
	Air vent closed	Open air vent

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4.2.6 Work equipment

Fault / error	Cause	Solution
Cylinder stretches when loaded	Piston seal in cylinder defective	Overhaul cylinder
Bearing clearance too high on equipment	Bearing points worn out	Replace bearing parts
Grab / bucket does not move	Valve block on tilting cylinder incorrectly switched	Switch over valve block
Add-on unit cannot be turned / rotated / operated	Auxiliary function has not been released	Release auxiliary function using switch S19
	Lines are not connected	Connect lines

4.3 Fuses and relays

4.3.1 Fuse box E50

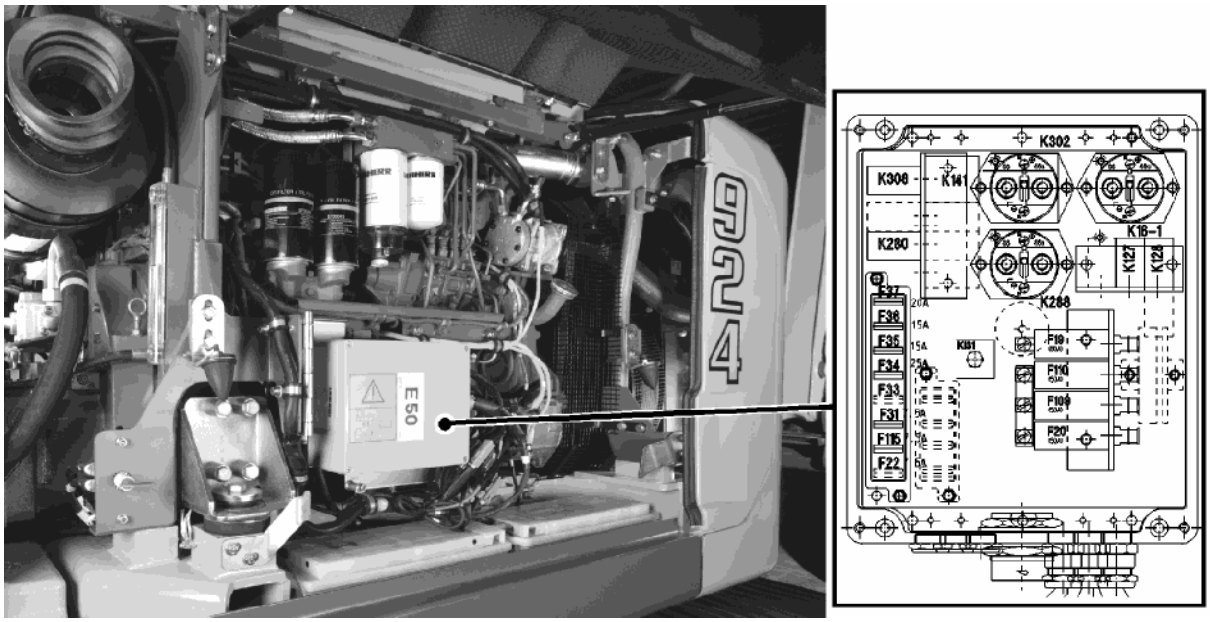

Fig. 4-2 *Fuse box E50*

Fuse box E50 is located behind the right side door, above the batteries.

F19	80 A	Preheating / refuelling pump
F20	50 A	Main fuse
F22	7,5 A	Hazard warning system
F31	7,5 A	Heating and air conditioning system
F33		Reserve (7,5 A refuelling pump system control*)
F34	15 A	Additional lights (option)
F35	15 A	Additional lights (option)
F36	15 A	Additional lights (option)
F37		Reserve

F109	50 A	Additional lights (option)
F110	50 A	EDC fuse
F115	7,5 A	Fuse for fixed rating into emergency position
K16	75 A	Engine starter
K127	5/10 A	Relay emergency position - fixed rating
K128	5/10 A	Relay emergency position - starter
K141	30/40 A	Relay additional light - front side*
K280	5/10 A	Relay additional light - back side*
K288	75 A	Main relay terminal 15
K302	75 A	Preheating relay
K308	5/10 A	Relaiy light on working equipment

* optional extra

4.3.2 A1010 (ESP02) board

All other fuses are situated in the left control panel of the operator's standing position.

Danger
Incorrect or bypassed fuses do not offer the machine's operator or the electrical system the required degree of protection.

- ▶ Only use original fuses.
- ▶ Never bypass electrical fuses.

If required, order replacement fuses from LIEBHERR.

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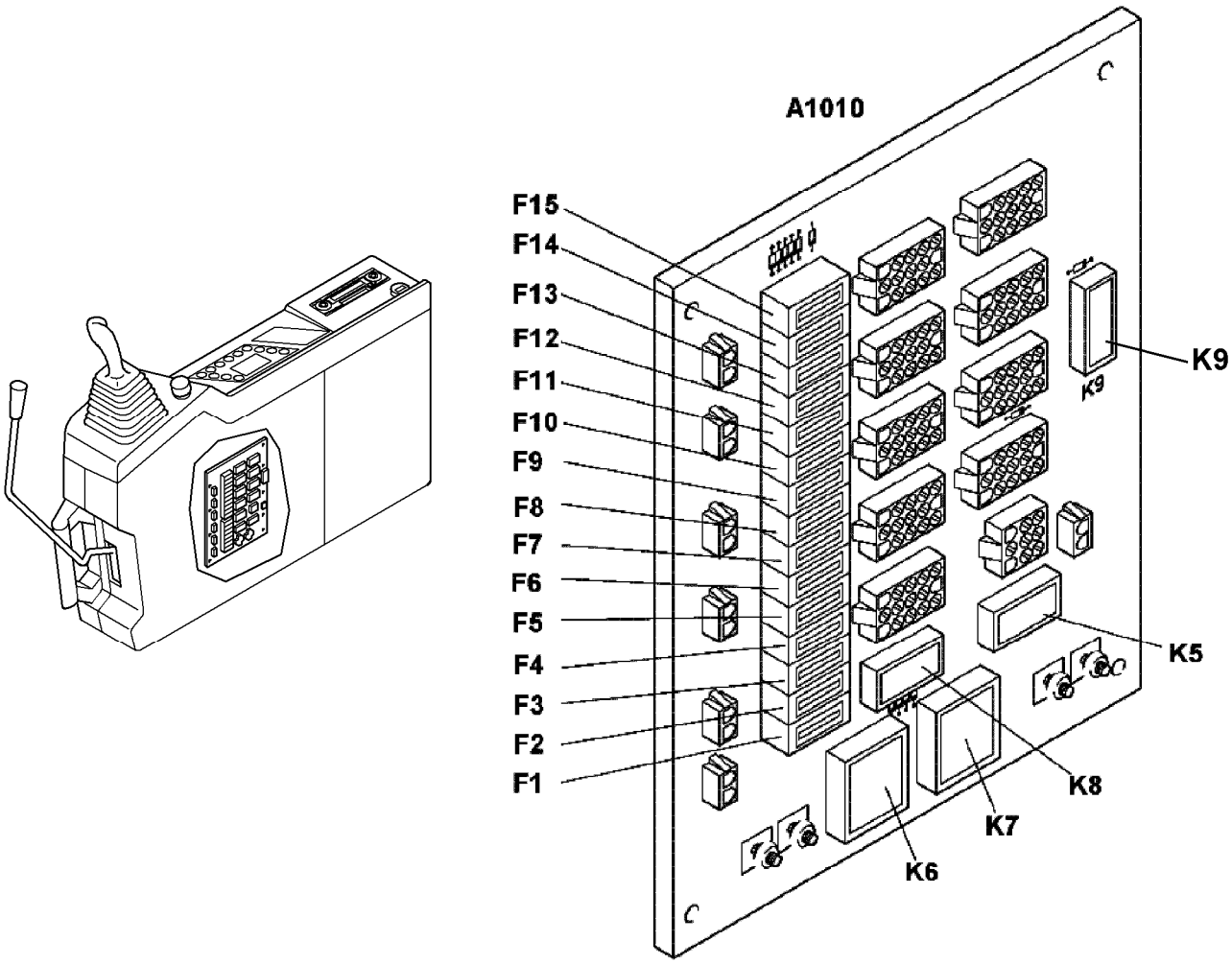

Fig. 4-3 *Fuses and relays, ESP02 board*

F1	15 A	option A1011 board, greasing unit
F2	15 A	option A1011 board
F3	15 A	option A1011board
F4	15 A	Windscreen washing system, windscreen wiper system, grab disconnection*, slewing grab*, rotating beacon*
F5	7,5 A	Windscreen wiper motor
F6	7,5 A	Speed adjustment in “MANU” control
F7	7,5 A	Keyboard and display
F8	15 A	solenoid valve for servo control, slewing gear brake, floating position, fast drive, safety lever, primary pressure, drive gear brake, emergency control
F9	15 A	Engine throttle control, Bus arbiter supply, hoist cylinder damping
F10	25 A	Cab head light, working equipment light, additional headlights*, additional working equipment light*
F11	15 A	Reserve

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F12	15 A	Reserve
F13	7,5 A	Contact key, starting circuit, transformator, engine stop*, Radio*, loudspeaker*
F14	15 A	Interior lighting, cigarette lighter, signal horn
F15	15 A	Reserve
K5 / **A1010**		Relay engine stop
K6		Horn relay
K7		Relay, additional headlights, cab roof
K8		Floating position relay
K9		Flow reduction emergency control relay

* Optional extras

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4.3.3 A1001 board

All other fuses are situated in the left control panel of the operator's standing position.

Danger
Incorrect or bypassed fuses do not offer the machine's operator or the electrical system the required degree of protection.

- ▶ Only use original fuses.
- ▶ Never bypass electrical fuses.

If required, order replacement fuses from LIEBHERR

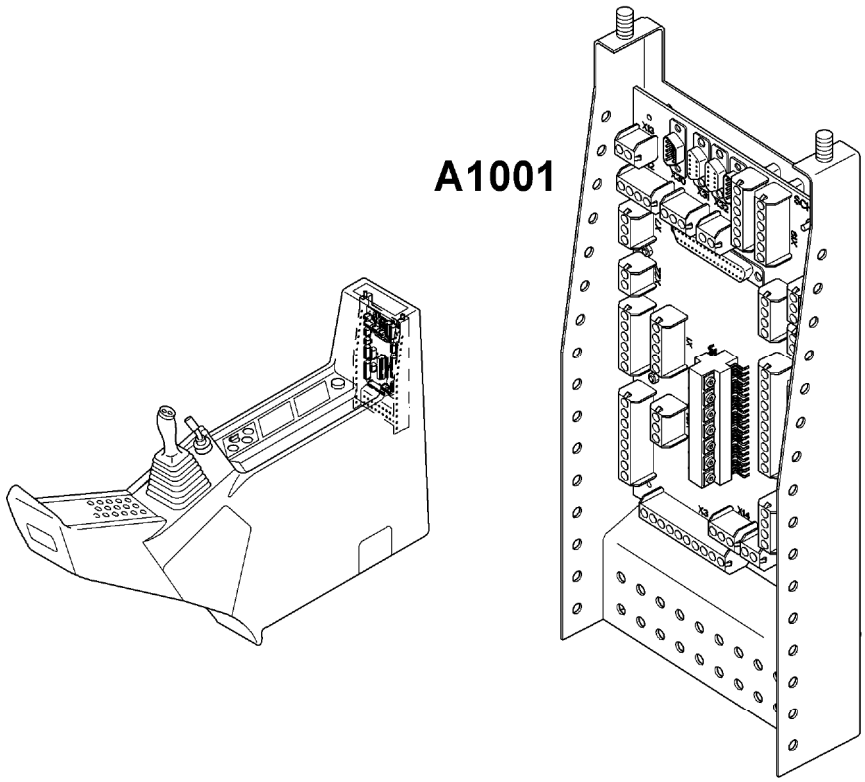

Fig. 4-4 *Fuses and relays, A1001 board*

K1	Relay windscreen wiper system
K2	Additional relay
K3	Additional relay
K4	Additional relay
K5 / **A1001**	Relais emergency control

5 Maintenance

5.1 Servicing the machine safely

5.1.1 General safety instructions

- Maintenance and repair work may only be carried out by specially trained personnel.
- Observe statutory timetables or intervals given in the operating instructions for repeat tests / inspections. It is imperative that a suitably equipped workshop is available in order to carry out maintenance work.
- The inspection and maintenance schedule given at the end of these operating instructions defines precisely who is required / permitted to carry out what work. Jobs listed as daily / weekly work may be carried out by the machine's driver or maintenance personnel when they have received appropriate instruction. The remaining work may only be carried out by specialist personnel with appropriate training.
- Replacement parts must correspond to the technical requirements determined by the manufacturer. Original replacement parts are always guaranteed to meet these criteria.
- Wear safe work clothes when carrying out maintenance work. Protective glasses and gloves are required in addition to a hardhat and safety shoes for some work.
- Do not permit unauthorised persons to approach the machine during maintenance work.
- Cordon off a wide maintenance area if required.
- Inform operational personnel before starting to carry out any special work and repair work. Designate persons in charge of supervision.
- In the absence of any other information in the operating instructions, carry out all maintenance work on the machine on level, firm ground with the working equipment set aside and the engine switched off.
- Pull out the ignition key and shut off the main battery switch.
- Always tighten any loose screw connections during maintenance and repair work.
- If safety devices have to be dismantled during set-up, maintenance and repair work, they must be immediately reinstalled and checked at the end of the work.
- When carrying out repair work, particularly when working under the machine, hang a “Do not start” warning sign in a clearly visible position on the starting lock. Pull out the start key and shut off the main battery switch.
- Operate combustion motors and fuel operated heaters only in well ventilated areas. Before operating these units, check ventilation.
- In addition, always follow applicable local regulations.

5.1.2 Cleaning

- Clean oil, fuel or care products off the machine before starting maintenance or repair work and pay particular attention to connections and screw fittings. Do not use aggressive cleaning products and use lint-free cleaning cloths.
- Do not use aggressive cleaning products or steam jet devices to clean the machine for the first two months after initial set-up of the machine (or after 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.

5.1.3 Crack testing

- Even when the machine is operated carefully, there is a possibility of individual cases of overloading occurring, which could lead to cracks or loose connections. The machine should therefore be checked regularly for cracks, loose connections or other visible damage to maintain operational safety.
- In order to be able to check for cracks, it is essential that the machine is kept clean and cleaned regularly.
- The tests should be carried out in accordance with the monitoring and maintenance plan:
  - every 250 operating hours by the machine owner's maintenance personnel.
  - every 500 operating hours by authorised specialist personnel.
- It is advisable to carry out these tests: supported, on firm, horizontal substrate, with the equipment in longitudinal and cross direction for variable loads. Current accident prevention regulations must be adhered to.
- Special care must be taken when testing load-bearing components, particularly:
  - the steel chassis members and axle and transmission mountings, the support, the lower rim bearing support and tower and ball rim bearing.
  - the steel upper structure members and bearing block for boom and boom cylinder, the upper rim bearing support, the cab mount and the mount for swing gear and ballast.
  - the steel components of the working equipment, e. g. the boom, stay, quick change adaptor, and bucket.
  - hydraulic cylinders, axles, steering, bolts and bolt connections, steps, ladders and mounting elements.

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– The crack test should be carried out visually. If a crack is suspected, the dye penetration test should be carried out as a crack test on areas which do not have good visibility, such as the rim bearing support, in order to increase testing safety.
– Any damage found must be rectified immediately. Welding work on load-bearing parts of the earth-moving machinery, loading devices and transport devices may only be carried out by trained specialist personnel and only in accordance with the accepted rules of welding engineering. In case of doubt, contact the LIEBHERR customer support service to discuss suitable remedies.

5.1.4 Welding, drilling, firing and grinding work

– Any welding on structural parts (as undercarriage, uppercarriage, equipment parts,...) may only be done the manufacturer, or authorized official dealer. If this rule is neglected, the warranty is voided.
– Only carry out welding, drilling, firing and grinding work on the machine with express authorization. Clean dust and combustible materials off the machine and its surrounding areas before welding, drilling, firing or grinding.
Ensure adequate ventilation. Risk of fire or explosion.
– Before welding repairs on other parts, always disconnect the battery. Always remove the negative terminal first and reconnect it last.
– Nevertheless if welding repair should be done on components which may contain inflammable gases (welded counterweight, hydraulic tank, fuel tank, ...), these components must be previously and sufficiently ventilated with pressurized air to avoid all fire or explosion hazard
– Before welding, connect the ground cable as close as possible to the welding point, so the welding current will not run through the swing ring, joints, gears, bushings, rubber parts and seals

5.1.5 Process materials

– When working with oils, greases and other chemical substances, observe the appropriate current safety regulations for the product.
– Ensure that process materials and replacement parts are disposed of in a safe and environmentally acceptable manner.
– Take care when handling hot process materials
(Risk of burning and scalding).

5.1.6 Repair work

– Do not attempt to lift heavy parts. Use devices which are suitable for this purpose and which have sufficient load capacity. When replacing single parts and larger subassemblies, carefully secure them on lifting devices them so that they do not present a risk. Only use suitable and correctly functioning lifting devices and load take-up devices with adequate load capacity.
Do not stand or work under swinging loads.
– Do not use lifting devices which are damaged or do not have sufficient load carrying capacity.
Wear work gloves when working with wire cables.
– Only permit experienced personnel to attach loads and give signals to the crane operator. The spotter must be positioned within the visual range of the operator or be in voice contact with him.

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- When working above body height, use safe climbing devices and working platforms which are appropriate for the job.
  Do not use machine parts as climbing devices if they are not designed for this purpose.
  When working at height, wear a harness to prevent falling.
  Ensure that all grips, steps, rails, platforms and ladders are free of dirt, snow and ice.
- Be sure to support yourself safely when working on the equipment (e.g. replacing teeth). Prevent metal touching metal when doing this.
- For safety reasons, never open and remove a track chain unless having previously totally released the pretension of the chain tensioning unit.
- Never lay under the machine if it is raised with work equipment and has not been securely supported with wooden beams.
- Always jack the machine up in such a way that any weight displacement does not jeopardize stability and prevent metal touching metal while doing this.
- Work on the suspension, brake and steering systems may only be carried out by trained specialist personnel.
- If the machine has to be repaired on a slope, secure the crawler with chocks and connect the upper structure to the chassis using stop bolts.
- Only personnel with special training and experience may work on hydraulic equipment.
- When searching for leakage, wear protective gloves. A fine jet of liquid under pressure can penetrate the skin.
- Do not unscrew any lines or connections before you have set aside the equipment, switched off the engine and depressurized the hydraulic system. After switching off the engine, you must operate all pilot control devices (joystick and pedals) in all directions with the start key in contact position in order to reduce the actuating and dynamic pressures in the work circuits. You must then reduce the internal tank pressure as described in these operating instructions.

5.1.7 Electrical system

- Check the electrical system regularly.
  Have all faults, such as loose connections, blown fuses and lamps and clogged or abraded cables rectified by personnel.
- Only use original fuses with approved current strength.
- For machines with electrical neutral and high tension leads:
  • switch the machine off immediately in the event of malfunctions in the power supply.
- Work on the machine's electrical equipment may only be carried out by skilled electrical personnel or by trained personnel under the supervision of an electrician in accordance with electrical regulations.
- When working on live parts, ensure that a second person is available to operate the emergency-off or the main switch and overvoltage release. Cordon off the working area with a red and white safety chain and a warning sign. Only use insulated tools.
- When working on neutral and high tension subassemblies, after releasing the voltage, briefly disconnect the supply cable at earth and electronic devices such as capacitors using an earthing rod.
- First test the released parts to make sure that they are off circuit, earth them and then disconnect them briefly. Insulate adjacent live parts.
- Disconnect the battery before working on the electrical system or carrying out any electric arc welding on the machine.

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First disconnect the negative, then the positive pole. When reconnecting, proceed in the reverse order.

5.1.8 Hydraulic accumulator

- All work on the hydraulic accumulators must be carried out by trained specialist personnel.
- Inexpert assembly and handling of hydraulic accumulators can cause serious accidents.
- Do not operate damaged hydraulic accumulators.
- Before working on a hydraulic accumulator, you must reduce the pressure in the hydraulic system (hydraulic system including hydraulic tank), as described in these operating instructions.
- Do not carry out welding or soldering or do any mechanical work on the hydraulic accumulator.
  The hydraulic accumulator can be damaged by heat penetration and can be made to rupture by mechanical working. RISK OF EXPLOSION!
- Only charge the hydraulic accumulator with nitrogen. There is a RISK OF EXPLOSION if oxygen or air is used.
- The accumulator body can become hot during operation; there is a risk of burning.
- New hydraulic accumulators must be charged with the pressure required for the purpose of use before installation.
- The operating data (minimum and maximum pressure) are marked permanently on hydraulic accumulators. Ensure that this marking remains visible.

5.1.9 Hydraulic hoses and sheathed cables.

- It is forbidden to carry out repair work on hydraulic hoses and sheathed cables!
- All hoses, sheathed cables and bolt connections must be checked regularly every 2 weeks for externally visible damage and any possible damage must be immediately checked for leakage.
  Never check for leaks with your bare hands, use a sheet of paper or something else.
  Any damaged parts must be removed immediately! Spurting oil can lead to injury and burns.
- Even with correct storage and permitted load, hoses and sheathed cables are subject to the natural aging process. This restricts their duration of use.
  - Incorrect storage, mechanical damage and unauthorized load are the most common causes of failure.
  - In relation to duration of use, current norms, regulations and guidelines pertaining to hoses and sheathed cables at place of use must be adhered to.
  - Use at the limit range of permissible load can shorten duration of use (e.g. high temperatures, frequent movement cycles, extremely high pulse frequencies, multiple shift usage).
- Hoses and sheathed cables should be replaced if the following are found during inspection:
  - Damage to the outer sheath as far as the liner (e.g. chafing, cuts and cracks);
  - Brittleness of the outer sheath (fracture formation in hose material);
  - Deformations which do not correspond to the natural form of the hose or sheathed cable, whether in a unpressurized or pressurized state or on bends e.g. sheath separation, blistering;
  - Unsealed areas;

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- 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.

5.2 Maintenance access doors

5.2.1 Overview of access doors

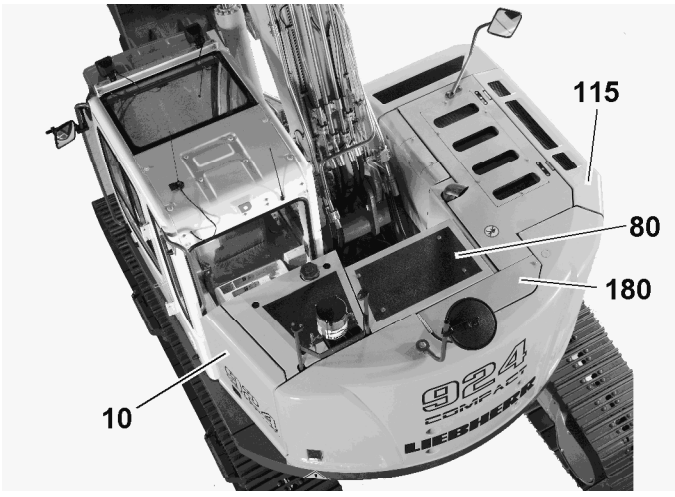

Fig. 5-1 *Access doors on the machine*

10	Side door, left	**115**	Side door, right
80	Centre cover	**180**	Right cover

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The machine has 2 access doors et 2 covers for daily maintenance. The locks integrated in the handles must be unlocked before starting to drive. The screws present into the covers has to be untighten and retired only in case of maintenance works.

Caution!
Access doors can close accidentally and trap the operator or maintenance personnel.

▶ When you have opened the access doors, latch them using the retainer.

Access door	Lock	Access to:
Right cover		– hydraulic tank – air filter – leakage filter
Center cover		– Control oil unit
Side door, left	Mechanical retainer	– access ladder – manuel greasing pump – fuel pump
Side door, right	self blocking	– Electrics box E50 – Batteries – Main battery switch – Diesel engine – Dry air filter – Hydraulic pump

Tab. 5-1

Tab. 5-2 *Access doors*

5.2.2 Door lock

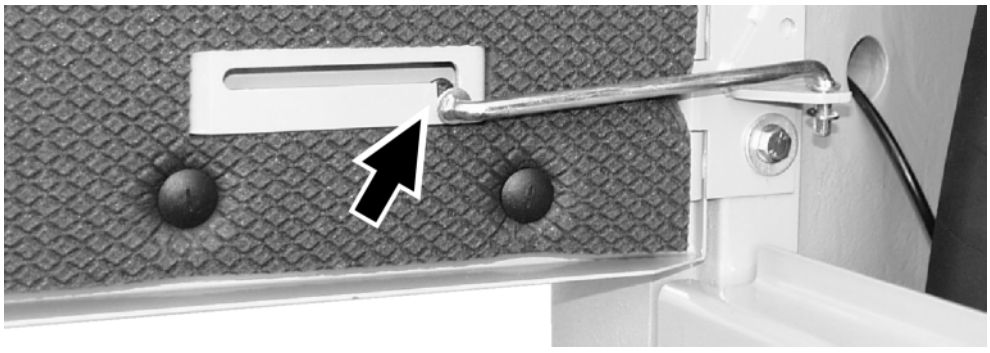

Fig. 5-2 *Door lock*

▶ To stop the access doors from moving unintentionally (eg. due to wind), open them fully and allow the door lock (see arrow) to latch in.

5.3 Lubricating and operating materials

5.3.1 General information on changing lubricating and operating materials

Note
The quantities given in the lubrication and operating material chart and on the lubrication chart in the cab are only guide values.

- ▶ After each oil change or refill, check the level in the relevant unit.

Note!
Adhering to regulations for lubrication, level checks and operating material changes guarantees a high degree of reliability and a long service life for the machine.
It is particularly important to adhere to the intervals for oil changes and use the lubricant quality indicated.

Note!
Cleanliness is of the utmost importance when changing oil.

- ▶ Clean all filler plugs, filler covers and drain plugs and their surroundings before opening.
- ▶ For preference, drain off oil when it is at operating temperature.
- ▶ Ensure that old oils are collected and disposed of in an environmentally acceptable manner using the removable oil filter cartridges.

Danger!
When checking and changing lubrication and operating materials, ensure that the following precautions are adhered to:

- ▶ Unless otherwise indicated, carry out all work on the machine on level, solid ground and with the engine switched off.
- ▶ Whenever you reach into the engine compartment, always secure the cover and side doors against accidentally falling back or closing.
- ▶ Only refuel the machine when the engine is switched off, do not smoke and avoid naked flame.
- ▶ Turn the main battery switch to position **0** (off) and remove the ignition key.

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5.3.2 Lubrication chart

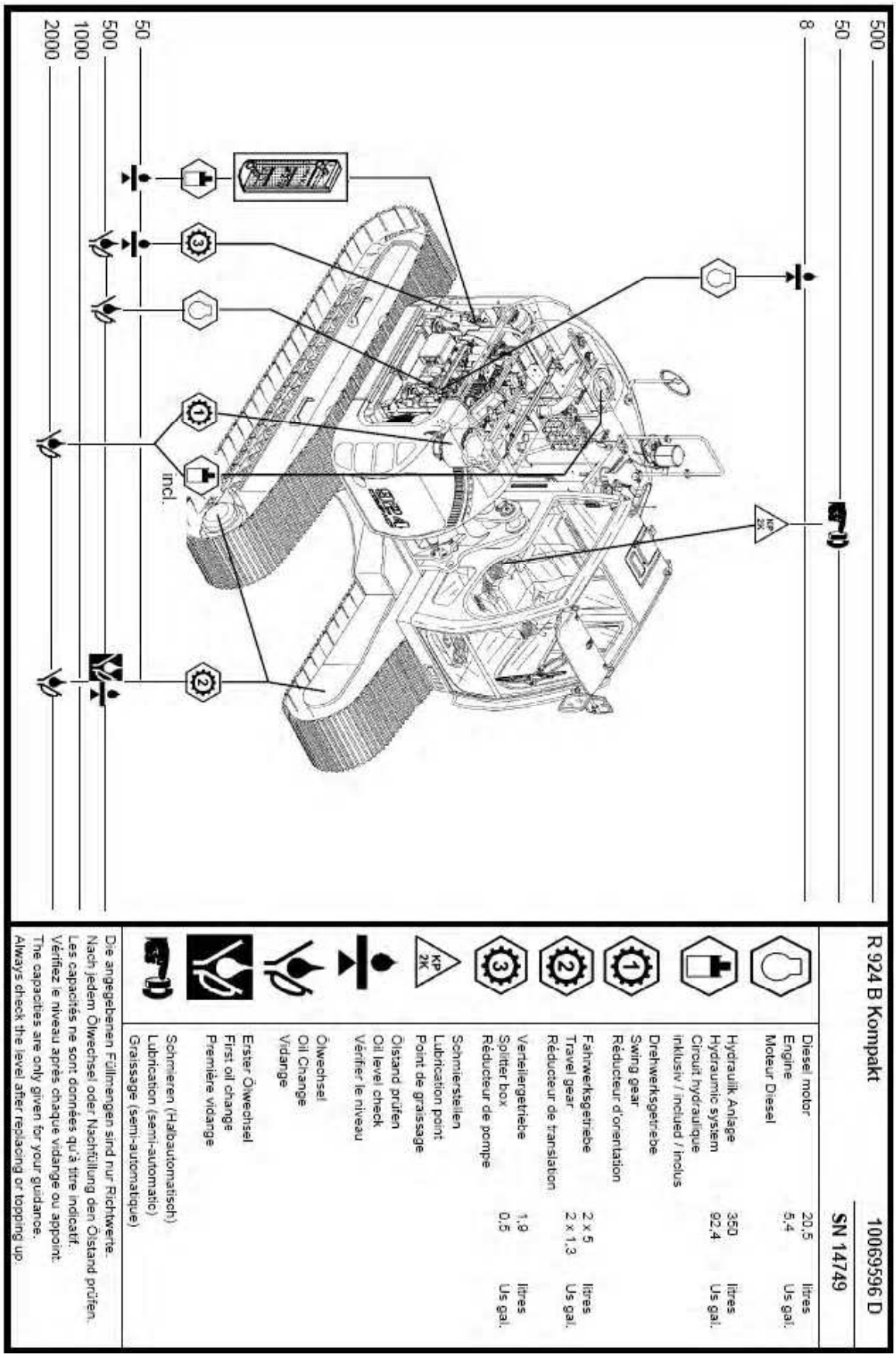

Fig. 5-3 *Lubrication chart for R924 K Litronic*

5.3.3 Lubricant chart

Designation	Medium	Symbol	Classification	Viscosity	CI *	Quantity (litres)**
Diesel engine	Engine oil		API-CG-4, CF-4, ACEA E2-96, E3-96, E4-98, E5-99 CCMC D4, D5	SAE 5W40 SAE 10W30 SAE 10W40 SAE 15W30 SAE 15W40	EO 0540 EO 1030 EO 1040 EO 1540	20,5
Hydraulic tank	Engine oil		API-CD, CD + SF ACEA E1, E3 CCMC D4, D5 Mercedes Benz 226 and 227 227.5, 228.1 and 228.3	SAE 10W SAE 10W-30 SAE 10W-40 SAE 15W-40 SAE 20W-20 SAE 30W	EO 10 EO 1030 EO 1040 EO 1540 EO 20 EO 30	350
Slewing gear transmission (as stop brake)	Transmission oil		See hydraulic system	See hydraulic system	See hydraulic system	inclued into hydraulic system
Slewing gear transmission (as positioning slewing brake)	Transmission oil		API-GL-5 MIL-L 2105 B, C or D	SAE 90	GO 90	5
Travelling gear transmission	Transmission oil		API-GL-5 MIL-L 2105 C	SAE 90	GO 90	1,9
Tracks and corresponding gearing of slewing ring, equipment mounting	Lubricating grease		High pressure grease KP2k or EP2	Consistency 2 NLGI classification	MPG-A	-
Hinges, joints, locks	Engine oil	-	-	-	-	-
Rubber seal on doors and trim panels	Silicon spray or talc	-	-	-	-	-

Tab. 5-3 *Lubricant chart*

*CI = regulation lubricant for construction machines and vehicles according to the national German construction industry federation (see brochures in Bauverlag GmbH – Wiesbaden and Berlin, Notes on lubrication and operating materials charts).

** = Indicativ values

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5.3.4 Operating material chart

Designation	Medium	Symbol	Quantity (litres)*
Fuel tank	Commercially available diesel fuel with sulphur content <= 0.5 %		345
Coolant	Anti-corrosion fluid and antifreeze Fill with DCA 4 CI = SP-C		25,0
Windscreen washing system	Commercially available windscreen washing fluid or methylated alcohol	-	5,2
Air conditioning system refrigerant	R 134 a	-	1,9 kg
Refrigerant oil in A/C compressor	PLANETELF PAG SP 20	-	0,21

Tab. 5-4 *Operating material chart*

*Indicativ values

5.4 Lubricating and operating material specifications

5.4.1 Lubrication oil for the diesel engine

Lubricating oil requirements for diesel engines are based on the following classifications:

Classification	Specification
API classification (American Petrol Institute)	CG-4, CF-4, CH-4, CI-4 oil change interval reduced
ACEA (CCMC) - classification (Association des Constructeurs Européens de l´Automobile)	E2-96 (D4), E3-96 (D5), E4-98, E5-99

Tab. 5-5 *Lubricating oil for the diesel engine*

Viscosity of lubricating oil

Excessive viscosity can lead to starting problems, insufficient viscosity endangers the lubrication function.

Refer to the SAE classification (Society of Automotive Engineers) when selecting a lubricating oil in terms of its viscosity. The ambient temperature is a decisive factor when selecting the SAE class.

Note!
A selection based on the SAE class does not provide any indication on the quality of the lubricating oil.

The engine oil for the diesel engine can be selected according to the following figure.

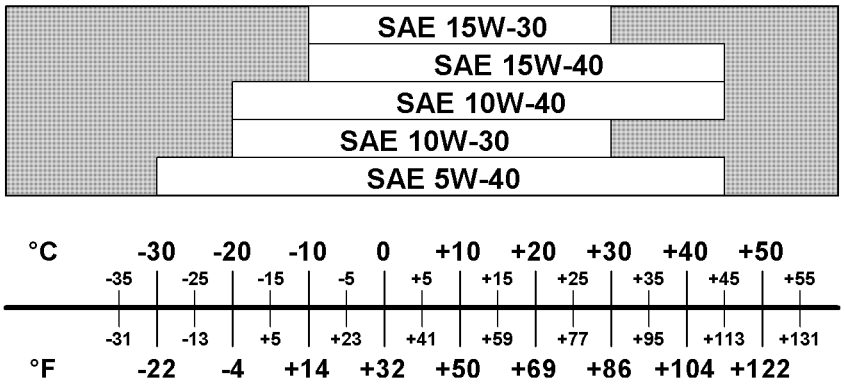

Fig. 5-4 *Engine oil for use as lubricating oil for the diesel engine*

Oil change intervals for the turbocharged engine

Conditions of use	Sulphur content in fuel	Oil change interval dependent on oil quality:	
		CF-4 CG-4 CH-4 CI-4	E3 E4 E5
Climate normal to -10 °C	up to 0.5 % above 0.5 %	250 h 125 h	500 h 250 h
below -10 °C	up to 0.5 % above 0.5 %	125 h -	250 h 125 h

Tab. 5-6 *Oil change intervals for the turbocharged engine*

Oil change intervals for the diesel engine depend on the following criteria:

– First oil and filter change at 500 operating hours when using initial fill oil of quality E4 or E5.
– Further filter changes every 500 operating hours.
– Further oil changes dependent on climatic zone, sulphur content in fuel and oil quality(siehe Tab. 5-6)
– If the operating hours given are not attained within one year, the engine oil and oil filter must be changed at least once a year.

5.4.2 Fuel

Diesel fuels should comply with the minimum requirements of the permitted fuel specifications given below.

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The sulphur content should not exceed 0.5 weight percent. A higher sulphur content will affect the oil change intervals and engine life.

Diesel fuels with a sulphur content > 1 % are not permitted.

Permitted fuel specifications

DIN EN 590

ASTM D 975 - 89a 1 D and 2 D

Diesel fuels acc. to DIN EN 590 with up to 5% Vol. FAME

Only use other fuel specifications after consulting LIEBHERR diesel engine development.

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Lubricating value

The reduction of sulphur content has raised the problem of diesel fuel lubrication characteristics. It has been shown that diesel fuels containing the maximum permitted European sulphur limit of 0.05 weight per cent can cause the fuel injection system to wear (particularly applicable to distributor-type injection pumps).

'Branded' fuels in Germany contain lubrication additives in their additive package. The fuel lubricating value must be 460 µm according to the HFFR(60°) test.

Suppliers should supply the additives as they are responsible for ensuring fuel quality. It is not recommended that clients add secondary lubrication additives.

A cetane number of at least 45 is required for fuels in accordance with ASTM D 975. A cetane number above 50 is preferred, particularly at temperatures below 0 °C.

Diesel fuels at low temperatures

When outside temperatures are below approx. 0 °C, the flow characteristics of summer diesel fuels may become insufficient due to the effects of paraffin dissipation.

The same effect occurs with winter diesel fuels at below approx. -15 °C. Frequently, diesel fuel is also available with additives that allows operation at temperatures down to -20 °C.

The use of a fuel filter heating system is recommended when the cold flow characteristics of the fuel are inadequate or temperatures are below -20 °C.

Caution!
Flow improvement additives will damage the engine as they provide insufficient lubrication.

- ▶ Never add petroleum or normal petrol.
- ▶ Never use generally available flow improvement additives.

Engine oil

Engine oils corresponding to the following specifications and regulations are stipulated:

Single-grade oils:	API - CD / CCMC - D4 / ACEA - E1 Mercedes-Benz regulations, sheet no. 226.0 and 227.0
Multigrade oils	API - CD + SF / CCMC - D5 / ACEA - E3 Mercedes-Benz regulations, sheet no. 227.5, 228.1 and 228.3

Tab. 5-7 *Stipulated engine oils for use as hydraulic oil*

The engine oil for use as a hydraulic oil can be selected according to the following graphic.

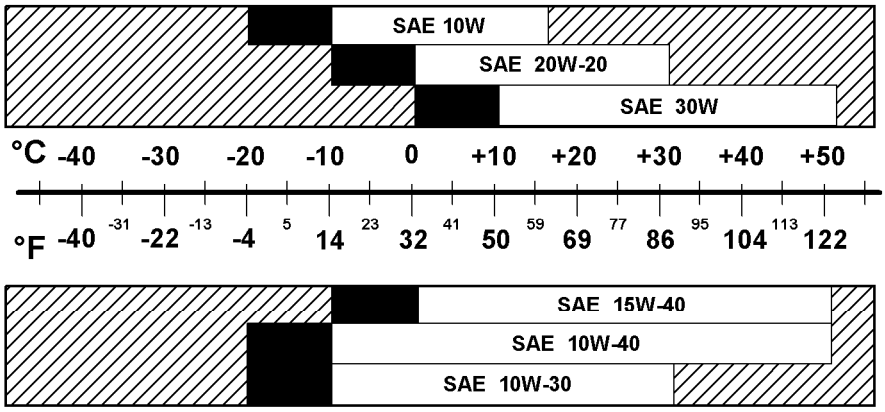

Fig. 5-5 *Engine oils for use as hydraulic oil*

Warm-up specification

At temperatures up to 10 °C below the given limit (black bar), the following warm-up specification applies:

Only adjust the diesel engine after starting to approx. 1 / 2 rated speed. Operate the hydraulic cylinder and motors, move cylinder briefly to the stop. Warm-up duration approx. 10 minutes.

At even lower temperatures: Prewarm the oil reservoir before starting the engine.

Environmentally-friendly hydraulic oils

Note!
Never mix environmentally-friendly hydraulic oils from different manufacturers and do not mix in any mineral oils.

The environmentally acceptable hydraulic oils recommended by LIEBHERR are limited to oils with a synthetic ester basis with a viscosity equivalent to ISO VG 46.

The initial oil fill is carried out at the works using an approved list. Any use of an environmentally acceptable hydraulic oil must first be agreed with LIEBHERR.

Plant-based oils are not to be used due to their insufficient temperature properties.

The use of partial flow filters is required.

Hydraulic oil monitoring

Note!
Environmentally acceptable hydraulic fluids should generally **be checked** at regular intervals by oil analysis.
Oil analysis is recommended for mineral oils.

▶ Machines in normal use: at least every 500 operating hours

▶ Machines in heavy dust use: at least every 250 operating hours
LIEBHERR recommends that oil analyses be carried out by the company WEAR CHECK and that oil changes are performed on the basis of the lab report (see also customer service and product information).

Hydraulic oil monitoring in normal use

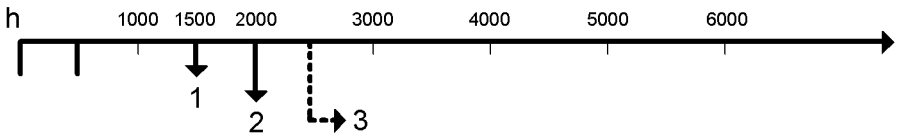

Fig. 5-6 *Taking oil samples and changing filters under normal operating condtions*

---	Taking oil samples	1	First oil sample
-	Filter change	2	Second oil sample
h	Operating hours	3	Further oil samples every 500 operating hours

Oil change according to analysis and lab report.

Change intervals for hydraulic oil return-line filter (20.5 µm): initially after 500 operating hours, further changes every 1000 operating hours.

Hydraulic oil monitoring in heavy dust use

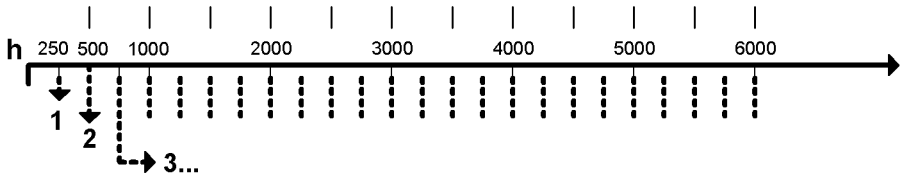

Fig. 5-7 *Taking oil samples and changing filters in heavy dust environments*

---	Taking oil samples	1	First oil sample
-	Filter change	2	Second oil sample
h	Operating hours	3	Further oil samples every 250 operating hours

Oil change according to analysis and lab report.

Change intervals for hydraulic oil return-line filter (10 µm): initially after 500 operating hours, further changes every 500 operating hours.

Notes on reducing hydraulic oil contamination in heavy dust use

If the machine is generally operated with the hydraulic hammer, or is used under similar circumstances (heavy dust occurrence), there is a risk that the hydraulic oil will become more than usually contaminated.

To prevent early wear of hydraulic components, the oil change intervals (and intervals between oil samples) should be reduced and the following regulations should also be noted:

– The filter cartridge(s) must be replaced every 500 operating hours.
– For the return-line filter, 10 µm filter cartridges must be used instead of the usual 20 / 5 µm filter cartridges.
– The vent filter on the hydraulic tank is to be replaced with a 2 µm fine filter (fineness of standard filter is 7 µm).
– The 2 µm vent filter must be replaced each time the hydraulic oil is changed (every 500 operating hours).

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Note!
Machines fitted with a hydraulic hammer at the works and retrofitted hydraulic hammer kits possess these 10-µm filter cartridges and 2-µm vent filters.

5.4.3 Transmission oil

Transmission oils must correspond to the specifications

– API-GL-5 and MIL-L-2105 B or C or D for viscosity class SAE 90

.

For viscosity classes SAE 80 and SAE 90 in accordance with MIL-L-2105 D, an oil of viscosity class SAE 80W90 can be used.

5.4.4 Lubricating grease and other lubricants

Lubricant	Description / manufacturer
Lubricating grease for the slewing ring / general oiling points 	The grease must correspond with the specification **KP2k**, consistency 2 or NLGI grade in accordance with DIN 51818 and DIN 51825 or EP 2 in accordance with NF-T-60 132. The grease must consist of a lithium complex and have a four ball tester value of at least 2300 N in accordance with DIN 51350 and ASTM D 2596.
Contact spray for slip rings	Cramolin
Lubricant for pistons, piston nuts and piston bearing installations on the hydraulic cylinders	Gleitmo 800
Special anti-corrosive material for installation areas of sealingelements on hydraulic cylinders	Castrol-Tarp
Anti-corrosion grease for open piston rods (cylinders that do not move often or transportation)	Liebherr special grease CTK

Tab. 5-8 *Lubricating grease and other lubricants*

5.4.5 Coolant

Coolants which contain inadequate anti-corrosion/anti-frost additives or which have been inadequately or incorrectly prepared may cause cavity or corrosion damage . This could result in the failure of cooling circuit equipment or components. Furthermore heat-insulating deposits may accumulate on components which are designed to transfer heat. This could lead to overheating and ultimately engine failure.

Mixture ratio water : anti-corrosion / anti-freeze fluid

Outside temperature up to	Water content in %	Anti-corrosion /anti-freeze fluid content in %
-37 °C / -34 °F	50	50
-50 °C / -58 °F	40	60

Tab. 5-9 *Mixture ratio water / anti-corrosion fluid / antifreeze*

Refilling the cooling system

- ▶ Before refilling new coolant check that the coolant system is clean and wash out if necessary.
- ▶ When filling for the first time or refilling the cooling system after repair work, DCA 4 in liquid form must be mixed with the coolant in addition to the DCA 4 concentration contained in the water filters.

Cooling system contents (litres)	Required amount of liquid DCA 4 (bundle* or litres)	DCA 4 water filter description
24 - 39	3 **or** 1,4	WF 2071
40 - 59	4 **or** 1,9	WF 2072
60 - 79	5 **or** 2,4	WF 2073
80 - 115	8 **or** 3,8	WF 2073

Tab. 5-10 *Cooling system quantities.*

* = about 0,5 liter each

Change intervals for the DCA 4 water filter

The DCA 4 water filter must be changed every 500 operating hours.

If there is no coolant loss in the cooling system, this means that at change intervals of 500 operating hours there is sufficient DCA 4 concentration in the cooling system.

Checking and replacing the coolant

The coolant must contain a minimum of 50 percent by volume of anti-corrosion /anti-freeze fluid all year round. This provides anti-freeze protection up to -37 °C and also ensures sufficient anti-corrosion protection.

When maintenance work is being carried out, the mixture ratio of the coolant and the DCA 4 concentration must be checked.

In certain cases it is possible to use anti-corrosion products (inhibitors). The use of emulsible corrosion protection oils is not permitted.

Note !

– The coolant must be changed every **2 years**.
– The DCA 4 concentration must be between **0.3** and **0.8** units per litre.
– To test this, testing kit CC 2602 M by Fleetguard is recommended.

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Note !
Always replace any lost coolant with a mixture of water and min. 50 Vol.% anti-corrosion/anti-freeze fluid.
Never let the anti-corrosion/anti-freeze content drop below 50 Vol.%.
Do not use more than 60% anti-corrosion / anti-freeze fluid!
The cooling properties and frost protection will reduce at higher content levels.

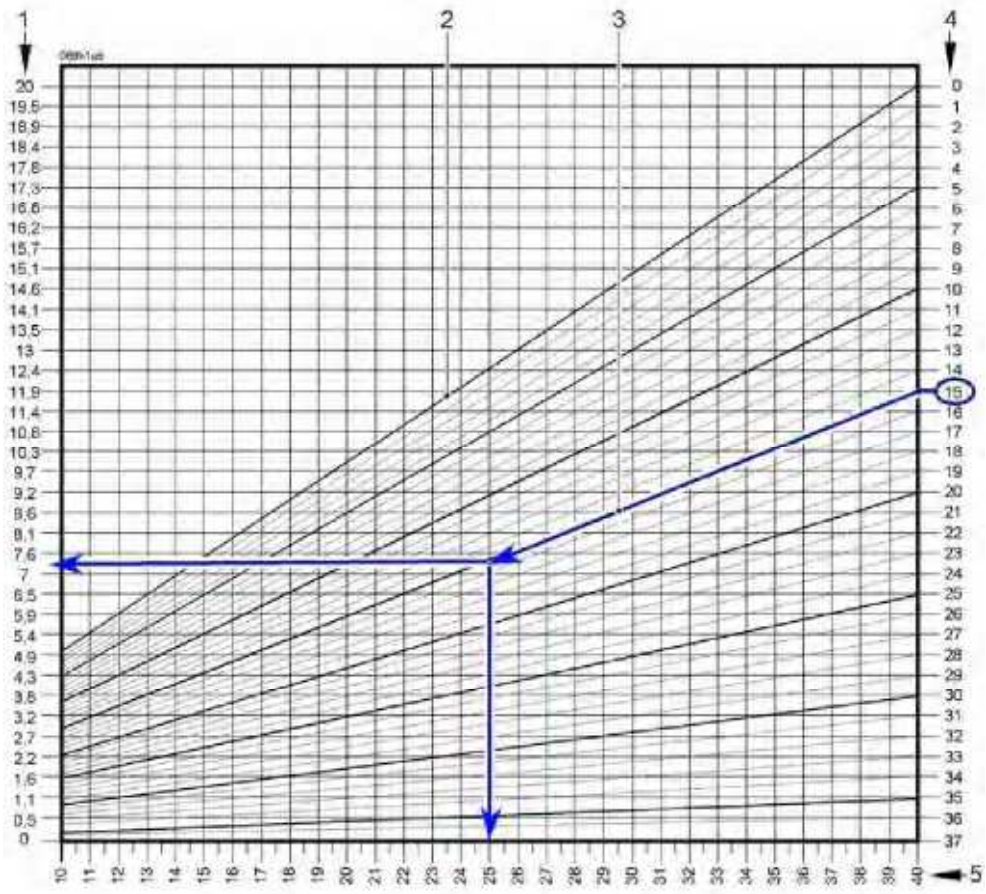

Fig. 5-8 *Select the anti-freeze concentration level*

Determining the top-up quantity - example -15 °C:

Refer to the diagram in (siehe Fig. 5-8) to determine the anti-corrosion/anti-freeze top-up quantity required for protection down to -37 °C.

The measured anti-freeze protection provided by the coolant was -15 °C:

– Determine the intersection point between the auxiliary line for the measured temperature (**3**) and the vertical line representing the fill capacity of the cooling system.
– Read off the required top-up quantity on the left scale at the height of the intersection point.

Correct the mixing ratio

❑ Required top up quantity has been determined.

▶ Drain the same amount of coolant as required for the top up.

▶ Top up with the required amount of anti-corrosion/anti-freeze.

▶ Adjust the coolant level with the previously drained coolant.

Anti-corrosion products

In **exceptional circumstances** and **at temperatures which are continually above freezing**, e g. in tropical areas, where there is clearly **no anti-corrosion / anti-freeze fluid available**, a mixture of **water and water soluble anti-corrosion fluid** may be used as **coolant**.

Note!
Completely drain the coolant when changing from anti-corrosion / anti-freeze fluids to anti-corrosion products or vice-versa.

Using DCA 4 without anti-corrosion / anti-freeze fluid

Check and (if necessary) correct the DCA 4 concentration level during maintenance.

Note!
– The coolant must be changed **annually**.
– The DCA 4 concentration must be between **0.6** and **1.06** units per litre.
– It is recommended that testing kit CC 2602 M by Fleetguard is used.

Using other water soluble anti-corrosion fluids

IWhen using Caltex / Chevron Texaco /Havoline / Total, check and (if necessary) correct the mixing ratio as part of the regular maintenance.

Note!
– The coolant must be changed **annually**.
– The mixture ratio must consist of **7.5 %** anti-corrosion fluid and **92.5 %** water.
– It is recommended that refractometer type Gefo 2710 is used for testing.

Use a refractometer to check the mixing ratio

Fig. 5-9 *Refractometer Gefo 2710*

Refractometer:

– Adjustment screw for setting the 0-line (water line)
– Adjust the focus by turning the eyepiece

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– soft eye guard on eyepiece
– rigid metal housing
– good grip provided by rubber casing

Measurement procedure:

▶ Carefully clean the cover and prism

▶ Apply 1 or 2 drops of testing fluid to the prism

▶ Close the flap
↳ The fluid will distribute itself.

▶ Look at a light background through the eyepiece.

▶ Focus the scale and read off the value on the blue line.

Conversion diagram:

Note!
Concentration measured using a Brix refractometer for Caltex / Chevron Texaco / Havoline / Total.

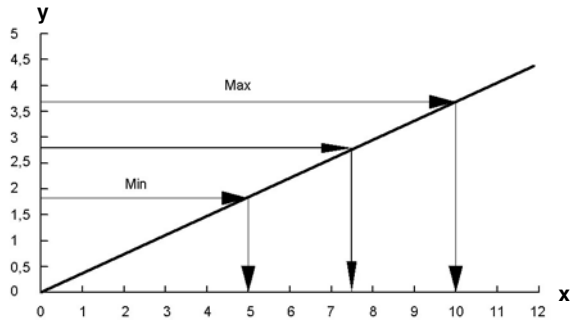

Fig. 5-10 *Conversion diagram*

x Concentration (vol%)
y Read off refractometer in 0-10% Brix

Overview of approved water soluble anti-corrosion fluids

Product description	Manufacturer
DCA 4 Diesel Coolant Additives	Fleetguard
Caltex CL Corrosion Inhibitor Concentrate	Caltex
Chevron Texaco Heavy Duty Extended Life Corrosion Inhibitor Nitrite Free	Chevron Texaco
Havoline Extended Life Corrosion Inhibitor (XLI)	Arteco
Total WT Supra	Total

Tab. 5-11 *approved water-soluble anti-corrosion fluids*

Disposal

Undiluted anit-corrosion/anti-freeze fluids should be treated as special waste. Observe the local regulations when disposing of used coolant.

Regulations on fresh water quality

Drinking water, clear, without collouring, without mechanical impurities and within values tolerances of following analysis is appropriate.

The drinking water analysis has to be asked to the competent communal autorities

Sea water, brackish water, brine and industrial wastewater are not suitable.

Contents	Quantity
Total earth alkaline content (water hardness)	0.6 bis 2.7 mmol/l (3 to 15 °d)
ph value at 20 °C	6.5 to 8.0
Chloride-ion content	max. 80 mg / l
Total chloride + sulphate	max. 80 mg / l

Approved anti-corrosion fluid / antifreeze

Concentrate, undiluted

Product description	Manufacturer	Country
Agip Antifreeze Plus	Agip Petrol S.p.A., Rome	I
Agip long-term anti-freeze protection	Autol-Werke GmbH, Würzburg	D
Antigel DB 486	Sotragal S.A., St. Priest	F
Aral radiator anti-freeze protection A	Aral AG, Bochum	D
Avia anti-freeze protection APN (G48-00)	Deutsche Avia-Mineralöl GmbH, Munich	D
BP Antifrost X 2270 A	Deutsche BP AG, Hamburg	D
BP Napgel C 2270 / 1	BP Chemicals LTD., London	GB
Caltex Engine Coolant DB	Caltex UK Ltd, London	GB
Caltex Extended Life Coolant	Caltex UK Ltd, London	GB
Castrol Anti-Freeze O	Deutsche Castrol Vertriebs GmbH, Hamburg	D
Century F.L. Anti-Freeze	Century Oils, Hanley, Stoke-on-Tent	GB
Chevron DEX-COOL Extended Life Anti-Freeze / Coolant	Chevron Texaco, San Ramon, CA	USA
DEUTZ anti-freeze protection 0101 1490	Deutz Service International GmbH, Cologne	D
Esso anti-freeze protection	Esso AG, Hamburg	D
Fircofin	Fuchs Mineralölwerke GmbH, Mannheim	D
Frostschutz Motorex (G48-00)	Bucher & Cie, Langenthal	CH
Anti-freeze 500	Mobil Oil AG, Hamburg	D
Glacelf Auto Supra	Total Nederland N.V., Den Haag	NL
Glycoshell AF 405	Shell Deutschland GmbH, Hamburg	D
Glycoshell N	Shell Deutschland GmbH, Hamburg	D

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Product description	Manufacturer	Country
Glysantin (G 48-00)	BASF AG, Ludwigshafen	D
Havoline XLC	Arteco, Gent	B
Havoline DEX-COOL Extended Life Anti-Freeze/ Coolant	Chevron Texaco, San Ramon, CA	USA
Igol Antigel Type DB	Igol France, Paris	F
Labo FP 100	Labo Industrie, Nanterre	F
Motul Anti-Freeze	Motul SA, Aubervilles	F
OMV anti-freeze protection	OMV AG, Schwechat	A
Organifreeze	Total Deutschland GmbH, Düsseldorf	D
OZO anti-freeze protection S	Total Deutschland GmbH, Düsseldorf	D
Total Antigel S-MB 486	Total Deutschland GmbH, Düsseldorf	D
Total Frostfrei	Total Deutschland GmbH, Düsseldorf	D
Veedol Anti-Freeze O	Deutsche Veedol GmbH, Düsseldorf	D
Wintershall anti-freeze	Wintershall Mineralöl GmbH, Düsseldorf	D

Tab. 5-12 *Approved anti-corrosion / antifreeze fluid (concentrate, undiluted)*

50:50 premix (water:anti-corrosion / anti-freeze fluid)

Product description	Manufacturer	Country
Liebherr Anti-Freeze APN Mix + DCA4 Ident-No. 10005347 - 20 liters barrels	Liebherr	D
Caltex Extended Life Coolant Pre-Mixed 50/50 (ready-to-use-version)	Caltex UK Ltd, London	GB
Chevron DEX-COOL Extended Life Prediluted 50/50 Anti-Freeze/Coolant	Chevron Texaco, San Ramon, CA	USA
Havoline XLC, 50/50	Arteco, Gent	B
Havoline DEX-COOL Extended Life Prediluted 50/50 Anti-Freeze/Coolant	Chevron Texaco, San Ramon, CA	USA
Organicool 50/50	Total Deutschland GmbH, Düsseldorf	D

Tab. 5-13 *Approved anti-corrosion / anti-freeze fluid / 50:50 premix*

5.5 Diesel engine

5.5.1 Checking the oil level in the diesel engine

Danger!
Risk of burning.
The engine oil is hot when it is at operating temperate.

▶ Do not allow the hot oil or oil-bearing parts to touch the skin.

❑ The machine must be standing level.

▶ Switch off the engine.

▶ Wait until the oil has collected in the oil sump.

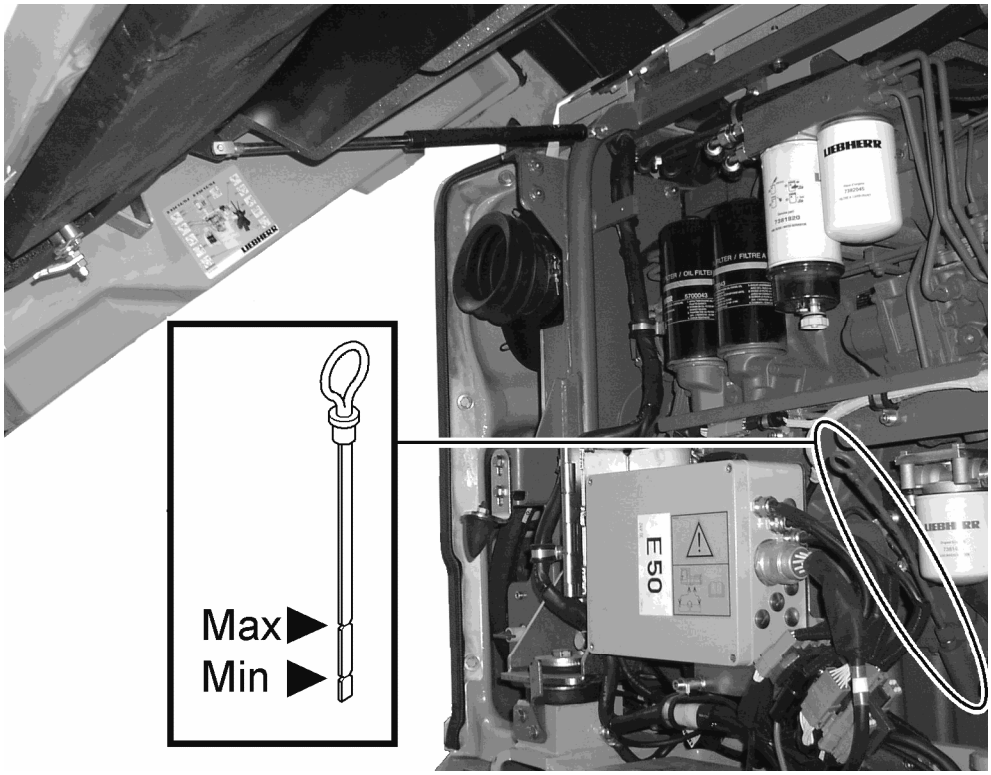

Fig. 5-11 *Oil level markings on the dipstick*

▶ Check the oil level in the engine.
↳ The oil must leave a mark between the **min** and **max** marks on the dipstick.

5.5.2 Changing the diesel engine oil

Note!

▶ Only carry out the oil change when the engine is warm.

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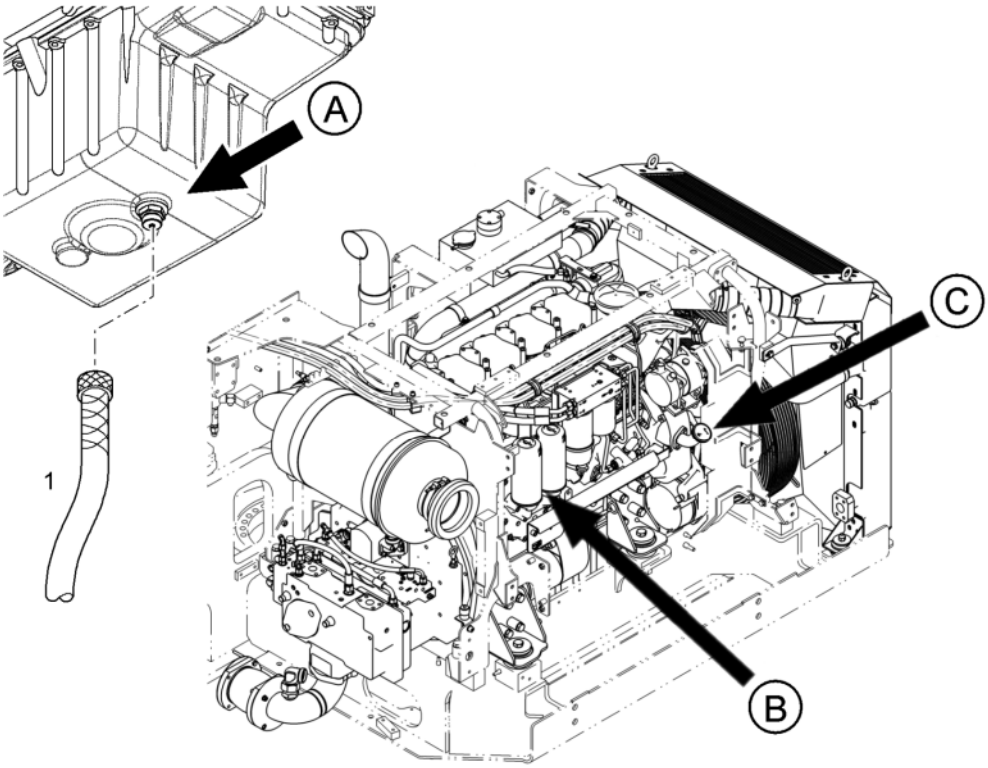

Fig. 5-12 *Drain valve on the oil sump, oil filter cartridges, oil filler cap*

To drain the oil (A):

- ▶ Screw the oil drain hose supplied **1** onto the oil sump's drain valve.
- ▶ Collect the oil in a suitable container.

To change the oil filter cartridges (B):

- ▶ Unscrew the oil filter cartridges.
- ▶ Clean the sealing surface on the filter bracket.

Danger!
Risk of burning.

- ▶ Avoid skin contact with the warm oil when unscrewing the oil filter cartridges.

- ▶ Oil the rubber sealing ring on the new oil filter cartridges.
- ▶ Screw the new filter element on until the sealing ring is laying on the filter head.
- ▶ Use the oil filter key to tighten the oil filter cartridges by a half turn **by hand**.

To add the oil (C):

- ▶ Add the oil to the oil filler cap until the level reaches the upper marking of the dipstick.

Quantity, oil quality and oil change intervals: see lubrication and maintenance chart.

5.5.3 Ribbed V-belt for the A/C compressor and alternator installation

The diesel engine is fitted with a tensioning device for the ribbed V-belt. This is self-

tensioning and is therefore maintenance-free. The ribbed V-belt should be checked regularly for wear and replaced if necessary.

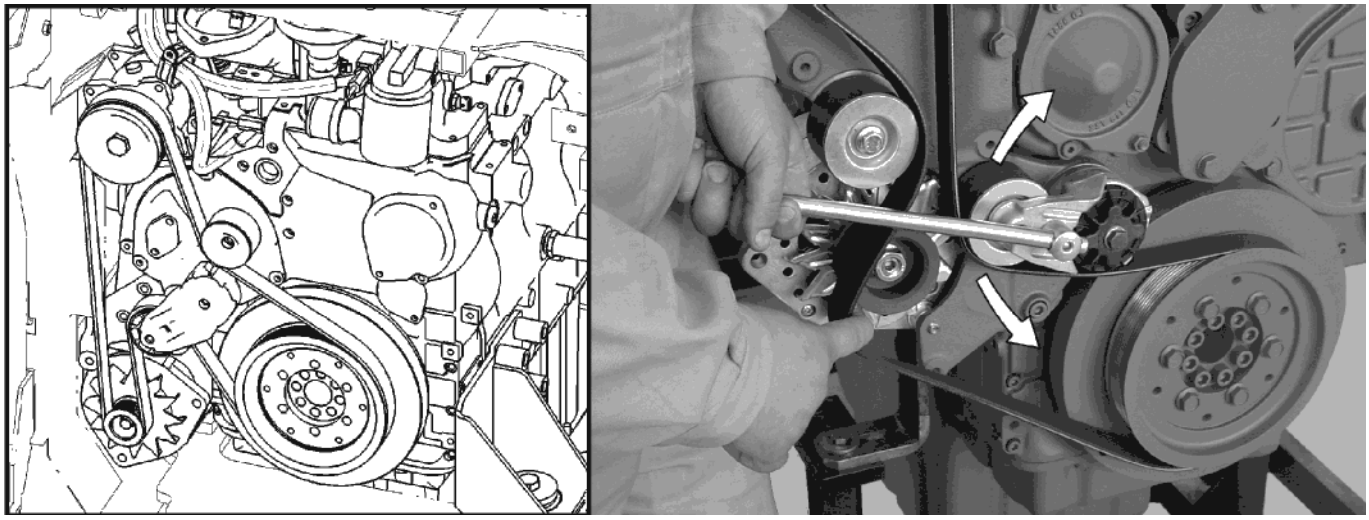

Fig. 5-13 *Replacing the ribbed V-belt*

To replace the ribbed V-belt:

- ❑ To replace the ribbed V-belt, you will need a ratchet equivalent to DIN 3122 D12.5 (1/2").
- ▶ Rotate the tensioning device back counter-clockwise against the spring force as far as the stop.
- ▶ Remove the ribbed V-belt.
- ▶ Lay the new ribbed V-belt on the belt pulleys for the crankshaft, A/C compressor, alternator and deflection pulley with the tensioning device rotated back.
- ▶ Move the tensioning device clockwise back into the tensioned position.

Note!
When replacing the ribbed V-belt, check the tensioning pulley and deflection pulley for ease of movement. Replace defective tensioning pulleys and deflection pulleys immediately.

5.5.4 Oil separator

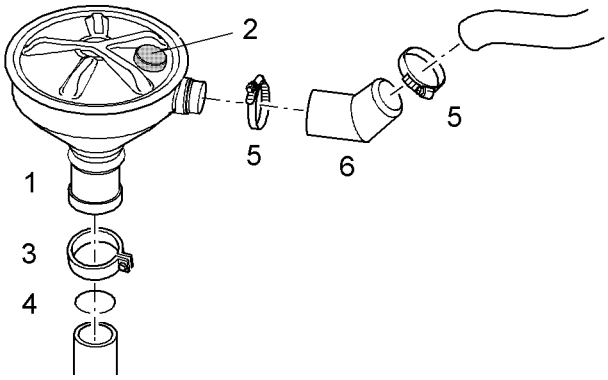

Fig. 5-14 *Replacing the oil separator*

1 Oil separator
2 Vent hole
3 Mounting clamp
4 O-ring
5 Hose clamp
6 Hose

A damaged oil separator (eg. indented cover) may not function correctly.

- In the event of damage or when oil vapour emits from the vent hole **2**, replace the oil separator.
- Replace the oil separator every two years.

To replace the oil separator:

- Unscrew the mounting clamp **3**.
- Unscrew the hose clamp **5**.
- Push the hose **6** back.
- Remove the oil separator **1**.
- Insert a new O-ring **4** in the oil separator.
- Place the oil separator **1** on top and tighten the mounting clamp **3**.
- Push the hose **6** up.
- Tighten the hose clamp **5**.

5.5.5 Greasing the flywheel starter toothed rim

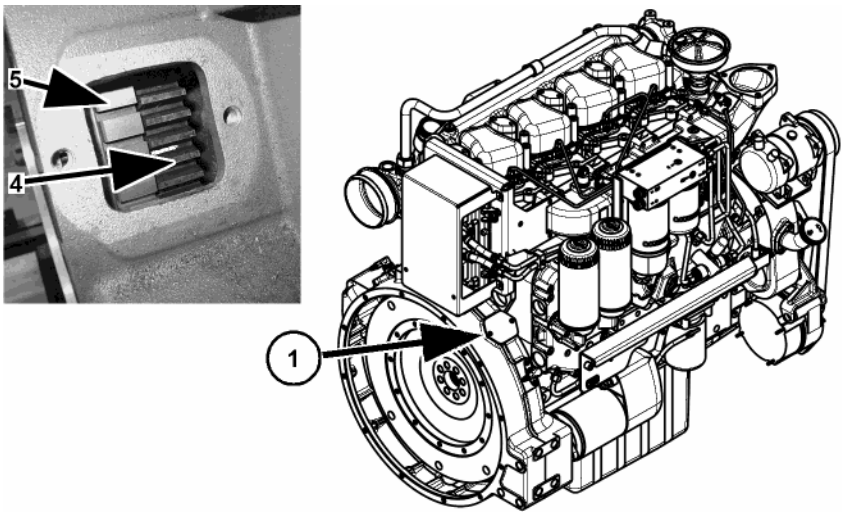

Fig. 5-15 *Flywheel toothed drim*

1 Cover
4 Starter toothed rim
5 Sensor toothed rim

The cover is located on the right side of the engine on the flywheel housing.

Greasing the toothed rim :

- Unscrew cover **1** from the flywheel housing.
- Grease only the starter thooted rim **4**, the sensor thooted rim **5** has to stay free of grease.

- ▶ Check out thooted rim condition et greas it slightly with a common grease.
- ▶ Turn the flywheel using the starter and repeat greasing on several locations.
- ▶ Mount cover **1**.

5.6 Cooling system

5.6.1 Checking and cleaning the cooling system

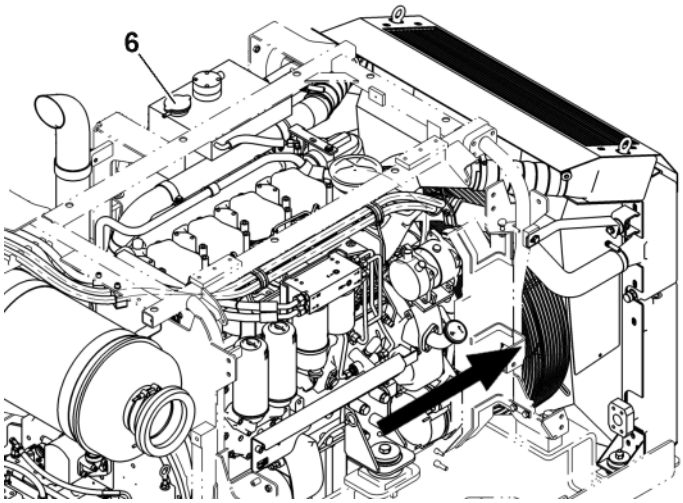

Fig. 5-16 *Cleaning the cooling fins*

The machine has a combined oil-water cooler.

Optimal cooling can only be achieved when the cooler is kept clean.

- ▶ Check the engine, fan and cooler for damage and clean if necessary.
- ▶ If required, clean the cooling fins with compressed air or a steam jet (from inside out, see arrow).
- ▶ In case of leaks, change the pressure relief valve **6** (equalizing reservoir lock ring).
- ▶ Check the condition and seals on the connecting clips between the coolant cooler and engine as well as on the coolant hoses regularly.

5.6.2 Checking the coolant level

Danger!
Risk of burning due to hot coolant.
The engine cooling system is hot and pressurized when at operating temperature.

- ▶ Avoid touching coolant or coolant-bearing parts.
- ▶ Only check the coolant level when the engine has cooled sufficiently.

- ▶ Turn the cap a half turn.
- ▶ Relieve any pressure that may be present in this position. After balancing the

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pressure, slowly turn fully.

The coolant surface, cold, must reach the lowest extremity of the immersed pipe under the equalizing reservoir cap.

- ▶ Add coolant if necessary.
- ▶ Close the lid.
- ▶ After adding coolant, allow the engine to run for a short time with the heating switched on and monitor the coolant level once again.

5.6.3 Coolant antifreeze and anti-corrosion fluid

The system must be filled with antifreeze all year round.

Upon dispatch, the coolant contains antifreeze for temperatures up to -37 °C (this is equal to approx. 50 % antifreeze).

Volume: see lubricant chart

- ▶ Keep the concentration of anti-corrosion additive contained in the cooling system constant, particularly when refilling.
- ▶ Check this concentration each time larger amounts of coolant are lost or at regular intervals. If necessary, add anti-corrosion additives to the coolant.
- ▶ If, however, no coolant is lost, only change the coolant filter regularly.

5.6.4 Changing water filters

The water filter contains an anti-corrosion additive in paste form which assures the coolant's correct anti-corrosive characteristics.

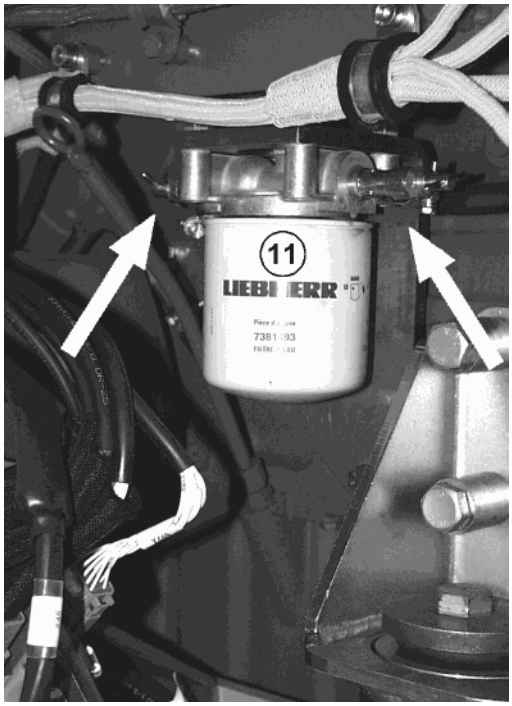

Fig. 5-17 *Water filter*

The water filter must be replaced every 500 operating hours:

- ▶ Close the shutoff valves (arrows) on the filter housing.
- ▶ Unscrew the filter element.
- ▶ Oil the sealing ring on the new filter element lightly.
- ▶ Screw the new filter element on until the sealing ring is laying on the filter head.

Note
The filter element could be damaged.

- ▶ Do not use tools to tighten the filter element.

- ▶ Tighten the filter element **by hand** with a half turn.
- ▶ Open the shutoff valves again.

5.6.5 Changing the coolant

Danger!
Risk of burning due to hot coolant.

- ▶ Only change the coolant when the engine is cold.

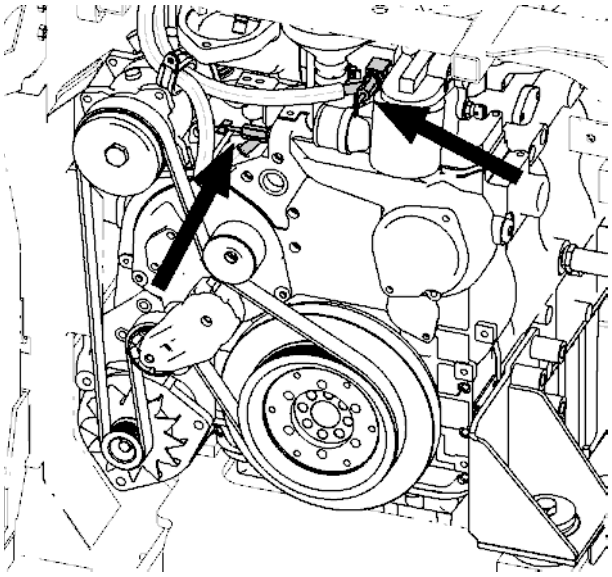

Fig. 5-18 *Cooling circuit shutoff valves*

The following points should be noted when changing the coolant:

- – Change the coolant in the entire coolant circuit at least every two years.
- – For preference, change the coolant with the shutoff valves for the coolant circuit closed.
- – Bleed the coolant circuit when refilled.
- – Coolant flow in the coolant circuit can only take place with the ignition key in the contact position.

Draining the coolant

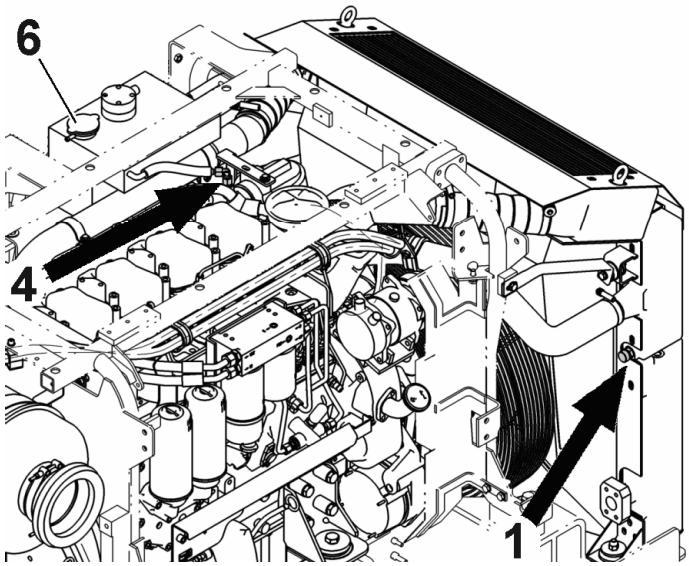

Fig. 5-19 *Draining the coolant*

To drain the coolant at the cooler:

- ▶ Open sealing cap **6** and drain valve **1** on the coolant cooler.
- ▶ Screw the drain hose supplied to the drain valve.
- ▶ Allow the coolant to drain into a suitable container.

To drain the coolant at the diesel engine:

- ▶ Unscrew the drain valve **2** on the engine's oil cooler plate.
- ▶ Allow the coolant to drain into a suitable container.

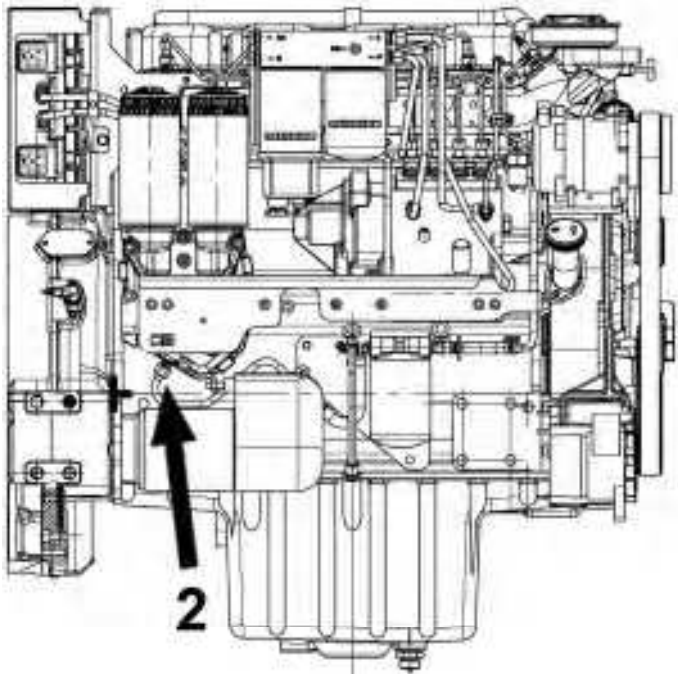

Fig. 5-20 *Cooling circuit drain plugs*

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Caution!
To completely empty the engine (when deactivating the machine for a longer period etc.), the coolant must also be drained at the water pump.

- ▶ Unscrew the drain plug **3** on the water pump.
- ▶ Allow the coolant to drain into a suitable container.

Refilling the coolant and bleeding the coolant circuit

- ▶ Close drain valve **1** on the coolant cooler.
- ▶ Close drain valve **2** on the engine.

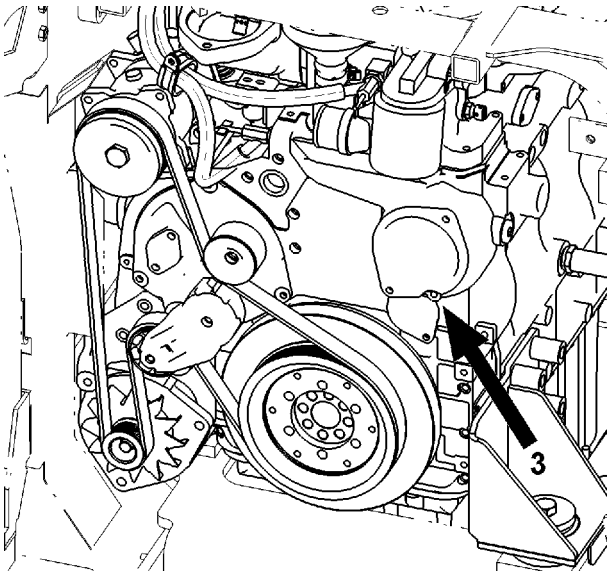

Fig. 5-21 *drain valve of the coolant circuit*

- ▶ Close drain valve **3** on the water pump.
- ▶ Open the shutoff valves for the coolant circuit (siehe Fig. 5-18).
- ▶ Fully open the control valve on the heating unit.
- ▶ Open the bolt connection **4** on the water collecting line.
- ▶ Use the filler neck **6** to add coolant up to the upper edge in the equalizing reservoir.
- ▶ Close the bolt connection **4** as soon as coolant starts to flow out.
- ▶ Close the sealing cap again.
- ▶ Allow the engine to run loaded for approx. 20 minutes.
- ▶ If necessary, cover the cooling system partially so that the opening temperature of the thermostats is exceeded.
  - The overheating display must not actuate here.
  - The water temperature display on the monitoring screen must remain below the red area.
- ▶ The cooling system cap should be removed again if necessary.
- ▶ Allow the engine to continue to run at a low idle for approx. one minute.
- ▶ Check the coolant level in the equalizing reservoir again and refill with coolant if necessary.
- ▶ Open the sealing cap.

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- ▶ Use the filler neck **6** to add coolant up to the middle in the equalizing reservoir's inspection glass.
- ▶ Close the sealing cap again.
- ▶ If the coolant level sensor actuates, check the coolant level (refill if necessary).
- ▶ Bleed as described above.

Caution!
The engine could be damaged.

- ▶ If the temperature or level display for the coolant level illuminates, bring the engine to a low idle immediately.
- ▶ Switch off the engine.
- ▶ Check the coolant level and refill with coolant if necessary.

5.7 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.

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5.7.1 Refuelling

Fuel filler cap

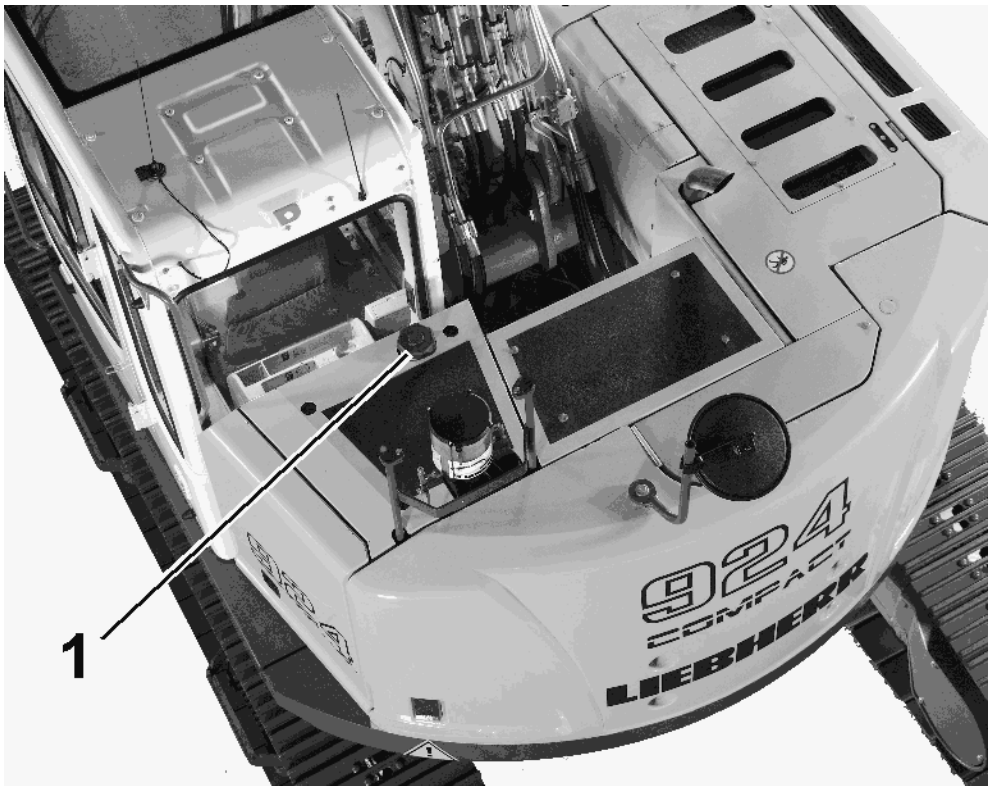

Fig. 5-22 *Fuel filler cap*

- ▶ Unscrew fuel filler cap **1**
- ▶ Add fuel via the filler sieve.

Electrical refuelling pump (optional extra)

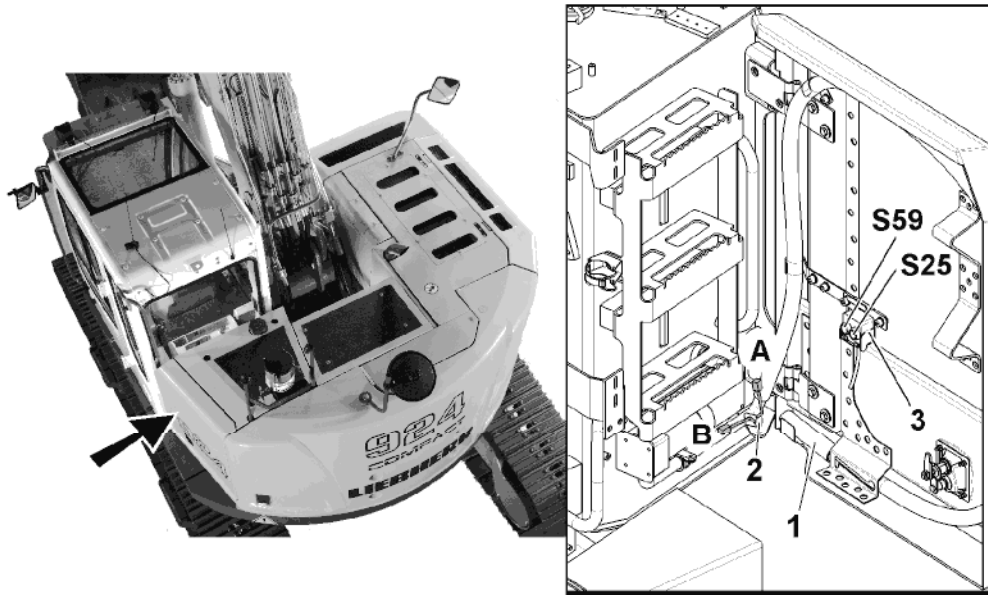

Fig. 5-23 *Electrical refuelling pump*

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The electrical refuelling pump is used to put fuel into the machine's fuel tank.

It is located under the side door left, on the right side of the fuel tank. The operating unit **3** is removable.

Proceed as follows when refuelling and stowing the hoses:

- ▶ Insert the free end of the intake hose **1** in the fuel supply tank.
- ▶ Open stop cock **2** (position **B**).
- ▶ Use switch **S25** (green) to switch on the refuelling pump in order to pump fuel into the machine's tank.
  - ↳ The pump switches off automatically as soon as the maximum fill level is reached.
  - ↳ The refuelling pump can be switched off at any time using switch **S59** (red).

Caution!
The pump must not be permitted to run dry.

- ▶ Ensure that the fuel level does not drop below the intake level of the intake hose.

- ▶ Close stop cock **2** (position **A**).
- ▶ Ensure that no fuel remains in the intake hose **1** before stowing.
- ▶ Roll up the intake hose **1** and place it in the stowing compartment.
- ▶ Close the hatch again.

5.7.2 Draining the fuel tank

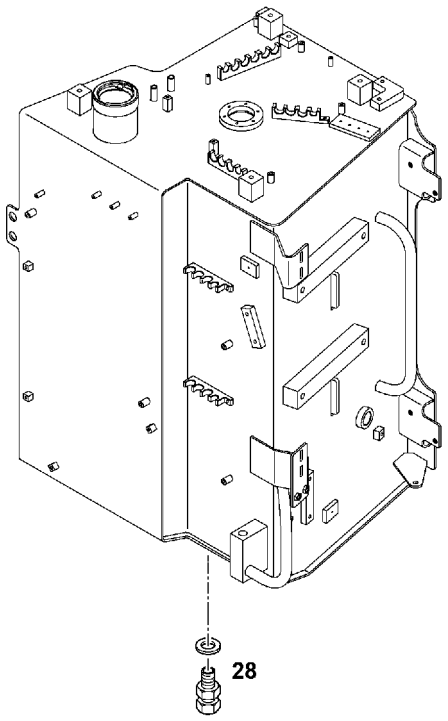


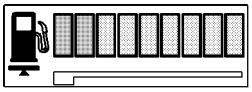
Fig. 5-24 *Draining the fuel tank*

To drain the fuel tank and the fuel system daily:

- ▶ Place a suitable container underneath.
- ▶ Unscrew the drain valve **28** found on the underside of the fuel tank.
- ▶ Drain off the water until fuel starts to come out.
- ▶ Screw drain valve **28** closed again.

If conditions of use and fuel quality permit, the maintenance interval can be increased to one week.

Note!
To reduce the formation of condensate in the tank, keep the fuel level as high as possible.



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.

5.7.3 Emptying and cleaning the fuel tank

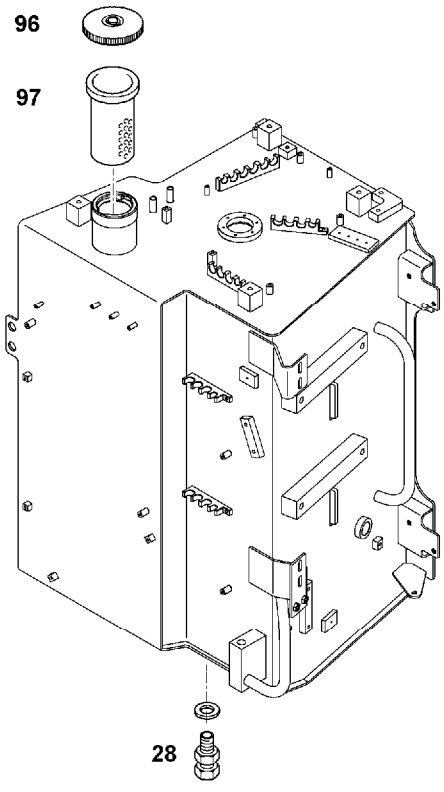


Fig. 5-25 *Fuel tank*

The tank floor is fitted with a drain valve **28**.

- ▶ Place a suitable container underneath.
- ▶ To drain off the water, unscrew the drain plug on the drain valve **28** by two turns until fuel which contains no water comes out.

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- ▶ Retighten the plug.
- ▶ To empty, remove the fuel filler cap **96** and the drain valve **28** and collect the fuel in a suitable container.
- ▶ Check the fuel tank and fill strainer **97** regularly for contamination.
- ▶ If necessary, replace the fill strainer **97** and / or wash out the fuel tank.

5.7.4 Draining and changing fuel filter cartridges

Preparation for fuel filter cartridges changing :

The instructions and executions concerning the fuel pre-filter with water separator differ according to diesel engine size.

Be ensured of the presence of :

- ❑ a suitable container for the fuel
- ❑ an original Liebherr filter cartridge or a filter set

Danger !
Risks of fire and explosion !

- ▶ No smoking.
- ▶ Avoid fire exposition.
- ▶ Intervene only with diesel engine stopped.

With a fuel shutoff valve :

- ▶ Close the fuel shutoff valve.
- ▶ Position the container under the fuel filter.
- ▶ Clean up carefully the fuel pre-filter and it's immediate accesses.

Changing the fuel pre-filter cartridge

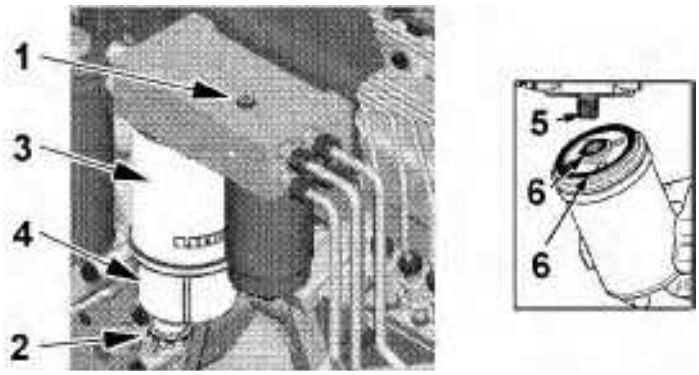

Fig. 5-26 *Changing the fuel pre-filter cartridge.*

- ▶ Drain off the fuel : unscrew bleeding screw **1** and draining screw **2**.
- ▶ Untighten and unscrew filter cartridge **3** using a ribbon key or any similar tool.
- ▶ Unscrew the water separator tank **4** from the cartridge filter.
- ▶ Recycle the old filter cartridge.
- ▶ Dip and clean up the water separator tank and dry it using compressed air.

▶ Screw the water separator tank on the cartridge filter.

▶ Chek out the filter base of dirtying and watch over that the adaptor **5** is hold firmly into the filter console.

❑ If the console is dirty :

▶ Clean up the filter console.

▶ Coat the gasket ring **6** from the new filter cartridge with proper fuel.

▶ Screw the cartridge filter on to the console and tight-it by hand.

▶ Open the fuel shutoff valve and bleed the fuel pre-filter.

▶ Screw the bleeding screw.

Draining the fuel filter cartridge's water separator :

▶ Check out the water separator of the pre-filter cartridge.

Note !
Problem resolution
In presence of water into the fuel filter cartridge's water separator :

▶ Do not star the diesel engine.

▶ Lay a suitable container under the water separator and possibly place a drain hose there.

▶ Unsrew bleeding screw **1** and drain screw **2**, drain off the water until fuel starts to flow out.

❑ When the fuel flows out :

▶ Screw and tighten bleeding screw **1** and drain screw **2**.

Changing the fuel fine filter cartridge

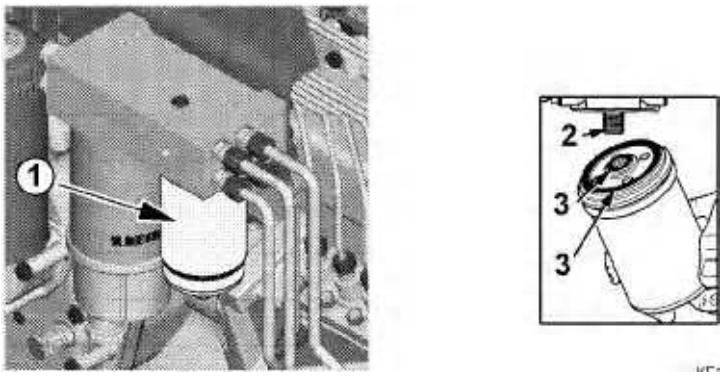

Fig. 5-27 *Changing the fuel fine filter cartridge*

▶ Untighten and unscrew the filter cartridge **1** using a ribbon key or any similar tool.

▶ Recycle the old filter cartridge.

▶ Chek out the filter base of dirtying and watch over that the adaptor **5** is hold firmly into the filter console.

❑ If the console is dirty :

▶ Clean up the filter console.

▶ Coat the gasket ring **3** from the new filter cartridge with proper fuel.

▶ Screw the cartridge filter on to the console and tight-it by hand.

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▶ Open the fuel shutoff valve and bleed the fuel filter.

▶ Screw the bleeding screw.

Intervals: see control and maintenance chart.

To empty the fuel filter cartridge water separator:

▶ Place a suitable container underneath.

▶ Unscrew the screw cap **3** of the fuel preliminary cartridge **1** daily.

▶ Drain off the water until fuel starts to flow out.

▶ Tighten the plug.

To change fuel filter cartridges:

▶ Unscrew fuel filter cartridge.

▶ Oil the rubber sealing ring on the new fuel filter cartridge.

▶ Screw fuel filter cartridge on.

▶ Bleed the fuel system.

5.7.5 Venting the fuel system

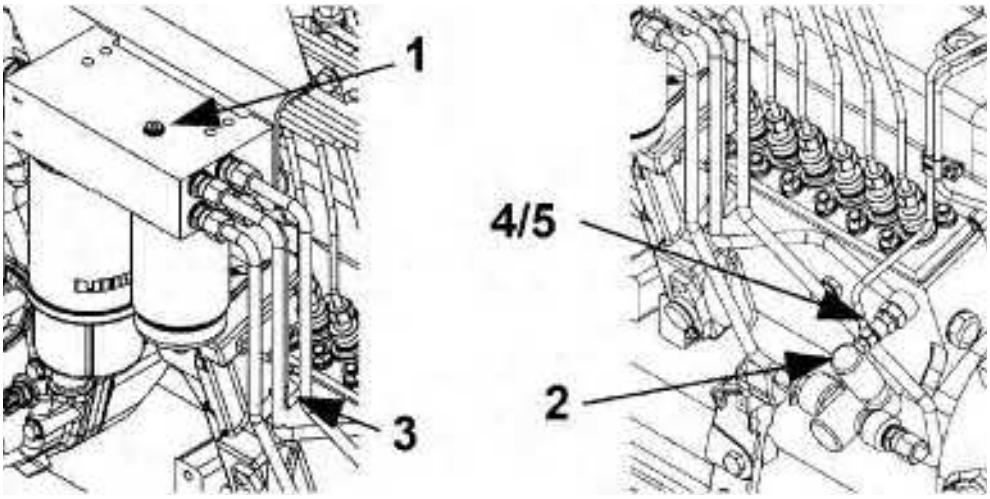


Fig. 5-28 *Venting the fuel system*

Preparation forventing the fuel system :

The venting is necessary after :

– cartridge filter changing
– cleaning of fuel tank
– repair on fuel system
– fuel break down

Be ensured of :

❑ the diesel engine is ready for the intervention

❑ a suitable container for the fuel is ready

❑ an original Liebherr filter cartridge or a filter set

Danger !
Risks of fire and explosion !

- No smoking.
- Avoid fire exposition.
- Intervene only with diesel engine stopped.

- If present, open the fuel tank's shutoff valve.

To vent the fuel system filter:

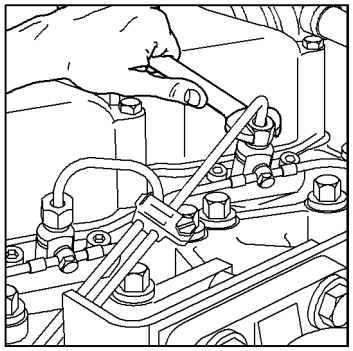
- Unscrew vent screw **1** on the filter panel and unscrew 2-3 thread pitches.
- Operate hand pump **2** until fuel flows out densely.
- Tighten the vent screw **1** on the filter panel.

To vent the fuel lines:

- Place a suitable container underneath.
- Unscrew fuel line **3** from the fuel filter on the injection pump.
- Operate hand pump **2** until fuel flows out densely.
- Retighten fuel line **3**.

To vent the overflow valve:

- Place a suitable container underneath.
- Unscrew overflow valve **4**.
- Operate hand pump **2** until fuel flows out densely.
- Retighten overflow valve **4**.



To vent injection lines:

- Place a suitable container underneath.
- Unscrew the union nuts of the injection lines at the injection valves.
- Operate the starter until fuel flows out densely.
- Tighten union nuts.
- Start the engine.
- If the engine does not start, repeat the venting procedure.

Note !
Problem resolution

- If the engine would not start, repeat the bleeding operation.

5.8 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

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maintenance intervals.

It is not recommended that filter elements be washed out for safety reasons.

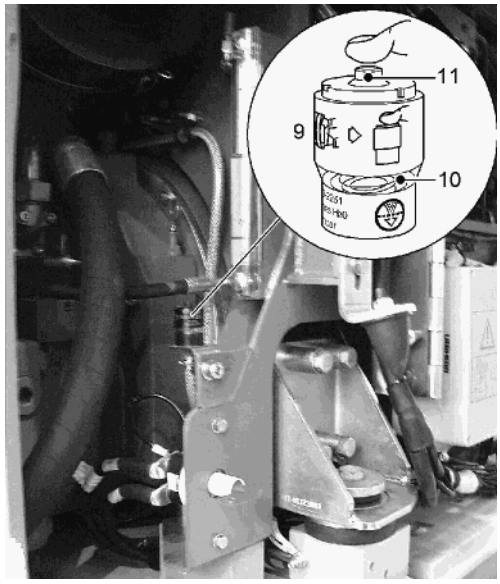

Fig. 5-29 *Vacuum gauge*

The vacuum gauge **9** stores the maximum intake low pressure reached on the filter outlet while the diesel engine is operating.

The appearance of the red display strip in alarm window **10** indicates that the maximum permissible low pressure of 50 mbar has been reached.

- ▶ Replace the main element.
- ▶ Press the reset button **11** to clear the stored low pressure reading.

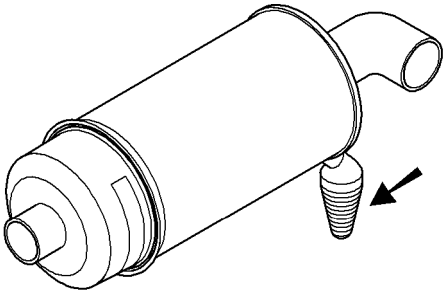

Fig. 5-30 *Dust discharge valve extractor slot*

- ▶ Push the extractor slot on the dust discharge valve up by hand once a week to ensure that it does not stick due to humidity and dust.

5.8.1 Changing the main element

Caution!
Only replace the main element when the maximum permissible intake low pressure has been reached, or at least once a year.

Installing and removing the main element too often could damage the seals between the filter element and the filter housing.

- ▶ Only replace the safety insert after every third change of the main element, or at least once a year.
- ▶ Before installing a new insert, clean the seal and the seal contact face in the housing carefully.

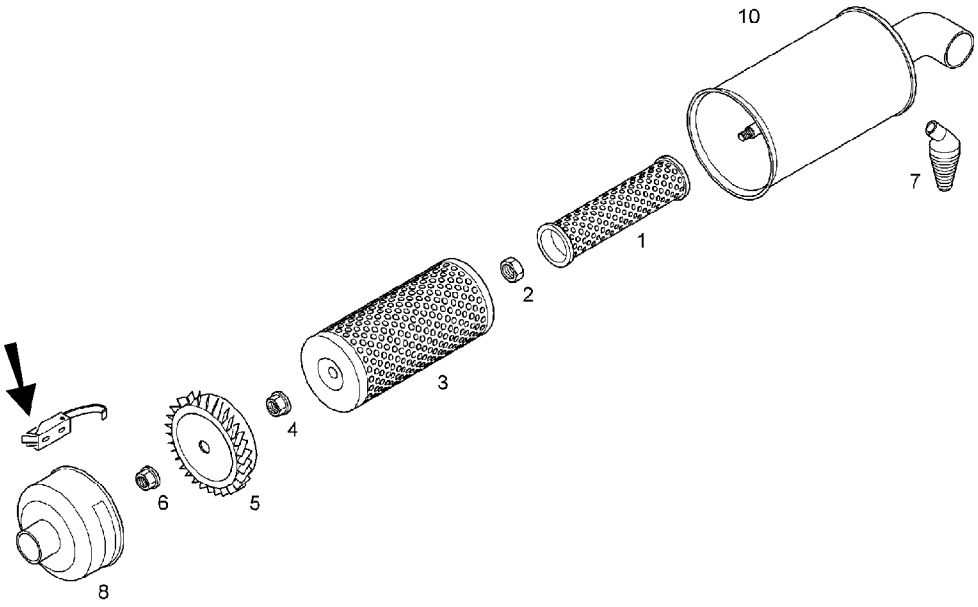

Fig. 5-31 *Changing the filter cartridges*

1 Safety element
2 H nut
3 Primary air filter
4 slot nut
5 deflector
6 slot nut
7 Dust discharge valve
8 Cover with tightening clasps
10 Filter housing

- ▶ With engine stopped, remove the cover **8**, after opening of the tightening clasps.
- ▶ Unscrew nut **6**.
- ▶ Remove deflector **5**.
- ▶ Unscrew nut **4**.
- ▶ Remove the contaminated main element **3**.
- ▶ Clean the interior of the air filter housing and the sealing surface in the housing using a damp cloth.

Caution!
Dirt could enter the engine intake!

- ▶ Do not clean the housing by blasting out with compressed air.

- ▶ Insert the new main element and ensure that it is sealed and positioned correctly.
- ▶ Screw nut **4**, tighten it slightly.

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- ▶ Mount deflector **5**.
- ▶ Screw nut **6**, tighten it slightly.
- ▶ Close the filter housing **10** with cover **8** and it's clasps.

5.8.2 Changing the safety element

Note!
Replace the safety element after replacing the main filter cartridge three times or at least once a year.
Replace the safety element immediately in the event that a visual check has shown that the safety element is very dirty.

- ▶ Remove the main element **3**.
- ▶ unscrew nut **2**.
- ▶ Remove the safety element **1**.
- ▶ Clean the interior of the air filter housing carefully using a damp cloth.
- ▶ Clean sealing surfaces in the housing and inspect for any damage.
- ▶ Insert the new safety element **1** carefully.
- ▶ screw nut **2**
- ▶ Insert the filter cartridge **3** and ensure that it is sealed and positioned correctly.
- ▶ Screw nut **4**, tighten it slightly.
- ▶ Mount deflector **5**.
- ▶ Screw nut **6**, tighten it slightly.
- ▶ Close the filter housing **10** with cover **8** and it's clasps.

5.8.3 Monitoring the filtered air line

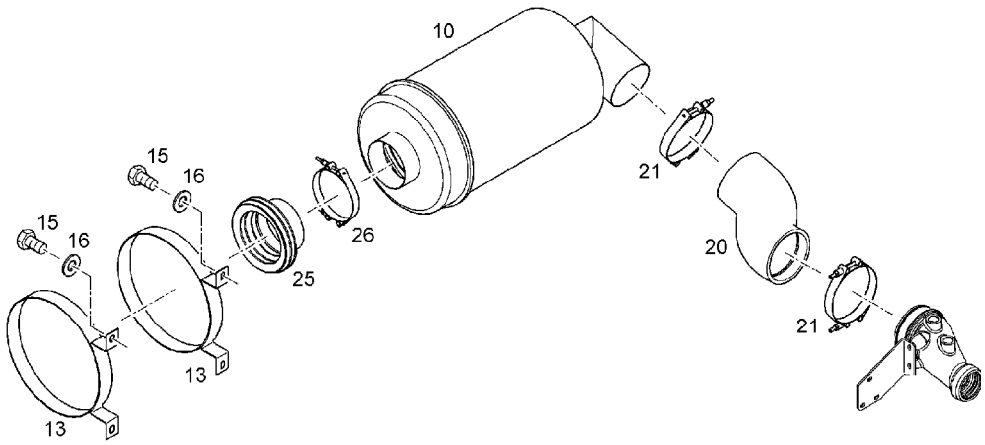

Fig. 5-32 *Monitoring the filtered air line*

- ▶ Monitor the filtered air line between the filter outlet and the engine intake pipe **20** for damage and leaks each time the filter element is replaced.
- ▶ If necessary, retighten the tensioning clamp screws **21** and **26**.

▶ Check out the filter house **10** bearing and if necessary retighten screws **15**.

5.9 Hydraulic system

Maintenance work on the hydraulic system is restricted mainly to the hydraulic tank.

All other units on the system do not require any special maintenance.

The pipe and hose network should be checked at regular intervals for leaks.

Note!
Strict cleanliness is of particular importance for the hydraulic system.

For this reason, the intervals given

– for changing the return-line filter
– for cleaning the oil cooler and
– for changing the oil must be adhered to.

5.9.1 Preparatory activities

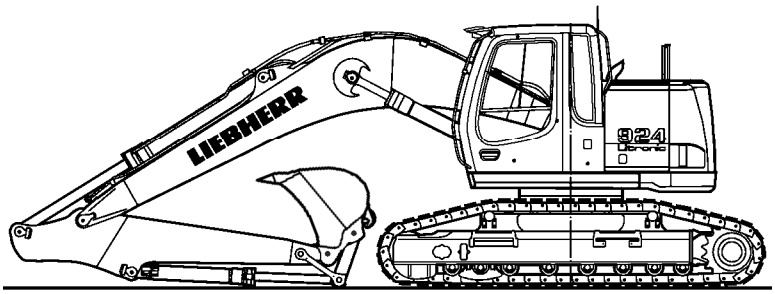

Fig. 5-33 *Machine position for checking the oil level of the hydraulic system*

When checking the oil level or refilling the oil:

– the machine must stand level,
– the work equipment must be laid down on even ground with the stanchion and tilt cylinder fully extended (bucket and stanchion fully tilted in),
– the support (shield or claw support) must also be extended.

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5.9.2 Checking the oil level in the hydraulic tank

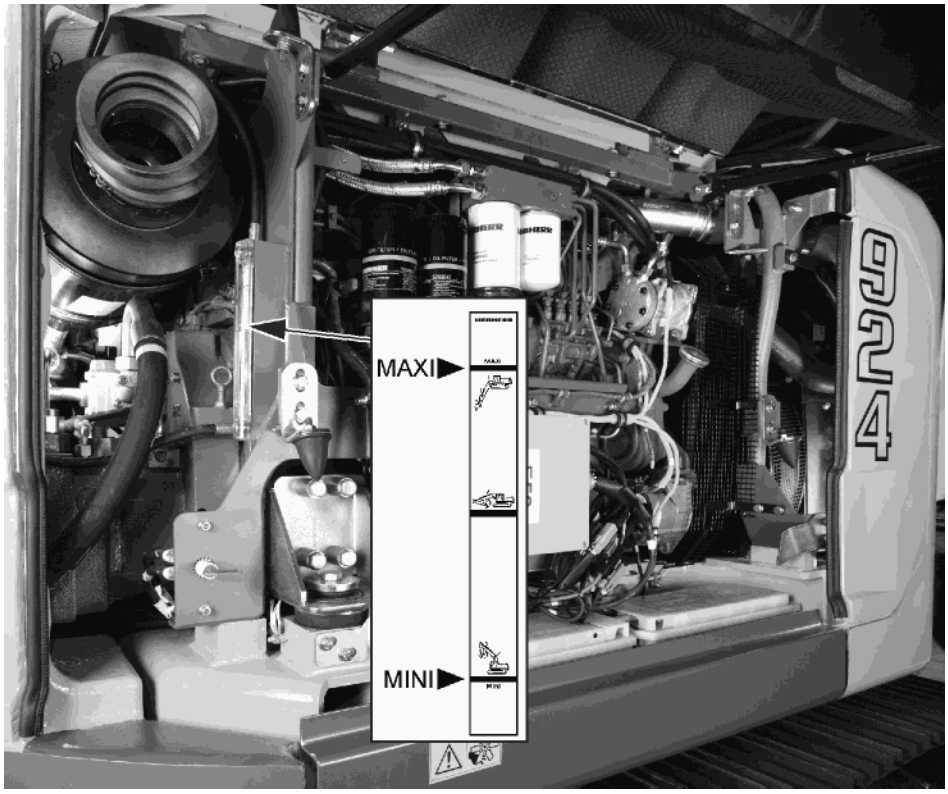


Fig. 5-34 *Hydraulic tank oil level*

When the machine is in the check position, the level must not lie below the central marking on the inspection window.

▶ If this is not the case, fill oil via the return-line filter until the level reaches the central marking.

The upper marking **MAXI** shows the maximum oil level if all cylinders are fully drawn in.

The lower marking **MINI** shows the minimum oil level if 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.

5.9.3 Depressurizing the hydraulic system

Danger!
A fine stream of liquid can penetrate the skin when under high pressure and cause serious injury.

▶ Before working on the hydraulic system, always remove the pressure.

▶ Do not inspect leaks with bare hands.

Note the following points:

❑ The machine must be in the position described above.

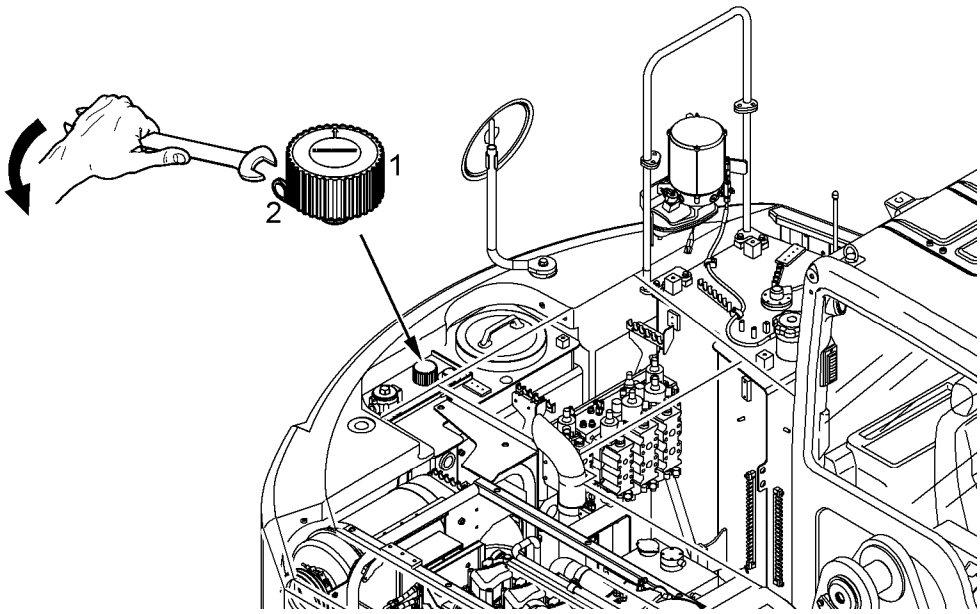
▶ Switch off the engine.

▶ Move the pilot control devices (joystick and pedals) in all directions (with the ignition key in the contact position).

Danger!
The hydraulic oil is hot when at operating temperature and could be pressurized.

▶ Do not allow the hot oil or oil-bearing parts to touch the skin.

Fig. 5-35 *Depressurizing the hydraulic system*



▶ Unscrew the vent filter **1** by a **maximum** of one turn.
↳ The hydraulic system 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.

Note !

▶ The safety stud **2** (or anti-vandalism key) has to be systematically dismounted from the vent filter and hanged to a set of ignition key..

5.9.4 Emptying and refilling the hydraulic tank

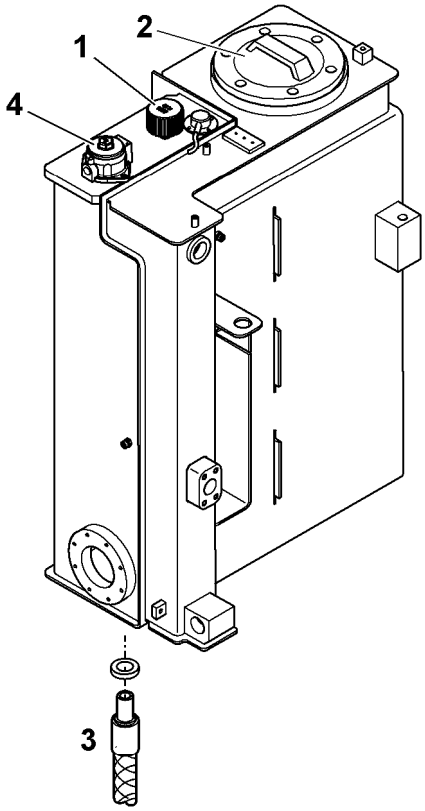


Fig. 5-36 *Draining and refilling the hydraulic oil*

1 Vent filter
2 Return-line filter
3 Drain valves
4 Return-line leakage filter

▶ 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 vent filter **1** by a maximum of one turn.
↳ The hydraulic system will depressurize.

▶ Remove the cover of the return-line filter **2**.

▶ Screw the drain hose to the drain valves **3** in the tank floor and let the oil flow out into a suitable container.

To refill the hydraulic oil:

▶ Unscrew the vent filter **1** by a maximum of one turn.
↳ The hydraulic system will depressurize.

▶ Remove the cover of the return-line filter **2**.

▶ Refill the oil through the filter cartridges until the level reaches precisely the central marking on the inspection window.

▶ Tighten the vent filter **1**.

▶ Screw on the cover of return-line filter **2**.

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Caution!

▶ After each hydraulic oil change, vent the hydraulic pumps.

To drain off condensate water (only for mineral oils):

▶ Drain off the condensate regularly.

▶ Place a suitable container underneath.

▶ Keep the drain hose on the drain valves **3** (siehe Fig. 5-36) until oil which contains no water flows.

Intervals: see maintenance chart

5.9.5 Return-line filter

The return-line filter is located on the top of the hydraulic tank.

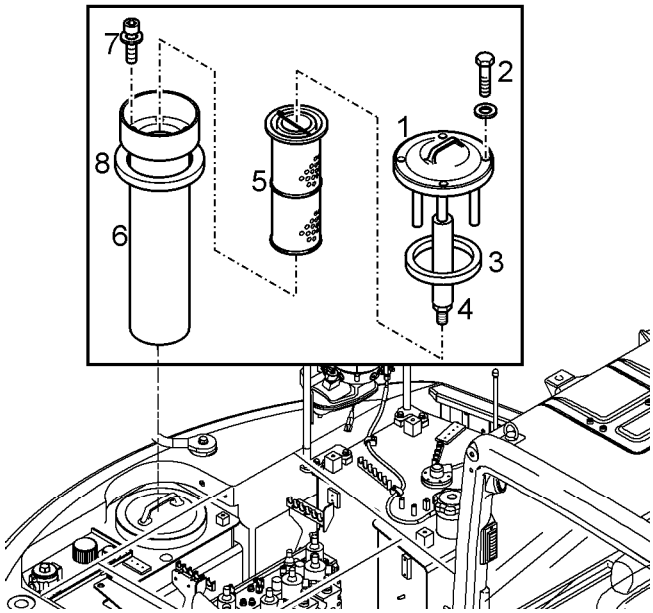

Fig. 5-37 *Return-line filter*

1 Cover
2 Hexagon screw
3 Gasket
4 Magnetic plug
5 Filter unit
6 Protective cylinder
7 Socket HD screw
8 Gasket

The magnetic plug **4** of the return-line filter must be cleaned and the glass fibre filter unit **5** replaced at fixed intervals (see maintenance chart).

Note

▶ When working in heavy dust conditions, please note the special regulations for changing the filter.

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To clean the magnetic plug and replace the filter element:

- ❑ The hydraulic system must be depressurized.
- ▶ Unscrew the four screws on the filter cover and lift out cover **1** and magnetic plug **4**.
- ▶ Carefully clean off any dirt sticking to the magnetic plug.
- ▶ Remove the used filter cartridge **5** on the bracket.
- ▶ Insert the new filter cartridge on the bracket vertically into the tank and press down lightly. Then lay the clamp to the side on the tank ring.

Caution!

- ▶ Ensure that the filter cartridge is standing vertical in the tank, and the gasket **8** may not be damaged.

- ▶ Centre and position the cover unit and bypass cage **4** on the filter unit **5**. When doing this, ensure that the gasket **3** is positioned correctly and is in good condition.

Note!
The filler aperture of the hydraulic tank is fitted with a protective cylinder **6**. This prevents objects getting into the hydraulic tank. The protective cylinder can be removed from the filler aperture if required.

Note!

- ▶ Each time you replace the filter unit **5**, also replace the pressure filter cartridge that is integrated in the control oil unit.

5.9.6 Leckage oil return filter

The leckage oil return filter is located on the top of the hydraulic tank.

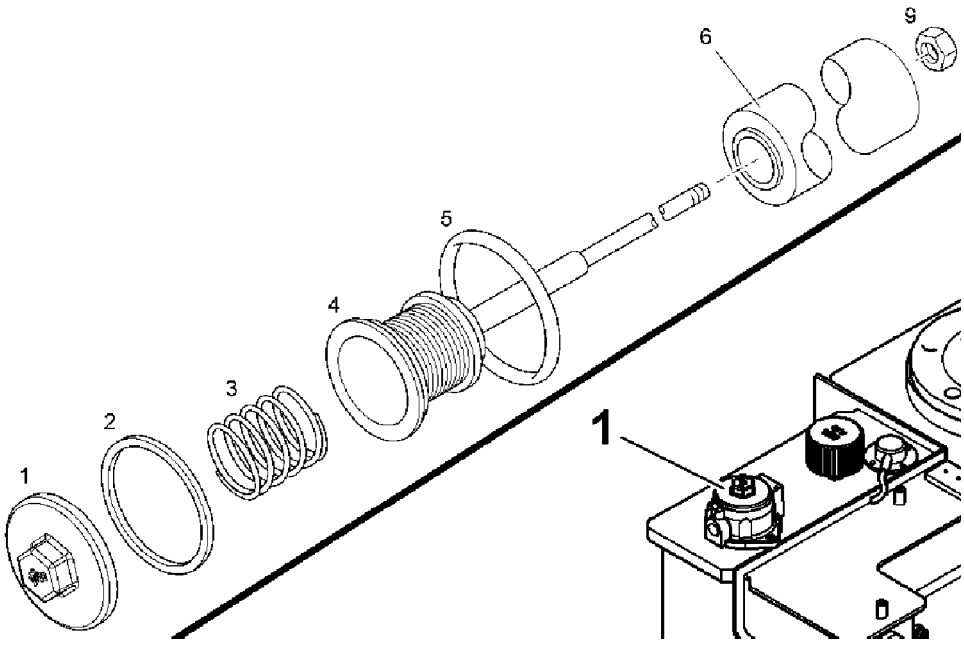

Fig. 5-38 *Leckage oil return filter*

1 Cover
2 gasket
3 Spring
4 Mounting
5 gasket
6 Filter element
9 Hex nut

The filter element **6** has to be replaced at fixed intervals (see maintenance chart).

Note!

▶ When working in heavy dust conditions, please note the special regulations for changing the filter.

Replace the filter element :

❑ The hydraulic system must be depressurized.

▶ Open cover **1**

▶ Extract spring **3**.

▶ Extract the filter element **6** with the mounting **4** on the bracket.

▶ Unscrew Hex nut **9**, replace filter element **6** and screw in hex nut **9**.

▶ Insert the new filter cartridge on the bracket vertically into the tank and press down lightly. Then lay the clamp to the side on the tank ring.

Caution!

▶ Ensure that the mounting is standing vertical in the tank, and the gasket **8** may not be damaged.

▶ Centre and position the spring **3** on the mounting **4**.

▶ Screw in cover **1**. When doing this, ensure that the gasket **2** is positioned correctly and is in good condition.

5.9.7 Control oil filter

The pressure filter **11** is part of the control oil unit **1** which is located on the rear of the hydraulic tank.

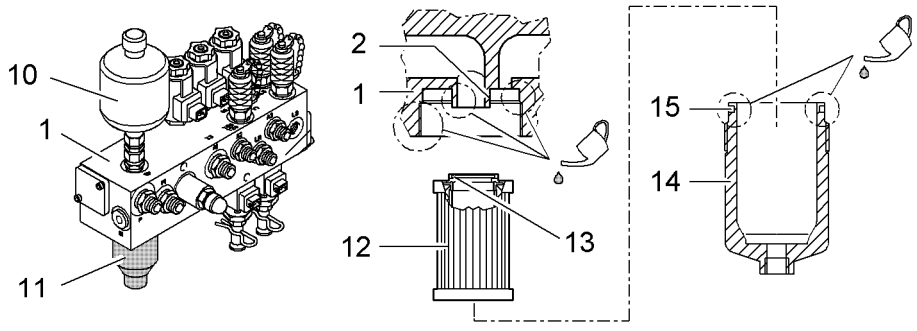

Fig. 5-39 *Control oil unit*

1 Control oil unit
12 Filter unit

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2	Centering pivot	**13**	Filter unit sealing ring
10	Pressure accumulator	**14**	Filter pot
11	Pressure filter	**15**	Filter pot sealing ring

Note!
It is not permitted to clean the filter unit.

▶ Change the filter unit each time you open the filter pot.

To replace the filter element:

❑ The hydraulic system must be depressurized.

▶ Unscrew filter pot **14** from pressure filter **11** and remove filter element **12**.

▶ Clean the filter pot.

▶ Oil the thread and sealing surfaces on filter pot **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 pot **14** as far as the stop and turn it back by hand with a **1/4** turn (approx. 90°).

5.9.8 Control circuit

The sensor devices do not require any special maintenance.

▶ Inspect the pipe network and connections on all units (pressure accumulator, pressure limiting valve, pressure filter etc.) regularly for leaks.

Danger!
The pressure accumulator **10** (siehe Fig. 5-39) keeps the control circuit under pressure for certain operations which also take place after the diesel engine has been switched off.
Before working on the control circuit, the control pressure must be depressurized as follows:

▶ Lay the work equipment on the ground.

▶ Switch off the engine.

▶ Operate both joysticks (with ignition key in contact position).

5.9.9 Bleeding the hydraulic pump

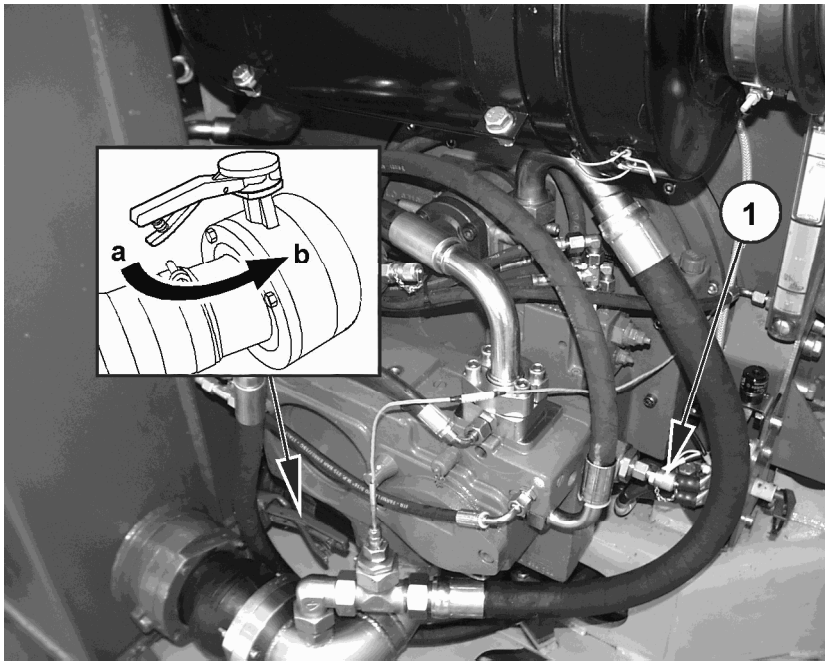

Fig. 5-40 *Hydraulic pump*

After working on the pump or after changing oil in the hydraulic system, the hydraulic pump must be bled.

- ▶ Unscrew the leakage oil hose **1** slightly and allow the air to escape.
- ▶ As soon as hydraulic oil flows out densely, close the leakage oil hose **1** again.

5.9.10 Bleeding the hydraulic cylinders

After working on the cylinders, they must be bled.

- ▶ Make the the engine run at low idle (800-900 tr/mn).
- ▶ Retract slowly the cylinder until stop and do not actuate the movement any more. Then extend slowly the cylinder until stop and do not actuate the movement any more. Repeat the operation 5 times.

If you do not follow this procedure, it can cause diesel effect (explosion of air bubbles) in the cylinder.

Unscrew the intake hose to the pump

The stop cock on the hydraulic tank to the intake hose has two positions:

a open **b** closed

- ▶ If the intake hose has to be unscrewed at the pump or at the hydraulic tank, close the stop cock on the hydraulic tank **b**.
- ▶ Depressurize the hydraulic system.

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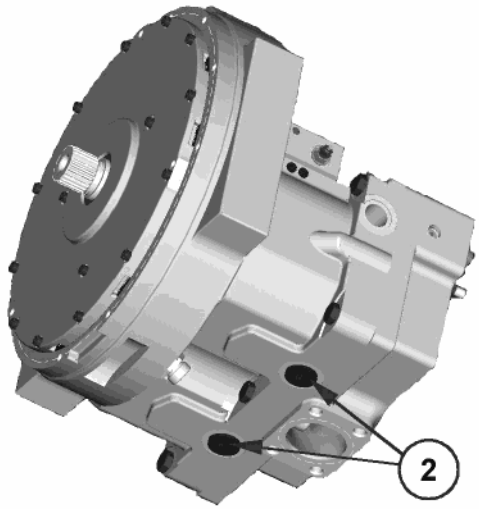

Fig. 5-41 *Hydraulic pump draining plugs*

- ▶ Place a suitable container under the pump and the intake hose. Unscrew sealing plugs **2** at the pump-end neck of the intake hose.
- ▶ Drain the hydraulic oil out of the pump and intake hose.

Note !
The oil is only drained out of the pump. Watch over the residual oil into the intake hose.

- ▶ Once the repair work is completed, retighten screws **2**.
- ▶ turn the stop cock back to its starting position **a** and engage.
- ▶ Retighten the vent filter on the hydraulic tank.

Vent filter on the hydraulic tank

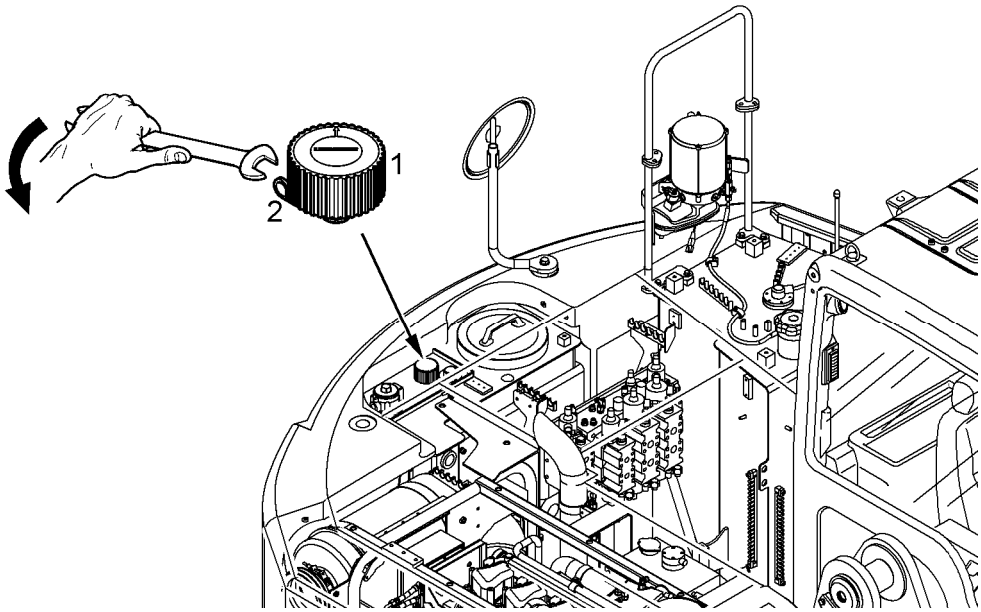

Fig. 5-42 *Hydraulic tank vent filter*

- ❑ The hydraulic system must be depressurized.

▶ Replace the filter **1** and retaining pin **2** each time the hydraulic oil is changed (see “Control and maintenance chart”).

Note!

▶ When working in heavy dust conditions, please note the special regulations for changing the filter.

▶ The retaining pine 2 (or anti vandalism key) has to be systematically removed from the event filter and attached to the ignition key

Bleeding the swing gear

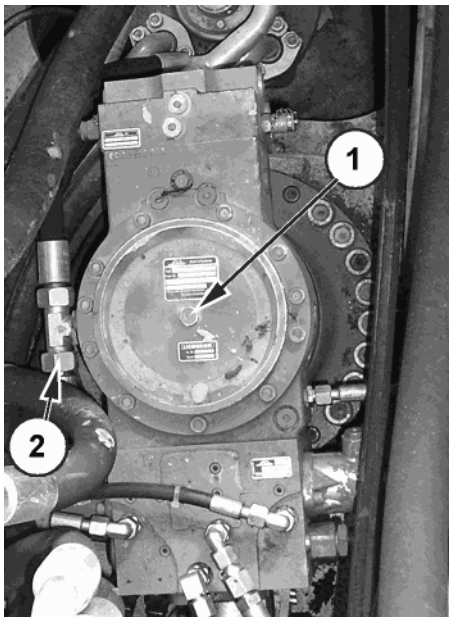

Fig. 5-43 *Bleeding the swing gear*

Before first use of the swing gear, after repair or replacement, the swing gear is fulled with oil using fitting **2**.

❑ The hydraulic system must be depressurized.

▶ Unscrew slightly screw **1** and allow the air to escape.

▶ As soon as hydraulic oil flows out densely, close the leakage oil hose **1** again.

5.9.11 Bleeding the hydraulic cylinders

A cylinder must be bled after having changed the cylinder or after having worked on the cylinder (Sealing change,...) or after having worked on the cylinder hydraulic circuit (Hose change, ...).

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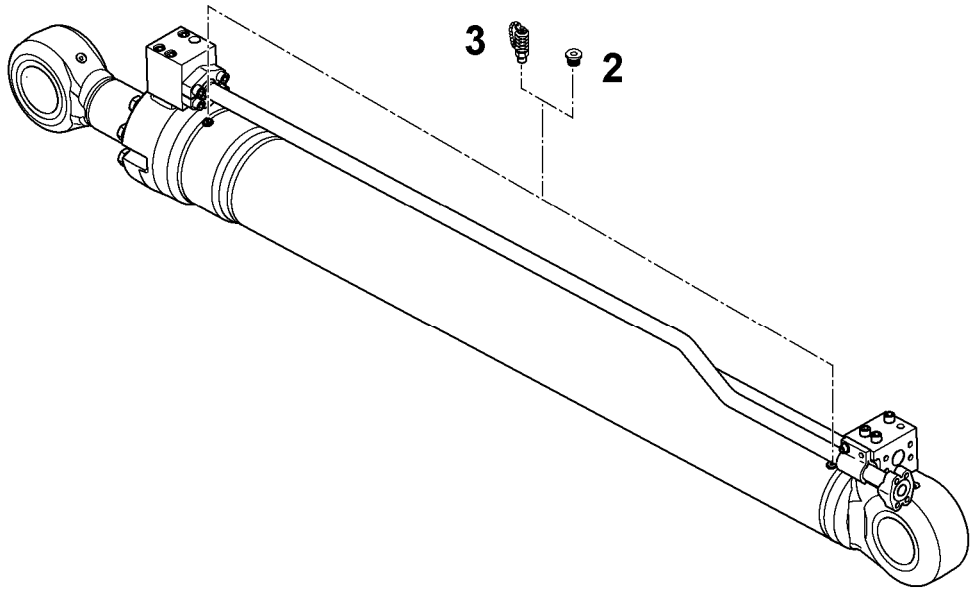

Fig. 5-44 *Hydraulic cylinder*

2 Locking screw for bleeding **3** Test point

Hydraulic cylinders equipped with locking screws for bleeding **2** must be bled following the procedure 1 and Hydraulic cylinders, which are not equipped with these locking screws for bleeding must be bled following the procedure 2.

Procedure 1

- ▶ Unscrew the locking screws for bleeding **2** both side.
- ▶ Screw two test points **3** instead of the locking screws and attach an test hose on each test point.
- ▶ Make the the engine run at low idle (800-900 tr/mn).
- ▶ If possible, make the attachment move in order to have the side to be bled in the higher position.
- ▶ Lightly 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 retractation in order to bleed the cylinder rod side).
- ▶ Redo this action until oil without air 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 test points **3** by the locking screws **2**.
- ▶ Perform the procedure 2.

Procedure 2

- ▶ Make the the engine run at low idle (800-900 tr/mn).
- ▶ Retract slowly the cylinder until stop and do not actuate the movement any more. Then extend slowly the cylinder until stop and do not actuate the movement any

more. Repeat the operation 5 times.

Danger!
If you do not follow this procedure, it can cause diesel effect (explosion of air bubbles) in the cylinder.

5.9.12 Bypass oil filter for hydraulic circuit (option)

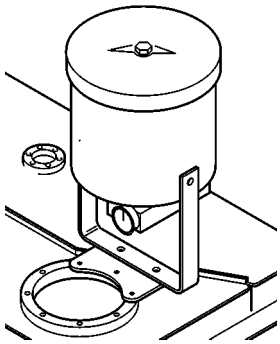

Fig. 5-45 *Bypass oil filter for hydraulic circuit*

The machine can be equipped with an additional oil filter. This filter can be mounted in the bypass of the hydraulic circuit between control valve block - return and the hydraulic tank. This filter can although be mounted in lubrication circuit of the engine. This additional oil filter is fixed on the hydraulic tank. During operation a small quantity of oil flows threw this filter in the bypass of the main return filter.

This filter is designed to drain water by absorbing the water contained in the oil. Monting bypass oil filter is especially recommended when using environmentally acceptable hydraulic fluids because these fluids have a greater capacity to absorb water than mineralhydraulic fluids.

Note !
IUsing this filter does not relieve the operator of the responsability of draining the water condensation from the hydraulic tank.

The filter element must be replaced every time the return filter element is changed. , but at least every six months.

Danger!
A fine stream of liquid can penetrate the skin when under high pressure and cause serious injury.

▶ Before working on the hydraulic system, always remove the pressure.

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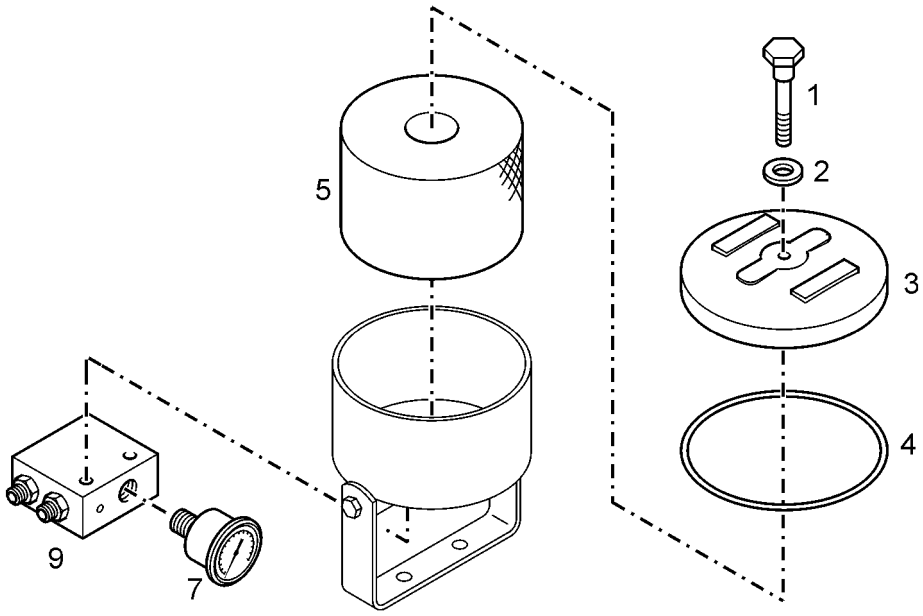

Fig. 5-46 *Change of the filter element*

1 Screw
2 Washer
3 Cover
4 Gasket ring
5 Filter element

- ▶ Loosen the screw **1**, remove the cover **3** and pull out the old filter element **5**.
- ▶ Insert a new filter element, clean the cover **3** and put in a new gasket ring **4**.
- ▶ Put on the cover **3** eand retighten the screw **1**.

5.9.13 Return oil filter for hydraulic hammer (option)

In case of use of an hydraulic hammer, it is strongly advised to install an extra return oil filter.

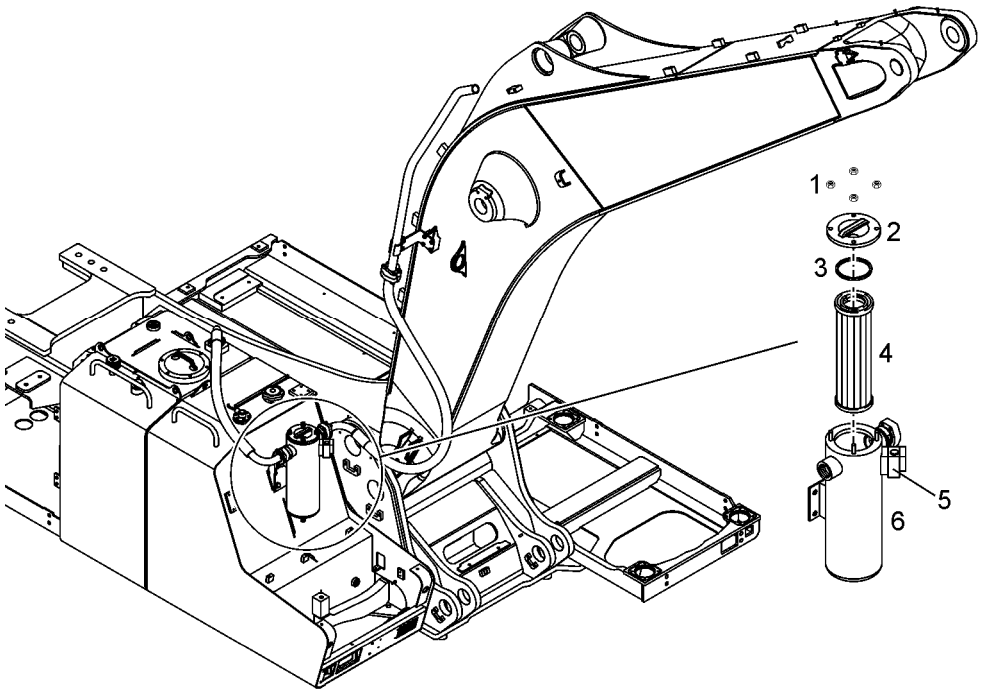

Fig. 5-47 *Return oil filter for hydraulic hammer*

1	Nuts	**3**	Seal kit	**5**	Contamination indicator
2	complete cover	**4**	Filter cartridge	**6**	Filter housing

The return oil filter for hydraulic hammer is mounted on the fuel tank. The intervall of maintenance depends on the indication given by the contamination indicator **5**.

If the indicator is green, the filter works correctly.

If the indicator is red, the filter is clogged and the filter unit has to be replaced.

Replacement of the filter cartridge

- ❑ The hydraulic system must be depressurized.
- ▶ Unscrew the four nuts **1** on the filter cover and lift out cover **2**.
- ▶ Remove the used filter cartridge **4**.
- ▶ Check the seal **3** and replace it if necessary.
- ▶ Carefully clean off any dirt sticking to the magnetic plug.
- ▶ Insert a new filter cartridge **4**.
- ▶ Put the seal **3** and the cover **2**.
- ▶ Coat the stud bolts of the filter housing **6** with anti-corrosion grease and tighten the nuts **1**.

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5.9.14 Servicing the hydraulic cylinder

Checking the condition of the piston rod mount

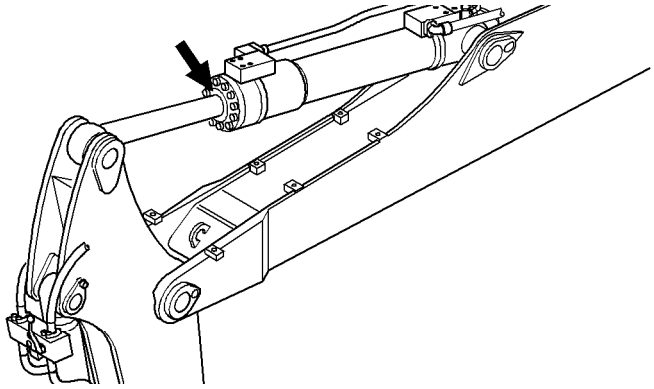

Fig. 5-48 *Piston rod mount*

Note
When a leak appears on the piston rod mount of a hydraulic cylinder (arrow), the sealing kit must be replaced by a LIEBHERR fitter.

Protecting the piston rods

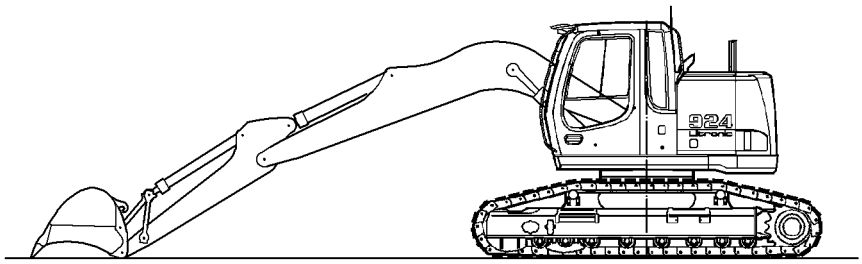

Fig. 5-49 *Machine with piston rods drawn in*

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.

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5.9.15 Replacing hydraulic hoses

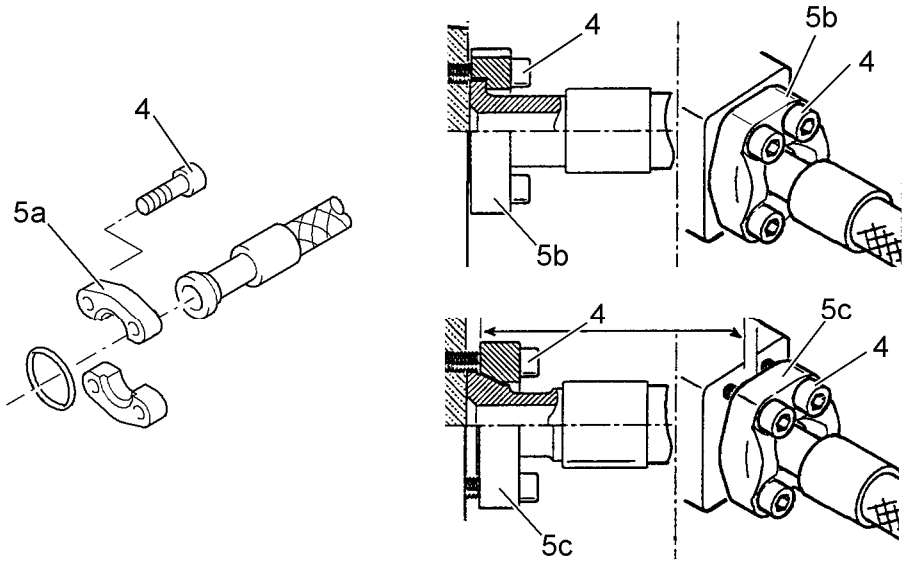

Fig. 5-50 *High pressure hose with SAE fitting*

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

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Tab. 5-14 *Tightening torques for SAE fittings - Quality 10.9*

Size of screw 4	Torque value in Nm - Quality 8.8
	Half flanges 5a
M8	22
M10	44
M12	76
M14	122
M16	187

Tab. 5-15 *Tightening torques for SAE fittings - Quality 8.8*

5.10 Oil changes on components

5.10.1 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.

Draining the slewing gear transmission

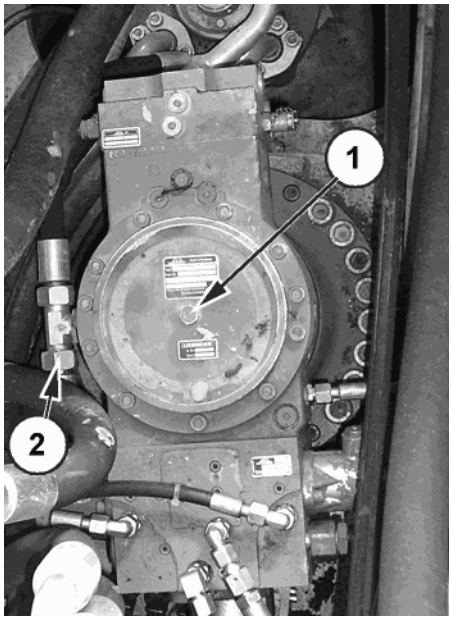

Fig. 5-51 *Drainig the slewing gear transmission*

1 Bleeding screw

2 Injection and oil return fitting

Via the injection and oil return fitting, the slewing gear is greased in a permanence way. For that reason, the oil draining of the slewing gear is not necessary.

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5.10.2 Splitterbox - Oil change

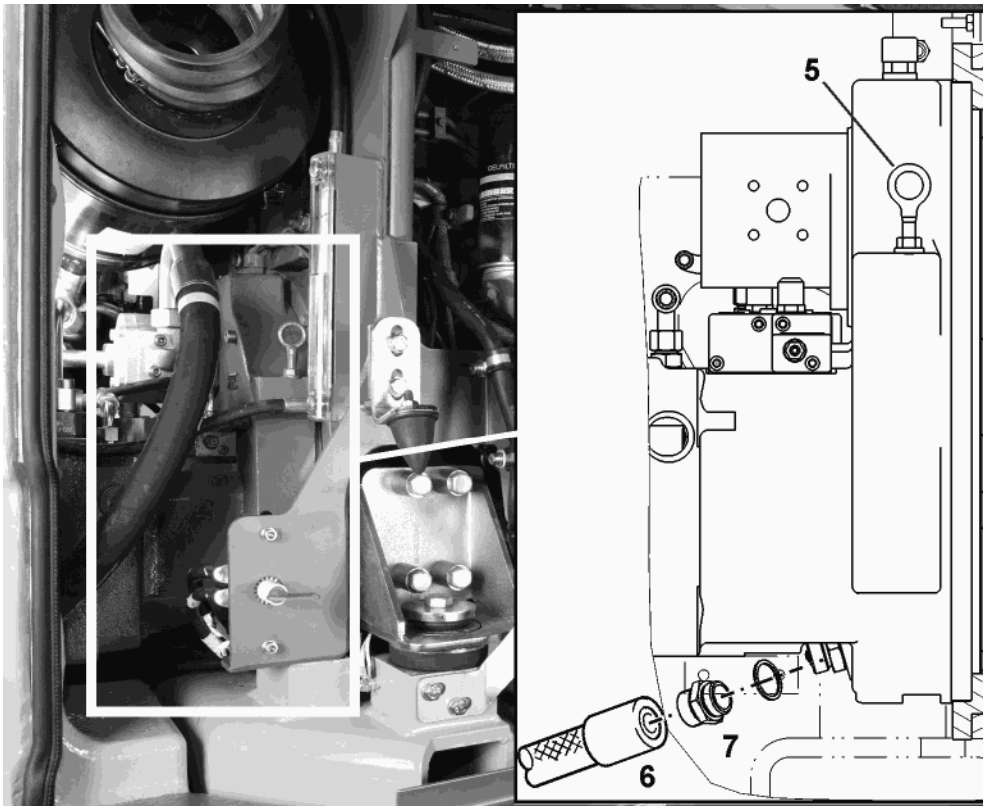

Fig. 5-52 *Changing oil in splitterbox*

5 Dipstick

6 Drain hose

7 Drain valve

Oil draining :

- ▶ Remove the dipstick **5**.
- ▶ 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.

Remplissage en huile :

- ▶ Add the oil via the dipstick **5** drilling until the level reaches the mark on the dipstick **5**.
- ▶ Insert dipstick **5**.
- ▶ Run the engine for a few minutes, stop it and recheck the oil level.

5.10.3 Travelling gear - changing the oil

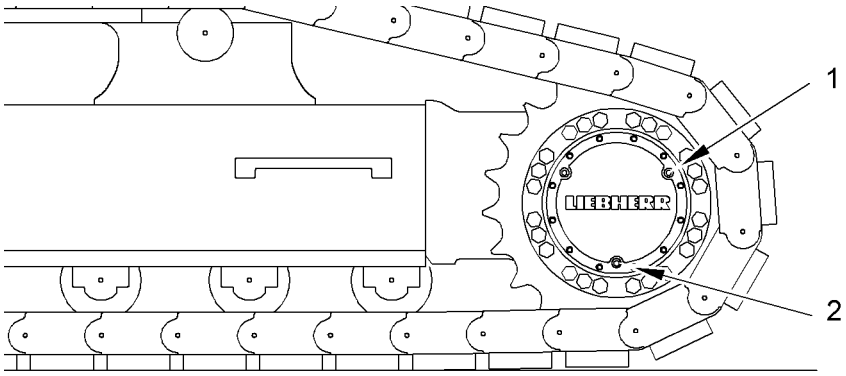

Fig. 5-53 *Travelling gear - adding and draining oil*

- ❑ Before draining the oil, the drive unit must be operated until one sealing plug is positioned exactly vertical to the centre axle of the transmission (position **2**).

To drain the oil:

- ❑ Ensure that you have a suitable oil drainage container to hand.
- ▶ Place the container beneath the drive unit.
- ▶ Remove sealing plug **1**.
- ▶ Remove sealing plug **2**.
  ↳ The oil drains into the container.

To add the oil:

- ▶ Screw in sealing plug **2**.
- ▶ Add the oil until the level reaches the bore hole **1**.
- ▶ Screw in sealing plug **1**.

5.11 Running gear

The running gear is maintenance-free until the regeneration of the treads or the cylinder or until all running gear parts are completely worn.

The lifetime design of the support rollers, track rollers and leading wheels increases the running gear's lifetime and metal gaskets make it insensitive to dirt.

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5.11.1 Checking the running gear component mountings

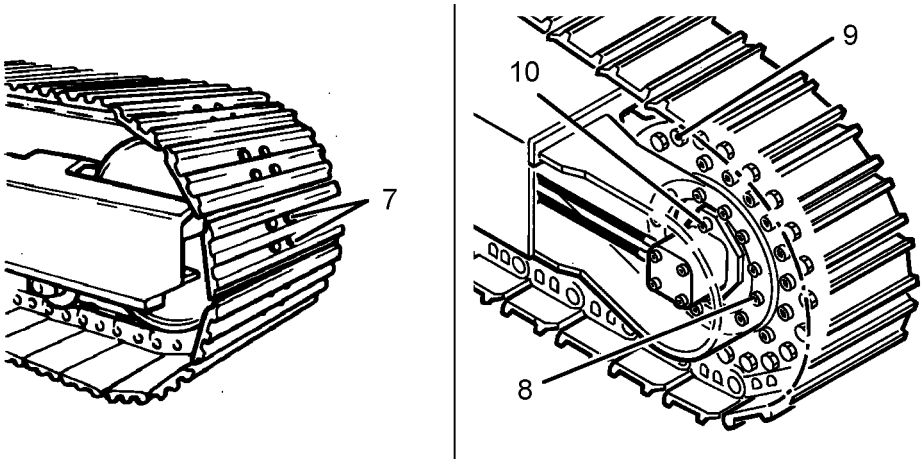

Fig. 5-54 *Running gear component mountings*

- ▶ Carry out regular checks for loose mounting screws on the base plates and travelling mechanisms.
- ▶ Monitor tightening torques.
  - Mounting screws **7** on base plates: **520 Nm**
  - Mounting screws **8** on the travelling mechanism: **560 Nm**
  - Mounting screws **9** on the tumbler wheel: **560 Nm**
  - Mounting screws **10** on the hydraulic motor: **280 Nm**

5.11.2 Monitoring the crawler tension

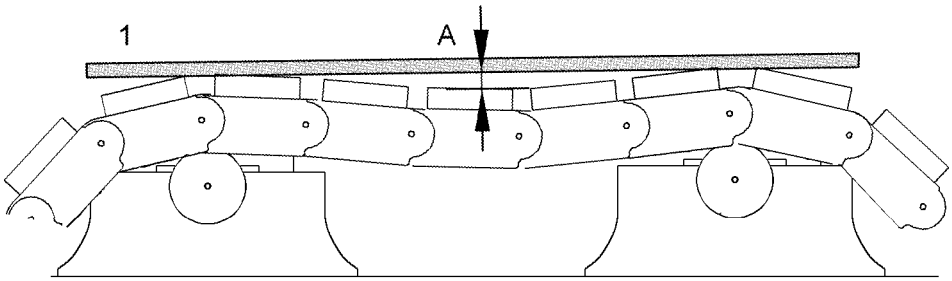

Fig. 5-55 *Monitoring the crawler tension*

- ▶ Relieve the crawlers by driving the machine forwards and backwards.
- ▶ Place the measuring rod **1** in the area between the support rollers
- ▶ Measure distance **A** between the measuring rod lower edge.
  - ↳ The crawler should, under operating conditions, sag **15 to 20 mm** between the support rollers.
  - ↳ Retension the crawlers if necessary.

5.11.3 Retensioning the crawler

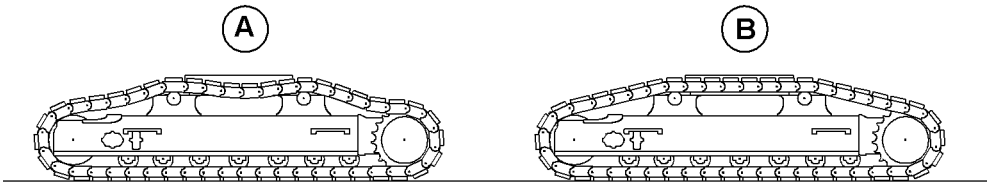

Fig. 5-56 *Crawler when insufficiently (**A**) and correctly (**B**) tensioned.*

With normal wear on the running gear, it is necessary to check the crawler tension regularly and retension the crawler if necessary.

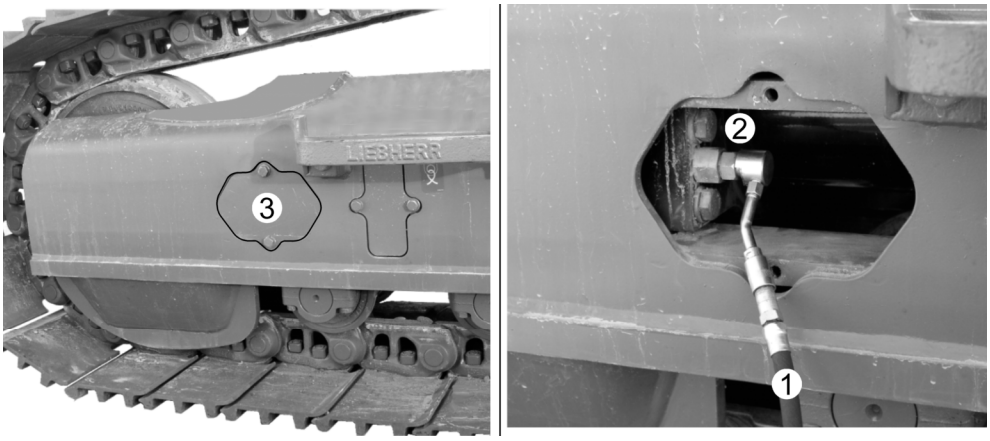

Fig. 5-57 *Retensioning the crawler*

- ▶ Remove the cover **3** on the longitudinal beam of the chassis.
- ▶ Screw high pressure hose **1** onto the manual grease gun.
- ▶ Through the opening, connect the high pressure hose **1** with the lubricating nipple **2** of the grease tension jack.
- ▶ Inject grease until the crawler is sufficiently tensioned.
- ▶ Monitoring the crawler tension

5.11.4 Releasing the crawler tension

Danger!
Risk of injury due to sudden dropping of the crawler and spraying grease.

- ▶ When releasing the tension on the crawler, keep your head away from the track roller frame.

- ▶ Carefully unscrew lubricating nipple **2** (siehe Fig. 5-57) by several thread pitches until the grease oozes out of the nipple's annular groove.
- ▶ Tighten lubricating nipple **2** as soon as the desired crawler tension is attained.
- ▶ After the adjustment procedure, drive the machine forwards and backwards and monitor the crawler tension once again.

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5.11.5 Cleaning the running gear

Do not operate the machine if larger stones, pieces of wood or metal, wires or cables are trapped in the running gear.

Dried or frozen mud and stones or other foreign bodies in the running gear parts could result in considerable damage to the machine if the machine is operated or an attempt is made to free the machine using engine power.

▶ In sub zero temperatures, set the machine on boards to prevent the crawlers becoming frozen to the subsoil.

Caution!
To avoid causing considerable damage to the frozen machine, never use force to tear it free.

▶ A frozen crawler can be freed by carefully heating the base plates.

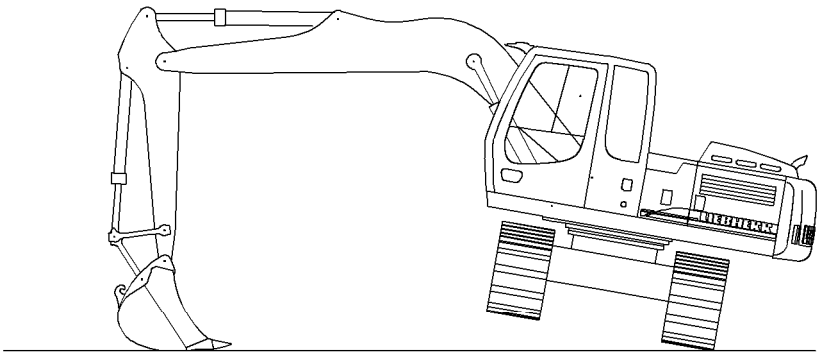

Fig. 5-58 *Raising the machine*

Caution!
The machine could slide away or back.

▶ Once you have supported the machine, prop it securely with wooden beams.

▶ Before setting down the machine, clean any very dirty parts of the running gear.

▶ Clean sand and dirt off the sliding surfaces on the tensioning units and grease.

▶ By using the work equipment to support the machine at the side, one side of the chassis can be raised to clean the running gear (siehe Fig. 5-58).

5.12 Electrical system

5.12.1 Notes on the electrical system

Danger!
Risk of injury due to formation of sparks.

▶ Avoid sparks and naked flame when charging batteries or working on the batteries.

▶ Always wear protective goggles and gloves.

- Check that the machine's electrical system is functioning correctly at regular intervals.
- Burnt-out fuses and bulbs should be replaced immediately once the cause of the defect has been rectified.
- Rectify defects such as loose connections, abraded cables or badly fastened clamps immediately.
- Disconnect the batteries when working on the electrical system or when carrying out electric arc welding on the machine.

Danger!
Risk of injury due to formation of sparks.

- Disconnect the negative terminal (-) first and connect it last.

5.12.2 Main battery switch

Caution!
Take particular care with machines with built-in independent heating.

- Only switch off the main battery switch when the independent heating's run-on is over.

Fig. 5-59 *Main battery switch*

- Before starting any work on the electrical system, including welding work on the machine, switch the main battery switch to position **0**.
- When washing the machine, cover the electrical units (particularly the alternator, generator, cabling, electronic components and measured value sensor) to prevent water penetrating.
- When cleaning the engine with a water / steam jet, do not subject electrical measured value sensors such as oil pressure switches to any direct jets.
  - If this happens, moisture could penetrate and lead to contact corrosion and the failure of the measuring function.
  - Oil pressure switches are not watertight due to the necessary presence of membrane ventilation.

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Note!
Batteries can become flat if the machine is out of service for longer periods.

▶ Before laying up the machine for longer periods, switch the main battery switch to position **0** (off).

5.12.3 Battery care

The battery must always be kept clean to ensure that it is able to function perfectly.

▶ Particular care should be taken to clean the pole ends and cable terminals **A** regularly and to then cover them with a thick layer of acidproof grease (siehe Fig. 5-60).

Danger!
Bent rubber hoses on the central gas outlet increase the risk of explosion!
The hydrogen contained in the batteries should not be allowed to build up in the accumulator box and must be able to escape via the rubber hoses. The central gas outlet hoses must be routed without kinks.

▶ Check the condition of the hoses **B** regularly, particularly after installing a battery (siehe Fig. 5-60).

The fluid level in the cells should be 10 to 15 mm above the top of the plate. Only distilled water is to be used for any refilling.

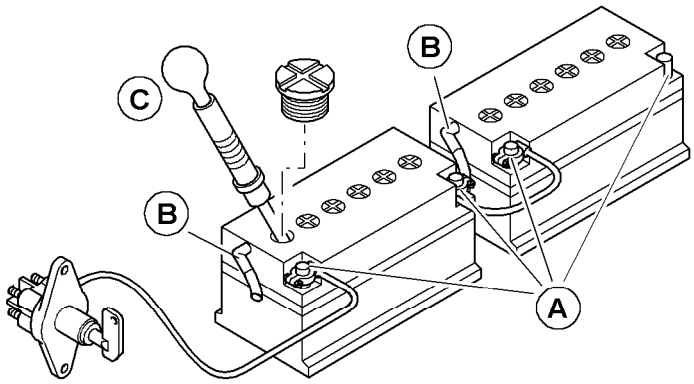

Fig. 5-60 *Battery care*

▶ From time to time, measure the acid concentration **C** using an acid tester.

When the battery is fully charged, the **unit weight is 1.28 kg/l (31.5° Bé)**.

▶ If the acid tester displays a lower value, the batteries is virtually flat and should be charged if necessary.

5.12.4 Slip ring assembly (optional extra)

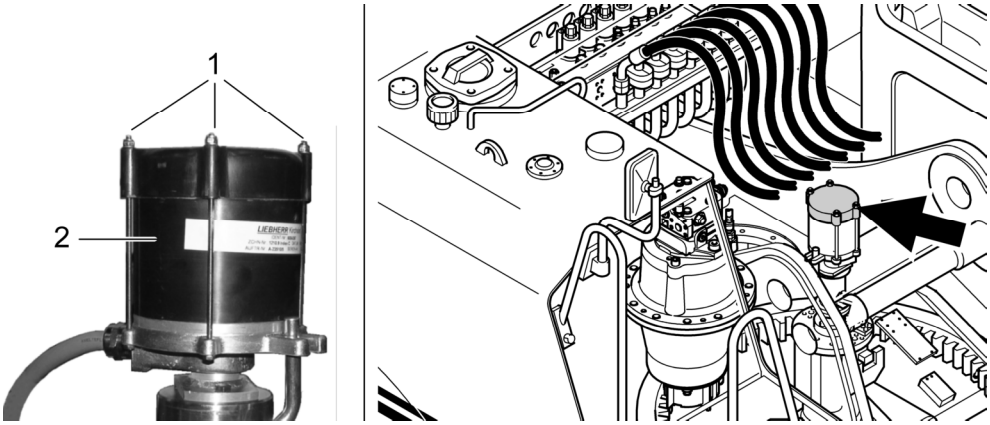

Fig. 5-61 *Slip ring assembly*

Slip ring assemblies are sensitive to moisture. An oxide layer can form on the conductive surfaces, which restricts the flow of current. Electrical consumers in the chassis will no longer be supplied with sufficient current, which can lead to malfunctions.

To prevent this, it is recommended that the following work is carried out every 500 operating hours.

- ▶ Unscrew the lock nuts **1**.
- ▶ Remove the housing **2** of the slip ring.
- ▶ Clean the oxidation off the slip ring assembly (use cleaning spray if necessary).
- ▶ Replace the damaged (corroded) cable lugs.
- ▶ Spray “Cramolin” contact spray on all slip ring elements.
- ▶ Replace the housing **1**.
- ▶ Fasten the housing **1** evenly using lock nuts **2**.

5.13 Heating/air-conditioning system

The machine has a combined heating / air-conditioning system as standard.

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5.13.1 Recirculated and fresh air filters

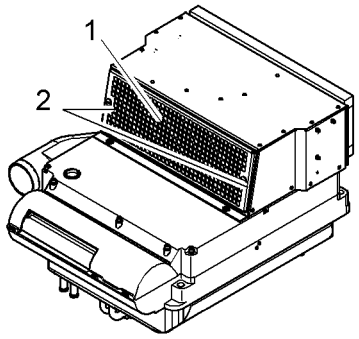

Fig. 5-62 *Recirculated air filter*

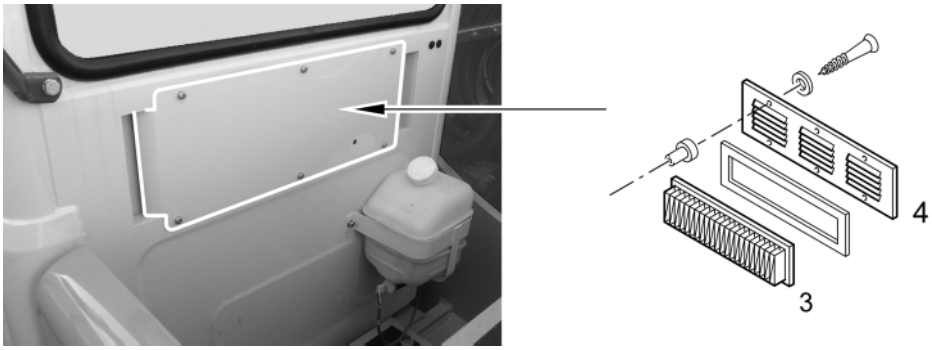

Fig. 5-63 *Fresh air filter*

The air flow in the heating / air-conditioning system is reduced when the filters are dirty and this frequently results in the system icing up or shutting down.

– Remove and clean the recirculated and fresh air filter **1**and**3** every 500 operating hours.
– Shorten cleaning intervals when working in heavy dust conditions.
– Do not operate the machine, even briefly, without these filters, since the heat exchanger **6** will otherwise quickly become blocked (siehe Fig. 5-64).

To clean and change the recirculated and fresh air filters:

▶ Push the backrest of the operator's seat forwards to remove the recirculated air filter **1**.

▶ Open the quick-release fasteners **2** by a quarter turn.

▶ Remove the recirculated air filter **1**.

▶ Remove the deflector **4**.

▶ Remove the fresh air filter **3**.

Note!

▶ Never wash the filter elements with hot water or a steam jet.

▶ If damaged or in a bad condition, replace the filter elements.

▶ Blow out the filter elements **1** and **3** using compressed air or clean in cold or lukewarm water.

5.13.2 Heating system

Carry out the following maintenance work on the heating system each year before the start of the heating period:

– Check the entire coolant circuit for leaks.
– Retighten the connection points for the coolant circuit, the hose connections on the heat exchanger, the seals on the shutoff valves and the hose clamps.
– Only operate the system with DCA 4 anti-corrosion fluid / antifreeze in the coolant.

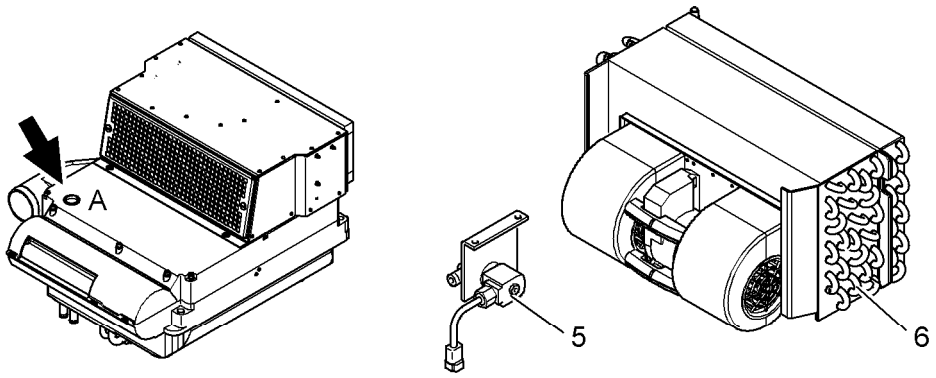

Fig. 5-64 *Heating unit with solenoid valve*

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.

5.13.3 Air-conditioning system

Switch on the air-conditioning system for approx. 10 minutes every 2 or 3 weeks, regardless of the season.

During the operating period, the following maintenance work is to be carried out every 500 operating hours:

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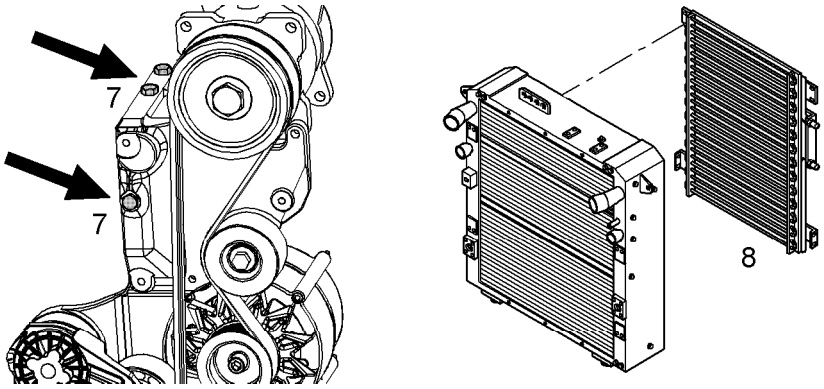

Fig. 5-65 *A/C compressor (left) and capacitor (right)*

To check the capacitor:

- ▶ Check the capacitor **8** for contamination.
- ▶ If necessary, fold down the capacitor **8** and blow out with compressed air from the inside (blower end) out.
- ▶ Ensure that the capacitor 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.
- ▶ Check the condition of the compressor drive belt.

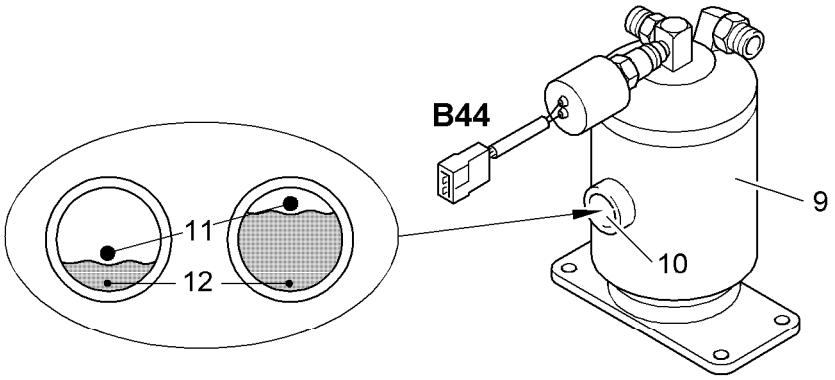

Fig. 5-66 *Dryer-accumulator unit*

To check the dryer-accumulator unit:

- ▶ With the diesel engine running and the air-conditioning system switched on, check the refrigerant level in the inspection glass **10** of dryer-accumulator unit **9**.

Note!
If there is insufficient refrigerant, the white float **11** lays at the bottom of the inspection glass.

- ▶ If the cooling effect is diminishing, have the system refilled by a refrigeration engineer.

- ▶ Determine the degree of moisture of the desiccant in dryer-accumulator unit **9**.
- ▶ To do this, observe the colour of the indicator pearl **12** in the inspection glass.

If the pearl is orange, the degree of moisture in the coolant circuit is OK. If, however, the pearl is not coloured, the dryer-accumulator unit is saturated with moisture.

- Change dryer-accumulator unit **9** immediately.
- Perform a visual check on the condition of dryer-accumulator unit **9**.
- If it is observed that dryer-accumulator unit **9** is rusted or damaged (e g. on the panel fastening or on the hose connection), replace dryer-accumulator unit **9** (pressure tank).

In the two cases referred to above and at least once a year, have the dryer-accumulator unit **9** replaced by a fitter trained in refrigeration engineering.

The coolant circuit must be emptied, checked for leaks and refilled. Check for abrasion, replace and if necessary retighten the hose connections on the hoses.

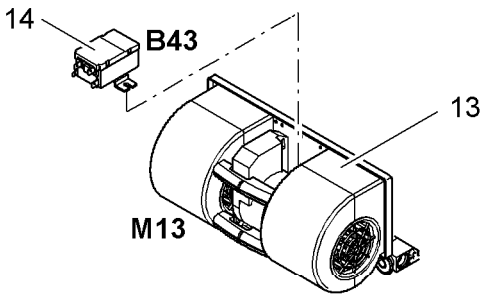

Fig. 5-67 *Fan motor on the heating/air-conditioning device*

Additional maintenance work:

The following maintenance work must also be carried out at least once a year by a fitter trained in refrigeration engineering:

- Check the function of the fan motor **13** (M13).
- Check the function of the ventilation flaps on the heating / air-conditioning system.
- Check the electrical connections for correct positioning (good contact).
- Check the electrical lines for abrasions.
- Check the defrost thermostat **14** (B43) in the evaporator (function, correct positioning and for damage).
- Check the function of the pressure switch **B44** on the dryer-accumulator unit **9** (siehe Fig. 5-66).

5.14 Greasing the machine

5.14.1 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.

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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 **X** as for secondary distributors **Z**.

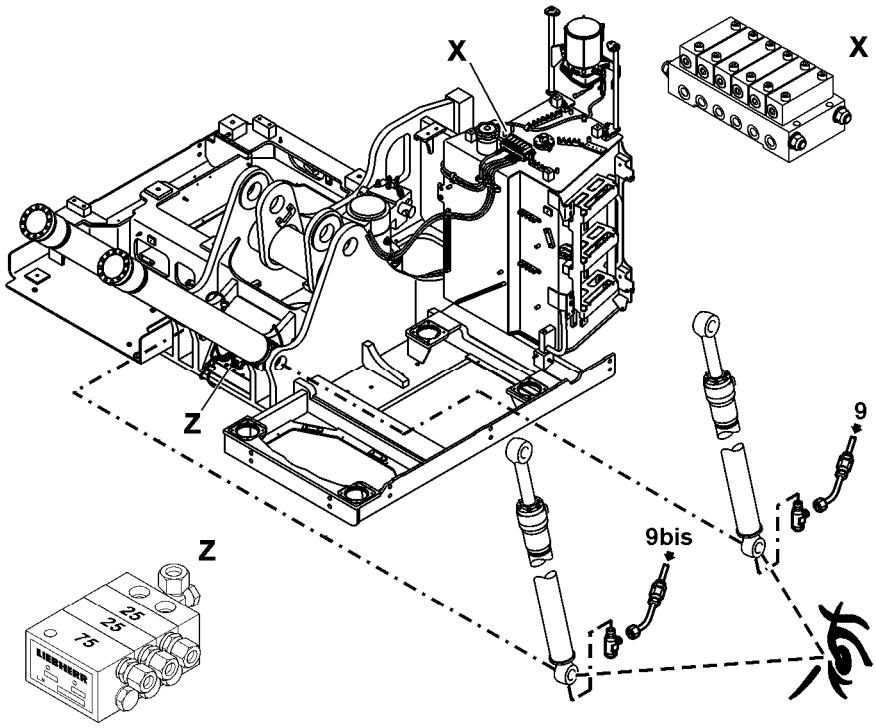

Fig. 5-68 *Centralized lubrication circuit*

5.14.2 Semi-automatic greasing

The machine is equipped with a semi-automatic central greasing system supplied by an electrical pump. This system saves considerable time during daily greasing and allows an almost complete greasing of the machine.

On standard backhoe attachments, the bearing points located in the area of the connector bracket and bucket cylinder are not connected to the semi-automatic central greasing system.

With special attachments (Telescopic stick, hydraulic offset boom, demolition stick...) some bearing points at the attachment or at the working tool are also possibly not connected to the semi-automatic lubrication system.

All these bearing points not connected to the semi-automatic lubrication system have to be lubricated daily via separately mounted, red marked lubricating nipples.

Operating the greasing system

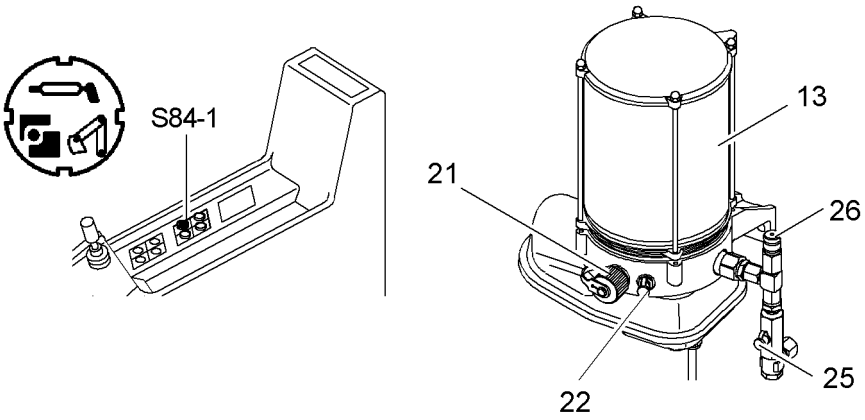

Fig. 5-69 *Central greasing pump*

13	Grease container	**21**	Adapter
22	Lubricating nipple – fill grease container	**25**	Lubricating nipple - fill central greasing system
S84-1	Greasing	**26**	Safety valve

❑ After switching on the machine,

▶ Press button S84-1
  ↳ the telltale light in button blinks.
  ↳ The greasing operation starts.

▶ By formation of grease bulges on bearings of boomcylinders **9** and **9 bis**, on piston's frontal surface side, press button S84-1.
  ↳ the telltale light in button lights off.
  ↳ The greasing operation is finished.

Warning !
Be sure to lubricate daily with a hand greasing pump all the bearing points that are not connected to the to the semi-automatic lubrication system (siehe "Greasing with the hand greasing pump" auf Seite 77)

The following defects are possible:

– Blockage or pinching of a supply line (grease flows out of safety valve **26**) or blockage in an oiling point.
– Defective proximity switch or defect in its supply cable.
– When very cold, the use of a grease which is too viscous.
– Lack of lubricant in the grease container.
– Breakdown in drive motor's supply circuit.

▶ Find and rectify the cause of the problem immediately.

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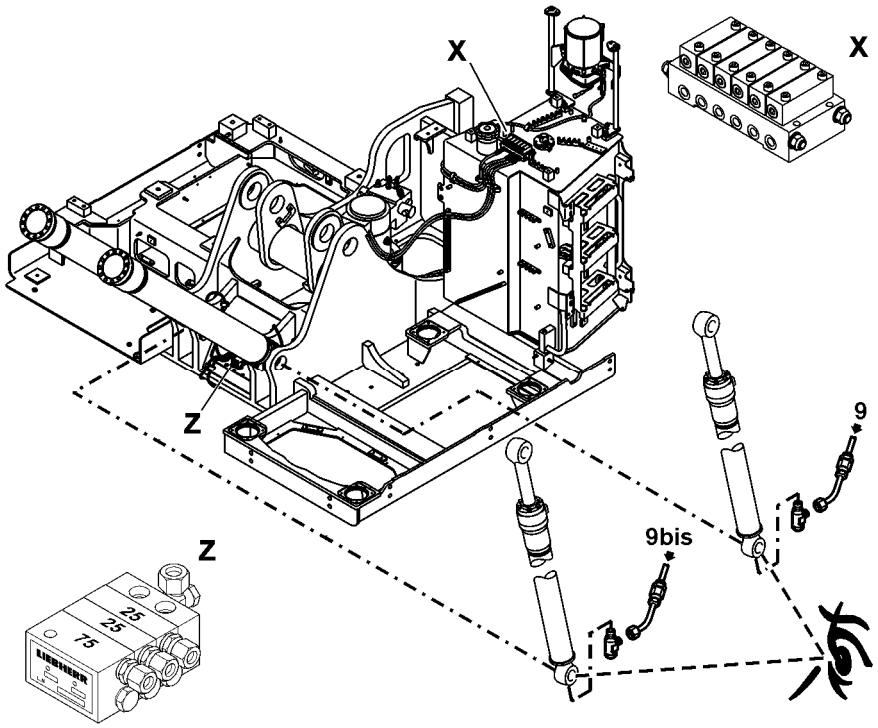

Fig. 5-70 *Semi-automatic greasing system*

When the greasing system is functioning, additional greasing with the greasing pump can be carried out at any time by pressing button **S84-1** on the right control panel.

If the greasing pump is defective, the attached greasing points can be greased centrally with a greasing pump via lubricating nipple **25**.

▶ Press grease in on the central lubricating nipple using the manual grease gun provided in the toolbox until formation of grease bulges on bearings of boomcylinders **9** and **9 bis**.

Grease quality: see lubrication chart

Greasing with the hand greasing pump

On standard backhoe attachments, the bearing points located in the area of the connector bracket and bucket cylinder are not connected to the semi-automatic central greasing system. The lubrication of these bearing points must be done via the 5 lubricating nipples **3** with the hand greasing pump.

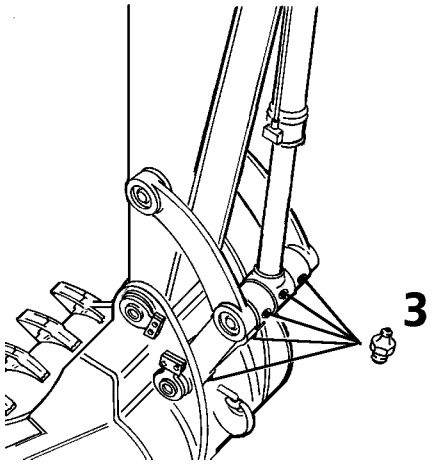

Fig. 5-71 *Grasing of the connector bracket and bucket cylinder*

With special attachments (Telescopic stick, hydraulic offset boom, demolition stick...) some bearing points at the attachment or at the working tool are also possibly not connected to the semi-automatic lubrication system.

All these bearing points not connected to the semi-automatic lubrication system have to be lubricated daily via separately mounted, red marked lubricating nipples.

Refilling the grease container

The level of grease in the grease container is to be checked once weekly and refilled if necessary. Refilling the grease container is usually carried out via the special adapter **21**.

▶ Insert a grease cartridge in the hand pump supplied, connect the pump to the adapter **21** and press the contents of the grease cartridge into the container.

If the hand pump or grease cartridge are not available, a grease pump can be used to fill the grease container using lubricating nipple **22**.

After filling the grease container, intermediate greasing must be started using button **S84-1** in the armrest.

5.14.3 Automatic greasing (optional extra)

On request, the semi-automatic central greasing system of the machine can be equipped with an electronical modul. This modul allows a complete automatic greasing.

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Operating the greasing system

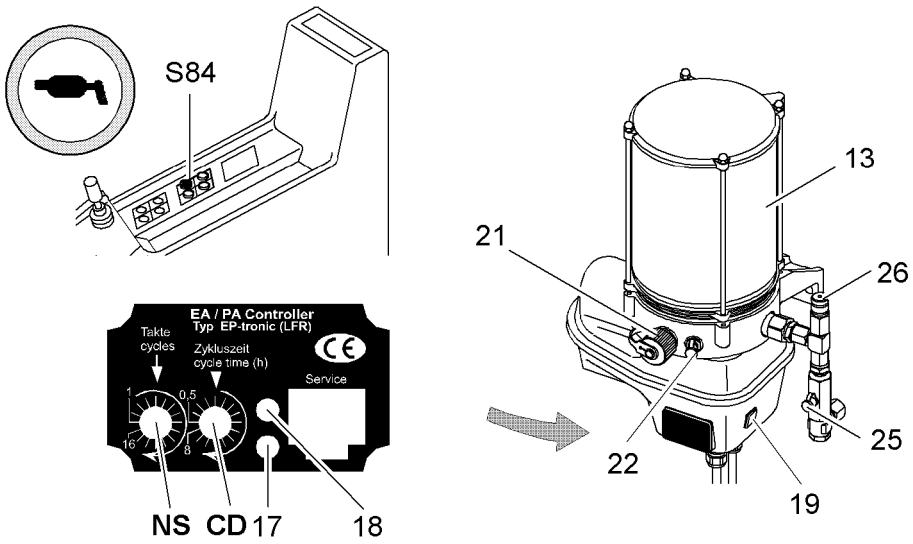
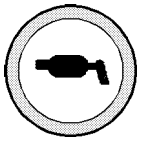


Fig. 5-72 *Central greasing pump*

13	Grease container	**21**	Adapter
17	LED, green	**22**	Lubricating nipple – fill grease container
18	LED, red	**25**	Lubricating nipple - fill central greasing system
19 / **S84**	Reset button and Intermediate greasing	**26**	Safety valve
NS /	Number of Strokes	**CD**	Cycle duration



After switching on the machine, the telltale light in button **S84** illuminates on the right control panel and the green LED **17** illuminates on the greasing pump for approx. 1.5 seconds. This indicates that the electrical pump is ready to operate.

The greasing process begins automatically after a pause and stops when all bearing points have been greased without the operator having to become involved.

Throughout the greasing process, button **S84** and green LED **17** are continuously illuminated. If there is a malfunction, both button **S84** and LEDs **17** and **18** flash simultaneously. The following defects are possible:

- Blockage or pinching of a supply line (grease flows out of safety valve **26**) or blockage in an oiling point.
- Defective proximity switch or defect in its supply cable.
- When very cold, the use of a grease which is too viscous.
- Lack of lubricant in the grease container.
- Breakdown in drive motor's supply circuit.
- Grease filter on the central lubricating nipple is contaminated.

▶ Find and rectify the cause of the problem immediately.

When the greasing system is functioning, additional greasing with the greasing pump can be carried out at any time by pressing button **S84** on the right control panel or by pressing button **19** on the greasing pump.

If the greasing pump is defective, the attached oiling points can be greased centrally with a greasing pump via lubricating nipple **25**.

In this case, press daily or per working shift approx. 80 cm3 grease into the fitting **25**

Adjustement and grease consumption

The Cycle Duration can be adjusted between 0,5 and 8 hours via the rotary switch **CD** (Cycle Duration) after removal of the transparent protection cover.

From factory, the Cycle Duration is adjusted to 1 hour.

The Number of Strokes to be carried out at main distributor for a complete lubricating procedure can be adjusted between 1 and 16 via the rotary switch **NS** (Number of Strokes) after removal of the transparent protection cover.

From factory, the number of strokes is adjusted to 5 (except "counterthumb for timber" equipement on 2 strokes).

The factory adjusted values for cycle duration and number of strokes determine a lubricant consumption of approx. 11 cm3 grease per lubrication cycle, it equals approx. 1 kg (5.1 lbs) grease every 100 working hours.

Refilling the grease container

The level of grease in the grease container is to be checked once weekly and refilled if necessary. Refilling the grease container is usually carried out via the special adapter **21**.

▶ Insert a grease cartridge in the hand pump supplied, connect the pump to the adapter **21** and press the contents of the grease cartridge into the container.

If the hand pump or grease cartridge are not available, a grease pump can be used to fill the grease container using lubricating nipple **22**.

After filling the grease container, intermediate greasing must be started using button **19** on the greasing pump or button **S84** in the armrest.

5.14.4 Greasing buckets / shovel tilting device

Buckets and the shovel tilting device are not greased via the central greasing system. The oiling points on the bucket and reversing lever / connecting clip must be greased manually. The relevant oiling points are marked in red.

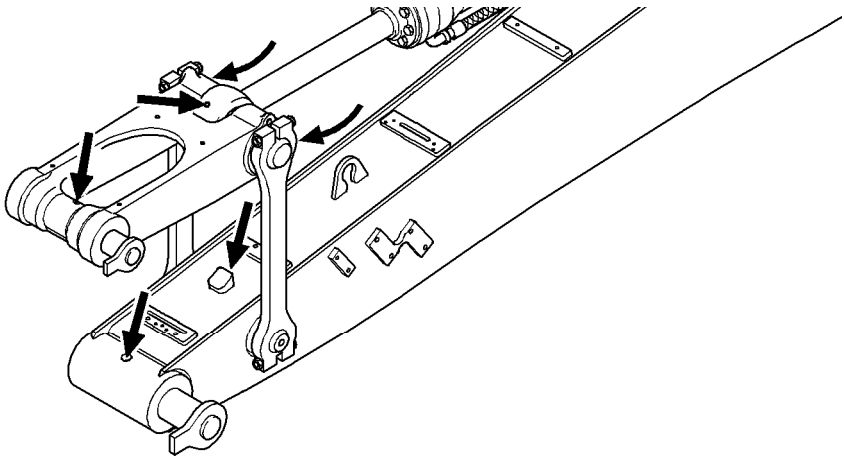


Fig. 5-73 *Greasing buckets*

In normal use, each oiling point must be greased weekly until clean grease flows out at the relevant bearing point.

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When the machine is working hard, eg. in material that causes wear, underwater or on multiple shifts, greasing must be carried out on a daily / per shift basis.

Grease quality: see lubrication chart

5.14.5 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.

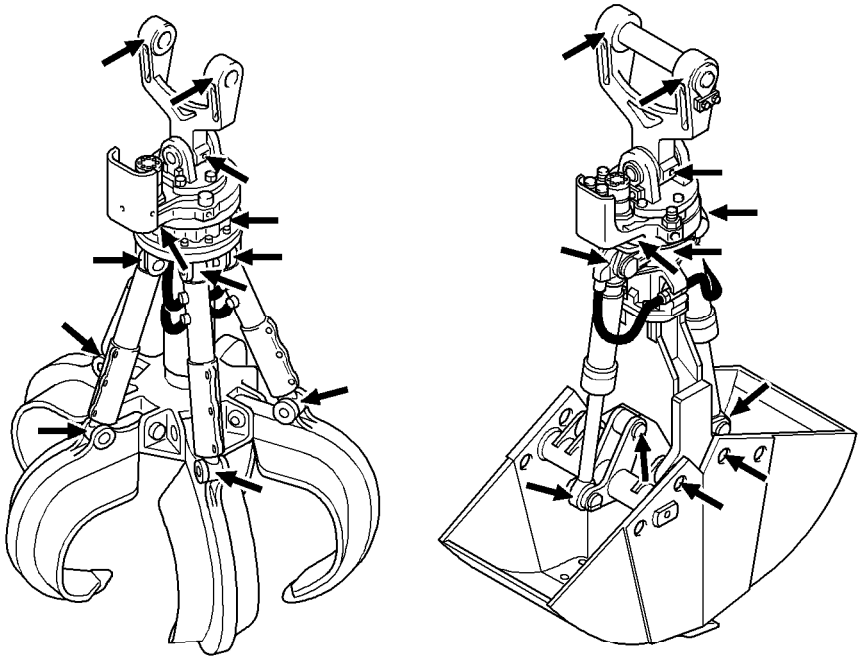

Fig. 5-74 *Greasing the grab*

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

5.15 Quick-change systems

5.15.1 Greasing the mechanical quick-change adapter (optional extra)

The mechanical quick-change adapter is not lubricated via the central greasing system. The bearing points must be greased using the grease gun.

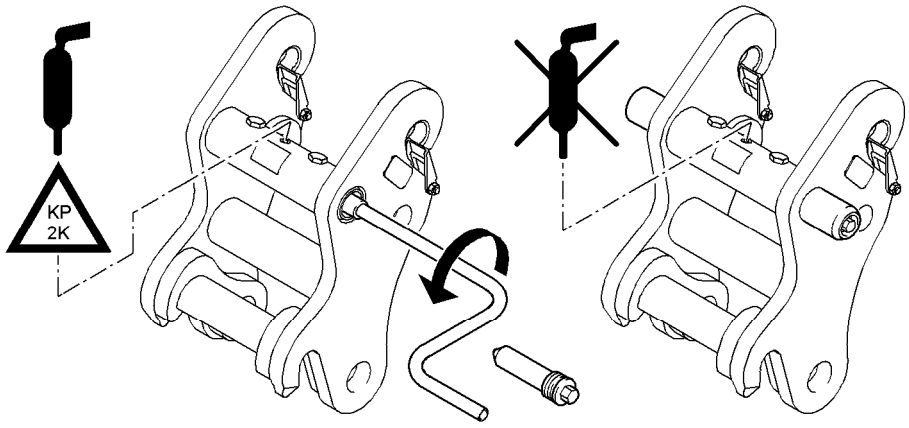

Fig. 5-75 *Greasing the mechanical quick-change adapter*

▶ 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.

5.15.2 Hydraulic quick-change adapter (optional extra)

Greasing the quick-change adapter

The hydraulic quick-change adapter is not lubricated via the central greasing system. The bearing points must be greased using the grease gun.

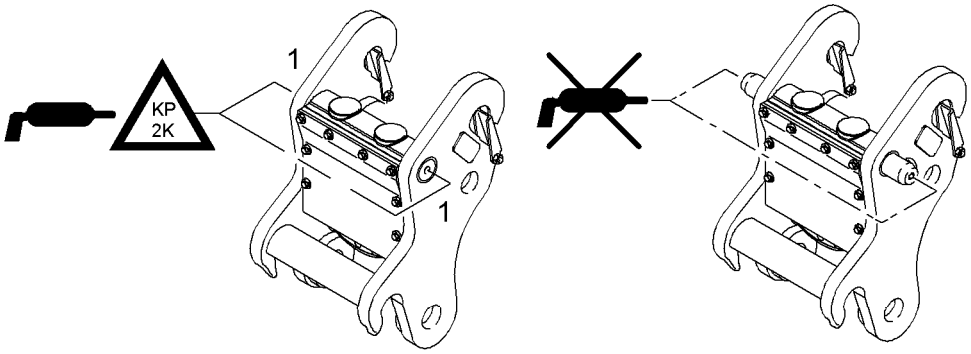

Fig. 5-76 *Greasing the quick-change adapter*

▶ Grease the locking pins **1** via the lubricating nipple using a grease gun.

Note!
The hydraulic quick-change adapter cannot be sufficiently greased if the locking pins are drawn out.

▶ Ensure that the locking pins are inserted when greasing.

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Cleaning the sieve filter

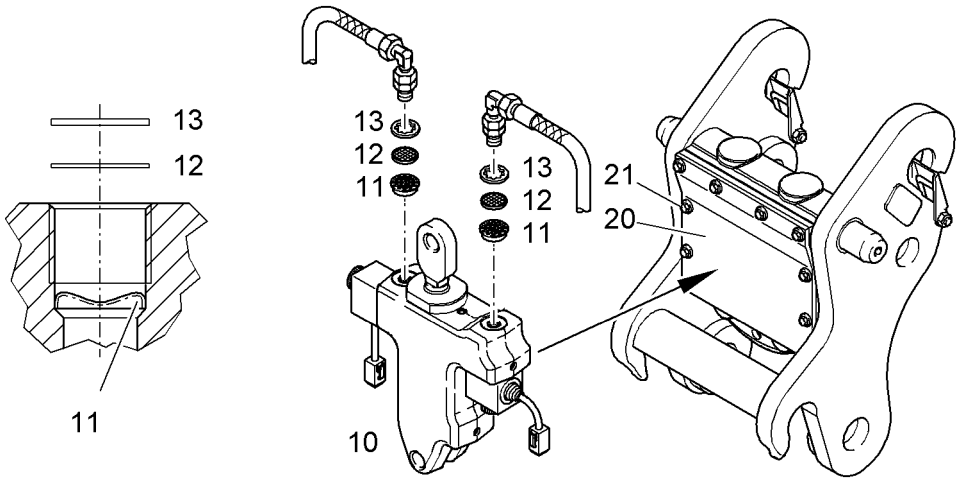

Fig. 5-77 *Cleaning the sieve filter*

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.

5.15.3 LIKUFIX (optional extra)

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.

Replacing the sealing ring

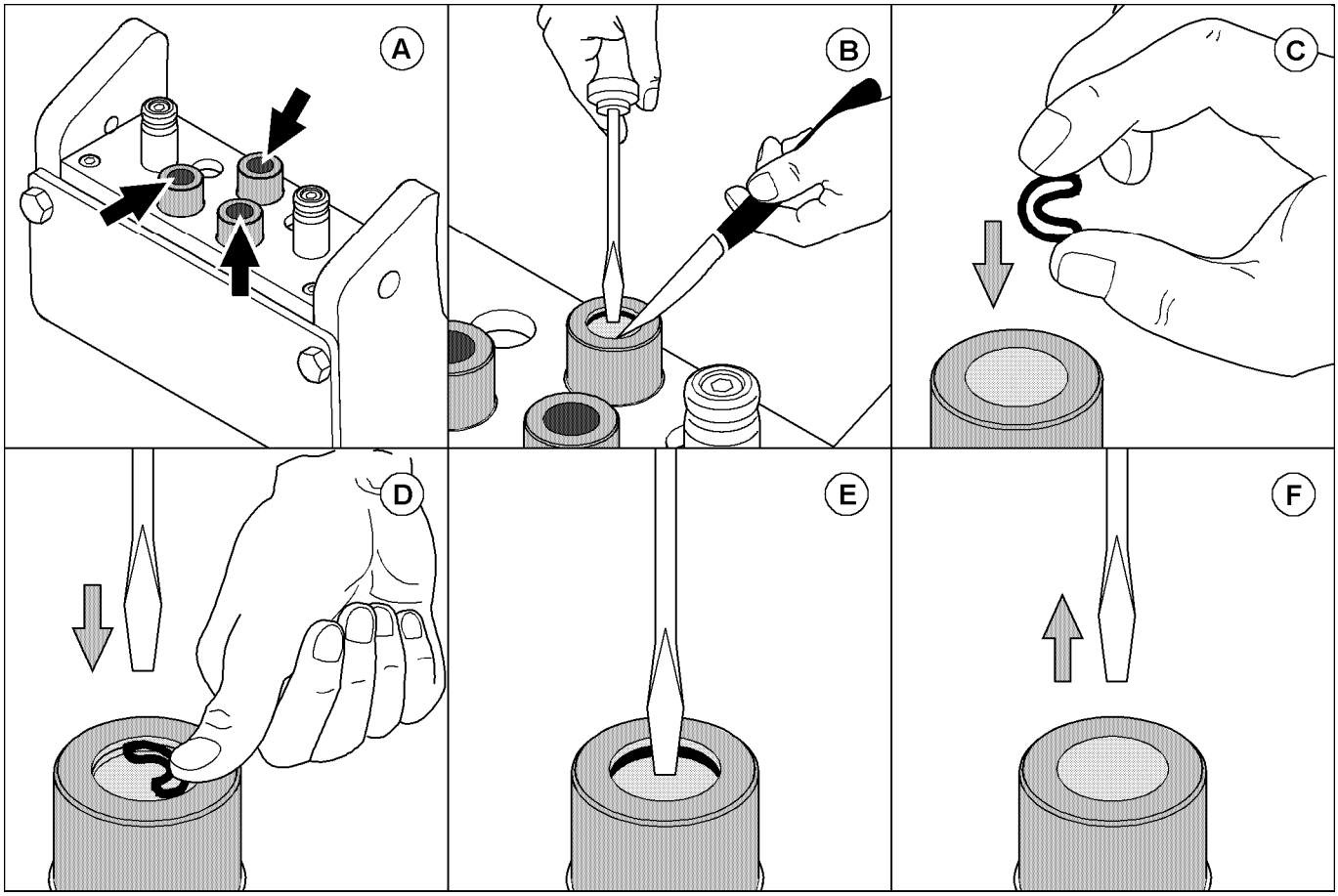

Fig. 5-78 *Replacing the sealing ring*

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.

5.15.4 Checking and maintenance of quick change coupler

Functional check out of quick change coupler

Daily, at machines operating start, check out the quick change coupler functions as well as its warning light and buzzer in the cab.This verification can also be done at the first daily tool change.

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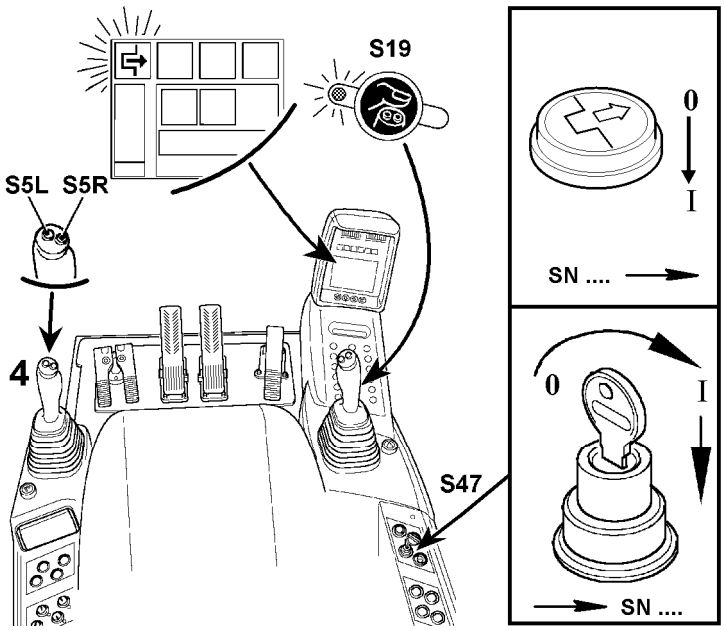

Fig. 5-79 *Functional check out of quick change coupler*

Proceed as below :

▶ Start the Diesel engine and let it run on low idle.

Opening the quick change coupler :

▶ Move the equipment so that the tool is lying on the ground, with the bucket cylinder fully extended.

▶ Press touch S19.
↳ Warning light integrated in the touch must light up.

▶ Depress the push button switch S47 (or turn the key switch S47 to the right, and push down the key) into position 1.

▶ Keep switch S47 depressed, press right push button S5R
↳ The quick change coupler locking pins must retract .
↳ The symbol "Locking pins retracted" appears on the screen .
↳ The buzzer in the cab must sound.

▶ Release the key and turn the switch S47 back to position 0.

Closing the quick change coupler :

▶ Depress the push button switch S47 (or turn the key switch S47 to the right, and press the key) into position 1.

▶ Keep S47 depressed, press left button S5L.
↳ The quick change coupler locking pins must come out.

❑ Befor the locking pins are fully out :
↳ Symbol "Locking pins retracted" must light off at the display.
↳ The buzzer in the cab must stop.

▶ Press touch S19,
↳ The warning light integrated in the touch must light off.

▶ Stop the Diesel engine.

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Daily visual check out

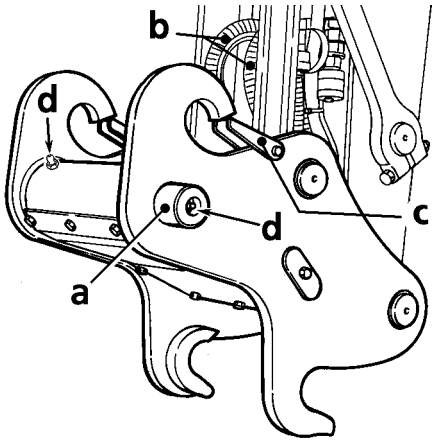

Fig. 5-80 *Functional check out of quick change adapter*

- ❑ After above described function verification,
- ▶ Control if locking pins **A** are in fully extended position, that means the tool's attachment bore holes must be flush with locking pins.
- ▶ Check also the good condition of the hydraulic hoses **B** and of the electrical supply bundle between end of stick and quick change coupler.
- ▶ Check that the safety latches **C** on the load hooks are in good working order.

5.16 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.

5.17 General maintenance points

5.17.1 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.

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This is particularly relevant for hoses and hydraulic lines, which must be preassembled at the works. For all other repairs, particularly when dismounting the ballast weight, works and dealership fitters are to be consulted.

5.17.2 Replacing the teeth on the bucket

Determine the degree of wear of the teeth visually.

With heavily worn teeth, considerably greater force will be required when using the bucket to penetrate the material to be excavated. The teeth must be replaced in good time to prevent any damage occurring to the tooth fitting piece.

Do not work with the machine if teeth on the bucket are missing or are heavily worn.

To attach and dismount the teeth:

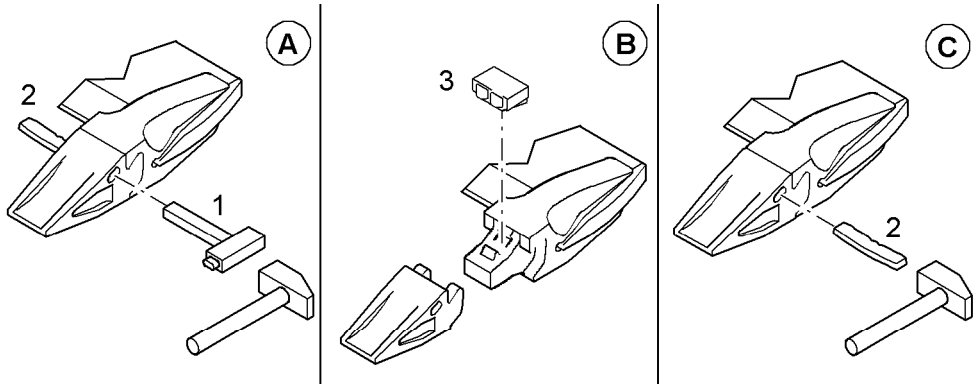

Fig. 5-81 *Replacing the teeth*

- ▶ 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**).

Teeth system sizes : Machine :	**ST 13 914 - 934**	**ST 16 914 - 944**	**ST 20 934 - 944**	**ST 25 944 - 964**
Wedge K	K13 3001157	K16 3001114	K20 3001158	K25 3001159
Wedge holder G	G13 9335853	G16 9329709	G20 9351304	G25 9351306
Tooth C	Z13C 3001288	Z16C 3001318	Z20C 3001319	Z25C 3001130
Tooth CL	Z13CL 3001579	Z16CL 3001132	Z20CL 3001588	Z25CL 3001589
Tooth L	Z13L 3001262	Z16L 3001216	Z20L 3001232	Z25L 3001235
Tooth SL	Z13SL 3001554	Z16SL 3001556	Z20SL 3001556	
Tooth R	Z13R 3001263	Z16R 3001217	Z20R 3001233	Z25R 3001236

Tab. 5-16 *Designation and ordering n° of elements*

Teeth system sizes : Machine :	ST 13 914 - 934	ST 16 914 - 944	ST 20 934 - 944	ST 25 944 - 964
Tooth P	Z13P 3001264	Z16P 3001218	Z20P 3001234	Z25P 3001237
Tooth PF	Z13PF	Z16PF 3001440	Z20PF 3001443	Z25PF

Tab. 5-16 *Designation and ordering n° of elements*

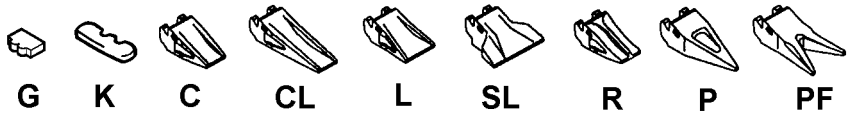

Fig. 5-82 *Thooth types*

5.17.3 Welding work on the machine

Welding work on all main components serving the power transmission (such as the chassis frame, rotating platform, equipment parts etc.) may only be carried out by the manufacturer or by an authorized workshop.

- ▶ 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!

Caution!
If high currents flow through the bearings or sealing elements, these could be burnt.

- ▶ Move the earthing cable of the welding tool as close as possible to the welding surface so that the welding current cannot flow over parts like the slewing ring, hinges, bearings, sockets, rubber elements or seals.

5.18 Control and maintenance chart

Caution!
Careful maintenance can only be carried out when the machine is clean. In particular, visual checks such as crack testing are only possible on a clean machine.

- ▶ Clean the machine before you start maintenance work (see also the chapter “Safe maintenance of the machine”, subheading “Cleaning and crack testing”).

Note
The daily maintenance work that the device operator has to carry out comprises a function check of the brakes (slewing gear, service and parking brake), steering and the electrical and hydraulic systems.
Additionally, a visual check must be made for leaks on the engine, hydraulic system, transmission and axles.

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Maintenance / inspection at operating hours						WORK TO BE CARRIED OUT R 924 B Li. Compact		
On delivery	Every 8 - 10	Every 10 -50	At 500, 1500	At 1000, 3000	At 2000, 4000	**By maintenance personnel (machine owner)** ■ First and only interval ● Repeat interval ♦ Special interval every 250 hours	**By authorized specialist personnel** ❑ First and only interval ❍ Repeat interval	**Note**
						DIESEL ENGINE		
❍	●	●	❍	❍	❍	Check oil level and oil pressure in engine		
❍	●	●	❍	❍	❍	Check coolant level and coolant temperature		
❍	●	●	❍	❍	❍	Check air filter on maintenance display		
	●	●	❍	❍	❍	Check and drain water separator and fuel filter		
		●	❍	❍	❍	Drain off water and sediment at fuel tank		
		●	❍	❍	❍	Empty dust collecting container on air filter (shorten or extend interval as required)		
		●	❍	❍	❍	Check out splitterbox oil level		
			❍	❍	❍	Replace splitterbox oil		
			❍	❍	❍	Check and clean cooler, pressure relief valve, coolant hose, ventilator		
			❍	❍	❍	Check condition of ribbed V-belt		
			❍	❍	❍	Replace lubricating oil filter cartridge		
			❍	❍	❍	Replace engine oil		1)
			❍	❍	❍	Check oil, cooling and fuel system for leaks and condition		
			❍	❍	❍	Replace water filter cartridge (at least 1 x yearly)		
			❍	❍	❍	Check anti-corrosion fluid / antifreeze in coolant (replace coolant every 2 years)		
			❍	❍	❍	Check out condition of engine control box's fixations		
			❍	❍	❍	Check out condition of sensors, transmitter, hoses and fittings		
			❑	❍	❍	Check intake and emission system for leaks and condition (first time at 500 op. hours)		
				❍	❍	Check and adjust speed adjustment		
				❍	❍	Check / adjust valve clearance		
				❍	❍	Check engine console and oil sump mounts		
				❍	❍	Grease flywheel gear		
				❍	❍	Check flame glow system (before start of winter)		
				❍	❍	Replace fuel fine filter cartridge (or as required)		4)

Maintenance / inspection at operating hours						WORK TO BE CARRIED OUT R 924 B Li. Compact		
On delivery	Every 8 - 10	Every 10 -50	At 500, 1500	At 1000, 3000	At 2000, 4000	**By maintenance personnel (machine owner)** ■ First and only interval ● Repeat interval ♦ Special interval every 250 hours	**By authorized specialist personnel** ❑ First and only interval ❍ Repeat interval	**Note**
				❍	❍	Replace fuel preliminary filter cartridge (or as required)		4)
						Replace air filter main element (according to maintenance display / annually)		
						Replace air filter safety element (every third change of main element / annually)		Never clean!
						Check air hoses between air filter and engine (at filter maintenance)		
						Replace oil separator (every 2 years)		
						Replace antifreeze and anticorrosive coolant mixture (every 2 years) (only by specialized and autorised personnel)		
				❍		Check / adjust injection valve (every 3000 op. hours or when performance diminishes)		
				❍		Check axial play of water pump (first time at 6000 then every 3000 hours)		
HYDRAULIC SYSTEM								
❍	●	●	❍	❍	❍	Check oil level in hydraulic tank		
❍	■	●	❍	❍	❍	Clean magnetic bar in return-line filter (daily during first 300 op. hours)		
			❑	❍	❍	Replace filtesr unit in return-line filters (first time at 500 op. hours)		2)
			❑	❍	❍	If mounted check return filter for hydraulic hammer for cleanliness, replace element if necessary		
			❍	❍	❍	Replace filter unit on control oil unit		
			❍	❍	❍	Check unit mounts		
			❍	❍	❍	Drain off water in hydraulic tank (when using environmentally acceptable fluids, max. 0.1 % water proportion permissible, insert partial flow filter, take oil sample)		
			❍	❍	❍	If mounted check return filter for hydraulic hammer for cleanliness, replace element if necessary		
				❍	❍	Clean or replace filter unit of leak oil filter		2)
				❍	❍	Clean hydraulic oil cooler (and as required)		
				❍	❍	Check hydraulic system for leaks and function		
				❍	❍	Check / adjust servo, primary and secondary pressures		
				❍	❍	Bleed servo system and hydraulic pumps		
					❍	Replace hydraulic oil in tank (or optimise interval with oil analyses)		2), 3)
					❍	Replace ventilation and vent filters on hydraulic tank		2)

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Maintenance / inspection at operating hours						WORK TO BE CARRIED OUT R 924 B Li. Compact		
On delivery	Every 8 - 10	Every 10 -50	At 500, 1500	At 1000, 3000	At 2000, 4000	**By maintenance personnel (machine owner)** ■ First and only interval ● Repeat interval ♦ Special interval every 250 hours	**By authorized specialist personnel** ❑ First and only interval ❍ Repeat interval	**Note**
						ELECTRICAL SYSTEM		
❍	●	●	❍	❍	❍	Check telltale lights and display devices		
❍				❍	❍	Check lighting		
			❍	❍	❍	Check acid concentration and level and cable terminals and pole ends on batteries		
			❍	❍	❍	Spray slip rings on slewing gear connection (if present) with Cramolin contact spray		
❍				❍	❍	Check function of entire system and units		
						SLEWING GEAR TRANSMISSION		
❍			❍	❍	❍	Check oil level and look for leaks		
				❍	❍	Check function and operation of slewing gear brake		
				❍	❍	Check transmission and oil motor mounts		
						BALL SLEWING RING		
	❍	❍	❍	❍	❍	Lube swing ring bearing		
	❍	❍	❍	❍	❍	Lube swing ring teeth		
				❍	❍	Check mounting screws for correct positioning and slewing gear pinion contact		
				❍	❍	Check pinion gear mesh		
						TRAVELLING GEAR		
❍			❍	❍	❍	Check oil level and look for leaks		
			❑	❍	❍	Check function and operation of drive unit brake		
				❍	❍	Check transmission and oil motor mounts		
			❑		❍	Replace transmission oil (first time at 500 op. hours)		
						DRIVE UNIT		
❍	●	●	❍	❍	❍	Visual check on crawler tension, retension if necessary		
	●					Clean crawler (when work is finished)		

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Maintenance / inspection at operating hours						WORK TO BE CARRIED OUT R 924 B Li. Compact		
On delivery	Every 8 - 10	Every 10 -50	At 500, 1500	At 1000, 3000	At 2000, 4000	**By maintenance personnel (machine owner)** ■ First and only interval ● Repeat interval ♦ Special interval every 250 hours	**By authorized specialist personnel** ❑ First and only interval ❍ Repeat interval	**Note**
		●	❍	❍	❍	Check mounts on base plates and tumbler wheels		
			❍	❍	❍	Clean and grease sliding surfaces of tensioning device		
			❍	❍	❍	Check for leaks on leading wheels, support rollers and track rollers		
						CAB + HEATING		
		●	❍	❍	❍	Check / refill washing fluid in windscreen washer system container		
❑				❍	❍	Check heating function (before start of winter)		
				❍	❍	Check heating system for leaks		
				❍	❍	Check door and window hinges and locks		
					❍	Check water inlet valve for function and dirt, clean if necessary		
						AIR-CONDITIONING SYSTEM		
		●	❍	❍	❍	Switch on air-conditioning system regularly (at least 1 x every 14 days)		
			❍	❍	❍	Check capacitor for contamination, blow out if required		
			❍	❍	❍	Clean recirculated / fresh air filter, replace if required, shorten maintenance interval for heavy dust use		
			❍	❍	❍	Check mounting screws and compressor drive belt		
			❍	❍	❍	Check dryer-collector unit (moisture, fill and condition), replace if required		
					❍	Check evaporator unit, clean if required		
					❍	Check electrical lines for abrasions and plug connections for correct positioning		
					❍	Check overpressure switch for function		
					❍	Check refrigerating capacity after opening or repair, or as required		
						Replace dryer-collector unit annually, check coolant circuit for leaks and replace refrigerant and refrigerant oil		
						Have function of ventilation flaps and defrost thermostat checked annually by a refrigeration engineer		
						CHASSIS + UPPER CARRIAGE + WORK EQUIPMENT		
	●	●	❍	❍	❍	Grease bearing points via central greasing point		

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Maintenance / inspection at operating hours						WORK TO BE CARRIED OUT R 924 B Li. Compact		
On delivery	Every 8 - 10	Every 10 -50	At 500, 1500	At 1000, 3000	At 2000, 4000	**By maintenance personnel (machine owner)** ■ First and only interval ● Repeat interval ♦ Special interval every 250 hours	**By authorized specialist personnel** ❑ First and only interval ❍ Repeat interval	**Note**
❍	●	●	❍	❍	❍	Grease bearing points (chassis and add-on units) (depending on use and daily for multiple shift operation)		
		●	❍	❍	❍	Visually check wear condition of teeth		
		♦	❍	❍	❍	Check parts for cracks		
		♦	❍	❍	❍	Check ballast weight and tank mounts		
			❍	❍	❍	Check line and screw connections for correct positioning		
				❍	❍	Check trim panel hinges, quick-release fasteners and gas pressure springs of hatches		
❍				❍	❍	Check the lowering speed of the atta hment		~4 sec.
❍						Indicate appropriate use of equipment		
❍						Have device lubricated according to lubrication chart by device operator and indicate any operating errors.		
	●					The daily maintenance work of the driver include the check of the proper function of hydraulic, electric and brakes systems before starting operation. He must alos perform daily a visual check of engine, hydraulic system, gears and track pats for leaks.		
HYDRAULIC QUICK-CHANGE ADAPTER								
❍	●		❍	❍	❍	Check function of visual and acoustic warning devices		
	●		❍	❍	❍	Visually check drawn out position of locking pins		
	●		❍	❍	❍	Check condition of hydraulic hoses and of cable kit		
		●	❍	❍	❍	Lubricate locking pins		
					❍	Clean sieve filter in bolt connections of hydraulic hoses		
MECHANICAL QUICK-CHANGE ADAPTER								
	●		❍	❍	❍	Visually check drawn out position of locking pins		
		●	❍	❍	❍	Lubricate locking pins		

Tab. 5-17 *Control and maintenance chart*

1 Engine oil change intervals can be shortened dependent on temperature, fuel and oil quality.

2 Note shortened maintenance intervals for heavy dust use.

3 When using environmentally acceptable hydraulic fluids, the maintenance interval is to be determined by regular analyses.

4 Shorten the maintenance interval dependent on conditions of use (eg. heavy dust use, barrel refuelling).

♦) For industrial equipment every 250 hours.

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