en

Operator's Manual

Hydraulic excavator
P944

from serial number 24 342

Document identification

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Manufacturer: LIEBHERR France S.A.S.

Type: P944

Type no.: 791 / 793

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1.1.3 Uppercarriage

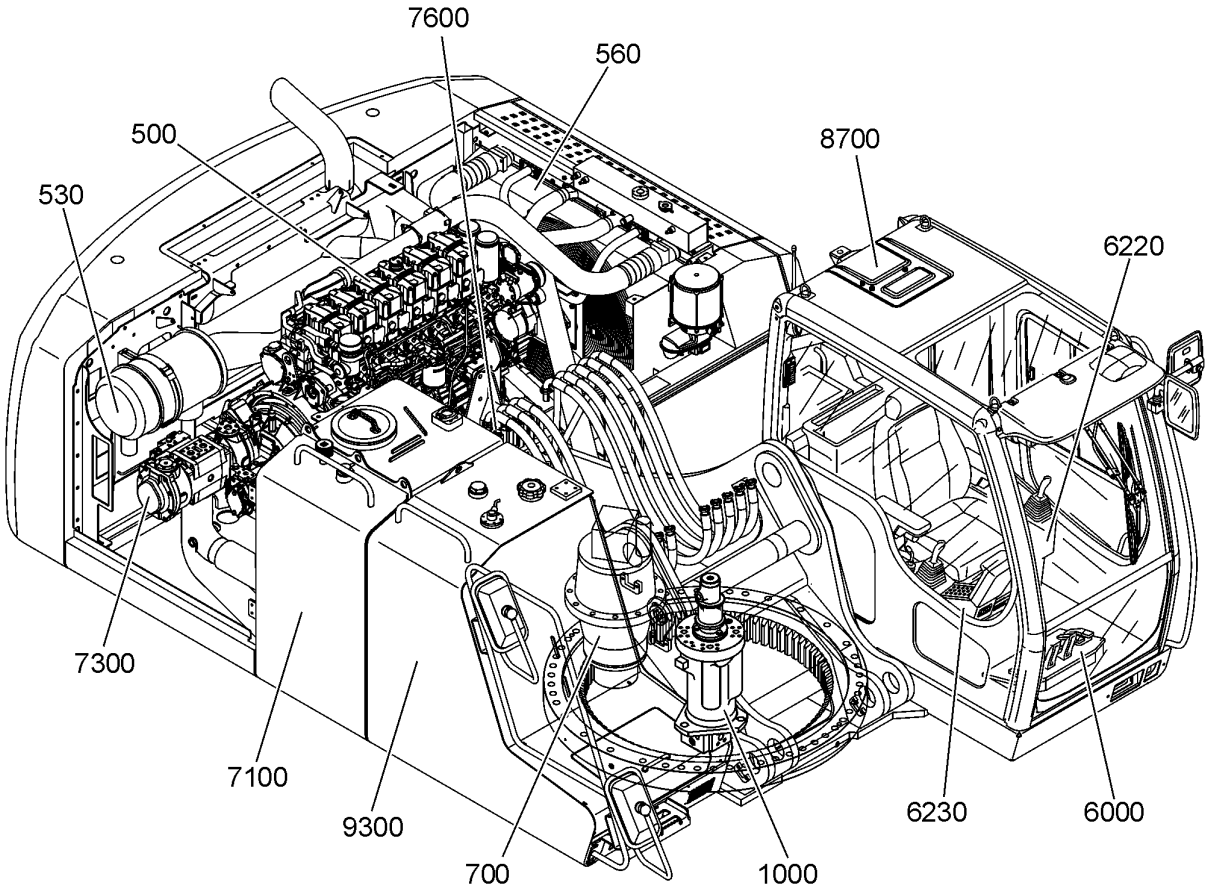


Fig. 1-3 *Uppercarriage*

500 Diesel engine
530 Dry air filter
560 Radiator
700 Swing gear
1000 Rotary connection
6000 Control cab
6220 Control panel, left
6230 Control panel, right
7100 Fuel tank
7300 Hydraulic pump
7600 Control valve block
8700 Cab
9300 Hydraulic oil tank

1.2 Vibration emissions

The operator seat built into the machine by the manufacturer conforms to ISO 7096:2000, EM 6. When replacing the seat, ensure that the new seat also conforms to this standard.

Comfort

In the operator station, the operator can look forward to a comfortably appointed workstation that is designed according to the most up-to-date ergonomically know-how. The standard automatic climate control provides a pleasant working environment at any weather condition.
Liebherr crawler excavators are particularly service-friendly: maintenance work is simply and quickly accomplished due to well accessible service points.

Standard maintenance advantage

Easy accessibility

All service points are easily accessible and the R 954 C features a central lubrication point as a standard feature. Daily preventive maintenance can be completed in a short period of time.

Maintenance friendly track components

Top rollers, track rollers and track link pins are lubricated for the life of the excavator. The grease cylinder of the idler tensioner is sealed against dirt.

Work place with feel-well character

Optimal visibility

The operator station's generously-sized windows provide outstanding visibility of the work and surrounding area.

Well thought-out arrangement

Design and arrangement of the seat, controls and displays are perfectly tuned to each other in an ergonomically-integrated concept. The operator's seat has shock-absorbing suspension and is adjustable to the individual preference of each operator.

Easy operation

The control consoles and information display are arranged within clear view of the operator and are easy to reach. New joysticks, with reduced operating force, are ergonomically shaped and allow pleasant and fatigue-free work.

Easy access

- Comfortably positioned ascents on both sides provide good accessibility to all service points
- Ergonomically positioned hand rails ensure secure ascent and descent
- Additional hand rails guarantee maximum safety

Liebherr Operator's station

- Generously-sized windows allow for optimal visibility
- Right-side window without vertical center post
- Standard automatic climate control
- Operator's seat is individually adjustable and includes a shock-absorbing cushion
- Lockable storage behind seat

Lift Capacities

with Straight Gooseneck Boom 6,80 m

Stick 2,10 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m) 3,0	4,5	6,0	7,5	9,0	10,5
12,0	HD-S						
	HD-SL						
10,5	HD-S						
	HD-SL						
9,0	HD-S			9,8# (9,8#)			
	HD-SL			9,8# (9,8#)			
7,5	HD-S			10,0 (10,9#)	6,8 (8,5#)		
	HD-SL			10,8 (10,9#)	7,4 (8,5#)		
6,0	HD-S	21,2# (21,2#)	14,5# (14,5#)	9,6 (11,4#)	6,7 (9,6#)		
	HD-SL	21,2# (21,2#)	14,5# (14,5#)	10,4 (11,4#)	7,3 (9,6#)		
4,5	HD-S		13,5 (16,7#)	9,0 (12,2#)	6,4 (9,9#)	4,8 (7,9)	
	HD-SL		14,9 (16,7#)	9,8 (12,2#)	7,0 (9,9#)	5,3 (8,0)	
3,0	HD-S			8,3 (12,9#)	6,1 (10,2#)	4,7 (7,8)	
	HD-SL			9,1 (12,9#)	6,7 (10,2#)	5,1 (7,8)	
1,5	HD-S			7,9 (12,9#)	5,8 (10,0)	4,5 (7,7)	
	HD-SL			8,7 (12,9#)	6,4 (10,0)	5,0 (7,7)	
0	HD-S		11,7 (13,2#)	7,7 (12,1#)	5,7 (9,6#)	4,5 (7,4#)	
	HD-SL		13,0 (13,2#)	8,5 (12,1#)	6,3 (9,6#)	4,9 (7,4#)	
-1,5	HD-S		11,8 (12,0#)	7,7 (10,5#)	5,7 (8,3#)		
	HD-SL		12,0# (12,0#)	8,5 (10,5#)	6,3 (8,3#)		
-3,0	HD-S		8,8# (8,8#)	7,9 (7,9#)	5,9 (5,9#)		
	HD-SL		8,8# (8,8#)	7,9# (7,9#)	5,9# (5,9#)		
-4,5	HD-S						
	HD-SL						
-6,0	HD-S						
	HD-SL						

Stick 2,60 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m) 3,0	4,5	6,0	7,5	9,0	10,5
12,0	HD-S						
	HD-SL						
10,5	HD-S						
	HD-SL						
9,0	HD-S			10,2 (10,3#)			
	HD-SL			10,3# (10,3#)			
7,5	HD-S			10,2 (10,3#)	7,0 (9,1#)		
	HD-SL			10,3# (10,3#)	7,5 (9,1#)		
6,0	HD-S		13,6# (13,6#)	9,7 (10,9#)	6,8 (9,2#)	4,9 (6,5#)	
	HD-SL		13,6# (13,6#)	10,6 (10,9#)	7,4 (9,2#)	5,4 (6,5#)	
4,5	HD-S		14,0 (15,8#)	9,1 (11,8#)	6,5 (9,6#)	4,8 (8,0)	
	HD-SL		15,4 (15,8#)	9,9 (11,8#)	7,0 (9,6#)	5,3 (8,0)	
3,0	HD-S		12,5 (17,6#)	8,4 (12,6#)	6,1 (9,9#)	4,6 (7,8)	
	HD-SL		13,8 (17,6#)	9,2 (12,6#)	6,7 (9,9#)	5,1 (7,8)	
1,5	HD-S		11,5# (11,5#)	7,9 (12,9#)	5,8 (9,9)	4,5 (7,6)	
	HD-SL		11,5# (11,5#)	8,7 (12,9#)	6,4 (10,0)	4,9 (7,6)	
0	HD-S		11,5 (14,3#)	7,6 (12,4#)	5,6 (9,7#)	4,4 (7,5)	
	HD-SL		12,8 (14,3#)	8,4 (12,4#)	6,2 (9,7#)	4,8 (7,5)	
-1,5	HD-S	10,5# (10,5#)	11,6 (13,5#)	7,6 (11,0#)	5,6 (8,7#)	4,4 (6,5#)	
	HD-SL	10,5# (10,5#)	12,9 (13,5#)	8,4 (11,0#)	6,1 (8,7#)	4,8 (6,5#)	
-3,0	HD-S		10,4# (10,4#)	7,7 (8,8#)	5,7 (6,8#)		
	HD-SL		10,4# (10,4#)	8,5 (8,8#)	6,2 (6,8#)		
-4,5	HD-S			5,4# (5,4#)			
	HD-SL			5,4# (5,4#)			
-6,0	HD-S						
	HD-SL						

Stick 3,30 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m) 3,0	4,5	6,0	7,5	9,0	10,5
12,0	HD-S						
	HD-SL						
10,5	HD-S			6,9# (6,9#)			
	HD-SL			6,9# (6,9#)			
9,0	HD-S				6,9# (6,9#)		
	HD-SL				6,9# (6,9#)		
7,5	HD-S			9,0# (9,0#)	7,1 (8,4#)	5,0# (5,0#)	
	HD-SL			9,0# (9,0#)	7,7 (8,4#)	5,0# (5,0#)	
6,0	HD-S			9,9 (10,0#)	6,9 (8,6#)	5,0 (7,7#)	
	HD-SL			10,0# (10,0#)	7,5 (8,6#)	5,4 (7,7#)	
4,5	HD-S	22,2# (22,2#)	14,4# (14,4#)	9,3 (11,0#)	6,5 (9,1#)	4,8 (7,8#)	
	HD-SL	22,2# (22,2#)	14,4# (14,4#)	10,1 (11,0#)	7,1 (9,1#)	5,3 (7,8#)	
3,0	HD-S		12,9 (16,7#)	8,6 (12,1#)	6,1 (9,6#)	4,6 (7,7)	3,5 (4,9#)
	HD-SL		14,3 (16,7#)	9,4 (12,1#)	6,7 (9,6#)	5,0 (7,8)	3,9 (4,9#)
1,5	HD-S		11,8 (16,3#)	7,9 (12,7#)	5,8 (9,9#)	4,4 (7,5)	3,5 (5,4#)
	HD-SL		13,1 (16,3#)	8,7 (12,7#)	6,3 (9,9#)	4,8 (7,6)	3,8 (5,4#)
0	HD-S	4,7# (4,7#)	11,4 (15,4#)	7,5 (12,5#)	5,5 (9,6)	4,3 (7,4)	
	HD-SL	4,7# (4,7#)	12,7 (15,4#)	8,3 (12,5#)	6,1 (9,7)	4,7 (7,4)	
-1,5	HD-S	9,7# (9,7#)	11,3 (14,9#)	7,4 (11,6#)	5,4 (9,1#)	4,2 (7,1#)	
	HD-SL	9,7# (9,7#)	12,6 (14,9#)	8,2 (11,6#)	6,0 (9,1#)	4,6 (7,1#)	
-3,0	HD-S	13,9# (13,9#)	11,4 (12,2#)	7,4 (9,8#)	5,4 (7,7#)	4,3 (5,4#)	
	HD-SL	13,9# (13,9#)	12,2# (12,2#)	8,2 (9,8#)	6,0 (7,7#)	4,7 (5,4#)	
-4,5	HD-S		8,4# (8,4#)	7,0# (7,0#)	5,1# (5,1#)		
	HD-SL		8,4# (8,4#)	7,0# (7,0#)	5,1# (5,1#)		
-6,0	HD-S						
	HD-SL						

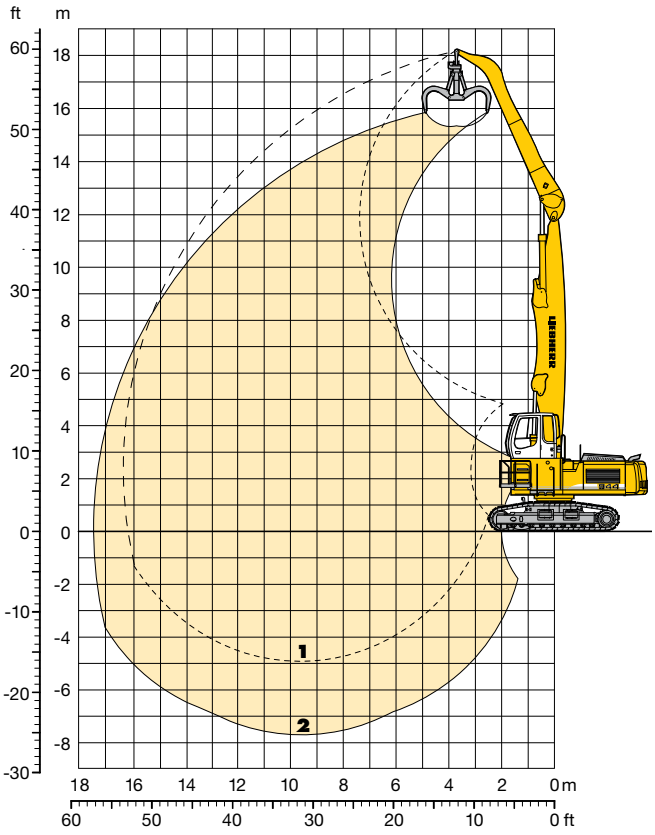
Stick 4,10 m

Height (m)	Under-carriage	Radius of load from centerline of machine (m) 3,0	4,5	6,0	7,5	9,0	10,5
12,0	HD-S						
	HD-SL						
10,5	HD-S						
	HD-SL						
9,0	HD-S				6,6# (6,6#)		
	HD-SL				6,6# (6,6#)		
7,5	HD-S				7,2# (7,2#)	5,2 (6,2#)	
	HD-SL				7,2# (7,2#)	5,6 (6,2#)	
6,0	HD-S				7,0 (7,8#)	5,0 (7,0#)	3,7 (4,1#)
	HD-SL				7,6 (7,8#)	5,5 (7,0#)	4,0 (4,1#)
4,5	HD-S		10,1# (10,1#)	9,6 (9,9#)	6,6 (8,3#)	4,8 (7,2#)	3,6 (6,0#)
	HD-SL		10,1# (10,1#)	9,9# (9,9#)	7,2 (8,3#)	5,3 (7,2#)	4,0 (6,0#)
3,0	HD-S	12,8# (12,8#)	13,6 (15,0#)	8,8 (11,0#)	6,2 (8,9#)	4,6 (7,5#)	3,5 (6,0)
	HD-SL	12,8# (12,8#)	14,9 (15,0#)	9,6 (11,0#)	6,8 (8,9#)	5,0 (7,5#)	3,8 (6,0)
1,5	HD-S	4,4# (4,4#)	12,1 (16,7#)	8,0 (11,9#)	5,8 (9,3#)	4,3 (7,5)	3,3 (5,8)
	HD-SL	4,4# (4,4#)	13,4 (16,7#)	8,8 (11,9#)	6,3 (9,3#)	4,8 (7,5)	3,7 (5,9)
0	HD-S	6,0# (6,0#)	11,3 (16,9#)	7,5 (12,2#)	5,4 (9,4#)	4,1 (7,2)	3,2 (5,7)
	HD-SL	6,0# (6,0#)	12,6 (16,9#)	8,3 (12,2#)	6,0 (9,4#)	4,6 (7,3)	3,6 (5,8)
-1,5	HD-S	9,1# (9,1#)	11,0 (15,7#)	7,2 (11,7#)	5,2 (9,1#)	4,0 (7,1)	3,2 (5,4#)
	HD-SL	9,1# (9,1#)	12,3 (15,7#)	8,0 (11,7#)	5,8 (9,1#)	4,4 (7,1)	3,6 (5,4#)
-3,0	HD-S	13,0# (13,0#)	11,0 (13,5#)	7,1 (10,4#)	5,2 (8,1#)	4,0 (6,2#)	
	HD-SL	13,0# (13,0#)	12,3 (13,5#)	7,9 (10,4#)	5,7 (8,1#)	4,4 (6,2#)	
-4,5	HD-S	12,3# (12,3#)	10,2# (10,2#)	7,2 (8,2#)	5,3 (6,3#)	4,1# (4,1#)	
	HD-SL	12,3# (12,3#)	10,2# (10,2#)	8,0 (8,2#)	5,8 (6,3#)	4,1# (4,1#)	
-6,0	HD-S		5,7# (5,7#)	4,7# (4,7#)	2,8# (2,8#)		
	HD-SL		5,7# (5,7#)	4,7# (4,7#)	2,8# (2,8#)		

The lift capacities on the load hook of the Liebherr quick change adapter 66 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 18 t. Without quick change adapter the lift capacities will increase by 430 kg, without bucket cylinder, link and lever they increase by an additional 570 kg. Lifting capacity of the excavator is limited by machine stability, hydraulic capacity and maximum permissible load of the load hook.
According to European Standard, EN 474-5: In the European Union excavators have to be equipped with an overload warning device, a load diagram and automatic check valves on the hoist cylinders, when they are used for lifting operations which require the use of lifting accessories.

Industrial Attachment

with Industrial-Type Straight Boom 9,50 m



Attachment Envelope

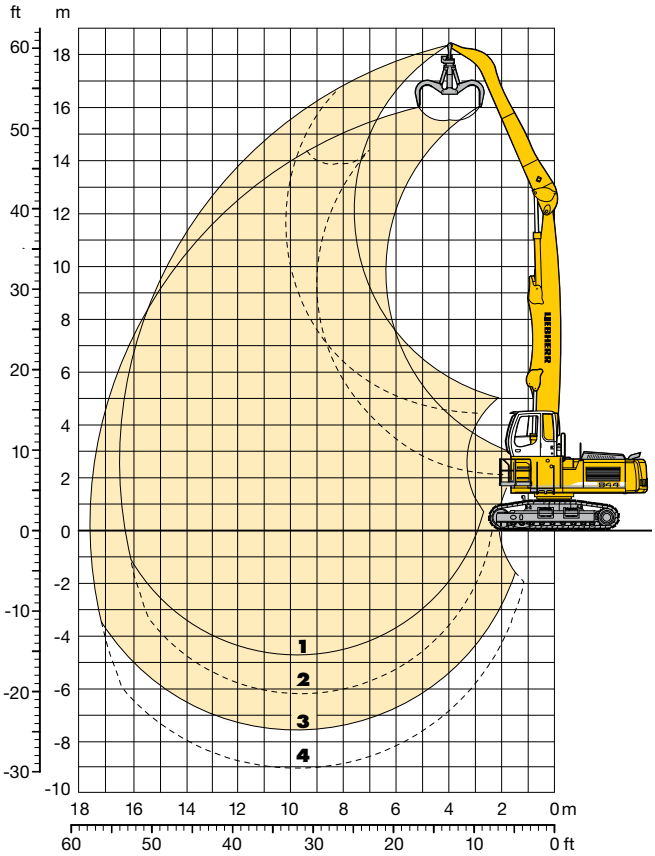
Kinematic variant 2A

1 with industrial stick 7,30 m
2 with industrial stick 7,30 and grapple model 70 C

Operating Weight and Ground Pressure

Operating weight includes basic machine with rigid cab elevation 1,2 m and counterweight 11,0 t, industrial-type straight boom 9,50 m, industrial stick 7,30 m and grapple model 70 C with 5 semi-closed tines 0,80 m³.

Undercarriage		EW	
Pad width	mm	600	750
Weight	kg	46100	46700
Ground pressure	kg/cm²	0,89	0,72



Attachment Envelope

Kinematic variants 3A/3B

1 with industrial stick 7,30 m (3B)
2 with industrial stick 7,30 m (3A)
3 with industrial stick 7,30 m and grapple model 70 C (3B)
4 with industrial stick 7,30 m and grapple model 70 C (3A)

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

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– Do not attempt to lift heavy parts. Use devices which are suitable for this purpose and which have sufficient load carrying capacity.
– Do not use cable which is damaged or does not have sufficient load carrying capacity. Wear work gloves when working with wire cables.
– When working on the equipment: switch off the engine and keep the safety lever tilted up. Never use your fingers to locate bores; use the correct punch for the procedure.
– During repair work: ensure that the hydraulic lines are secured correctly and that all bolts and connections are tight.
– When you have removed and chocked an equipment part, close open areas of the hydraulic circuit to stop dirt entering. Only allow authorized persons in the vicinity of the machine or the lifting device used.

Removing and installing equipment bolts safely

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

Transporting the machine safely

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

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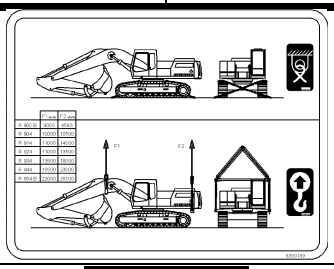
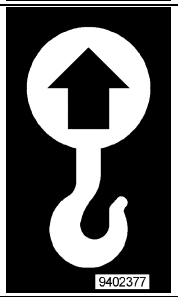
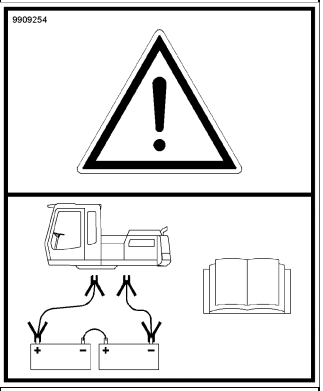
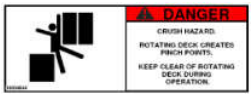
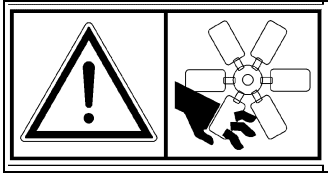
"O.C."	" N.A. "	
		**Plate 35: Loading and anchoring points** Identifies the positions of the loading and anchoring points, as well as the relevant weight of the machine.
		**Plate 40: Lashing point** Indicates the machine's lashing points.
		**Plate 45: Stop-lift point** Indicates the machine's stop-lift 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.

Function of push buttons and switches on US version with lifting magnet

For machines destined to the North American market, and which are fitted with a lifting magnet, the functions are as follows:

Button -Switch	Function
Push button S5L	Travel alarm cut-off See in this chapter "Travel alarm (optional equipment)".
Push button S5M	Horn
Push button S5R	Unlocking of a movement cut-off by end position switch See in this chapter "Attachment movement cut-off by end switch (optional equipment)".
Push button S6L	Rotating device left See in this chapter " control of rotating device (rotating, tilting, locking and unlocking a working tool)".
Push button S6M	Reserve or Float position of the boom cylinders with shovel attachment See the section "working attachment control", further in this chapter.
Push button S6R	Rotating device right See in this chapter " control of rotating device (rotating, tilting, locking and unlocking a working tool)".
Push switch S55	Lifting magnet See in this chapter "Lifting magnet (optional equipment)"
Rocker switch S57	Swing brake control in semi automatic mode See in this chapter "Swing movements and swing brake control".

Tab. 3-2 *Functions of push buttons and switches for US version with lifting magnet*

Warning symbols for operating faults in the SY field

Each of the following symbols will be assigned an error code in the form "E 5xx". Each occuring error will be stored via the relevant error code.

E 502–Coolant low

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

The buzzer sounds simultaneously.

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

Caution!

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

E 503 –Coolant overheat - Warning stage

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

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

E 504–Hydraulic oil level low

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

The buzzer sounds simultaneously.

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

E 505 –Hydraulic oil overheat

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

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

E 506 – Splitterbox oil overheat

This symbol appears if the oil temperature in the splitterbox exceeds 100 °C.
(This temperature monitoring is connected only on modells R954C and above).

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

▶ Press the **Menu** key again.
↳ The screen 1/4 is displayed.

To exit the menu:

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

i - I/O

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

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

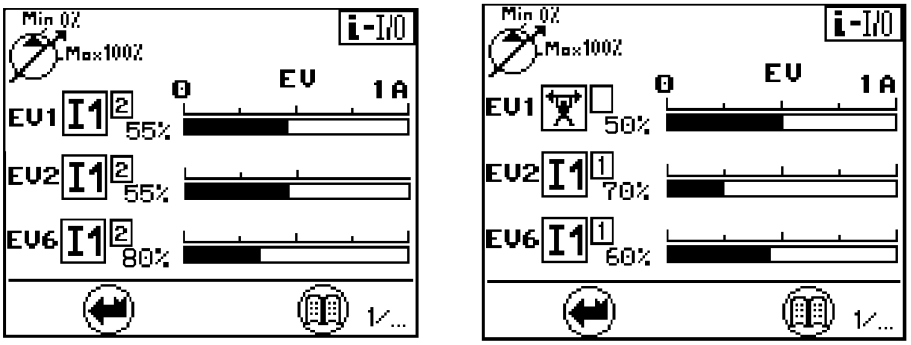


Fig. 3-18 *Menu "Info In/Outputs"- flow and pressure limitations*

The screen 1/8 displays

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

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

On the right picture, an internal limitation (Pressure increase) and an internal limitation (Hardware input I1, option 1) are activated at the same time.
Due to the internal limitation, the flow of the pump P1 is limited to 50% of its maximum value via the solenoid valve EV1.
Due to the external limitation, the flow of the pump P2 is limited to 70% of its maximum value via the solenoid valve EV2 and the pressure in the hydraulic system to 60% of its maximal value via the solenoid valve EV6.

When several limitations are activated at the same time, only the one with the smallest percentage value is decisive for each regulating solenoid valve.

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

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

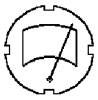
Turn the key switch S168 to the right, in position „1" to limit the velocity of all the movements of the working attachment.

S200 – Push button / Height adjustable cab - up

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

S201 – Push button / Height adjustable cab - down

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

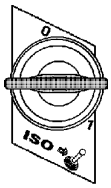


S218 – Touch / Cab roof window wiper

When the ignition key is in contact position, pressing the switch S218 activates the cab roof window wiper.

S232 – Control unit / Standstill cab heater

This unit controls an eventually installed standstill heater for the cab or for other circuits on the uppercarriage. Refer to the section "Standstill heater", further in this manual.



S247 – Key switch / Commutation Normalized control system - Special control system

See also "Special control systems for joysticks" in this chapter.

S275 – Touch / Additional floodlight on rear of cab roof

See the section "lighting" in this chapter.

S276 – Touch / Additional floodlight on counterweight

See the section "lighting" in this chapter.

S362 – Push button / Washer for cab roof window

The button turns on the electric cab roof window washer system. Washer fluid will be sprayed to the window and the cab roof window wiper will be actuated as long as the push button S362 is depressed.

S422 - Radio muting

3.1.7 Display for LIEBHERR particle filter (optional).

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

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

To change the position of the windscreen

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

3.2.5 Sunshade

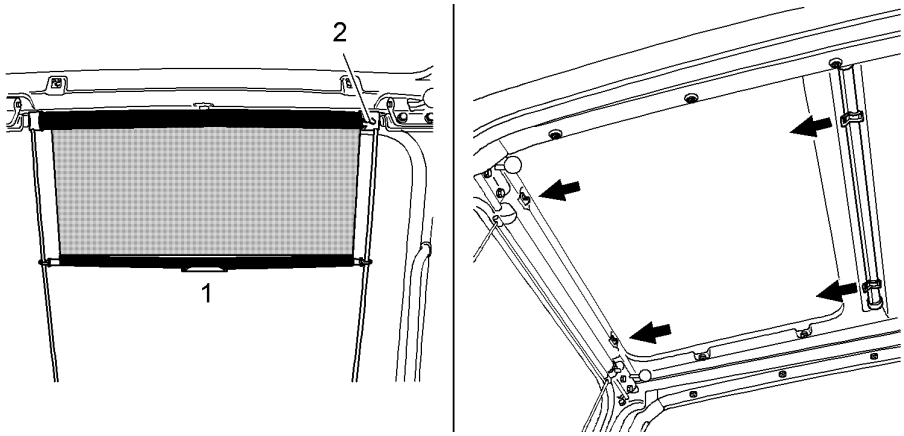


Fig. 3-43 *Sunshades at windscreen and at cab roof*

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

Maneuvering the sunshade at the windscreen

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

Maneuvering the sunshade at the cab roof

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

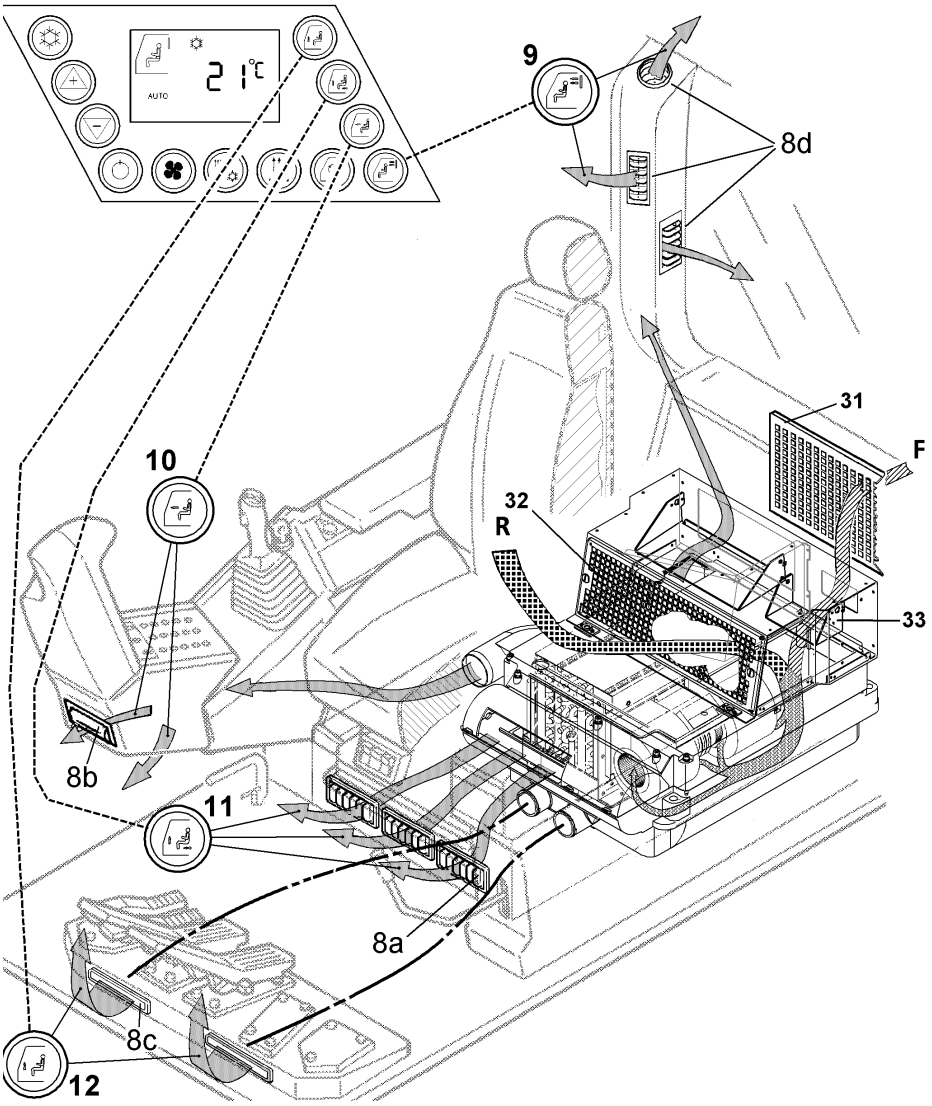


Fig. 3-54 *Air repartition in the cab*

To reach a maximal feeling of comfort:

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

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

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

▶ After symbol "**Preheating END**" has appeared (about 2 seconds), turn the ignition key to start position **3**.

▶ Release the ignition key as soon as the engine starts.

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

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

3.3.4 Speed adjustment and operating modes

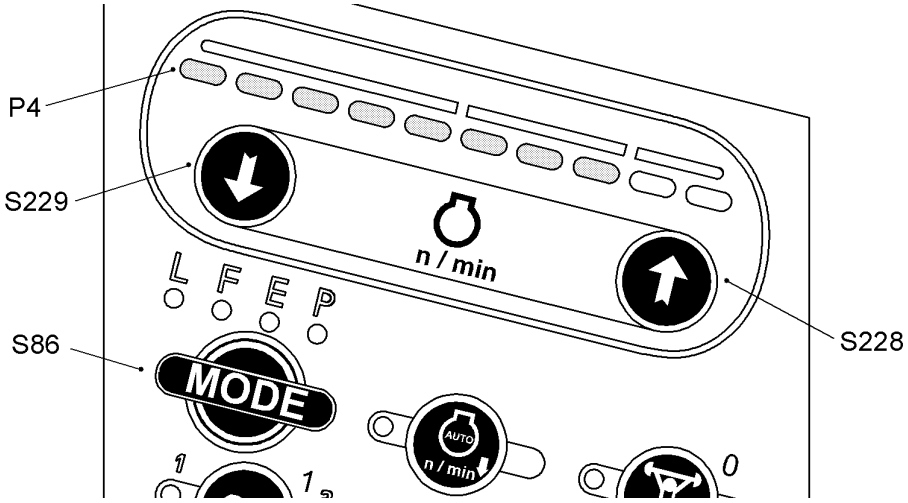


Fig. 3-59 *Speed adjustment and operating modes selection*

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

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

Engine speed and operating mode selection via the mode switch

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

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

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

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

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

Travel forwards:

▶ Push on pedal **6** forward (**6a**).

Travel backwards:

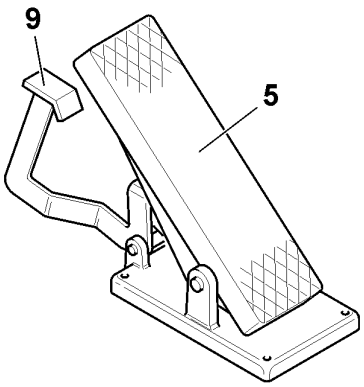
▶ Push on pedal **6** backward (**6b**).

Brake when travelling:

▶ Release the pedal **6** and push on pedal **5** forward (**5a**).

Immobilize the excavator's during the work

▶ Push on pedal **5** forward and block it in this position with the lever **9**.



Caution!
Before travelling again, ensure that the brake pedal is released.

Manual control of the travelling movements

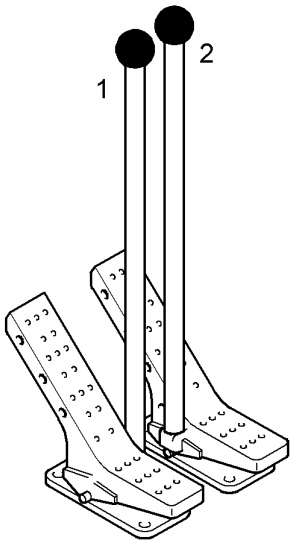


Fig. 3-66 *Hand levers for manual travel control*

- 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 maximal speed and the speed may only be reduced using the accelerator pedals.
- Load an occupied truck only if all safety requirements are fulfilled, notably in order to protect the truck operator.
- For demolition work, digging and crane operations etc., always use protective devices specifically designed for the purpose.
- For terrain which is difficult to gain an overview of and whenever necessary, ask for the assistance of a spotter. Only permit one person to give you signals.
- Only permit experienced personnel to attach loads and give signals to the machine operator. The spotter must be positioned within the visual range of the operator or be in voice contact with him.
- Depending on the equipment combination, there is a risk of collision between the work tool and the cab, the cab protection or the boom cylinders. The greatest degree of care must be taken to avoid damage when the hoe teeth come within this area.
- Depending on the equipment combination, there is a risk of collision between the lift ring of the attachment and the cab or the cab protection. Before operating, ensure that there is no risk of collision, especially on excavator with cab elevation. If necessary remove the lift ring.
- In case of a thunderstorm :
  - lower the attachment to the ground and if possible anchor the digging tool into the soil.
  - leave the cab and move away from the machine before the storm breaks out. Otherwise, you must stop the excavator, turn off the radio and keep inside the closed cab until the end of the storm.
- Auxiliary control units can have various functions. Always check their functions when starting up the machine.
- Stop the swinging motion of the uppercarriage when lowering the attachment into a ditch without striking the attachment on the ditch walls.
- Inspect the machine for damage if the attachment has been swung into a wall or any other obstacles.
- Applications in which the attachment is to be used to strike the material being extracted are not permitted, even when working in a longitudinal direction.
- Repeated strikes against an object leads to damage to the steel structures and machine components.
- Please refer to your LIEBHERR dealer if special teeth for heavy-duty or special applications are required.
- Do not attach too large bucket or bucket with side cutters or that are during operations with rocky material. This would prolong the work cycles and may lead to damage to the bucket as well as further machine components.
- With the 2x45° offset articulation, the offset position may only be employed if the working tool or the attachment does not touch the material.
- Operation of the offset articulation to drill into the material is not permitted.
- Do not lift the machine during operation. Should this happen, lower the machine slowly back to the ground.

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▶ Depress the touch **S19**.
  ↳ the control circuit of the rotating device (for ex. rotating grapple) is activated.
  ↳ the LED in the touch is lighting.

▶ Press the left push button **S5L** and keep it depressed.
  ↳ the rotating device is actuated to the left (the grapple is rotated to the left, or the bucket is swivelled to the left, or the locking pins of the hydraulic quick change adapter are driving out, ...).

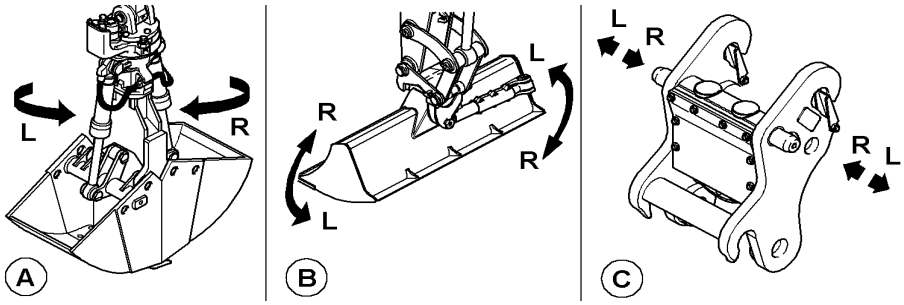

Fig. 3-84 *Movement of rotating devices*

▶ Press the right push button **S5R** and keep it depressed.
  ↳ the rotating device is actuated to the right (the grapple is rotated to the right, or the bucket is swivelled to the right, or the locking pins of the hydraulic quick change adapter are retracted, ...).

The movement of the rotating device is stopped as soon as the push button **S5L** or **S5R** is released.

Caution!
On machines destined to the North American market, and which are fitted with a lifting magnet, the rotating device is controlled by the push buttons S6L and S6R in the handle of the right joystick 3.
Also see the section "joysticks" in this chapter.

The stanchion cylinder shut-down point

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

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

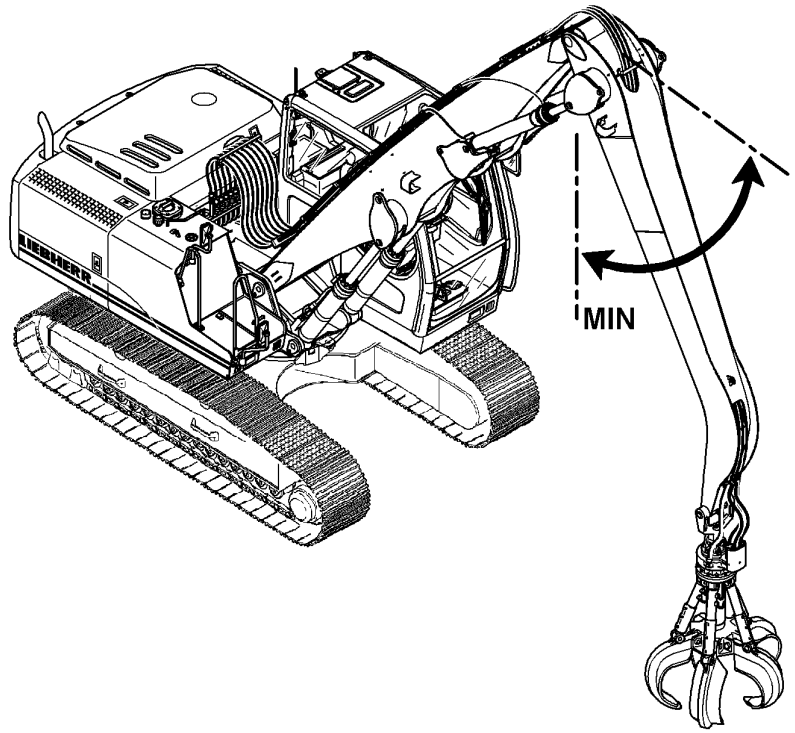

Fig. 3-95 *Stanchion cylinder shut-down - shut-down point*

Bypassing stanchion cylinder shut-down

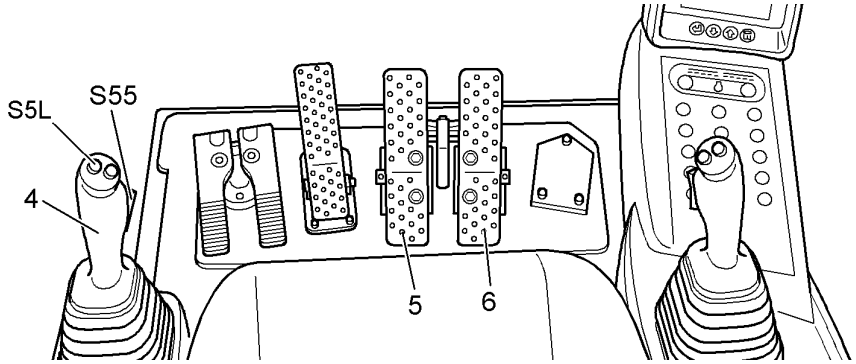

Fig. 3-96 *Flip switch on left joystick*

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

- ❑ 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.

▶ 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.

▶ 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

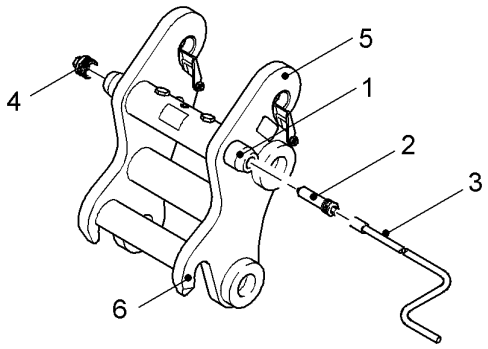

Fig. 3-108 *Mechanical quick-change adapter*

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".

3.6.7 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.

– 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.

3.7.2 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.

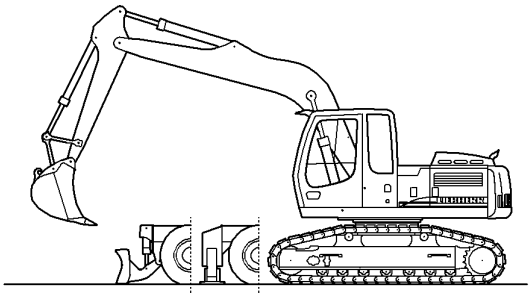

Fig. 3-119 *Working position – machine*

▶ Position the machine so that the load or grab material can be taken up above the rigid axle or the leading wheel.

▶ 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.

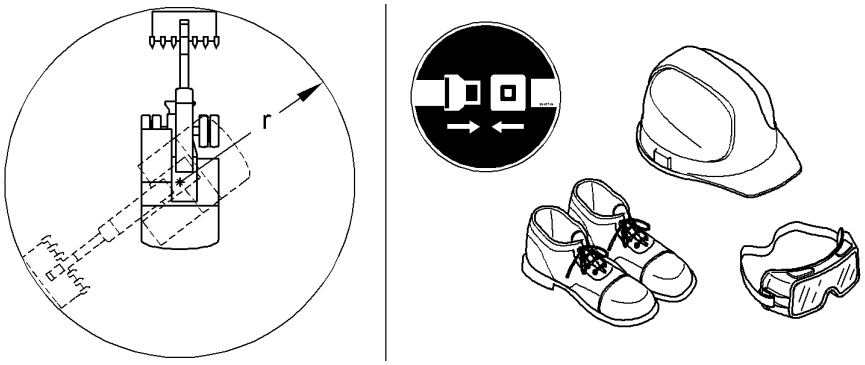

Fig. 3-120 *Safe working*

Loading a machine with a gooseneck boom:

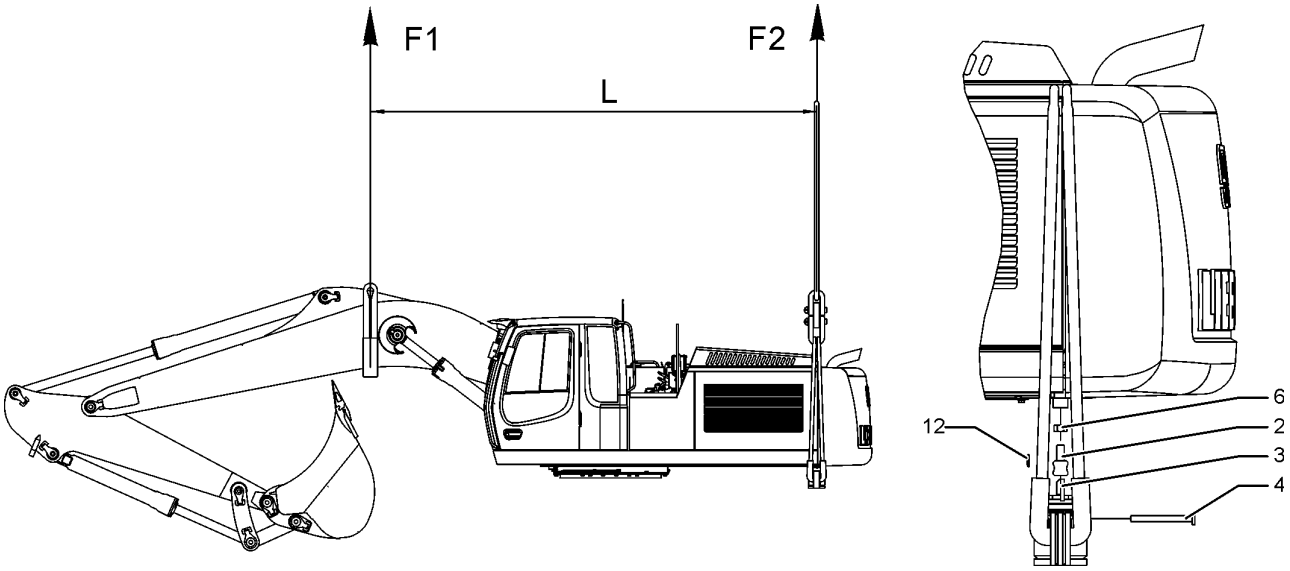

Fig. 3-134 *Suspending the machine with gooseneck boom*

2 Spacer
3 Plate
4 Axle
6 Counternut
12 Pin

❑ Only use cargo handling gear which is sufficiently dimensioned or which has been specially developed by LIEBHERR for this purpose.

The following chart give the forces wich must be considered to size the suspending system.

Excavator's model	F1 [daN]	F2 [daN]	L [mm]
R 934 C	18000	21000	4850
R 944 C	22000	26000	5785

Warning!
The forces indicated F1 and F2 are the maximum values which schould be considered and in all the case sufficient for the tools and lifting systems definition.
For the excavators with demolition equipment, these values are not sufficient, consult your after sales service Liebherr for lifting these excavators.

▶ 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.

Error code	Effect	Cause	Measure / remedy
E 539	Symbol appears	Fuel pressure too low in rail 2 - Safety level	See symbol description
E 597	Symbol appears Engine power reduction Buzzer sounds	Turbocharged air temperature too high - Warning level	See symbol description

4.2 Faults and remedies

4.2.1 Diesel engine and fuel system

Fault / error	Cause	Solution
Diesel engine does not start	Fuel tank almost or completely empty	Fill tank and vent fuel system
	Low pressure in tank	Remove fuel filler cap
	Fuel filter dirty	Clean or change filter and vent fuel system, drain fuel / clean tank
	Outside temperature below 0 °C	For operation under specific climatic conditions, see operating instructions
	Starter motor not drawing through	Check line connections, overhaul starter motor
	Batteries have no power	Charge / replace
Engine starts but stops immediately after or runs irregularly	Fuel tank empty (low pressure in tank)	Fill tank and vent fuel system
	Fuel filter dirty	Clean or change filter and vent fuel system (tank)
	Particularly in winter: too viscous engine oil used	Use engine oil suitable for the outside temperature
	Dry-air filter dirty	Clean or change main filter element
	Air in fuel system	Vent fuel system
	Ventilation in fuel tank obstructed	Clean
	Fuel line bent	Check line and repair if required
Diesel engine emitting grey or black smoke	Dry-air filter dirty	Clean or change filter
Diesel engine continually emitting 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

5 Maintenance

5.1 Servicing the machine safely

General safety instructions

- Maintenance and repair work may only be carried out by specially trained personnel.
- Observe statutory timetables or intervals given in the operating instructions for repeat tests / inspections. It is imperative that a suitably equipped workshop is available in order to carry out maintenance work.
- The inspection and maintenance schedule given at the end of these operating instructions defines precisely who is required / permitted to carry out what work.
  Jobs listed as daily / weekly work may be carried out by the machine's driver or maintenance personnel when they have received appropriate instruction.
  The remaining work may only be carried out by specialist personnel with appropriate training.
- Replacement parts must correspond to the technical requirements determined by the manufacturer. Original replacement parts are always guaranteed to meet these criteria.
- Always wear safe work clothes when carrying out maintenance work. Avoid the wearing of rings, wrist watches, ties, scarves, open jackets, baggy clothing etc... There is a risk of injury from, for example, getting caught up or being drawn in.
  Protective goggles, safety helmets, safety shoes and gloves, reflective vests and ear protection etc. are required for specific jobs.
- Do not remain in direct proximity of the diesel engine while the diesel engine is running.
  Persons with pacemakers should not approach within 20 cm of the running diesel engine.
  Do not touch voltage-carrying parts on the electrical connection of the individual solenoid injection pumps (Unit Pumps UP) while the diesel engine is running.
- Do not permit unauthorised persons to approach the machine during maintenance work.
- Cordon off a wide maintenance area if required.
- Inform operational personnel before starting to carry out any special work and repair work. Designate persons in charge of supervision.
- In the absence of any other information in the operating instructions, carry out all maintenance work on the machine on level, firm ground with the working equipment set aside and the engine switched off.
- For some machines, the only one position which enables a secured access to every maintenance locations on the uppercarriage, is when the uppercarriage is aligned with the undercarriage so that the sprockets locate at the back-end.
  The ladder situated on the undercarriage only corresponds with the uppercarriage's access when the excavator is in this configuration.
- Pull out the ignition key and shut off the main battery switch.
- Always tighten any loose screw connections during maintenance and repair work.
- The mounting bolts of the main components, of the hydraulic hoses and of the counterweight must be replaced after every removal.
- If safety devices have to be dismantled during set-up, maintenance and repair work, they must be immediately reinstalled and checked at the end of the work.

LFR / en / Edition: 02.2009

Symbol	Display
	Diesel engine
	Hydraulic tank
	Swing gear transmission
	Splitterbox
	General oiling points
	Check gear oil level
	Check engine oil level
	Check hydraulic oil level
	Oil change
	First oil change
	Semi-automatic lubrication
	Manual lubrication
	Operating instructions

Tab. 5-2 *Lubrication chart key*

Engine oils that are to be used as hydraulic oils must conform to the following specifications:

Single-grade oils (1):	API - CD / ACEA - E1 Mercedes-Benz regulations, sheet no. 226.0 and 227.0
Multigrade oils (2):	API - CD, CE, CF / ACEA - E2, E3, E4 Mercedes-Benz regulations, sheet no. 227.5, 228.1, 228.3 et 228.5

Tab. 5-10 *Engine oils for use as hydraulic oil*

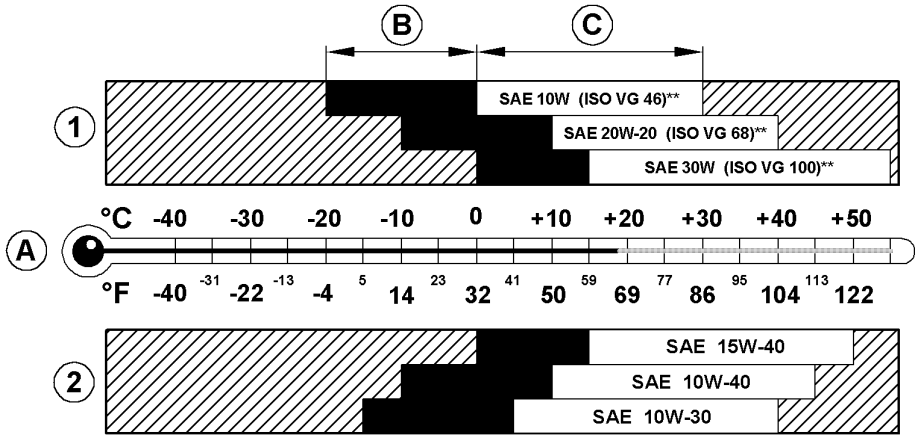

Fig. 5-7 *Engine oils for use as hydraulic oil (SAE classes)**

A Ambient temperature
B Cold-start range with warm-up instruction
C Operating range
1 Single grade engine oil
2 Multigrade oils

*temperature-based selection of the SAE class
** for deviating viscosity grade: consult the LIEBHERR customer service department

Warm-up instruction

The black bar **B** indicates that the ambient temperatures are maximum 20 °C below the operating range **C**.

In the event of a cold start at an ambient temperature included in range **B**, the following warm-up instruction applies to the hydraulic oil:

▶ **1.** Start the diesel engine and run it at approx. 1/2 rated speed. Carefully activate the working hydraulic circuits. Operate a hydraulic cylinder (Stick- for example) and move them to the stop quickly and many times. After approx. 5 minutes, start the travel hydraulic circuits.
Warm-up duration: approx 10 minutes

At even lower temperature:

▶ **2.** Before starting the engine, warm up the hydraulic oil tank. Then proceed according to the warm-up instructions in **1**.

The oil separator is mounted on the right-hand side of the Diesel engine on the same side of the flywheel.

The oil separator filter element must be replaced every 1000 working hours.

To replace the oil separator filter element:

- ▶ Ensure that an original LIEBHERR oil separator filter element is on-hand.
- ▶ Clean the oil separator and the surrounding area thoroughly.
- ▶ Unscrew and remove the oil separator sealing cap, if required use a screwdriver.
- ▶ Pull out the oil separator filter element and dispose of in an environmentally-friendly manner.
- ▶ Insert new oil separator filter element and push in up to the stop.
- ▶ Mount the oil separator sealing cap and tighten by hand to the stop.

5.5.8 Heater flange

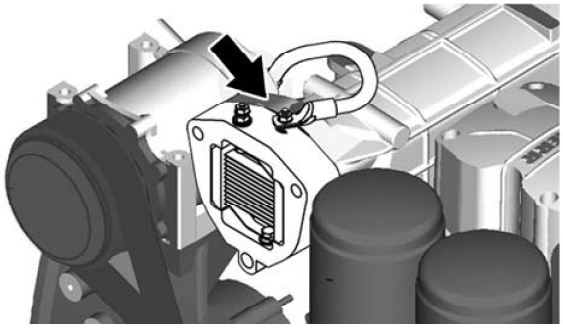

Fig. 5-17 *Heater flange*

- ▶ Switch off battery main switch and disconnect the negative cable from the battery.
- ▶ Disconnect the electrical cable on the heater flange.
- ▶ Connect the ohmmeter to the terminals and check the resistance.
- ▶ If a resistance value of $250^{\pm 10}$ mOhms at 20°C is not reached, the heater flange must be replaced.
- ▶ Reconnect the electrical cable on the heater flange, as well as the negative cable on the battery.

5.5.9 Checking and adjustment of valve clearance

Preparation

- ❑ It must be ensured that :

– the diesel engine is in the maintenance position,
– the diesel engine is cooled,
– a manual engine barring device is on-hand,
– new seals for the cylinder head cover are on-hand.

5.8.2 Electrical refuelling pump (optional extra)

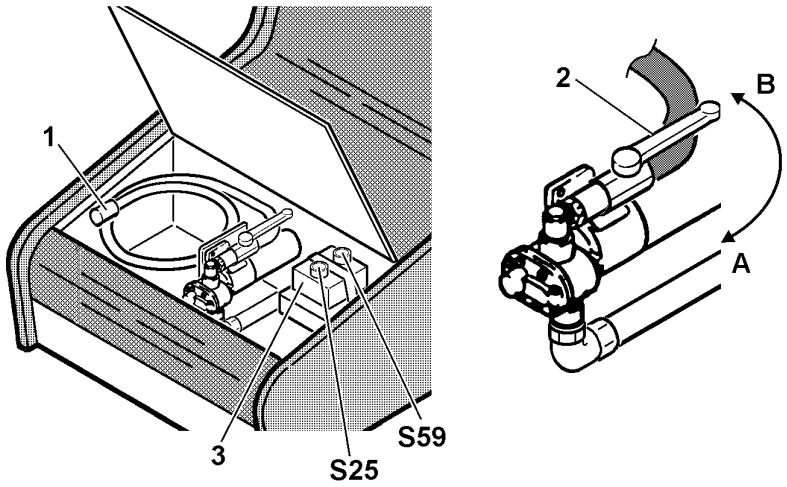

Fig. 5-28 *Electrical refuelling pump*

1	Intake hose	**S25**	Button ON
2	Shut off valve	**S59**	Button OFF
3	Operating unit		

The electrical refuelling pump is used to put fuel into the machine's fuel tank.

It is located under the hatch on the front end of the hydraulic oil and fuel tank. The operating unit **3** is removable.

Proceed as follows when refuelling and stowing the hoses :

- ▶ Unscrew the fuel filler cap **15**.
- ▶ Insert the free end of the intake hose **1** in the fuel supply tank.
- ▶ Open the shut off valve **2** (position **B**).
- ▶ Use switch **S25** (green) to switch on the refuelling pump in order to pump fuel into the machine's tank.
  - ↳ The pump switches off automatically as soon as the maximum fill level is reached.
  - ↳ The refuelling pump can be switched off at any time using switch **S59** (red).

Caution!
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.
- ▶ Screw the fuel filler cap **15**.

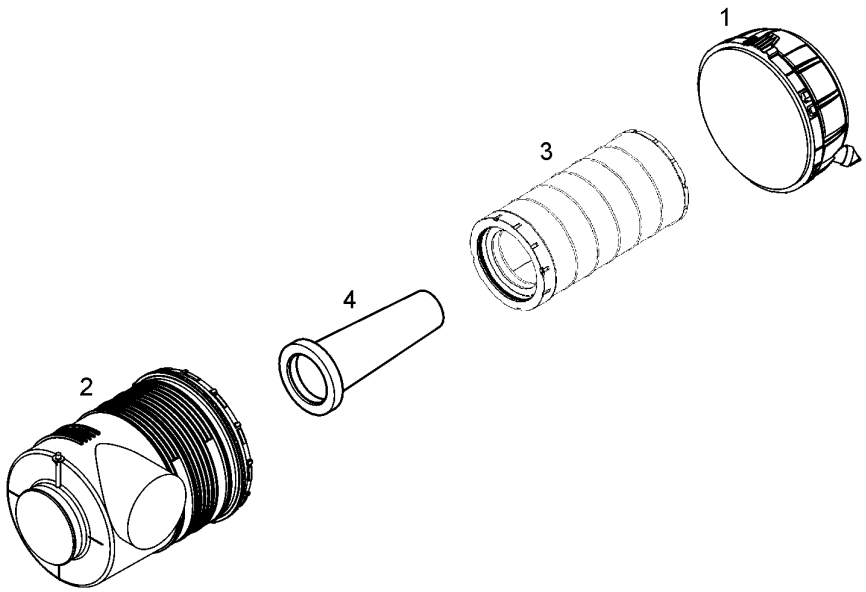

Fig. 5-37 *Changing the filter cartridges*

1 Filter housing cover
2 Filter housing
3 Main element
4 Safety element

- ▶ Remove the cover **1** with the engine switched off.
- ▶ 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.
- ▶ Insert the new main element and ensure that it is sealed and positioned correctly.
- ▶ Close the filter housing **2** with cover **1**.

5.9.2 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**.
- ▶ Remove the safety element **4**.
- ▶ Clean the interior of the air filter housing carefully using a damp cloth.
- ▶ Clean sealing surfaces in the housing and inspect for any damage.

Caution!
Dirt could enter the engine intake!

- ▶ Do not clean the housing by blasting out with compressed air.

- ▶ Insert the new safety element **4** carefully.

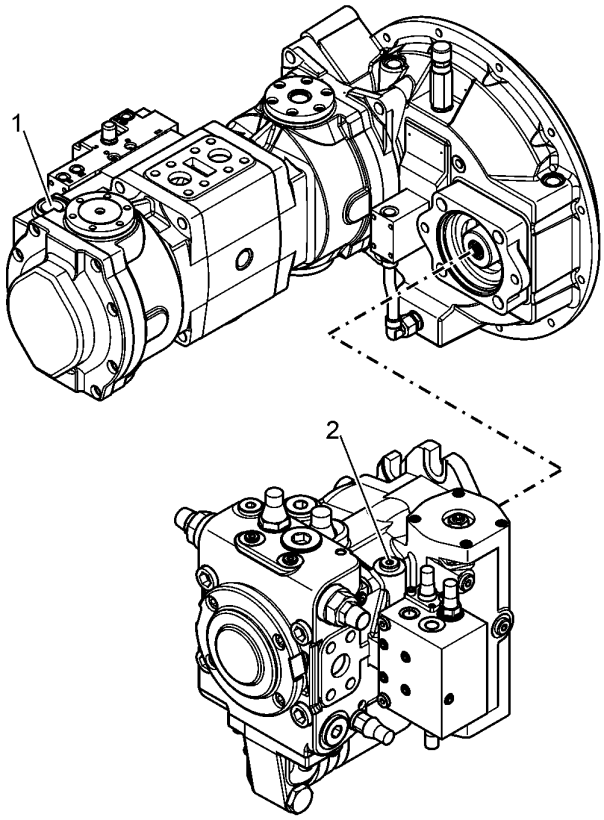

Fig. 5-46 *Hydraulic pumps*

1 Bleeding screw / working pumps **2** Bleeding screw / swing pump

▶ To bleed the working pumps, loosen the screw **1** and let the air escape. As soon as oil flows without air, retighten the screw **1**.

▶ To bleed the swing pump, loosen the screw **2** and let the air escape. As soon as oil flows without air, retighten the screw **2**.

Before starting the pump for the first time after repairing or replacing the pump, the pump housing must be filled with hydraulic oil via the same connection.

5.10.16 Replacing hydraulic hoses

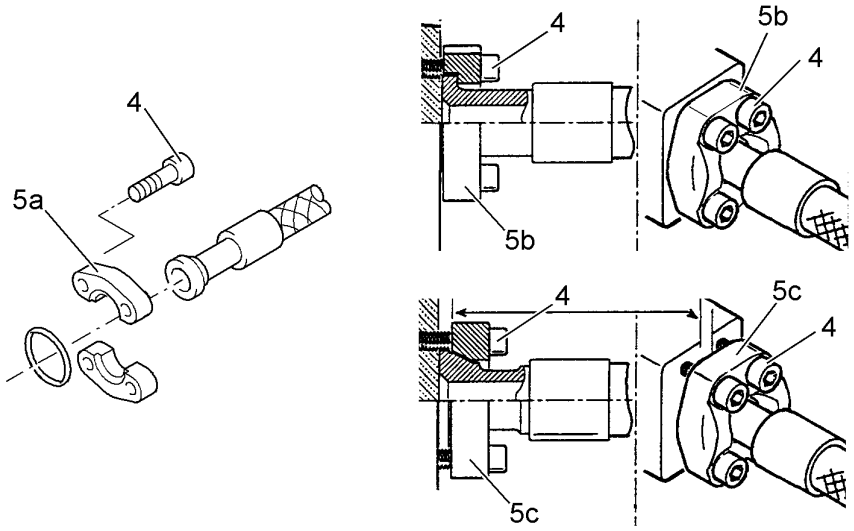

Fig. 5-57 *High pressure hose with SAE fitting*

Danger!
A defective hydraulic hose can cause accidents and injuries.

- ▶ Replace defective hydraulic hoses (bubbles, moisture, damaged top edge etc.) immediately.
- ▶ Install new hoses in such a way that torsion loading is avoided.
- ▶ Ensure that the hydraulic hose is not twisted when mounting.

Installed high pressure hoses with SAE connections have a nominal diameter of 16, 20, 25, 32 or 40 (5/8", 3/4", 1", 1"1/4, or 1"1/2).

You must tighten the mounting screws of the SAE fittings with the following tightening torques.:

Size of screw 4	Torque value in Nm - Quality 10.9		
	Half flanges 5a	Flat flange 5b	Conical flange 5c
M8	31	/	/
M10	62	45	65
M12	108	70	110
M14	172	120	180
M16	264	170	250
M20	350	250	450

Tab. 5-13 *Tightening torques for SAE fittings - Quality 10.9*

Size of screw 4	Torque value in Nm - Quality 8.8
	Half flanges 5a
M8	22

Tab. 5-14 *Tightening torques for SAE fittings - Quality 8.8*

5.14 Greasing the machine

5.14.1 The centralized lubrication system

The machine is serially fitted with a centralized lubrication system.

With this system all or nearly all of the lube points of the machine which require at least daily lubrication are lubricated via an electrical driven grease pump which is turned on during machine operation.

This grease pump is mounted in the area behind the driver's cab.

Construction and operation of the centralized lubrication system .

The grease delivered by the pump U4 is distributed to the different lubrication points LP in metered quantities, first via the main distributor **2** and further via the secondary distributors **3, 4, 5,** ... mounted to the front of the upper carriage and to the working attachment.

The lubrication unit complete **U4** mainly consists of a transparent grease container **13**, and an electric motor **14** driving a lube pump **15**.

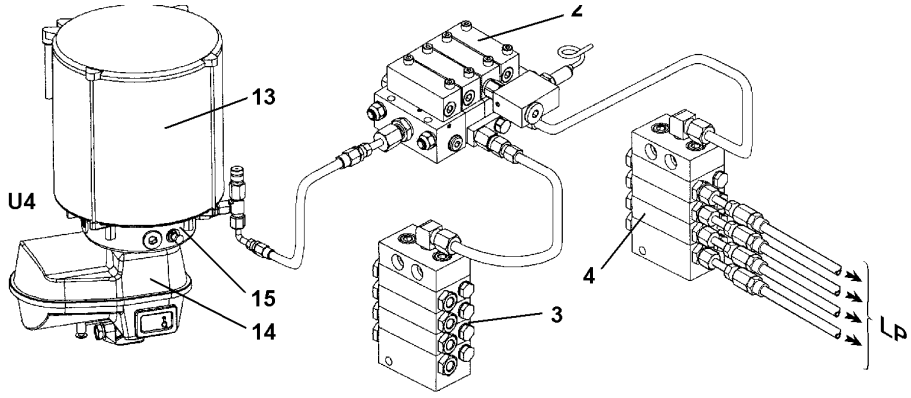

Fig. 5-68 *Centralized lubrication system*

2	Main distributor	**3**	Sercondary distributor
4	Sercondary distributor	**13**	Grease container
14	Electric motor	**15**	Grease pump
U4	Lubrication pump complete	**LP**	Lubrication points

During a lubricating procedure, all of the lube points **LP** connected to the system are lubricated one after the other in a predetermined sequence (progressive system).

The flow sequence and amount of lubricant for each lubrication point depend on the combination of the distributors and lubrication lines and on the piston sizes of the different distribution elements.

Lube points connected to the central lubrication system:

– the ball bearing races of the swing ring,
– the housing around the output pinion of the swing ring, which contains the grease reserves for the swing ring teeth lubrication,
– all (or the most of) the lubrication points of standard working attachments.

Replacing the sealing ring

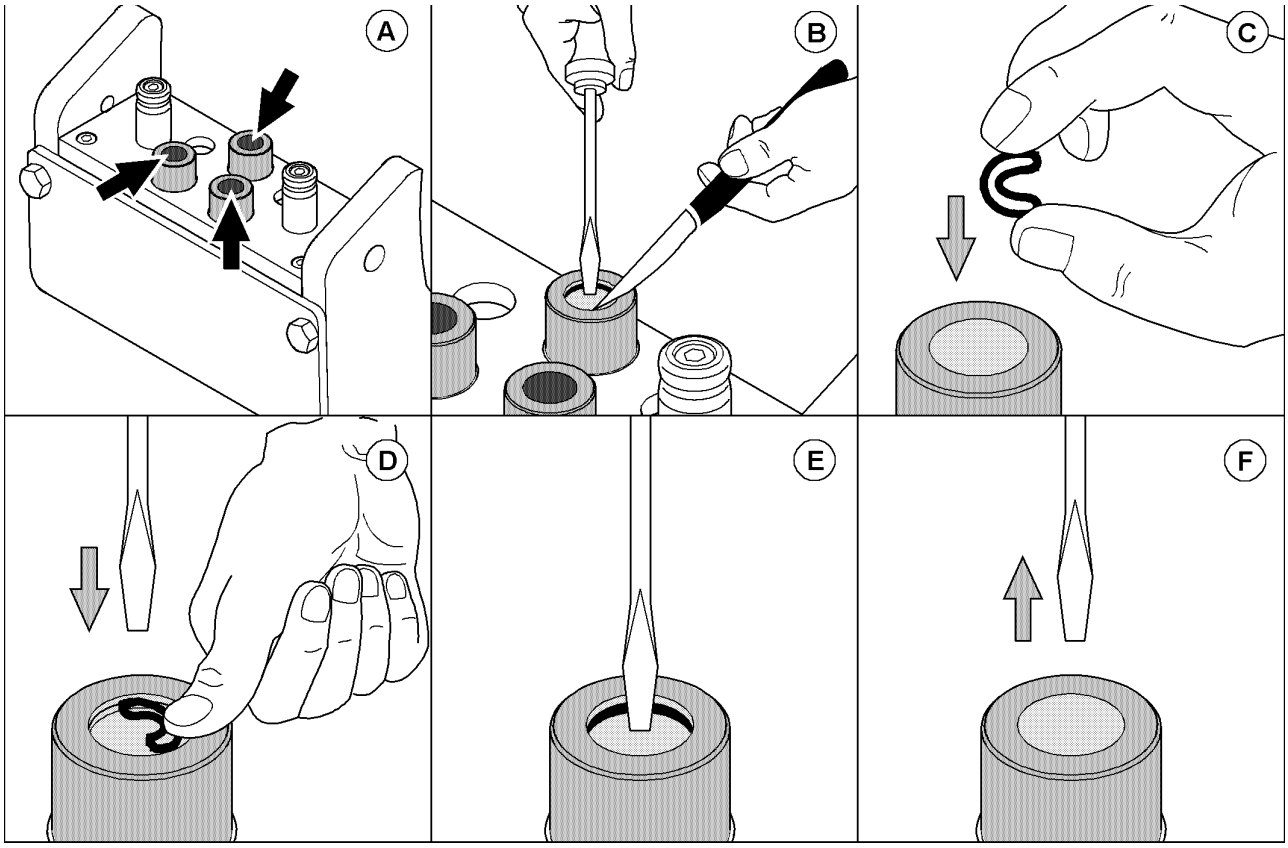

Fig. 5-78 *Replacing the sealing ring*

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.

5.16 Check mounting bolts for tightness

The mounting bolts listed below must be regularly checked and retighten if necessary. See maintenance chart for the checks intervals.