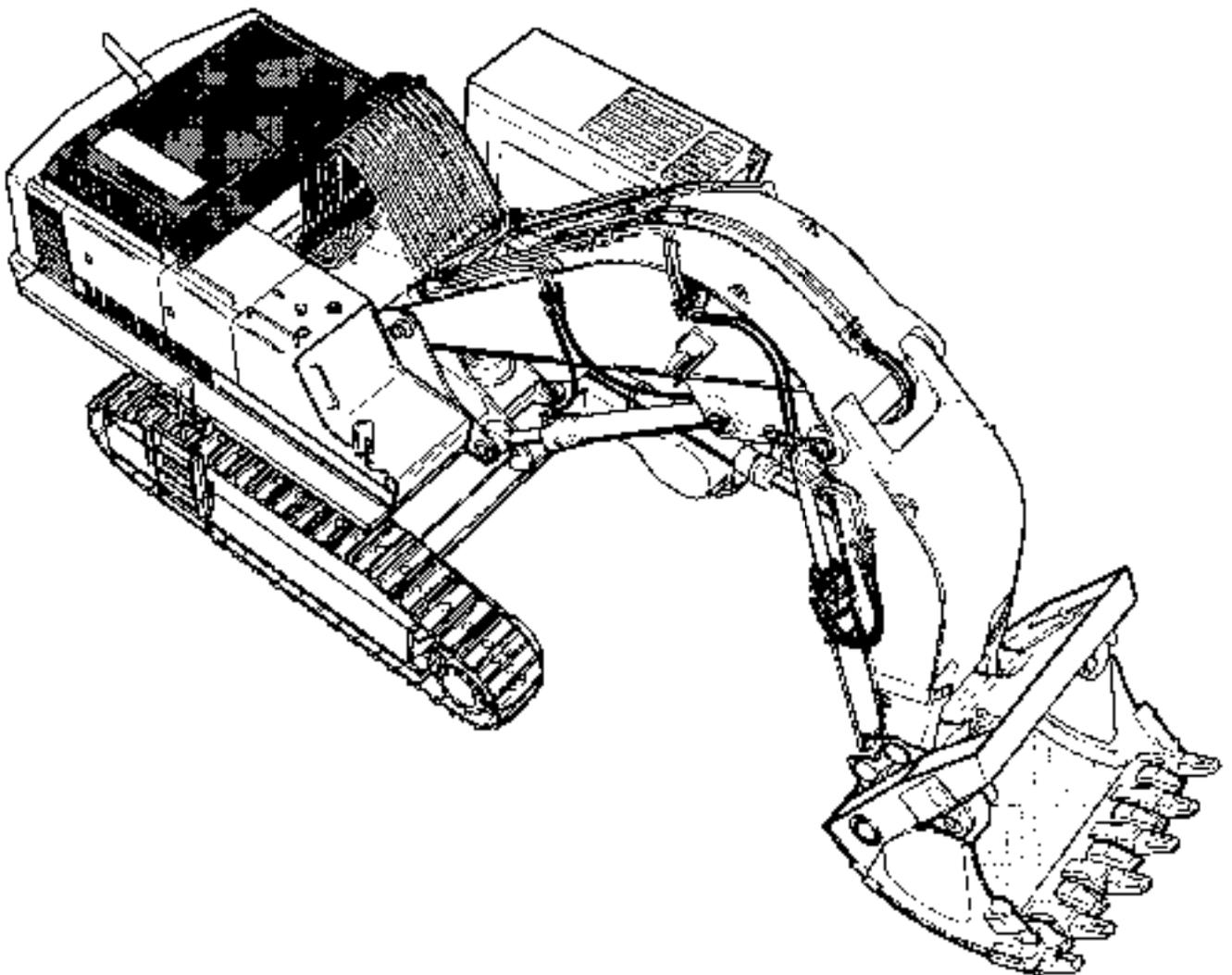


Operation and Maintenance Manual

R 984 C

Litronic



FOREWORD

This manual is primarily for the operator and the maintenance crew and contains information which is vital to the correct and secure operation and proper maintenance of the LIEBHERR excavator

It includes:

- Accident Prevention Guidelines
- Operating Instructions
- Maintenance Instructions.

This Operation and Maintenance manual should be given to the OPERATOR and any other person, who might work on the machine. It is very important that should read the manual carefully before operating or working on the LIEBHERR excavator and at regular intervals thereafter, for example:

- Operation, including installing and removing the attachments, trouble shooting during operation, removing production residue, care, disposing of operating and auxiliary fluids,
- Maintenance work (maintenance, inspection, repair),
- Transportation.

The manual will make it easier for the operator to get accustomed to the hydraulic excavator and to prevent any problems due to improper handling.

All maintenance personnel should follow the operating and maintenance instructions and your LIEBHERR excavator will give you constant and reliable service with excellent performance, reducing repair costs and down time.

In addition to the operating and maintenance guidelines is this manual, additional local and national accident prevention guidelines and environmental regulations might be applicable and must be observed.

The Operation and Maintenance Manual is part of the machine and should be left in the glove compartment of the operator's cab.

Please take notice that we cannot honor any claims which could arise due to careless handling, improper operation, inadequate maintenance, use of unauthorized oils or lubricants, non-observance of the safety instructions, etc

LIEBHERR reserves the right to cancel any warranty claims, service contracts etc. without prior notice if any other than Original LIEBHERR parts or parts sold by LIEBHERR are being used for maintenance and repairs.

This Operation and Maintenance manual contains all necessary information to operate and maintain your Litronic track type excavator. However, should you need additional information or explanations, please contact LIEBHERR's Technical Documentation, Service school or Customer Service Department.

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INFORMATION TO THE OPERATION AND MAINTENANCE MANUAL R 984 C Litronic

ISSUE : 03 / 2005

ID. / NO : 8504499 C

This **Operation and Maintenance Manual** is valid for **R 984 C** excavators from the following serial numbers:

	TYPE		Valid from Serial Number
	922	/	13 321
HD	759	/	13 321
EW	977	/	13 321

We recommend that you fill in the following table as soon as you receive your excavator. This will also be helpful when you order parts.

Product Id. No. (PIN No.):

Manufacturing Date :

CE 2005

Delivery Date :

.. / .. / ..

This excavator meets EC Safety guidelines 89/392/EEC, 89/336/EEC, 91/368/EEC und 93/44/EEC.

We reserve the right to make any technical changes compared to data and illustrations given in this manual.

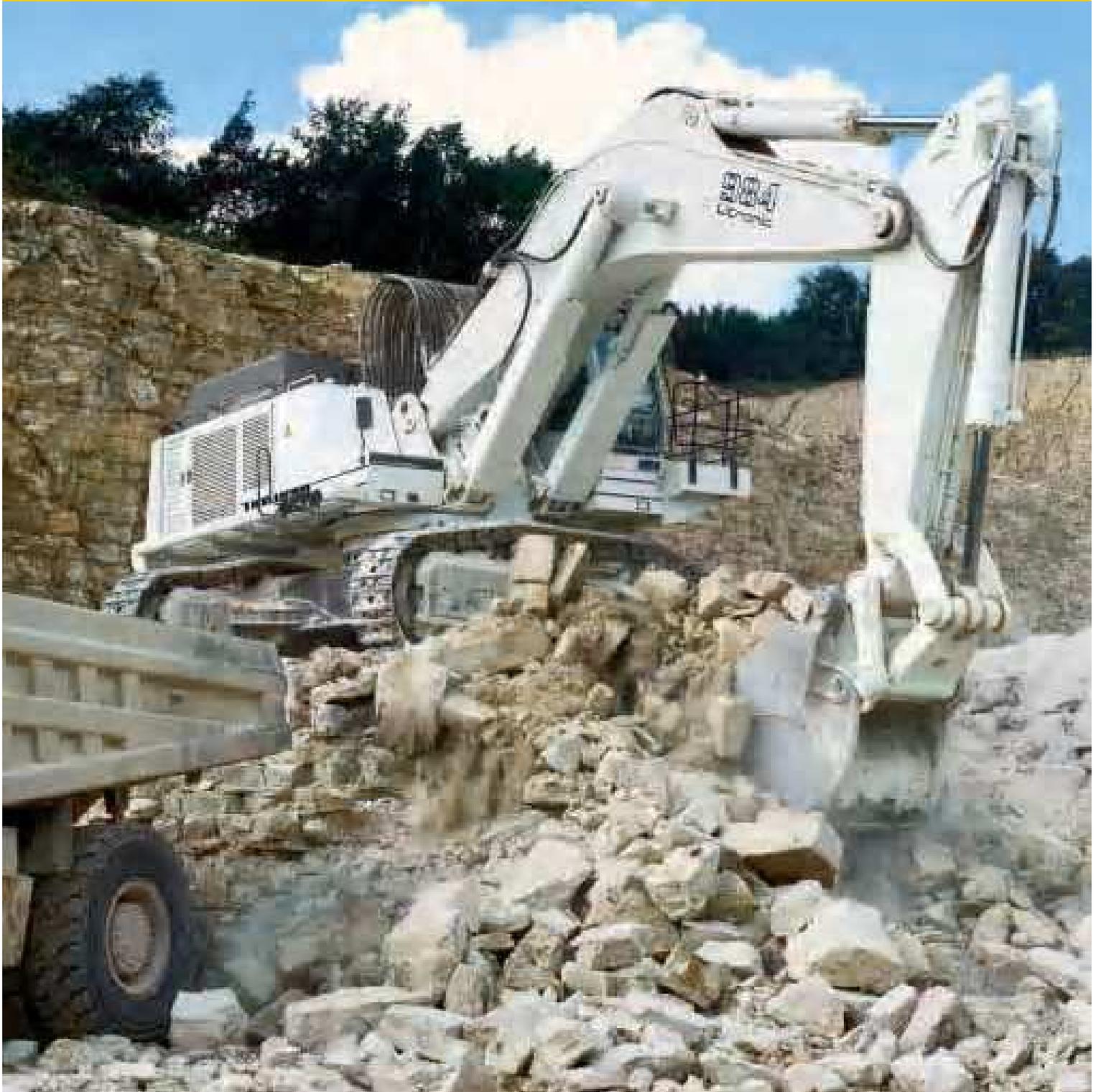
Warranty and liability are subject to LIEBHERR's general business terms and conditions are changed in any way by instructions in this manual.

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Technical Description Hydraulic Excavator

R 984 C
Litronic®

Operating Weight with Backhoe Attachment 118,6 - 123,4 t
Operating Weight with Shovel Attachment 123,1 - 125,0 t
Engine Output 504 kW (685 HP)
Bucket Capacity 2,90 - 10,00 m³
Shovel Capacity 5,70 - 10,50 m³



LIEBHERR

<https://www.truck-manuals.net/>

Technical Data



Engine

Rating per ISO 9249	523 kW (710 HP) at 2100 RPM reduced to 504 kW (685 HP) at 1800 RPM
Model	Cummins-QSK-19 C 750
Type	6 cylinder in-line engine
Bore/Stroke	159/159 mm
Displacement	18,9 l
Engine operation	4-stroke diesel direct injection turbo-charged reduced emissions
Cooling	water-cooled
Air cleaner	dry-type air cleaner with pre-cleaner, primary and safety elements, automatic dust discharge
Fuel tank	1585 l
Standard	sensor controlled engine idling
Electrical system	
Voltage	24 V
Batteries	2 x 144 Ah/12 V
Starter	24 V/9,0 kW
Alternator	three phase current 24 V/100 A



Hydraulic System

Hydraulic pump for attachment and travel drive	3 Liebherr variable flow, swash plate pumps
Max. flow	3 x 472 l/min.
Max. pressure	320 bar
Pump regulation	electro-hydraulic with electronic engine speed sensing regulation, pressure com- pensation, automatic oil flow optimizer
Hydraulic pump for swing drive	reversible, variable flow, swash plate pump, closed-loop circuit
Max. flow	403 l/min.
Max. pressure	340 bar
Hydraulic tank	880 l
Hydraulic system	1660 l
Hydraulic oil filter	2 full flow filters in return line with inte- grated fine filter area (5 µm), 1 high pres- sure filter for each main pump
Cooler	compact cooler, consisting of a water cooler, sandwiched with hydraulic oil cooler and aftercooler cores and hydrostatically driven fan
MODE selection	adjustment of machine performance and the hydraulics via a mode selector to match application
LIFT	for lifting
FINE	for precision work and lifting through very sensitive movements
ECO	for especially economical and environ- mentally friendly operation
POWER	for maximum digging power and heavy duty jobs
R.P.M. adjustment	stepless adjustment of engine output via the r.p.m.at each selected mode



Hydraulic Controls

Power distribution	via control valves in single block with inte- grated safety valves
Flow summation	to boom stick and bucket cylinders
Closed-loop circuit	for uppercarriage swing drive
Servo circuit	
Attachment and swing	– proportional via joystick levers
Travel	– proportional via foot pedals or removable hand levers
Additional functions	via foot pedals or joystick toggle switch



Swing Drive

Drive by	Liebherr swash plate motor
Transmission	Liebherr compact planetary reduction gear
Swing ring	Liebherr, sealed single race ball bearing swing ring, internal teeth
Swing speed	0–5,2 RPM stepless
Swing torque	390 kNm
Holding brake	wet multi-disc (spring applied, pressure released)
Option	pedal controlled positioning brake



Uppercarriage

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



Operator's Cab

Cab	profiles and deep drawn technology, resil- iently mounted, sound insulated, tinted windows. Front window armored glass, door with sliding window
Operator's seat	shock absorbing suspension, adjustable to operator's weight, 6-way adjustable seat with mountable head rest
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 over- heating, low engine oil pressure or low hydraulic oil level
Heating system	standard automatic air conditioning, com- bined cooler/heater, additional dust filter in fresh air/recirculated



Undercarriage

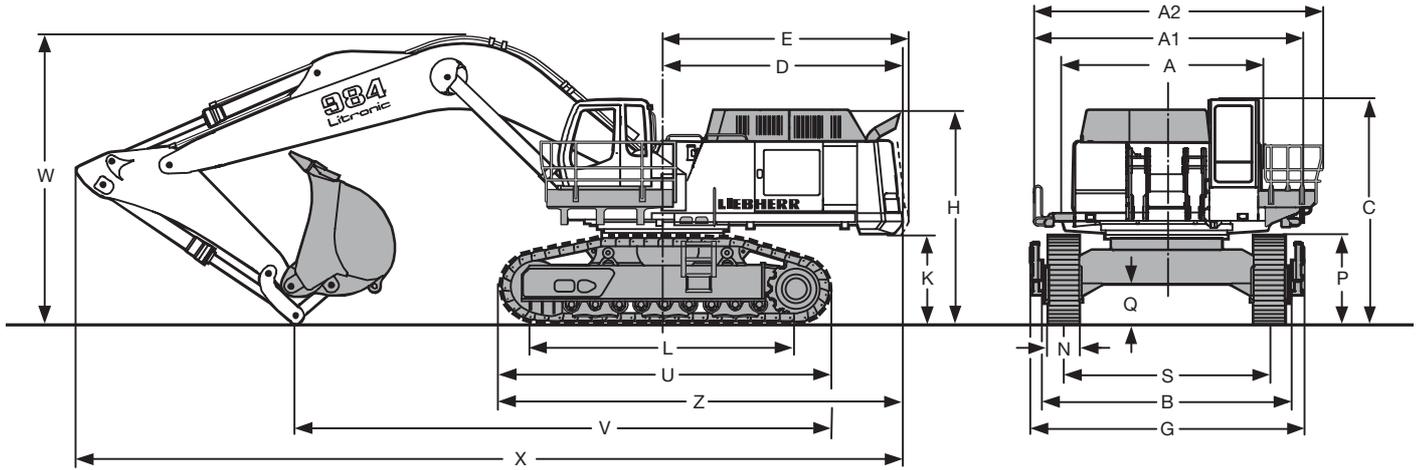
Version HD	heavy duty
Drive	Liebherr swash plate motors
Transmission	Liebherr planetary reduction gears
Travel speed	0–2,9 km/h
Drawbar pull max.	872 kN
Track components	track pitch 280 mm, maintenance-free
Track rollers/ Carrier rollers	9/2
Track pads	double grouser
Digging locks	wet multi-discs (spring applied, pressure released)
Brake valves	integrated in main valve block



Attachment

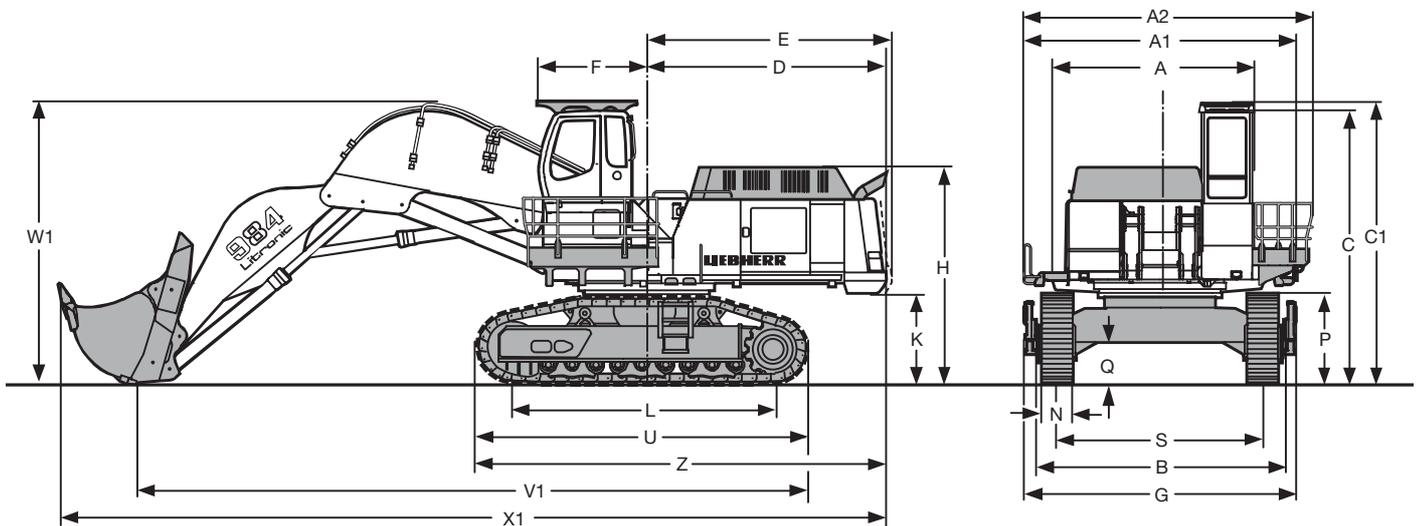
Type	box-type, combination of resistant steel plates and cast steel components
Hydraulic cylinders	Liebherr cylinders with special sealsystem, shock absorbed
Pivots	sealed, low maintenance
Pivots bucket-to-stick bucket-to-link	O-ring sealed and completely enclosed
Lubrication	automatic lubrication system Lincoln "Centromatic" for attachment and swing ring
Hydraulic connections	pipes and hoses equipped with SAE split- flange connections
Bucket	standard equipped with 27 t lifting eye

Dimensions



	mm		
A	4050		
A1	5260		
A2	5690		
C	4455		
D	4690		
E	4805		
H	4235		
K	1830		
L	5055		
P	1745		
Q	860		
S	4000		
U	6471		
N	500	600	750
B	4830	4830	4830
G	5290	5290	5290
Z	7980		

	Stick Length	Gooseneck Boom 7,80 m	Gooseneck Boom 9,20 m	Gooseneck Boom 11,00 m
	m	mm	mm	mm
V	3,40	8800	10550	-
	4,50	8500	10250	12150
	5,60	-	10150	11900
	6,80	-	8350	10000
W	3,40	5650	5850	-
	4,50	6300	6250	6650
	5,60	-	6950	7000
	6,80	-	7950	7750
X	3,40	14850	16250	-
	4,50	14300	15650	17400
	5,60	-	15400	17200
	6,80	-	14700	16750

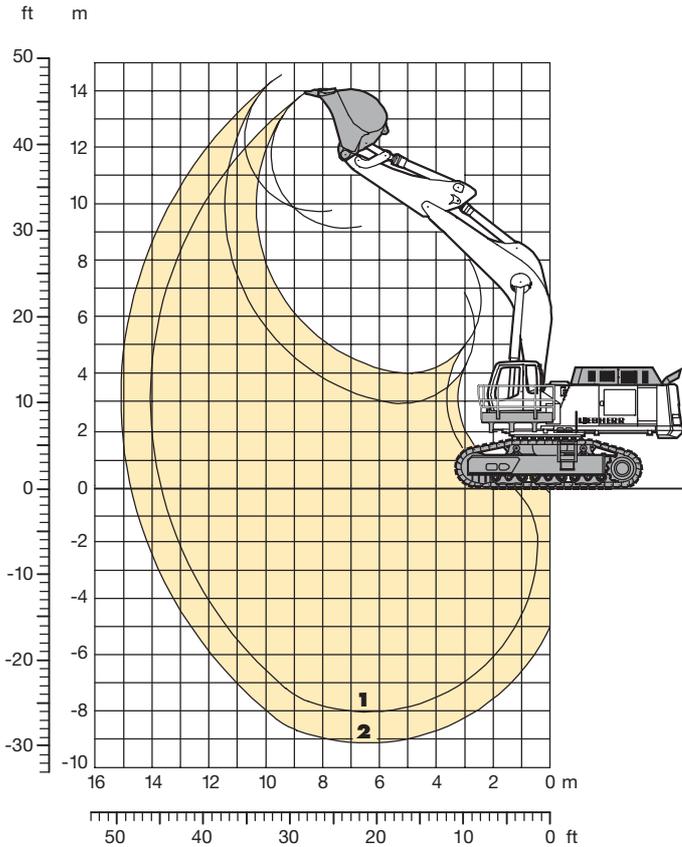


	mm		
A	4050		
A1	5260		
A2	5690		
C	5255		
C1	5430		
D	4690		
E	4805		
F	2075		
H	4235		
K	1830		
L	5055		

	mm		
P	1745		
Q	860		
S	4000		
U	6471		
Z	7980		
N	500	600	750
B	4830	4830	4830
G	5290	5290	5290
V1	12600		
W1	5400		
X1	15500		

Backhoe Attachment

with Gooseneck Boom 7,80 m



Digging Envelope

		1	2
Stick lengths	m	3,40	4,50
Max. digging depth	m	7,95	9,05
Max. reach at ground level	m	13,70	14,75
Max. dump height	m	9,20	9,80
Max. teeth height	m	14,00	14,65
Digging force SAE	kN	416	346
	t	42,4	35,3
Digging force ISO	kN	437	367
	t	46,6	37,4
Breakout force SAE	kN	550	550
	t	56,1	56,1
Breakout force ISO	kN	590	590
	t	60,2	60,2

Operating Weight and Ground Pressure

Operating weight includes basic machine with gooseneck boom 7,80 m, stick 3,40 m and bucket 7,00 m³.

Undercarriage		HD	
Pad width	mm	600	750
Weight	kg	118600	119800
Ground pressure	kg/cm ²	1,78	1,44

Buckets

Cutting width	mm	1600 ¹⁾	1900 ²⁾	1800 ¹⁾	2100 ²⁾	2000 ¹⁾	2300 ²⁾	2200 ¹⁾	2400 ¹⁾	2600 ³⁾	2800 ³⁾	2800 ⁴⁾
Capacity ISO 7451	m ³	4,70	5,20	5,50	6,00	6,20	6,70	7,00	7,70	8,50	9,30	10,00
Weight	kg	4970	6200	5280	6680	5700	7030	6050	6310	6650	6800	6540
Suitable for material up to a specific weight of												
with stick 3,40 m	t/m ³	–	2,20	2,20	2,00	2,00	1,80	1,80	1,65	1,50	1,35	1,20
with stick 4,50 m	t/m ³	2,20	2,00	2,00	1,80	1,80	1,65	1,65	1,50	1,35	1,20	–

¹⁾ Medium-duty bucket with teeth size V 69 SD (appropriate for materials up to classification 5, according to VOB, Section C, DIN 18300)

²⁾ Heavy-duty rock bucket with teeth size V 71 SD (appropriate for materials above classification 6, according to VOB, Section C, DIN 18300)

³⁾ Loading bucket with teeth size V 61 SYL

⁴⁾ Coal bucket with teeth size 25

Lift Capacities

with Gooseneck Boom 7,80 m

Stick 3,40 m

Height (m)	Radius of load from centerline of machine (m)									
	4,5	6,0	7,5	9,0	10,5	12,0	13,5	15,0	16,5	18,0
12,0										
10,5										
9,0				15,5# (15,5#)	14,4# (14,4#)					
7,5				16,3# (16,3#)	14,8# (14,8#)					
6,0			20,4# (20,4#)	17,5# (17,5#)	15,4# (15,4#)					
4,5	43,3# (43,3#)	29,6# (29,6#)	22,9# (22,9#)	18,9# (18,9#)	16,2# (16,2#)	13,9 (14,4#)				
3,0		33,5# (33,5#)	25,1# (25,1#)	20,2# (20,2#)	17,0# (17,0#)	13,4 (14,7#)				
1,5	23,7# (23,7#)	35,8# (35,8#)	26,8# (26,8#)	21,2# (21,2#)	16,4 (17,5#)	12,9 (14,8#)				
0	29,7# (29,7#)	36,2# (36,2#)	27,3 (27,4#)	20,4 (21,7#)	15,8 (17,7#)					
- 1,5	39,2# (39,2#)	35,0# (35,0#)	26,6 (26,9#)	19,9 (21,3#)	15,5 (17,0#)					
- 3,0	42,4# (42,4#)	32,2# (32,2#)	25,0# (25,0#)	19,7# (19,7#)						
- 4,5	35,3# (35,3#)	27,5# (27,5#)	21,5# (21,5#)	16,3# (16,3#)						
- 6,0	24,9# (24,9#)	19,9# (19,9#)	14,8# (14,8#)							
- 7,5										
- 9,0										
- 10,5										
- 12,0										

Stick 4,50 m

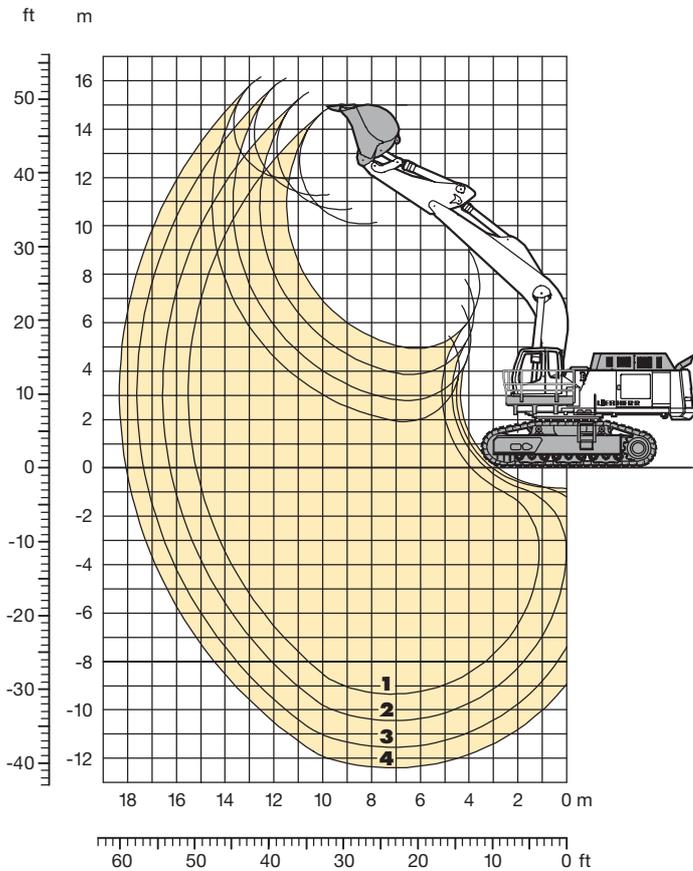
Height (m)	Radius of load from centerline of machine (m)									
	4,5	6,0	7,5	9,0	10,5	12,0	13,5	15,0	16,5	18,0
12,0										
10,5					11,6# (11,6#)					
9,0					12,2# (12,2#)					
7,5					12,6# (12,6#)	11,9# (11,9#)				
6,0					15,0# (15,0#)	13,4# (13,4#)	12,3# (12,3#)			
4,5					19,9# (19,9#)	16,6# (16,6#)	14,4# (14,4#)	12,8# (12,8#)		
3,0					30,1# (30,1#)	22,7# (22,7#)	18,3# (18,3#)	15,4# (15,4#)	13,4# (13,4#)	
1,5	29,5# (29,5#)	33,7# (33,7#)	25,0# (25,0#)	19,8# (19,8#)	16,3# (16,3#)	12,8 (13,8#)				
0	28,9# (28,9#)	35,5# (35,5#)	26,4# (26,4#)	20,5 (20,7#)	15,7 (16,9#)	12,2 (14,0#)				
- 1,5	34,1# (34,1#)	35,7# (35,7#)	26,5 (26,8#)	19,6 (21,0#)	15,1 (16,9#)	11,9 (13,6#)				
- 3,0	42,6# (42,6#)	34,2# (34,2#)	26,0 (26,0#)	19,2 (20,3#)	14,8 (16,1#)					
- 4,5	41,7# (41,7#)	30,9# (30,9#)	23,7# (23,7#)	18,4# (18,4#)	13,9# (13,9#)					
- 6,0	33,7# (33,7#)	25,5# (25,5#)	19,5# (19,5#)	14,4# (14,4#)						
- 7,5		16,6# (16,6#)	11,5# (11,5#)							
- 9,0										
- 10,5										
- 12,0										

The load values are quoted in tons (t) on the backhoe bucket's load hook, and may be swung 360° on firm and even ground. Values quoted in brackets apply to the undercarriage when in longitudinal position. Capacities are valid for 600 mm wide double grouser pads. Indicated loads are based on ISO 10567 standard and do not exceed 75 % of tipping or 87 % of hydraulic capacity (indicated via #). Maximum load for the backhoe bucket's lifting eye is 27 t. Without bucket (6,20 m³), the lift capacities will increase by 5700 kg, without bucket cylinder, link and lever they increase by an additional 1900 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.

Backhoe Attachment

with Gooseneck Boom 9,20 m



Digging Envelope		1	2	3	4*
Stick lengths	m	3,40	4,50	5,60	6,80
Max. digging depth	m	9,25	10,35	11,45	12,30
Max. reach at ground level	m	15,20	16,25	17,35	18,10
Max. dump height	m	10,20	10,85	11,45	12,20
Max. teeth height	m	15,00	15,70	16,35	16,40
Digging force SAE	kN	416	346	300	273
	t	42,4	35,3	30,6	27,8
Digging force ISO	kN	437	367	316	284
	t	46,6	37,4	37,4	29,0
Breakout force SAE	kN	550	550	550	405
	t	56,1	56,1	56,1	41,3
Breakout force ISO	kN	590	590	590	445
	t	60,2	60,2	60,2	45,4

* with stick 6,80 m with R 974 B Litronic[®] buckets

Operating Weight and Ground Pressure

Operating weight includes basic machine with gooseneck boom 9,20 m, stick 4,50 m and bucket 4,70 m³.

Undercarriage	HD	
Pad width	mm	600 750
Weight	kg	118800 120000
Ground pressure	kg/cm ²	1,78 1,44

Buckets

Cutting width	mm	1300 ¹⁾	1300 ¹⁾	1400 ¹⁾	1600 ¹⁾	1800 ¹⁾	2000 ¹⁾	1350 ²⁾	1550 ²⁾	1750 ²⁾
Capacity ISO 7451	m ³	2,90	3,50	3,90	4,70	5,50	6,20	2,70	3,20	3,80
Weight	kg	3720	4080	4530	4970	5280	5700	3060	3310	3610
Suitable for material up to a specific weight of										
with stick 3,40 m	t/m ³	–	2,20	2,00	1,80	1,50	1,20	–	–	–
with stick 4,50 m	t/m ³	2,20	2,00	1,80	1,50	1,20	–	–	–	–
with stick 5,60 m	t/m ³	2,00	1,80	1,50	1,20	–	–	–	–	–
with stick 6,80 m	t/m ³	–	–	–	–	–	–	1,80	1,50	1,50

¹⁾ Medium-duty bucket with teeth size V 69 SD (appropriate for materials up to classification 5, according to VOB, Section C, DIN 18300)

²⁾ Bucket R 974 B Litronic[®] with teeth size V 61 SD

Lift Capacities

with Gooseneck Boom 9,20 m

Stick 3,40 m

Height (m)	Radius of load from centerline of machine (m)									
	4,5	6,0	7,5	9,0	10,5	12,0	13,5	15,0	16,5	18,0
12,0										
10,5					12,2# (12,2#)					
9,0					12,5# (12,5#)	11,7# (11,7#)				
7,5				14,8# (14,8#)	13,1# (13,1#)	11,9# (11,9#)				
6,0		25,4# (25,4#)	19,5# (19,5#)	16,1# (16,1#)	13,8# (13,8#)	12,3# (12,3#)				
4,5			21,9# (21,9#)	17,5# (17,5#)	14,7# (14,7#)	12,9# (12,9#)	10,8# (11,5#)			
3,0			23,9# (23,9#)	18,8# (18,8#)	15,6# (15,6#)	13,1# (13,4#)	10,4# (11,7#)			
1,5			25,1# (25,1#)	19,8# (19,8#)	15,6# (16,2#)	12,5# (13,7#)	10,0# (11,9#)			
0		28,6# (28,6#)	25,1# (25,6#)	19,0# (20,2#)	14,9# (16,6#)	12,0# (13,9#)				
- 1,5	21,2# (21,2#)	32,2# (32,2#)	24,6# (25,2#)	18,5# (20,1#)	14,5# (16,5#)	11,7# (13,6#)				
- 3,0	31,6# (31,6#)	30,2# (30,2#)	24,0# (24,0#)	18,4# (19,3#)	14,4# (15,8#)	11,8# (12,7#)				
- 4,5	33,8# (33,8#)	27,1# (27,1#)	21,9# (21,9#)	17,7# (17,7#)	14,2# (14,2#)					
- 6,0	27,7# (27,7#)	22,7# (22,7#)	18,5# (18,5#)	14,7# (14,7#)						
- 7,5		16,1# (16,1#)	12,8# (12,8#)							
- 9,0										
- 10,5										
- 12,0										

Stick 4,50 m

Height (m)	Radius of load from centerline of machine (m)									
	4,5	6,0	7,5	9,0	10,5	12,0	13,5	15,0	16,5	18,0
12,0										
10,5							9,8# (9,8#)			
9,0							9,9# (9,9#)	9,5# (9,5#)		
7,5							10,2# (10,2#)	9,6# (9,6#)		
6,0						14,0# (14,0#)	12,1# (12,1#)	10,8# (10,8#)	9,8# (9,8#)	
4,5		25,9# (25,9#)	19,4# (19,4#)	15,6# (15,6#)	13,2# (13,2#)	11,5# (11,5#)	10,2# (10,2#)			
3,0			21,8# (21,8#)	17,2# (17,2#)	14,2# (14,2#)	12,1# (12,1#)	10,3# (10,6#)			
1,5		29,2# (29,2#)	23,7# (23,7#)	18,5# (18,5#)	15,1# (15,1#)	12,4# (12,7#)	9,8# (11,0#)			
0		28,9# (28,9#)	24,8# (24,8#)	19,1# (19,3#)	14,9# (15,7#)	11,8# (13,1#)	9,4# (11,1#)			
- 1,5	18,3# (18,3#)	33,1# (33,1#)	24,5# (25,0#)	18,3# (19,7#)	14,2# (15,9#)	11,3# (13,2#)	9,2# (11,0#)			
- 3,0	25,5# (25,5#)	31,9# (31,9#)	24,1# (24,5#)	17,9# (19,4#)	13,9# (15,7#)	11,1# (12,9#)	9,1# (10,3#)			
- 4,5	34,3# (34,3#)	29,6# (29,6#)	23,1# (23,1#)	17,9# (18,4#)	13,9# (14,8#)	11,2# (11,8#)				
- 6,0	34,0# (34,0#)	26,2# (26,2#)	20,7# (20,7#)	16,5# (16,5#)	12,9# (12,9#)					
- 7,5	26,8# (26,8#)	21,1# (21,1#)	16,7# (16,7#)	12,9# (12,9#)						
- 9,0			9,9# (9,9#)							
- 10,5										
- 12,0										

Stick 5,60 m

Height (m)	Radius of load from centerline of machine (m)									
	4,5	6,0	7,5	9,0	10,5	12,0	13,5	15,0	16,5	18,0
13,5						8,1# (8,1#)				
12,0										
10,5						8,1# (8,1#)				
9,0						8,1# (8,1#)				
7,5						8,9# (8,9#)	8,4# (8,4#)	8,0# (8,0#)		
6,0					10,7# (10,7#)	9,6# (9,6#)	8,8# (8,8#)	8,2# (8,2#)		
4,5				13,9# (13,9#)	10,4# (11,8#)	9,3# (10,4#)	8,5# (9,3#)			
3,0			19,9# (19,9#)	15,7# (15,7#)	13,0# (13,0#)	11,2# (11,2#)	9,8# (9,8#)	8,3# (8,8#)		
1,5		30,6# (30,6#)	22,3# (22,3#)	17,3# (17,3#)	14,1# (14,1#)	11,9# (11,9#)	10,1# (10,3#)	7,9# (9,0#)		
0		31,3# (31,3#)	24,0# (24,0#)	18,6# (18,6#)	15,0# (15,0#)	12,0# (12,5#)	9,5# (10,7#)	7,6# (9,2#)		
- 1,5	16,5# (16,5#)	31,9# (31,9#)	24,9# (24,9#)	18,8# (19,3#)	14,5# (15,6#)	11,4# (12,9#)	9,1# (10,8#)	7,3# (9,1#)		
- 3,0	21,7# (21,7#)	33,1# (33,1#)	24,4# (25,0#)	18,1# (19,6#)	14,0# (15,8#)	11,1# (12,9#)	8,9# (10,7#)			
- 4,5	28,3# (28,3#)	31,7# (31,7#)	24,1# (24,2#)	17,8# (19,1#)	13,7# (15,4#)	10,9# (12,5#)	8,9# (10,0#)			
- 6,0	36,6# (36,6#)	29,3# (29,3#)	22,6# (22,6#)	17,8# (17,9#)	13,8# (14,3#)	11,0# (11,3#)				
- 7,5	33,7# (33,7#)	25,4# (25,4#)	19,8# (19,8#)	15,6# (15,6#)	12,1# (12,1#)					
- 9,0	25,5# (25,5#)	19,7# (19,7#)	15,2# (15,2#)	11,4# (11,4#)						
- 10,5										

Stick 6,80 m

Height (m)	Radius of load from centerline of machine (m)									
	4,5	6,0	7,5	9,0	10,5	12,0	13,5	15,0	16,5	18,0
12,0							8,8# (8,8#)			
10,5							8,7# (8,7#)	7,5# (7,5#)		
9,0							8,9# (8,9#)	8,8# (8,8#)		
7,5							9,3# (9,3#)	9,0# (9,0#)		
6,0							10,4# (10,4#)	9,8# (9,8#)	9,3# (9,3#)	7,5# (7,5#)
4,5							11,4# (12,6#)	10,4# (11,4#)	9,7# (10,4#)	8,6# (8,6#)
3,0				20,0# (20,0#)	16,4# (16,4#)	14,1# (14,1#)	12,4# (12,4#)	11,1# (11,1#)	10,2# (10,2#)	8,4# (9,3#)
1,5		30,9# (30,9#)	23,1# (23,1#)	18,4# (18,4#)	15,4# (15,4#)	13,3# (13,3#)	11,8# (11,8#)	9,9# (10,6#)	8,1# (9,5#)	
0		34,2# (34,2#)	25,4# (25,4#)	20,1# (20,1#)	16,6# (16,6#)	14,2# (14,2#)	11,7# (12,3#)	9,5# (10,9#)	7,8# (8,9#)	
- 1,5	18,0# (18,0#)	35,1# (35,1#)	27,0# (27,0#)	21,3# (21,3#)	17,0# (17,5#)	13,7# (14,8#)	11,2# (12,7#)	9,2# (11,1#)		
- 3,0	21,6# (21,6#)	36,6# (36,6#)	27,4# (27,7#)	20,7# (21,9#)	16,3# (18,0#)	13,1# (15,1#)	10,8# (12,9#)	9,0# (11,0#)		
- 4,5	26,6# (26,6#)	36,0# (36,0#)	26,7# (27,6#)	20,1# (22,0#)	15,8# (18,0#)	12,8# (15,0#)	10,6# (12,6#)	8,9# (10,4#)		
- 6,0	32,9# (32,9#)	34,4# (34,4#)	26,6# (26,6#)	19,9# (21,3#)	15,7# (17,4#)	12,7# (14,4#)	10,6# (11,7#)			
- 7,5	41,2# (41,2#)	31,5# (31,5#)	24,6# (24,6#)	19,8# (19,8#)	15,8# (16,0#)	12,9# (12,9#)				
- 9,0	35,7# (35,7#)	27,0# (27,0#)	21,3# (21,3#)	16,9# (16,9#)	13,2# (13,2#)					
- 10,5	26,1# (26,1#)	20,2# (20,2#)	15,7# (15,7#)	11,7# (11,7#)						
- 12,0										

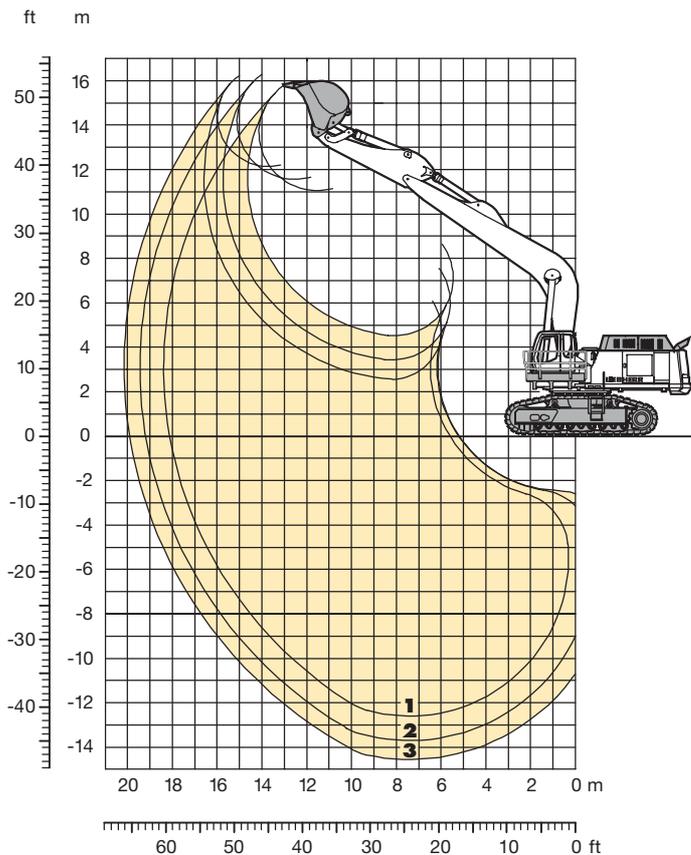
The load values are quoted in tons (t) on the backhoe bucket's load hook, and may be swung 360° on firm and even ground. Values quoted in brackets apply to the undercarriage when in longitudinal position. Capacities are valid for 600 mm wide double grouser pads. Indicated loads are based on ISO 10567 standard and do not exceed 75 % of tipping or 87 % of hydraulic capacity (indicated via #). Maximum load for the backhoe bucket's lifting eye is 27 t. Without bucket (3,90 m³/2,70 m³*), the lift capacities will increase by 4530 kg/3190 kg*, without bucket cylinder, link and lever they increase by an additional 1900 kg/1100 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.

* Just for stick 6,80 m

Backhoe Attachment

with Gooseneck Boom 11,00 m



Digging envelope

		1	2	3*
Stick lengths	m	4,50	5,60	6,80
Max. digging depth	m	12,50	13,60	14,45
Max. reach at ground level	m	18,15	19,20	20,00
Max. dump height	m	11,25	11,80	12,65
Max. teeth height	m	16,05	16,60	16,80
Digging force SAE	kN	346	300	273
	t	35,3	30,6	27,8
Digging force ISO	kN	367	316	284
	t	37,4	37,4	29,0
Breakout force SAE	kN	550	550	405
	t	56,1	56,1	41,3
Breakout force ISO	kN	590	590	445
	t	60,2	60,2	45,4

* with stick 6,80 m with R 974 B Litronic[®] buckets

Operating Weight and Ground Pressure

Operating weight includes basic machine with heavy counterweight with gooseneck boom 11,00 m, stick 5,60 m and bucket 2,90 m³.

Undercarriage		HD
Pad width	mm	600 750
Weight	kg	122200 123400
Ground pressure	kg/cm ²	1,83 1,48

Buckets

Cutting width	mm	1300 ¹⁾	1300 ¹⁾	1400 ¹⁾	1600 ¹⁾	1200 ²⁾	1350 ²⁾	1550 ²⁾
Capacity ISO 7451	m ³	2,90	3,50	3,90	4,70	2,20	2,70	3,20
Weight	kg	3720	4080	4530	4970	2840	3060	3310
Suitable for material up to a specific weight of								
with stick 4,50 m	t/m ³	2,00	1,80	1,50	1,20	-	-	-
with stick 5,60 m	t/m ³	1,80	1,50	1,20	-	-	-	-
with stick 6,80 m	t/m ³	-	-	-	-	1,80	1,50	1,20

¹⁾ Medium-duty bucket with teeth size V 69 SD (appropriate for materials up to classification 5, according to VOB, Section C, DIN 18300)

²⁾ Bucket R 974 B Litronic[®] with teeth size V 61 SD

Lift Capacities

with Gooseneck Boom 11,00 m

Stick 4,50 m

Height (m)	Radius of load from centerline of machine (m)									
	4,5	6,0	7,5	9,0	10,5	12,0	13,5	15,0	16,5	18,0
12,0							5,5# (5,5#)			
10,5							5,5# (5,5#)	5,5# (5,5#)		
9,0							5,7# (5,7#)	5,4# (5,4#)		
7,5						6,8# (6,8#)	6,1# (6,1#)	5,6# (5,6#)		
6,0				10,7# (10,7#)	8,7# (8,7#)	7,4# (7,4#)	6,5# (6,5#)	5,9# (5,9#)	5,6# (5,6#)	
4,5				12,2# (12,2#)	9,7# (9,7#)	8,1# (8,1#)	7,0# (7,0#)	6,2# (6,2#)	5,7# (5,7#)	
3,0				13,6# (13,6#)	10,7# (10,7#)	8,8# (8,8#)	7,5# (7,5#)	6,6# (6,6#)	6,0# (6,0#)	
1,5				14,8# (14,8#)	11,6# (11,6#)	9,5# (9,5#)	8,0# (8,0#)	6,9# (6,9#)	6,1# (6,2#)	
0			20,7# (20,7#)	15,7# (15,7#)	12,4# (12,4#)	10,1# (10,1#)	8,4# (8,4#)	7,2# (7,2#)		
- 1,5			21,0# (21,0#)	16,2# (16,2#)	12,9# (12,9#)	10,5# (10,5#)	8,7# (8,8#)	7,1# (7,4#)		
- 3,0	13,0# (13,0#)	20,3# (20,3#)	20,9# (20,9#)	16,3# (16,3#)	13,1# (13,1#)	10,4# (10,7#)	8,5# (8,9#)	7,0# (7,4#)		
- 4,5	19,9# (19,9#)	26,3# (26,3#)	20,4# (20,4#)	16,1# (16,1#)	13,0# (13,0#)	10,4# (10,6#)	8,5# (8,8#)			
- 6,0	27,7# (27,7#)	24,7# (24,7#)	19,4# (19,4#)	15,5# (15,5#)	12,5# (12,5#)	10,2# (10,2#)	8,2# (8,2#)			
- 7,5	29,2# (29,2#)	22,4# (22,4#)	17,8# (17,8#)	14,3# (14,3#)	11,5# (11,5#)	9,1# (9,1#)				
- 9,0	24,5# (24,5#)	19,1# (19,1#)	15,3# (15,3#)	12,2# (12,2#)	9,5# (9,5#)					
- 10,5		14,2# (14,2#)	11,2# (11,2#)	8,2# (8,2#)						
- 12,0										

Stick 5,60 m

Height (m)	Radius of load from centerline of machine (m)									
	4,5	6,0	7,5	9,0	10,5	12,0	13,5	15,0	16,5	18,0
12,0										4,4# (4,4#)
10,5										4,3# (4,3#)
9,0										4,5# (4,5#)
7,5									5,1# (5,1#)	4,7# (4,7#)
6,0								6,4# (6,4#)	5,6# (5,6#)	5,1# (5,1#)
4,5							10,8# (10,8#)	8,7# (8,7#)	7,2# (7,2#)	6,2# (6,2#)
3,0							12,4# (12,4#)	9,8# (9,8#)	8,0# (8,0#)	6,8# (6,8#)
1,5							18,6# (18,6#)	13,8# (13,8#)	10,8# (10,8#)	8,8# (8,8#)
0							20,0# (20,0#)	15,0# (15,0#)	11,7# (11,7#)	9,5# (9,5#)
- 1,5							13,3# (13,3#)	20,8# (20,8#)	15,8# (15,8#)	12,4# (12,4#)
- 3,0	11,0# (11,0#)	17,8# (17,8#)	21,1# (21,1#)	16,2# (16,2#)	12,8# (12,8#)	10,4# (10,4#)	8,4# (8,6#)			
- 4,5	16,2# (16,2#)	23,4# (23,4#)	20,9# (20,9#)	16,3# (16,3#)	13,0# (13,0#)	10,3# (10,5#)	8,3# (8,7#)	6,7# (7,2#)		
- 6,0	22,2# (22,2#)	26,6# (26,6#)	20,3# (20,3#)	16,0# (16,0#)	12,8# (12,8#)	10,3# (10,4#)	8,3# (8,5#)	6,8# (6,8#)		
- 7,5	29,4# (29,4#)	24,8# (24,8#)	19,2# (19,2#)	15,2# (15,2#)	12,2# (12,2#)	9,8# (9,8#)	7,8# (7,8#)			
- 9,0	29,7# (29,7#)	22,2# (22,2#)	17,3# (17,3#)	13,8# (13,8#)	10,9# (10,9#)	8,5# (8,5#)				
- 10,5	24,2# (24,2#)	18,4# (18,4#)	14,4# (14,4#)	11,3# (11,3#)	8,5# (8,5#)					
- 12,0		12,6# (12,6#)	9,5# (9,5#)							

Stick 6,80 m

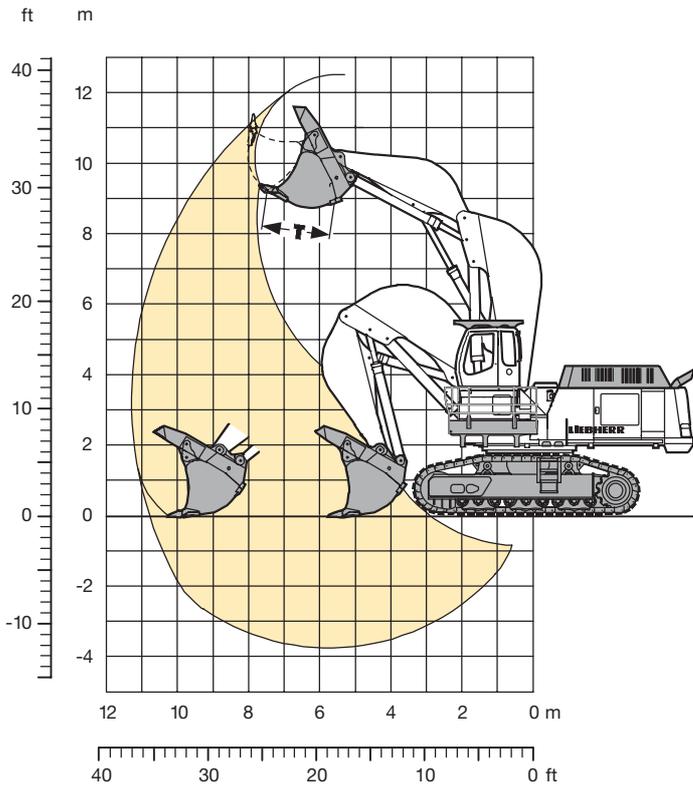
Height (m)	Radius of load from centerline of machine (m)									
	4,5	6,0	7,5	9,0	10,5	12,0	13,5	15,0	16,5	18,0
12,0										5,6# (5,6#)
10,5										5,5# (5,5#)
9,0										5,6# (5,6#)
7,5								6,0# (6,0#)	5,8# (5,8#)	5,7# (5,7#)
6,0								6,9# (6,9#)	6,4# (6,4#)	6,0# (6,0#)
4,5								8,6# (8,6#)	7,6# (7,6#)	6,9# (6,9#)
3,0								17,6# (17,6#)	13,7# (13,7#)	11,2# (11,2#)
1,5								20,0# (20,0#)	15,4# (15,4#)	12,4# (12,4#)
0								21,9# (21,9#)	16,8# (16,8#)	13,5# (13,5#)
- 1,5		15,3# (15,3#)	23,1# (23,1#)	17,9# (17,9#)	14,4# (14,4#)	11,9# (11,9#)	10,2# (10,2#)	8,8# (8,8#)	7,6# (7,8#)	6,3# (7,0#)
- 3,0	11,7# (11,7#)	18,5# (18,5#)	23,8# (23,8#)	18,6# (18,6#)	15,0# (15,0#)	12,5# (12,5#)	10,5# (10,6#)	8,8# (9,2#)	7,4# (8,0#)	
- 4,5	15,9# (15,9#)	22,8# (22,8#)	24,1# (24,1#)	19,0# (19,0#)	15,3# (15,4#)	12,4# (12,8#)	10,2# (10,8#)	8,6# (9,3#)	7,3# (8,0#)	
- 6,0	20,6# (20,6#)	28,1# (28,1#)	23,8# (23,8#)	18,9# (18,9#)	15,1# (15,4#)	12,2# (12,8#)	10,1# (10,8#)	8,5# (9,2#)		
- 7,5	26,3# (26,3#)	29,7# (29,7#)	23,0# (23,0#)	18,5# (18,5#)	15,1# (15,1#)	12,3# (12,6#)	10,2# (10,5#)	8,7# (8,7#)		
- 9,0	33,2# (33,2#)	27,6# (27,6#)	21,6# (21,6#)	17,4# (17,4#)	14,3# (14,3#)	11,8# (11,8#)	9,6# (9,6#)			
- 10,5	32,6# (32,6#)	24,6# (24,6#)	19,4# (19,4#)	15,6# (15,6#)	12,7# (12,7#)	10,1# (10,1#)				
- 12,0	26,1# (26,1#)	20,0# (20,0#)	15,8# (15,8#)	12,5# (12,5#)	9,5# (9,5#)					

The load values are quoted in tons (t) on the backhoe bucket's load hook, and may be swung 360° on firm and even ground. Values quoted in brackets apply to the undercarriage when in longitudinal position. Capacities are valid for 600 mm wide double grouser pads. Indicated loads are based on ISO 10567 standard and do not exceed 75 % of tipping or 87 % of hydraulic capacity (indicated via #). Maximum load for the backhoe bucket's lifting eye is 27 t. Without bucket (3,90 m³/2,70 m³*), the lift capacities will increase by 4530 kg/3190 kg*, without bucket cylinder, link and lever they increase by an additional 1900 kg/1100 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.

* Just for stick 6,80 m

Shovel Attachment



Digging Envelope

Max. reach at ground level	10,80 m
Max. dump height	8,90 m
Max. crowd length	4,50 m
Bucket opening width T	1900 mm
Max. crowd force SAE	750 kN/76,5 t
Max. crowd force at ground level SAE	550 kN/56,1 t
Max. breakout force SAE	550 kN/56,1 t

Operating Weight and Ground Pressure

Operating weight includes basic machine with shovel attachment and bottom dump bucket 7,00 m³, level II.

Undercarriage		HD-S	
Pad width	mm	600	750
Weight	kg	123800	125000
Ground pressure	kg/cm ²	1,86	1,47

Bottom Dump Bucket

Cutting width SAE	mm	2500 ¹⁾	2500 ¹⁾	2900 ¹⁾	2900 ¹⁾	2900 ¹⁾	3200 ²⁾
Capacity SAE	m ³	5,70	5,70	7,00	7,00	7,70	10,50
Weight	kg	10600	11200	10500	10900	11200	11200
Suitable for material up to a specific weight of	t/m ³	2,20	2,20	1,80	1,80	1,65	1,20
Wear kit level		II	III	I	II	I	-

¹⁾ Bottom dump bucket with Delta cutting edge and teeth V 69 RYL

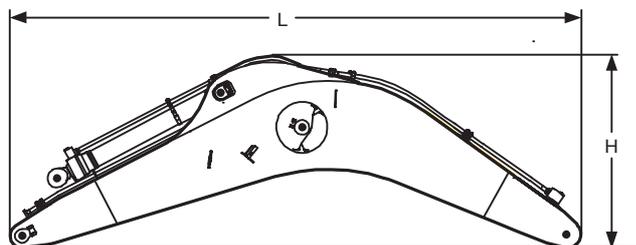
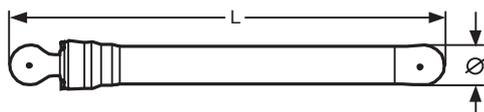
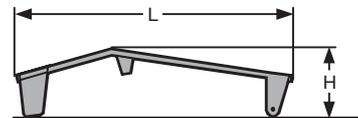
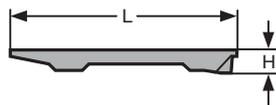
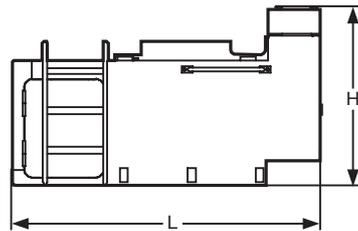
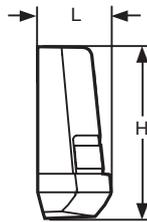
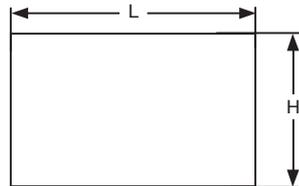
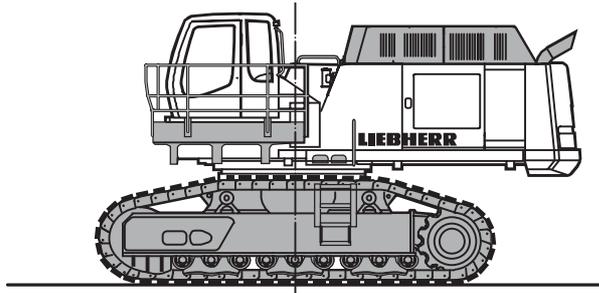
²⁾ Coal bottom dump bucket with straight cutting edge and teeth size V 61 RYL

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

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

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

Component Dimensions and Weights



Basic Machine (with Catwalks)

Track pads	mm	600	750
Weight with counterweight 19000 kg	kg	89140	90330

Catwalks and Railings (Wooden Crate)

L Length	mm	3500
H Height	mm	2400
Width	mm	1900
Weight	kg	1800

Counterweight

L Length	mm	900	900*
H Height	mm	1800	1800*
Width	mm	4050	4050*
Weight	kg	19020	22000*

* only with 11,00 m gooseneck boom

Cab Elevation

L Length	mm	1950
H Height	mm	1130
Width	mm	1250
Weight	kg	600

Protective Grid Up

L Length	mm	1730
H Height	mm	185
Width	mm	950
Weight	kg	30

Front Window Screen

L Length	mm	1970
H Height	mm	500
Width	mm	970
Weight	kg	45

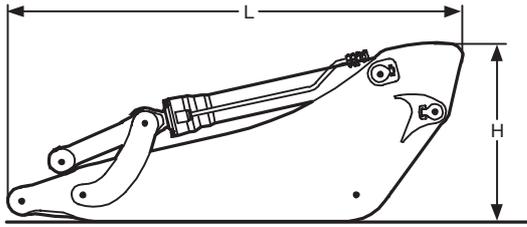
Hoist Cylinder (two)

L Length	mm	3300
Ø Diameter	mm	400
Weight	kg	2 x 1330

Gooseneck Boom with Stick Cylinder

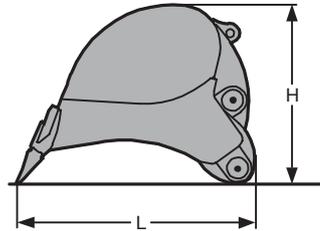
Boom length	m	7,80	9,20	11,00
L Length	mm	8200	9600	11400
H Height	mm	2800	2800	3250
Width	mm	1600	1600	1600
Weight	kg	13345	14285	15810

Component Dimensions and Weights



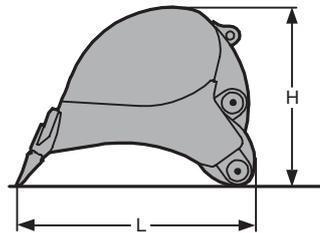
Stick with Bucket Cylinder

Stick length	m	3,40	4,50	5,60	6,80
L Length	mm	4800	5700	6800	8000
H Height	mm	1850	1650	1550	1400
Width	mm	945	945	945	945
Weight	kg	7400	7730	7885	6600



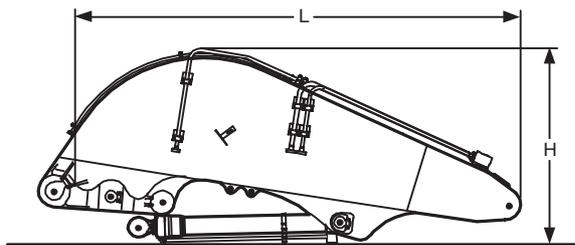
Backhoe Buckets

Cutting width	mm	1300	1300	1400	1600	1900	1800	2100
Capacity	m ³	2,90	3,50	3,90	4,70	5,20	5,50	6,00
L Length	mm	2700	2900	2900	2900	3000	2900	3000
H Height	mm	2100	2250	2250	2250	2250	2250	2250
Width	mm	1350	1350	1450	1650	1900	1850	2150
Weight	kg	3720	4080	4530	4870	6200	5280	6680



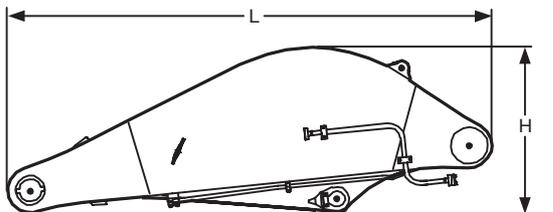
Backhoe Buckets

Cutting width	mm	2000	2300	2200	2400	2600	2800	2800
Capacity	m ³	6,20	6,70	7,00	7,70	8,50	9,30	10,00
L Length	mm	2900	3000	2900	2900	2900	2900	3000
H Height	mm	2250	2250	2250	2250	2250	2250	2250
Width	mm	2050	2350	2250	2450	2650	2850	2850
Weight	kg	5700	7030	6050	6310	6650	6800	6540



Shovel Boom

L Length	mm	5800
H Height	mm	2400
Width	mm	1800
Weight without crowd cylinder	kg	11090
Weight crowd cylinder	kg	2 x 563



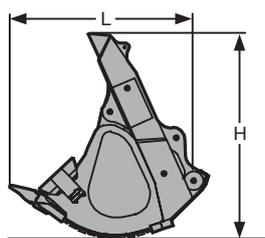
Shovel Stick

L Length	mm	4350
H Height	mm	1500
Width	mm	1900
Weight	kg	6130



Shovel Bucket Cylinder (two)

L Length	mm	3350
Ø Diameter	mm	300
Weight	kg	2 x 810



Bottom Dump Buckets

Cutting width	mm	2500	2900	2900	3200
Capacity	m ³	5,70	7,00	7,70	10,50
L Length	mm	2800	2800	2850	3000
H Height	mm	2900	2900	2950	3100
Width	mm	2500	2900	2900	3200
Weight					
Wear kit level I	kg	-	10500	10900	11200
Wear kit level II	kg	10600	11200	-	-
Wear kit level III	kg	11200	-	-	-

Equipment



Undercarriage

	S	O
Three track guide per track	•	
Integrated travel drive	•	
Digging locks	•	
Different undercarriage versions		•
Different track pad width		•



Uppercarriage

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



Hydraulics

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



Engine

	S	O
Direct injection	•	
Turbo charger	•	
Air filter with pre-cleaner, main and safety element	•	
Air filter with automatic dust ejector	•	
Automatic idling	•	
Main switch for electric circuit	•	
Cold start aid	•	
Fuel pre-heater		•



Operator's Cab

	S	O
Profile and deep drawn component	•	
Tinted side windows	•	
Armored windshield	•	
Door with sliding window	•	
Washer and wiper	•	
6-way adjustable cloth suspension seat	•	
Seat and consoles independently adjustable	•	
Coat hook	•	
Dome light	•	
Sun blinds	•	
Radio installation prep-kit	•	
Removable handle for travel pedals	•	
Cigar lighter and ashtray	•	
Removable custom floor mat	•	
Storage and literature tray	•	
Digital instrumentation	•	
Digital instruments for oil temp. engine RPM and oil pressure	•	
Digital hour meter visible from outside	•	
Automatic air conditioning system	•	
AM/FM stereo radio w/cassette		•
Air power seat adjustment with heating		•
Warning beacon		•
Additional flood lights		•



Attachment

	S	O
Cylinders with shock absorber	•	
Sealed pivots	•	
Two flood lights on the boom	•	
Bucket mounted 27 t lifting eye	•	
Automatic lubrication system Lincoln "Centromatic" for attachment and swing ring	•	
Safety check valves		•
Overload warning device		•
Hydraulic quick change tool adapter		•
Liebherr equipment program		•
Special buckets		•
Cylinder – rod protection		•

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.

2.SAFETY INFORMATION

Working with an excavator can be dangerous, it could result in injury or death if proper precautions are not taken! **WE URGE YOU TO READ THIS MANUAL CAREFULLY!** This safety information is provided to operators and maintenance mechanics to ensure the safe operation and maintenance of the excavator. It is essential that you read and familiarize yourself with this information, which explains safety requirements and precautions and specific hazards of which you should be aware. This also applies to any personnel which might be working on the machine only occasionally, such as during set up or maintenance.

- Careful adherence to these safety guidelines will permit safe operation and maintenance and potentially prevent personal injury to yourself and others, and possible damage to the excavator.
- Important safety notes such as DANGER, CAUTION or NOTE are used throughout this manual to emphasize important or critical instructions.

In this manual, DANGER, CAUTION or NOTE are defined as follows :



Denotes an extreme intrinsic hazard which could result in a high probability of death or serious injury if proper precautions are not taken.



Denotes a reminder of safety practices or directs attention to unsafe practices if proper precautions are not taken.

NOTE

NOTE describes operation and maintenance procedures which should be followed to keep your excavator operation and to insure long machine life and/or to facilitate certain procedures.

In addition to these instructions you must follow the safety regulations applicable to your work environment and job site and any federal, state and local safety requirements. (All model excavators must also follow local and federal highway regulations).

For EC countries, guidelines 89 / 655 : EWG contain the minimum safety guidelines for users.

DESTINED USE

The excavator with the standard backhoe, grapple or bucket attachment may only be used to loosen, pick up, move, load and dump soil, gravel, rock, or other material and to load trucks, barges, conveyor belts, or rock crushing systems.

Special guidelines are applicable for machines used for lifting applications and special safety devices must be installed.

Any other use above and beyond the applications described above, such as breaking out rock or demolishing buildings, pounding in posts etc. requires special attachments and safety devices.

If the machine is exposed to the risk of falling down objects during operation, the cab of the machine must be fitted with a safety device according to the FOPS prescriptions.

Transporting personnel or loads etc. is not considered destined use and is therefore prohibited. The manufacturer / dealer is not responsible for any resulting damage. Any risk must be carried by the user himself.

Destined use is considered part of observing and adhering to all regulations and inspection and maintenance guidelines given in this Operation and Maintenance Manual.

GENERAL SAFETY INFORMATION

- Study the Operation and Maintenance Manual before operating or working on the excavator. Make sure that you have additional information for special attachments of your machine, read it and understand it!
- Allow only authorized personnel informed about the safety rules to operate, service or repair the excavator. Make sure to observe any minimum applicable age requirement.
- Allow only properly trained personnel to operate or work on the excavator, make sure to clearly specify the person who is responsible for set up, maintenance and repairs.
- Make sure the operator knows his responsibility regarding the observance of traffic regulations and permit him to refuse any unsafe instructions given by a third person.
- Any persons still in training should only operate or work on the machine under the supervision and guidance of an experienced person.
- Check and observe any person working or operating the excavator periodically and regularly, if they observe safety instructions and guidelines given in the Operation and Maintenance Manual.
- Wear proper work clothing when operating or working on the excavator. Rings, watches, bracelets and loose clothing such as ties, scarves, unbuttoned or unzipped shirts and jackets are dangerous and could cause injury! Wear proper safety equipment, such as safety glasses, safety shoes, hard hats, work gloves, reflector vests and ear protection.
- Consult your employer or supervisor for specific safety equipment requirements and safety regulations on the job site.
- Always tilt up the safety lever before leaving the operator's seat.
- Do not carry tools, replacement parts or other supplies while climbing on or off the excavator. Never use the steering column, control levers or joysticks as handholds.
- Never jump off the excavator, climb on and off the excavator using only the steps, rails and handles provided.
When climbing on or off the excavator, use both hands for support and face the machine.
- If needed, use the front window as an escape hatch.
- If no other guidelines are given, perform maintenance and repairs utilizing the following precautions :
 - Park excavator on firm and level ground. Rest the attachment on the ground.
 - Place all control in neutral position and raise the safety lever.
 - Turn the engine off and remove the ignition key.
- Before working on the hydraulic circuit, move all joysticks and pedals with the ignition key in contact position and the safety lever tilted down to relieve the servo pressure and the remaining pressures in the different main circuits. In addition, relieve the pressure in the hydraulic tank as described in the Operation and Maintenance Manual.
- Secure all loose parts on the excavator.
- Never operate the excavator without a complete walk around inspection. Check if all warning decals are on the machine and if they are all legible.
- Observe all danger and safety guidelines.
- For certain special applications, the excavator must be equipped with specific safety equipment. Use the excavator only, if they are installed and functioning properly.
- Never perform any changes, additions or modifications on the machine, which could influence the safety, without obtaining the written permission from the manufacturer. This also applies to the installation and adjustment of safety devices and safety valves as well as to any welding on load carrying parts.
It is forbidden to repair the cab.
- Do not install any equipment or attachments made by other manufacturers or any which are not specifically authorized by LIEBHERR for installation without first obtaining the written permission from LIEBHERR. LIEBHERR will issue any required technical documentation for approved installations.
- Should the electrical circuit be modified or additional components be installed, so the modification must be performed according to the national standards and safety regulations (such as OSHA per the USA). The installation must be certificated by an approved organization and a copy of the certification has to be sent to the LIEBHERR company.

CRUSHING AND BURN PREVENTION

- Never work underneath the excavator unless it is safely resting on the ground and / or is properly blocked and supported.
- Never use damaged or insufficient wire ropes, slings or chains. Always wear gloves when handling wire ropes.
- Never reach into bores during attachment installation or removal. Never align bores with your fingers or hands. Use proper alignment tools when installing, changing or servicing attachments by qualified mechanics
- Keep objects away from the radiator fan. Rotating fans will swirl and throw out objects, which can become very dangerous and cause severe injury to yourself and others.
- Avoid contact with any components containing coolant.
At or near operating temperature, the engine coolant is hot and under pressure and could cause severe burns.
- Check the coolant level only after the radiator cap is cool enough to touch. Remove the radiator cap slowly to relieve pressure .
- Do not allow your skin to come into contact with hot oil or components containing hot oil. At or near operating temperature, engine and hydraulic oil is hot and can be under pressure.
- Always wear safety glasses and protective gloves when handling batteries. Keep sparks or open flames away!
- Never permit anyone to hand guide the bucket or grapple into position.
- When working in the engine area, make sure the top covers and side doors are properly secured or closed with the appropriate supports.
- Never work underneath or on the excavator unless it is properly blocked and supported.

FIRE AND EXPLOSION PREVENTION

- Always turn off the engine while refuelling the excavator.
- Never smoke or allow an open flame in refuelling areas or where batteries are being charged, or where batteries or flammable materials are stored.
- Never leave machine unattended while fuelling. During this operation, no one but the employee in charge of refuelling is allowed to stay on the excavator.
- Always start the engine as described in the Operation and Maintenance Manual.
- Check the electrical system regularly and frequently.

All defects, such as loose connections, burnt out fuses and bulbs, burnt or damaged cables must be repaired immediately by a licensed electrician or specially trained personnel.

- Never store flammable fluids on the machine except in storage tanks intended for the excavator's operation.
- Inspect all components, lines, tubes and hoses for oil and fuel leaks and / or damage.
Replace or repair any damaged components immediately.
Any oil, which escapes from leaks, can easily cause a fire.
- Be certain that all clamps, guards and heat shields are installed. These components prevent vibration, rubbing, chafing and heat build-up. Install tie wraps to fasten hoses and wires, as required.
- Cold start ether is extremely flammable. Do not use together with preheat. Use ether only in ventilated areas and as directed. Never use it near heat sources or open flames, do not permit anybody to smoke.
- Know the location of the excavator's fire extinguisher and be familiar with its operation. Make sure you know your local fire regulations and fire reporting procedures.
- A fire extinguisher can be attached inside the operator's cab, using the four threaded holes provided in the rear left support of the cab.

MACHINE START UP SAFETY

- Before excavator start up, perform a thorough walk around inspection.
- Visually inspect the excavator, look for loose bolts, cracks, wear, any leaks and any evidence of vandalism.
- Never start or operate an unsafe excavator.
- Report all defects to your foreman or supervisor and make sure they are corrected immediately.
- Make sure all covers and doors are closed and all warning decals are on the machine.
- Make sure all windows, as well as inside and outside mirrors are clean, and secure all doors and windows to prevent any unintentional movement.
- Be certain that the area surrounding the excavator is free of other personnel, and that no one is working on or under the excavator before starting the engine.
- Covers and boxes locks have to be unlocked, to facilitate the fight against fire in case of.
- Proceed with the same precaution while climbing up and down the cab, as for the ascension of the machine
- Keep ladders, footsteps, handles and handrail in clean condition and always free them from mud, oil, grease, ice, snow or any other obstacles.
- To guarantee an easy opening of the cab door in all weather conditions, coat the rubber seals around the door with silicon oil or talcum every two months and more often if necessary. Regularly grease the hinges and lock of the cab door as well the fixing device of the door in opened position.

During maintenance works, always wear safety glasses and proper protective clothes..

- To climb up or down the cab, the excavator must be parked on firm, flat and level ground and the uppercarriage must be swung so to align ladders and steps on upper and undercarriage.
- Face the excavator when climbing up or down and always hold on to the machine at three points, i. e. keep the contact with the access components at the same time with two hands and one foot or with one hand and the two feet.
- As soon as you can reach the handle of the door with your free hand unlock it, and keeping yourself apart from the slewing range of the door, open the door before climbing up any more. Some external influences, and especially the wind, may make the opening of the door uneasy. For this reason, keep and guide the door all the way with your hand and lock it in its opened position, making sure it is securely fixed in this position, so it can not be slammed by the wind.

- If the weather conditions are bad, increase your attention to realise climbing or descent from the cab with a maximum of precautions, and do or let do the preliminaries operations of preparation which are necessary so you can move safely.
- With those conditions be especially vigilant.
- Go on climbing up, always holding yourself by three points, enter the cab and seat down to the seat
- If applying fasten the seat belt. Unlock the door using the unlocking lever and close the door holding it by the handle designed for this purpose. Only thereafter lower the safety lever and start the machine.
- It is essential to have your seat belt fastened if you want to operate the machine with the cab door opened.
Should the belt be missing on your machine, so you must compulsorily get one installed before you start working with opened cab door.
- After entering the cab, adjust the operator's seat and controls, the inside and outside mirror, the armrests and fasten and adjust the seat belt. Be certain that all controls can be reached comfortably.
- All noise protection devices on the machine must be functional during operation.

ENGINE START UP AND OPERATING SAFETY

- Before start up, check if all indicator lights and instruments are functioning properly, place all controls in neutral position and tilt the safety lever up.
- Before starting the engine, alert any nearby personnel that the excavator is being started by sounding the horn.
- Start the machine only when seated in the operator's seat, and with the seat belt fastened (if installed).
- If you have no other instructions, start the engine as outlined in the Operation and Maintenance Manual.
- Tilt the safety lever down and check all indicators, gauges, warning devices and controls for their proper indication.
- Start and operate the engine only in a well ventilated area. If necessary, open doors and windows.
Warm up the engine and hydraulic system to operating temperatures. Low engine and hydraulic oil temperatures can cause the excavator to be unresponsive.
- Check that all attachment functions are operating properly.
- Move the excavator slowly into an open area and check all travel functions for their proper operation, check travel and swing brakes, the steering function as well as the turn signals and lights.

MACHINE OPERATING SAFETY

- Familiarize yourself with job site rules. Be informed about traffic and hand signals and safety signs. Ask who is responsible for signalling.
Check your surrounding for any obstacles in the working and movement range, check the load carrying capacity of the terrain, and secure the job site to shield it from any public highway traffic.
Rope off the working area of the machine and install the necessary signs to forbid any non authorized person entering the area.
- Always keep a safe distance from overhangs, walls, drop offs, and unstable ground.
- Be alert of changing weather conditions, bad or insufficient visibility and of changing ground conditions.
- Be alert for utility lines, check the location of underground cables, gas and water lines, and work especially careful in that vicinity. If necessary and/ or if required, call local authorities to mark the location, and take precaution against contact with underground utilities.
- Keep sufficient distance to electrical lines. When working in the vicinity of high voltage electrical

lines, keep proper distance to assure that the attachment does not come close to the lines. **DANGER!** You must inform yourself about safe distances.

Preferably have the electrical lines de-energized (and lockout / tagged out according to the regulations applicable on the job-site) each time it is possible, and in any case if the closeness of the working area make it necessary.

- In case you do touch a high voltage line by accident, proceed as follows:
 - do not leave the machine,
 - move the machine, if possible, from the danger zone until you obtain sufficient distance,
 - 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.
 - 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, make sure that the attachments and equipment is secured properly to avoid accidents.
- When travelling on public roads, make sure to observe traffic regulations, and make sure that the machine meets federal and local public highway standards.
- Always turn on the lights if visibility is bad or if you are still working during dusk.
- Never allow other personnel on the excavator.
- Operate the excavator only while seated and with the seat belt fastened, if installed.
- Report any problems or needed repairs to your foreman or supervisor and make sure they are corrected immediately.
- Do not move the excavator until you are certain that no one is endangered by moving the excavator.
- On machines without negative brakes check the brake system before starting to work, as outlined in the Operation and Maintenance Manual.
- Never leave the operator's seat while the machine is still moving.
- Never leave the machine unattended (within view of machine), with the engine running.
- When moving the excavator, keep the uppercarriage in lengthwise direction and keep the load as close as possible to the ground.

- Prevent any working movements, which could tip the machine over. If the excavator begins to tip or slip on a grade, immediately lower the attachment and load to the ground and turn the excavator facing downhill.
If possible, always operate the excavator with the attachment positioned uphill or downhill, never sideways.
- Always travel slowly on rough or slippery ground and on slopes, and on loose soils.
- Always travel downhill at permissible speed, so you don't lose control over the machine. The engine must run at nominal speed, use only the foot pedals to brake and slow down the machine.
Never shift during down hill travel, always shift to a lower gear before travelling downhill.
- Load an occupied truck only if all safety requirements are fulfilled, notably in order to protect the truck operator.
- For demolition work, clearing, crane operation, etc. always use the appropriate protection device designed for this specific application.
- If operating in visually obstructed terrain or whenever necessary, have another person guide you. Always have only one person signal you.
- Allow only experienced persons to attach loads or to guide operators. The guide must be visible by the operator and / or must be in voice contact with him.
- Depending on the attachment combination, it is possible for the bucket teeth to hit the cab, the cab protection or the boom cylinders. Be very careful when the bucket teeth get in this range to prevent any damage.
- 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).
- 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.

MACHINE PARKING SAFETY

- Park the excavator only on firm and level ground.
If it becomes necessary to park the machine on a grade, properly block and secure it with wedges.
- Lock the uppercarriage with the lock pin (if lock pin is installed).
- Lower the attachments to the ground and anchor the bucket lightly in the ground.
- Bring all operating levers in neutral position and engage the travel and swing brakes.
- Turn the engine off as outlined in the Operation and Maintenance Manual and raise the safety lever before you leave the operator's seat.
- Proceed with the same precaution while climbing up and down the cab, as for the ascension of the machine
- Before climbing down the cab, you must make sure the machine is parked on a flat, firm and level ground and the ladders and steps are aligned on upper and undercarriage.
- Then open the cab door and lock it in opened position and make sure it is securely fixed in this position.
Be aware of difficult weather conditions and anticipate their possible consequences. The wind for example could slam the cab door. If necessary unfasten the seat belt.
- Carefully begin climbing down, facing the machine and always holding the contact at three points, keeping the contact with the access components at the same time with two hands and one foot or with one hand and the two feet, until you reach the height where you can close the cab door in the best conditions, keeping yourself apart from its slewing range. Unlock the door using the unlocking lever designed for this purpose and close the door guiding it by the handle.
If you want so lock the door and take away the key.
- Slowly and carefully go down to the floor.
- Lock the cab, covers and boxes, remove all keys and secure the excavator against vandalism, unauthorized use, and any attractive nuisance.
- Before loading, secure the uppercarriage with the undercarriage with the lock pin (if lock pin is installed).
- Align the machine with the loading ramp.
- Attach the manual control levers to the foot pedals for sensitive control.
- Have another person guide and signal the operator.
- Have blocks or wedges ready to block the machine, if necessary, to prevent the machine from rolling backwards. Be careful to crushing risks when handling and applying these wedges. Keep clear of wheels and do not attempt to chock or block the machine before its complete standstill.
- Retract the attachment as far as possible and lower the attachment as close as possible to the loading surface and carefully drive up the ramp and onto the flat bed trailer.
- When the excavator is on the trailer, release the uppercarriage lock pin, turn the uppercarriage back and lower the attachment.
If the backhoe attachment is attached, tilt the stick and bucket in and relock the uppercarriage (if lock pin is installed).
- Carefully secure the uppercarriage and other parts with chains, wedges and blocks to prevent slipping.
- Release the hydraulic pressure, remove the ignition key, raise the safety lever, close and lock the cab and close and secure all other doors and leave the machine.
- Carefully check out the transport route. Make sure that width, height and weight allowances are within the permitted limits.
- Check that there is enough clearance underneath all bridges, underpasses, utility lines, and in tunnels.
- During the unloading procedure, proceed with the same care and caution as during the loading procedure. Remove all chains and wedges. Start the engine as outlined in the Operation and Maintenance Manual. Carefully drive off the loading platform. Keep the attachment as close as possible to the ground level. Have another person guide and signal you.

MACHINE TRANSPORTING SAFETY

- Use only suitable transporting and lifting devices with sufficient capacity.
- Park the machine on firm and level ground and block the chains or wheels.
- If necessary, remove part of the attachments during transport.
- When loading the machine on a flatbed trailer or railroad car, be sure that the loading ramp incline is less than 30° and covered with wooden planks to prevent skidding.
- Remove all mud, snow or ice from track components before moving up the ramp.

MACHINE TOWING SAFETY

- Observe the correct procedure: check the index in your Operation and Maintenance manual and refer to the appropriate section : "Towing the Excavator".
- Only tow the excavator if absolutely necessary, for example to remove it for repairs from a dangerous job site.
- Be sure all towing and pulling devices such as cables, hooks, and couplers are safe and adequate.
- Make sure that the cable or the towing rod are strong enough and are routed around the centre of the undercarriage or to the towing hook on the undercarriage, which is designated for this purpose. Be aware that any damage to the machine caused by towing is never covered by the manufacturer's warranty.
- Never allow anyone to stand near the cable when pulling or towing the excavator.
- Keep the cable tight and free of kinks.
- Engage travel slowly, and do not jerk. With a slack cable, the sudden impact of the load being towed could snap and break.
- Keep personnel out of area. If cable breaks while under stress, it could cause severe injury.
- During the towing procedure, keep within the required transport position, permissible speed and distance.
- After the towing procedure is completed, return the machine to its previous state.
- Proceed as outlined in the Operation and Maintenance Manual when putting the excavator back in service.

MACHINE MAINTENANCE SAFETY

- The machine may not be made unsafe when performing maintenance work. Never attempt maintenance procedures or repairs you do not understand.
- Check the Operator's and Maintenance Manual for service and maintenance intervals. Make sure you use only appropriate tools for all maintenance work.
- Refer to your Operator's and Maintenance Manual to see, who is authorized to perform certain repairs. The operator should only perform the daily / weekly maintenance procedures.
The remaining work may only be performed by especially trained personnel.
- Use only replacement parts corresponding to the technical requirements specified by the manufacturer. This is assured by using only original Liebherr replacement parts.

- Always wear proper work clothing when maintaining the excavator. Certain work may only be performed with a hard hat, safety shoes, safety glasses and gloves.
- During maintenance, do not allow unauthorized personnel to enter the maintenance area.
- Secure the maintenance area, as necessary.
- Inform the operator before any special or maintenance work. Make sure he knows the person, who is in charge of the work.
- If not otherwise noted in the Operation and Maintenance Manual, always make sure the excavator is parked on firm an level ground and the engine is turned off.
- During maintenance and service work, make sure you always retighten any loosened screw connections!
- If it is necessary to disconnect or remove any safety devices during set up, maintenance or repair, make sure that after completion of repairs, the safety devices are reinstalled and checked for proper function.
- Before any maintenance work and especially when working under the machine, make sure a "Do not operate" tag is attached to the starter switch. Remove the ignition key.
After end of maintenance works or repair, restart the machine according to the instructions "Machine start up", in this manual.
- Before any repairs or maintenance work, clean any oil, fuel and / or cleaning substances from any fittings and connections .
Don't use any harsh cleaners and use only lint free cloths.
- Use only non-flammable cleaning fluids to clean the machine.
- Any welding, torch or grinding work on the machine must be explicitly authorized. Written authorization is necessary for welding on carrying structures. Before any using a welder, torch or grinder, clean off any dust and dirt and remove any flammable materials from the surrounding area. Make sure the area is sufficiently ventilated.
Danger of Fire and Explosion!
- Before cleaning the machine with water or steam (high pressure cleaning) or other cleaning fluids, make sure that all openings, which , for safety and/ or functioning reasons should not be exposed to water / steam/ cleaners, are covered and / or masked off. Especially sensitive are electrical motors, control boxes and plug connectors.

- Make sure that the temperature sensors of the fire alarm and extinguishers system do not come in contact with the hot cleaning fluids, which could trigger the fire extinguishing system. Remove all coverings and masking material after completing the cleaning procedure. Then check all fuel lines, engine oil lines and hydraulic oil lines for leaks, loose connections, chafing and / or damage. Fix any problems immediately.
- 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
- Never employ high pressure cleaning apparatus during the two first months following machine delivery or repainting.
- Observe all product safety guidelines when handling oils, grease, and other chemical substances.
- Make sure service fluids and replacement parts are disposed of properly and in an environmentally sound manner.
- When using hot service fluids, be very careful. (They can cause severe burns and injury!).
- 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.
- Never try to lift heavy parts. Use appropriate lifting devices with sufficient load carrying capacity. When replacing or repairing parts or components, make sure they are mounted very carefully on lifting devices, to prevent any possible danger. Use only suitable and technically sound lifting devices, make sure that lifting tackle, wire cables, etc. has adequate load carrying capacity. Never position yourself, walk or work underneath suspended loads.
- Never use damaged lifting devices, or devices which are not sufficient to carry the load. Always wear gloves when handling wire cables.
- Ask only experienced personnel to attach loads and guide and signal the crane operator. The guide must be within the visibility range of the operator and / or must be in direct voice contact with the operator.
- When working overhead, use appropriate and safe ladders, scaffolding or other working platforms designated for that purpose. Never step on parts or components on the machine when maintaining or repairing items overhead. When working high above ground, make sure you are fitted with ropes and appropriate safety devices which will prevent a possible fall. Always keep handles, steps, railings, platforms and ladders free of dirt, snow and ice!
- When working on the attachments, for example when replacing the bucket teeth, make sure the attachment is supported properly. Never use metal on metal support!
- For safety reasons, never open and remove a track chain unless having previously totally released the pretension of the chain tensioning unit.
- Never work underneath the machine if it is raised or propped up with the attachment. The undercarriage must be supported with wooden blocks and supports.
- Always support the raised machine in such a way that any shifting to the weight change will not influence the stability. Do not support the machine with metal on metal support.
- Only qualified, especially trained personnel may work on travel gear, brake and steering systems.
- If it becomes necessary that the machine must be repaired on a grade, block the chains with wedges and secure the uppercarriage to the undercarriage with the lock pin.
- Only qualified, especially trained personnel may work on the hydraulic system.
- Never check for leaks with your bare hands, always wear gloves. Fluid escaping from a small hole can have enough force to penetrate the skin.
- Never loosen or remove lines or fittings before the attachment has been lowered to the ground and the engine has been turned off. Then turn the ignition key to contact position with tilted down safety lever, move all servo controls (joysticks and foot pedals) in both direction to release pressures. Then release the tank pressure as outlined in this Operation and Maintenance Manual.
- Always disconnect the battery cable before working on the electrical system or before any arc welding on the machine. Always disconnect the negative (-) cable first and reconnect it last.

- Check the electrical system regularly. Make sure that any problems, such as loose connections, burnt out fuses and bulbs, scorched or chafed cables are fixed immediately by an electrician or qualified personnel.
 - Use only Original fuses with the specified amperage. Never use a different size or stronger fuse than the original fuse.
 - On machines with electrical medium or high voltage systems:
 - If there is any problem with the electrical energy supply, turn the machine off immediately.
 - Follow established lockout / tag out procedures where applicable.
 - Any work on the electrical system may only be performed by a qualified electrician or qualified personnel under the guidance and supervision of an electrician, according to electro - technical regulations.
 - If any work is required on any parts which carry current, use a second person to turn off the main battery switch, if necessary. Rope the work area off with a safety rope or chain, and set up warning signs. Use only insulated tools.
 - When working on medium and high voltage components, shut off the voltage and connect the supply cable to the ground and ground the components, such as the condenser, with a grounding rod.
 - Check all disconnected parts if they are truly free of current, ground them and close them off quickly. Insulate any close-by, current carrying parts.
- Hoses and lines must be replaced if any of the following points are found during an inspection (see guidelines ISO 8331):
 - Damage on the external layer into the inner layer (such as chaffing, cuts and rips);
 - Brittleness of the outer layer (crack formation of the hose material);
 - Changes in shape, which differ from the natural shape of the hose or line, when under pressure or when not under pressure, or in bends or curves, such as separation of layers, blister or bubble formation, crushing or pliers.
 - Leaks;
 - Non observance of installation requirements;
 - Damage or deformation of hose fittings, which might reduce the strength of the fitting or the connection between hose and fitting;
 - Any movement of hose away from the fitting;
 - Corrosion on fittings, which might reduce the function or the strength of the fitting;
 When replacing hoses or lines, always use Original replacement parts.
 - Route or install the hoses and lines properly. Do not mix up the connections!
 - Always take care to avoid torsional strain when installing a new hose. On high pressure hydraulic hoses, the mounting screws must be first mounted on both hose ends (full flange or half clamp) and tightened only thereafter.

On high pressure hoses having one curved end, always tighten first the screws on the curved hose end and only then the screws on the straight hose end.

Install and tighten the hose clips that may be mounted on the hose middle only when the both hose ends are already tightened.

HYDRAULIC LINES AND HOSES

- Hydraulic lines and hoses may never be repaired!
- All hoses, lines and fittings must be checked daily, but at least every 2 weeks for leaks and any externally visible damage! Never check for leaks with your bare hands, use a sheet of paper or something else. Any damaged sections must be replaced immediately! Escaping oil can cause injuries and fires!
- Even if hoses and lines are stored and used properly, they undergo a natural aging process. For that reason, their service life is limited. Improper storage, mechanical damage and improper use are the most frequent causes of hose failures. Concerning the hoses, you must follow the safety regulations applicable to your work environment and job site and any federal, state and local safety requirements.
- Using hoses and lines close to the limit ranges of permitted use can shorten the service life (for example at high temperatures, frequent working cycles, extremely high impulse frequencies, multi shift or around the clock operations).
- Always install hoses so to avoid any friction with other hoses and parts.

We recommend to keep a distance between hose and other parts of at least one half of the hose outer diameter. Keep a minimum gap of 1/2 inch in any case.

After mounting a hose connecting two parts that are movable to each other, check during the return to service that the hose is not rubbing in the whole moving range.

Check daily that all flanges and covers are fixed correctly. It will prevent vibrations and damage during operation.

PROTECTION AGAINST VIBRATION

- Stress caused by vibration in mobile construction machinery is predominantly a result of the way in which it is operated. The following parameters have a particularly significant influence:
 - Terrain conditions: Unevenness and potholes;
 - Operational technique: Speed, steering, braking, control of the machine's operating elements during travel and during operation.
- The machine operators themselves are largely responsible for the actual stress caused by vibration as the operators determine speed, gear transmission, manner of handling and travel routes.

Thus, a wide range of different forms of vibrational stress are resulted for the same machine type.

Vibrational stress of the machine operator's body can be reduced by noting the following recommendations:

Select the correct machine, equipment and accessories for each respective application.

- Use a machine which features a suitable seat (thus, for earthmoving machines, e.g. hydraulic excavators, a seat which complies with EN ISO 7096).
- Ensure that the seat remains in good condition and adjust the seat as follows:
 1. Adjustment of the seat, and thus the vibrations being produced from the seat, should be carried out in relation to the weight and size of the operator
 2. Check the vibration absorption and adjustment mechanisms of the seat regularly and ensure that condition of the seat always adheres to the specifications of the seat manufacturer.
- Check the maintenance condition of the machine, in particular: tyre pressure, brakes, steering, mechanical connections, etc.
- Do not carry out steering, braking, acceleration and switching, or move or load the machine's working attachment, in jerky movements.
- Adapt the machine speed to the travel path to reduce vibrational stress:
 - Reduce the speed when negotiating rough terrain;
 - Travel around obstacles and avoid very rough terrain whenever possible.
- Ensure that the terrain over which the machine is being driven or operated is well maintained:
 - Remove large stones and obstacles;
 - Fill in ditches and holes;
 - Ensure that machines are on-hand for the preparation and upkeep of practical terrain

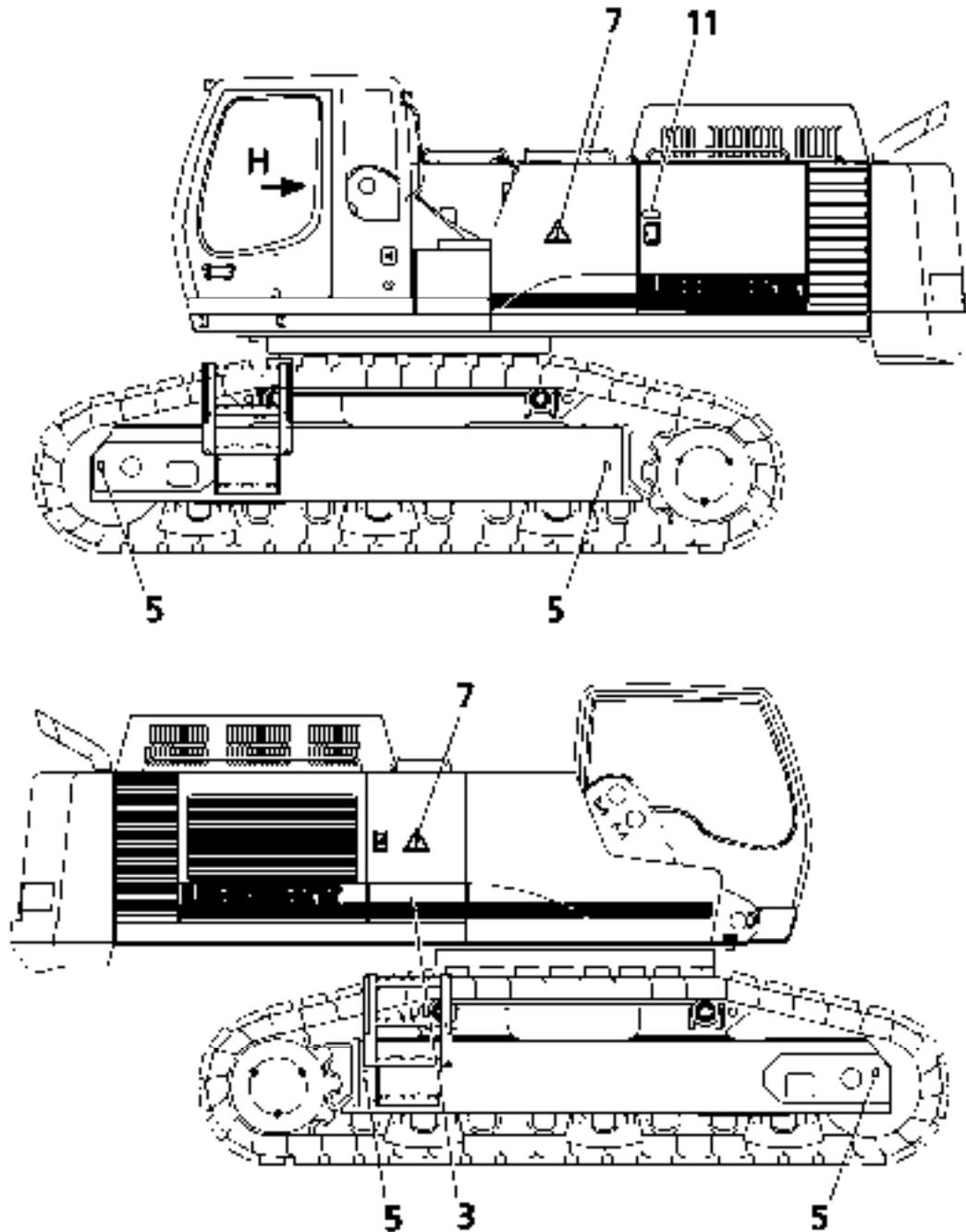
conditions and that sufficient time for this work is allowed for.

- Travel over longer distances (e.g. on public roads) with adequate (average) speed.
- For machines which are used primarily for travelling, use special auxiliary systems for the journeys (wherever available), allowing a vibration reduction for this application type.
Should these auxiliary systems not be available, regulate the speed so that a "vibrational build-up" of the machine is avoided.

SIGNS ON THE HYDRAULIC EXCAVATOR

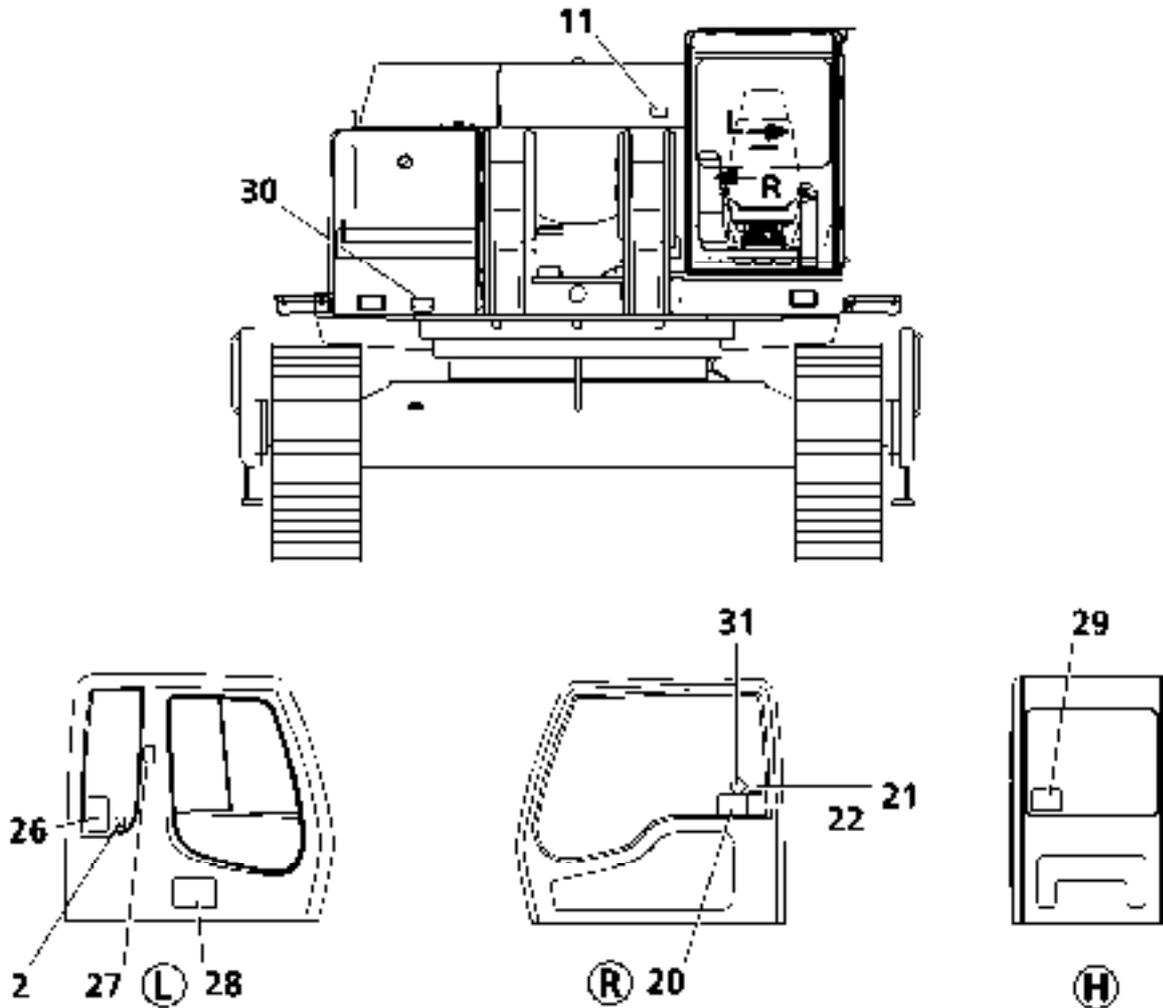
Your hydraulic excavator has several kinds of signs.

- **Warning Signs:** Warnings on accident risks with potentially serious or fatal injuries.
- **Notices:** Indicate specific points of control, maintenance and properties of the excavator.
- **Identification Tags**
Contents and location are described hereafter.
Order numbers are contained in the spare parts list



- 2 Notice Sound Power Level L WA
- 3 Notice External Start
- 5 Notice Latch Points

- 7 Warning Sign Danger Zone
- 10 Prohibition Sign



- 11 Warning Sign Engine Shut Down
- 20 Sign Control Symbols
- 21 Warning Sign Attachment
- 22 Notice Accident Prevention
- 26 Lifting capacity chart
- 27 Notice Safety Lever
- 28 Lubrication Chart
- 29 Notice Latching and Lifting Points
- 30 ID Tag Hydraulic Excavator
- 31 Notice Safety Belt



Sign 2 Sound Power Level L WA

Meaning: Indicates the sound power level of the hydraulic excavator to the surrounding area in dB(A).

(*) Value is given as an example.



Sign 3 External Start

Meaning: When jump starting the hydraulic excavator, observe the notices in the operating instructions precisely.



Sign 5 Latch Points

Meaning: Indicates the latch points on the hydraulic excavator.



Sign 7 Danger Zone

Meaning: It is prohibited to be and remain in any danger zone!



Sign 10 Prohibition Sign

Meaning: It is prohibited to enter the area designated.

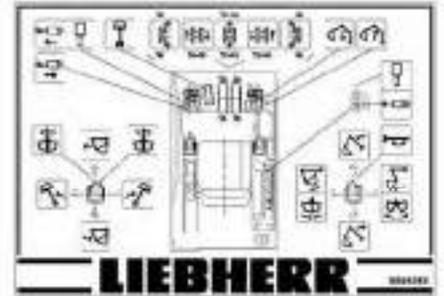
Sign 11 Engine Shut Down

Meaning: Open only when the engine is shut off!



Sign 20 Information about Control Symbols

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



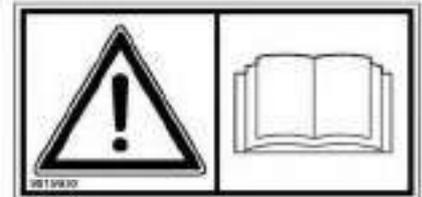
Sign 21 Attachment

Meaning: Attachment reaches up to the operator's cab!
Be aware of retracted attachments.



Sign 22 Accident Prevention

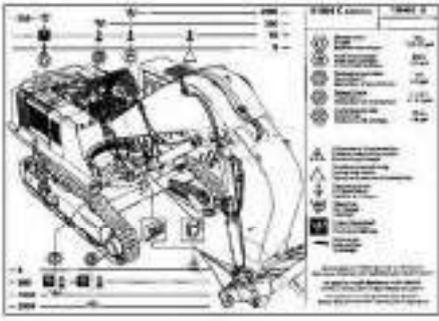
Meaning: When operating the hydraulic excavator, observe the printed prescriptions on accident prevention in the operating instructions precisely.



Sign 27 Safety Lever

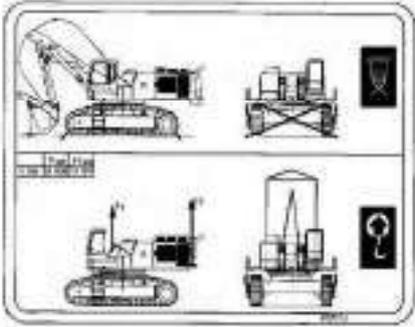
Meaning: Before leaving the operator's seat, pull the safety lever all the way up.





Sign 28 Lubrication chart

Meaning: See the lubrication chart of the machine on page 5.11.



Sign 29 Latch Points and Lifting Points

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



Sign 31 Seat Belt

Meaning: Before beginning to work with the machine, you must fasten the seat belt.



ID TAGS

ID Tag 30 Hydraulic Excavator

The ID tag contains the following information:

- Type
- Vehicle identification number
- Authorized Total Weight
- Year of manufacture
- Authorized Axle Load front
- Authorized Axle Load rear
- Engine output
- Maximum Travel Speed

3. CONTROLS AND INSTRUMENTATION

OPERATOR'S SEAT



Before adjusting the operator's seat and the joysticks, make sure that the safety lever (fig. 1) is in the uppermost position to avoid any unexpected movements of the hydraulic excavator.

Your hydraulic excavator comes equipped with a standard operator's seat (fig. 3) or optionally with a suspension seat (fig. 4).

ADJUSTMENT

Adjusting the operator's seat horizontally with respect to the 2 control panels is possible after lifting lever 1 (fig. 2)

Independent of this adjustment, the entire seat including the 2 control panels can be slid horizontally after lifting lever 2.

Adjusting the seating suspension to body weight is done via the outer ring of the rotary switch 5 (fig. 3) or via key 7 (fig. 4).

Adjusting the seat cushion angle and the seat height is done via levers 4a and 4b (fig.s 3 and 4).

- By lifting lever 4a the seat cushion in back can be tilted up or down
- By lifting lever 4b the seat cushion in front can be tilted up or down.

Adjusting the angle of the back rest is done via lever 6 (fig.s 3 and 4).

- Lift lever 6
- Move the back rest to the desired angle
- Release lever 6.

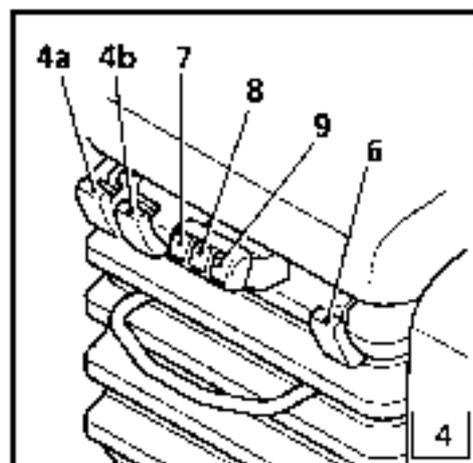
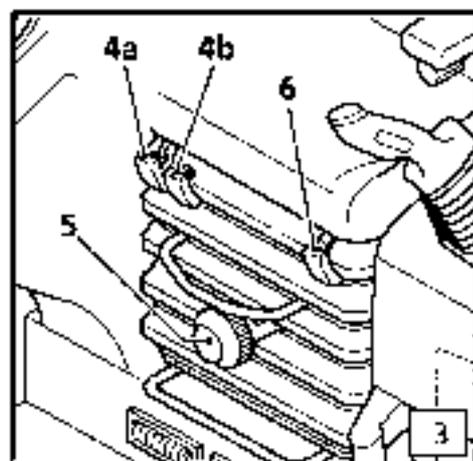
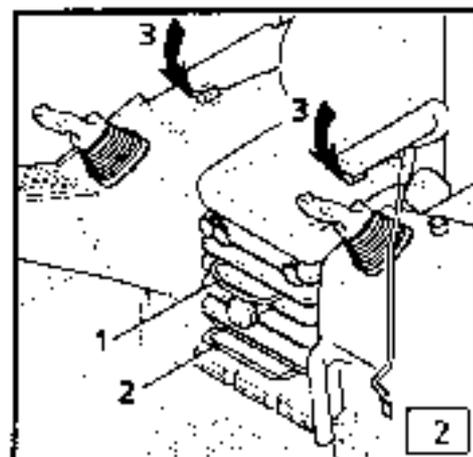
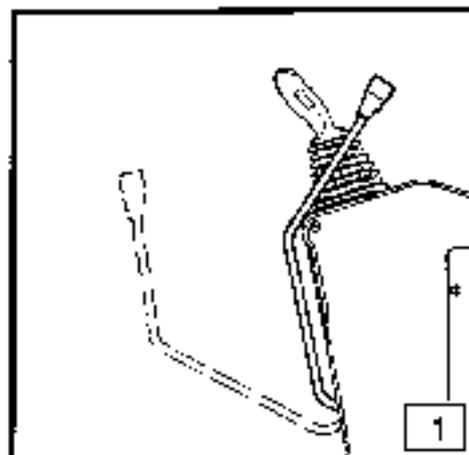
Adjusting the lower back support in the back rest occurs via keys 8 and 9 (fig. 4).

The angle of the right and left arm rests can be adjusted. Turn the knurled screws 3 (fig. 3) beneath the arm rests in the appropriate direction.

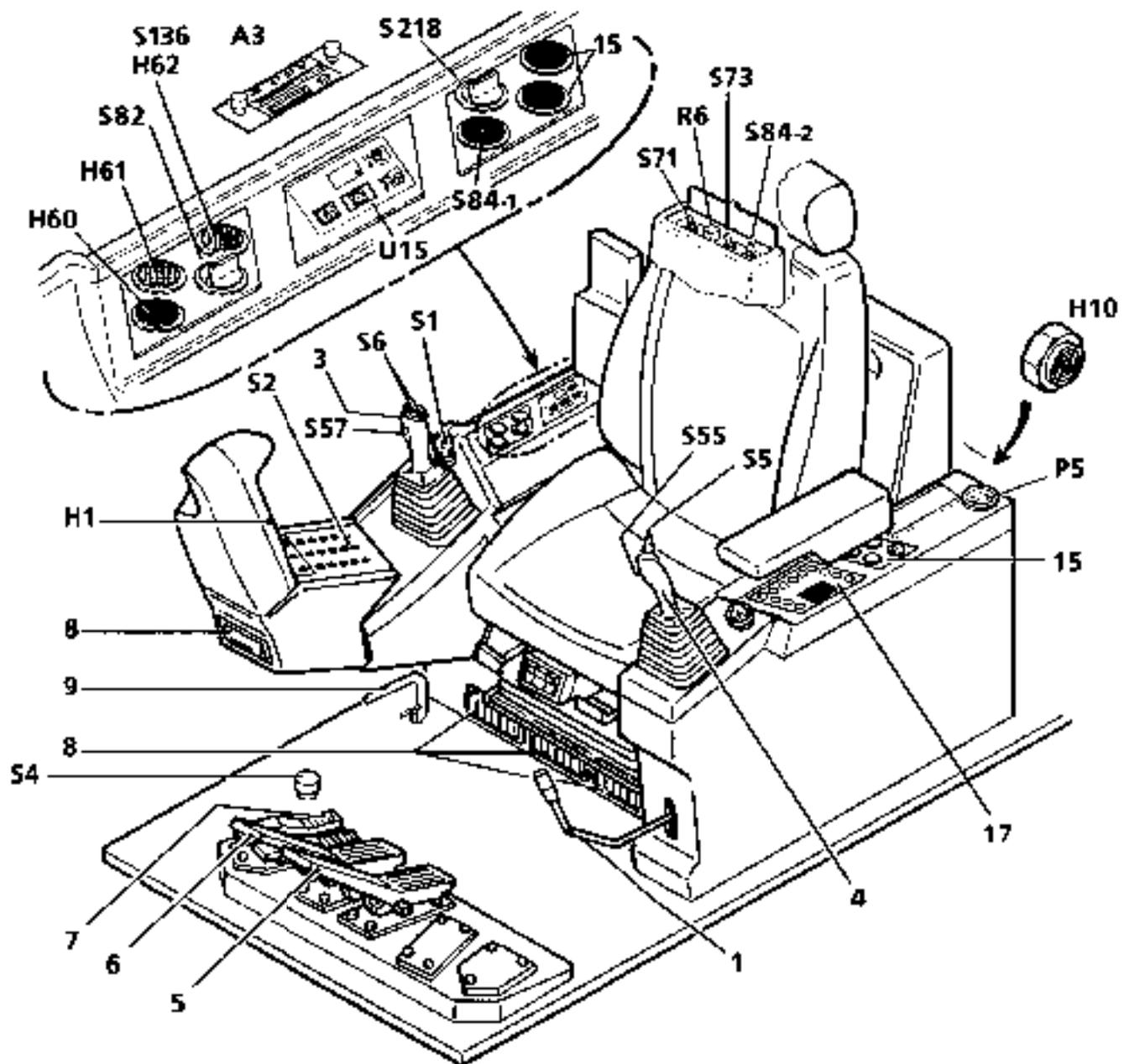
VIBRATION DAMPING

The seat mounted in the excavator corresponds to ISO 7096 standards.

When used according to the excavator's specifications, the values of the vibration load transmitted by the operator's seat are less than or equal to the test vibrations of the corresponding machine type according to ISO 7096 standards. The resulting vibration acceleration values " a_{zw} ", measured according to ISO 2631, part 1, standards, meet the demands for vibration protection of the entire body according to EN 474-1 (acceleration " a_{zw} " between 0,5 and 2,5 $m.s^{-2}$)



CONTROLS AND INSTRUMENTATION IN THE CAB



1	Safety lever- Servo control
3	Right joystick
4	Left joystick
5	Pedal for left travel gear
6	Pedal for right travel gear
7	Attachment or special attachment control*
8	Air conditioner vent
9	Uppercarriage Lock
15	Control units - additional attachments* (See page 3.18)
17	Control unit - air conditioner
A3	Radio*
H1	Monitoring display
H10	Buzzer
H60	Engine monitoring sys./ indicator light "STOP"
H61	Monitoring system/ indic. light "WARNING"
H62	Monitoring sys./ indic. light "PROTECTION"
P5	Hourmeter
R6	Engine RPM adjustment +/- Manu
S1	Ignition key
S2	Switching unit

S4	Horn(NA+a)
S5	Push buttons for rotating device* (grapple, shear, or horn, or float position boom(NA))
S6	Push buttons for float position boom or rotating device(NA)
S55	Switch for lifting magnet*, control commutation between additional movements*
S57	Switch for swing brake control
S71	Switch / Engine RPM control in Manu
S73	Switch / Safety mode of the servo circuits
S82	Rotary switch / Fault codes INC. - DEC.
S84 1	Push button / Swing ring teeth lubrication
S84 2	Safety switch / central lubrication
S136	Diagnostic switch
S218	Cab roof window wiper and washer
U15	Control unit / central lubrication

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

Safety lever - Servo control 1

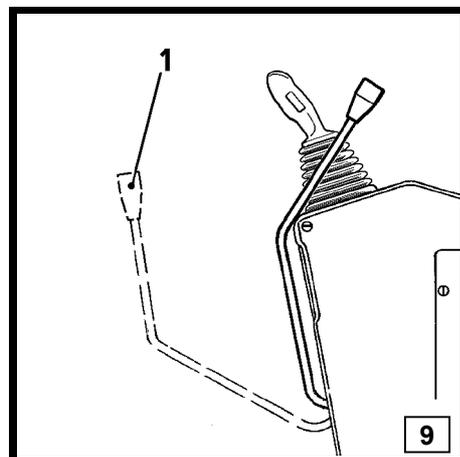
For safety reasons, a safety lever is installed on the left console. The operator must move this lever up before leaving the operator's seat.

The operator may only push the lever down when he is again seated in the operator's seat, ready to work.

When the safety lever is up, the servo pressure supply is interrupted, and no working movements are possible if the joysticks are accidentally actuated.

At the same time the swing brake apply and can no longer be released via the button S17.

When pushing the safety lever down, the brakes recover the previous state (applied or released) before the lever had been pulled up.



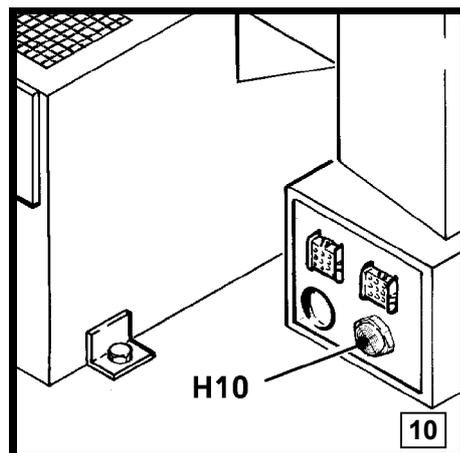
Buzzer H10

During operation, the buzzer H10 sounds to alert the operator, in case of upcoming of an operating fault as:

- a low pressure of the engine lubrication oil,
- a low level of the engine coolant,
- a low hydraulic oil level,
- a charge air overheating,
- an engine coolant overheating,

In case such an error is detected, a corresponding warning symbol will be displayed on the screen.

For the possible symbols, the results of the errors and the corrective actions to perform, see page 3.10 and following.



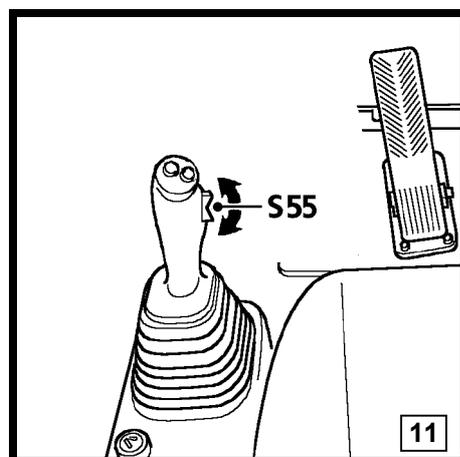
Switch S55



On machines with US version, the function of S55 is different from the one described below, refer to page 7.1.

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

- on machines fitted with a travel alarm, each time a travel pedal is pushed, the travel alarm will sound. This sound can be silenced 10 seconds after travel start by tilting the rocker switch S55.
- it may also be used to unlock a cylinder end position that has previously been preselected via switch S54, see on page 3.20.



Switch S57 for swing brake control

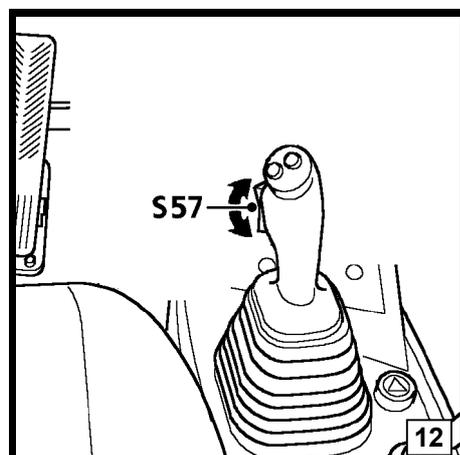
This rocker switch controls the swing brake when the brake is preselected in semiautomatic operating mode via the push button S17 (see on page 4.12).

Switches S71, S72 and S73

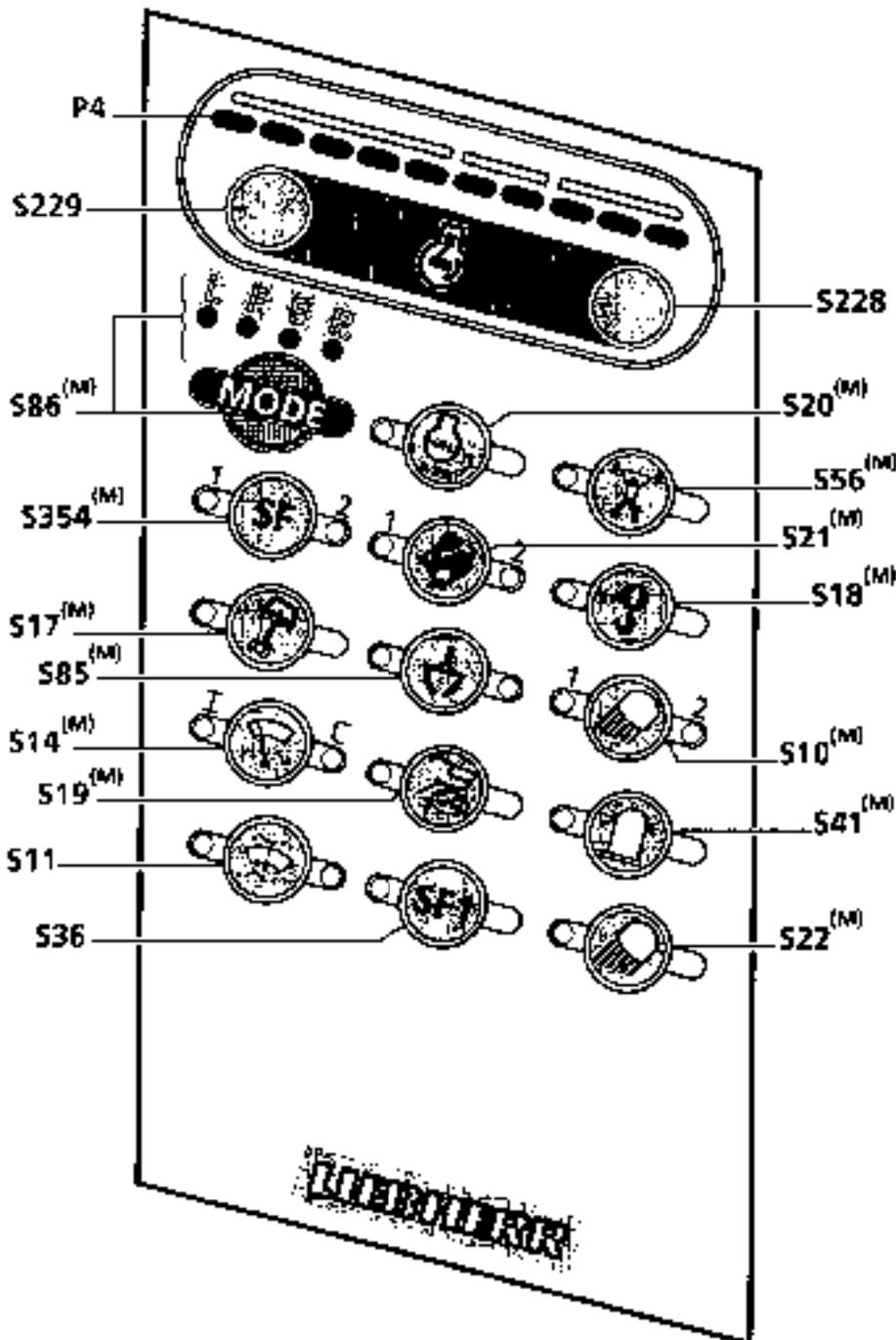
See on page 3.26.

Control lights H60, H61, H62, switches S82 and S136

See on page 3.28.



CONTROL UNIT



- P4 LED indicator for engine RPM
- S10 Lights on uppercarriage and working attachment
- S11 Windshield washer
- S14 Windshield wiper
- S17 Swing brake
- S18 Overload warning device *
- S19 Rotating device*
- S20 Automatic low idle
- S21 Not used
- S22 Auxiliary floodlights*
- S36 Cold starting aid (Startpilot)
- S41 Beacon *
- S56 Pressure cut-in stage boom*
- S85 Grapple operation *
- S86 Operation mode selection
- S228 Engine RPM increase
- S229 Engine RPM reduce
- S354 Parking brakes (travel gear)

* Optional installation

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



S10 - Floodlights

Depressing the push button will successively:

- turn on the floodlights on the uppercarriage,
- turn on only the working floodlights on attachment,
- turn on all the above floodlights,
- switch off all the above floodlights.



S11 - Windshield washer

-> page 3.25



S14 - Windshield wiper

-> page 3.25



S17 - Preselection of swing brake operating mode

With this button the swing brake can be switched, either in position "brake applied" or in position "brake in semiautomatic" (see on page 4.12)

Pushing the button shifts the brake from one operating mode into the other

With the brake applied, the red diode in the push button is on.



S18 - Overload warning device

Via this push button, the overload warning device is alternately turned on and off.

This device alerts the operator that the authorized lift capacity of the machine has been reached. It must be turned on before using the excavator for lifting operation. Also refer to page 7.5 to turn on the overload warning device.



S19 - Rotating device (grapple, ...)

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

The push button S19 turns on and off the control circuit of these specific equipments. If S19 turned on, the specific equipments can be actuated using the push buttons S5 on top of the left joystick handle.

When no rotating device is operated, the button S19 must be turned off

The button S19 is operative only if the safety lever is pushed down.



S20 - Low idle automatic (see page 4.5)

Via this push button the function "low idle automatic" is turned on, resp. off (the light diode in the button is on, resp. off).

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



S21 - Travel speed increase (not used)



S22 - Auxiliary floodlights (Optional installation)



S36 - Cold starting aid (Startpilot)

The push button S36 controls the cold start system.

When the button is depressed, an ether based starting fluid is sprayed into the air inlet manifold of the Diesel engine. At the same time, the control light inside the push button will light up.

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



S41 - Beacon (Optional installation)



S56 - Pressure increase

When this function is turned on (light diode in the button is on), the forces on the working attachment are increased, and the movements of the machine become slow at the same time (load lifting operation...).



S85 - Grapple operation

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



S86 - Engine speed adjustment with mode preselection (see page 4.4 - 4.5)

Depressing the button S86 causes to change from one mode into the next, in the order L, F, E, P, L, . and so on.

- L (Mode LFI) = RPM stage 5
- F (Mode FINE) = RPM stage 10
- E (Mode ECO) = RPM stage 8
- P (Mode POWER) = RPM stage 10

RPM stage 8 corresponds to the most favorable specific fuel consumption, RPM stage 10 is full engine RPM.

In mode E or P, the Diesel engine is at the nominal power corresponding to the selected RPM stage. In the opposite, for modes L and F, the engine output is reduced by about 20%.



S228 - Engine RPM increase

→ Page 4.4



S229 - Engine RPM reduce

→ Page 4.4



S354 - Parking brakes

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

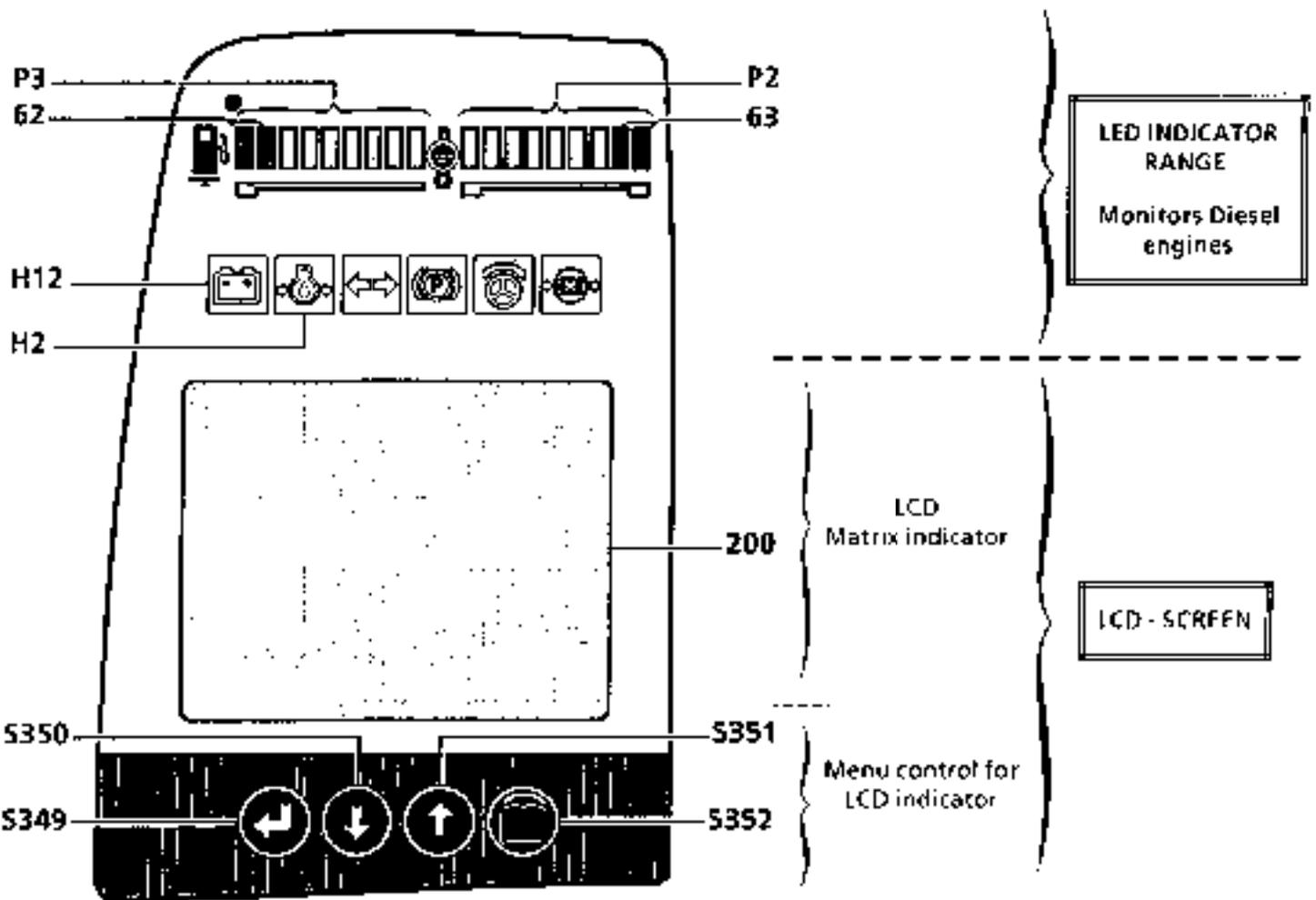
When the light diode 1 of the button is on, the brakes are applied, see page 4.11.

LED indicator P4 for engine RPM

Via this indicator, the engine RPM is displayed.

The complete RPM range is divided into 10 stages.

MONITORING DISPLAY



LED INDICATOR RANGE

Indicator light H2 - low engine oil pressure



If the engine oil pressure drops during operation below a preset value, which depends on the momentary Diesel engine RPM, the indicator light H2 lights up after 2 seconds. At the same time, the buzzer will sound to alert the operator that the oil pressure is too low. Return the engine immediately to low idle.

Charge indicator light H12



Indicator light H12 lights up if the starter key is moved to contact position and turns off as soon as the engine starts. During operation, this indicator light lights up if the alternator V-belt or the electrical charge system is defective. Turn the engine off and correct the problem.

Engine coolant temperature gauge P2

During operation, the indication must remain in the green range.

If the engine coolant overheats (coolant is above 100°C = 212°F), the red LED indicator light 63 starts to light up on the right end of the indicator.

Simultaneously, the buzzer will sound in the cab and the warning signal E503 will appear on the LCD screen. The engine power is reduced.

Stop working soon and keep the engine running at high idle.

If the default persists for over 60 seconds, lower the engine RPM to low idle and turn the engine off after 3 -5 minutes.

Locate the reason for the trouble and get it repaired.

Fuel gauge P3

The LED indicator lights show the fuel level.

When the both red LED 62 light up, about 10% to 20% fuel are left in the tank as reserves.

LCD SCREEN

Adjust the contrast on the LCD screen

The contrast on the LCD monitor can be changed by simultaneously pushing the 'MENU' key and the "UP" or "DOWN" key. The new setting will be stored in the system.

To retrieve the original contrast setting, depress the both arrow keys "UP" and "DOWN" at the same time during system start (when all the light diodes are on).

Adjust the background lighting on the LCD screen

The background lighting on the LCD monitor can be changed by simultaneously pushing the 'RETURN' key and the "UP" or "DOWN" key. The new setting will be stored in the system.

A light sensor on the upper left hand side of the display controls the LCD lighting, depending on the ambient light conditions.

The follow up control by the light sensor is performed around the basic setting adjusted via the keys. If the ambient light conditions are low, the background lighting will be reduced accordingly.

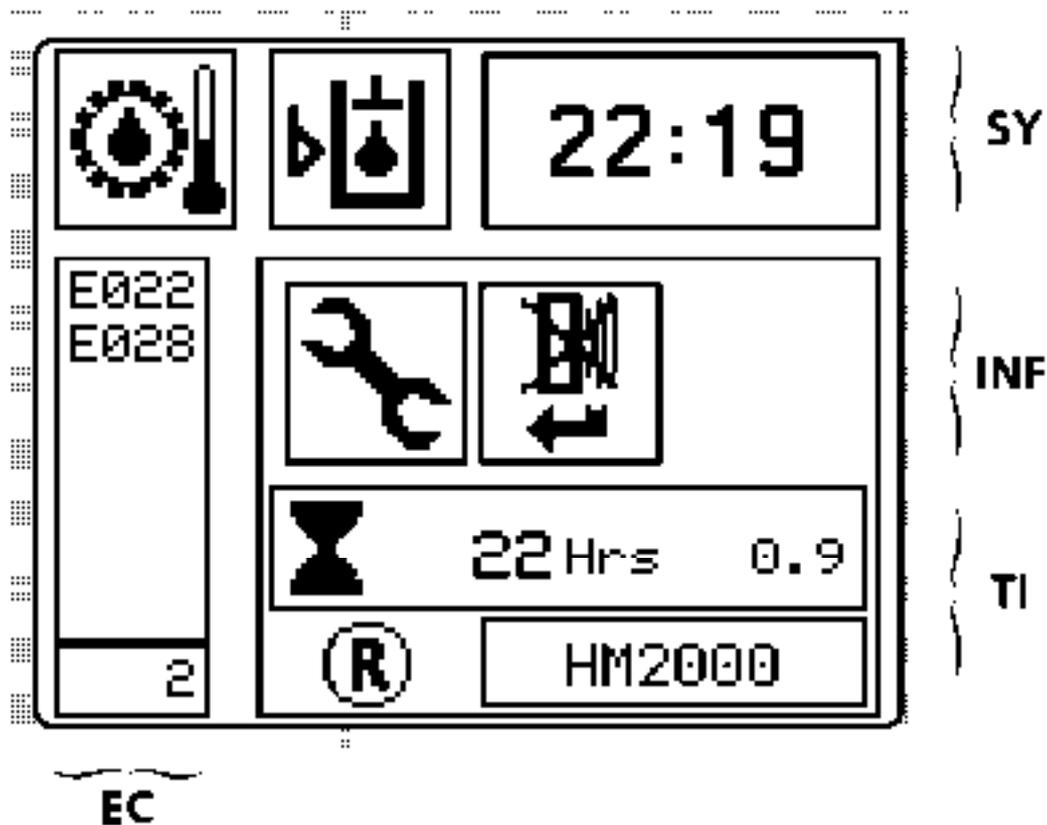
LCD screen control keys

The display can be controlled via 4 keys S349 "RETURN", S350 "DOWN", S351 "UP" and S352 "MENU" (see above illustration).

These keys are used to change from the main display to the menu selection and to scroll through various other menus.

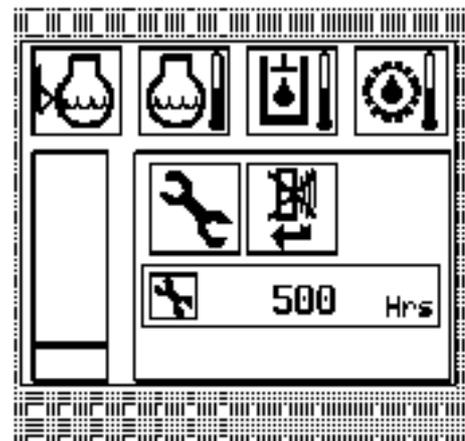
MAIN SCREEN

The main screen appears after the unit is turned on and remains in place until the "MENU" key is pressed to change to the menu selection..



Main screen view

- SY field :** The upper field of the monitor shows warning and indicator symbols, up to maximum 4 symbols at the same time.
If more than 4 symbols must be shown, then every 10 seconds, the symbols move to the left by one symbol.
The following list shows all symbols which can appear in this field.
- EC field:** The EC window displays any applicable error codes for any electrical errors in the excavator electronics, (line errors, sensor errors, ...). Max. 7 error codes can be displayed at the same time . If more than 7 errors occur, an arrow next to the error code window points to additional error codes on the list.
Press the arrow key to move the error code window in the selected direction on the error code list.
For detailed error codes list, refer next pages.
- INF field:** The INF field on the right hand side of the main screen displays temporary information, also in graphic form.
If more than 3 symbols must be shown, then every 10 seconds, the symbols move to the left by one symbol.
Displays are shown as graphics or text and inform about specific operating conditions (such as actuated flow reduction, emergency operation of Diesel engine or hydraulic pumps, ...).
- This field, at the bottom right of the screen displays the main hourmeter and the daily hourmeter of the machine.



TI field This field, at the bottom right of the screen displays the main hourmeter and the daily hourmeter of the machine.
 During the display start-up phase, the operator will be alerted about a possible upcoming service interval, by a graphic symbol. In this case the hours of this interval are displayed instead of the machine hourmeter (as an example 500 hours on fig. beside).
 The recalling of upcoming service interval lights up to about 8 seconds.

The symbol  is displayed when a external pressure and flow limitation (function "set option") is activated for the pumps.

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

After choosing the tool (function "set option"), the name of the tool appears (for example HM200).

Control of the screen at error recognition:

In case a new error, displayed in field SY, is recognized, the presentation will return to main screen, and the corresponding symbol is displayed.
 Depending on the default (urgency step), the buzzer will alert acoustically at the same time, either buzzing in continuous or emitting intermittent sounds.



The symbol  signals that the buzzer of the control unit is activated. Using the key  it is possible to quit the defaults indicated by a continuous buzzing.

Symbols for operating errors displayed in field SY

Each one of the following symbols has one error code assigned to it, which is displayed as "E 5xx". As soon as an error appears, the control unit enters the corresponding error code in the stored error statistics.



E 502

Low coolant level

This symbol appears if the coolant level drops below the minimum level. At the same time the buzzer will sound in the cab.
 Bring the engine to low idle and turn it off after about 5 seconds.
 Find and repair the coolant loss.



E 503

Engine coolant overheating

This symbol appears simultaneously with the lightning of the red LED 63 on the engine coolant temperature gauge P2, see on page 3.7.
 At the same time the buzzer will sound in the cab.



E 504

Low hydraulic oil level

This symbol appears if the oil level in the hydraulic tank drops below the minimum level. At the same time the buzzer will sound in the cab.
 Turn the engine off, find and repair the cause of the oil loss. Add hydraulic oil only via the return filter (see page 5.16).



E 505

Hydraulic oil overheating

This symbol appears if the hydraulic oil temperature in the tank exceeds 98°C (208°F).
 Turn the engine off, find and correct the problem (oil cooler dirty, blower or thermostat defective,...).



E 506

Splitterbox oil overheating

This symbol appears if the oil temperature in the splitterbox exceeds 100°C (212°F).
 Turn the engine off, find and correct the problem (splitterbox cooler dirty).



E 511

Overvoltage in electrical system

This symbol appears if during operation the system voltage exceeds 30 Volts during at least 0,5seconds.

Operating errors displayed in field SY	Error code
Low engine oil pressure *	F 501
Low coolant level	E 502
Engine coolant overheat	E 503
Low hydraulic oil level	E 504
Hydraulic oil overheating	E 505
Splitterbox oil overheating (on machines R 934 and above)	E 506
Overvoltage in electrical system	E 511

* Error indicated by the LED H2 on the monitoring display

Indicator symbols displayed in field INF



Preheat

This symbol appears as long as a preheat action is activated.



End of preheat

After about 20 seconds, the preheat action will be stopped automatically and the symbol "end of preheat" will be displayed on the LCD screen.



Overload warning device

On machines with overload warning device: when this device is turned on via the push button S18, this symbol appears when the load limit has been reached. At the same time an audible signal alerts the operator to this fact.



No overload warning device

This symbol appears when switching on the overload warning device via the push button S18 (see page 3.4) and if no overload warning device has been correctly installed and initialized on the machine.



Warm up procedure

This symbol shows that a warm up procedure is actually current.



Upcoming service interval

This symbol appears to alert that the working hours for the next service interval have been reached.

The symbol will go out after the corresponding service works have been carried out and confirmed using the menu "set service" of the display (see thereafter).



Engine RPM in safety mode

The symbol informs the excavator's operator that the Diesel engine RPM control has been turned into safety control, see page 3.3.



Servo pressure circuit in safety mode

These symbols show that the servo pressure circuit has been turned into emergency mode, see page 3.26.

ERROR CODES FOR ELECTRICAL ERRORS OF THE ELECTRONIC CONTROL SYSTEM

Detected errors	Error Type	Error code
Engine oil pressure	Short circuit to earth Short circuit + 24 V Cable break	E 001 E 002 E 003
Engine coolant level	Short circuit to earth Short circuit + 24 V Cable break	E 004 E 005 E 006
Coolant temperature	Short circuit to earth Short circuit + 24 V Cable break	E 007 E 008 E 009
Hydraulic oil level	Short circuit to earth Short circuit + 24 V Cable break	E 010 E 011 E 012
Hydraulic oil temperature	Short circuit to earth Short circuit + 24 V Cable break	E 013 E 014 E 015
Gear oil temperature	Short circuit to earth Short circuit + 24 V Cable break	E 016 E 017 E 018
Diesel engine RPM	Short circuit to earth Short circuit + 24 V Cable break	E 022 E 023 E 024
Solenoid valve for power control (LR)	Cable break	E 027
Solenoid valve for engine RPM control (EV4)	Cable break	E 030
Solenoid valve for cooler fan regulation (Y347)	Cable break	E 033
Solenoid valve for flow control (Hydraulic pump 1) EV1	Cable break	E 036
Solenoid valve for flow control (Hydraulic pump 2) EV2	Cable break	E 039
Solenoid valve – Reserve (EV3)	Cable break	E 042
Solenoid valve – Pressure operate (EV6)	Cable break	E 045
Servo motor / engine RPM	Diesel engine speed servomotor faulty	E 046
Fan RPM	Fan RPM defective	E 068
Keyboard	No coding plug	E 302
Keyboard	No CAN bus connection to BST	E 303
Keyboard	No CAN bus connection to ESP01 board	E 305
Display	No connection between keyboard and display	E 308
Display	No Software compatibility between keyboard and display	E 309
BST	No compatibility between hardware coding and software coding	E 319
BST	No reception of recognised machine typ by BBT	E 321
BST	Unknown Hardware coding	E 322
Hand signal sensor boom 1	Short circuit to earth Short circuit + 24 V or Cable break	E 411 E 413
Hand signal sensor boom 2	Short circuit to earth Short circuit + 24 V or Cable break	E 414 E 416
Hand signal sensor bucket 1	Short circuit to earth Short circuit + 24 V or Cable break	E 417 E 419
Hand signal sensor bucket 2	Short circuit to earth Short circuit + 24 V or Cable break	E 420 E 422
Hand signal sensor stick 1	Short circuit to earth Short circuit + 24 V or Cable break	E 423 E 425
Hand signal sensor stick 2	Short circuit to earth Short circuit + 24 V or Cable break	E 426 E 428
Hand signal sensor swing 1	Short circuit to earth Short circuit + 24 V or Cable break	E 429 E 431
Hand signal sensor swing 2	Short circuit to earth Short circuit + 24 V or Cable break	E 432 E 434
Travel signal 1	Cable break	E 437
Travel signal 2	Cable break	E 440
Joystick left	Short circuit + 24 V Short circuit to earth or Cable break	E 442 E 443
Joystick right	Short circuit + 24 V Short circuit to earth or Cable break	E 445 E 446
Rotation gear speed	Short circuit + 24 V Short circuit to earth or Cable break	E 454 E 455
Fuel tank sensor	Short circuit to eart Short circuit + 24 V or Cable break	E 456 E 458
Output stage ESP01	Connection default	E 601

INFORMATIONS PROVIDED IN THE MENUS OF THE LCD SCREEN

MENU SELECTION

Depressing the "MENU" key when the main screen is displayed shows the list of the accessible menus (see fig 45)

The current menu selection can be changed by pressing the "UP" and "DOWN" keys (the selected menu is inverse displayed, as an example in fig. 45 the menu "reset hours" is selected)

When depressing the "MENU" key again, the inverse displayed function is branched out

MENU ("i-hours")

Information about operating hours for various components and movements

The information screens 1 to 3 (fig. 46a to 48a) shows an overview about operating hours for various components, functional flows and operating modes.

As an example, the screen fig. 46a indicates the operating hours for:

- Diesel engine in mode P
- Diesel engine in mode E
- Diesel engine in mode F
- Diesel engine in mode L
- Diesel engine at maximum RPM
- Diesel engine at low idle
- Manual operation for Diesel engine RPM control

the screen fig. 46b the operating hours for:

- Attachment movements
- Travel movements
- indication for - normal
- increased speed

and the screen fig 48a the operating hours for

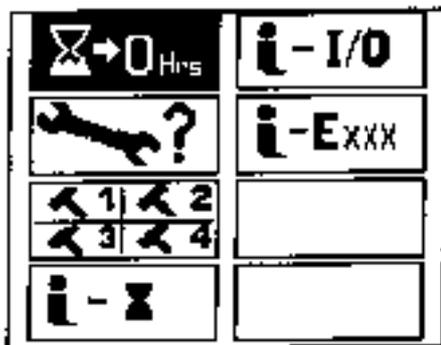
- swing movements
- additional attachment movements.

And the screen fig. 48b gives informations about the machine type and serial number and about the software version actually mounted to the machine.

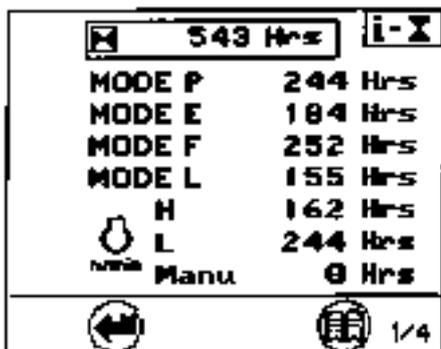
The two indications behind "Nom" are for the rated RPM and for the number of teeth of the flywheel of the Diesel engine.

These both indications are determined by the position of a codage bridge on the print plate U16 (BST regulator).

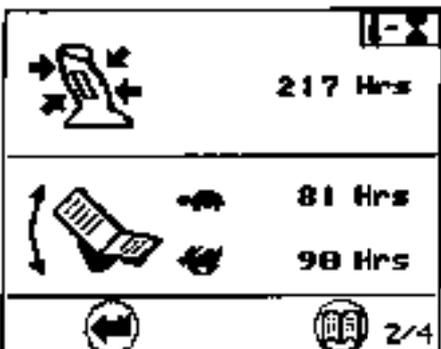
The last line provides indication for the momentaneous operating voltage



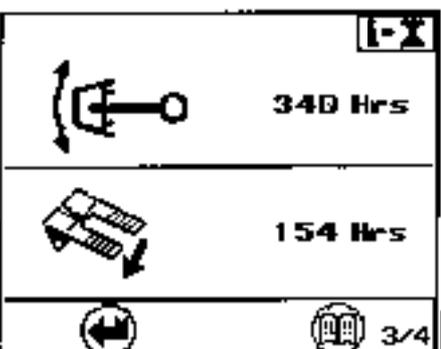
45



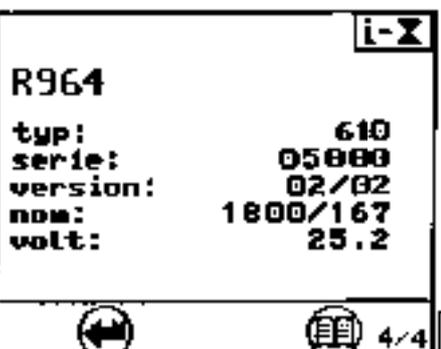
46a



46b



48a



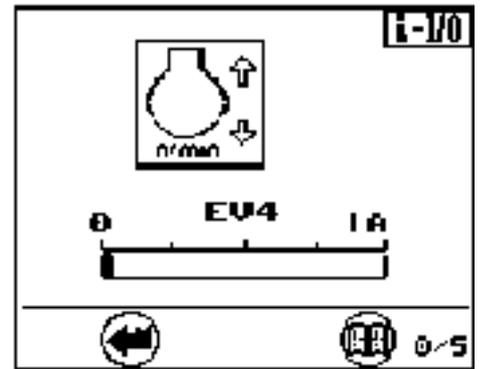
48b

MENU **i**-I/O

a) INFORMATION ABOUT THE CONTROL OF THE ENGINE RPM (This function is existing since Software Version V2.4).

The screen 0/5 appears only on machines on which the engine RPM is adjusted by an hydraulic cylinder via an electronic regulation.

The graphic bar in the lower part of the screen gives the momentary value of the regulation current to the RPM control cylinder.



49

b) INFORMATION ABOUT THE HYDRAULIC PUMP : information screens 1/5 (50a - 50b) and 2/5 (51)

This screen gives information about the operating position of the hydraulic pumps.

The screen 1/5 gives following indications for each working pump if the flow and pressure limitation is activated, and its percentage.

The screen shows for this limitation a graphic bar with electric current value and indicates for the pump the amount of the momentary flow control signal

On figure 50a, an external limitation (Hardware entry I1, option 2) ist activated. With this option, the pump flow and operating pressure are limited to 55% of the maximal value.

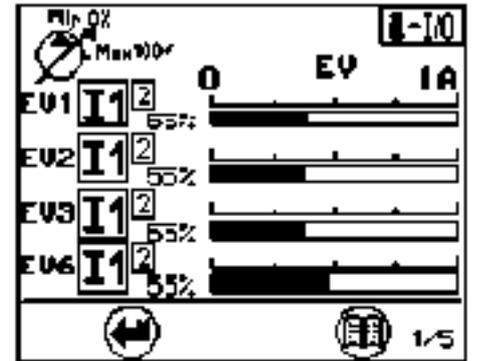
In case of an external activation of limitation, the symbol "R" is displayed in the field T1, see main screen.

The figure 50b, two internal limitations (Pressure cut in stage

boom  and translation M1) are simultaneously activated with the external limitation (Hardware entry I1, option1).

With simultaneously activation of several limitations, the one with the smallest value is decisive for the hydraulic pump. In that case, the symbol "R" is displayed in the field T1.

In case of only one activation of limitation, the symbol "R" turns into "●".



50a

Notice :

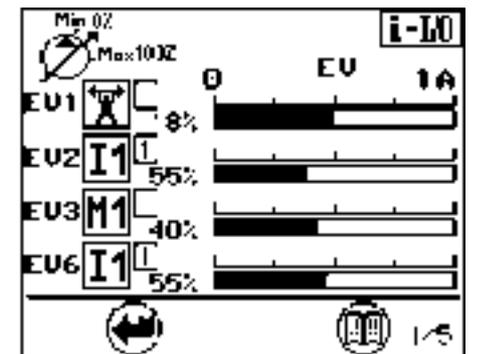
For R 904 to R924 machines, the signal of regulation solenoid valve EV1 limits both pumps.

For R 934 to R974 machines, every pump can independently being limited true regulation solenoid valves EV1 and EV2.

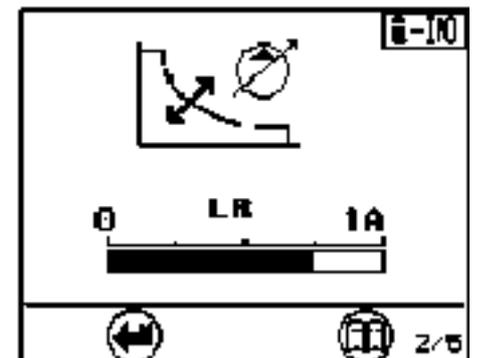
For R 984 machines, every pump can independently being limited true regulation solenoid valves EV1, EV2, and EV3.

For every machine, the operating pressure is limited true regulation solenoid valve EV6

- The internal flow limitation M1 is active during the translation.
- The internal flow limitation M2 is active by use of pressure cut in stage boom  on keyboard .
- The internal flow limitation M3 is active while the flap is operated.
- The internal limitation SF, by SF-button switched on.



50b



51

The display 2/5 (51) represents the present current of regulation solenoid valves LR (current value for power regulation).

c) INFORMATION CONCERNING THE COOLER FAN CONTROL SYSTEM

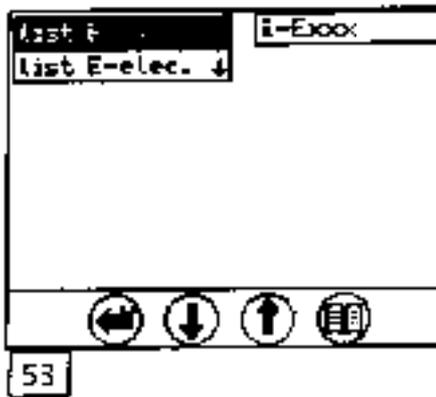
information screens 3/5 (52)

The screen 3/5 appears only on machines fitted with an electronically regulated cooler fan drive.

The graphic bar in the lower part of the screen gives the momentary value of the current to the regulation solenoid valve EV5 for the fan RPM.



52

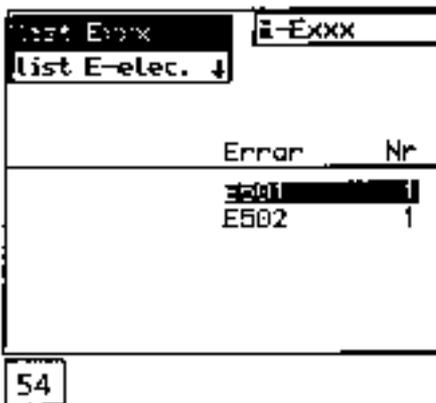


MENU **i-Exxx** ("i-errors")

INFORMATION ABOUT DETECTED ERRORS (OPERATING AND ELECTRICAL SYSTEM ERRORS)

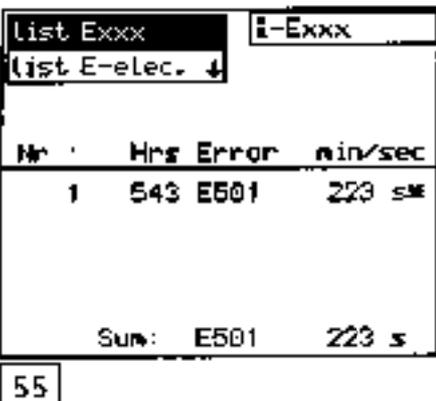
In this menu (fig. 53):

- select "list Exxx" to list all the operating errors detected by the switches and sensors for machine parameters monitoring (fig. 54),
- select "list S-Exxx", to show a listing of the above mentioned errors which occurred during service operation,
- select "list E-elec.", to show a listing of all the electrical errors (system errors) detected during operation of the machine,



When selecting the operating errors "list Exxx" all the errors according to the list on pages no. 3.9 and 3.10 are listed, with error code and number of occurrence (fig. 54).

Move the arrow keys "UP" and "DOWN" to select the desired error.



By pressing the "MENU" key, the overview of the selected error appears (fig. 55), with the indication of the operating hour and duration for the 10 first and the 10 last occurrences of the error.

Move the arrow keys "UP" and "DOWN" to page in this overview.



When selecting the electrical errors "list E-elec" all the system errors according to the list on page no. 3.11 are listed, with error code and number of occurrence (fig. 56 and 57).

The column "Sum" shows the number of all errors which were ever noted

The column "Test" shows the number of errors occurred since the last deletion of this test error memory listing.

The operating hours above the test column show the operating hour when the last test memory was deleted (reset).

Error	Sum	Test
E001	2	2
E004	2	2
E007	2	2
E010	2	2
E013	1	1

57

Selecting "list S-Exxx" also shows the errors according to the list in pages no. 3.9 and 3.10, but this time only the errors which occurred during "service operation" (fig. 58 and 59).

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

Error	Nr
E501	1
E502	1
E504	1
E505	1
E503	1

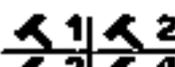
58

Nr	Hrs	Error	min/sec
1	172	E501	137 s
Sum:		E501	138 s

59

Error	Nr
E501	1
E502	1
E504	1
E505	1
E503	1

60



MENU  **3**  **4** ("set option")

ALLOCATION OF FLOW LIMIT OPTIONS TO EXTERNAL INPUT I1
 (Special attachment input; as an example when operating a hammer pedal)

In this menu, pre-defined flow limitations (options) are allocated to the hardware input I1.

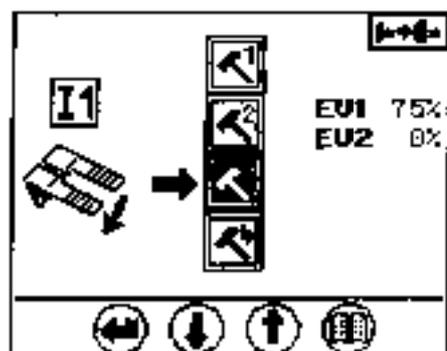
The arrow near the symbol gives the actual allocation

In example fig. 62, the option 3 is active for the input I1, this means, if the external hardware input I1 is activated, then the nominal pump values allocated in option 3 for the excavator control are given as maximum nominal values.

If another option must be allocated to input I1 (as an example due to a modification of the working attachment), so first select another attachment in the vertical symbol range via the key "UP" or "DOWN".

Confirm the selected option by pressing the "MENU" key, the new option must then appear in the column

The right part of the screen provides indication for the currently set pump values corresponding to the option shown in the selection window.



62



63

MENU  **?** ("set service")

INFORMATION AND CONFIRMATION OF SERVICE INTERVAL

This screen is an information screen and can be used to confirm a completed service interval

The screen shows the operating hour for the next service interval (in example fig. 63 = "500 hrs") and the current operating hours ("174 hrs").

An upcoming service interval can be confirmed within max. 50 operating hours before the next service interval (fig. 64).

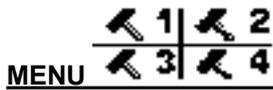
When this time frame is reached, the screen will display a question regarding completion of the service works for this interval.

If the question is answered with "OK" then this menu will be discontinued.

If it is answered with "OK", then the current operating hour will be stored as the last confirmed service interval



64



a) ALLOCATION OF FLOW LIMIT OPTIONS TO EXTERNAL INPUTS I1 (Special attachment input; as an example when operating a hammer pedal)

In this menu, pre-defined flow limitations (options) are allocated to the hardware input I1.
The arrow near the symbol gives the actual allocation (Fig. 65a and Fig. 65b).

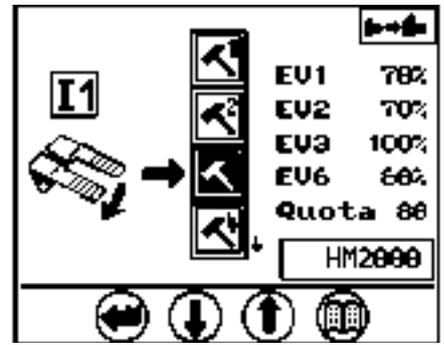
In example beside, the option 3 is active for the input I1, this means, if the external hardware input I1 is activated, then the nominal pump values allocated in option 3 for the excavator control are given as maximum nominal values.
If another option must be allocated to input I1 (as an example due to a modification of the working attachment), so first select another attachment in the vertical symbol range via the key "UP" or "DOWN", as for example Option 10 in Fig. 65b

Confirm the selected option by pressing the "MENU" key, the new option must then appear in the column.
The right part of the screen provides indication for the currently set pump values corresponding to the option shown in the selection window.

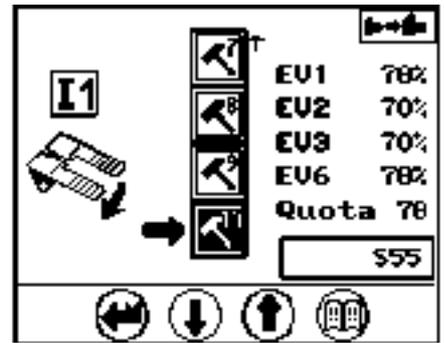
The values EV1 up to EV3 determines the initiated working pump flow limitation while additional attachment operating

- Notice :**
- The pump choice EV2 does not appear for Load Sensing machines R 904 up to R 924.
 - The pump choice EV3 appears only for machines provided with 3 separately adjustable working pumps (R984, Special machines, ...).

The value EV6 determines the permitted maximal pressure level for the additional attachment feeding.
The value after "Quota" choice has no importance for crawling excavator.
While choosing an option appears in the lower section of the screen its designation, if it has been defined on option parameterisation.
As example on fig.66 appears "HM2000", option designation allocated to the hydraulic hammer.



65



66



69

MENU  ("set service")

INFORMATION AND CONFIRMATION OF SERVICE INTERVAL

This screen (fig.69) is an information screen and can be used to confirm a completed service interval. The screen shows the operating hour for the next service interval (in example beside = "500 hrs") and the current operating hours ("174 hrs").



70

An upcoming service interval can be confirmed within max. 50 operating hours before the next service interval. When this time frame is reached, the screen (fig.70) will display a question regarding completion of the service works for this interval.

If the question is answered with "OK" then this menu will be discontinued. If it is answered with "OK", then the current operating hour will be stored as the last confirmed service interval.



71

MENU  **0 Hrs** ("reset data")
RESET OF THE DAILY HOURMETER

This menu (fig.71) allows to reset to 0 the daily hourmeter. To reset the daily hourmeter, first select "OK" via the key "UP" or "DOWN", and then confirm this choice by pressing the "MENU" key.



MENU ("set clock")

This menu permits to set the time shown into upper section of the screen.

The selection of this menu is possible only on machines fitted with a display with software versions 2.6 / 5.6 and later.

(since SN 13469 for R914B / since SN 13436 for R924B)

(since SN 12077 for R934B / since SN 13274 for R944B).

After function start, the presently set time will appear in the lower section of the screen with the first digit shown inversely (unity digit of the minutes), Fig. 72.

Use the arrow key to modify the inversely displayed position

Use the „MENU“ key to change the inversely displayed number to the next higher number (more left digit).

When the highest number has been reached, it will start over with the lowest number

Once all the digits have been set, press the „RETURN“ key to leave the function and to store the set time.

The confirmation message “update xx : xx” will appear momentarily on the screen.



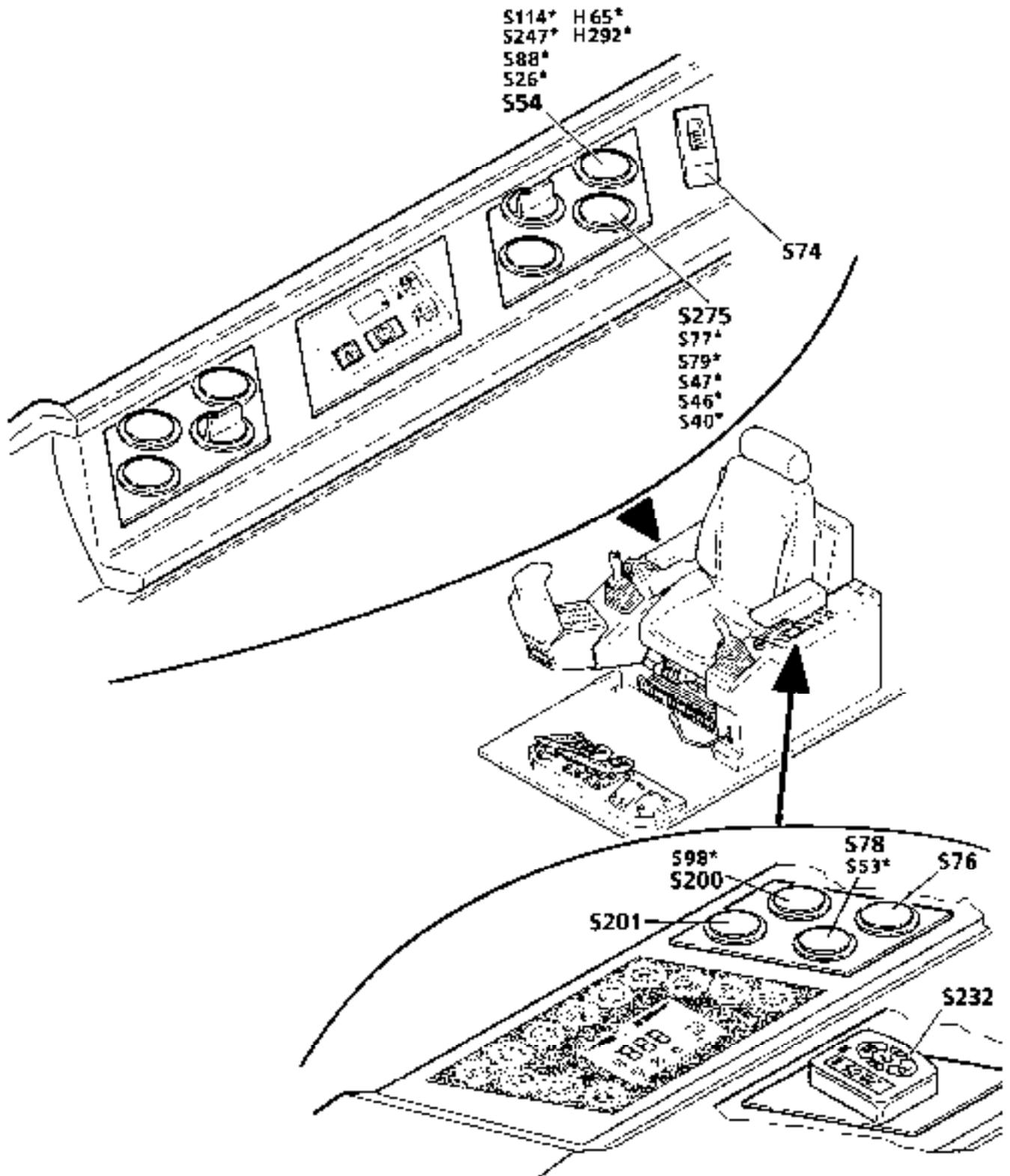
72



73



74



CONTROLS AND INSTRUMENTATION FOR OPTIONAL EQUIPMENTS

Right side control desk

H65	Control light / Starting of engine locked
H292	Control light / Special control system
S26	Touch / Fuel preheater
S40	Touch / Frequency commutation for hydraulic hammer
S46	Touch / Lifting magnet
S47	Key switch / Quick disconnecting device
S54	Key switch / Unlocking of hydraulic cylinder end position
S74	Code key / Start locking device
S77	Touch / Pressurized driver's cab
S79	Touch / Flow divider for special attachment
S88	Key switch / Commutation hammer and additional cylinder
S114	Rotating switch / Control of special attachments with the rocker switch S55 on joystick
S247	Key switch / Commutation of control system Normalized control / Special control
S275	Touch / Additional floodlight rear of cab roof

Left side control desk

S53	Touch / Special control circuit
S76	Touch / Travel brakes
S78	Push button / Height adjustable cab - emergency down
S98	Touch / Low pressure protection for boom cylinders
S200	Push button / Height adjustable cab - up
S201	Push button / Height adjustable cab - down
S232	Control unit S232 / Standstill cab heater

* The location of these controls may differ, depending on the type of the other installed optional equipments..



Control light H65 – Starting of engine locked

This control light lights up to show that the hydraulic oil shut-off valve between the hydraulic tank and the pump suction pipes is not in its fully opened position.

The Diesel engine cannot be started in this case.

Check the shut-off valve for correct position, and, if necessary the proximity switches on the valve for function.

**Control light H292 - Spécial control system**

This control light lights up to indicate that a special, non standart lever arrangement has been turned on via the key switch S247.

**Touch S26 - Fuel preheater**

This button turns on the installed fuel heating system (Thermoline fuel hose, or heater resistor inside the fuel filter).

The Control light inside the push button shows when the heating system is on.

Touch S40 - Frequency commutation for hydraulic hammer

This touch allows to increase the cycle frequency of an hydraulic hammer.

Touch S46 - Operation with a lifting magnet

This button turns on the generator which supplies the lifting magnet, and also switches on the control circuit of the magnet (push buttons S6 at the top of the right joystick handle, see also page 4. 17).

The control light inside the touch lights up when the control circuit is on.

In this case, the engine idle automatic is deactivated; the engine RPM is automatically set to a fixed value and can not longer be set using the buttons S228, S229 and S86.

**Key switch S47 - Quick change adapter**

The key switch S47 turns on the control circuit for the quick change adapter for the working tool.

The locking pins of the adapter can then be retracted and inserted using the both push buttons S5 on the top of the left joystick handle. (Also see on chapter 8.2).

**Touch S53 - Special control circuit supply**

When this touch is actuated, an additional control circuit for a special equipment is made alive.

The green indicator light in the touch lights up to show that the additional servo control circuit is under pressure.

Key switch S54 - Unlocking of cylinder end position

On some special working attachments, or on attachment showing particular kinematic capacities (as example on industrial attachment), certain movement(s) may be stopped automatically by electrical end switches.

The main purpose of this movement limitation is to prevent possible damages due to components frequently reaching their end stops.

With the key switch S54 turned to the left into position I, the automatic limitation can be unlocked temporarily while tilting up or down the rocker switch S55 mounted to the left joystick handle (see page 3.2).

Notice : on machines destined to the north-american market and also fitted with a lifting magnet controlled via the rocker switch S55, the both push buttons S5 at top of the left joystick handle must be used to unlock the limitation.

Should a special attachment comprise two different automatic stops of movement, so the key switch S54 must be turned to the right into position II to be able to release from the second automatic limitation.

No unlocking is possible with the switch S54 in neutral position.



Code key switch S74 - Anti-theft protection system

The Auto-Scan protection unit interrupts the current supply of the excavator about 30 seconds after shut down of the machine (ignition key in 0-position), the red LED lights up.

To restart the machine, a code key must be stuck briefly in the anti-theft system S74 to unlock the protection. The red LED will then turn off and the electrical system must be energized immediately thereafter (ignition key in contact position).

Touch S76 - Travel parking brake



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

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

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

Touch S77 - Pressurized driver's cab



Depressing this button start the air fan for the pressurization of the driver's cab.

The entering of dust or no filtered air into the cab is then almost prevented.

Touch S79 – Flow divider for special attachment



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

The indicator light in the touch is then lighting up.

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

Key switch S88 – Commutation hammer – additional cylinder



This key switch is mounted on machines fitted with a special hydraulic circuit for the supply and the control of either a hydraulic hammer or an additional hydraulic cylinder.

The switch S88 must be turned into the position corresponding to the operated working tool.

In position hydraulic hammer, the pump flow reduction which is actually set for the hammer at the monitoring display is activated, and at the same time, the pressure level in the circuit is adapted to hammer operation.

Special case : Should two hydraulic hammer with different working pressures be used alternately, so S88 is a three positions rotary switch. Select the positions of the switch as follows :

- position "0" when using the hammer requiring the lower pressure
 - position "1" when using the hammer requiring the higher pressure
 - position "2" for operation of the special equipment with additional cylinder (shear, ...)
-

Touch S98 - Low pressure protection for boom cylinders



If the touch S98 is actuated, the pressure protection of pressure relief valve in the circuit for retraction of the boom cylinders is reduced, so to limit the possible downward thrust exerted by the working attachment onto the materials to be digged out.

This device is actuated by switching on the touch S98 and by tilting up or down the rocker switch S55 (see drawing 60 page 4.15).

This safety device must be turned on, as an example, when unloading a boat or a barge, so to avoid damage to its bottom.



Rotating switch S114 – Control of special attachments with the rocker switch S55 on joystick

This switch allows to flip the control of certain attachment from the pedals normally foreseen to this effect, via the rocker switch S55 on the left joystick.
When the switch is in position "joystick", special attachments as hydraulic hammer or scrap shear are controlled via the three positions rocker switch S55.
With the switch turned to position "pedal", these attachments are controlled using the pedals 7c and 7d, as described on pages 4.15 and 4.16.

**Key switch S247 - Commutation Normalised control system / Special control system**

This key switch allows to commute electrically from a Standard lever arrangement (ISO - PCSA) into a Special lever arrangement (LIEBHERR, other lever arrangement, ...).

**Touch S275 - Additional floodlight on rear of cab roof**

Actuating the touch will turn on and off above mentioned floodlight. At the same time, the control light inside the button will light up and go out.

**Control unit S232 - Standstill cab heater**

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

OUTFIT OF DRIVER'S CAB

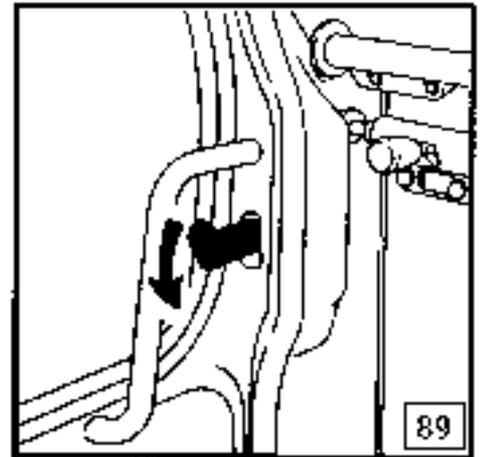
ENTERING OR EXITING THE OPERATOR'S CAB

The excavator must be entered and exited at all times via the steps provided for this purpose



CAUTION

**Never jump off of the hydraulic excavator!
Never use the control elements as handles!**



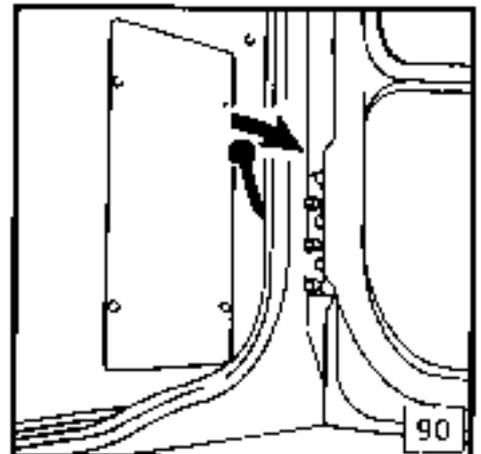
OPERATOR'S CAB DOOR

Opening the cab door from the inside:

- Push down the lever (fig. 89) on the door's lock.
- Open the door completely and secure it in stop position.

Unlocking the cab door after being opened completely:

- Push out the lever (fig. 90) next to the operator's cab frame.



FIRE EXTINGUISHER / FIRST AID KIT*

Optional installation

The storage space for the fire extinguisher and the first aid kit is to be found at the bottom in the rear left corner of the operator's cab.

* Operator's prescription!

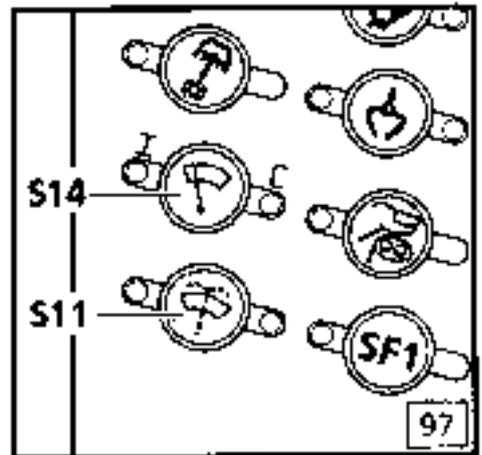
WINDSHIELD WIPER S14

Switch 514 has the following function (when the ignition is on) (fig. 97):

- First push = Intermittent (indicator lamp I lights up)
- Second push = continuous operation (indicator lamp C lights up)
- Third push = Windshield wiper is shut off (both indicator lamps are extinguished)

Adjusting the delay time for intermittent switching is also done via switch 514 as follows.

- Select intermittent switching and keep the switch activated until the indicator lamp I starts to blink.
- Release the switch as soon as the desired interval time (settings from 2 – 9 seconds) is obtained.



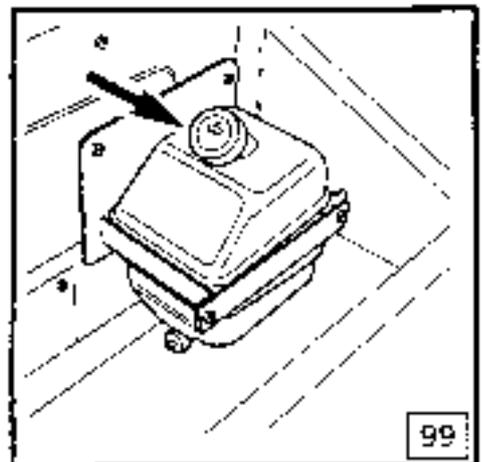
WINDSHIELD WASHING DEVICE S11

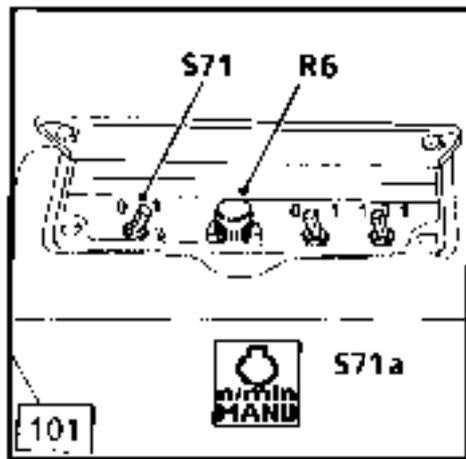
The electrical windshield washing device is activated by pushing the button 511 (fig. 97) when the ignition is on. The detergent is sprayed and the windshield wipers operate as long as the button is pushed. The windshield wipers are turned off about 3 seconds after releasing the button.

The tank for the windshield washing detergent is located outside, on the back of the operator's cab.

After opening the cover, standard windshield washing detergent can be refilled via the opening (fig. 99).

Level see Lubrication chart





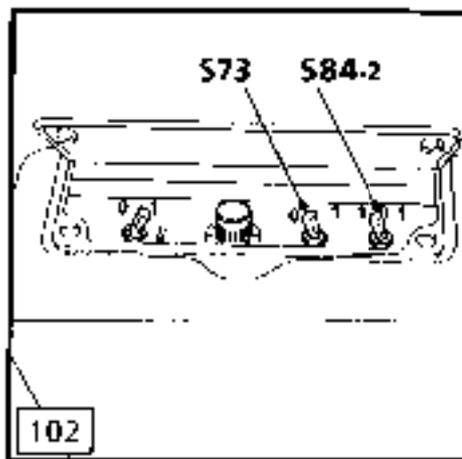
Switch S71 and potentiometer R6 for safety control of engine RPM

In normal operation, the engine RPM is controlled by an electronic circuit, depending on the rated RPM value which has been set via the buttons S86, S278 and S279 (see page 4.4).

This automatic control may be turned off by tilting the switch S71 to position "MANU" (control light next to the switch goes on and the indicator symbol S71a appears on the display).

The engine RPM can now be controlled by the potentiometer R6:

- turning R6 clockwise increases the RPM,
- turning R6 counterclockwise reduces the RPM.

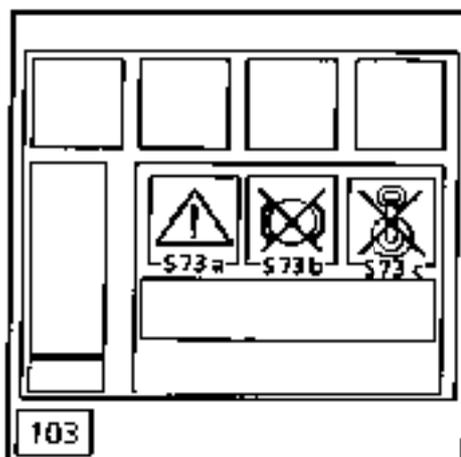


Switch S73 for safety mode of the servo pressure circuits

During normal operation, the servo pressure supply to the swing brake and to the joysticks and pedals is controlled over the electronic circuit of the machine.

While tilting the switch S73 in safety position, this servo pressure supply can be enforced, and is maintained even in case of a trouble in the normal control circuit.

The operator is alerted that the servo circuits safety mode is turned on by the three indicator symbols S73a, S73b and S73c (fig. 103) appearing on the display of the machine.



The safety mode must be turned on only temporarily and in order to move the machine for emergency reasons and when, due to a trouble in the normal control circuit, releasing the swing brake, releasing the travel brakes or supplying the pilot controls is hindered.

In safety mode, the swing as well the travel brakes will be released as soon as the ignition key is turned to contact position, and the normal control of the brakes (see page 4.11 and 4.12) is out of function.

However, even with the switch S71 in safety position, the interruption of the servo pressure supply to the joysticks and pedals when lifting the safety lever (see page 3.3) is maintained.

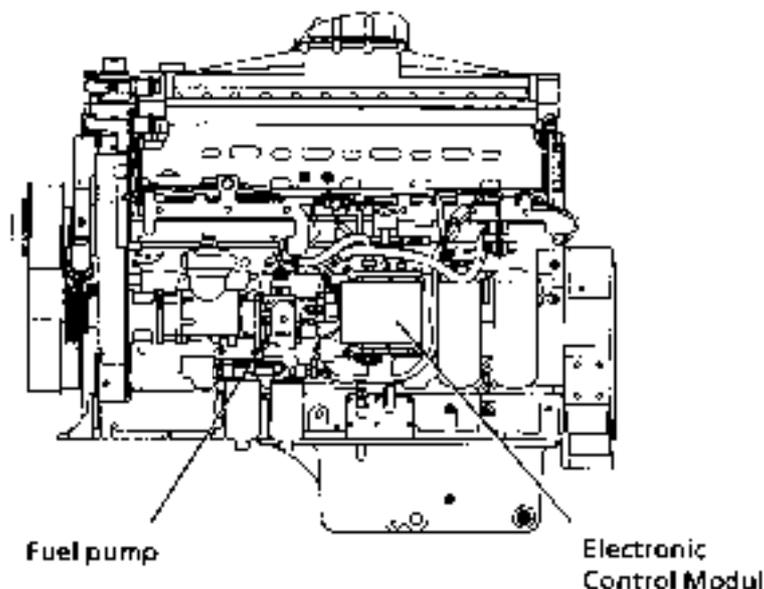
Switch S84-2 for safety operation of the central lubrication

Tilting the switch S84-2 briefly to the left or to the right for about two seconds when the control unit U15 of the central lubrication is out of order will cause the lubrication system to start a complete lubrication cycle.

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

MONITORING SYSTEM OF THE DIESEL ENGINE (QSK SYSTEM)

INDICATOR LIGHTS H60, H61 AND H62



All the troubles appearing on the Diesel engine or in its monitoring circuit are centrally indicated via the 3 indicator lights H60, H61 and H62.

These 3 control lights are connected to the ECM (Electronic Control Modul) of the QSK system, which is mounted to the engine, next to the fuel pump.

Apart from its monitoring function, the QSK fuel system has been designed to control the engine speed and fuel pressure so to optimise the exhaust emissions.

The red indicator light STOP (H 60) lights up when an important fault which could cause serious engine damage is detected.

If the stop light comes on while the engine is running, it may be automatically stopped by the monitoring system in case an important trouble is detected.

For the other faults, the monitoring system protects the engine while reducing its power or RPM.

Also in this case, the engine has to be brought to low idle and stopped in a safe manner as soon as possible.

Afterwards recognize the detected error(s) using the diagnostic switches S136 and S82.

Depending on the kind and severity of the recognized trouble, the system may cause automatic engine shutdown, power or speed derating.

The yellow indicator light WARNING (H 61) indicates an engine error which does not necessitate an immediate engine shutdown.

Recognize the detected error using the diagnostic switches, after stopping the engine.

Get the cause of the problem remedied as soon as is convenient regarding the cause of the problem.

The detected error can result in a power loss.

The red indicator light PROTECTION (H 62) shows that any parameter supervised by the system has come out of its normal operation range.

The engine is automatically stopped by the monitoring system in case one of the following troubles is detected:

- Low engine oil pressure
- High coolant temperature
- Low engine coolant pressure
- High intake air manifold temperature

For some other parameters the monitoring system achieves protection by derating the engine speed or the torque correspondingly.

The engine may be kept in operation temporarily, (eventually the engine power is reduced by the monitoring system), the problem must be diagnosed via the switches S136 and S82.

Automatic torque derate will happen in case one of the following troubles is detected:

- High fuel temperature
- High blowby pressure (= pressure in crankcase housing)
- Low coolant pressure (first stage), also causes speed derate
- Low oil pressure (first stage)

- High coolant temperature (first stage)
- High intake air manifold temperature (first stage)

DIAGNOSTIC SWITCHES S82 AND S136 FOR ENGINE MONITORING SYSTEM

These switches permit to recognize the faults which are detected by the engine monitoring system (electronic control module). These faults are connected to the centralized warning lights H60, H61 and H62 of the control desk.

There are two types of fault codes:

- the engine electronic system fault codes which will light up the indicator lights H60 and H61.
- the engine protection system fault codes which will light up the indicator lights H62.

All fault codes recorded will either be active (fault code is presently active on the engine) or inactive (fault code was active at some time, but is not presently active).

All active fault codes can be diagnosed as described below using both lamps H60 and H61.

Inactive fault codes can only be viewed with the optional equipment "Insite".

Diagnostic of the detected faults using the switches S82 and S136

If an indicator light H60, H61 and H62 is lighting, proceed as follows to recognize the detected errors:

- turn the ignition key to "OFF" then to "contact" position
- depress the switch S136 to position "ON", the indicator lamp H62 inside the switch lights up.

If no active fault codes are recorded, all three lights will come on and stay on.

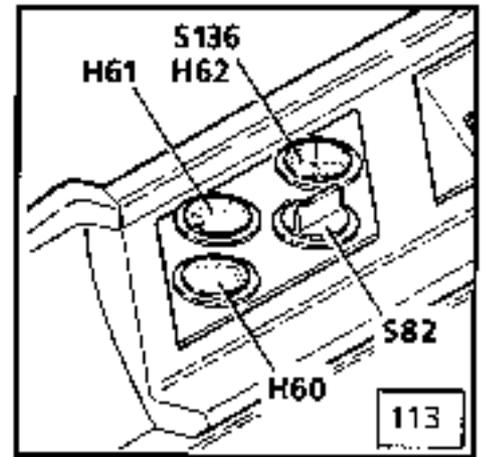
If active fault codes are recorded, all three lights will come on momentarily, and then .

- first the yellow lamp H61 will flash one time
- then the red indicator light H60 will blink, the sequence of blinking corresponds to the code of the error detected by the system. Between two consecutive blinking sequences for indication of the fault code, the yellow light H61 comes on.

Also see the section "Diagnostic fault codes" and the chart for diagnostic fault codes in the Cummins operation and maintenance manual .

- The sequence is repeated as long as the switch S136 remains on "ON" position, the yellow indicator light H61 goes briefly on between two consecutive flashing sequences.
- Remaining errors which are still detected can be recognized on the same way, using the rotary switch S82.

Briefly turning the switch S82 to the right "INC" causes the blinking sequence of the error with the code directly above to be displayed on indicator light H60, turning briefly S82 to the left "DEC" will display the error with the code directly below.



4. OPERATING PROCEDURES

PRE-STARTING INSPECTION

CHECK AIR FILTER FOR CONTAMINATION

Check the dry air filter on side of the Diesel engine to determine the degree of contamination.

When the maximum permissible depression has been reached, a red stripe will appear in the inspection port of the maintenance indicator 16 (fig. 1) and the filter must be serviced, see page 6.16.

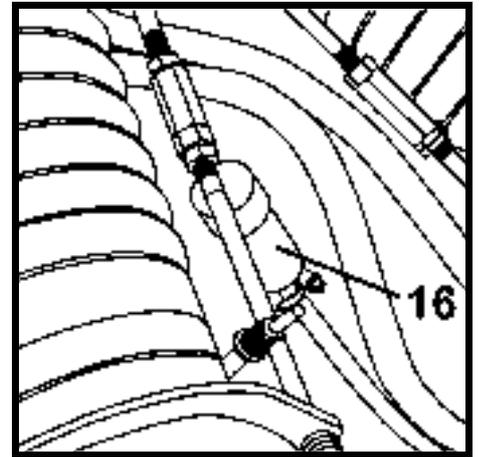


Fig. 1

ENGINE OIL LEVEL

Check the engine oil level with the machine on level ground. After engine shut down, allow 5 minutes for the oil to drain into the oil pan.

The oil level must be between the MIN. and MAX. mark on the dipstick, see fig. 2.



CAUTION

The engine oil is very hot at or near operating temperature. Avoid contact with hot oil and components containing oil, since it could cause severe burns.

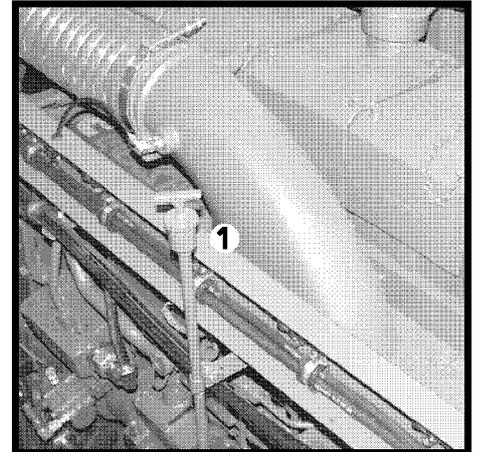


Fig. 2

COOLANT LEVEL



CAUTION

At or near operating temperature, the engine coolant is hot and under pressure.

Avoid contact with components containing coolant, since it could cause severe burns.

Check coolant level only after the cap 6 at the filler tube is cool enough to touch.

To check the coolant level, turn the filler cap 6 slowly to relieve pressure .

When the engine is very hot first let the pressure escape by slowly turning the pressure relief valve - radiator cap 7 (fig. 4) before removing cap 6.

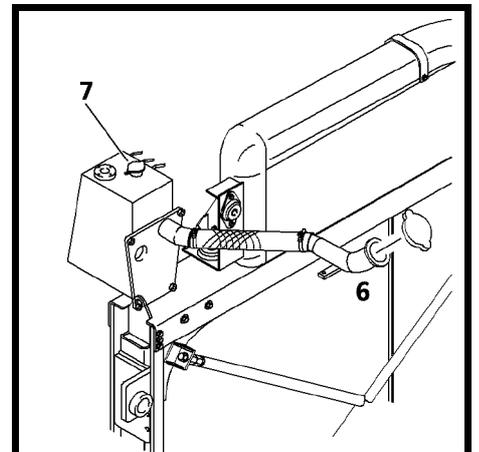


Fig. 3

When the coolant is cold, the coolant level should reach the top of the tube under the filler cap (fig. 3, pos. 6).

The proper antifreeze concentration (about 50% antifreeze) must be maintained all year long.

The excavator is delivered from the factory with a cooling system protection to -31 °F (-35 °C).



CHECK FUEL SYSTEM : FUEL LEVEL

The condensation in the fuel system and fuel tank must be checked daily.

Turn the plug 3 (fig. 5) on the water separator of the filters.

Drain the condensation until fuel drains off and retighten the plug.

Under ideal operating conditions, this interval may be extended to one week.

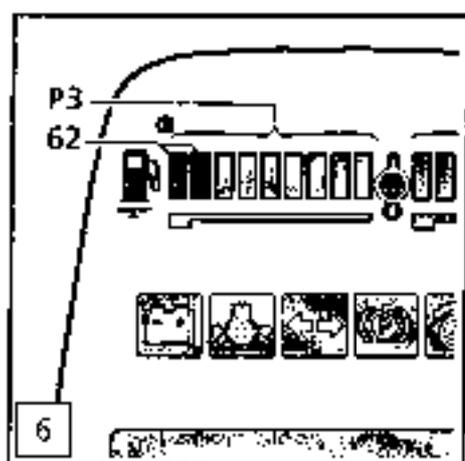
Check the fuel gauge P3 on the monitoring display (fig. 6) before starting to work.

If the red diodes 62 on the left of the indicator P3 light up, only a little reserve of fuel remains in the tank. For remaining quantity, see page 3.7.

Refill the tank, if fuel level is low.

Notice:

Since a high fuel level in tank reduces condensation inside the tank, the refueling should be done preferably at the end of the working day.



HYDRAULIC OIL

When checking the oil level or adding oil,

park the machine on level ground,

rest the attachments on the ground, with stick and lift cylinders fully extended and, if applying, with bottom dump bucket closed.

Check oil level in the hydraulic tank

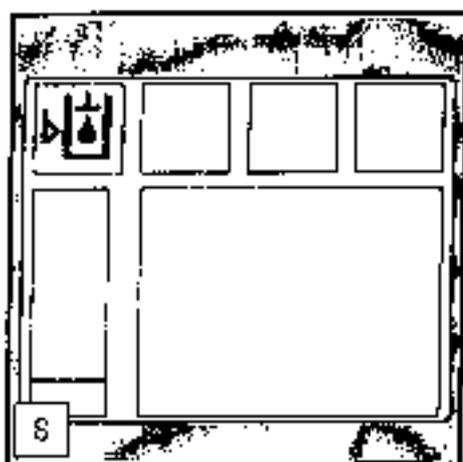
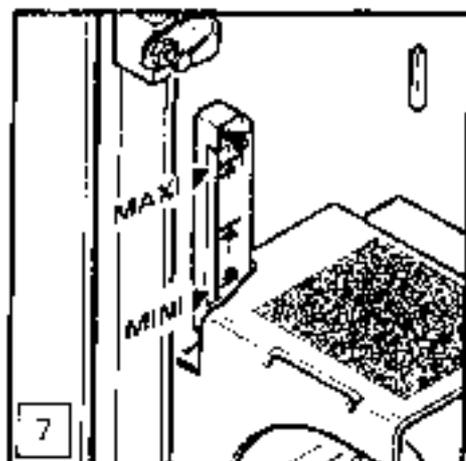
If, in this position, the oil level is below the middle mark on the sight gauge (fig. 7), oil has to be added through the return filter until the oil reaches the middle mark.

See page 5.1.6 for description of procedure for adding oil.

The upper mark (maxi) shows the maximum oil level when all cylinders are retracted.

The lower mark (mini) shows the minimum oil level when all cylinders are extended.

If the oil level drops below the lower mark on the sight gauge, the corresponding warning symbol appears on display (fig. 8).



MACHINE START UP SAFETY

- Before excavator start up, perform a thorough walk around inspection.
- Visually inspect the excavator, look for loose bolts, cracks, wear, any leaks and any evidence of vandalism.
- Never start or operate an unsafe excavator.
- Report all defects to your foreman or supervisor and make sure they are corrected immediately.
- Make sure all covers and doors are closed and all warning decals are on the machine.
- Make sure all windows, as well as inside and outside mirrors are clean, and secure all doors and windows to prevent any unintentional movement.
- Be certain that the area surrounding the excavator is free of other personnel, and that no one is working on or under the excavator before starting the engine.
- After entering the cab, adjust the operator's seat and controls, the inside and outside mirror, the armrests and fasten and adjust the seat belt. Be certain that all controls can be reached comfortably.
- All noise protection devices on the machine must be functional during operation.

DIESEL ENGINE OPERATION

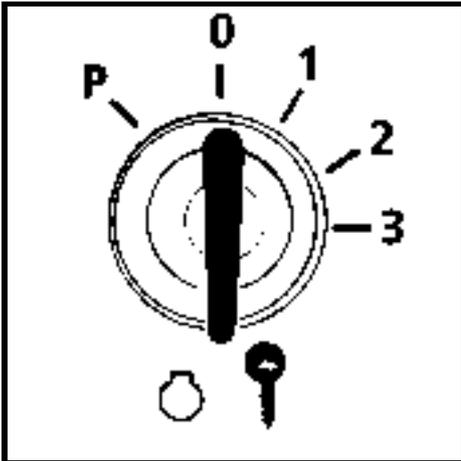


Fig. 13

IGNITION KEY POSITIONS (Fig. 13).

- 0- Off
- 1- Contact position
- 2- Not used (preheat)
- 3- Start

TURN ON THE ELECTRICAL SYSTEM

Turn the key to contact position -1-.

Immediately after turning the system on, the display and the control unit will run through a self test.

Make sure all indicators function properly after turning the electrical system on, i.e. the light emitting diodes (indicator lights and gauges) turn on for a short time then the complete field of the LCD indicator 200 turns momentarily black (the matrix indicator is energized completely for a short time).

Only the diode in the button S22 (Fig. 14) turns not on at that time.

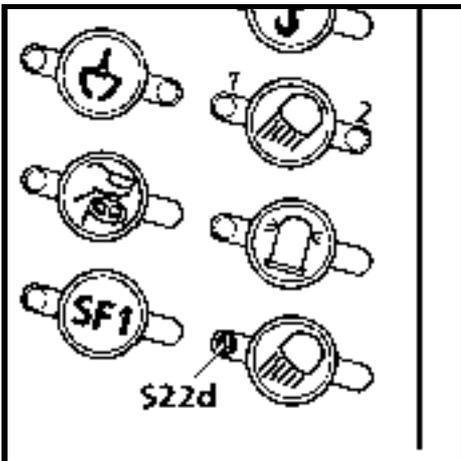


Fig. 14

STARTING THE ENGINE AT AMBIENT TEMPERATURES DOWN TO -0°C (32°F)

- Turn the ignition key to starting position 3.
- As soon as the engine is running, release the key.

The engine can not be cranked for more than 10 seconds!

If the engine does not start, turn the key back to off position prior to attempt to start again.

Repeat the starting procedure at one minute intervals to allow the starter motor to cool off.

ENGINE SPEED ADJUSTMENT

The LED indicator P4 (Fig. 15) displays the engine RPM.

It divides the complete RPM range into 10 Stages.

The engine RPM can be set either using the arrow keys S228 and S229, or using the MODE key S86 (Fig. 15).

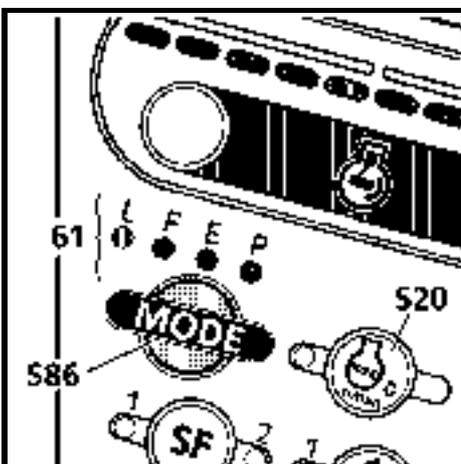


Fig. 15

With the arrow keys



Depressing an arrow key causes the RPM to jump in the next higher or lower RPM stage.

With mode preselection



Via the MODE key, different preset RPM can be selected. Depressing the button S86 causes to change from a preselected mode into the next, in the following order L, F, E, P, L, ... and so on. Immediately after starting, the engine will run either on RPM stage 1 (low idle) or on RPM stage 3 if a warm up procedure of the engine is necessary.

One of the four light emitting diodes (fig. 17, pos. 61) blinks to show which mode L, F, E or P is preselected (the preselected mode which was in use before the machine was turned off remains stored).

L	Mode LIFT	=	RPM stage 5
F	Mode FINE	=	RPM stage 10
E	Mode ECO	=	RPM stage 8
P	Mode POWER	=	RPM stage 10

By pushing the mode key S86, the initial condition is confirmed, the corresponding engine speed and power are transferred to the running Diesel engines, and the LED remains on.

If the engine speed is changed via the arrow keys to the engine speed for mode L, F, E or P, then it jumps automatically to the corresponding mode.

If the engine speed do not correspond to the preselected mode (either because the engine speed had been changed via the arrow keys or lowered via the low idle automatic), the LED blinks to indicate the mode selected before.

In mode E and P, the engine is running at its rated power curve (line II on fig. 18), in mode L and F it works at a power reduced by approx. 20% (line I)

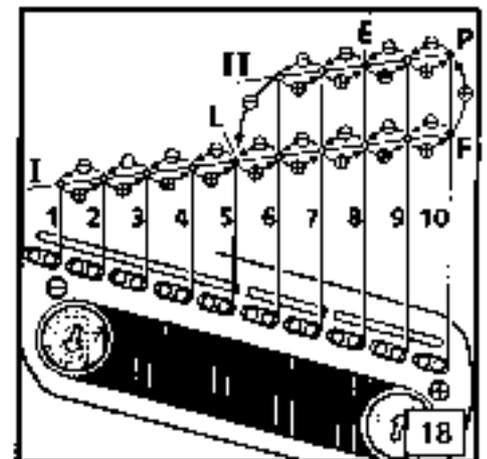
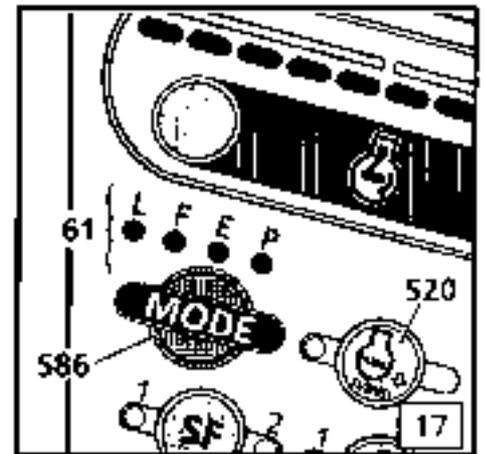
The fig. 18 also show the variation for RPM stages and corresponding engine power when using the buttons S228 and S229

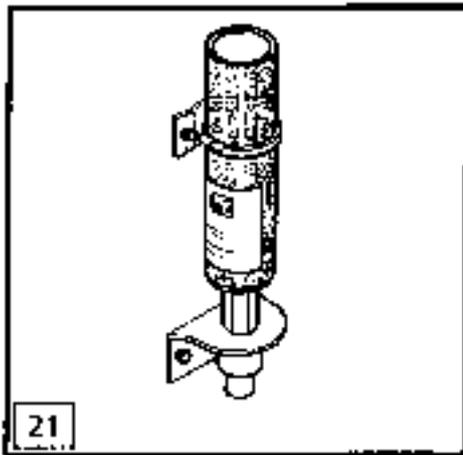
Adjustment via low idle automatic



The low idle automatic is turned on or off via the key S20 (left light emitting diode on the switch is on or off).

When the low idle automatic is turned on, the engine speed increases by itself to the preselected RPM stage as soon as any one of the pilot control units is actuated, and it is automatically reduced to low idle speed, if no pilot control unit is actuated within a given time frame.





STARTING THE ENGINE WITH THE COLD START SYSTEM AT AMBIENT TEMPERATURES BELOW 32° F (0° C)

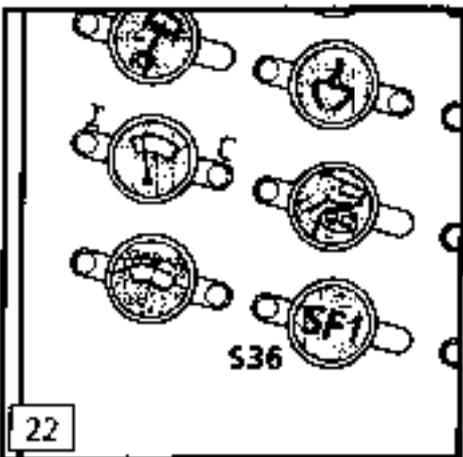
A cold start system is standard equipment (fig. 21), it greatly improves starting the engine at low temperatures.

Turn the ignition key to starting position and at the same time push in the button S36 (fig. 22) to actuate the cold start system.

Release the ignition key as soon as the engine has started.

The engine can not be cranked for more than 10 seconds!

If the engine does not start, repeat the starting procedure at one minute intervals.



AFTER THE ENGINE IS RUNNING

The following indicator lights must turn off after the engine is running (Fig. 23)

- H2 - Oil pressure
- H12 - Battery charge indicator

At low engine oil pressure or water level in the cooling device, the buzzer will sound, and the appropriate indicator light H2 or the corresponding symbol appears on Display.

In both cases, immediately reduce engine speed to low idle, and turn off after 5 seconds.

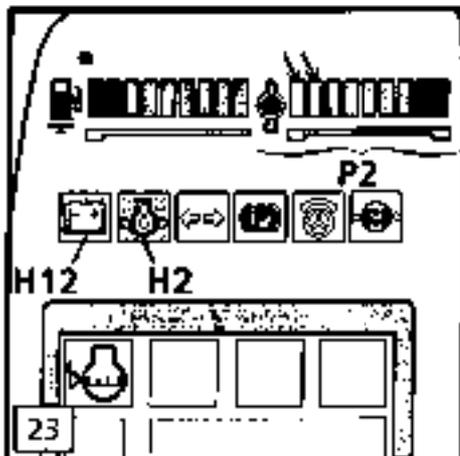
WARM UP PROCEDURE FOR ENGINE

With cold engine coolant (temperature below 20° C), the engine RPM will be set automatically to stage 3.

The warming up procedure will continue until the coolant reaches 20° C, however it will not exceed 3 minutes.

Increase the engine load slowly, until the second green lighting diode goes on on the temperature gauge P2 (fig. 24).

Do not run the engine for more than 10 minutes at low idle, or the engine can be damaged. Turn the engine off if the machine is not used for a longer period of time.



WARM UP PROCEDURE FOR HYDRAULIC CIRCUIT

With cold hydraulic oil (temperature below 20° C), the pump output is automatically limited (LR-current is limited to the value set for mode F).

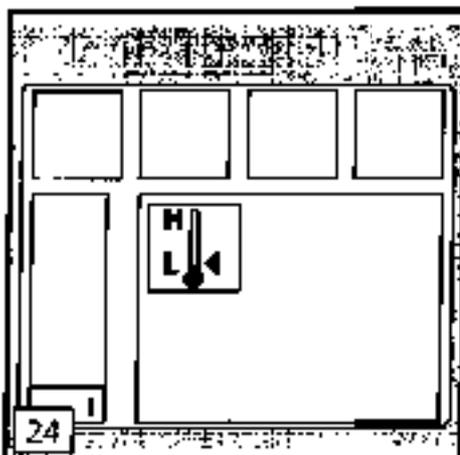
As soon as the oil temperature increases above 20° C, the full power of the machine is available.

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

During a warm up procedure for Diesel engine or hydraulik oil, the symbol (fig. 24) will be displayed on the screen.



Only run the engine if good ventilation is provided. Open doors and windows, if necessary, to provide sufficient ventilation.



CAUTION

- Run the engine until the hydraulic oil is at operating temperature. Low engine and hydraulic oil temperatures cause the excavator to be sluggish and unresponsive.
- Carefully move the machine outside and check the function of the travel and swing brakes.
- Check if all attachment functions are operating properly.

ENGINE SHUT DOWN PROCEDURE

Do not suddenly turn the engine off when the engines are running at high idle.

Reduce first the engine RPM to low idle via the arrow key S229, and continue to run the engine run for 3-5 minutes to lower the temperature.

Then turn the ignition key to the "0" position (fig. 25) to turn the engine off and remove the key.

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

EXTERNAL STARTING PROCEDURE

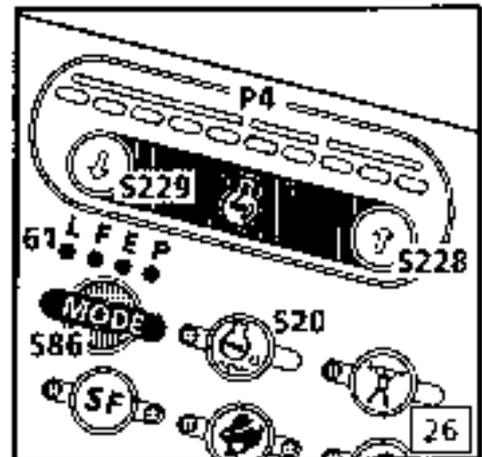
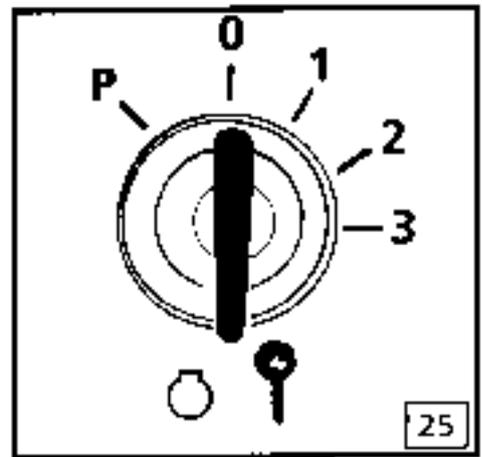
CAUTION

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

- First connect one cable to the \oplus terminal of the discharged battery and then to the \oplus terminal of the charged (external) battery. next connect the second cable to the \ominus terminal of the discharged battery and then to the \ominus terminal of the charged battery.
- Start the engine as described on previous pages.

Before removing the external starting cables, always bring to low idle the Diesel engine of the excavator and, if applying, also the Diesel engine of the external machine.

- First disconnect the cable from the \ominus terminal of the charged (external) battery and then from \ominus terminal of the discharged battery. next disconnect the cable from the \oplus terminal of the charged battery and then from the \oplus terminal of the discharged battery.



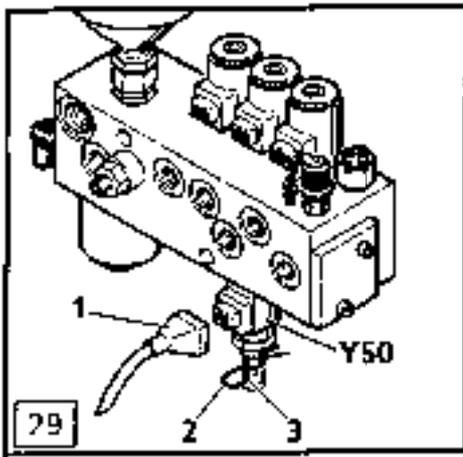
HYDRAULIC PUMPS SAFETY OPERATION

During normal operation of the excavator, the electronic horsepower control continuously adjusts the pumps flow to the pressure level of the working circuits.

If a trouble occurs in the circuit of the regulator, the pumps are swivelled back to minimal flow.

However, it remains possible in this case to carry on the working with the machine (with somewhat reduced pump power) by changing over the lever 3 on the servo oil unit which is mounted to the rear face of the spool valve console.

Disconnect the connector 1 from the solenoid valve, pull out the pin 2 and tilt the lever 3 in horizontal position (safety position).



MACHINE OPERATING SAFETY

- Familiarize yourself with job site rules. Be informed about traffic and hand signals and safety signs. Ask who is responsible for signalling.
Check your surrounding for any obstacles in the working and movement range, check the load carrying capacity of the terrain, and secure the job site to shield it from any public highway traffic. Rope off the working area of the machine and install the necessary signs to forbid any non authorized person entering the area.
- Always keep a safe distance from overhangs, walls, drop offs, and unstable ground.
- Be alert of changing weather conditions, bad or insufficient visibility and of changing ground conditions.
- Be alert for utility lines, check the location of underground cables, gas and water lines, and work especially careful in that vicinity. If necessary and/ or if required, call local authorities to mark the location, and take precaution against contact with underground utilities.
- Keep sufficient distance to electrical lines. When working in the vicinity of high voltage electrical lines, keep proper distance to assure that the attachment does not come close to the lines. DANGER! You must inform yourself about safe distances.
Preferably have the electrical lines de-energized (and lockout / tagged out according to the regulations applicable on the job-site) each time it is possible, and in any case if the closeness of the working area make it necessary.
- In case you do touch a high voltage line by accident, proceed as follows:
 - do not leave the machine,
 - move the machine, if possible, from the danger zone until you obtain sufficient distance,
 - 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.
 - 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, make sure that the attachments and equipment is secured properly to avoid accidents.
- When travelling on public roads, make sure to observe traffic regulations, and make sure that the machine meets federal and local public highway standards.
- Always turn on the lights if visibility is bad or if you are still working during dusk.
- Never allow other personnel on the excavator.
- Operate the excavator only while seated and with the seat belt fastened, if installed.
- Report any problems or needed repairs to your foreman or supervisor and make sure they are corrected immediately.
- Do not move the excavator until you are certain that no one is endangered by moving the excavator.
- On machines without negative brakes check the brake system before starting to work, as outlined in the Operation and Maintenance Manual.
- Never leave the operator's seat while the machine is still moving.
- Never leave the machine unattended (within view of machine), with the engine running.
- When moving the excavator, keep the uppercarriage in lengthwise direction and keep the load as close as possible to the ground.
- Prevent any working movements, which could tip the machine over. If the excavator begins to tip or slip on a grade, immediately lower the attachment and load to the ground and turn the excavator facing downhill.
If possible, always operate the excavator with the attachment positioned uphill or downhill, never sideways.
- Always travel slowly on rough or slippery ground and on slopes, and on loose soils.
- Always travel downhill at permissible speed, so you don't loose control over the machine. The engine must run at nominal speed, use only the foot pedals to brake and slow down the machine. Never shift during down hill travel, always shift to a lower gear before travelling downhill.
- Load an occupied truck only if all safety requirements are fulfilled, notably in order to protect the truck operator.
- For demolition work, clearing, crane operation, etc. always use the appropriate protection device designed for this specific application.
- If operating in visually obstructed terrain or whenever necessary, have another person guide you. Always have only one person signal you.
- Allow only experienced persons to attach loads or to guide operators. The guide must be visible by the operator and / or must be in voice contact with him.
- Depending on the attachment combination, it is possible for the bucket teeth to hit the cab, the cab protection or the boom cylinders. Be very careful when the bucket teeth get in this range to prevent any damage.
- 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.

TRAVEL FUNCTIONS

When traveling, align the uppercarriage up with the undercarriage (idlers in front, sprocket wheels in the rear).

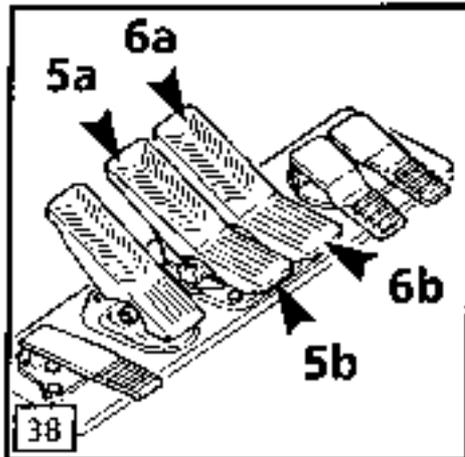
STRAIGHT TRAVEL

- Travel forward :

Push both foot pedals equally forward with your toes (Fig. 38, pos 5a and 6a)

- Travel reverse :

Push both foot pedals equally downward with your heels (Fig 38, pos 5b and 6b).



Before you travel in reverse make sure , it is clear and nobody is in your way!

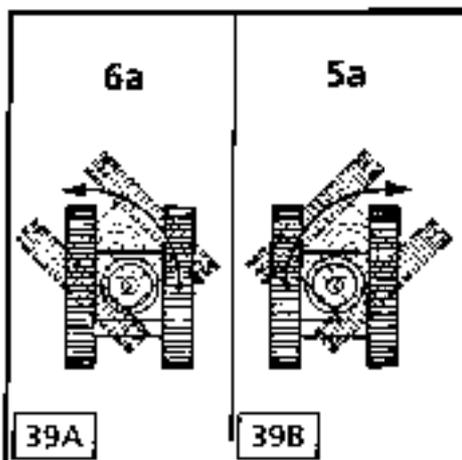
TO TURN OVER ONE TRACK

- To turn left forward (Fig. 39 A) :

Push the right foot pedal forward (pos. 6a).

- To turn right forward (Fig. 39 B) :

Push the left foot pedal forward (pos. 5a)



To protect the track components, reverse turns should be avoided.

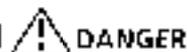
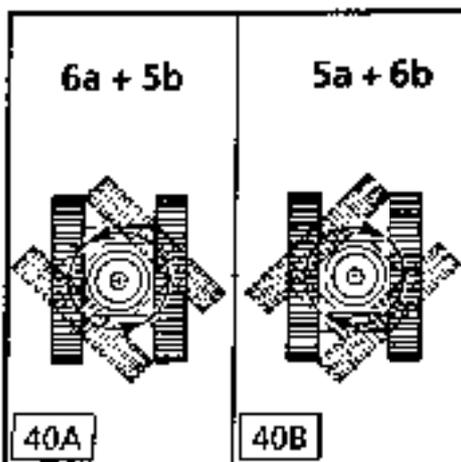
COUNTER ROTATION (Fig. 38)

- To turn left (Fig 40A) :

Push the right pedal forward (pos. 6a) and at the same time push the left pedal down with your heel (pos. 5b).

- To turn right (Fig. 40 B) :

Push the right pedal down with your heel (pos. 6b) and at the same time push the left pedal forward (pos. 5a).



If the uppercarriage is turned by 180°, note that the direction of travel is reversed when you push the pedals!

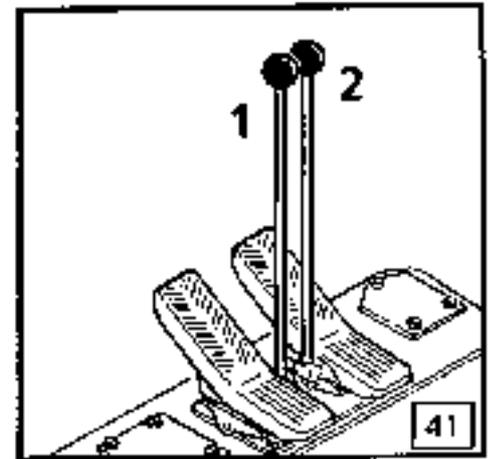
HAND LEVERS FOR TRAVEL

A more sensitive travel control can be achieved by using the two hand levers included in the tool kit (fig. 41, pos 1 and 2).



CAUTION

Attach the levers to the foot pedal and use this manual control when loading or unloading the machine from a flat bed trailer.



THE TRAVEL BRAKES

Travel brakes (hydraulic brakes) :

Releasing the foot pedals will automatically return them to neutral position.
This is sufficient to stop the machine on a level surface.

Run away of the machine traveling down a slope is prevented by the automatically acting brake valves.

The maximum travel speed cannot be exceeded.

Parking brakes (mechanical brakes) :

An electro-hydraulic controlled and negatively acting multi-disc brake is integrated in each travel gear. These brakes are actuated via the touch S354 (fig. 43).

They are used to fix the machine in any position (during parking, maintenance, transporting, working on a slope, ...).

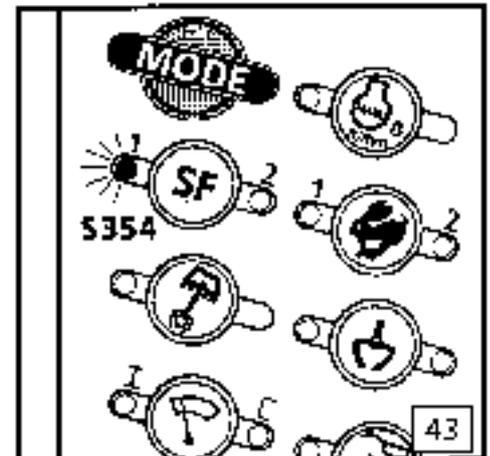
When the red light diode beside the touch S354 is on, the parking brakes are applied and the travel pedals are without function (servo pressure supply to the pedals is interrupted).

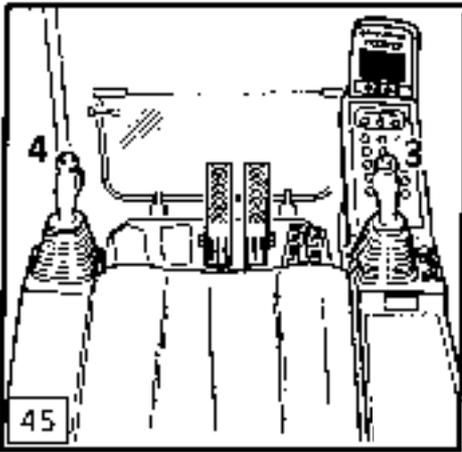
When the diode is off, the brakes are released and the travel pedals are enabled.



CAUTION

The parking brakes are designed to maintain the already stopped machine.
They are not destined to bring to standstill the travelling excavator.





LOCATION OF THE TWO JOYSTICKS

The right lever (Fig. 45, pos. 3)
- Boom and bucket movements

The left lever (Fig. 45, pos. 4)
Stick and swing movements

CONTROL OF THE SWING (left joystick)

Moving the joystick (Fig. 46, pos. 4) to the left (c) causes the uppercarriage to turn to the left (Fig. 47).

Moving the joystick 4 to the right (d) causes the uppercarriage to turn to the right (Fig. 47).

SWING BRAKE

1) Hydraulic service brake

No deceleration of the uppercarriage is achieved by moving the swing joystick to neutral position.

By moving the joystick to the opposite direction, maximum hydraulic braking action is achieved.

2) Mechanical parking brake

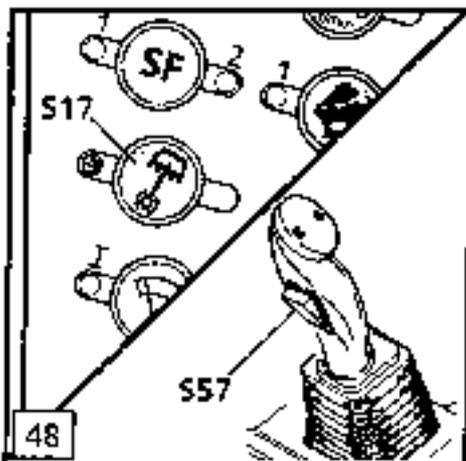
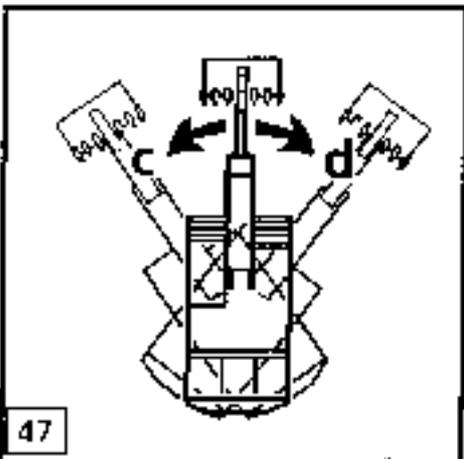
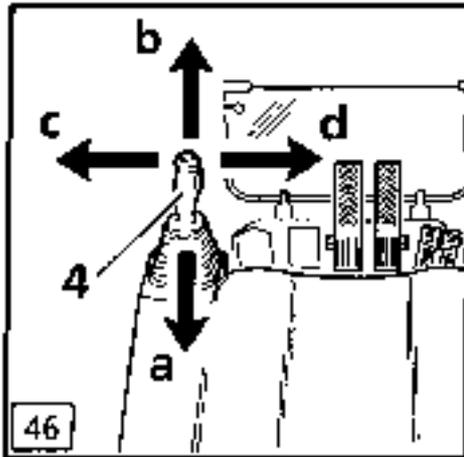
A multi disk swing brake, which is integrated in the swing gear, serves as an additional mechanical brake.

The brake is negatively acting, hydraulically actuated and serves as a holding or parking brake. When working, the swing can be locked in any position with this brake.

The operating mode of the mechanical brake is preselected via the push button S17 (fig. 48).

- In one position the brake remains always applied.
- In the other position, the brake is in semiautomatic mode and is controlled via the rocker switch S57 mounted to the right joystick lever.
- with the rocker switch S57 tilted down, the brake is applied, respectively it applies as soon as the uppercarriage speed gets lower than a limit value.
- with the switch tilted up, the brake remains released.

Notice: 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 preselect the semiautomatic mode.



CAUTION

The brake only applies when the uppercarriage is near standstill!

In order to stop the uppercarriage when working on a slope, tilt the switch S57 (fig. 48) down and reduce the uppercarriage speed by braking with joystick 4.

Move the joystick 4 back to "0" position only after the brake has applied.

Optional foot pedal for "positioning brake"

This pedal (Fig. 49, pos. 89) can be actuated progressively while working, this allowing a more sensitive deceleration or positioning of the uppercarriage (necessary as an example when working on a slope, lifting loads, ...).

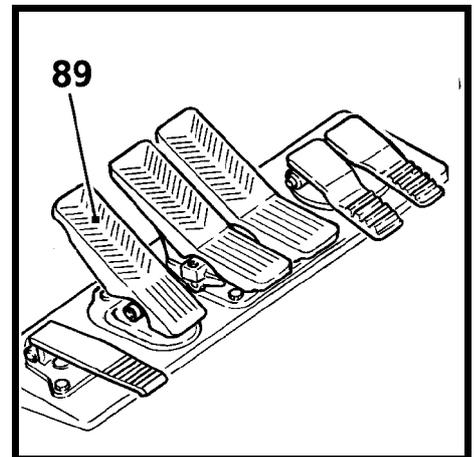


Fig. 49

CAUTION

This pedal should only be used as a positioning and standstill brake, not to stop continuously the uppercarriage from maximum swing speed.

Emergency Stop of the uppercarriage swing motion :

The swing brake can be applied independently of the uppercarriage RPM by pushing the button S17 (Fig. 48) in position "brake applied"

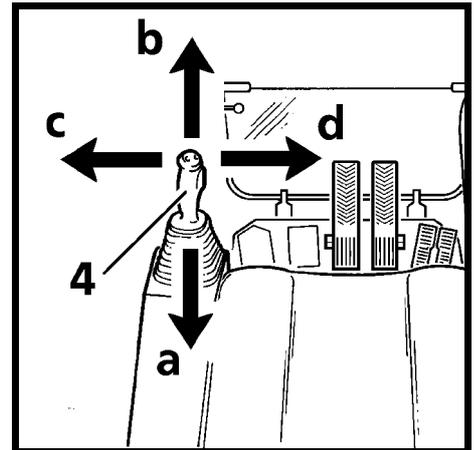


Fig. 50

CAUTION

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

To check the swing brake :

Apply the swing brake via push button S17 (Fig. 48).

Then move the left joystick 4 (Fig. 50) to the right and then to the left to stop.

The brake is working properly if the uppercarriage does not move.

WORKING POSITION

When working in longitudinal direction, the machine should be operated on the idlers with the sprockets behind (fig. 53).

NOTES ON MACHINE-FRIENDLY OPERATION WITH THE ATTACHMENT

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.

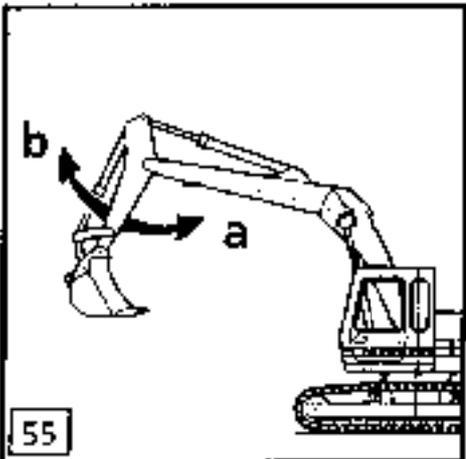
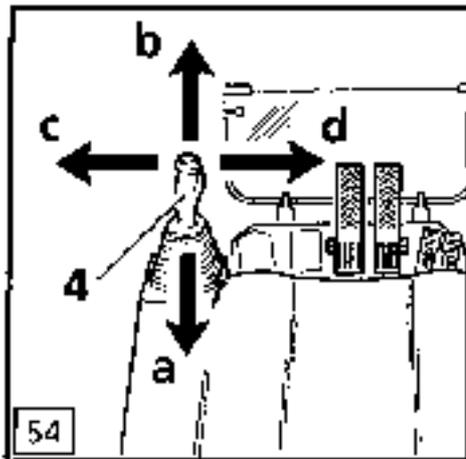
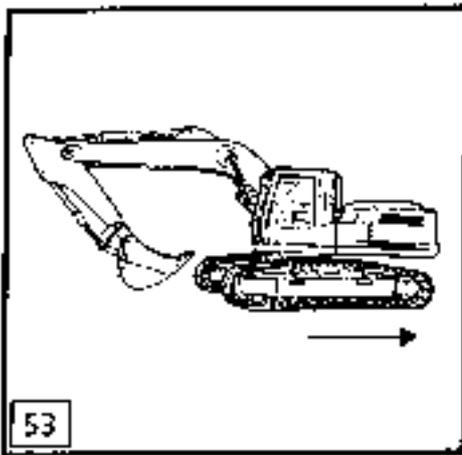
Do not let the machine fall heavily on the ground and do not hold it back with the hydraulics. This would damage the machine.

ATTACHMENT CONTROL

CONTROL OF THE STICK CYLINDER (left joystick 4 - fig. 54)

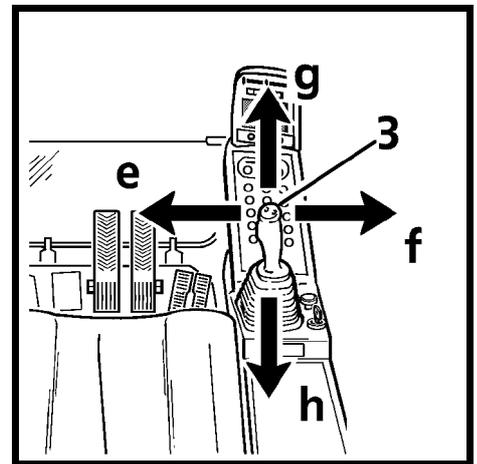
Pull joystick 4 backwards (a) to move the stick in, (fig. 55).

Push joystick 4 forward (b) to move the stick out.



**CONTROL OF BOOM CYLINDER
(right joystick 3 - fig.57)**

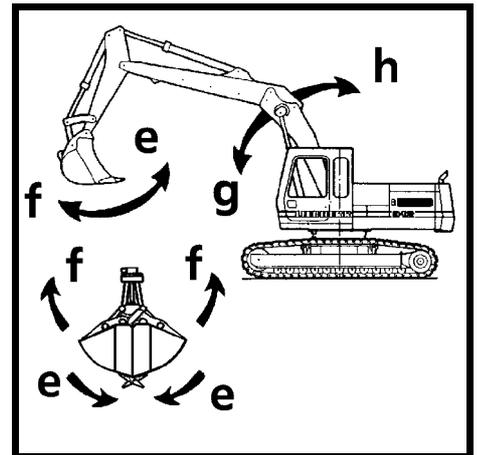
- Push joystick 3 forward (g) to lower the attachment (fig.58).
- Pull joystick 3 backward (h) to lift the attachment.



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**CONTROL OF THE BUCKET OR GRAPPLE CYLINDER
(right joystick 3 - fig. 57)**

- Push joystick 3 to the left (e) to tilt the bucket in or close the grapple (fig. 58).
- Push joystick 3 to the right (f) to tilt the bucket out or open the grapple.



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! DANGER

Never allow anybody to guide the grapple by hand !

CONTROL OF A SPECIAL EQUIPMENT (TELESCOPIC STICK, PULLING DEVICE, ...)

The control of special equipments such as telescopic stick (fig. 59A), pulling device (fig. 59B), hydraulic adjustable boom, ... is achieved using the two pedals, 7c and 7d (fig. 61).

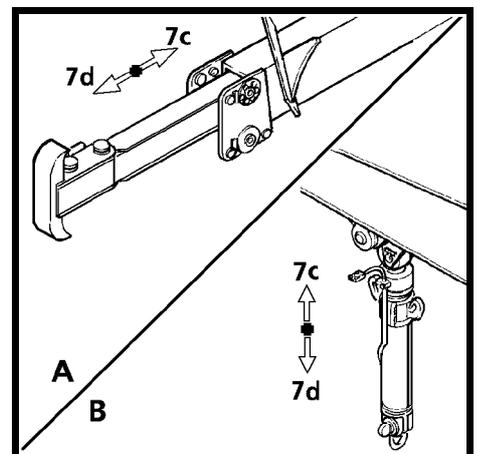
For special equipments with two hydraulic cylinders, the second cylinder is controlled via the pedals 7a and 7b (fig.61) of the right pilot control.

If in case of an additional equipment having several hydraulic users, the right pedals 7a and 7b are used to control two different movements, the commutation from one movement into the other is obtained while tilting the rocker switch S55 in the left joystick handle.

! CAUTION

Auxiliary control units can have various functions. Always check their functions when starting up the machine.

Depending on the function and on the type of the special tool, it may be necessary, before attempting to control the special equipment, to confirm the corresponding choice of pump parameters, using the menu "Set Option" of the display.

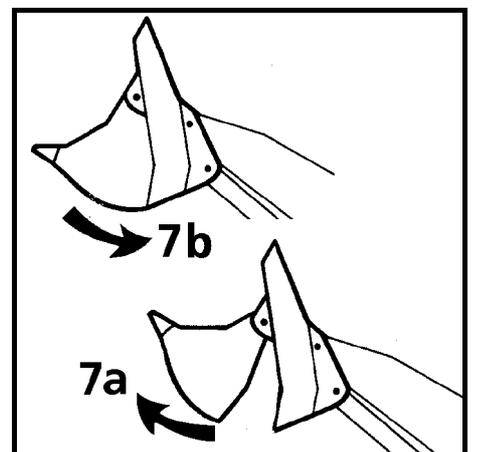


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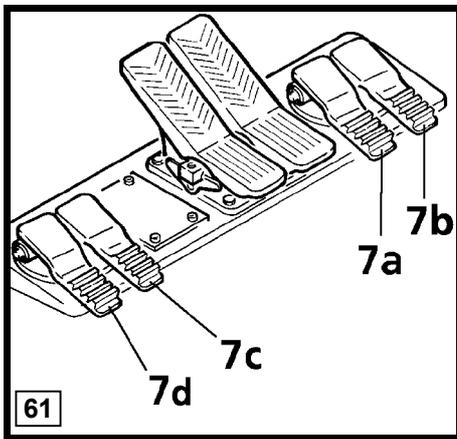
**CONTROL OF THE BOTTOM DUMP SHOVEL BUCKET
(optional equipment)**

The **bottom dump shovel** bucket is moved via two pedals, 7a and 7b (fig. 61).

- Push pedal 7a to open the shovel bucket (fig. 60).
- Push pedal 7b to close the shovel bucket

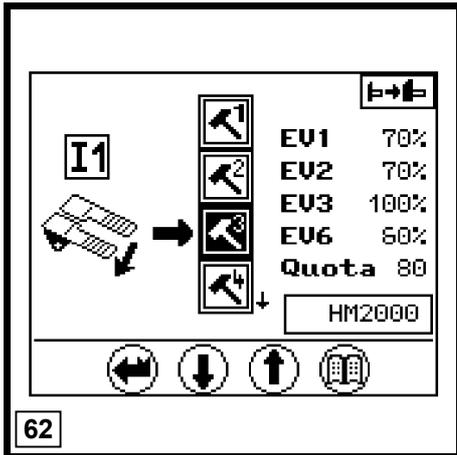


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CONTROL OF HYDRAULIC HAMMER (optional equipment)

- The hydraulic hammer is actuated via the pedal 7d of the left pilot control (fig. 61).
- **Notice:**
The operation of a hydraulic hammer requires the previous setting of the correct option which have been allocated to use of this hammer, using the menu "Set Option" of the display (fig. 62). Normally the designation appearing in the lower right corner of the screen must correspond to the definition of the installed hammer.
- In case of a doubt, contact your supervisor to obtain this information.



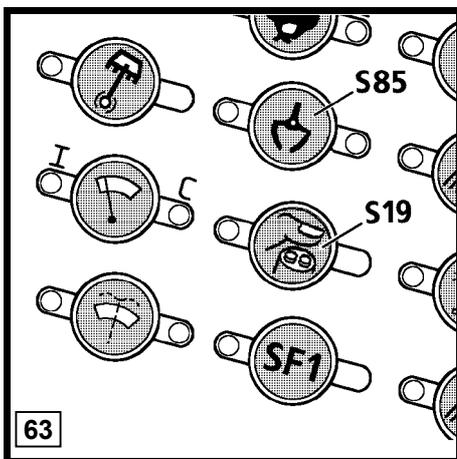
⚠ CAUTION

The choice of the option in the menu "set option" determines pressure and oil flow adjustment in the hydraulic circuit.

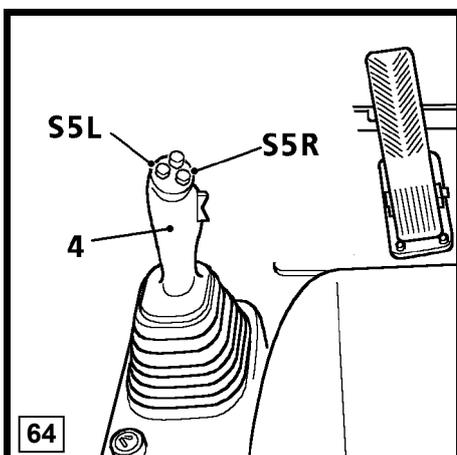
A wrong choice of the option could lead to damage or unsatisfactory operation of the additional equipment.

The choice of the option does neither have an influence upon the allocation of the pedals, nor lead, to a switching-off of the pedal function.

For operation with a hydraulic hammer:



- The hydraulic hammer must be selected with particular care. When using a hydraulic hammer not permitted by LIEBHERR, steel structures or the other machine components can become damaged.
- Before beginning breaking tasks, position the machine on firm and level ground..
- Use a hydraulic hammer designed exclusively for breaking stone, concrete and other breakable materials.
- Only operate the hydraulic hammer in the longitudinal direction of the machine and with the windshield closed or with a front protective grid.
- Ensure during hammer operation that no cylinder is entirely extended or retracted and that the stick is not in the vertical position.
- In order to avoid damages to the machine, try not to break stone or concrete while performing retraction and extension motions of the hydraulic hammer.
- Do not apply the hydraulic hammer uninterrupted for more than 15 secs. at a time to the same place. Change the breaking point. Too long uninterrupted operation of the hydraulic hammer leads to an unnecessary overheating of the hydraulic oil.
- Do not use the drop force of the hydraulic hammer to break stone or other materials. Do not move obstacles with the hydraulic hammer. Misuse of this nature would damage both the hammer and the machine.
- Do not use the hydraulic hammer to lift objects.





CAUTION

SPECIAL CONTROLS ON US VERSION

On machines sold in North America, the controls for rotating device, lifting magnet and for float position differ from those described below. For US version controls, refer to page 7.01.

CONTROL OF A ROTATING DEVICE

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

Depress the switch S19 (fig. 63) to make operative the control circuit of the added attachment

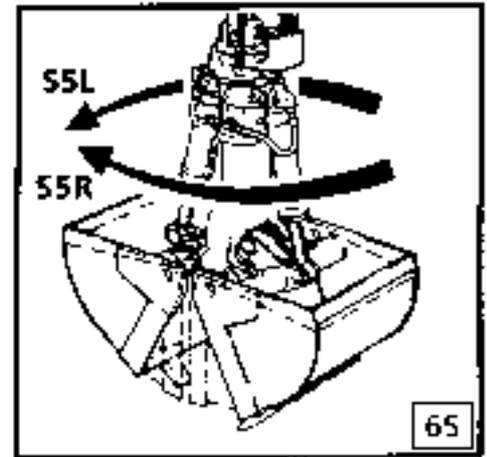
The specific equipment with rotating device is then controlled via the both push buttons S5 in the left joystick handle 4 (fig. 64 and 65).

Example: Control of a rotating grapple

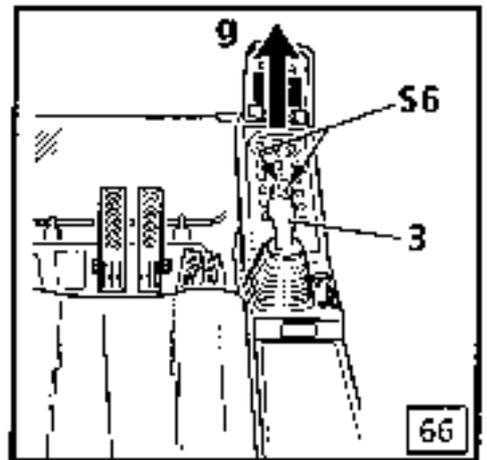
If the right button S5R is pushed, the grapple will rotate clockwise

If the left button S5L is pushed, the grapple turns counterclockwise.

The grapple rotates until the buttons are released.



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66

CONTROL OF A LIFTING MAGNET (optional equipment)

The control circuit for the lifting magnet is made alive while depressing the touch S4B on the rear control desk (see page 2.18)

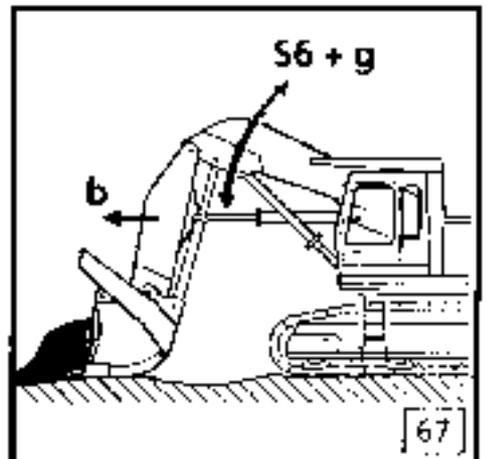
The lifting magnet is energized and de-energized via the both push buttons S6 on the right joystick 3 (fig. 66).

FLOAT POSITION OF LIFT CYLINDER FOR BUCKET OPERATION (optional equipment)

To turn on the float position for the lift cylinders, move the right joystick 3 forward (g) and push one button S6 on top of the handle at the same time (fig. 66).

Now the bucket can be used for grading work while moving the joystick 4 forward (fig. 68-b) to extend the crowd cylinders.

The attachment can then move up or down depending on grade and the bucket will automatically follow the ground contour (fig. 67)



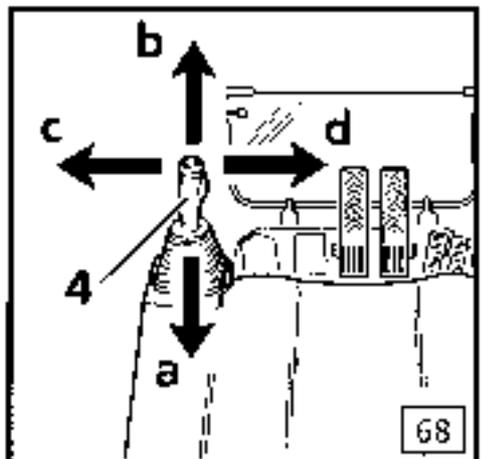
67

COMBINATION OF JOYSTICK MOVEMENTS

A diagonal movement of the joystick combines the movements of the attachment functions. This makes it possible for all attachment movements to be controlled at the same time.

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

- When the swing movement is actuated, all working functions/movements are possible without affecting the swing movement.
- During travel, every attachment movement is possible, but the swing movement has priority. In this case, the travel movement is reduced.



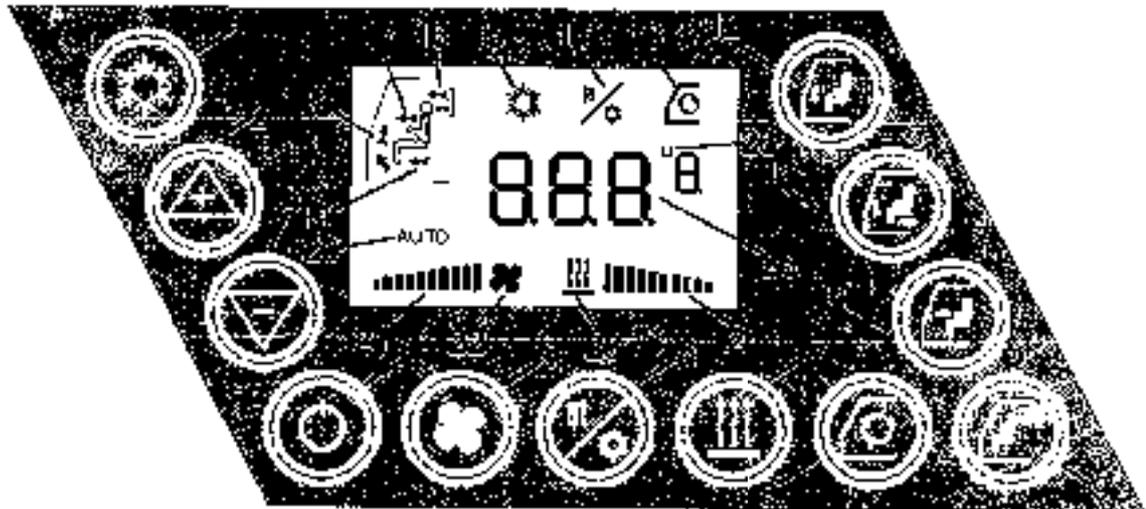
68

THE HEATER AND AIR CONDITIONER

As standard equipment the driver's cab is fitted with a heater and air conditioner unit (fig.76) which can be used for heating, cooling off and also as a fresh air ventilation for the cab.

The main functions of the control unit for this heater and air conditioner are described thereafter.

THE CONTROL UNIT



Control touches

- 1 - Touch - Air conditioner On / Off
- 2 - Touch - Increasing the set value for cab temperature, fan RPM, ...
- 3 - Touch - Reducing the set value for cab temperature, fan RPM, ...
- 4 - Touch - Control unit heater and air conditioner On / Off
- 5 - Commutation Touch - manual / automatic control for evaporator fan RPM
- 6 - Touch - REHEAT operation On / Off
- 7 - Commutation - Heater control manual / automatic
- 8 - Touch - Fresh air admission On / Off
- 9 - Touch - ventilation flap to cab rear side OPEN / CLOSED
- 10 - Touch - ventilat. flap to control board OPEN / CLOSED
- 11 - Commutation Touch - Lower ventilation flap in MIDDLE position - CLOSED
- 12 - Commutation Touch - Lower ventilation flap OPEN / in MIDDLE position

LCD- Indication

- 13 - Symbol indicates recirculated air operation
- 14 - Symbol indicates REHEAT operation
- 15 - Symbol indicates air conditioner on
- 16 - Symbol indicates ventilation flap to cab rear side OPEN
- 17 - Symbol indicates ventilation flap to control board OPEN
- 18 - Symbol indicates lower ventilation flap in MIDDLE position
- 19 - Symbol indicates lower ventilation flap OPEN
- 20 - Symbol indicates full automatic operation is ON
- 21 - Bar graph shows fan RPM (if manually adjusted)
- 22 - Symbol indicates manual fan control is ON
- 23 - Symbol indicates manual heating power control is ON
- 24 - Bar graph shows heating power (if manually adjusted)
- 25 - Indicates set value for temperature or error code
- 26 - Indicates the employed temperature unit - (°) or (F)

TURNING THE CONTROL UNIT ON

The heater and air conditioner is turned on via the touch (4). After turning on, the control unit will perform an autocheck for approx. 2 seconds.

Heater and fresh air ventilation of the cab are now operative.

The control unit controls in automatic the heating power and the RPM of the fan inside the heater and air conditioner.

However heating power, respec. fan RPM can also be adjusted manually while actuating the touch (7) respec. (5) and adjusting immediately after the heating

power respec. the fan RPM via the touches (2) and (3).

ADJUSTMENT OF DESIRED CAB TEMPERATURE

The 4 positions indication range (25) shows the set value for cab temperature.

Use the touches (2) and (3) to increase or reduce this value

RECIRCULATED AIR AND FRESH AIR OPERATION

The heater and air conditioner can be operated with 100% recirculated air, but also with a mixing of fresh air (F) and recirculated air (R).

Depressing the touch (8) alternately opens and closes the fresh air flap.

The recirculated air operation is indicated by the symbol (13).

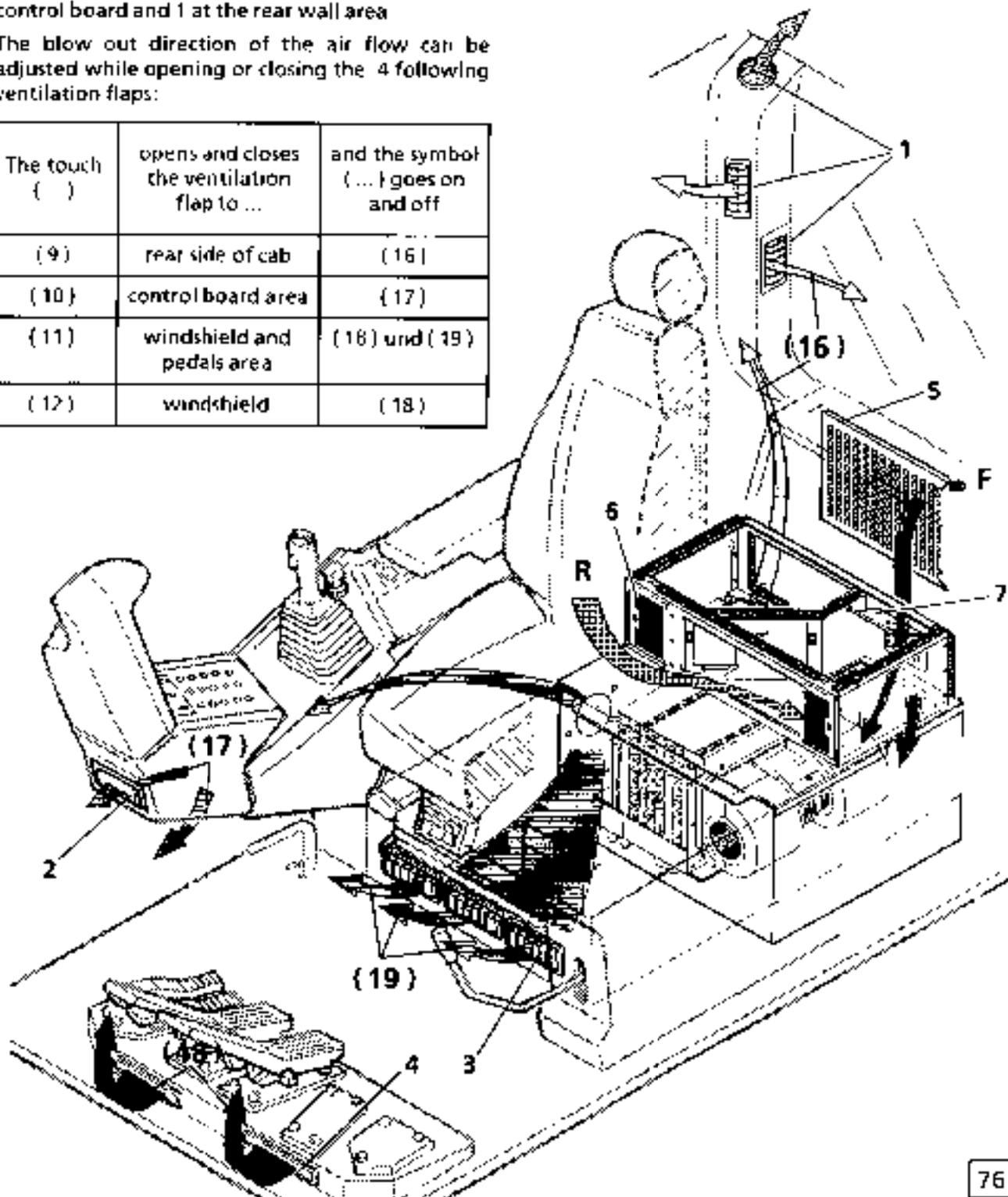
In position "fresh air" the fresh air flap 7 is open, and about 10% fresh air is admitted into the cab (depending on the contamination of the filters 5 and 6).

ADJUSTMENT OF THE AIR FLOW

The air flow enters the cab via the louvers 3 at the seat console, 4 at the front windshield, 2 at the control board and 1 at the rear wall area

The blow out direction of the air flow can be adjusted while opening or closing the 4 following ventilation flaps:

The touch ()	opens and closes the ventilation flap to ...	and the symbol (...) goes on and off
(9)	rear side of cab	(16)
(10)	control board area	(17)
(11)	windshield and pedals area	(18) und (19)
(12)	windshield	(18)



TURNING ON THE AIR CONDITIONER

The air conditioner operation is turned on and off via the touch (1). The symbol (15) indicates that the air conditioner is on.

The electronic control system then turns the compressor on and off according to the desired cooling effect and automatically adjusts the RPM of the evaporator fan inside the heater and air conditioner.

The air conditioner should only be turned on after the engine is running. This will prevent an overload on the starters and batteries.

The air conditioner may also be switched on temporarily in winter season to dehumidify the cab by high air moisture.

To do this actuate the "REHEAT" touch (6). The reheat operation is indicated by the symbol (14) of the control unit. The reheat operation will turn off automatically after 10 minutes.

IMPORTANT REMARKS

The air flow through the heater and air conditioner unit is controlled by adjustable and swivelling louvers.

To reach a maximal feeling of comfort we recommend:

- when heating, to blow the air out of the louvers 2 at the control console, 3 at the seat console and 4 at the windshield,
- during air conditioner operation, to blow the air out of the louvers 1 in the air ducts at the rear cab corners and 2 in the control console area.

The best heating, resp. cooling effect is reached in recirculated air operation (symbol 13 is displayed).

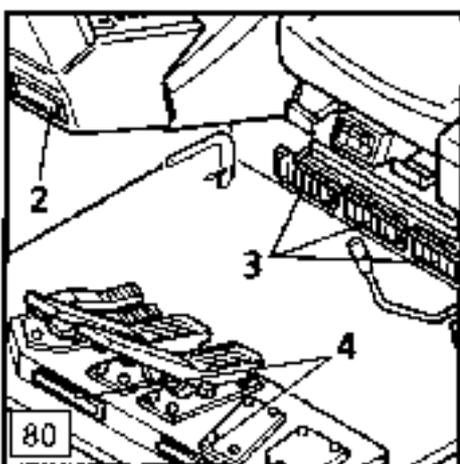
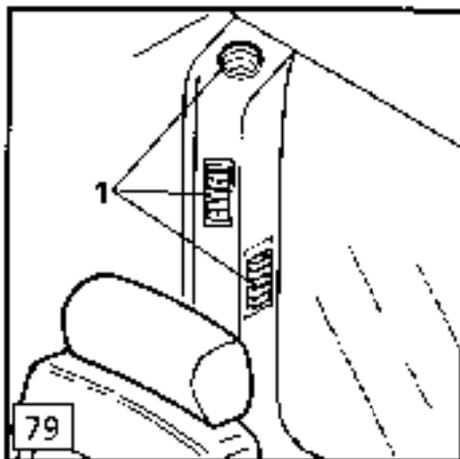
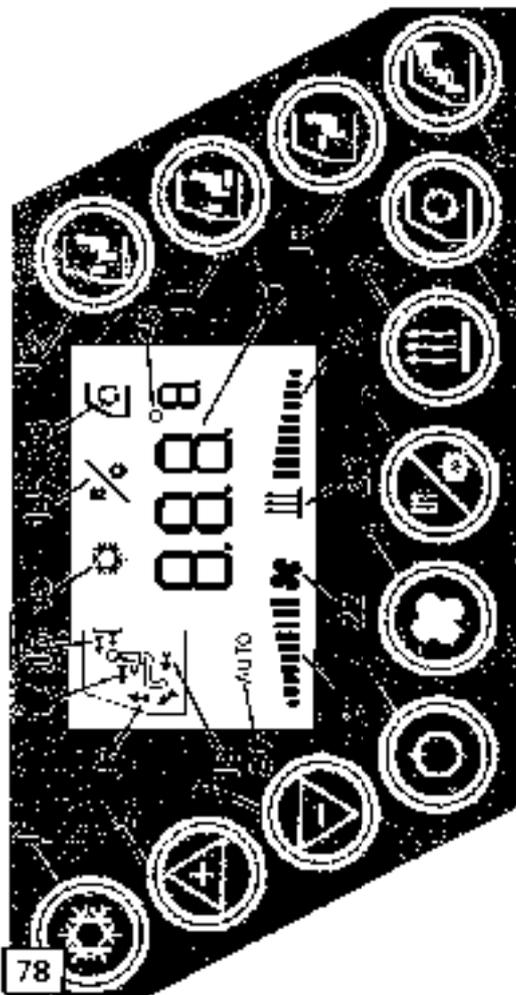
To defrost or dehumidify the windshield quickly, blow the whole air flow out of only the louvers 2 in the control console area and 4 at the windshield.

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

Open the windows and the door for a few minutes and adjust the blower fan to maximum RPM via the touches (5) and (2).

In case of very high outside temperature, preferably close the louver 4, so to avoid an unnecessary warming up of the inside air along the windshield.

Should the machine be operated for a longer period without use of the air conditioner (winter season, ...), so it is necessary to start the compressor for about 10 minutes every second week while actuating the "REHEAT" touch (5).



TRANSPORTING THE EXCAVATOR

LOADING THE EXCAVATOR ONTO FLAT BED TRAILERS OR RAILWAY CARS

Use only suitable transporting devices and lifting tackle with sufficient load carrying capacity.

Park the flat bed trailer on firm and level ground and block the chain or wheels.

If necessary, remove the attachments from the excavator for the duration of the transport.

When loading the machine on a flatbed trailer, be sure that the loading ramp incline is less than 30° and covered with wooden planks to prevent skidding.

Remove all mud, snow or ice from track components and wheels before moving up the ramp.

Before loading, secure the uppercarriage to the undercarriage with the lock pin.

Carefully align the excavator with the loading ramp.

Attach the manual control lever to the foot pedals to obtain a more sensitive travel control (see page 4.11).

Have another person guide and signal you.

Have blocks or wedges ready to block the machine, if necessary, when you move the excavator up the loading ramp to prevent it from rolling backwards.

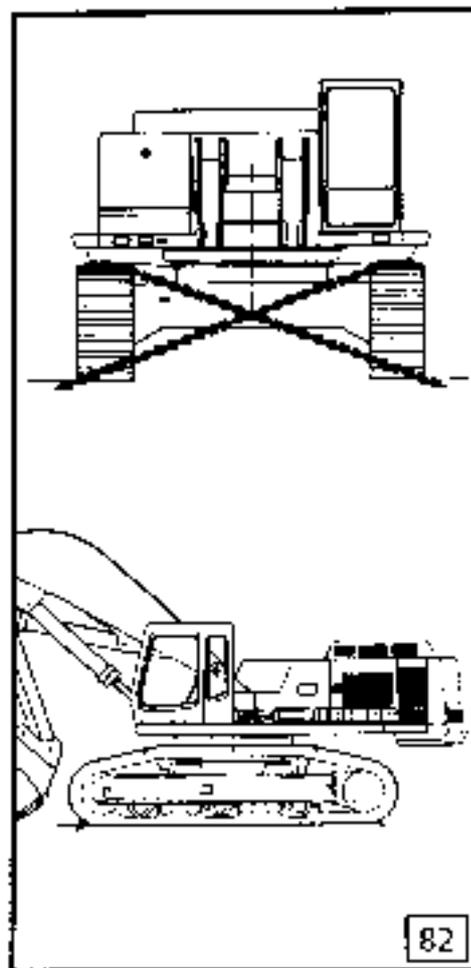
Retract the attachment as far as possible and lower the attachment as close as possible to the loading surface and, very carefully, drive up the ramp and onto the railway car or flat bed trailer.

When the excavator is on the trailer, release the uppercarriage lock pin, turn the uppercarriage toward the rear and lower the attachment.

If the backhoe attachment is attached, tilt the stick and bucket in. Relock the uppercarriage.

Apply the parking brakes and carefully secure the uppercarriage and other parts with chains and blocks to the trailer to prevent any slippage or movement (fig. 82).

Relieve the pressure lines, remove the ignition key, raise the safety lever, close all doors and leave the machine.



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LOADING THE EXCAVATOR USING A CRANE

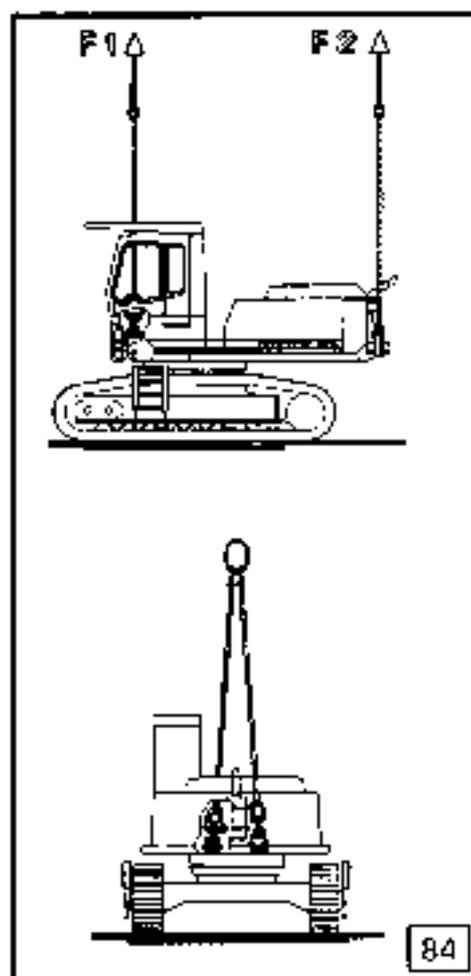


DANGER

Should the complete excavator be lifted with a crane (to load or discharge it from a ship or a railway car, ...) so we recommend the use of the LIEBHERR loading tools specially worked out to perform this operation with the maximal safety (Fig. 84).

Following schedule indicates the order numbers for the loading tools, as well the necessary lifting forces (in daN) when using this tools.

	R 974	R 984		
Order No.	9754404	9756619		
Force F1	37000	47000		
Force F2	19500	22000		



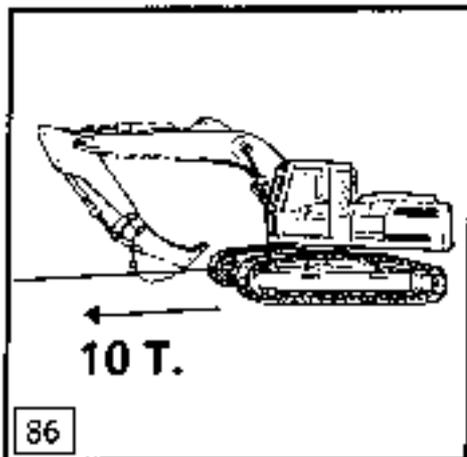
84

TRANSPORTING THE EXCAVATOR ON FLAT BED TRAILERS

Carefully check out the transport route. Make sure that width, height and weight allowances are within the limits.

Check that there is enough clearance underneath all bridges, underpasses, utility lines and in tunnels.

During the unloading procedure, proceed with the same care and caution as during the loading procedure. Remove all chains and wedges. Start the engine as outlined in the Operation and Maintenance Manual. Carefully drive off the loading platform. Keep the attachment as close as possible to the ground level. Have another person guide and signal you.



TOWING THE EXCAVATOR

The excavator should not be towed until absolutely necessary.

Towing is always the responsibility of the operator.

Be aware that any damages or accidents, which can occur when the excavator is towed, are never covered by warranty.

Tow the excavator only if absolutely necessary, for example to remove it for repairs from a dangerous job site.

Make sure that the cable or the towing rod are strong enough and are routed around center of the undercarriage or to the towing hook on the undercarriage, which is designated for this purpose (fig. 86).

This hook has a 10 ton towing capacity in direction of the center axle of the undercarriage.

CAUTION!

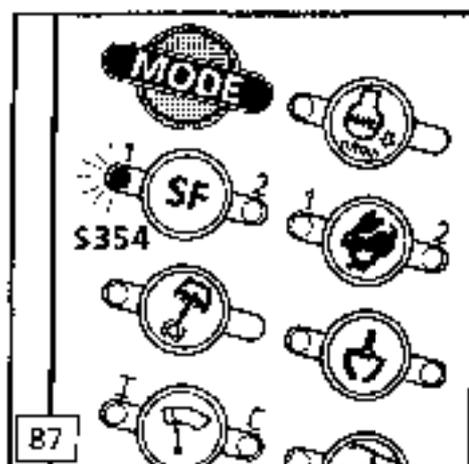
During towing, the disk brakes in the travel gears have to be released via the touch S354 (fig. 87) and the travel direction has to be controlled by the foot pedals.

The ignition key has to be turned to contact position.

If the battery is not charged properly and/or servo pressure is insufficient, check how the travel brakes can be released.

If necessary, consult a LIEBHERR mechanic!

After the towing procedure is completed, return the machine to its previous state.



Never allow anyone to stand near the cable when pulling or towing the excavator.

Keep the cable tight and free of kinks.

Pull the cable slowly.

The cable could snap and break if it suddenly jerked.

TRAVELLING PROCEDURES FOR MINING MACHINE

The life expectancy of undercarriage components is based on standard working conditions with a maximum travel ratio of 5% per service meter unit. Working and / or travelling on uneven ground and / or abrasive material will influence the lifetime of the components and attract additional cost for the undercarriage components.

In general travel action has to be kept to the lowest level that is possible. Minimize travelling with turning through a narrow turning circle and long distance travel.

To minimize the travel ratio, professional mine planning with longfront winning sections is preferred. If digging operations at various spots are necessary, a proper short term and long term plan of winning operations has to be employed to guarantee long term use of the excavator at one place before moving to another location.

However, if frequent machine movement is necessary, the following set of procedures defined by LIEBHERR to minimize possible machine damage, downtime and wear have to be taken into consideration

General

In order to move the machine forwards: with the excavator in standard forward position, depress travel pedals all the way forward with the toes. Direction of travel is in the direction of idlers.

In order to move the machine backwards: with the excavator in standard forward position, depress travel pedals all the way down with the heels. Direction of travel is in the direction of the drive sprockets.

Moving the machine during loading operations

Moving the machine during loading operations means adjustment of excavator digging and / or truck loading position of some meters.

Important procedures:

- Before moving the machine, empty the bucket and close up the attachment to a position as close as possible to the excavator undercarriage
The practice of placing the attachment on the ground and lifting the machine, then counter turning the undercarriage, is not allowed, because it could cause premature structural damage to the machine
- If there is a build up of material around the tracks where the machine will not turn, you must move the machine several meters forwards and / or backwards and attempt to turn again
- If mine safety regulations allow, the operator can use the swing function to assist in turning the tracks, i.e. if turning to the right, swing upper deck to the left and vice versa.

Walking the machine over distance

Walking the machine distances means any movement of the machine of more than 100m or for a time period longer than 3 minutes, whatever comes first.

In addition to above mentioned guidelines, when moving the machine during loading operations, the following procedures apply:

- It is required to have somebody standby with a heat gun, to monitor the temperature of the drive components, including the track and carrier rollers
- If temperature of any moving part is growing up about 20°C above ambient temperature, interrupt travel and only commence again after parts have sufficiently cooled
- To prevent overheating during travelling or to speed up cooling procedure it is advisable to have a water truck standby, to hose the heating components during travelling or cooling break.
- Move with idler and attachment forwards. Whenever possible, and not to contravene with mine safety regulations, swing whilst travelling to equally load track rollers. However, always ensure that clear forward vision is maintained.

Travelling the machine down grades or upgrades

In addition to above mentioned guidelines, when moving the machine during loading operations or when walking the machine distances, the following procedures apply :

- When travelling down grades greater than ten percent, it would be better to walk the machine down with the track motors first, i. e. the machine is moved backwards
- When travelling up an incline, the final drives must be at the rear of the excavator
- When walking down from a bench, firstly prepare a ramp, making it no more than a 30° slope (machine must be able to walk up unaided). When moving down the ramp never allow the machine to fall down on the attachment. When walking up the ramp never use attachment to assist the movement by pushing with the hydraulic power of the bucket, stick or boom.

Travelling the machine first time

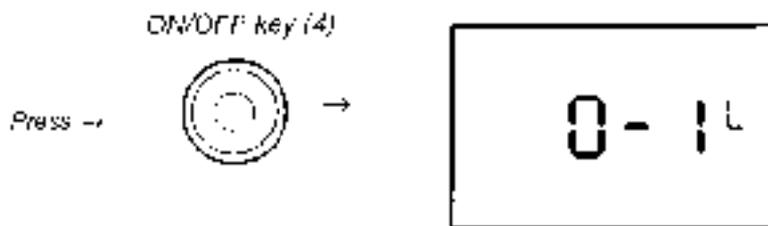
The slide bearing (friction bearing) of the track rollers needs some time for running-in. If the bearing becomes hot at an early stage of machine life, this may cause lubrication problems during further life. Therefore when travelling the machine the first time aside from all above mentioned guidelines it is strongly recommended to move carefully and at reduced speed.

Note: Warranty may become void if failure to recognize and comply with the recommended travel operating procedures, as outlined in this document, is noted.

Detailed description of the heating and air-conditioning

Fig. 1

Switching on the system:



Comment:

As the control unit is carrying out a self test, the software version is displayed for approx. 12 sec.!

Fig. 2

Setting the desired cab temperature:

Set cab temperature is displayed in °C, e.g. 26 °C.
Control unit is in automatic operation, the circulated air/fresh air fan is open (fresh air operation). All other vent flaps are closed!

Desired cab temperature 21 °C is displayed.
The evaporator fan turns at min. speed, as all air flaps are closed!

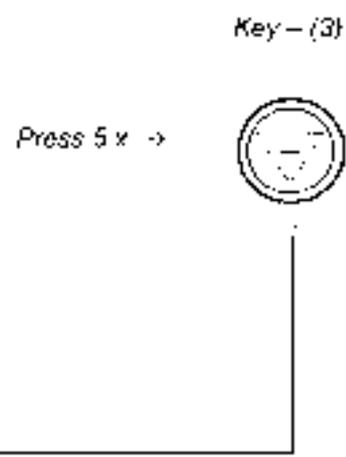
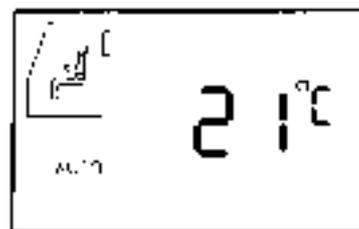
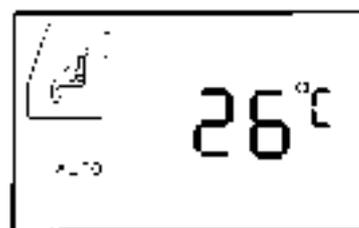


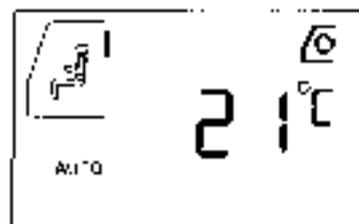
Fig. 3.

Fresh air- / circulated air operation:

Key - (8)



Press 1 x



The fresh air flap is closed. symbol (13) indicates circulated air operation.

Note:

By applying the key once again - (8) fresh air operation is reactivated. Symbol (13) will no longer be displayed.

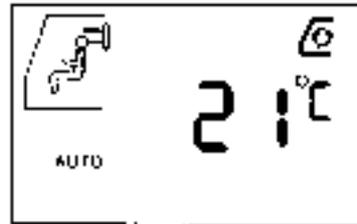
Fig. 4

Opening / closing the vent flap rear panel:

Key - (9)



Press 1 x



The vent flap's rear panel opens, symbol (16) indicates that the vent flap is open

Note:

By applying the key once again - (9) the vent flap's rear panel is closed, symbol (16) will no longer be displayed

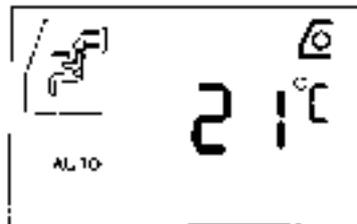
Fig. 5.

Opening / closing the vent flap armrest:

Key - (10)



Press 1 x



The vent flap's arm rest is opened, symbol (17) indicates that the vent flap is open

Note:

By applying the key once again - (10) fresh air circulation is reactivated, symbol (17) will no longer be displayed.

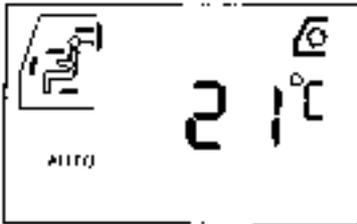
Fig. 6.

Opening / closing the vent flap front window and foot room area:

Key - (11)



Press 1 x



The vent flap front window and foot room area are opened, symbol (18 + 19) indicates that the vent flap front window and foot room area is open.

Note:

By applying the key once again - (11) the vent flap front window and foot room area are closed again, symbols (18+19) are no longer displayed

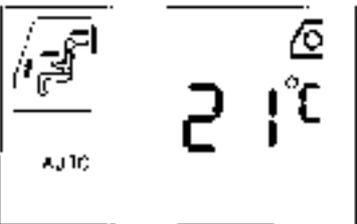
Fig 7

Opening / closing the vent flap foot room area:

Key - (12)



Press 1 x



The vent flap front room area opens, symbol (18) indicates that the vent flap foot room area is open

Note:

By applying the key once again - (12) the vent flap foot room area is closed again, symbol (18) is no longer displayed

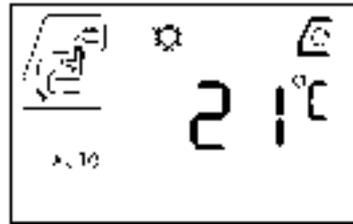
Fig. 8.

Switching air-conditioning operation on / off:

Key (1)



Press 1 x



Air-conditioning operation has now been activated. Symbol (15) indicates that air-conditioning operation is on, the compressor is activated from the control unit as required.

Note:

By applying the key once again – (1) air-conditioning operation is deactivated, symbol (15) is no longer displayed.

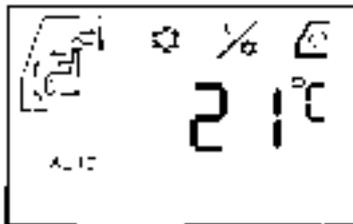
Fig. 9

Switching REHEAT operation on / off:

Key – (6)



Press 1 x



REHEAT operation has now been activated, symbol (14) indicates that REHEAT operation is on, the compressor is constantly active. The evaporator fan speed is raised to 100 %, the vent flap front window and foot room area opens in order that the front window is cleared of condensation. The control unit switches on the heating as required to retain the room temperature of a set value. REHEAT operation is heated to 10 min. automatically.

Note:

By applying the key once again – (6) REHEAT operation is deactivated, symbol (14) is no longer displayed.

Fig. 10

Manual setting of the evaporator fan speed:

Key – (5)



Press 1 x



Manual fan speed is set at 100%

Manual setting of the fan speed is now active, the symbol (21) in the bar display shows the current set fan speed, symbol (20) AUTO is no longer displayed. The fan symbol (22) flashes for 5 sec. and during this time, the fan speed can be adjusted in 10% steps via keys + (2) or (-). The lowest speed which can be set is 30% (three bars are displayed).

Note:

By applying the key twice (5) automatic operation is reactivated, symbol (20) is displayed. Symbols (21+22) are no longer displayed.

Fig. 11

Manual setting of the heating output:

Key – (7)



Press 1 x



Manual heating output is set at 70%

Manual setting of the heating output is now active, the symbol (24) in the bar display shows the current set heating output, symbol (26) AUTO is no longer displayed. The heating symbol (23) flashes for 5 sec. and during this time, the heating output can be adjusted in 10% steps via keys + (2) or (-). The lowest heating output which can be set is 0% (no bars are displayed).

Note:

By applying the key twice (7), automatic operation is reactivated, symbol (26) is displayed. Symbols (23+24) are no longer displayed.

Fig. 12.

Switching over the temperature display in ° Fahrenheit:

Press + hold



Set temperature is displayed at 21° Celsius!



key - (8) then
press

key - (3)



Set temperature is displayed at 69° Fahrenheit!

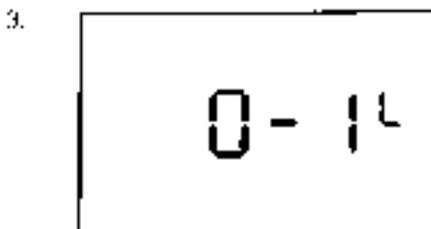
Note:

By applying the keys (8+3) once again, the temperature display is changed over to ° Celsius again!

Fig. 13

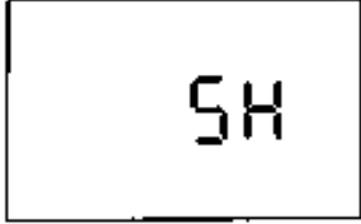
Operation with auxiliary heating: (optional)

1.  Ignition is switched off
2. Auxiliary heating control unit authorizes standard heating operation.



Comment:
As the control unit is carrying out a self-test, the software version is displayed for approx. 12 sec!

Note:
It is not possible during auxiliary heating operation to carry out manual settings. The heating valve position is always 100%. The evaporator fan speed is 50%.

4.  Auxiliary heating operation is indicated in the display

5. **Start**
 Ignition key
After the diesel engine has been started, standard heating operation is switched off and normal operation is reactivated. The setting, which was last stored is active.



Display of faults and notes on fault remedying

Fig. 14

Error code "F0" faulty room temperature gauge:



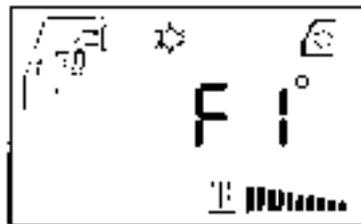
Room temperature gauge error is displayed flashing!

Note:
Should a gauge error occur, the regulator continues to operate to the setting which was valid before the fault was recognised!

Note:
The control unit has recognised a faulty room temperature gauge, the regulation is no longer ready for operation.
Cause of gauge error: short-circuit or interruption of gauge power supply line, plug connection on gauge or control unit, temperature gauge faulty.
The regulator is then only ready for operation again when the fault of the gauge has been remedied, the gauge error will then no longer be displayed!

Fig. 15

Error code "F1" faulty blow-out temperature gauge:



Note:

The control unit has recognised a faulty blow-out temperature gauge, the regulation is no longer ready for operation.
Cause of gauge error, short-circuit or interruption of gauge power supply line, plug connection on gauge or control unit, temperature gauge faulty.
The regulator is then only ready for operation again when the fault of the gauge has been remedied, the gauge error will then no longer be displayed!

Blow-out temperature gauge error is displayed

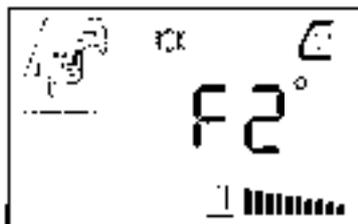
flashing!

Note:

Should a gauge error occur, the regulator continues to operate to the setting which was valid before the fault was recognised!

Fig. 16

Error code "F2" faulty reserve temperature gauge:



Note:

The control unit has recognised a faulty reserve temperature gauge, the regulation is no longer ready for operation.
Cause of gauge error, short-circuit or interruption of gauge power supply line, plug connection on gauge or control unit, temperature gauge faulty.
The regulator is then only ready for operation again when the fault of the gauge has been remedied, the gauge error will then no longer be displayed!

Reserve temperature gauge error is displayed

flashing!

Note:

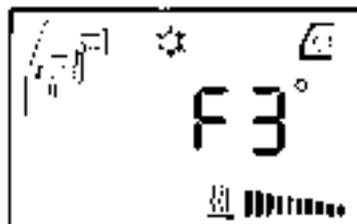
Should a gauge error occur, the regulator continues to operate to the setting which was valid before the fault was recognised!

Note!

is not currently used!!!!

Fig. 17

Error code "F3" faulty vent flap foot room area and front window:



Note:

The control unit has recognised a faulty vent flap room area and front window, the regulation is once again ready for operation.
Cause of flap fault, short-circuit or interruption of the power supply line, plug connection on fan flap motor or control unit, flap motor faulty.
After remedying of the fault, the fault is no longer displayed!

Vent flap foot room area and front window error is displayed flashing!

Note:

Should a flap error occur, the regulator carries on working as usual, only the middle position of the vent flap can no longer be started!

Fig. 18

Error code "F4" pressure fault and faulty magnetic coupling:



Note:

The control unit has recognised a pressure fault or faulty magnetic coupling.
Cause of fault, short-circuit or interruption of the power supply line in the magnetic coupling, plug connection on the coupling or control unit, overpressure or underpressure (lacking refrigerating agent) in the refrigerating system of the air conditioning unit.
After remedying of the fault, the fault is no longer displayed!

Pressure fault and faulty magnetic coupling is displayed flashing!

Note:

Should a pressure fault or faulty magnetic coupling occur, the regulator carries on working as usual, only the magnetic coupling output is interrupted!

Fig. 19

Error code "F5" faulty data transmission operating feature / control unit:



Note:

Data transmission from the operating feature to the control unit is faulty, cause of the fault, short-circuit or interruption of the data line to control unit, plug connection on operating feature or control unit

The operating feature continues to try to establish data connection to the control unit. If the connection is once again OK, "F5" - fault will no longer be displayed

Faulty data transmission is displayed flashing!

Note:

If the data transmission from the operating feature can not be established again, the ignition must be switched off, and RESET will be carried out following the restart!

5. LUBRICATION

GENERAL SAFETY INFORMATION

It is very important that all guidelines describing lubrication, checking the oil level, replacing the oil are strictly adhered to !

This maintenance increases the life of the excavator and improves its dependability.

It is especially important to change the oil regularly and in the intervals noted on the maintenance schedule ! Only use specified lubricants and oils !



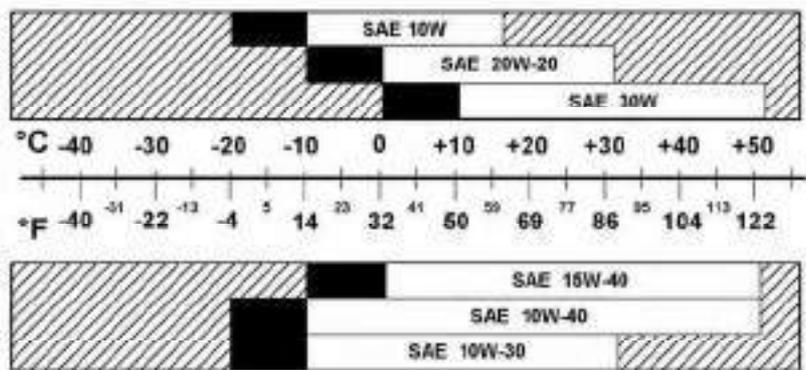
When checking or replacing the oil, observe the following :

- Park the machine on level ground, if not otherwise stated, and turn the engine off.
 - When working in the engine area, make sure the covers and side doors are secured.
 - Only add fuel when the engine is turned off.
 - Never smoke or allow an open flame in refueling areas.
 - Cleanliness is especially important when changing engine, gear or hydraulic oil. Before removing fittings or plugs, make sure the surrounding areas are cleaned. When changing the oil, clean the fill or drain plugs.
-

IMPORTANT !

Be sure to drain oil into a suitable container and dispose of oil and filter cartridges properly.

LUBRICANT AND FUEL CHART R 984 C Litronic

COMPONENTS	SYMBOL	VISCOSITY SAE DIN 51512	QUANTITY
DIESEL ENGINE (Turbocharged)			
- Lubricant		See the Operation and Maintenance Manual for CUMMINS engine	58 l. 15.5 US gal.
- Fuel		See the Operation and Maintenance Manual for CUMMINS engine	1580 l. 415 US gal.
- Antifreeze		See the Operation and Maintenance Manual for CUMMINS engine	88 l. 23 US gal.
HYDRAULIC SYSTEM		 <p>WARMING UP THE HYDRAULIC SYSTEM :</p> <ol style="list-style-type: none"> 1. For temperatures 18°F (10°C) below the lower limits : ████████ Run engine at half speed. Warm up the hydraulic system by fully actuating hydr. Cylinders and motors for shorts periods. Continue warm up for about 10 minutes or until operating temperatures are reached. 2. For temperatures below the limits listed under 1 : Preheat hydraulic oil in the tank before starting the engine. 	In hydraulic tank 880 l. 232 US gal. In hydraulic system 1660 l. 439 US gal.

LUBRICANT AND FUEL CHART R 984 C Litronic

COMPONENTS	SYMBOL	VISCOSITY	SPECIFICATION	QUANTITY
SWING GEAR		1) With swing brake only used as a parking brake	SAE 90 API GL-5 and MIL-L-2105 B, C or D	31 l.
		2) With swing brake also used as a service brake (Actuated via a footpedal)	SAE 90 LS API GL-5 and MIL-L-2104 C or D MIL-L-2105 B	8,2 US gal.
TRAVEL GEAR		SAE 90	API GL-5 and MIL-L-2105 B, C or D	2 x 20 l. 2 x 5,3 US ga
SPLITTERBOX		SAE 90	API GL-5 and MIL-L-2105 B, C or D	14,5 l. 3,8 US gal
SWING RING TEETH		Special grease	See lubricant specification	
GENERAL LUBRICATION POINTS		CONSISTENCY 2 NLGI N° 2 Grade	MULTI PURPOSE GREASE KP2k or EP2 (Extreme pressure N° 2 Grade)	
Swing ring Attachment bearings Track tensioner...				
Hinges, couplings, locks			Engine oil	
Rubber seal on doors and covers			Silicon Spray or talcum	
REFRIGERATING AGENT FOR AIR CONDITIONER			R 134 a	1,9 kg (4,5 lbs)
REFRIGERATOR OIL IN AIR CONDITIONER COMPRESSOR			Planetel PAG SP20 (ELF)	0,21 l. (5 oz)
WINDSHIELD WASHER SYSTEM			Commercial Windshield washer fluid Denatured alcohol	3,5 l. 0,92 US gal

LUBRICANT AND FUEL SPECIFICATIONS

INFORMATION TO THE LUBRICANTS AND LUBRICATION CHARTS

The capacities in the lubricants chart and on the lubrication chart inside the cab are only given for your guidance.

Always check the level of a component after replacing its oil or when topping it up



1) LUBRICANTS FOR DIESEL ENGINE :

See the Operation and Maintenance Manual for CUMMINS engine.



4) HYDRAULIC OIL :

Hydraulic oil specifications

1. Mineral oils

Recommended and approved are engine oils, which conform to the following specifications and regulations :

For single viscosity oils : API - CD / CCMC - D4 / ACEA - E*
Mercedes-Benz specifications - page No 226.0 and 227.0

For multi viscosity oil : API - CD+SE / CCMC - D5 / ACEA - E3
Mercedes-Benz specifications - page No 227.5, 228.1 and 228.3

2. Environmentally friendly hydraulic fluids (also called "BIO oils" -bio degradable oils-)

The "environmentally friendly hydraulic fluids" recommended by LIEBHERR are limited to synthetic ester based hydraulic fluids with a viscosity according to ISO VG 46.

Initial filling is performed ex works according to customer desires. The use of environmentally-friendly hydraulic fluids must be arranged with the LIEBHERR Co beforehand.

Organic oils should not be used due to their poor temperature consistency.

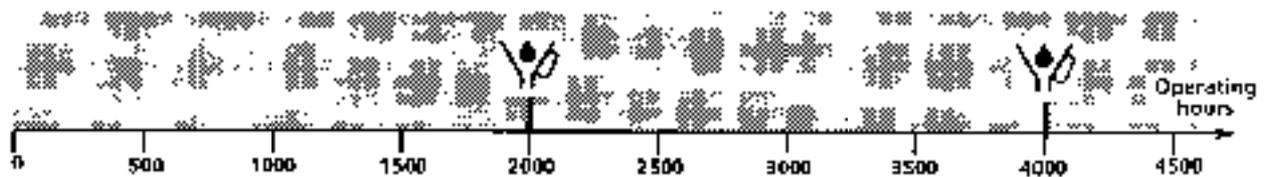
Note: It is absolutely necessary never to mix different brands of environmentally friendly hydraulic fluids or to mix fluids with mineral oils.

For further information on operating while using environmentally friendly hydraulic fluids, see page 8.7.

Hydraulic oil change intervals

1. Oil changes in preset intervals

Note: Oil changes in preset intervals are only permitted for mineral oils. When using environmentally friendly hydraulic fluids, oil sample analysis reports must be used to determine the time of the oil change, see 52.



2. Optimized oil change intervals determined through oil sample analysis reports

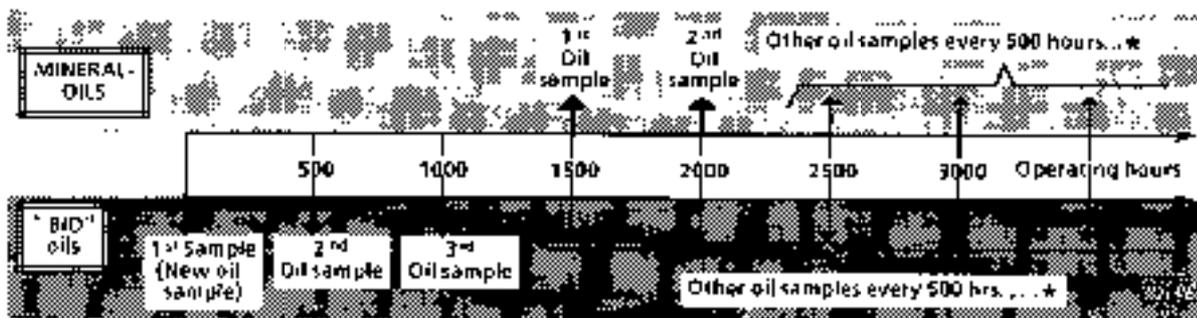
Use this procedure to take oil samples in preset intervals. The intervals may be extended between two oil changes as long as the properties of the oil are still satisfactory.

The time when the oil must be changed is determined by the lab report.

LIEMHERR recommends to submit the oil samples to "WEAR - CHECK" for oil analysis.

A kit for a complete analysis at WEAR - CHECK is available: Id. No. 7018368 (The kit contains the sample containers, documentation, shipping container and oil sample hose).

A hand pump is required to take the oil sample, and should be ordered separately (Id. No. 8145666).



* ... time for oil change determined by lab report



5) GEAR OILS

Gear oils for viscosity classification SAE 90 must meet the specifications API-GL-5-90 and MIL - L 2105 B, C or D.

For SAE 90 viscosity, SAE 80W90 can also be used



6) GREASE FOR SWING RING ROLLER RACES AND GENERAL LUBRICATION POINTS :



This grease must meet specifications, consistency classification 2 in NL-GI viscosity per DIN 51 818 and DIN 51 825 or EP2 per NF-T-60 132.

The grease must be lithium-complex based, with VKA value of at least 2300 N per DIN 51350 or ASTM D 2596.

GREASE FOR AUTOMATIC LUBRICATION SYSTEM

For the temperature range +60° C to -10° C { 140° F to -50° F} use a grease meeting the consistency classification 2 in NL-GI viscosity.

LIEBHERR recommends the use of :

- Multi-service grease RPL - LIEBHERR part N° : 8501565 / 1 pack
5 cartridges of 400 grammes.
- Multi-service grease AVIA - LIEBHERR part N° : 8500299 / drum of 25 Kg.

For operating in ambient temperatures that are expected to remain under -10° C, it is recommended to make an early change of the grease type to a specific "LOW TEMPERATURE" grade, which can be recommended to you from your grease supplier and which will have the necessary pumpability and "WORKED PENETRATION" consistency between 265 - 295 at -10° C temperature.



7) GREASE FOR SWING RING TEETH

- Compound Spray 2000 E - LIEBHERR part N° : 8612107
- Paste RHZ 2 * - LIEBHERR part N° : 8612304 / 1 piece (1 Kg)
8500752 / 1 pack (10 pieces)
8500799 / drum of 5 Kg.

Molydag 147 / 400 * - for cold countries (below - 20 °C, - 4 °F).

(*) also suitable for automatic lubrication systems.

8) REFRIGERATOR OIL IN AIR CONDITIONER COMPRESSOR :

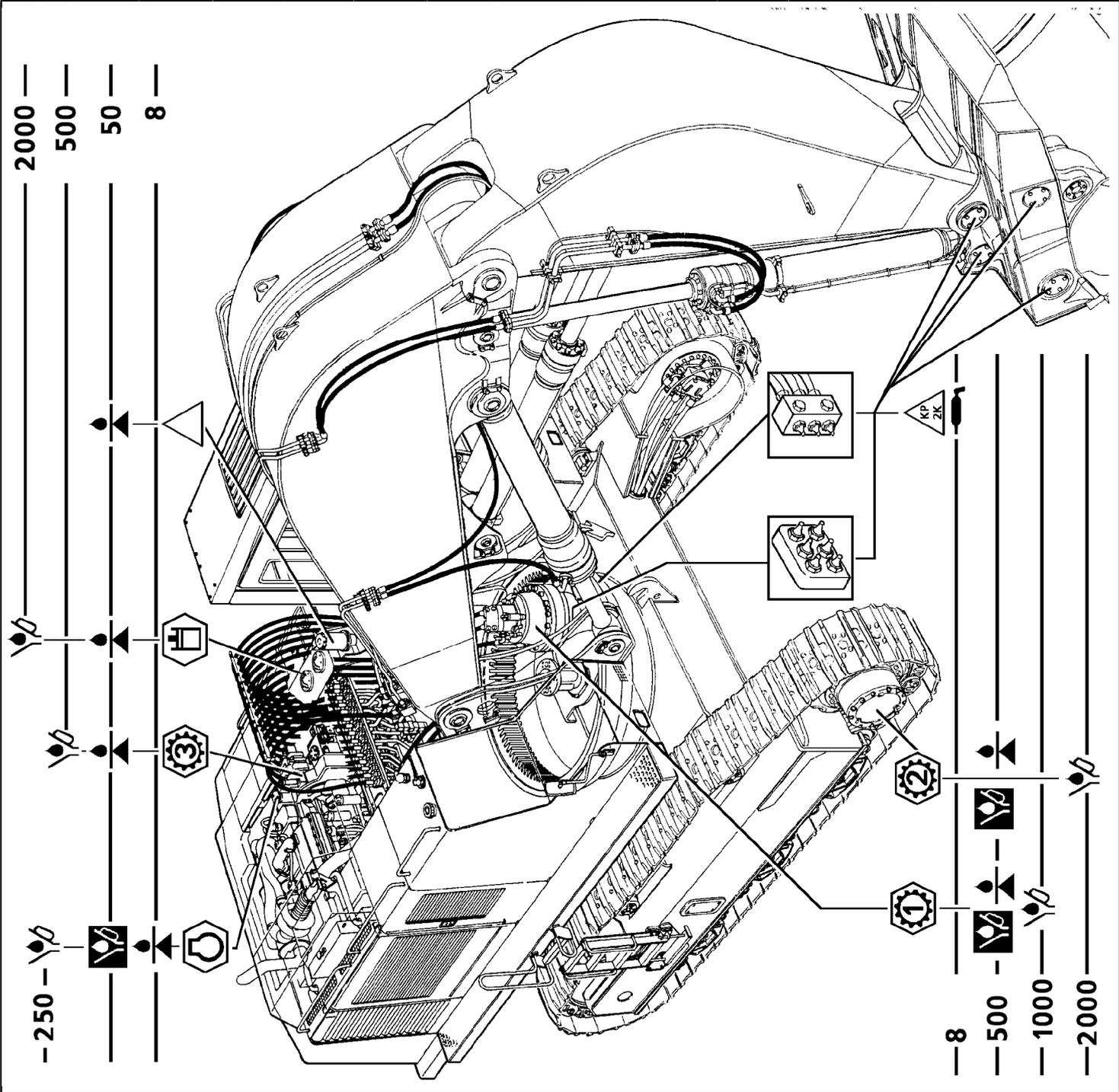
The following refrigerator oil may be used:

Brand	Manufacturer	LIEBHERR part N°
Planetel® PAG SP20	ELF	0,25 liter (6 oz.) can of oil 8504414

PAG oils (Polyalkylen-Glycol oils) are the only oils presently authorized by the compressor manufacturer when using refrigerant R 134 a.

R 984 C Litronic		7369042 D
	Dieselmotor Engine Moteur Diesel	58 l 15.5 US Gal
	Hydraulikanlage Hydraulic system Circuit hydraulique	880 l 232 US Gal
	Drehwerkgetriebe Swing gear Réducteur d'orientation	31 l 8.2 US Gal
	Fahrwerkgetriebe Travel gear Réducteur de translation	2 x 20 l 2 x 5.3 US Gal
	Verteilergetriebe Spitterbox Réducteur de pompes	14.5 l 3.8 US Gal
	Allgemeine Schmierstellen General lubrication points Points de graissage	
	Drehkranzverzahnung Swing ring teeth Denture de couronne d'orientation	
	Ölstand prüfen Oil level check Vérification du niveau	
	Ölwechsel Oil change Vidange	
	Erster Ölwechsel First oil change Première vidange	
	Schmieren Lubrication Graissage	

Die angegebenen Füllmengen sind nur Richtwerte.
Nach jedem Ölwechsel muss Hartfüllung des Ölsand prüfen.
 The capacities are only given for your guidance.
 Always check the level after replacing oil or topping up.
 Les capacités ne sont données qu'à titre indicatif.
 Vérifiez le niveau après chaque vidange ou appoint.

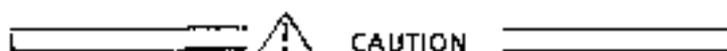


DIESEL ENGINE

CHECKING THE ENGINE OIL LEVEL

Park the machine on firm, level ground to check the engine oil level. Turn the engine off and wait a few minutes for the oil to collect in the oil pan.

The oil must be between the minimum and maximum mark on the dipstick 1 (fig. 1).



The engine oil is very hot at or near operating temperature. Avoid contact with hot oil and components containing oil, since it could cause severe burns.

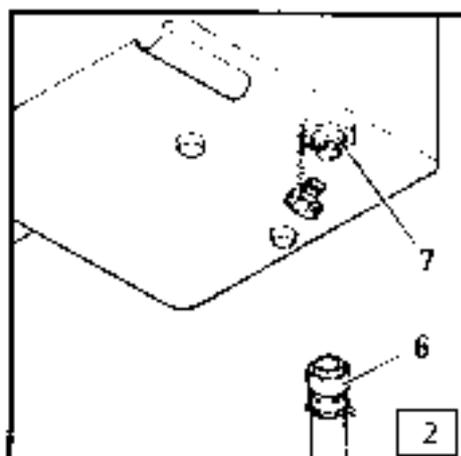


CHANGING THE ENGINE OIL

To drain the oil :

To change the oil, bring the engine to operating temperature.

Attach the oil drain hose (fig. 2, pos. 6) to the drain 7 and drain the oil into an appropriate container.



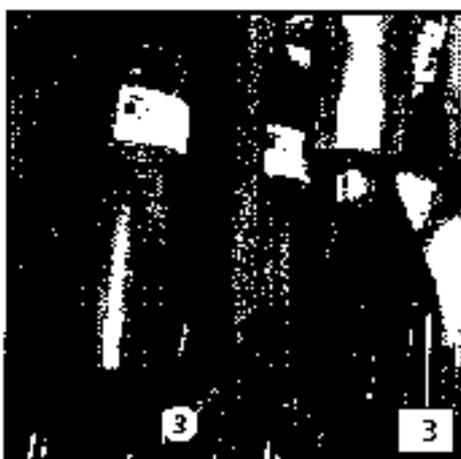
To replace the oil filter elements (fig. 3) :

Remove the filter element.

Clean the sealing surface on the filter mount.



Be careful when removing the filter cartridge to avoid contact with hot oil.

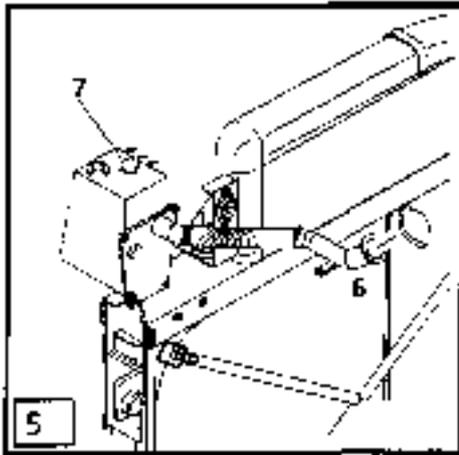


Tightly lubricate the seal with oil and tighten the filter element, using both hands.

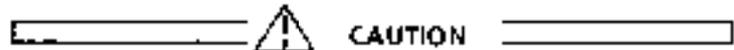
Add oil (fig. 4) to the upper mark of the dipstick (fig. 1) cap of the filler neck.

See Maintenance and Lubrication chart for oil quality, oil quantities and oil change intervals.





CHECKING THE COOLANT LEVEL



At or near operating temperature, the engine coolant is hot and under pressure.

Avoid contact with components containing coolant, since it could cause severe burns.

Check coolant level only after the cap of filler neck 6 is cool enough to touch.

To check the coolant level, turn the cap 6 slowly to relieve pressure.

When the engine is very hot first let the pressure escape by slowly turning the pressure relief valve - radiator cap 7 (fig. 5) before removing cap 6.

When the coolant is cold, the coolant level should reach the top of the filler neck under the cap 6 of the radiator (fig. 5).

ANTIFREEZE AND CORROSION PROTECTION OF THE COOLANT

Add the proper antifreeze mixture to the cooling system on a year round basis, not just in the cold season.

The excavator is delivered from the factory with a cooling system protection to -35°C (-31°F) (this corresponds to about 50 % antifreeze).

The cooling system capacity : 23.2 gal (88 l)

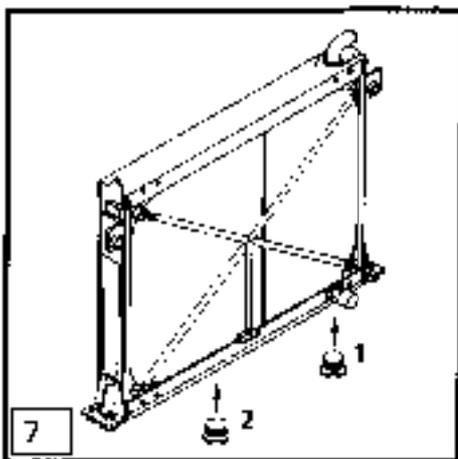
Water ratio. 11.6 gal (44 l)

Antifreeze ratio 11.6 gal (44 l)

Also the correct concentration of corrosion inhibitors inside the coolant must be maintained permanently.

Replacing the water filter (fig. 1*, pos. 10) at regular intervals is normally sufficient to maintain this correct concentration.

However the concentration has to be checked at regular intervals and if necessary, anticorrosion additives must be added to the cooling system, refer to the attached operation and maintenance manual for the CUMMINS engine.



CHANGING THE COOLANT

The coolant in the cooling system has to be changed at least once every two years

Fig 7, pos. 1 shows the drain plug on the radiator

For procedure to drain and to refill the cooling circuit, refer to the attached operation and maintenance manual for the CUMMINS engine.

Important!

When adding coolant, make sure that the expansion tank is filled all the way to the top of the fitting, add coolant until the level does no longer drop (it is not possible to overfill the tank if the pressure relief valve 7 (fig. 5) is not removed).

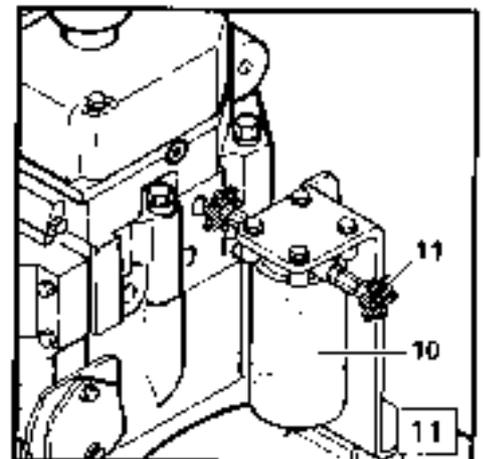
CHANGING THE WATER FILTER

The water filter contains paste like corrosion inhibitors which ensure the adequate corrosion protection of the coolant.

The water filter (fig. 11, pos. 10) must be replaced every 250 working hours.

- close the shut-off valves 11 on the inlet and return lines,
- unscrew the used element,
- apply a light even coat of lubricating oil to the seal of the new element,
- install the new element, tighten until the seal touches the filter head. Tighten by hand an additional one-half to three-fourths turn (don't tighten using a tool as a filter wrench, ...),
- open the 2 shut-off valves 11

See also the attached operation and maintenance manual for the CUMMINS engine for further information.



CHANGING THE OIL IN THE SPLITTERBOX

Fig. 13, pos. 4 shows the oil filler and bleeder screw of the splitterbox and pos. 5 shows the dipstick to check the oil level.

TO CHECK THE OIL LEVEL

Check the oil level a few minutes after turning off the engine.

TO DRAIN THE OIL

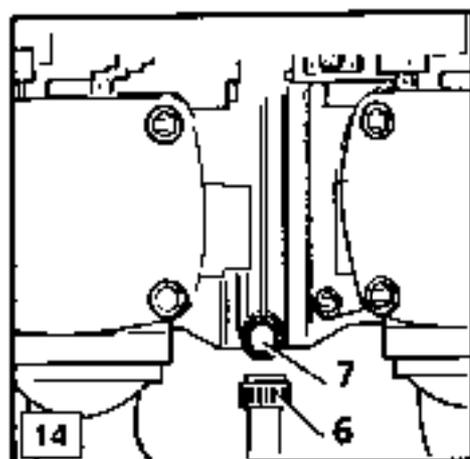
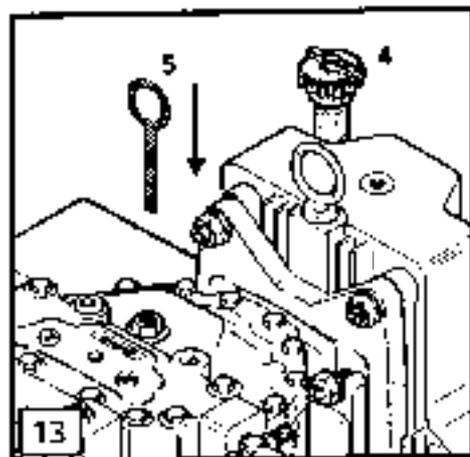
Drain the oil when the oil is at operating temperature. To drain, remove the cap on the drain 7 (fig. 14), install drain hose 6 and drain the oil into an appropriate container.

TO ADD OIL

Add oil to the oil level mark on the dipstick, run the engine for a few minutes, stop it and recheck the oil level.

See lubrication chart for oil quantities and specifications.

See maintenance chart for oil change intervals.



CHANGING THE OIL IN THE TRAVEL GEAR

If possible, drain the oil when the oil is at operating temperature.

Before draining or adding oil, move the machine until the middle one of three plugs is straight below the center axle of the gear (fig. 17, pos 2).

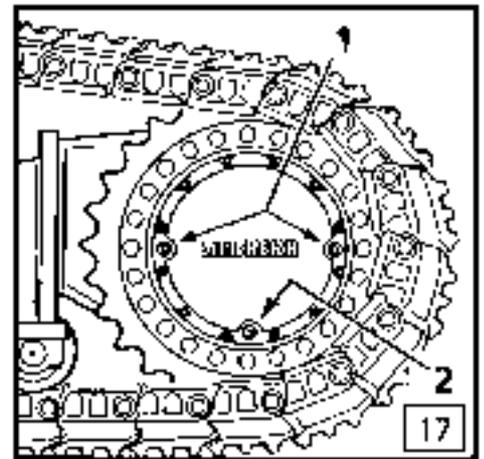
TO DRAIN THE OIL

Remove the lower plug 2 and an upper plug 1, drain the oil into a suitable container.

TO ADD OIL

Reinstall plug 2 and add oil until it drains from bore 1, then reinstall the plug 1.

See lubrication charts for quantities and specifications, see maintenance chart for oil change intervals.



CHANGING THE OIL IN THE SWING GEAR

If possible, drain the oil when the oil is at operating temperature.

Fig. 20 shows:

- 1 : Oil drain valve
- 2 : Dipstick
- 3 : Oil filler tube
- 4 : Oil filler cover / breather cover

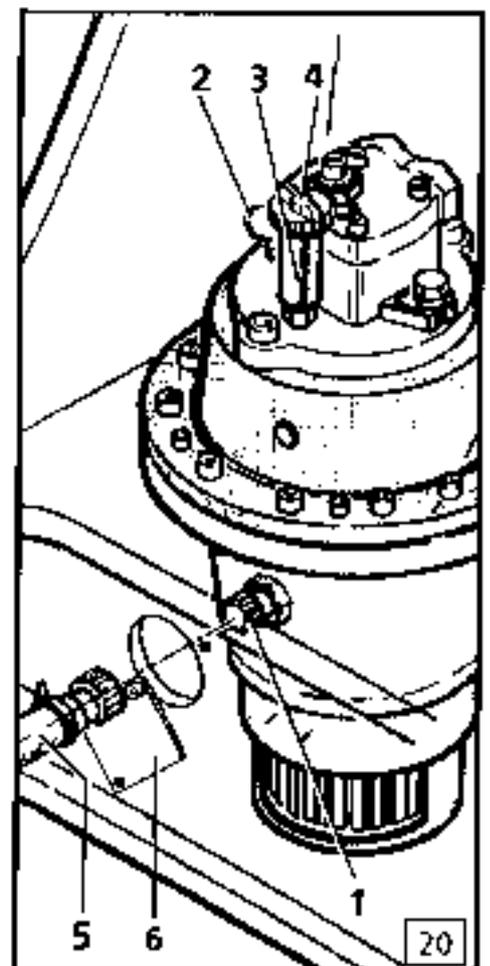
TO DRAIN THE OIL

Remove the protective plate 6.
Remove the cover 4 through the opening in the front sheet of the uppercarriage and unscrew the cover of the drain valve 1. Attach the oil drain hose 5 to the valve 1 and drain the oil into an appropriate container.
Remove the drain hose and reinstall the plug of the drain valve 1.
Reinstall the protective plate 6.

TO ADD OIL

Remove the cover 4. Add oil via the filler tube 3 until the level reaches the upper mark on the dipstick 2. Reinstall the cover 4.

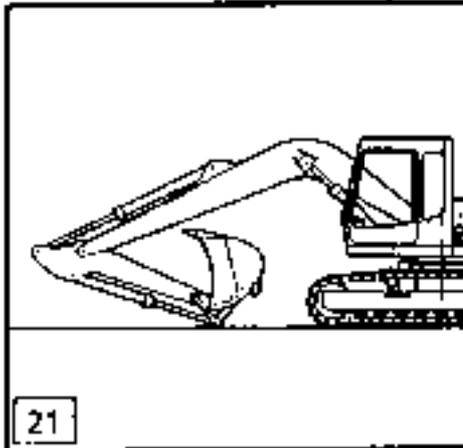
See lubrication charts for quantities and specifications, see maintenance chart for oil change intervals.



OIL IN THE HYDRAULIC SYSTEM

When checking the oil level or adding oil (fig. 21),

- Park the machine on level ground,
- rest the attachments on the ground,
- with stick and tilt cylinders fully extended and, if applying, with bottom dump bucket closed.
- turn the engine off.



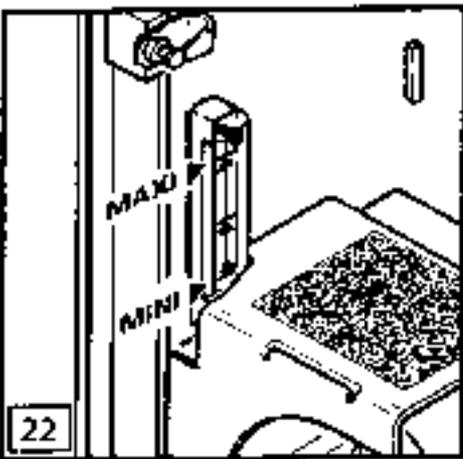
21

CHECK HYDRAULIC OIL LEVEL

In this position the oil level may not drop below middle level on the sight gauge (fig. 22) or oil must be added to the tank.

Level "MAXI" shows the maximum oil level when all cylinders are retracted.

Level "MINI" shows the minimum oil level when all cylinders are all the way extended.



22

TO ADD OIL TO THE HYDRAULIC TANK



Before draining the tank or removing the cover on the oil return filter, you always must first unscrew the breather filter (fig. 23, pos. 4) one turn to relieve tank pressure (fig. 23).

Remove the cover of the return filter (fig. 24) and add oil via the filter element until the oil level reaches middle level on the sight gauge.

Close the breather filter.

Add some more oil to fill the tank up to the top.

Reinstall the filter cover 1.

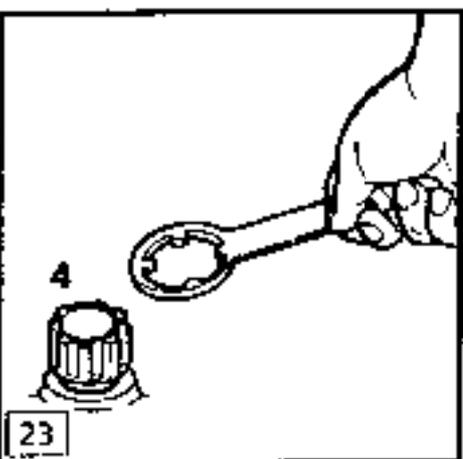
The hydraulic system should always be refilled or drained using a filler pump.

The tank can also be drained with the drain hose connected to the drain valve on the bottom of the tank.

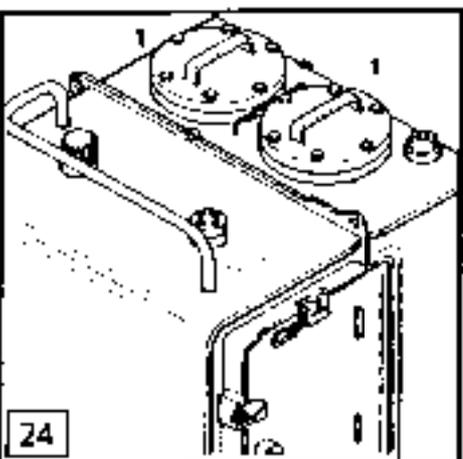


The hydraulic pumps must be bled after every oil change (see page 6.12).

See lubricant chart for oil specifications and maintenance chart for oil change intervals.



23



24



CAUTION

The hydraulic pumps must be bled after every oil change (see page 6.12).

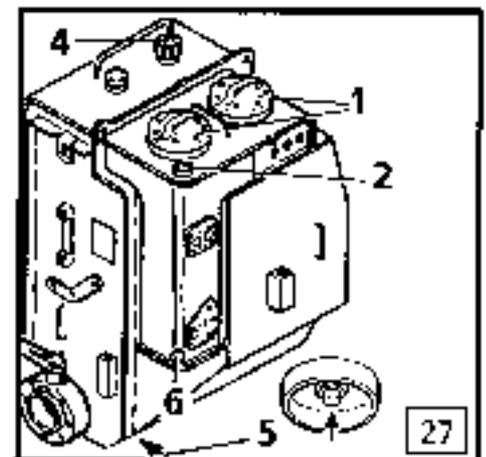
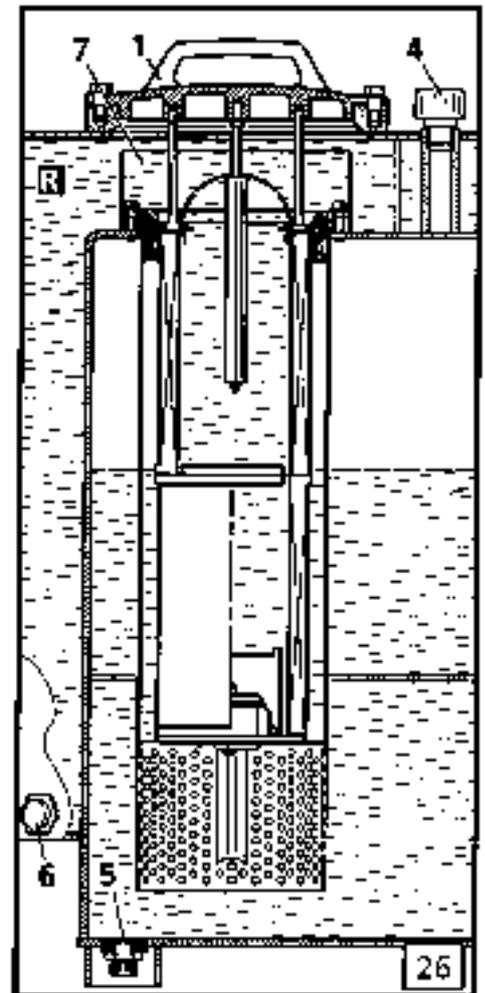
See lubricant chart for oil specifications and maintenance chart for oil change intervals.

TO DRAIN OFF CONDENSATION

Drain off condensation regularly. To do so, place the drain hose onto the drain valves 5 and 6 (fig. 26 and 27) until the oil runs clear of any water. (For intervals, refer to maintenance plan).

Note :

When using "environmentally friendly hydraulic fluids" and after machine down time (after about 24 hours) we recommend to drain off any moisture in the hydraulic tank before operating the machine.



SWING RING LUBRICATION

LUBRICATION OF THE SWING RING TEETH

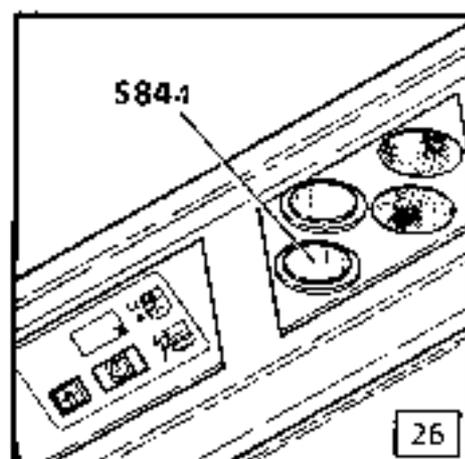
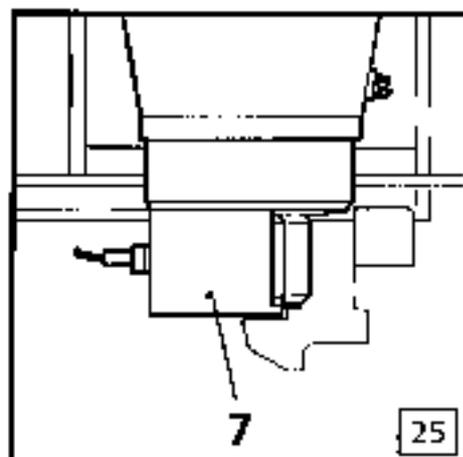
A housing around the pinion of the swing gear contains all the necessary lubrication reserves for the swing ring teeth lubrication (fig. 33, pos. 7).

During operation lubricate the teeth at regular intervals to replace this reserve.

To lubricate, hold the push button S84-1 (fig. 34) depressed for approx. one minute.

During the lubrication procedure, turn the uppercarriage by at least one complete rotation (360°) to make sure that the complete gear is lubricated. Afterward, turn the uppercarriage once more by 360°, without adding more grease.

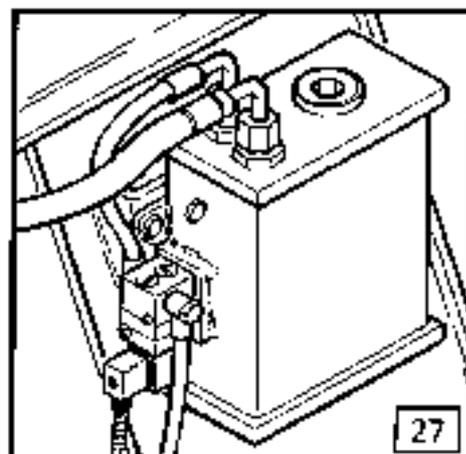
This procedure must occur at least once per shift. In heavy applications, lubricate the gear at least once every four hours.



CHECK THE GREASE TANK

The grease tank level (fig. 35) must be checked at least once a week. If necessary, add more grease.

See lubrication chart for grease specifications



LUBRICATING OF SWING RING ROLLER RACES

The swing ring races are greased by the semi-automatic centralized lubrication system, simultaneously with the lubrication points of the working attachment, see on next page.

LUBRICATION OF ATTACHMENT BEARING POINTS

All the lubrication points of the working attachment, including those in the area of the grab tool are connected to the semi-automatic lubricating system and are greased automatically and at regular intervals while working

See the lubricant chart for grease specification

1 Function

Structure

The lubrication unit comprises a grease reservoir, a pneumatic lubrication pump and a control unit which triggers the lubrication operations.

The grease reservoir and pneumatic lubrication pump are situated behind the cab. The command unit U15 is into the cab rear control panel integrated.

1.2 Sequence of a lubrication cycle

Upon expiration of the pause phase the pump P1 begins operation and delivers the lubricant via the main line to the injectors SL1. The pistons in the injectors are actuated by the lubricant pressure and issue a metered quantity of lubricant to the connected lubrication points.

The pressure in the main line increases further until the value (240 bar) set at the pressure switch B51 is reached. The control unit closes the pneumatic solenoid valve Y34-1 (the pump stops) and, at the same time, the main line is relieved by means of the solenoid valve Y34-2. The depressurized lubricant reaches the reservoir of the pump via a bypass.

The pistons in the injectors SL1 return to their original position by means of spring power.

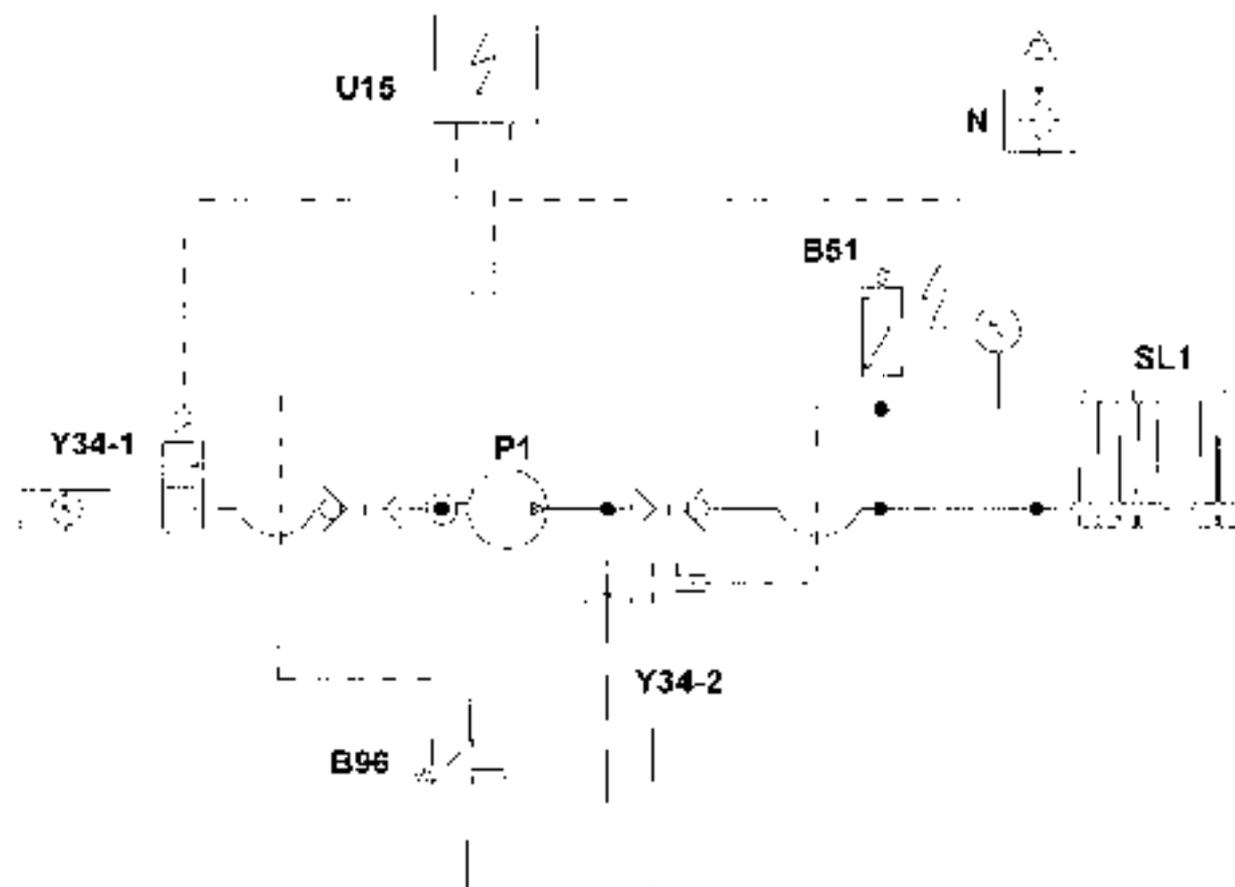
The pause phase begins. The system is ready for a new lubrication cycle.

1.3 Manual Emergency Lubrication

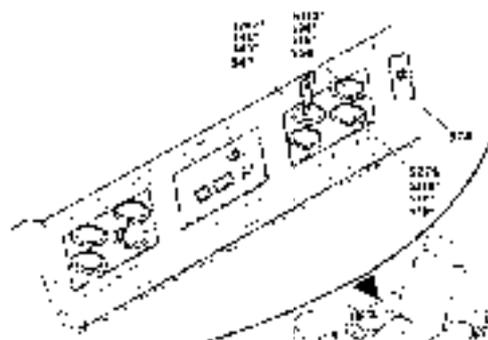
To provide the lube points with lubricant by hand, first of all the 2/2-way solenoid valve (Y34-2) must be closed by pressing down the solenoid pin (see 9.3A-B8001-A97 Page 5, Fig. 5 of attachment). Thus, a backflow of the lubricant to the reservoir can be avoided.

In continuation, the system can be lubricated by hand on the lube fitting block (N) via an external pump. (see 9.5A_9419A.2D Page 2)

Pressurize the system with a pressure of 240 bar for 30 seconds in order to make sure that all lubricant metering devices have been activated.



2 Operation



CAUTION

- Only allow operation by properly instructed personnel
- Do not exceed permissible system pressures
- Top up lubricant or change drum in good time

When the excavator is started the lubrication system is automatically alive.

The lubrication pump then carries out a complete lubrication cycle, is stopped only for the duration of the set pause time, etc.

The pause time is factory set at 2 hours.

During lubrication the diesel engine must be in operation because the lubrication pump is driven via the compressed air of the excavator. During a lubrication cycle, the pump function is represented by a rotating girder on the field indicator.

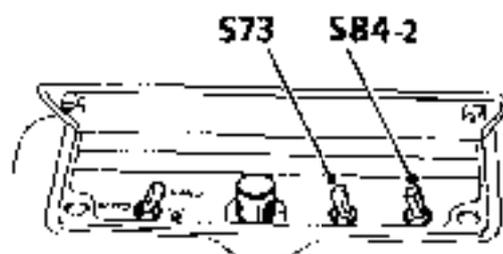
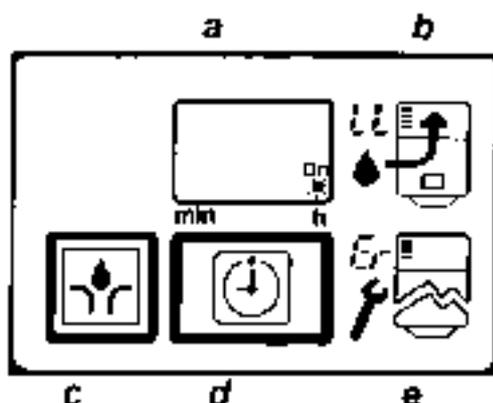
The delivery of grease can be checked by ensuring that the control pin of each injector moves back and forth.

The flashing of the pushbutton **C** indicates a malfunction in the automatic lubrication system (lubrication cycle still not completed after about one hour).

The fault is also indicated by means of an intermittent whistling sound at the control unit. Possible causes of malfunction are:

- Blockage or breakage of the main line
- Fault of the pressure switch
- Lack of lubricant in the grease reservoir
- Fault in the power supply of the lubrication system
- Fault in the compressed air system

An additional lubrication cycle can be triggered at any time by pressing the key **c** on the control unit **J15** (at least 2 sec).



On malfunction of the command unit **U15**, an additional lubrication cycle can be triggered by key **S84-2** of the emergency unit command **E52**.

Pressure switch



2.1 Manual Emergency Lubrication:

When lubricating the system with an external pump make sure that the relief valve is actuated by hand at the same time so that the lubricant will be supplied to the system and not back to the reservoir. In continuation, the system can be lubricated via the lubrication fitting block.

The pressure switch must be pressurized with 240 bar for approximately 30 seconds in order to make sure that all lubricant metering devices have been activated. In case of a failure of the pump, this lubricating procedure has to be carried out every two hours daily.

Relief valve

Lubrication fitting block
(with lubricant filter)

3 Inspection and maintenance



- Do not perform any repairs while system is pressurized.
- To relieve pressure open a threaded connection carefully.
- Caution: Lubricant may escape while pressurized.

Regular inspection and maintenance are the prerequisites for proper operation of the centralized lubrication system over a prolonged period of time. The warranty on our product can only be valid if the prescribed maintenance intervals are adhered to. The regular inspections and maintenance procedures are described below:

1. System as a whole

- Daily:** Visual check of the hose connections for leaks or wearing.
Visual check of the lubrication points for escaping lubricant.
- Weekly:** Visual check of the screwed pipe connections for leakage.
Determining the time for one operating cycle. If the time determined differs from the usual operating time, the individual components (pump station, injectors, pipes) must be checked.
Functional check of the pressure switch.

2. Pump station

- Weekly:** Check that threaded connections and hoses are firm and tight.
Visual check that connections and couplings have no leaks.
Check function of the solenoid valve.
Check electrical cable connections.
Clean outside of pump station.
- Yearly:** Pump 82718 Maintenance of the control head (grease according to maintenance instruction, page 16 In User's Information 7.3A-35015-A08).

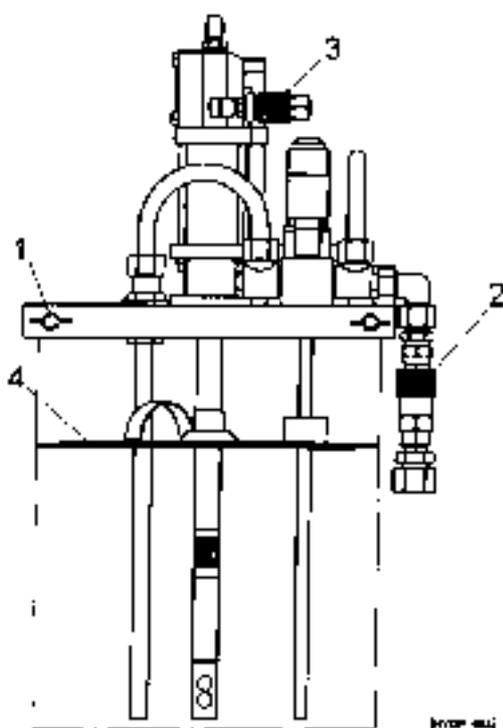
3. Injectors

- Daily:** Check movement of control pins: During the work cycle the pins must be retracted depending on the metering quantity; in the resting phase all the pins must be extended
- Weekly:** Visual check for leaks

4 Exchanging / topping up grease reservoirs

CAUTION

- Lines are pressurized. Be careful when decoupling.
- Observe extreme cleanliness when exchanging or topping up the grease reservoirs.
- Contaminated lubricant causes malfunctions and premature wear of the grease pump and other components of the system.
- Clean surroundings before exchanging or topping up.
- Switch off centralized lubrication system (turn off engine).



- Open cover of the lubrication box and lock in place
- Loosen air coupling 3 and grease coupling 2
- Loosen three thumb screws 1 of the drum cover
- Pull pump out of the empty drum. Also remove the follower plate from the drum, grasping it by the handle.
Caution: Do not place on a dirty surface!
- Replace the empty drum with a full one
- Place follower plate on top of the grease in the full drum. Try not to trap any air under the follower plate.
- Sink pump into the full drum and tighten the thumbscrews 1
- Reattach grease hose and air hose

5 Malfunctions and their remedy

In the following, only malfunctions of the system as a whole are described. You will find detailed remedies for malfunctions of the individual units in the respective User's Information.

Malfunction: No pressure build-up in the system

• **Cause:**

- Malfunctions of the pump
- Leakage in the main line
- Air trapped in the main line
- Injectors leaky or worn

• **Remedy:**

- See Troubleshooting: Pump
- Check main lines, eliminate leaks, tighten threaded connections, replace defective hoses
- De-aerate the line
- See Troubleshooting: Injectors

Malfunction: No pressure relief or too slow pressure relief in the main line

• **Cause:**

- Pressure control device faulty
- Solenoid valve faulty
- Grease too hard or not suitable for low temperatures

• **Remedy:**

- Replace pressure control device, check electric cable
- Replace solenoid valve, check voltage supply
- Change lubricant

MACHINE MAINTENANCE SAFETY

- The machine may not be made unsafe when performing maintenance work. Never attempt maintenance procedures or repairs you do not understand.
- Check the Operator's and Maintenance Manual for service and maintenance intervals. Make sure you use only appropriate tools for all maintenance work.
- Refer to your Operator's and Maintenance Manual to see, who is authorized to perform certain repairs. The operator should only perform the daily / weekly maintenance procedures.
The remaining work may only be performed by especially trained personnel.
- Use only replacement parts corresponding to the technical requirements specified by the manufacturer. This is assured by using only original Liebherr replacement parts.
- Always wear proper work clothing when maintaining the excavator. Certain work may only be performed with a hard hat, safety shoes, safety glasses and gloves.
- During maintenance, do not allow unauthorized personnel to enter the maintenance area.
- Secure the maintenance area, as necessary.
- Inform the operator before any special or maintenance work. Make sure he knows the person, who is in charge of the work.
- If not otherwise noted in the Operation and Maintenance Manual, always make sure the excavator is parked on firm and level ground and the engine is turned off.
- During maintenance and service work, make sure you always retighten any loosened screw connections!
- If it is necessary to disconnect or remove any safety devices during set up, maintenance or repair, make sure that after completion of repairs, the safety devices are reinstalled and checked for proper function.
- Before any maintenance work and especially when working under the machine, make sure a "Do not operate" tag is attached to the starter switch. Remove the ignition key.
- After end of maintenance works or repair, restart the machine according to the instructions "Machine start up", in this manual.
- Before any repairs or maintenance work, clean any oil, fuel and / or cleaning substances from any fittings and connections. Don't use any harsh cleaners and use only lint free cloths.
- Use only non-flammable cleaning fluids to clean the machine.
- Any welding, torch or grinding work on the machine must be explicitly authorized. Written authorization is necessary for welding on carrying structures. Before any using a welder, torch or grinder, clean off any dust and dirt and remove any flammable materials from the surrounding area. Make sure the area is sufficiently ventilated.
Danger of Fire and Explosion!
- Before cleaning the machine with water or steam (high pressure cleaning) or other cleaning fluids, make sure that all openings, which, for safety and/ or functioning reasons should not be exposed to water / steam / cleaners, are covered and / or masked off. Especially sensitive are electrical motors, control boxes and plug connectors.
- Make sure that the temperature sensors of the fire alarm and extinguishers system do not come in contact with the hot cleaning fluids, which could trigger the fire extinguishing system. Remove all coverings and masking material after completing the cleaning procedure. Then check all fuel lines, engine oil lines and hydraulic oil lines for leaks, loose connections, chafing and / or damage. Fix any problems immediately.
- 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
- Never employ high pressure cleaning apparatus during the two first months following machine delivery or repainting.

- Observe all product safety guidelines when handling oils, grease, and other chemical substances.
- Make sure service fluids and replacement parts are disposed of properly and in an environmentally sound manner.
- When using hot service fluids, be very careful. (They can cause severe burns and injury!).
- 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.
- Never try to lift heavy parts. Use appropriate lifting devices with sufficient load carrying capacity. When replacing or repairing parts or components, make sure they are mounted very carefully on lifting devices, to prevent any possible danger. Use only suitable and technically sound lifting devices, make sure that lifting tackle, wire cables, etc. has adequate load carrying capacity. Never position yourself, walk or work underneath suspended loads.
- Never use damaged lifting devices, or devices which are not sufficient to carry the load. Always wear gloves when handling wire cables.
- Ask only experienced personnel to attach loads and guide and signal the crane operator. The guide must be within the visibility range of the operator and / or must be in direct voice contact with the operator.
- When working overhead, use appropriate and safe ladders, scaffolding or other working platforms designated for that purpose. Never step on parts or components on the machine when maintaining or repairing items overhead. When working high above ground, make sure you are fitted with ropes and appropriate safety devices which will prevent a possible fall. Always keep handles, steps, railings, platforms and ladders free of dirt, snow and ice!
- When working on the attachments, for example when replacing the bucket teeth, make sure the attachment is supported properly. Never use metal on metal support!
- For safety reasons, never open and remove a track chain unless having previously totally released the pretension of the chain tensioning unit.
- Never work underneath the machine if it is raised or propped up with the attachment. The undercarriage must be supported with wooden blocks and supports.
- Always support the raised machine in such a way that any shifting to the weight change will not influence the stability. Do not support the machine with metal on metal support.
- Only qualified, especially trained personnel may work on travel gear, brake and steering systems.
- If it becomes necessary that the machine must be repaired on a grade, block the chains with wedges and secure the uppercarriage to the undercarriage with the lock pin.
- Only qualified, especially trained personnel may work on the hydraulic system.
- Never check for leaks with your bare hands, always wear gloves. Fluid escaping from a small hole can have enough force to penetrate the skin.
- Never loosen or remove lines or fittings before the attachment has been lowered to the ground and the engine has been turned off. Then turn the ignition key to contact position with tilted down safety lever, move all servo controls (joysticks and foot pedals) in both direction to release pressures. Then release the tank pressure as outlined in this Operation and Maintenance Manual.
- Always disconnect the battery cable before working on the electrical system or before any arc welding on the machine. Always disconnect the negative (-) cable first and reconnect it last.
- Check the electrical system regularly. Make sure that any problems, such as loose connections, burnt out fuses and bulbs, scorched or chafed cables are fixed immediately by an electrician or qualified personnel.
- Use only Original fuses with the specified amperage. Never use a different size or stronger fuse than the original fuse.
- On machines with electrical medium or high voltage systems:
 - If there is any problem with the electrical energy supply, turn the machine off immediately.
 - Follow established lockout / tag out procedures where applicable.
 - Any work on the electrical system may only be performed by a qualified electrician or qualified personnel under the guidance and supervision of an electrician, according to electro - technical regulations.

- On machines with electrical medium or high voltage systems,
 - if there is any problem with the electrical energy supply, turn the machine off immediately.
 - Any work on the electrical system may only be performed by a qualified electrician or qualified personnel under the guidance and supervision of an electrician, according to electro - technical regulations.
- If any work is required on any parts which carry current, use a second person to turn off the main battery switch, if necessary. Rope the work area off with a red and white safety rope or chain, and set up warning signs. Use only insulated tools.
- When working on medium and high voltage components, shut off the voltage and connect the supply cable to the ground and ground the components, such as the capacitors, with a grounding rod.
- Check all disconnected parts if they are truly free of current, ground them and close them off quickly. Insulate any close-by, current carrying parts.

Hydraulic lines and hoses - Maintenance safety

- Hydraulic lines and hoses may never be repaired!
- All hoses, lines and fittings must be checked daily, but at least every 2 weeks for leaks and any externally visible damage! Never check for leaks with your bare hands, use a sheet of paper or something else. Any damaged sections must be replaced immediately! Escaping oil can cause injuries and fires!
- Even if hoses and lines are stored and used properly, they undergo a natural aging process. For that reason, their service life is limited.
Improper storage, mechanical damage and improper use are the most frequent causes of hose failures.
Concerning the hoses, you must follow the safety regulations applicable to your work environment and job site and any federal, state and local safety requirements.
Using hoses and lines close to the limit ranges of permitted use can shorten the service life (for example at high temperatures, frequent working cycles, extremely high impulse frequencies, multi shift or around the clock operations).
- Hoses and lines must be replaced if any of the following points are found during an inspection (see guidelines ISO 8331):
 - Damage on the external layer into the inner layer (such as chaffing, cuts and rips);
 - Brittleness of the outer layer (crack formation of the hose material);

- Changes in shape, which differ from the natural shape of the hose or line, when under pressure or when not under pressure, or in bends or curves, such as separation of layers, blister or bubble formation, crushing or pliuere.
- Leaks;
- Non observance of installation requirements;
- Damage or deformation of hose fittings, which might reduce the strength of the fitting or the connection between hose and fitting;
- Any movement of hose away from the fitting;
- Corrosion on fittings, which might reduce the function or the strength of the fitting;

When replacing hoses or lines, always use Original replacement parts.

- Route or install the hoses and lines properly. Do not mix up the connections!
- Always take care to avoid torsional strain when installing a new hose. On high pressure hydraulic hoses, the mounting screws must be first mounted on both hose ends (full flange or half clamp) and tightened only thereafter.

On high pressure hoses having one curved end, always tighten first the screws on the curved hose end and only then the screws on the straight hose end.

Install and tighten the hose clips that may be mounted on the hose middle only when the both hose ends are already tightened.

- Always install hoses so to avoid any friction with other hoses and parts.
We recommend to keep a distance between hose and other parts of at least one half of the hose outer diameter. Keep a minimum gap of 1/2 inch in any case.
After mounting a hose connecting two parts that are movable to each other, check during the return to service that the hose is not rubbing in the whole moving range.
- Check daily that all flanges and covers are fixed correctly. It will prevent vibrations and damage during operation.

THE FUEL SYSTEM

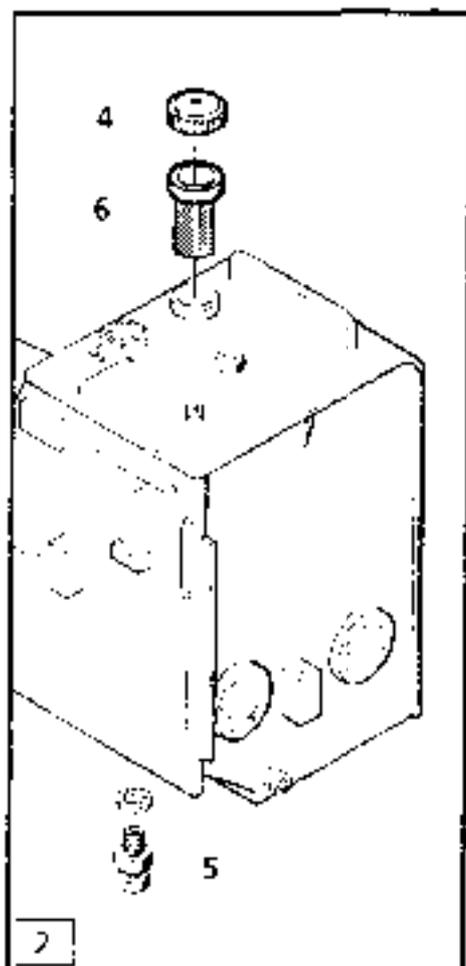
TO DRAIN AND CLEAN THE FUEL TANK

To drain the water of the tank, unscrew the plug 5 about two turns, then retighten the plug as soon as water free fuel flows out.

The fuel tank (Fig. 2) is equipped with drain plug 5. To empty the tank remove the cover 4 and drain plug 5 and drain the fuel into a suitable container.

Regularly check the tank and filter 6 for contamination.

If necessary, replace the fuel filter 6 and/or flush the fuel tank.



TO DRAIN THE WATER SEPARATOR OF THE FUEL FILTERS

Drain the contaminant from the fuel system daily.

Open the drain plugs 3 (Fig. 3) of the filter elements, drain the water until fuel emerges, then retighten the drain plugs.

For other maintenance works on the fuel system refer to the Cummins Operation and Maintenance Manual.

THE AIR SYSTEM

While working, the white pointer of the air pressure gauge 87 (Fig. 4) must read between 6,2 and 7,2 bar (90-105 PSI).

AIR PRESSURE REGULATOR AND COMPRESSOR

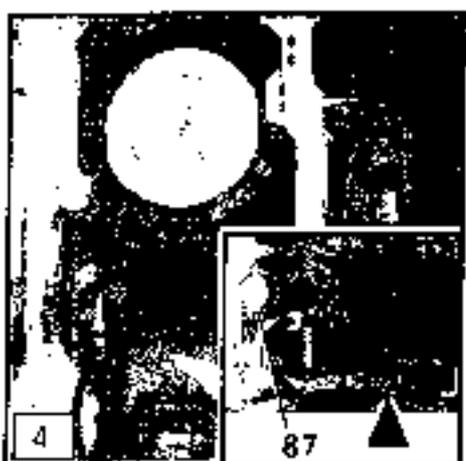
Listen to pressure regulator 1 (Fig. 5), at regular intervals it should unload and switch back to charging the compressor 2.

To check this:

- run the Diesel engine at low idle,
- slowly lower the air pressure down to less than 6,2 bar (as example by actuating the air pressure gun)
- the pressure regulator must then switch the compressor on,
- when a pressure of 7,2 bar is reached, it must turn it off.

Check this every 500 operating hours. If necessary, adjust the regulator until both pressures are correct.

Check the condition of the compressor every two years, as described in the Cummins Operation and Maintenance Manual.



THE ANTIFREEZE PUMP (Fig. 6, pos. 3)

The antifreeze pump, allows the compressed air system to work properly during the cold season.

Fill it with about .5 pt. (1/4 l) denatured alcohol.

Check alcohol level daily.

The antifreeze pump injects 0.5 cm³ of alcohol in the compressed air system every time the compressor turns on and off.

TO DRAIN THE AIR TANK

Water in the air tank is automatically drained via the drain valve when the pressure in the system drops.

However, it is recommended to manually drain any remaining water from the air tank :

- during the summer, push the pin on the underside of the drain valve (Fig. 4) once a week,
- and during the winter months, push it once a day.

AIR FILTER AND AIR LUBRICATOR FOR CENTRAL LUBRICATION

The condensation and the impurities in the air filter 4 (Fig. 8) and in the lubricator must be drained weekly.

With the central lubricating in operation, turn the drain screw at the bottom of the transparent polycarbonate bowls from several turns.

If the polycarbonate bowls are dirty, stop the central lubrication, remove the bowls and clean them in a soapy solution.

If the element of the filter 4 is clogged, replace it or clean it in alcohol.

Check the oil level in the lubricator weekly.

If necessary, remove the filter plug 6 and add oil (viscosity between SAE 10 and SAE 30) until the level is about 1 cm from the top of the transparent bowl.

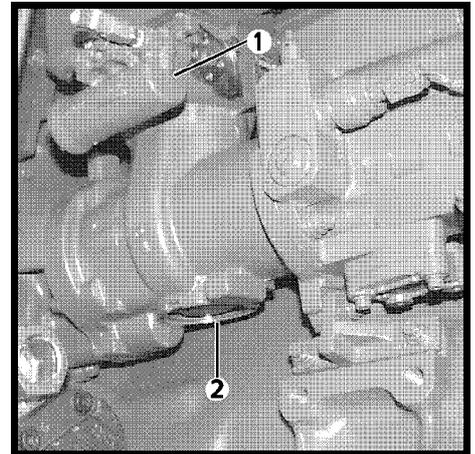


Fig. 5

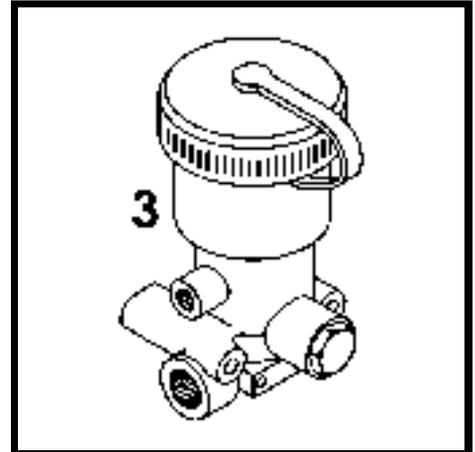


Fig. 6

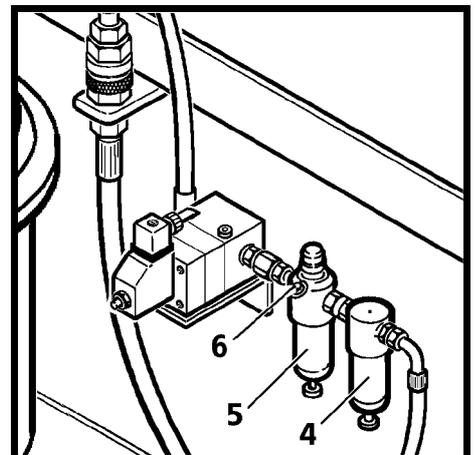


Fig. 8

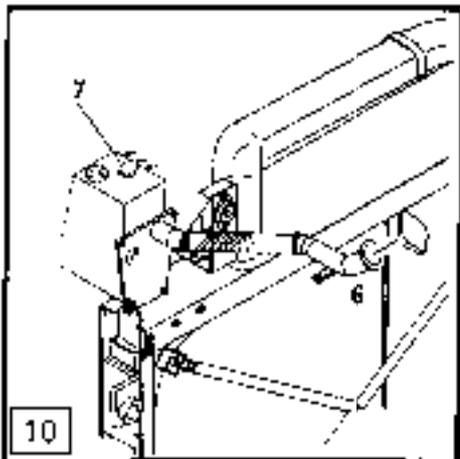
THE DIESEL ENGINE

Refer to the Cummins Operation and Maintenance Manual for description of maintenance work. In addition, observe the following and perform all maintenance work according to intervals given on the maintenance chart.

COOLING CIRCUIT

If necessary, clean the cooling circuit, replace the pressure relief valve if it leaks (fig. 9, pos. 7 and pos. 6)

Check the condition and for leaks of the hoses between the radiator and engine and check the heater hoses regularly.

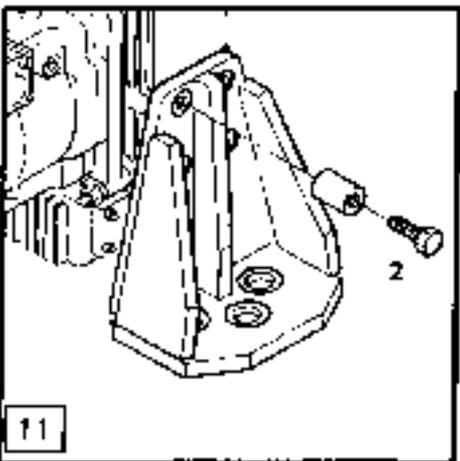


MOUNTING SCREWS

Check the mounting screws on the engine mounts (fig. 11, pos. 2 and fig. 12, pos. 4) and retighten them, if necessary.

Torque the screws pos. 2 to 310 Nm (230 ft lbs).

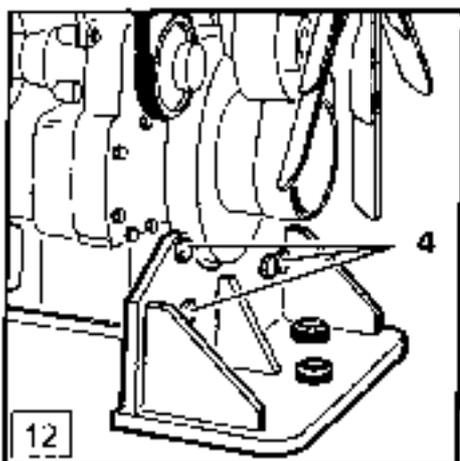
Torque the screws pos. 2 to 203 Nm (150 ft lbs).

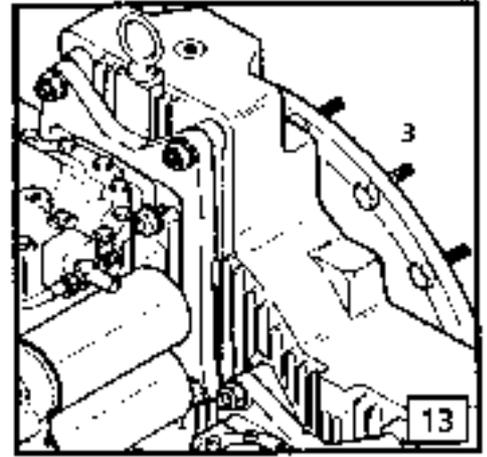


SPLITTERBOX MOUNTING SCREWS

The mounting screws (fig. 13, pos. 3) from splitterbox to the Diesel engine SAE housing must also be checked regularly and retightened, if necessary.

Torque: 140 Nm (103 ft lbs)

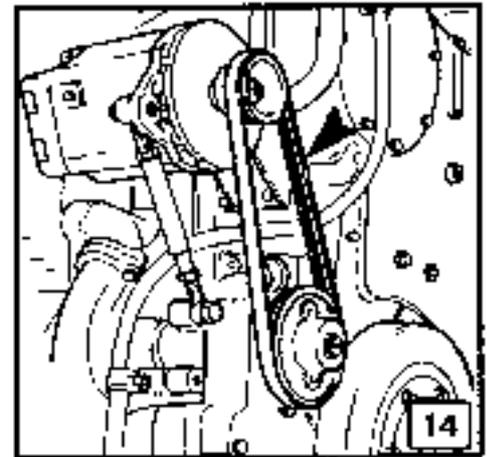




V-BELTS

Daily check the V-belts for good condition and for right tension and if necessary, retighten or replace the V-belt(s).

Refer to the attached Operation and Maintenance Manual for CUMMINS engine.



THE TRACK COMPONENTS

The tracks are maintenance free until the track pads or flanges need to be reconditioned or replaced. The lifetime seals in carrier rollers, track rollers and idlers increase the life expectancy of the tracks and protect from dirt and contamination.

However, even though the track is virtually maintenance free, the following points do need to be checked.

TIGHTENING THE TRACK TENSION

Fig. 17 A shows a track, that is not tightened properly, Fig. 17 B shows a track that is tightened properly.

The track tension needs to be checked regularly due to normal wear of the tracks, and tightened, if necessary.

The track chain tension is correct when the slack between both carrier rollers is about 1.2" (30 mm)

To check the chain slack (fig. 18) :

- measure X_1 , distance between running surface of carrier roller and top of sideframe
- measure X_2 , distance between chain link and top of sideframe
- calculate chain slack = $X_1 - X_2$.

To tighten a track :

Remove the access cover (Fig. 19, pos. 4) on the side frame of the undercarriage.

Attach a special fitting 2 to grease gun 1 (Fig. 20). Connect the grease gun to cylinder 3.

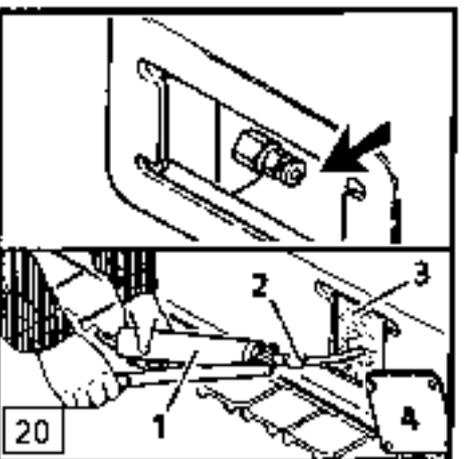
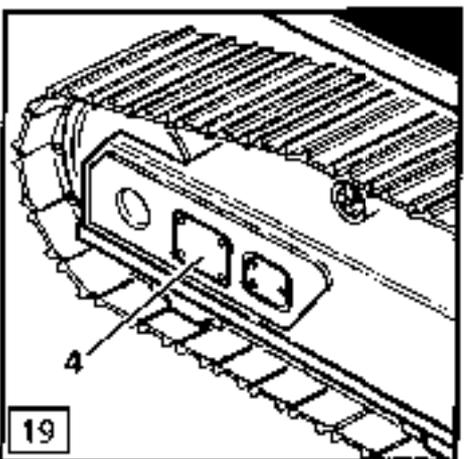
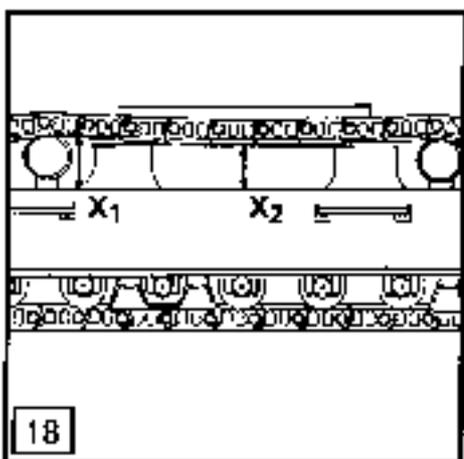
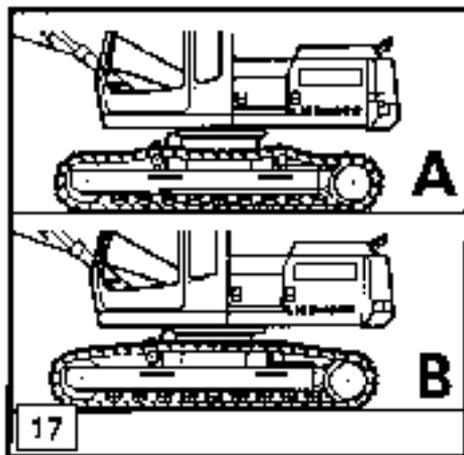
Pump grease into cylinder 3 until the track chain is properly tensioned.

To release track tension, carefully release some grease from the grease cylinder by loosening and turning the grease fitting counterclockwise.



DANGER

When adjusting the chain tension, keep your head clear of the access hole. The grease cylinder is under high pressure and the chain will sag. Grease is under high pressure and might squirt out.



CHECKING TIGHTNESS OF TRACK PADS

Check mounting screws 5 weekly for tightness and, if necessary, retighten (fig. 21).

Torque the track pad bolts - 1 "1/8 - 12 UNF to 2300 Nm (1700 ft.lbs.).

CHECKING MOUNTING SCREWS OF TRAVEL GEARS AND SPROCKET WHEELS

This screws must regularly be checked and retightened.

Torque the mounting screws of the travel gears onto the side frames (fig.22, pos. 6) to 2100 Nm (1550 ft lbs).

Torque the mounting screws of the sprocket wheels onto the travel gears (fig 22, pos. 7) to 2100 Nm (1550 ft.lbs.).

Torque the mounting screws of the hydraulic motors onto the travel gears (fig 22, pos. 8) to 960 Nm (710 ft.lbs.).

CLEANING THE TRACK COMPONENTS

At the end of a workday, the complete undercarriage should be checked and, if necessary, cleaned and repaired



DO NOT operate machine if large rocks or pieces of wood, steel, wires or cable are wedged into the track components.

Do not allow mud, rocks, etc. to collect on track components.

Dried or frozen mud, as well as rocks or other debris in the track components could cause serious damage to the machine if operated, or if it is attempted to break the machine loose under engine power.

If the machine is frozen to the ground, heat the ground or the track pads to free the machine.

In freezing weather, park machine on planks or logs so the tracks will not freeze to the ground.

The machine can be supported and lifted slightly on each side with the attachment, so the tracks can be cleaned.

Clean the surfaces of the tension unit and apply grease



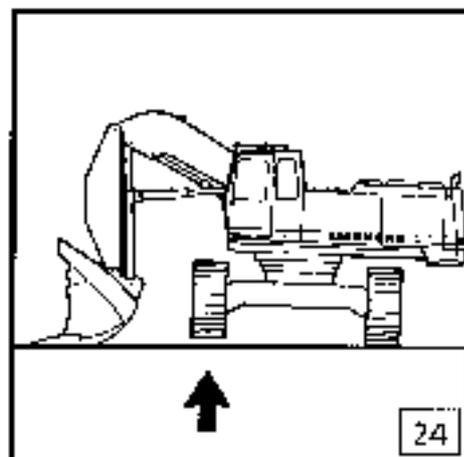
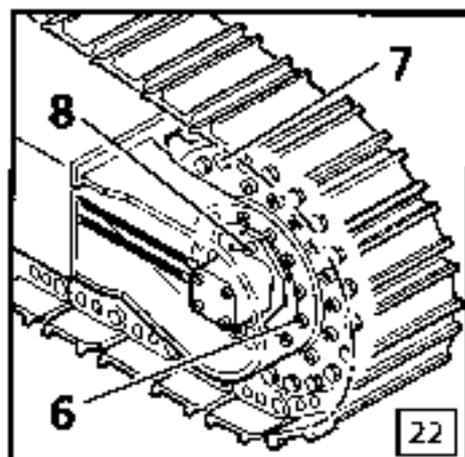
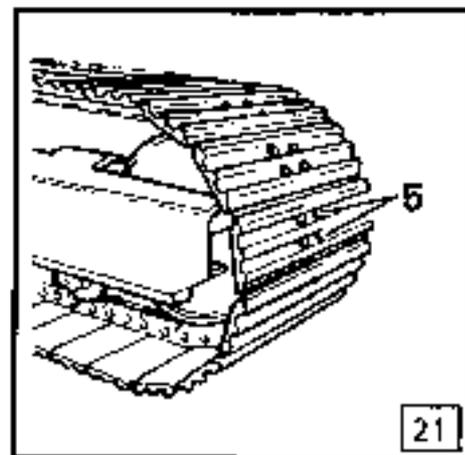
Make sure the excavator is supported with wooden blocks.

Notice: The track chain components of the machines working with their undercarriage the most of time underwater, are exposed to increased rust and premature wear.

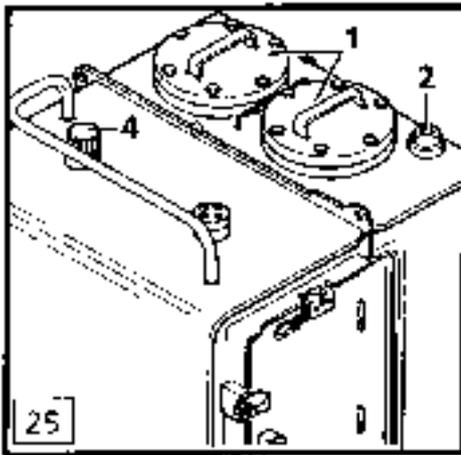
On these machines, the oil level in travel gears, track rollers and guide wheels must be checked daily.

Weekly perform an oil analysis for these components to check the water content of the oil and the component wear.

In addition, the oil change intervals must be reduced to 100 working hours.



THE HYDRAULIC SYSTEM



Maintenance of the hydraulic system is limited to the hydraulic tank.

None of the other components in the hydraulic system require special maintenance.

However, hydraulic lines and hoses must be regularly checked for leaks.

Cleanliness in the hydraulic system is especially important.

For this reason, the given maintenance intervals to replace the return filter, to clean the oil cooler, and to change the oil need to be strictly observed.



DO NOT ALLOW YOUR SKIN TO COME INTO CONTACT WITH HOT OIL OR COMPONENTS CONTAINING HOT OIL.

At or near operating temperature, engine and hydraulic oil is hot and can be under pressure.

Always relieve the hydraulic pressure before working on the hydraulic system.

Apply both joysticks (with ignition key in contact position) and then unscrew breather filter (Fig. 29, pos 4) one turn to depressurize the hydraulic tank.

OIL COOLER

A clean oil cooler is necessary to achieve optimum hydraulic oil cooling.

Clean the cooling circuit with air or steam at the intervals specified in maintenance schedule, and more often if the working conditions make it necessary.

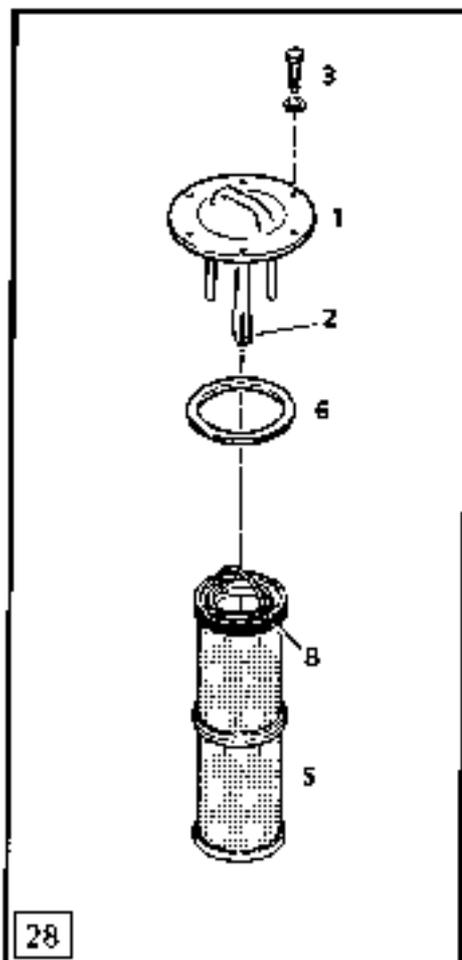
RETURN FILTERS

The magnetic rod in the return filter (Fig. 28, pos 2) should be cleaned daily during the first 300 operating hours, then every week.

Change fibre glass filter element 5 after the first 500 and 1000 operating hours.

Further changes of this element

- every 1000 operating hours,
- and with every occurrence of damage caused by contamination of the hydraulic system.



To check and clean the magnetic rod and to replace a filter element :

Remove screws 3 (Fig. 28) and pull off cover 1 with magnetic rod 2.

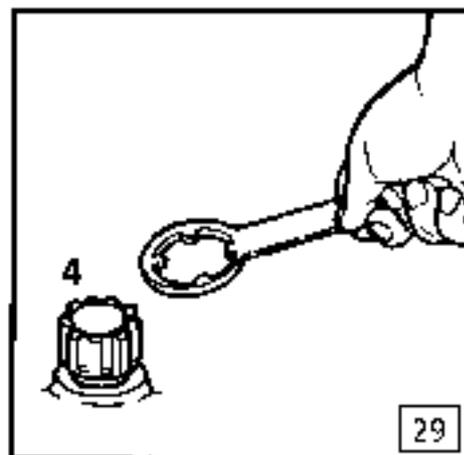
Carefully clean magnetic rod 2.

Remove the filter element 5 and insert the new element, with the LIEBHERR decal on top

While inserting the new element 5, be sure the O-ring 8 is not damaged.

Install cover 1 and make sure the seal 6 is seated correctly.

Reinstall and regularly tighten the screw 3.



SERVO FILTER

The pressure filter integrated in the control oil unit (fig. 30, pos 1) is to be cleaned regularly and the filter cartridge changed.

For maintenance intervals, see Maintenance Chart.

Cleaning the filter :

Remove the filter, remove the filter element and clean the filter housing.

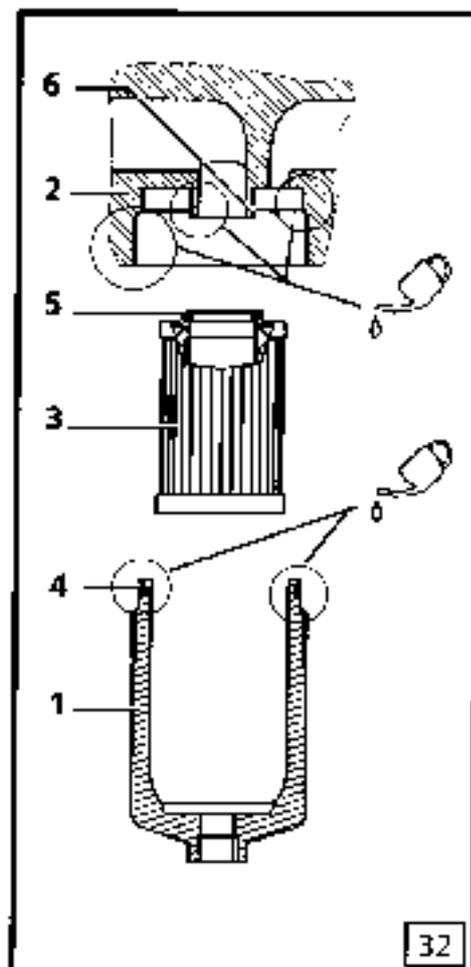
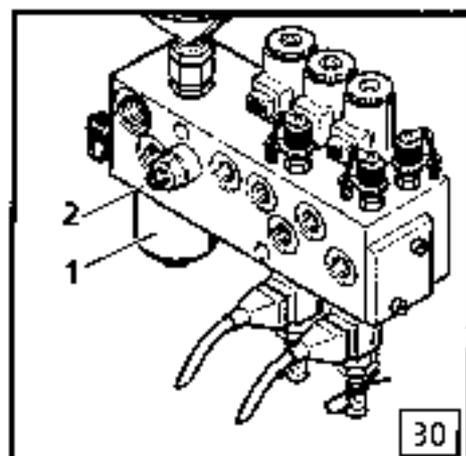
To install a new filter element :

Coat with hydraulic oil the O-rings 4 and 5 and the threads and the sealing faces on the filter head 2 and on the housing 1

Insert with care the new element 3 onto the centering pin 6.

Reattach the filter housing 1, screw it by hand to the pin 6.

Reattach the filter housing 1, screw it by hand to the stop and then unscrew it from a quarter turn.



REPAIRING THE HYDRAULIC SYSTEM

Part of the maintenance consists of checking the complete hydraulic system for leaks, loose connections, frayed, worn or damaged lines, tubes and hoses and cleaning the hydraulic cooler as necessary.

⚠ DANGER

NEVER CHECK FOR LEAKS WITH YOUR BARE HANDS. Fluids escaping from a small hole can have enough force to penetrate the skin.

Never disconnect lines or hoses before the attachment is lowered to the ground, the engine is turned off, both joysticks are moved, with ignition key in contact position, and the hydraulic pressure in the tank is relieved by turning the breather filter (Fig. 29, pos. 4).

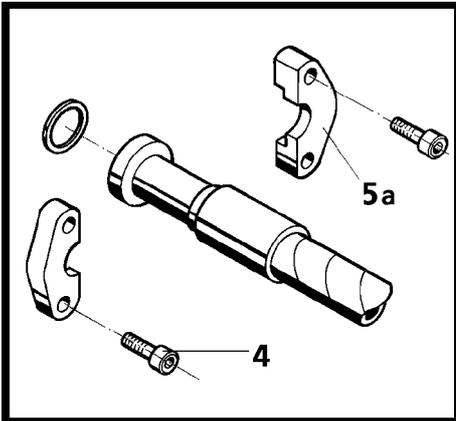


Fig. 33

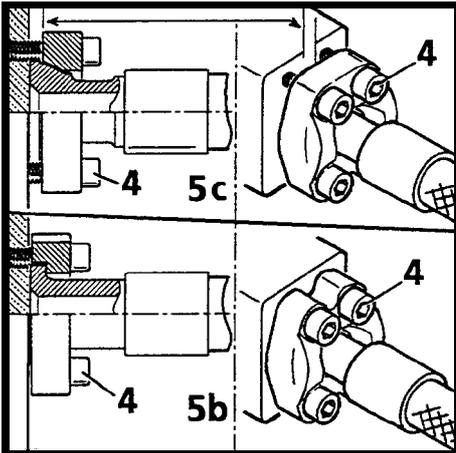


Fig. 34

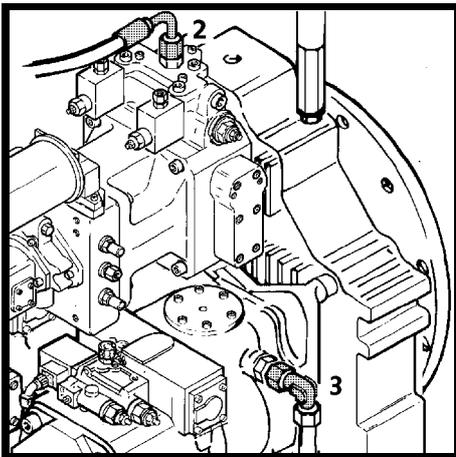


Fig. 35

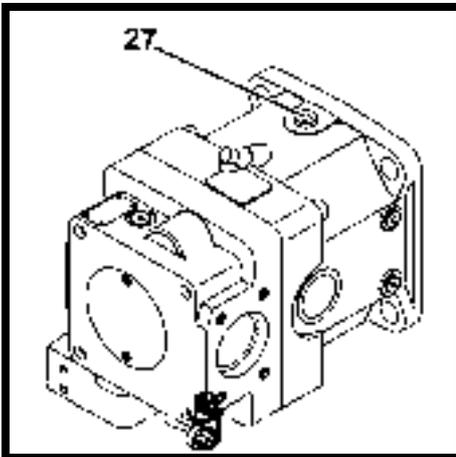
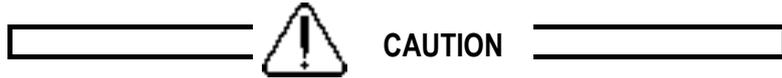


Fig. 36

High pressure hoses with nominal size NW 20, NW 25, NW 32 and with SAE fittings are installed on your machine (Fig. 33).



**Any time a high pressure hoses is defective (bubbles, moisture, damage on the surface, etc.), it must be replaced. When installing the replacement hose, avoid any stress and strain on the hose.
Do not turn or twist the hose!**

The following O-rings are needed for hydraulic hoses :

NW 20 : 25X3,53	Id. No. 7367610
NW 25 : 32,9X3,5	Id. No 7367611
NW 32 : 37,7X3,5	Id. No 7367612

The mounting screws on the SAE fittings for high pressure hoses must be tightened to the following torque values :

Screw 4 size	Torque value in Nm – Quality 10.9		
	Half flange 5a	Flat flange 5b	Conical flange 5c
M10	62	45	65
M12	108	70	110
M14	172	120	180
M16	264	170	250

Notice : tighten the screws 4 evenly and crosswise !

BLEEDING THE HYDRAULIC PUMPS

Bleed the hydraulic pumps after any repairs on the pumps and / or after every oil change.

To bleed the swing pump, loosen the union at the leak oil hose (Fig. 35, pos. 2) and let the air escape. As soon as hydraulic oil flows out of the hose, reconnect the leak oil hose.

To bleed a working pump, loosen the corresponding union 3, let the air escape and retighten the screw as soon as hydraulic oil flows out.

Fill the pumps with hydraulic oil through the same connection or plug before initial start up, or after repairs or replacement.



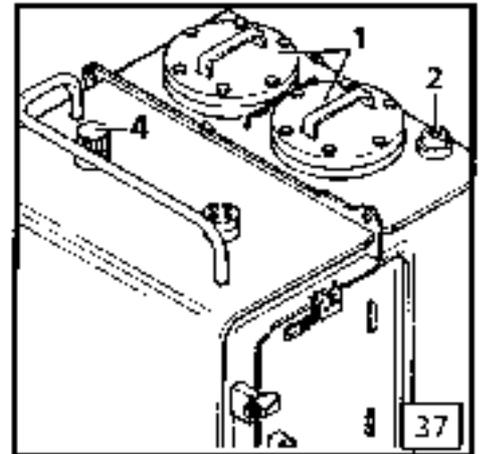
Bleed the pump for fan drive after any bleeds on the hydraulic pumps

BLEED THE PUMP FOR FAN DRIVE

To bleed the pump for fan drive, loosen the locking plug (Fig. 36, pos. 27), let the air escape and retighten the locking plug as soon as hydraulic oil flows out.

BREATHER FILTER ON HYDRAULIC TANK

This breather filter (fig. 37, pos. 4) **must** be replaced at each hydraulic oil change.



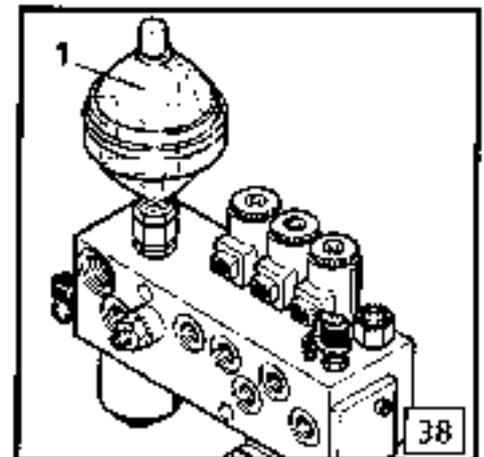
THE SERVO CONTROL SYSTEM

The servo control valves need no special maintenance. However, all tube and hose connections to components as accumulator, pressure relief valves, filter etc. , must be regularly checked for leaks.



The accumulator (fig. 38, pos. 1) keeps the servo control system pressurized even after the engine is turned off. Before any repair in the servo circuit, the pressure must be relieved:

Lower the attachment to the ground, turn the engine off, apply both joysticks (with ignition key in contact position).



HYDRAULIC CYLINDERS

IMPORTANT :

Before attempting to repair, replace or reseal hydraulic cylinders (Fig 39) or any other components, contact your **LIEBHERR** dealer.

Piston rod preservation :

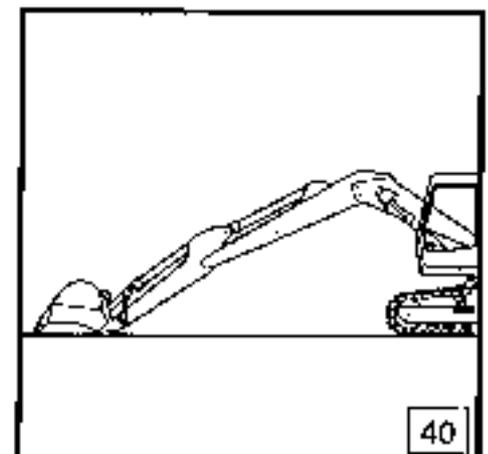
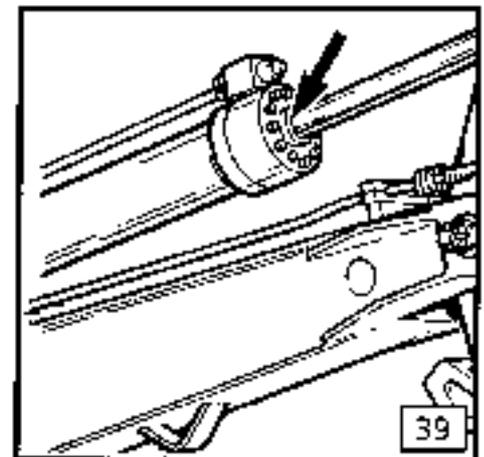
Corrosion is comparable to wear and tear. Therefore, if the machine is not being used for longer than 4 weeks or if the machine is transported by ship, the following should be done:

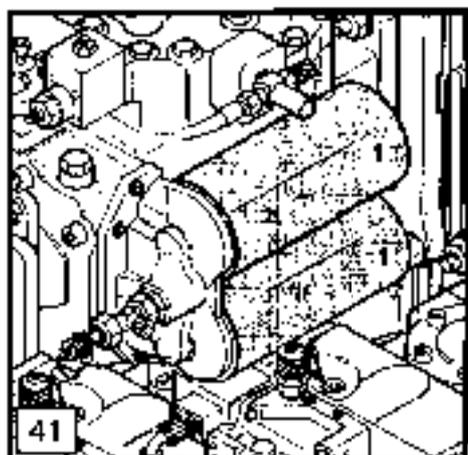
Park the crawler loader in a way so that the piston rods are retracted as much as possible (fig. 40).

Lubricate all bearings, ball joints, hinges, exposed parts, cable connections and exposed cylinder rods with anti-corrosive grease (LIEBHERR CTK, Id. No 86' 331301).

If the machine is used during certain working applications with only a short stroke, the cylinder should also be lubricated.

If the machine is transported by ship (sea water) or in the winter (road salt), the preservation of the piston rods must be rechecked after the machine has been loaded since the anti corrosive grease may have been removed by the wiper ring.



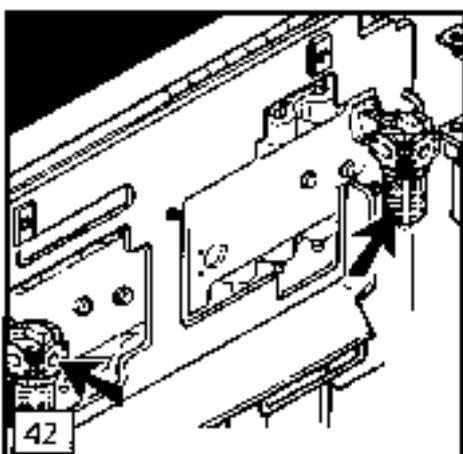


REPLENISHING OIL FILTER IN SWING CIRCUIT

The element in replenishing oil filter 1 (fig. 41) has to be changed regularly.

For maintenance intervals, see Maintenance Chart.

HIGH PRESSURE FILTERS IN WORKING CIRCUIT



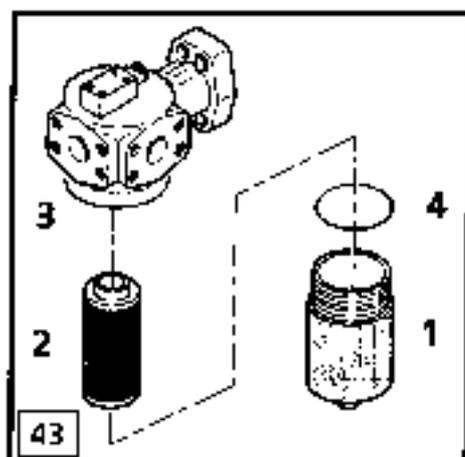
These filters (fig. 42) are mounted to the inlets of the control valve blocks

The filter elements must be checked and if necessary cleaned :

- regular every 2000 operating hours
- each time a working pump is replaced.

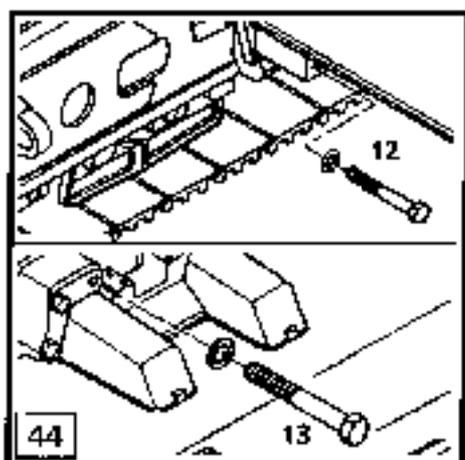
To clean a filter element :

- Relieve tank pressure (see page 6 10)
- Remove filter housing 1 (fig. 43)
- Remove filter element 2, clean it in gasoline or replace it.
- clean the filter housing 1 and filter top 3 and reinstall; replace the O-ring 4 by a new one and make sure it is seated correctly.
- Tighten the breather filter on the hydraulic tank



Important : Anytime the element is cleaned or replaced, check for leaks.

Start the engine, work with the machine for a short period and then check for leaks between the filter housing 1 and the filter top 3



THE SWING AND TRAVEL BRAKES

The travel as well as the swing brakes are wet disk brakes, they are hydraulically vented and fully sealed and integrated into the travel and swing gear

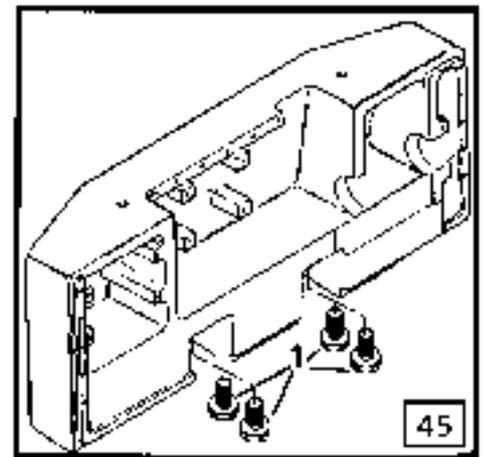
They are used as a parking brake and are wear resistant and maintenance free.

CHECKING MOUNTING SCREWS FOR TIGHTNESS

The mounting screws listed below must regularly be checked and retightened if necessary. See maintenance chart for check intervals.

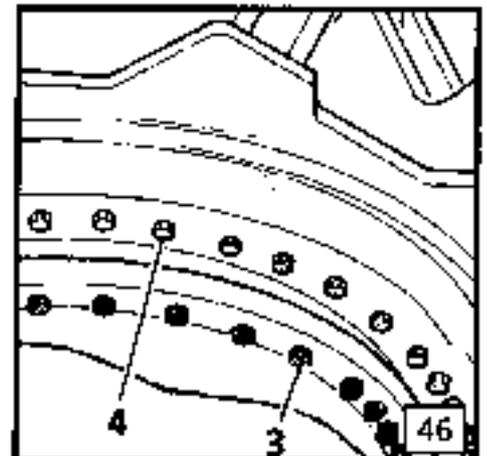
MOUNTING SCREWS OF THE COUNTERWEIGHT

This mounting screws M42 (fig. 45, pos. 1) must be torqued to 5940 Nm (4380 ft.lbs.).



MOUNTING SCREWS OF THE SWING RING

The mounting screws M30 swing ring to undercarriage (fig. 46, pos. 3) and uppercarriage to swing ring (pos. 4) must be torqued to 1900 Nm (1400 ft.lbs.).



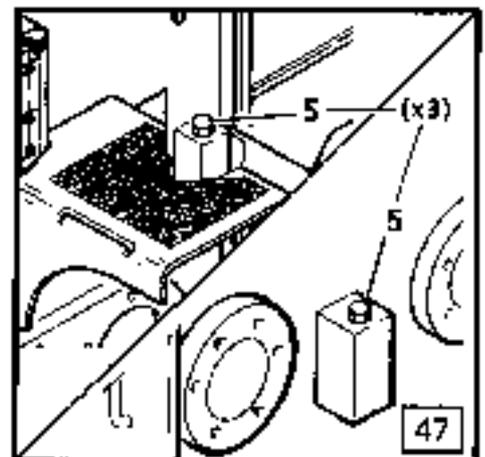
MOUNTING SCREWS OF THE HYDRAULIC OIL AND FUEL TANK

This mounting screws M20 (fig. 47, pos. 5) must be torqued to 560 Nm (413 ft.lbs.).

MOUNTING SCREWS OF THE SWING GEAR AND MOTOR

The mounting screws M30 of the swing gear (fig. 48, pos. 6) must be torqued to 1900 Nm (1400 ft.lbs.).

The mounting screws M24 of the swing motor (pos. 7) must be torqued to 960 Nm (708 ft.lbs.).

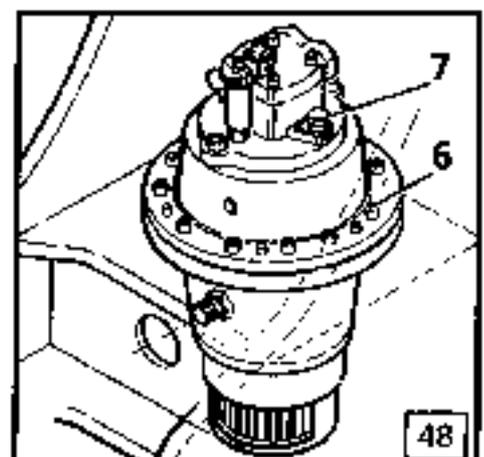


CONNECTION OF CENTRAL PIECE AND SIDE FRAMES (Machines with removable track gauge)

These bolts must be checked every 500 working hours, and if necessary retightened.

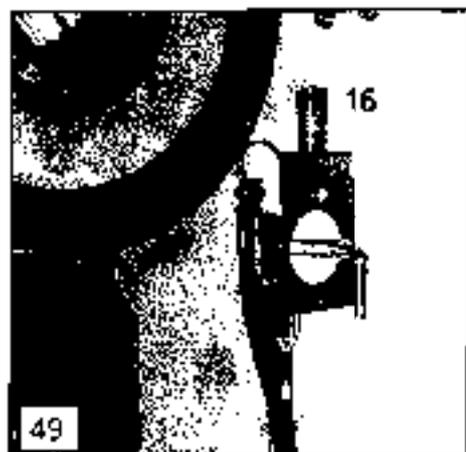
The lower bolts M42 (fig. 44, pos. 12) must be torqued to 5940 Nm (4380 ft.lbs.)

The upper bolts M30 (fig. 44, pos. 13) must be torqued to 1900 Nm (1400 ft.lbs.).



THE DRY AIR FILTER

ENGINE AIR INTAKE SYSTEM



For maximum engine protection, the air intake system must be checked and serviced at regular intervals (fig.49).

The air cleaner is designed to give maximum protection at longest maintenance intervals.

Maintenance consists of replacing the filter elements. We do not recommend to clean the filter elements.

The maintenance indicators (fig. 49, pos. 16) store the maximum recorded depression at the filters outlet, during the Diesel engine operation

When the red stripe (fig 50, pos. 17) appears in the window 18, the maximum permissible vacuum of 5 kPa (50 mbar) has been reached.

At that time, the corresponding primary filter element must be replaced

To reset the vacuum indicator, press the "Reset" button '9.

We recommend that the primary filter element 3 is only removed and replaced after the maximum permissible depression has been reached.

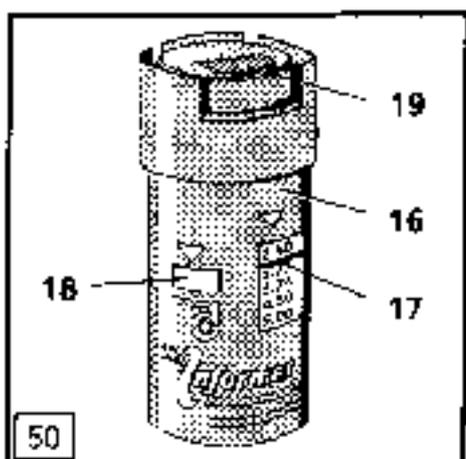
However, it should be replaced at least once a year.

Seals between filter element and housing can be damaged if the filter element is removed too often

The safety element should be replaced after the primary element has been changed 3 times, or at least once a year

Before the new element is installed, carefully clean the seal and the sealing surface of the filter housing

The dust extracted in the whipler type pre-cleaner is carried out over the exhaust system of the Diesel engine



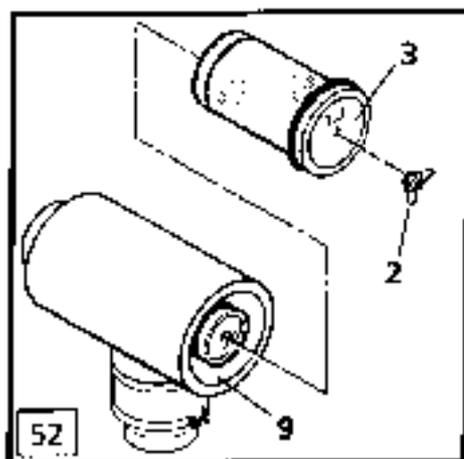
CHANGING THE PRIMARY FILTER ELEMENT

Turn the engine off, remove the wing nut 2 and carefully pull out the primary element 3 (fig. 52)

Clean the inside of the filter housing 9 and the sealing surface with a damp rag.

Do not direct compressed air into the housing.

Insert the new element, make sure it is seated correctly, install and tighten the nut 2.



REPLACING THE SAFETY ELEMENT (Fig. 54)

The safety element 6 should be replaced at least once a year or after the main element has been replaced 3 times.

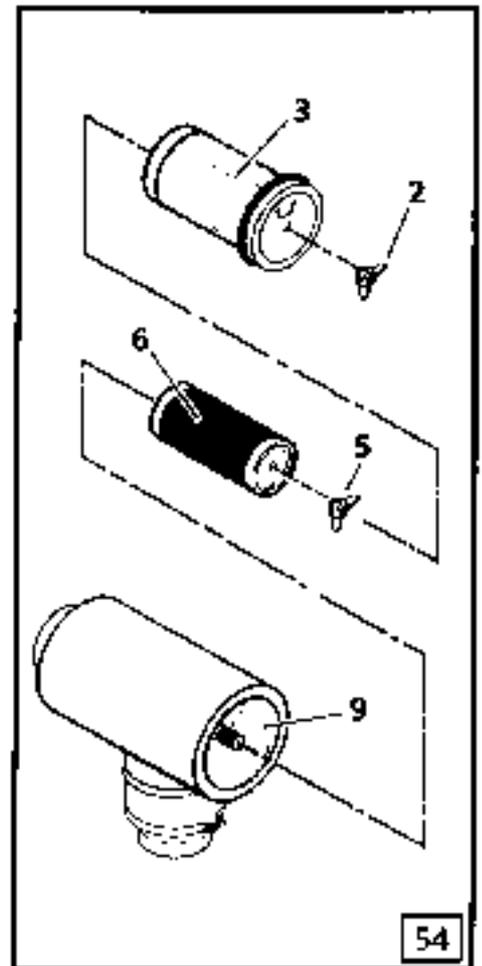
Visually check the safety element. It should be replaced if it looks dirty.

This safety element should only be replaced by a LIEBHERR mechanic!

Remove the main element as described before. Remove wing nut 5 and remove safety element 6. Carefully clean the inside of the filter housing with a damp rag. Clean the sealing surfaces and check for damage.

Carefully insert the new safety element and reinstall wing nut 5.

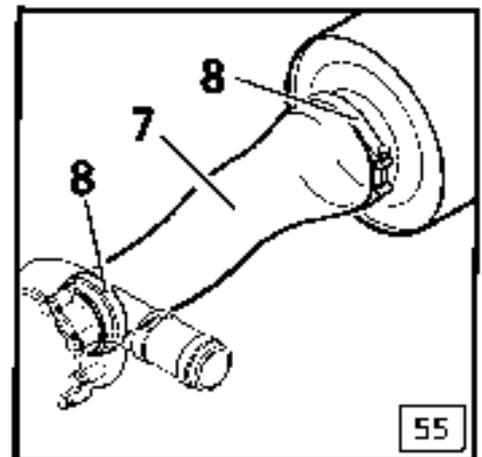
Install the main filter element 3 as described on previous page and close filter housing.



CHECKING THE AIR INLET HOSE (fig. 55)

The connection (exp. pos. 7), especially the air intake hoses between air cleaner, turbocharger, air exchanger (if mounted) and engine intake must be checked for damage and leaks whenever the filter elements are replaced.

If necessary, retighten the screws of the fixing clamps (exp. pos. 8).



THE ELECTRICAL SYSTEM

To insure troublefree operation of your machine, the electrical system must be in good condition. The gauges, indicators and components of the electrical system should be checked daily for proper function.

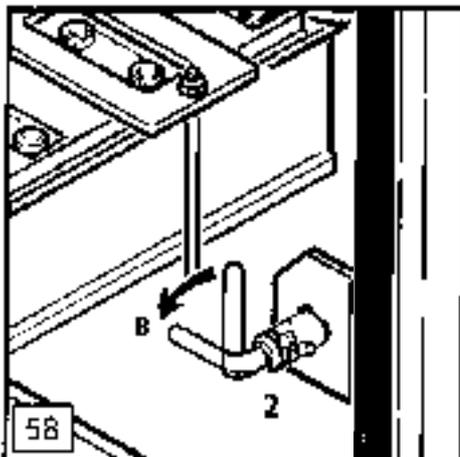
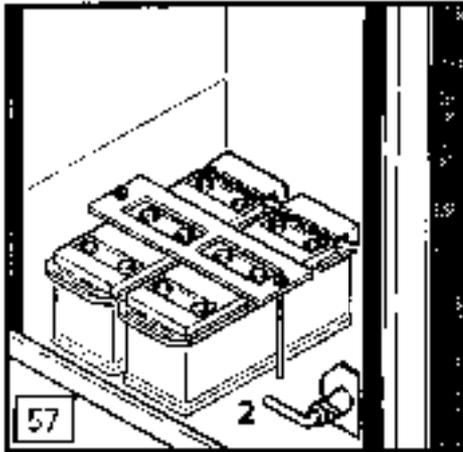
Always replace burnt out fuses and bulbs. **DO NOT** repair fuses.

Check for bare and damaged wires which could cause damage to the electrical system or a fire. Check for loose, dirty or corroded connections.

IMPORTANT :

When performing repairs on the electrical system, or before using an arc welder on the machine, tilt the battery switch 2 to position B (fig. 57 and 58) to disconnect the batteries (grounding connection opened).

Cover the electrical components (especially the alternator) when washing the excavator to protect it from water.



BATTERY MAINTENANCE

In order for the batteries to function properly, it is important to keep them clean at all times.

The battery poles and cable clamps in particular should be cleaned regularly and then coated with acid resistant grease (fig. 58).

To check the electrolyte level, open battery compartment door, lift up rubber cover and remove caps.

The electrolyte level should be 1/2" (10 - 15 mm) above the plates.

If the electrolyte level is low, add distilled water.

Regularly check the specific gravity with a hydrometer. A fully charged battery should have a value of 1.28 kg/l (31.5°).

Batteries with a lower value should be recharged. Reinstall caps, check mounting security of batteries and close the battery compartment door.



WARNING

Wear protective gloves and safety glasses when handling batteries!

Keep sparks and open flame away from battery.

Battery fumes are highly flammable and explosive.

Batteries contain acid which should not be touched. In case of contact, flush with water and get medical attention.

ARRANGEMENT OF THE CIRCUIT BREAKERS AND FUSES

The circuit breakers and the fuses F22, F31 to F37 are located in the box (fig. 60, pos. 1) near the hydraulic pumps.

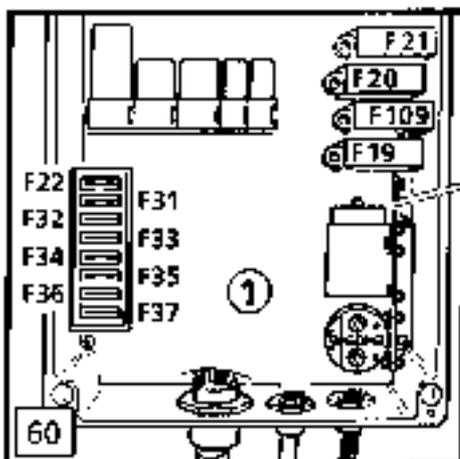
To rearm the circuit breakers F19, F20 and F109, push the corresponding button.

All other fuses are located on the printed circuit in the electrical box of the left console (fig. 64). Lift off the cover to get to the box.



CAUTION

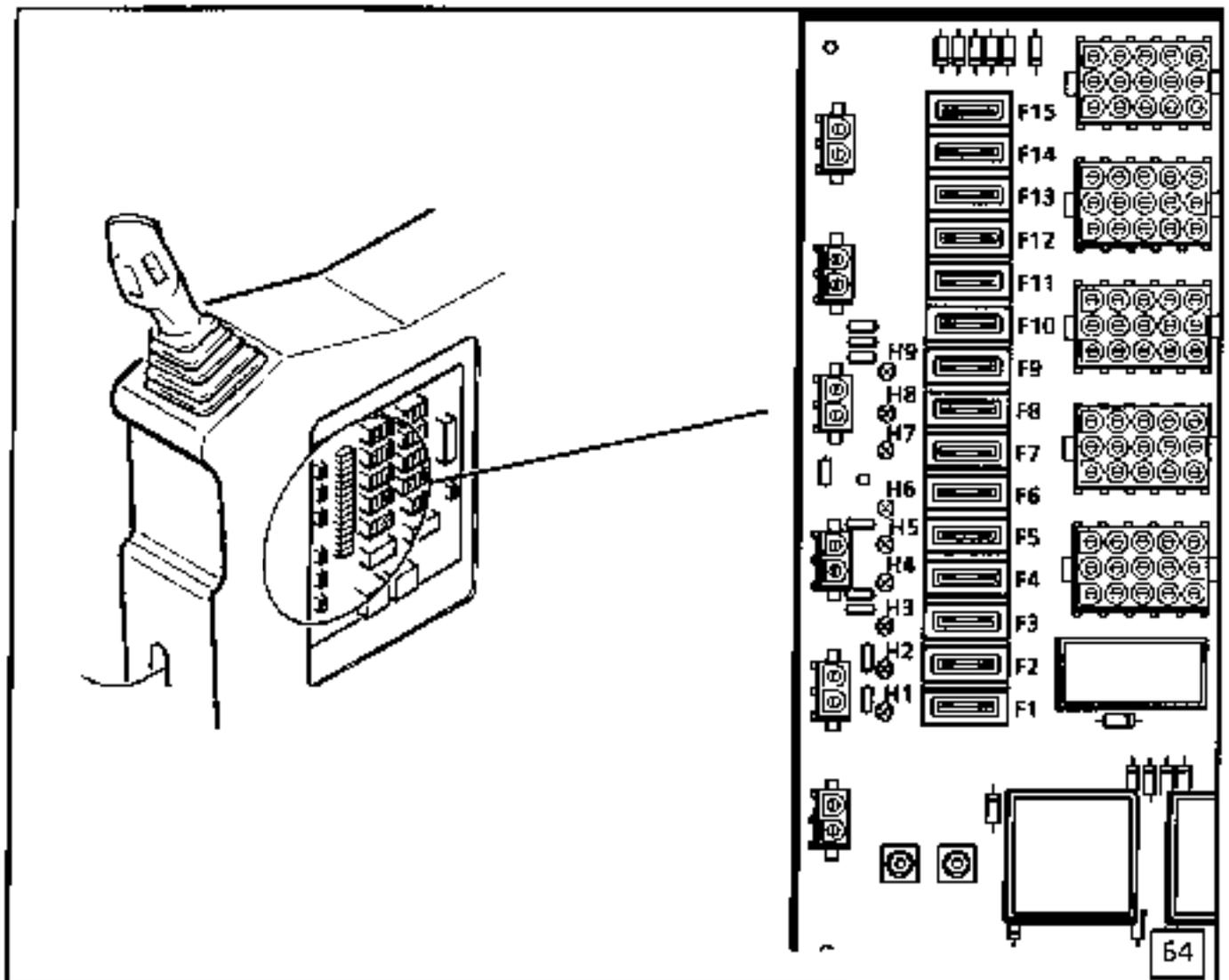
Use only original replacement fuses. If fuses blow frequently, the defect in the affected circuit must be checked and corrected. Never repair a blown fuse!



LOCATION OF FUSES AND CIRCUIT BREAKERS

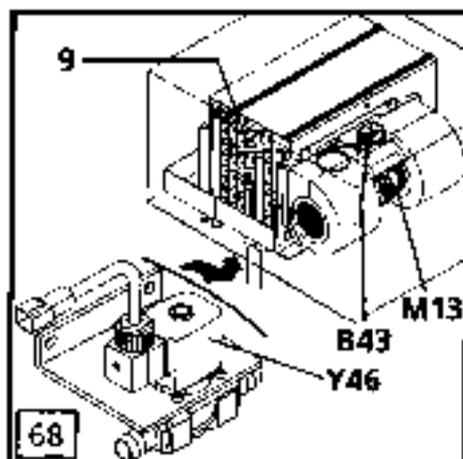
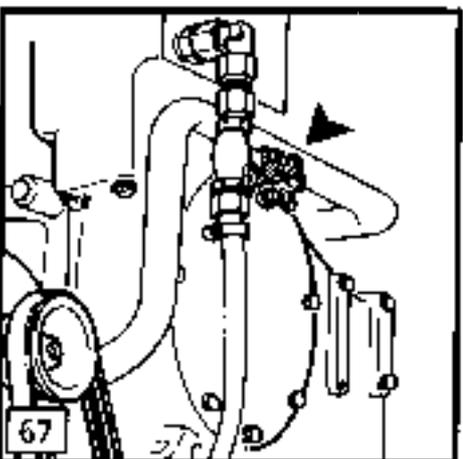
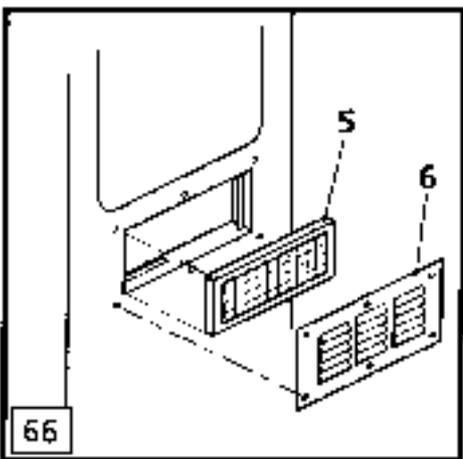
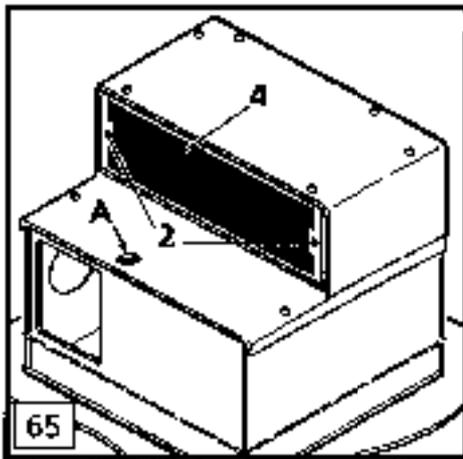
F1	Reserve	F13	Ignition key / Starting circuit
F2	Reserve, Control circuit additional floodlights*	F14	Dome light, Cigarettes lighter, Horn, reserve
F3	Reserve, Central lubrication / control unit*, Swing ring teeth lubrication	F15	Reserve
F4	Windshield washer, Control circuit / cold start system, Beacon*, Rotating grab*, Qmin* 24V stabilized supply for servos and detectors	Page 6 18, fig. 60	
F5	Windshield wiper motor	F19	QUANTUM control unit (Diesel motor)
F6	Regulation engine RPM / manual	F20	Main circuit
F7	Control unit and Display	F109	Starter circuit
F8	Safety level, Control circuits for servo circuit, Swing brake, Travel brakes & pressure cut off*	F22	Quantum / motor stop, Solenoid valve / cold start system, Hourmeter
F9	Power supply BST	F31 and F32	Heater and air conditioner
F10	Floodlights on uppercarriage and cab deck	F34	Additional floodlights / cab front
F11	Reserve	F35	Additional floodlights / attachment
F12	Reserve	F36	Additional floodlights / cab rear
		F33 and F37	Reserve
		*	Optical installation

F6 to F8, F22 and F31	Fuse	7,5 A
F1 to F5, F9, F11 to F15, F32 to F37	Fuse	15 A
F10	Fuse	25 A
F19	Circuit breaker	15 A
F20 and F109	Circuit breaker	50 A



THE HEATER AND AIR CONDITIONER

HEATER AND AIR CONDITIONER UNIT



Remove and clean the recirculated air filter 4 and the fresh air filter 5 of the air conditioner unit every 500 working hours and more often in very dusty conditions.

If the filters are contaminated, the air flow through the exchangers is reduced, this causing frequent icing and stop of the airco plant.

Blow out the filter elements with pressure air, or clean them in cold or lukewarm water. Never wash the elements with warm water or using a steam jet. Filter elements which are damaged or in bad condition must be replaced at once.

Never operate the machine, even for a short time when the filters are removed, this would cause a very quick clogging of the heat exchangers of the unit.

To remove the recirculated air filter 4, tilt the backrest of the driver's seat forward and turn both quick locks (pos. 2, fig. 65) by 90 degrees.

The fresh air filter 5 is accessible from the outside of the cab, after removal of the deflector 6 (fig. 66).

Once a year check for damage the lamellas of the heat exchanger 9 (evaporator and heater unit) and in case of clogging blow the exchanger out with pressure air.

If necessary put the lamellas straight.

Heater circuit

The following maintenance should be performed annually before the beginning of the cold season:

- check the heater water circuit for leaks,
- check and if necessary retighten all connections, hose clamps and the seals on the water valves,

The heater should only be used with a DCA4 antifreeze and anticorrosive mixture.

When changing the engine coolant, close the heater valves on the engine (fig. 67). Otherwise the heater core must be vented correctly after refilling the circuit.

To vent the circuit, remove the red cap at bleeder valve through the opening A (fig. 65), press the valve to let the air escape.

In addition, annually before the beginning of the cold season, and at least if insufficient heating is noticed, remove and clean the solenoid valve Y46 (fig. 68) which controls the warm water flow.

Clean the membrane of the solenoid valve with clear water and check that the compensation orifice at the membrane is not clogged.

The air conditioner plant

Operate the air conditioner every second week for about 10 minutes regardless of the season.

During the warm season, perform following checks or maintenance works every 500 operating hours :

- check the condenser heat exchanger for clogging, if necessary swing the exchanger out and blow it out from inside (fan side) using pressure air or steam jet until the cooler core is clean. A clogged exchanger core would cause the pressure to increase in the coolant circuit and the air conditioner to be automatically turned off.
- check and retighten the mounting screws of the compressor and its support to the Diesel engine.
- check for tension and good condition of the compressor driving belt (fig. 69).
- check the refrigerating agent level at the sight glass 3 of the drier + receiver unit 7 (fig. 70), with Diesel engine running and turned on air conditioner. If the white float ball 4 (fig. 71) is in the bottom of the sight glass it indicates a lack of refrigerating agent. If in this case a drop of the refrigerating efficiency is noticed, get the installation refilled by an air conditioner specialist.

determine the degree of moisture in the drying substance inside the drier + receiver unit 7 by checking the colour of the indicator pearl 5 (fig. 71) in the sight glass: the degree of moisture is correct as long as the pearl is blue, at the contrary if the pearl is rose coloured the drier + receiver unit is saturated with humidity and must be replaced immediately.

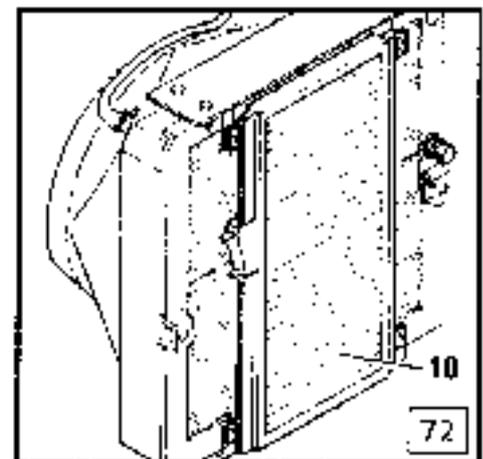
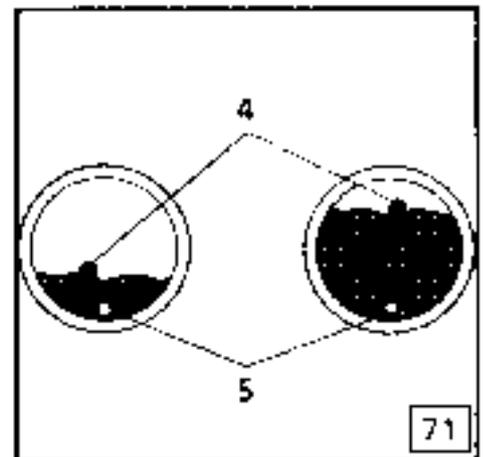
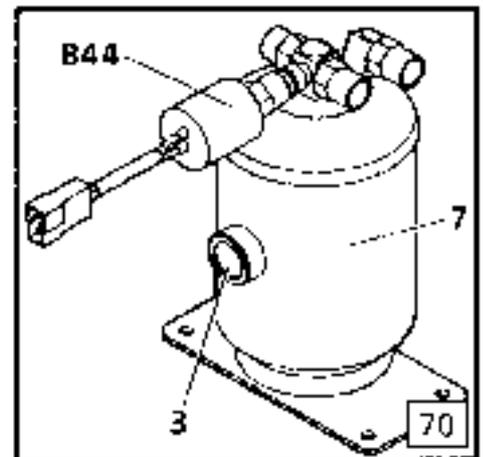
visually check the condition of the refrigerating agent drier + receiver unit 7. If mechanical damage or rust formation is noticed (also at mounting remote or hose connections) the receiver must be replaced (Pressure reservoir).

In the both last cases and at least once a year, the drier + receiver unit 7 must be replaced by a qualified air conditioner mechanic.

The air conditioner circuit must then be drained, checked for leaks and then refilled with refrigerating agent and refrigerating oil for the airco compressor. On the occasion also check the hoses of the air conditioner circuit for externally visible damage and if necessary retighten the hose fittings.

In addition, the following maintenance works must be performed at least once a year by an air conditioner specialist:

- check the function of the motor M13 for the evaporator fan and of air dispatching flaps.
- check the airco electrical circuit for good connections and the electrical wires for external damage.
- check the thermostat B43 inside the evaporator unit (for function, correct fixing and damage).
- check the correct function of the pressure switches B44 at the drier + receiver unit 7.



REPLACING WEAR AND TEAR ITEMS

In addition to regulator maintenance, which is to be performed at given intervals, the following repairs may be performed by the operator or maintenance personnel:

- Replacing the worn teeth on the bucket, see page 6.22.
- Replacing the defective seals on hoses and pipes and connections to the hydraulic components. (However, the operator may not work on the pressure relief valves, which are secured with lead seals.)
- Replacing hydraulic hoses, lines, and fittings in the hydraulic circuit.
- Use only genuine LIEBHERR parts (i.e. hoses, hydraulic lines).
All other repairs should only be done by trained LIEBHERR service personnel.
Always consult your LIEBHERR dealer, especially when removing counterweight.

WELDING

Any welding on structural parts may only be done by LIEBHERR service personnel. If this rule is neglected, the warranty is voided.

Before welding repairs on other parts, always disconnect the battery. Always remove the negative terminal first and reconnect it last.

Nevertheless if welding repairs should be done on components which may contain inflammable gases (welded counterweights, hydraulic tanks, fuel tanks, ...), 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.

Check / Maintenance
at Operating Hours

Works to be performed R 984 C Litronic

Notes:
performance
guidelines

For fill
quantities,
see lubrica-
tion chart

 By maintenance personnel
(Operator)

 By authorized trained
personnel

First and only interval

Repeat interval

At delivery	every 8-10	every 10-50	at 250, 750,...	at 500, 1500,...	at 1000, 3000,...	at 2000, 4000,...
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DIESEL ENGINE & SPLITTERBOX

<input type="checkbox"/>	Check engine oil level							
<input type="checkbox"/>	Check oil pressure and coolant temperature during operation							
<input type="checkbox"/>	Check for air filter clogging at the maintenance indicator							
<input type="checkbox"/>	Check coolant level							
		<input type="checkbox"/>	Empty water separator at fuel filter and drain fuel tank					
		<input type="checkbox"/>	Check oil level in splitterbox					
		<input type="checkbox"/>	Replace oil in the splitterbox					
		<input type="checkbox"/>	Check and clean cooler, hoses, ventilator					
		<input type="checkbox"/>	Check condition and tension of V-belts					
		<input type="checkbox"/>	Replace lube oil filter cartridge					
		<input type="checkbox"/>	Change engine oil	1)				
		<input type="checkbox"/>	Replace the water filter, check the concentration of anticorrosion additive DCA4 in the coolant					
		<input type="checkbox"/>	Check crankcase breather tube, clean it if necessary					
		<input type="checkbox"/>	Replace fuel filter elements					
		<input type="checkbox"/>	Check and if necessary adjust engine speed control					
		<input type="checkbox"/>	Check mounting screws of engine consoles, oil pan and splitterbox					
		<input type="checkbox"/>	Check intake and exhaust system for condition and tightness					
							Replace main element on air filter (as necessary, at least once a year)	
							Replace safety element on air filter (as necessary, at least once a year)	
							Check air hoses between air filter and engine (at filter maintenance)	
							Replace antifreeze and anticorrosive coolant mixture (every 2 years)	
							Every 1500 Hours or 1 Year perform a complete "1500 hours" Maintenance Work, as stated in Operation and Maintenance Manual for Cummins Engine	
							Every 6000 Hours or 2 Years perform a complete "6000 hours" Maintenance Work, as stated in Operation and Maintenance Manual for Cummins Engine	

AIR SYSTEM

<input type="checkbox"/>	Check alcohol level in the antifreeze pump (during cold season)							
<input type="checkbox"/>	Drain air tank (in winter daily and in summer weekly)							
<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check cut in and cut out pressures of air pressure regulator	

Check / Maintenance at Operating Hours						Works to be performed R 984 C Litronic		Notes, performance guidelines For fill quantities, see lubrication chart
At delivery	every 6-10	every 10-50	at 500, 1500, ...	at 1000, 3000, ...	at 2000, 4000, ...	<input type="checkbox"/> by maintenance personnel (Operator)	<input type="checkbox"/> By authorized trained personnel	
						<input type="checkbox"/> First and only interval	<input type="checkbox"/> Repeat interval	
HYDRAULIC SYSTEM								
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check oil level in hydraulic tank
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Clean magnetic rods in return filters (daily during the first 300 hrs.)
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Replace oil filter in the servo control circuit
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Replace replenishing oil filter on swing pump
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check mounting of components
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Drain condensation water at hydraulic tank (When using environmentally friendly hydraulic fluids keep water percentage below 0,1%, if necessary install a bypass oil filter)
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			If mounted check return filter for hydraulic hammer for cleanliness, replace element if necessary
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Replace return filter cartridges (first at 500 hours.)
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			If mounted, replace bypass oil filter element (first 500 hours, and at least every 6 months)
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check cleanliness of hydraulic oil cooler, clean it as necessary
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check hydraulic system for function and leaks
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check and adjust primary and secondary pressure relief valves
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Bleed servo system and hydraulic pumps
				<input type="checkbox"/>	<input type="checkbox"/>			Replace hydraulic oil (or optimize intervals according to oil sample analysis reports)
				<input type="checkbox"/>	<input type="checkbox"/>			Replace breather filter on hydraulic tank
				<input type="checkbox"/>	<input type="checkbox"/>			Check filter elements of high pressure filters, if necessary clean or replace them
ELECTRICAL SYSTEM								
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check indicator lights and gauges on control panel when starting
<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check head and floodlights
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check level and specific gravity of electrolyte in the batteries
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check and clean battery terminals
<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check system and components for function
SWING GEAR								
<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check oil level and for leaks
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Replace gear oil (first at 500 hrs.)
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check function and operation of swing brake
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check mounting of gear and oil motor

Check / Maintenance at Operating Hours						Works to be performed		Notes, performance guidelines For fill quantities, see lubrication chart
At delivery	every 8 - 10	every 10 - 50	at 500, 1500, ...	at 1000, 3000, ...	at 2000, 4000, ...	<input checked="" type="checkbox"/> by maintenance personnel (Operator)	<input checked="" type="checkbox"/> By authorized trained personnel	
						<input type="checkbox"/> First and only interval	<input type="checkbox"/> Repeat interval	
SWING RING								
	<input type="checkbox"/>			Lube swing ring teeth				
	<input type="checkbox"/>			Check grease level in lube pump for swing ring teeth				
				<input type="checkbox"/>	<input type="checkbox"/>			Check, if necessary tighten mounting screws
				<input type="checkbox"/>	<input type="checkbox"/>			Check pinion gear mesh
TRAVEL GEARS								
<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check oil level and for leaks
				<input type="checkbox"/>	<input type="checkbox"/>			Check function and operation of travel brakes
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check mounting screws of gears, sprocket wheels and oil motors
					<input type="checkbox"/>			Replace gear oil (first at 500 hrs.)
SAT 90 IN CAT 80W90								
TRACKS								
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check track chain tension visually, retighten if necessary
	<input type="checkbox"/>							Clean track chains (after working hours)
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check and tighten mounting screws of track pads and sprocket wheels
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Clean and lubricate sliding surfaces of chain tensioners
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check idlers, carrier and track rollers for leaks
CENTRAL LUBRICATION								
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check movement of control pins and hoses for leaks (see page 5.23)
	<input type="checkbox"/>			Perform a complete weekly maintenance, as listed page 5.23				
								Yearly perform a lube pump control head maintenance (see page 5.23)
CAB & HEATER								
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			Check level in reservoir for windshield washer, refill if necessary
<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>			Check function of heater, (before start of cold season)
				<input type="checkbox"/>	<input type="checkbox"/>			Check heater system for leaks
				<input type="checkbox"/>	<input type="checkbox"/>			Check and grease locks and hinges on doors and windows
					<input type="checkbox"/>			Check the warm water solenoid valve for function and chocking, clean it as necessary

Check / Maintenance at Operating Hours						Works to be performed	Notes, performance guidelines For lift quantities, see lubrication chart	
At delivery	every 8-10	every 10-50	at 500, 1500,	at 1000, 3000, ...	at 7000, 40000,			
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> by maintenance personnel (Operator) <input type="checkbox"/> First and only interval	<input type="checkbox"/> By authorized trained personnel <input type="checkbox"/> Repeat interval	
AIR CONDITIONER								
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Operate the air conditioner (at least once every second week)		
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check the condition of condenser, blow it out if necessary		
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Clean, if necessary replace both air filters in airco unit Reduce maintenance interval in very dusty conditions		
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check the mounting screws and the drive belt of airco compressor		
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check the drier / receiver unit for moisture degree, coolant level and good condition (no rust), replace it if necessary		
					<input type="checkbox"/>	Check the condition of evaporator unit, clean as necessary		
					<input type="checkbox"/>	Check electrical wires for damage and for loose connections		
					<input type="checkbox"/>	Check pressure switch for function		
					<input type="checkbox"/>	Check efficiency of air conditioner after opening the circuit, repairs or as necessary		
						Yearly replace the drier receiver unit, for the occasion check the whole circuit for leaks and replace refrigerating agent and refrigerator oil		
						Yearly have the function of the air flaps and of the defrosting thermostat checked by a refrigeration specialist.		
UNDER / UPPERCARRIAGE, & ATTACHMENTS								
	<input type="checkbox"/>	Check bucket teeth visually for wear						
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Lubricate all grease and lubrication points		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check all parts for cracks		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check mounting screws of counterweight and tanks for tightness		
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check and lubricate cover hinges and locks, check mounting and efficiency of cover lifting cylinders		
<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check the lowering speed of the attachment		= 5 sec
<input type="checkbox"/>						Explain proper use and maintenance to the operator		
<input type="checkbox"/>						Ask the operator to lubricate the machine using the lube chart, explain defects and deficiencies		
	<input type="checkbox"/>					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 also perform daily a visual check of engine, hydraulic system, gears, and track parts for leaks.		

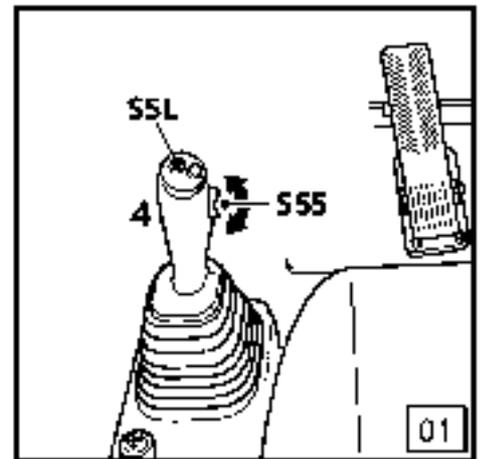
- 1) Depending on temperature, fuel and oil qualities, the intervals for engine lube oil changes may be reduced, see page 5.4
 - 2) If very dusty working atmosphere, the intervals for replacing the filters may be reduced, see special instructions on page 5.9.
 - 3) When using environmentally friendly hydraulic fluids, maintenance interval must be determined through oil sample analysis reports
- Δ) For industrial attachment perform check every 250 hrs

CONTROLS ON JOYSTICK HANDLES FOR US - VERSION

FUNCTIONS CONTROLLED VIA THE SWITCHES IN THE HANDLE OF LEFT JOYSTICK 4 (fig. 1)

- S55 = Lifting magnet ON / OFF
- S5L = Float position
- or – Unlocking of end position of a cylinder *
(if no float position mounted)
- or – Travel alarm cut-off *
(if neither float position nor unlocking)

* If machine has float position, these functions are controlled via switches on the rear control desk



Operation of lifting magnet

- Rocker switch S55 DOWN – Magnet OFF
- Rocker switch S55 UP – Magnet ON

Travel alarm cut-off

Each time the travel pedal is pushed, the travel alarm will sound automatically. This sound can be silenced earliest 10 seconds after travel start with push button S5L.

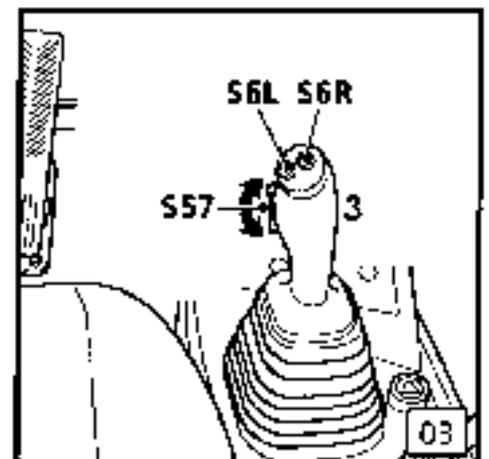
The travel alarm will be reactivated with every new travel operation

Unlocking of end position of a cylinder

Press S5L to unlock a cylinder end position that has previously been preselected via switch S54, see on page 3.20.

FUNCTIONS CONTROLLED VIA THE SWITCHES IN THE HANDLE OF RIGHT JOYSTICK 3 (fig. 3)

- S6L – Rotating device left (grapple or magnet rotation, ...)
- S6R = Rotating device right
- S57 = Swing brake semi automatic mode
(standard function on R 934 and above, see page 4.12)



GUIDELINES FOR HYDRAULIC EXCAVATORS

- WHEN THEY ARE USED FOR LIFTING LOADS SUCH AS PIPES, GIRDERS, ETC. .

GENERAL

On April 1, 1970, the German trade unions for below grade and earthmoving construction put safety guidelines in force for excavators, loaders, dozers, etc. , VBG 40, governing hydraulic excavator use, especially when they are used for lifting and transporting loads overhead. These new safety guidelines must be observed.

Overhead lifting, handling and transporting of loads such as pipes, girders, etc (lifting operation), requires different safety guidelines than just removing, loading and unloading dirt, stone, minerals etc. (digging or excavating operation), because another person (or persons) is required to enter the swing range of the excavator in order to attach or remove the load on boom or stick.

To protect these persons attaching or removing the loads during lifting operation, certain requirements have to be met by excavators, which are used for lifting loads overhead.

Hydraulic excavators, when they are used for lifting operation, must have all the following mentioned special safety devices installed :

- A load hooking system which must ensure safe attaching and removing of the loads and be designed such that accidental unhooking or uncontrolled movement is minimized
- An overload warning device must be installed, which alerts the operator optically via a warning symbol and acoustically via a buzzer that the weight of the load is heavier than the load permitted by the rated lift capacity chart
- A boom lowering control device (such as load check valves) must be installed according to the international standard ISO 8643 to prevent unintentional lowering or dropping of the boom because of the weight of the load, which could happen if a line in this hydraulic circuit suddenly develops a leak (for example, should a hydraulic line break or a hose burst, ..).
These valves are installed between the boom cylinders, see fig. 12 (or the stick cylinder) and the control valve block, directly on hydraulic pressure connections of cylinders.
- With a rated lift capacity chart attached inside the cab and within the view of the operator.

Every LIEBHERR hydraulic excavator can be fitted with an "overload warning device" and/or with load check valves.

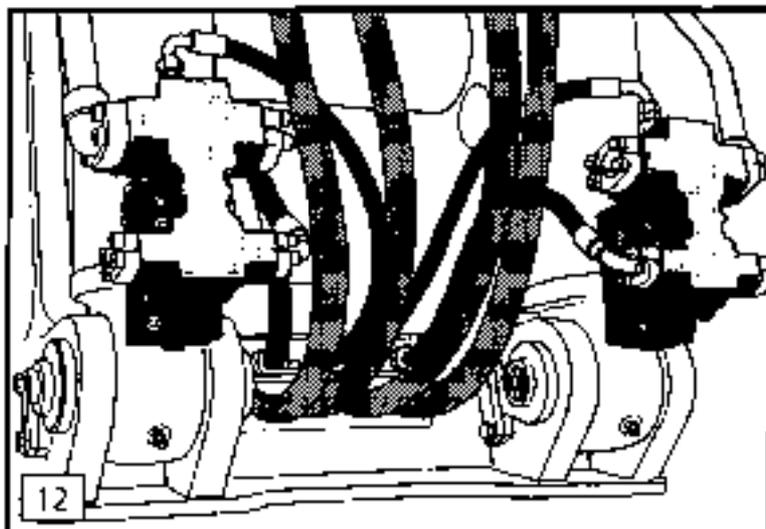


DANGER

Never use your machine for lifting operation without it is fitted with all the above mentioned devices.

Never lift loads over people.

No person may fasten or unfasten a load without approval of the operator and this person may only approach the load from one side. The operator may only approve this action when the excavator has stopped and the attachment is not moving.



Only employ sling ropes and accessories which are permitted for lifting operation, regularly checked and in good condition.

THE OVERLOAD WARNING DEVICE

An overload warning device does not stop a machine when the permissible load range is exceeded. The operator and nearby personnel are only informed and alerted about the fact that the authorized lift capacity has been reached.

The overload warning device may only be used for lifting operation. For digging operation, the overload warning device must be turned off.

FUNCTION

The overload warning device warns the operator optically via a warning symbol on the display (fig. 24A) and acoustically via a buzzer when the maximum lift capacity (per ISO 10567) has been reached. The device does not turn the excavator off.

The signal is given by a pressure switch 1, which is connected with the piston bottom side of the boom cylinders.

Every reach has a corresponding lift capacity. When a load corresponding to this weight is attached, pressure is created in the boom cylinders and the overload warning device is actuated at a certain pressure.

This capacity can be changed and set by adjusting the pressure setting on the switch depending on the boom position via cam plate 2 and lever 3.

The cam plate is designed to adjust the pressure setting of the switch in relation to the boom position.

Depending on the machine type (with or without outriggers, different track or wheel base width or different types of attachments), appropriate cam plates can be installed on the overload warning device to the right of the swing ring bearing mount.

As per ISO 10567 the rated lift capacity chart indicates either 75% of the static tipping load or 67% of the hydraulic lift capacity (smaller of both).

The stability margin of 25% is valid with the machine on firm, flat ground and for full uppercarriage swing.

OPERATION OF OVERLOAD WARNING DEVICE

For lifting operation

Adjust the overload warning device before using it for the first time.

To put the overload warning device in operation:

- Move lever 3 on switch 1 into working position,
- Open shut off valve 5 (move it to position A),
- Turn the overload warning device "on" via switch S18.



CAUTION

Make sure to observe all accident prevention regulations when lifting loads with an hydraulic excavator. Only lift loads of known weight, check your attachment data sheets for load limits, which differ by machine type.

For digging operation

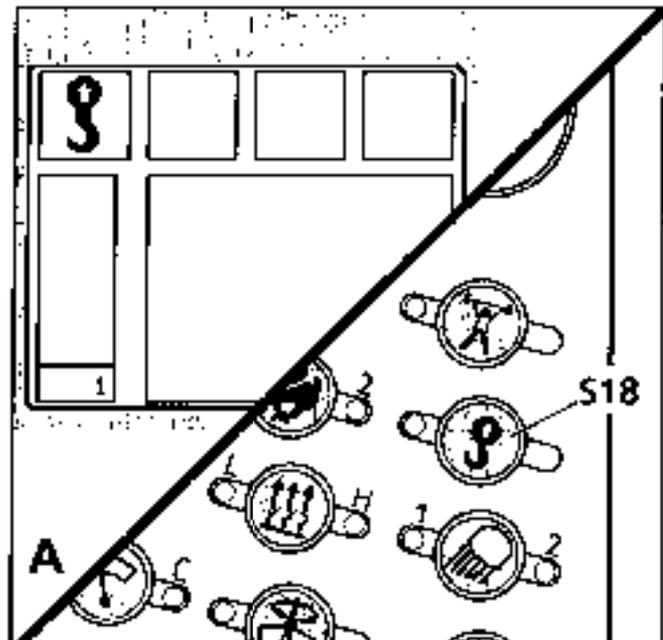
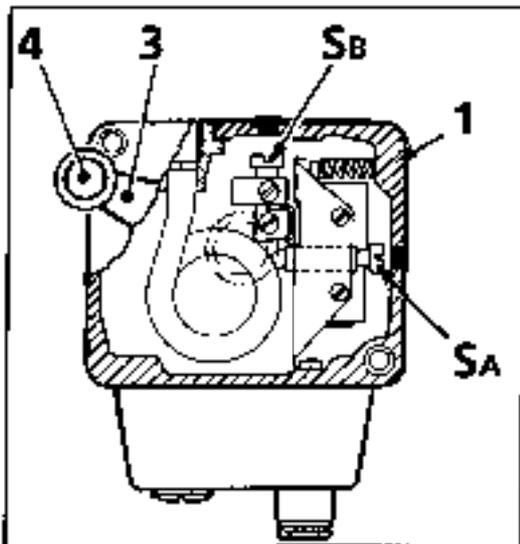
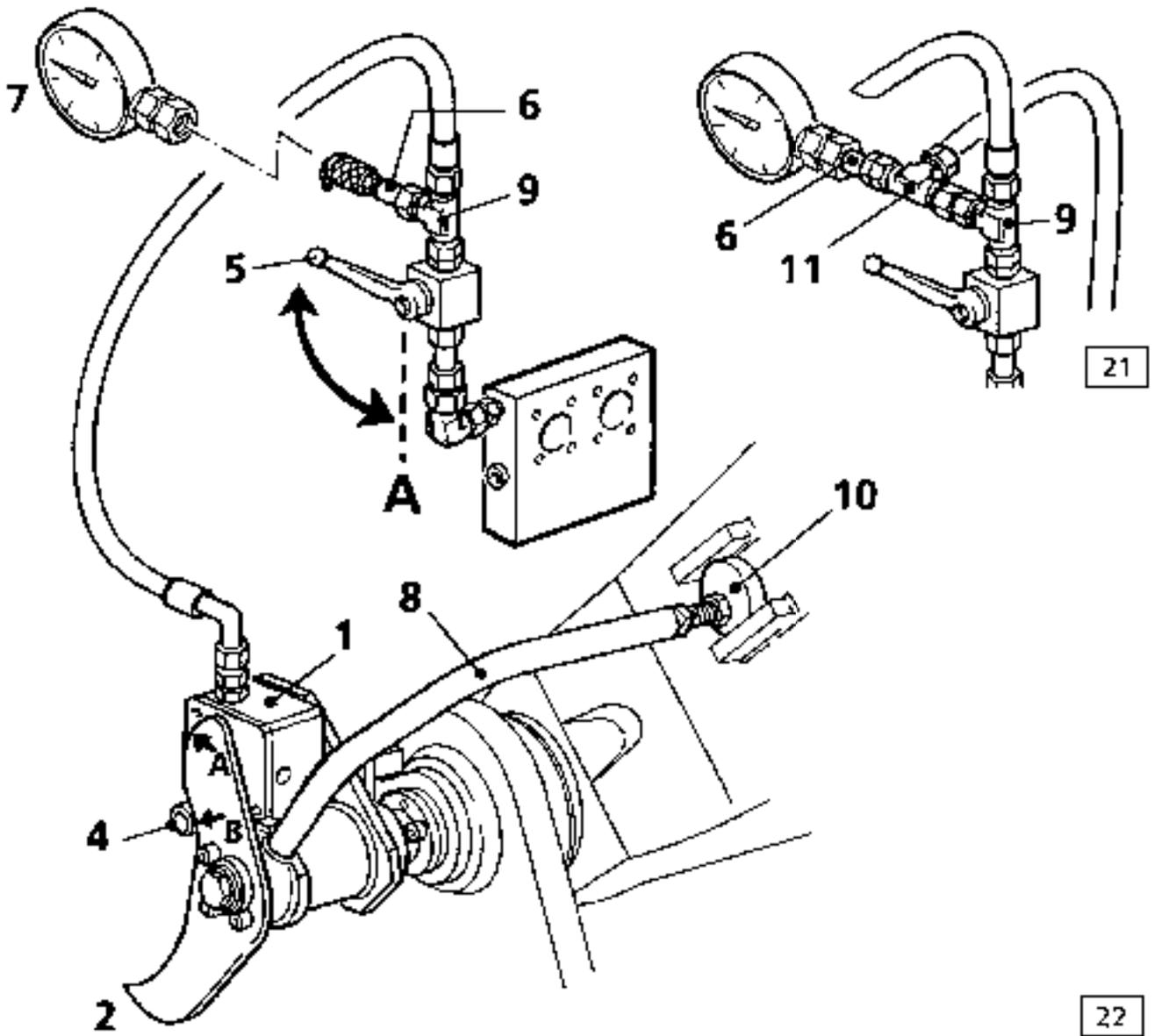
The overload warning device may only be used for lifting operation.

For excavating work, turn the overload warning device off as follows:

- Turn the overload warning device off on switch S18,
- Close the shut off valve 5,
- Turn the lever 3 on switch 1 to "off" position and lock it.

Function Tests

- Check all moving parts regularly for easy movement and lubricate them.
- Check the function of the system daily by extending the boom cylinder all the way to build up maximum operating pressure. The overload device must then actuate the warning buzzer and indicator light.



- If an excavator is used for lifting operation, it must be tested once a year for stability:
 - Choose any combination of lift capacity / reach in the rated lift capacity chart which is valid for the attachment, which is installed on your machine,
 - multiply the weight by 1,25 and attach this test load to the attachment, at the chosen reach,
 - slightly lift the load,
 - the machine may not tilt, the overload warning device must give an optical and acoustical warning signal.

Important ! This test is - besides a stability test - only a function test for the warning system (qualitative test), it does not mean that the adjustment is correct

- For this reason, the warning device must be checked once a year and adjusted, if necessary, as described below (quantitative test).

TEST AND ADJUSTMENT

Adjustment with boom up (point A)

Remove the cap on test point 6, mount a 0-400 bar pressure gauge 7 so the gauge is visible from the cab.

Move the boom up all the way and, if necessary, adjust bracket 8 via the eccentric plate 10 until roller 4 is exactly on the mark for point A on cam plate 2.

Turn on the warning device on the instrument panel (fig. 24, pos. 518) and open the shut off valve 5 between the warning device and the boom cylinder connection (Position A)

Move the joystick slightly, extend the boom all the way to build up the pressure set on point A on cam plate 2.

This must actuate the warning device.

If the warning device does not turn on (warning symbol and acoustical signal), the shifting point on switch 1 must be reduced.

Remove side cap and adjust screw S_A (fig. 23) :

- turn clockwise to increase pressure,
- turn counterclockwise to decrease pressure

A lower shifting point is permissible.

Adjustment with boom down (point B)

Lower the boom until point B on the cam plate is reached.

Build up pressure as set on point B, as follows:

turn off shut off valve 5, and via an additional I-fitting 11 between pressure gauge and L-fitting 9 (fig. 21), build up pressure on the switch 1,

- either with a separate hand pump
- or via a mini test hose, connected to a pressure test point of the main control valve block for high pressure. The pressure is increased through this hose as soon as any movement is selected

When the set pressure is reached, the overload warning device must actuate.

If this is not the case, take off the upper cap and adjust the screw S_B on the switch 1 (fig. 23) :

- turn clockwise to increase pressure,
- turn counterclockwise to decrease pressure.

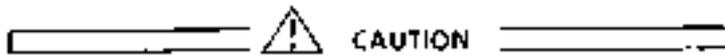
A lower shifting point is permissible.

Reinstall caps for screws S_A and S_B , remove pump, mini test hose and pressure gauge, check all moving parts of the overload warning device for easy movement.

ADJUSTABLE OPERATOR'S CAB

The hydraulically adjustable operator's cab is additional equipment which allows the height and/or inclination of the operator's cab to be adjusted steplessly.

- With a cab adjustable in height on hoist frame the height can be adjusted steplessly (fig. 1).
- With an operator's cab adjustable in height and tiltable on hoist frame, the height and inclination can be simultaneously, steplessly adjusted (fig. 2)
By modifying the bolting on the hoist frame, see pages 8.1.4 and 8.1.5, the "Cab adjustable in height only" can be switched over.
- With an operator's cab tiltable to 30 degrees inclination between 0 and 30 degrees upwards only can be steplessly adjusted (fig 3).



When operating the adjustable cab, the travel route of the excavator must be clear. It must be even, free of any obstructions and may not go down an incline, which could influence the stability of the excavator.

The cab may only be adjusted when the excavator is not moving.

During the cab adjustment, no personnel may be in close range of the excavator!

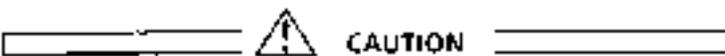
Check every day the fixation of the cab support before using the excavator!

ENTERING OR LEAVING THE CAB

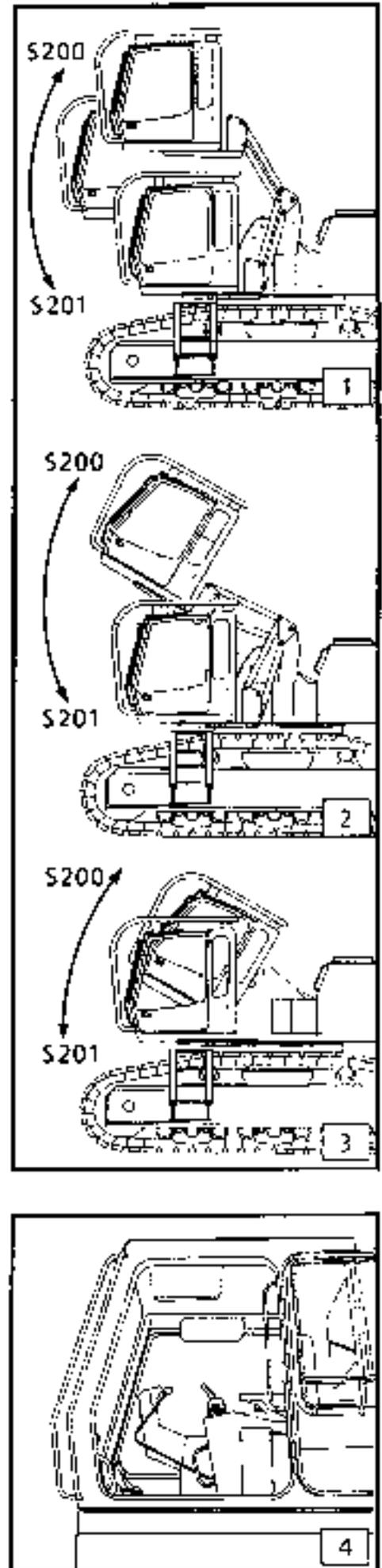
To enter or leave the cab, always use the intended entry aids (steps and hand rails).

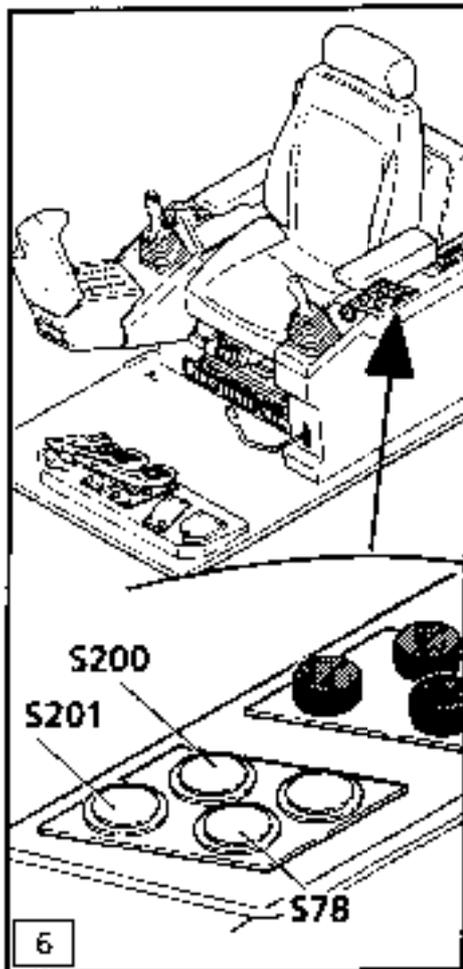


NEVER JUMP OFF THE HYDRAULIC EXCAVATOR.



It is essential to have your seat belt fastened if you want to operate the machine with the cab door opened. If your machine is not fitted out with a belt, so you must compulsorily get one installed before you start working with opened cab door.





CAB HEIGHT ADJUSTMENT

TO RAISE THE CAB S200



Push the button S200 cab "up" (fig. 6) and raise the cab to the desired position.

TO LOWER THE CAB S201



Push the button S201 cab "down" (fig. 6) and to lower the cab

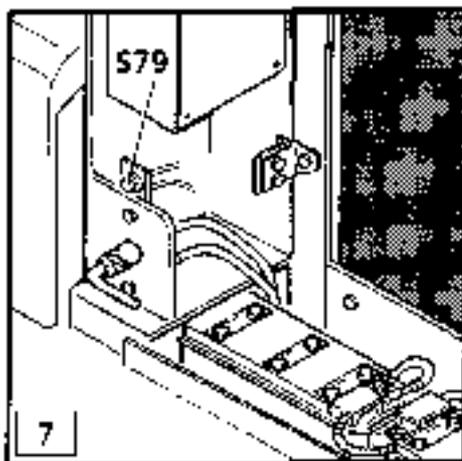
EMERGENCY DOWN S78



If there is a problem on the Diesel engine or in case of some other defect, then the cab can be lowered by pressing the emergency down button S78 (fig. 6)

EMERGENCY DOWN S79

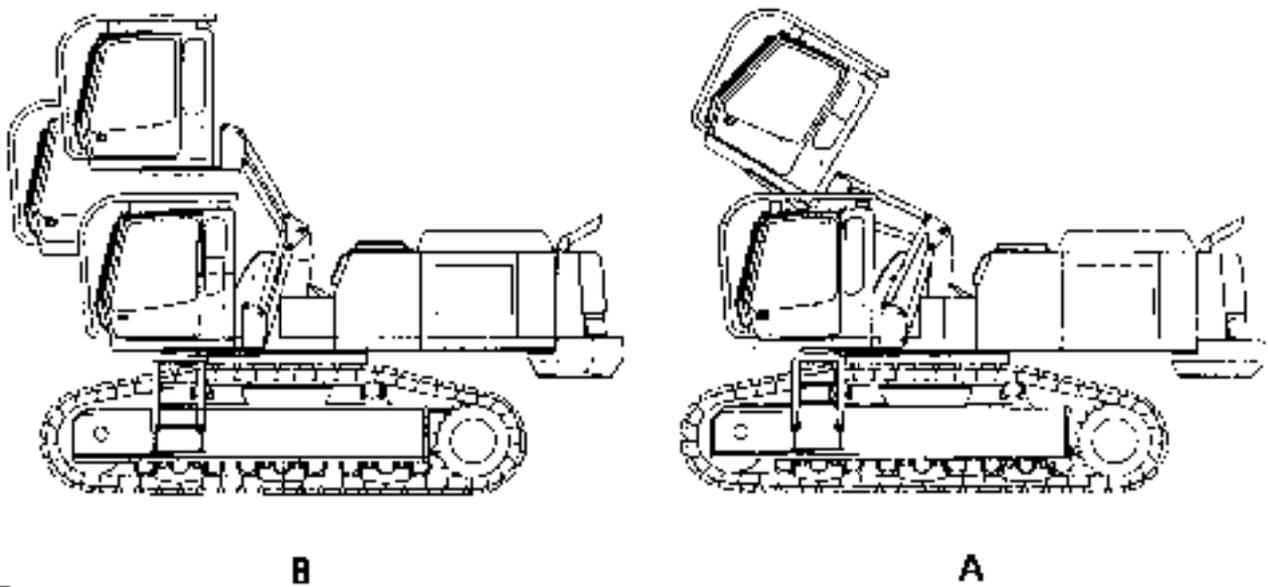
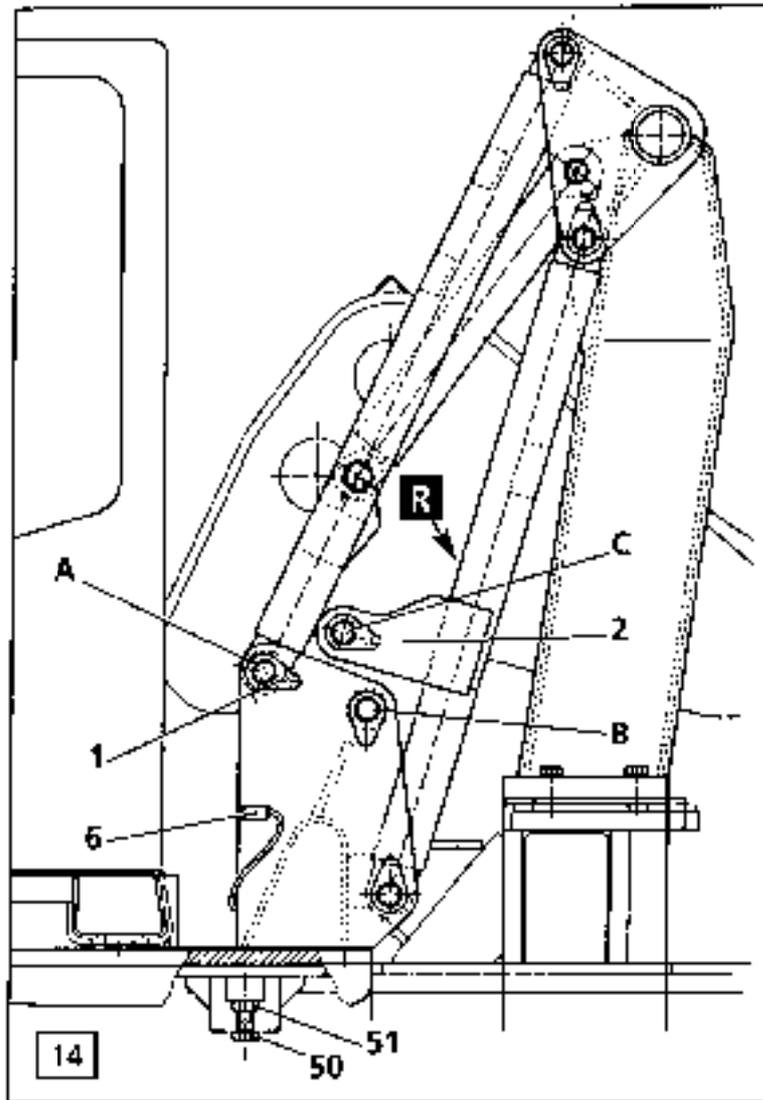
The cab can also be lowered externally via the emergency down button S79
The emergency down button is accessible through a side door on the left rear (battery compartment - R964, rear right) (fig. 7).



REPAIRS AND MAINTENANCE

If possible, repairs and maintenance on the cab, the lift arms or the corresponding hydraulic system should be carried out when the cab is lowered

The cab must be supported with suitable support devices before carrying out any repairs and maintenance tasks, which must be done when the cab is raised.



16

HEIGHT ADJUSTABLE AND TILTING OPERATOR'S CAB (Optional Version)

The hydraulically height adjustable and tilting operator's cab tilts progressively to the rear when moving up.

This allows the excavator operator a better view of upper areas on any raised attachment (operating with a demolition attachment, when using lifting tackle, ...).

By changing the pins near the hoist frame fittings to the operator's cab mounting, the "Operator's cab tilting" version can be changed to the "Operator's cab not tilting" version, and vice versa.

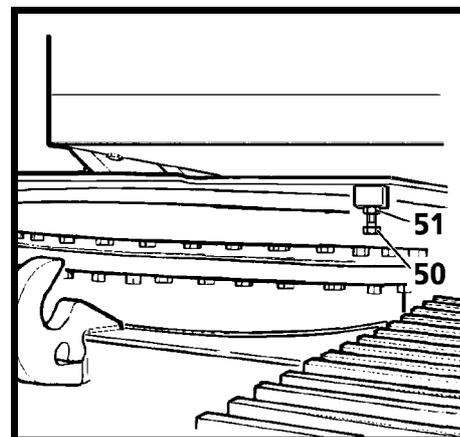


Fig. 17

Changing the position of the operator's cab from tilting to not tilting

Proceed in the following manner :

- 1- Put the operator's cab in the lowermost position.
- 2- Remove the covering in front of the hoist frame.
- 3- Release counter nut 51 (Fig. 14 and 17) below on the inside of the operator's cab and screw in screw 50 until the operator's cab comes to rest
Retighten counter nut 51.
- 4- Remove both pins 1 (one per side) and both pins 2 and place in holders 4 in rear frame R (Fig. 14 and 18).
- 5- Connect control device S (Fig. 19) to plug 6.
- 6- Start the Diesel engine and let it run in low idle.
- 7- Actuate the variable adjustment cylinder of the operator's cab using the control device :

ON = raise

OFF = lower

Until the two pins 1 can be placed in the desired bore hole A or B (Fig. 14). If necessary, adjust the position of screw 50.

Bore hole A means "Operator's cab tilting" position (Fig. 16A).

Bore hole B means "Operator's cab not tilting" position (Fig. 16B).

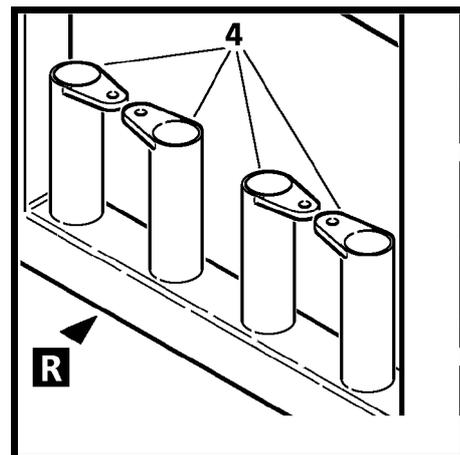


Fig. 18

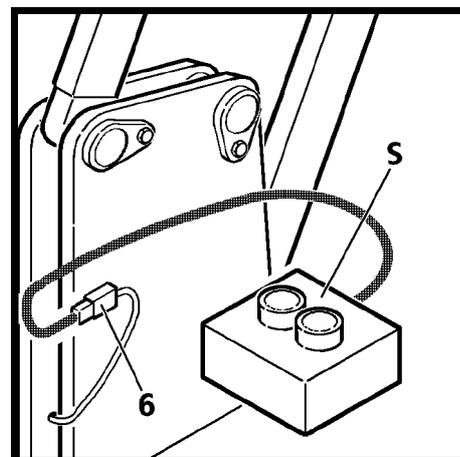


Fig. 19



CAUTION

Pins 2 are to be placed in bore hole C on "tilting" version only. On the "not tilting" version, pins 2 remain in the holders in the rear frame.

Secure all pins via fastening screw, even those remaining in holders 4.

- 8- Disconnect control device S and stow in the operator's cab.
- 9- Return screw 50 to original position and secure via counter nut 51.

HYDRAULIC QUICK CHANGE ADAPTER (SWH)

SAFETY RECOMMENDATIONS

- The operator must make sure every time any tool is changed that the locking pins of the quick change coupler are inserted into the bore holes provided on the tool and that the tool is attached properly.
Make a direct visual check that the tool is fitted securely.
- In addition, the operator must perform a cycle with the tool where the tool may only be raised far enough that the secure fitting, e.g. if the pins are in the pin holes, can be checked by tilting the tool in and out.
- Check fitting of locking pins visually on a daily basis.
- Check for proper function of warning devices visually and acoustically by actuating the SWH coupler.
- If a buzzer sounds or a warning symbol lights up and no locking or unlocking procedure was initiated, shut down operation immediately.
This may be due to the locking pins changing their fitting position unchecked, e.g. because of leakage.
If buzzer/warning light are not actuated during any procedure, shut down operation immediately. This may be due to breaks in the cable, a defective plug connection or a defective proximity switch.
Operation may only be reinitiated after defective parts have been repaired or replaced.
- The load capacity of the hydraulic quick change coupler (SWH) and/or the integrated load hook can be less than or greater than the load capacity of the basic machine.
During operation, make sure that the values found on the load capacity chart and in the Technical Data of the basic machine are maintained when checking the authorized load capacity of the SWH and/or the integrated load hook.

HYDRAULIC QUICK CHANGE COUPLER (SWH)

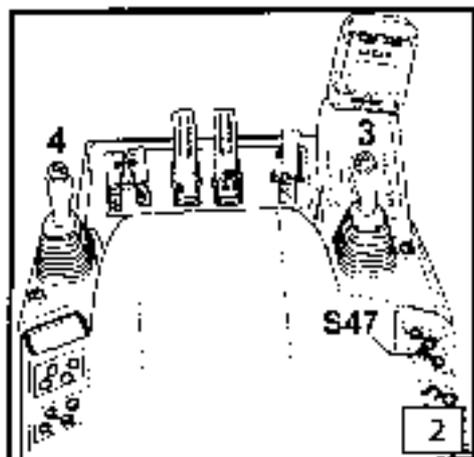
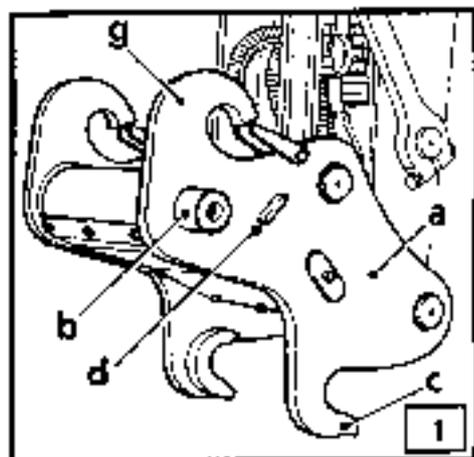
- a coupler
 - b locking pins (extended)
 - c attachment hook for tool
 - d stop
 - g load hook
- 3 right joystick
 - 4 left joystick with push-buttons left / right

S47 push-button switch with key

S19 push button for grapple rotation drive



symbol "locking pins inserted" on the screen



TECHNICAL DATA

Maximum operating pressure 100 bar.

PUSH BUTTON S19 (fig. 3)

The hydraulic additional attachment function for grapple rotation drive is actuated via push button S19 (indicator light in the button lights up).

SYMBOL "Locking pins inserted" (fig. 3)

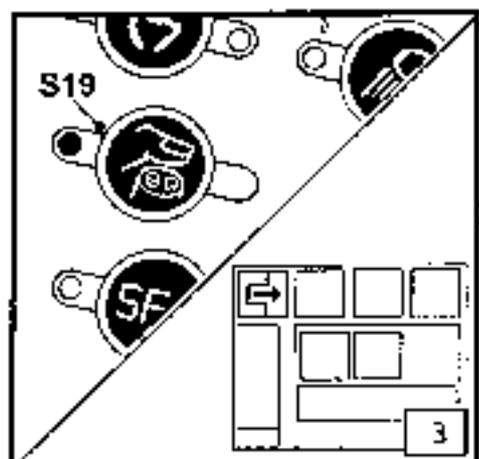


If this symbol appears on the screen, the pins are retracted (tool unlocked).



DANGER

The attachment is only connected to the attachment hook of the "quick change coupler".



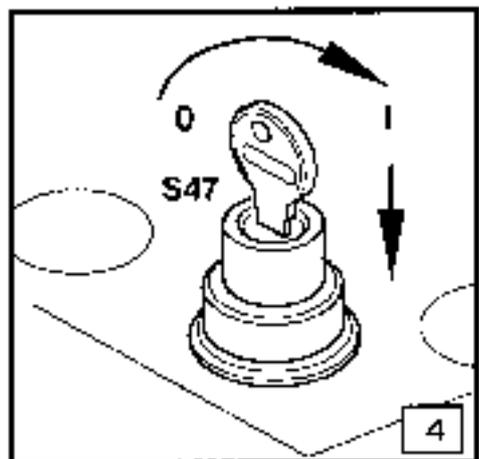
PUSH-BUTTON SWITCH WITH KEY S47 (fig. 4)

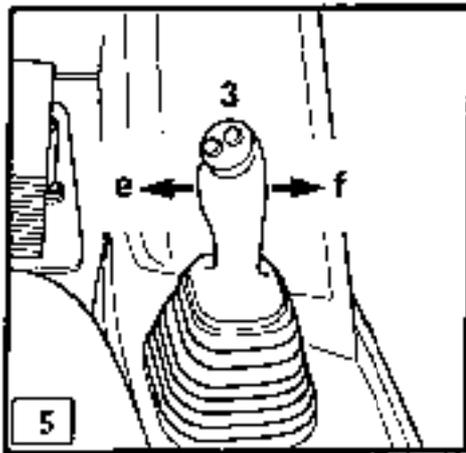
POSITION "0"

Zero position; it is not possible to actuate the locking pins of the quick change coupler SWH.

POSITION "1"

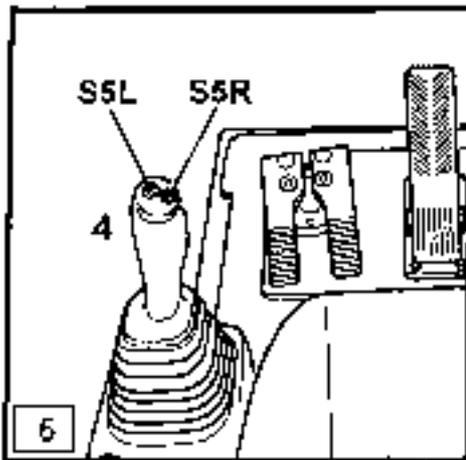
The switch is released by turning the key to position "1".
When push button S19 is on, the locking pins can be actuated by pressing and holding the button.





JOYSTICK RIGHT 3 (fig. 5)

- TOWARD "e" = extend bucket cylinder
- TOWARD "f" = retract bucket cylinder



JOYSTICK LEFT 4 (fig. 6)

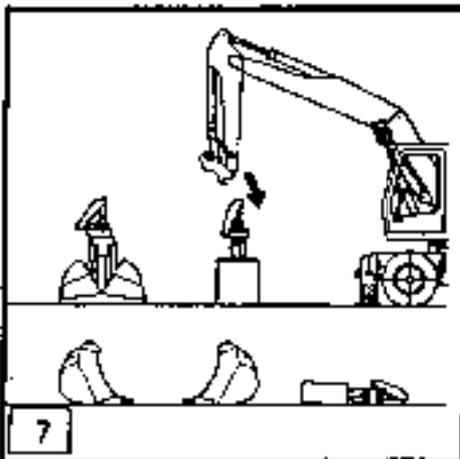
- PUSH-BUTTON LEFT "S5L" = extend locking pins (attachment locked)
- PUSH-BUTTON RIGHT "S5R" = retract locking pins (attachment unlocked)

USING BOTH HANDS

The quick change coupler SWH is controlled by using both hands. The locking pins may only be extended or retracted when push button S19 is actuated and at the same time push-button switch S47 and the push-buttons S5L or S5R on the left joystick are depressed.

INSTALLING TOOLS

Position stick and tool as in figure 7.



CAUTION

The tool must be lying freely on level ground.

Deflect right joystick 3 (fig. 5) toward "f" and retract the bucket cylinder fully.

Switch on the additional attachment function "rotate grapple" by actuating push button S19 (fig. 3) (indicator light on the button lights up).

Unlock push-button switch S47 with the key (fig. 4) and press it.

When switch S47 is depressed, press right push-button "S5R" on left joystick 4 (fig. 6) until the locking pins (fig. 1, pos. B) are fully retracted.

The symbol "locking pins retracted" appears on the screen and the buzzer sounds.

Release switch S47.

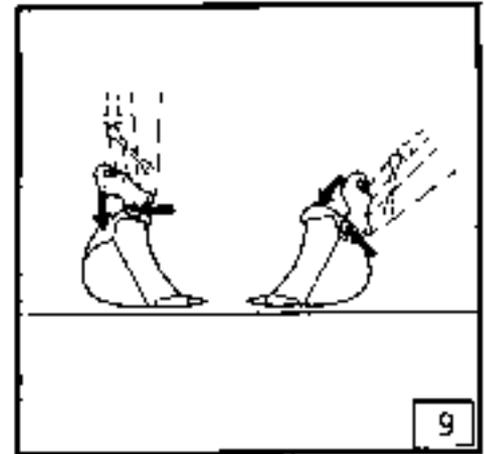
ATTACHING TOOLS

Position the quick change coupler in such a way that the tool can be mounted on the attachment hook (fig. 9 and 10).

Backhoe buckets can alternatively be used as front buckets after changing the attachment pins.

Raise the tool from the ground and extend the bucket cylinder until the bearing plates of the tool (fig. 11) are resting at the stops of the quick change coupler SWH (fig. 1, pos. d).

The attachment bore holes of the tool must be flush with the locking pins (fig. 11 and 12).



 **CAUTION**

Keep tools near the ground.

LOCKING THE COUPLER

Keep switch S47 depressed (fig. 4) and press left push-button "SSL" (fig. 6) on left joystick 4 until the locking pins are completely out.

Release switch S47. The symbol "locking pins" on the screen should extinguish and the buzzer should stop sounding.

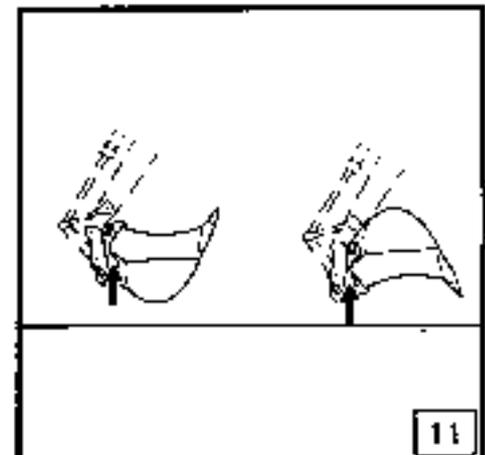
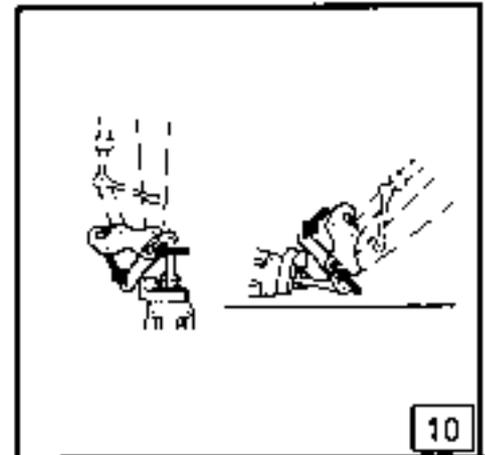
Deactivate push button S19 (indicator light extinguishes).

If properly attached, the tool is now locked in place.

Check visually if the tool is fitted firmly.

In addition, the operator must perform a cycle with the tool where the tool may only be raised far enough that the secure fitting, e.g. if the pins are in the pin holes, can be checked by tilting the tool in and out.

No one is permitted in the danger zone during a test run!



 **DANGER**

If a buzzer sounds or a warning symbol lights up and no locking or unlocking procedure was initiated, shut down operation immediately.

This may be due to the locking pins changing their fitting position unchecked, e.g. because of leakage.

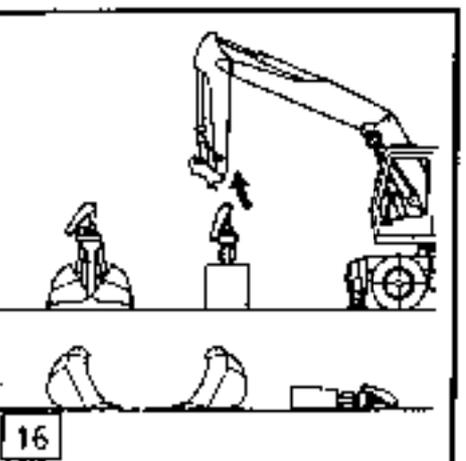
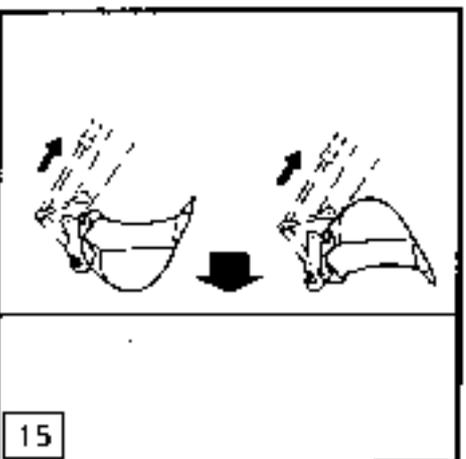
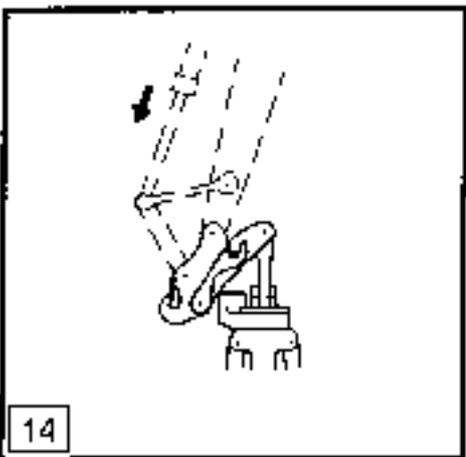
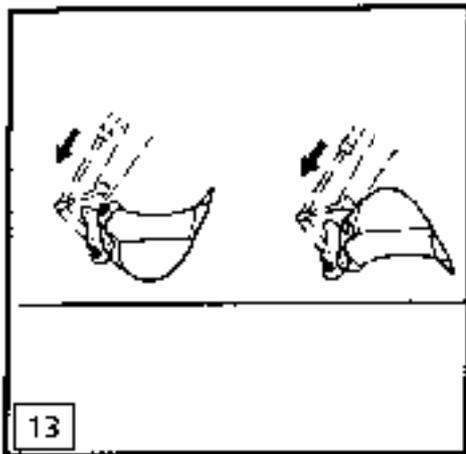
If buzzer/warning light are not actuated during any procedure, shut down operation immediately. This may be due to breaks in the cable, a defective plug connection or a defective proximity switch.

Operation may only be reinitiated after defective parts have been repaired or replaced.



Notice: Before starting operation with tools, e.g. grapple, ditch cleaning bucket, observe all special instructions for mounting and dismantling.

DISMANTLING TOOLS



CAUTION

Always keep the tool at a minimum distance from the ground during any unlocking procedure to avoid dangerous movements.

Deflect right joystick 3 (fig. 5) toward "e" and extend the bucket cylinder fully (fig. 13 and 14).

Switch on the additional attachment function "grapple rotation drive" by actuating push button S19 (fig. 3) (indicator light on the button lights up).

Unlock push-button switch S47 with the key (fig. 4) and press it.

When switch S47 is depressed, press right push button "SSR" on left joystick 4 (fig. 6) until the locking pins (fig. 1, pos. b) are fully inserted.

The symbol "locking pins retracted" appears on the screen and the buzzer sounds.

Release switch S47.



DANGER

There is no rigid connection between the coupler and the tool present.

The tool can be released.

To avoid dangerous movements, keep the tool at a minimum distance from the ground.

Slowly retract bucket cylinder and lay the tool on the ground (fig. 15 and 16).

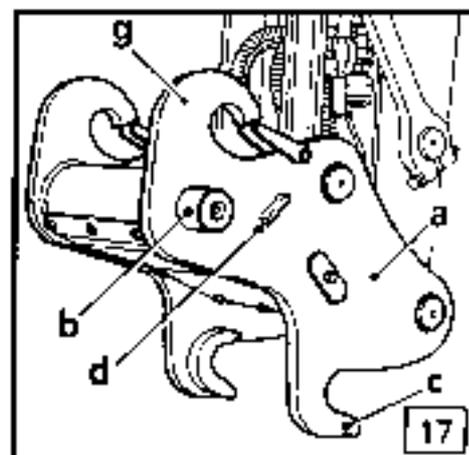
Deactivate push button S19.

LIFTING TACKLE INSERT

The standard hydraulic quick change coupler comes equipped with two integrated load hooks (fig. 17, pos. g). The hydraulic excavator may only be operated with lifting tackle when the additional safety devices described in chapter 4 "lifting tackle" are present and operational.



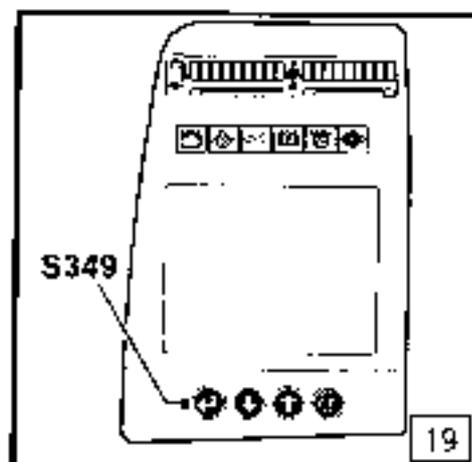
Never use attachment hook pos. c to fix loads because the attachment hooks do not provide any secure hold for load attachment items such as cables or chains.



The maximum load capacity of each individual load hook can be found on the quick change coupler. The load capacity of the quick change coupler and/or the integrated load hook can be less than or greater than the load capacity of the basic machine. During operation, make sure that the values found on the load capacity chart and in the Technical Data of the basic machine are maintained when checking the authorized load capacity of the coupler and/or the integrated load hook.

Any load lifting work can only be performed when the tool is attached or dismantled. When the tool is dismantled, it is recommended to fully retract the locking pins on the lifting tackle insert. This prevents the load attachment items (cables, chains) from being routed over the locking pins and thus protects them from being damaged.

If the overload warning device is switched on, the warning buzzer for the retracted locking pins can be turned off via switch S349 (fig. 19) to prevent any constant noise pollution. The symbol "locking retracted" remains visible/lit up on the instrument panel. The warning buzzer is reactivated automatically when the locking pins are reactivated.



MECHANICAL QUICK CHANGE COUPLER (SWM)

SAFETY RECOMMENDATIONS

- The operator must make sure every time any tool is changed that the locking pins of the quick change coupler are inserted into the bore holes provided on the tool and that the tool is attached properly.
Make a direct visual check that the tool is fitted securely.
- In addition, the operator must perform a cycle with the tool where the tool is guided as near to the ground as possible.
No one is permitted in the danger zone during this trial run.
- Check fitting of locking pins visually on a daily basis.
- Check for a secure fitting of the stop screw daily.
- The load capacity of the mechanical quick change coupler SWM and/or the integrated load hook can be less than or greater than the load capacity of the basic machine.
During operation, make sure that the values found on the load capacity chart and in the Technical Data of the basic machine are maintained when checking the authorized load capacity of the SWM and/or the integrated load hook.

MECHANICAL QUICK CHANGE COUPLER (SWM)

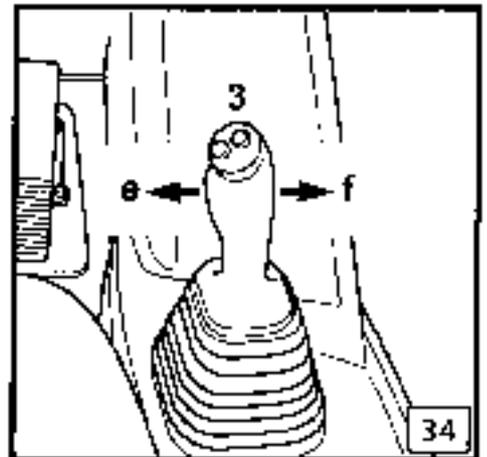
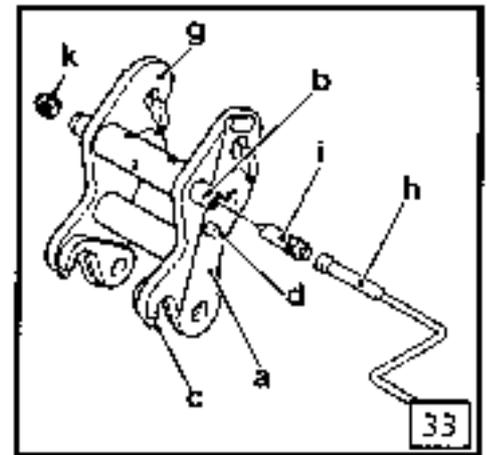
- a coupler
- b locking pins (extended)
- c attachment hook for tool
- d stop
- g load hook
- h crank
- i stop screw
- k plug screw

3 right joystick

Deflecting the joystick to the right

Toward "e" = extend bucket cylinder

Toward "f" = retract bucket cylinder



ATTACHING TOOLS

Approach the SWM from the side (fig. 33) and unscrew the stop screw (i) with the crank (h) from the locking pin (b).

Insert the crank (h) in the locking pin (b) and turn it to the left (counterclockwise) until both locking pins (b) are retracted to the stop.

Notice: The stop and plug screws can be screwed in on the opposite side to facilitate left-handed operation.

 **DANGER**

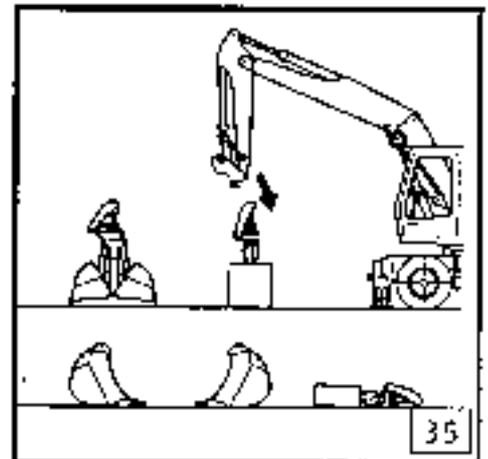
Make sure that no third person can move the working attachment during this procedure!

Position stick and tool as in figure 35.

 **CAUTION**

The tool must rest freely on the ground.

Deflect right joystick 3 (fig. 34) toward "f" and fully retract the bucket cylinder.

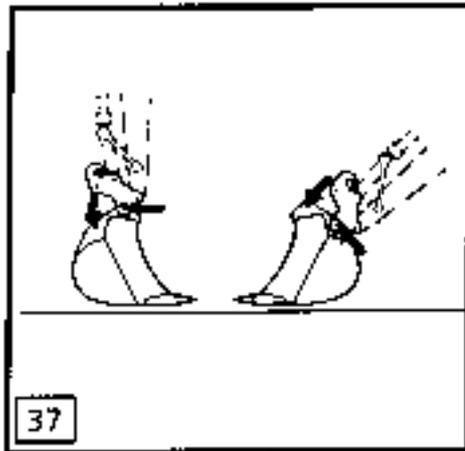


ATTACHING TOOLS

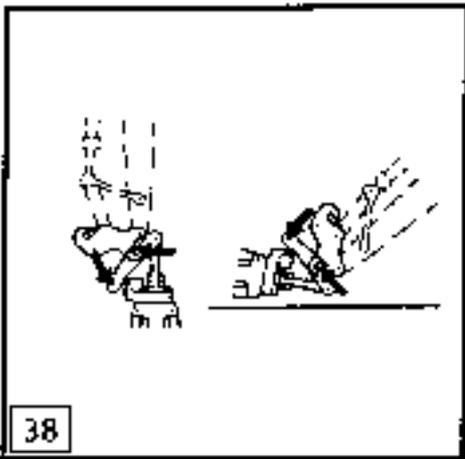
Position the quick change coupler in such a way that the tool can be mounted on the attachment hook (fig. 37 and 38)

Backhoe buckets can alternatively be used as front buckets after changing the attachment pins.

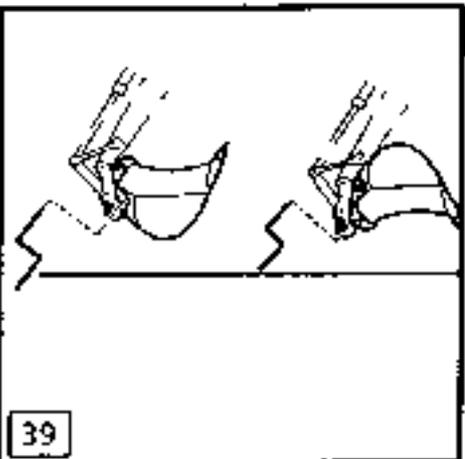
Raise the tool from the ground and extend the bucket cylinder until the bearing plates of the tool are resting at the stops of the mechanical quick change coupler. The attachment bore holes of the tool must be flush with the locking pins (fig. 39 and 40).



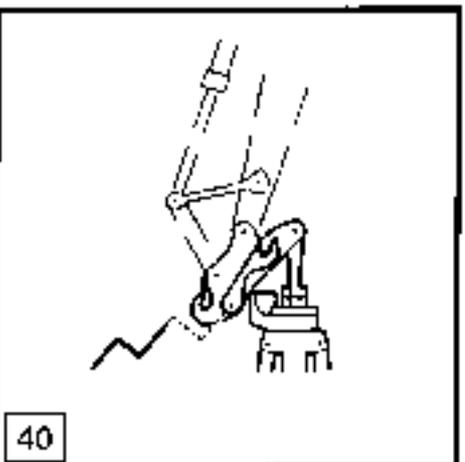
37



38



39



40



CAUTION

Keep tools near the ground.

LOCKING THE COUPLER

Insert the crank (h) in the locking pin (b) (fig. 33) and turn it to the right (clockwise) until both locking pins (b) are extended to the stop (fig. 39 and 40).



DANGER

Make sure that no third person can move the working attachment during this procedure!

Then screw in the stop screw (i) into the locking pin (b)



DANGER

Make sure that the locking pins are always closed on one side by the plug screw and on the other side by the stop screw!

Check for a secure fitting of the stop screw daily.

Notice: Before starting operation with tools, also observe all instructions for attaching and dismantling attachments.

DISMANTLING TOOLS

 **CAUTION**

Always keep the tool at a minimum distance from the ground during any unlocking procedure to avoid dangerous movements.

Extend bucket cylinder fully to the stop (fig. 41 and 42).

Approach the SWM from the side (fig. 33) unscrew the stop screw (i) with the crank (h) from the locking pin (b).

Insert the crank (h) into the locking pin (b) and by turning it to the left (counterclockwise), turn the pin to the stop.

 **DANGER**

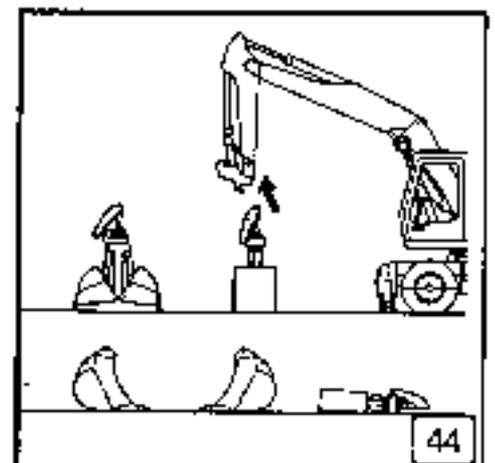
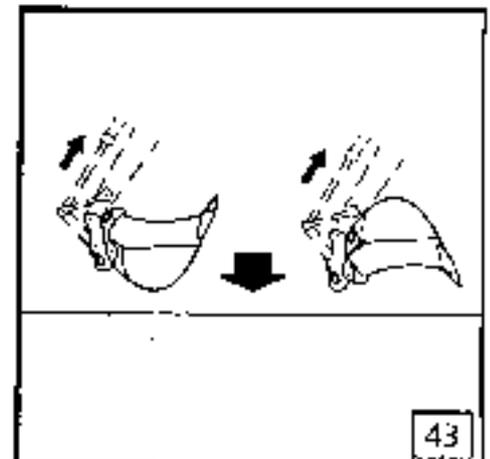
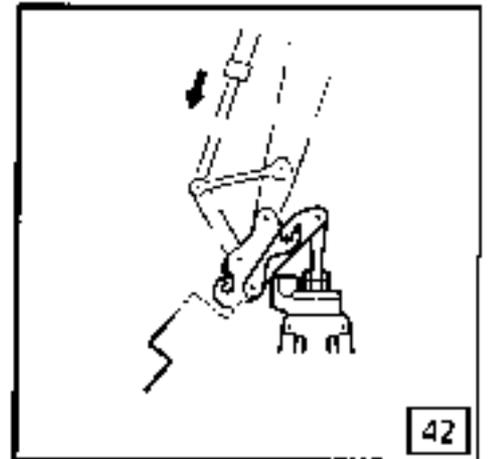
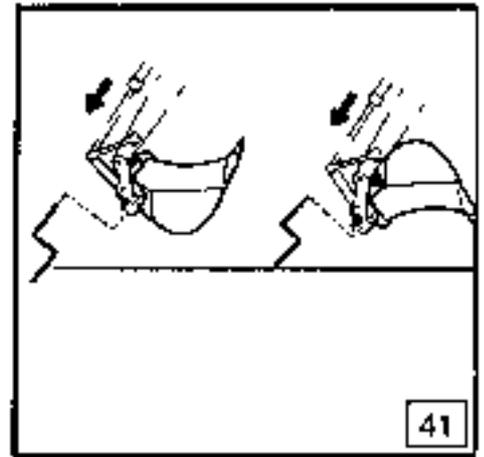
There is no rigid connection between the coupler and the tool present.

The tool can release itself.

To avoid dangerous movements, keep the tool at a minimum distance from the ground.

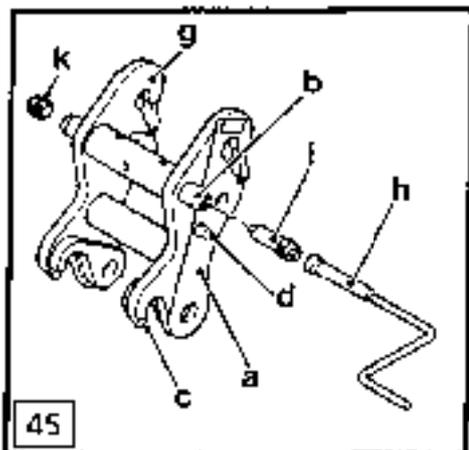
Slowly retract bucket cylinder and lay the tool freely on the ground (fig. 43 and 44).

A new tool can now be attached.



LIFTING TACKLE INSERT

The standard mechanical quick change coupler (SWM) comes equipped with two integrated load hooks (fig. 45, pos. g). The hydraulic excavator may only be operated with lifting tackle when the additional safety devices described in chapter 4 "Lifting tackle" are present and operational.



DANGER

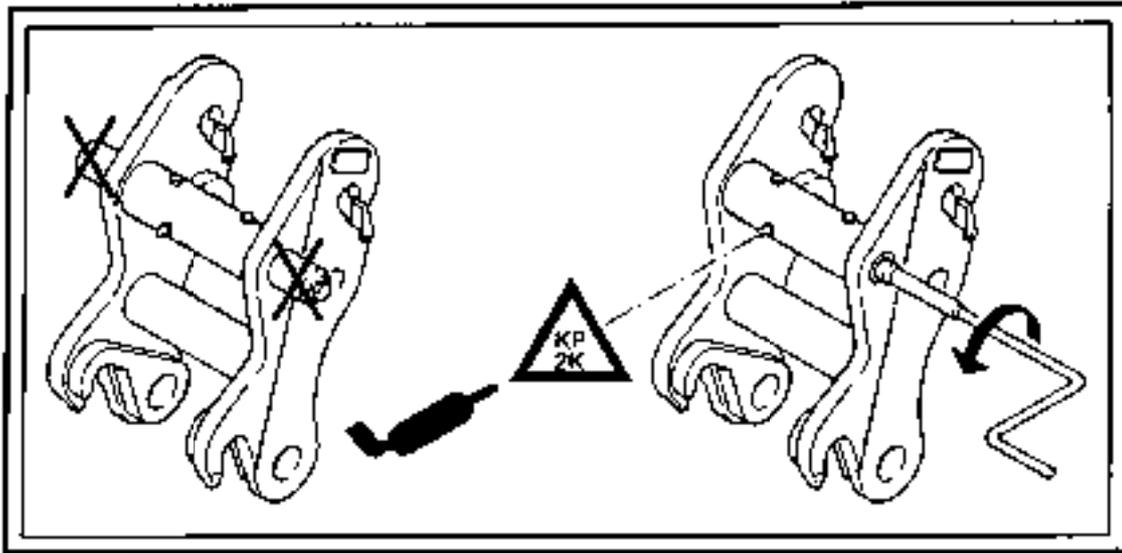
Never use attachment hook pos. c to fix loads because the attachment hooks do not provide any secure hold for load attachment items such as cables or chains.

The maximum load capacity of each individual load hook can be found on the SWM. The load capacity of the SWM and/or the integrated load hook can be less than or greater than the load capacity of the basic machine. During operation, make sure that the values found on the load carrying chart and in the Technical Data of the basic machine are maintained when checking the authorized load capacity of the SWM and/or the integrated load hook.

Any load lifting work can only be performed when the tool is attached or dismantled. When the tool is dismantled, it is recommended to fully retract the locking pins on the lifting tackle insert. This prevents the load attachment items (cables, chains) from being routed over the locking pins and thus protects them from being damaged.

MAINTENANCE RECOMMENDATIONS

The bearing lube points of the mechanical quick change coupler must be lubricated at least once a week.



NOTICE

Make absolutely sure that the locking pins are retracted when lubricating.

If the locking pins are extended, the hollow space between the locking pins fills up with grease so that these pins can no longer be moved.

For grease specifications, see grease and service items charts.

BYPASS OIL FILTER FOR HYDRAULIC CIRCUIT

Your Liebherr hydraulic excavator can be equipped with additional oil filters mounted in the bypass of the hydraulic circuit between control valve block - return and the suction line of the working pumps. During operation a small amount of oil always flows via these filters in the bypass to the main return filter.

Predominantly, these filters are designed to drain water by absorbing the water contained in the oil. This guarantees the oil all positive qualities and/or characteristics between oil changes. See next page "appendix 1" as well.

Mounting bypass oil filters .. especially recommended when using environmentally safe oils ("bio oils") because these kinds of oil feature a greater capacity to absorb water.

Note: Using these kinds of filters does not relieve the operator of the responsibility of regularly draining the water condensation from the hydraulic tank, see page 5.17

FILTER LOCATION

Depending on the size of the machine model, filters with one or two filter elements are mounted

- in machine models R 904 to R 944:
a filter is mounted next to the hydraulic pump (fig. 1)
- in machine models R954 to R 974:
there are two filters in line either
 - on the back of the control spool board (R 954);
 - on the front of the hydraulic tank (R 964, R 974, fig. 2)

CHANGING FILTER ELEMENTS

The filter elements must be replaced every time return filter elements are changed (see 6.10 and Maintenance Schedule), but at least every six months.

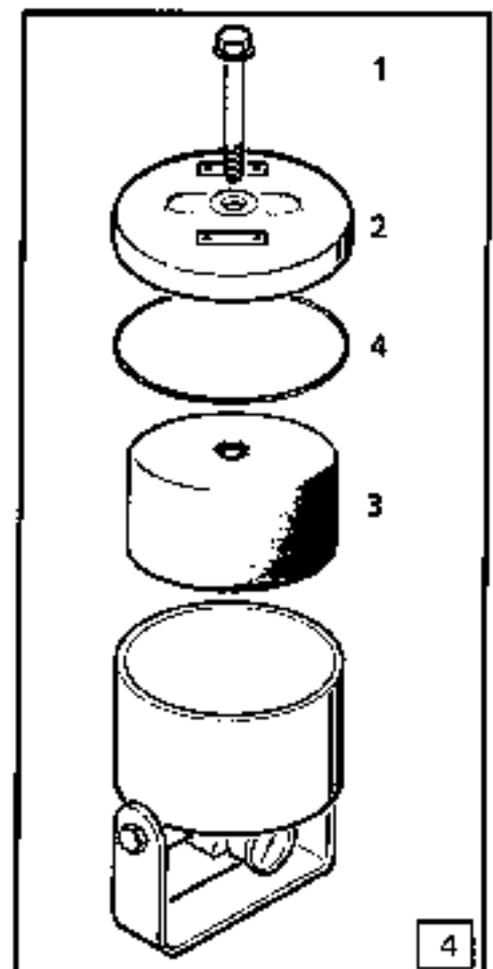
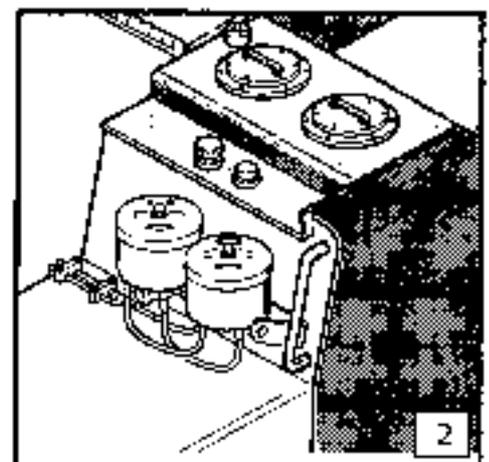
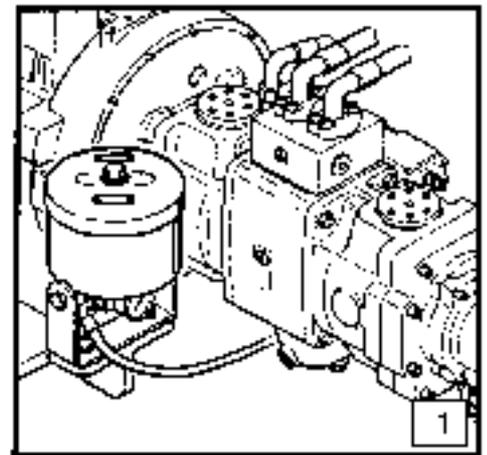


Never disconnect lines or hoses before the attachment is lowered to the ground, the engine is turned off, both joysticks are moved, with ignition key in contact position, and the hydraulic pressure in the tank is relieved by turning the breather filter.

Loosen screw 1, remove cover 2 and pull out the old filter element 3.

Insert a new filter element into filter, clean cover 2 and put in a new O-ring 4.

Put on filter cover 2 and retighten screw 1.



Appendix 1 - THE KLEENOIL FILTER - CARTRIDGE

Description

The Kleenoil Filter Cartridge is made of densely wound long fibre cellulose. It is covered with a material casing and comes in specified sizes for use in the appropriate filter housings.

The variety of applications to which the cartridge is applicable is explained in greater detail in the appropriate data sheets.

Action of Cartridge

The filter cartridge acts both by absorption and adsorption in a continuous recycling process. The long cellulose fibres attract the water formed either through the combustion process or by condensation and absorb it like a sponge, at the same time rejecting the larger oil molecules which are forced to pass between the tight windings of the cartridge. As the oil passes through the cartridge minute particles of carbon, wear metals, and silicon are extracted from the oil by adhering to the many surfaces of the filter - a process known as adsorption. Thus, the cartridge by removing water inhibits the production of acids which both degrade the oil and cause excessive wear. The simultaneous removal of minute contaminants as they occur enables the oil life to be extended whilst remaining within its original operating specification, as laid down by its manufacturer.

Important note

While the filter is extracting the water and contaminants it is continuously safeguarding the desirable elements compounded within the actual oil in use. These typically include, dependent on use, dispersants, detergents, oxidation and rust inhibitors, metal de-activators, pour-point depressants, VI improvers, lubricity agents, fungicidal, anti-foaming and gelling additives. These additives are held in suspension and their levels can be critical if the oil is to maintain its beneficial effect. The Kleenoil filter will not remove these additives.

Specification



Identification :	SDFC 1888, Super Duty Filter Cartridge for use with SDU 9788 Super Duty Unit
Application :	1. As an engine oil filter for sumps up to 80 ltrs. 2. As a hydraulic oil filter 3. As a Diesel oil filter
Water retention level :	0,26 gall. / 1,2 ltr. (to less than 0,05%)
Weights and dimensions	Height : 110 mm Diameter : 195 mm Weight : 900 g. \pm 5%

Oil flowrate : Output levels are dependent on viscosity, temperature, degree of contamination, and oil pressure. Pressure difference - begin : Δp - 3 bar.

Filtration level : Particulate contaminants in accordance with BS 5540 part 4 : 1981 and ISO/DIS 4406. ISO 14/9 equivalent to NAS 1638 class 6 (hydraulic oil specification).

USE OF ENVIRONMENTALLY FRIENDLY HYDRAULIC FLUIDS IN LIEBHERR EARTHMOVING MACHINES

General

If specific applications require that even in the case of accidents or leakage there may be no damage caused to the environment, hydraulic excavators using environmentally friendly hydraulic fluids can be operated.

These lubricants are free of mineral oils, they are water-soluble in every proportion and meet the requirements for biodegradability.

Never mix them together or with lubricants based on mineral oils.

The following recommendations state how to proceed when using these biodegradable hydraulic fluids in LIEBHERR earthmoving machines.

Prescriptions for biodegradable hydraulic fluids

When using environmentally friendly hydraulic fluids, we exclusively recommend synthetic ester oils with a viscosity according to ISO VG46.

Note :

Due to their limited high temperature stability, vegetable oils cannot be used.

Polyglycols decompose various machine paints and should only be used in special cases. In this instance, the material compatibility in regard to seals, paints, etc., has to be observed.

Due to the lack of experience with the various products, a "Warranty Declaration" has to be inquired from the Oil Supplier if LIEBHERR earthmoving machines are to be operated with environmentally friendly hydraulic fluids based on synthetic ester upon "customer's demand". The declaration applies for hydraulic components in the case of damage caused by the hydraulic fluid. This 'warranty declaration' together with the completely filled out confirmation has to be sent to LIEBHERR.

Fundamentally, the supplier is responsible to maintain the standard of quality, standards and specifications of his product when environmentally friendly products are being used.

In order to avoid misunderstandings, a distinct reference must be made on the hydraulic tank, stating the fluid which the machine is operating with.

Attention :

Mixing various "environmentally friendly hydraulic fluids" together is prohibited.

The name "synthetic ester" for example does not mean, that all products carrying this name have the same contents. The lack of experience with biodegradable products does not allow a general statement.

Oil change intervals

The oil changes in preset intervals are not allowed for environmentally friendly hydraulic fluids.

The time for oil change must be determined by oil sample analysis and according to the laboratory reports. See page 5.8.

To take the oil samples, LIEBHERR offers its customers a complete Analysis-Set for Wear Check Lubrication-Analysis (Id. No. 7018368), which consists of 6 coded sample containers, 6 sample cover letters, 6 envelopes as well as a 3 mtr. silicon hose. Oil analysis and laboratory report are already included in the price for the set! Furthermore, only with the first command, a hand pump (Id.No. 8145666) or, as an alternative, an extraction valve (Id.No. 7019068) and a high pressure hose for pressure test-point (Id.No. 7002437), will be necessary only once.

Further oil analysis or oil change intervals have to be carried out according to the sample analysis in the laboratory report from Wear Check. The evaluation result has to be sent to LIEBHERR and the customer.

Oil filters change intervals

The filters change intervals as stated by LIEBHERR must be adhered to.

Use only Original LIEBHERR Filters. We recommend the use of special "bio oil filters" to reduce the percentage of zinc in the system (see also chart of return filters).

Water Condensation

Water Condensation must be drained from the hydraulic tank in regular intervals (drain plug on the tank). It is recommended to do this after the machine was stopped for a longer period of time, for exp Monday morning.

The percentage of condense water is not allowed to exceed 0,1 wgt.‰.

Changing to environmentally friendly hydraulic fluid

If machines which used to operate with mineral oils or other hydraulic fluids are modified to operate with environmentally friendly hydraulic fluids, it is imperative to observe all LIEBHERR guidelines for modifications. Flushing the system is absolutely necessary to ensure trouble-free operation.

Never install attachments from other machines without strictly adhering to all guidelines for modifications with regards to the interior coating of components (e.g. the hydraulic tank), and the procedure for flushing with flusher oil (to drain the mineral oil, ...)

The percentage of mineral oil, resulting from changing or mixing with other mineral oil based fluids, remaining within the system is not allowed to exceed 2 wgt %.

If the changing guidelines stated by LIEBHERR are not adhered to, warranty will be refused in case of damage. In case of a doubt, first obtain these guidelines from your LIEBHERR representative.

Having changed to environmentally friendly hydraulic fluid or when initially filling the system a reference fresh oil sample must be taken after initial warm-up and sent to the laboratory for analysis. The sample must be taken while the machine is running using pressure test-point valve (Id.No 70 19068) or right after stopping the engine via the breather valve using the vacuum pump

Particular precautions

- When disposing of these fluids make sure that this medium is not treated as a mineral oil, i.e. there are special regulations for the disposal of these fluids in individual countries.

In case you have any questions please contact your representative waste oil recycler.

- When handling the medium simply use gloves and, in case there is a risk of spraying, use safety goggles as well.

Wash your hands before taking a break and at the end of your shift. In case the fluids come into contact with skin, rinse with lots of water; in case of eye contact, rinse with water for 10 to 15 minutes.

- After any fluid is spilled or runs out, wash away any smaller amounts with lots of water; larger amounts must be properly collected and disposed of.
- In case of fire, the usual fire extinguishers may be used (like water vapor, CO₂, foam, dry ice extinguishers, ...).

Never aim a stream of water directly at hot, burning material (risk of splattering)

Thermal decomposition generates CO and/or CO₂

REFUELING PUMP

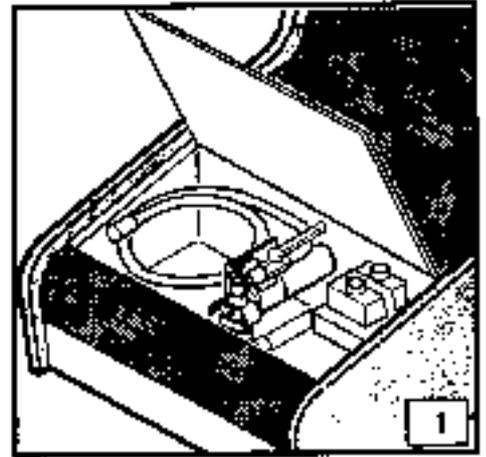


DANGER

Never smoke or allow an open flame in refueling areas.

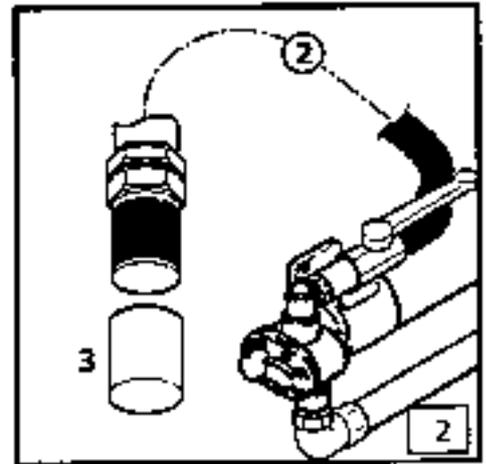
The fuel tank can be refilled thanks to an optionally mounted refueling pump driven by an electric motor fed by the batteries.

The equipment, located in the compartment in front of the fuel tank (fig. 1), consists of the pump (whose outlet is connected directly to the tank), a stop valve at the inlet of the pump, an electrical unit, a control box and a flexible suction hose.



Refueling proceeds as follows :

- Take the hose 2 out of the compartment, remove protective covering 3 (fig. 2) of the suction strainer at the end of the hose and insert the hose into a fully drum of fuel.
- Open stop valve 4 (move the lever to position A). (fig. 3).
- The pump can now be started, by pushing the green control button on the electric box E13.
When the fuel reaches the maximal allowed level in the tank, the pump will automatically stop.
The pump can be stopped any time by pushing the red button.



After use, wind up the cable and position the box properly and secure using the tightener provided.

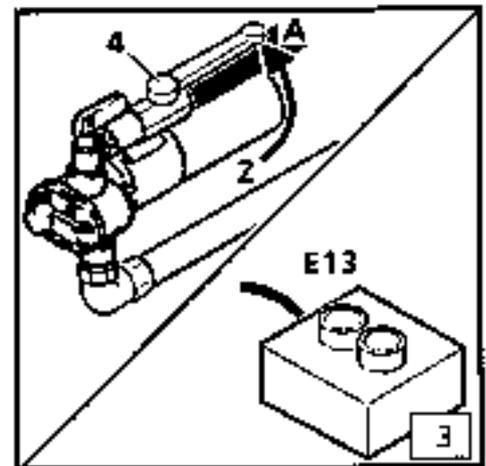


CAUTION

Only use the pump to deliver fuel.

Never let the pump run unloaded (sucking air) even for a short moment. Stop it immediately when the level in the barrel gets too low or during the lapse of time which is necessary to put the suction hose into a new barrel.

Otherwise the pump would be destroyed rapidly.



After refueling, reclose stop valve 4 (position Z), then get hose 2 slowly out of the drum being used, to drain the remaining fuel in the hose into it.

Replace protective covering 3 on the strainer, coil the hose and route it in the space provided. Reclose the compartment.

If at customer's wish the tank has to be refilled with a fast refueling system (for an example from Wiggins) the tank can also be fitted with the adequate receiver.

FIRE SUPPRESSION SYSTEM

The maintenance of the fire suppression system must only be done by the system supplier or the system dealer.

The maintenance intervals must be strictly observed.