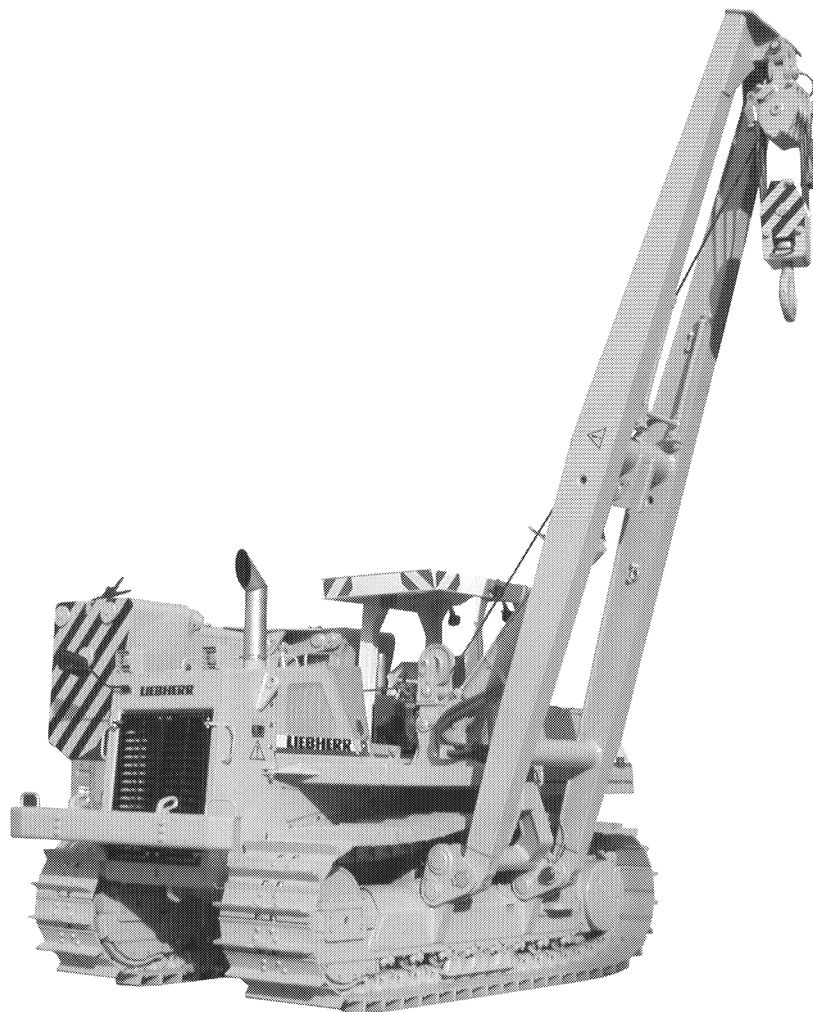

Operating manual

RL 52 Litronic®



FOREWORD

This manual has been written primarily for the operator of this **LIEBHERR** machine and for its maintenance personnel.

This manual contains:

- Safety information
- Operating instructions and guidelines
- Maintenance guidelines
- Instructions and guidelines for special attachments / optional equipment.

This manual should be given to the operator and maintenance personnel who should read it carefully at regular intervals and before operating or servicing the machine, before performing any of the following tasks:

- **Operation**, including set up, troubleshooting during operation, removal of production debris, service, removal of oils, lubricants, fuels and operating fluids,
- **Maintenance**, including inspection, upkeep and/ or
- **Transportation**.

Reading this manual will familiarize the operator with his **LIEBHERR** machine and prevent problems due to improper operation.

Following the operation and maintenance guidelines by maintenance personnel will:

- increase reliable service,
- increase service life expectancy of your **LIEBHERR** machine and
- reduce repair costs and downtime.

The Operation and Maintenance Manual is part of the machine. Keep a copy of this manual in the glove compartment in the operators cab to assure that it can be consulted and referred to at any time.

Any existing federal, state and local safety requirements and regulations governing accident prevention and environmental safety must be added to this Operation and Maintenance Manual.

In addition to the guidelines given in this Operation and Maintenance Manual, all safety and accident prevention regulations applicable to the country and job site you operate in, including any technical rules and regulations to assure safe and proper operation must be followed.

This Operation and Maintenance Manual includes the necessary information to operate and maintain your machine. If you need any additional information and / or clarification, please contact Liebherr's Technical Documentation, Customer Service School or Service Department.

We hope you will understand that **LIEBHERR** cannot honor warranty claims resulting from improper operation, inadequate maintenance, use of wrong, unauthorized oils, lubricants, fuels and operating fluids and /or from disregard of safety information and guidelines.

LIEBHERR reserves the right to reject any warranty claims, service contracts or agreements established by **LIEBHERR** or any of its dealers without prior notice, if any other than Original **LIEBHERR** part or parts sold by **LIEBHERR** are being or have been used for maintenance and repairs.

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OPERATION AND MAINTENANCE MANUAL

Issue 07 / 03
Id. No.: 9084519
VALID FOR: RL 52 from S/N 739 / 2001



We recommend that you fill in the following information in the space provided as soon as you receive your machine.

This information will also be helpful when ordering spare parts.

Serial / PIN number of machine:

Year / Model: **CE**

Delivery date:

* This information is found on the data tag of your machine, on the left front of the main frame.

Manufacturer:

LIEBHERR Werk Telfs GMBH
 Hans Liebherr - Straße 35,
 A - 6410 / TELFS, Austria

Noise level:

- Acoustic sound level LwA according to 2000/14/EG
 RL52 = 116 db(A)
- Sound pressure level LpA according to ISO 6396
 RL 52 = 82 db(A)

The following certificates have been issued for this machine:

- CE

Under extreme working conditions, the maintenance intervals may have to be reduced as compared to intervals listed on the inspection schedule.

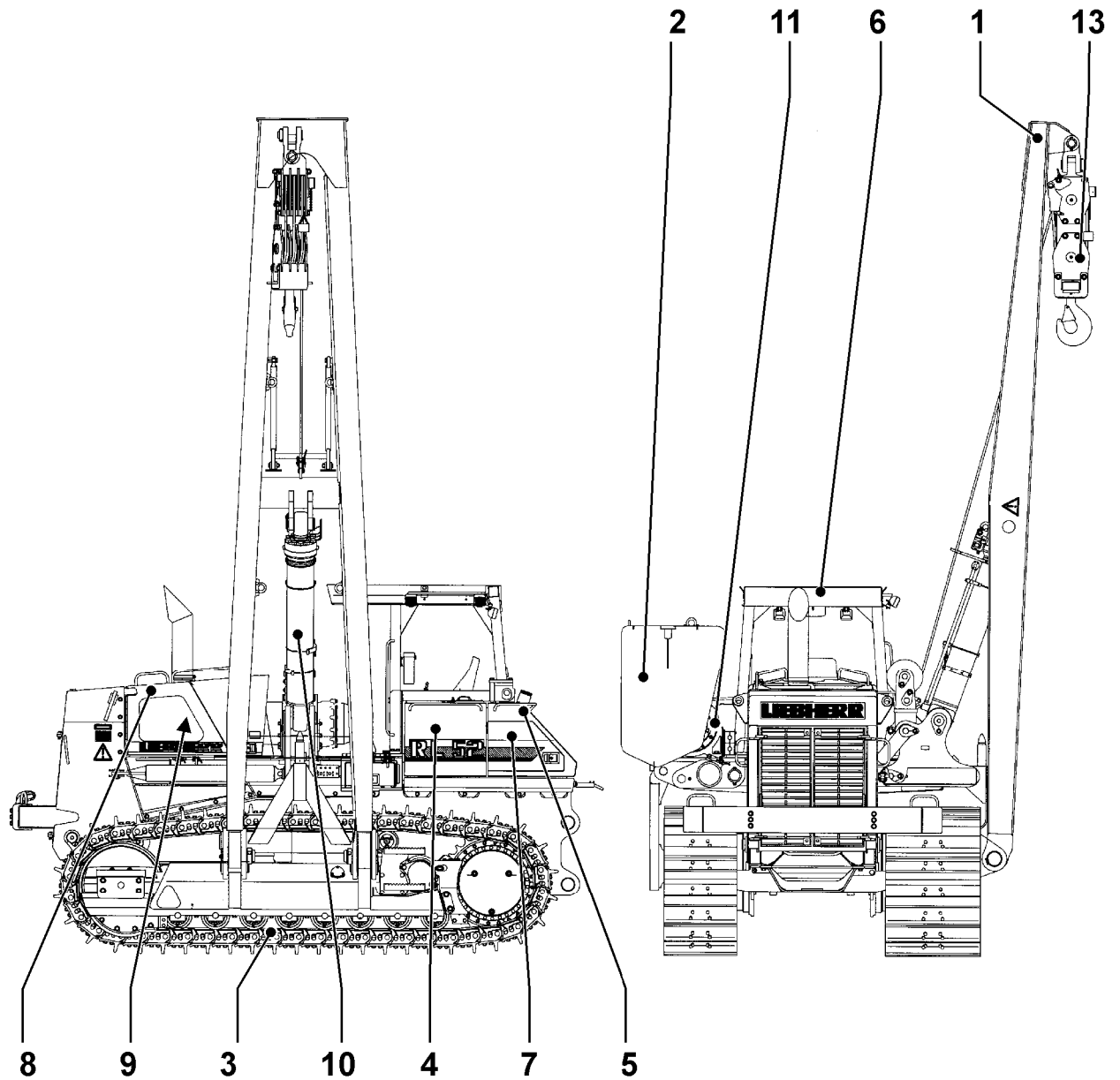
Some drawings and photographs in this manual may show details which are different from your machine. Improvements in design may cause changes in your machine not reflected in this manual. We reserve the right to make technical changes. Manuals are reviewed and reprinted periodically to include such design changes.

The following guidelines will not expand LIEBHERR's general business conditions regarding warranties and liability.

This manual is intended for internal use of the machine owner. No part of this publication, technical or otherwise, may be reproduced or copied in any form or by any means, without our written permission. All rights reserved.

1. TECHNICAL DATA

1.1 COMPONENT OVERVIEW



- | | | | |
|---|--|----|--------------------------------------|
| 1 | Boom | 7 | Battery compartment |
| 2 | Counterweight | 8 | Cover |
| 3 | Travel gear | 9 | Diesel engine with pump installation |
| 4 | Hydraulic tank | 10 | Hoist cylinder boom |
| 5 | Fuel tank | 11 | Cable winch |
| 6 | Canopy / Roll over protective structure (ROPS) | 13 | Hook block |

Technical Description

Pipe Layer

RL 52
Litronic®

Engine output 243 kW/330 HP
Max. lift capacity 80 tons/176,400 lb
Operating weight 52.3 tons/115,322 lb



LIEBHERR

The Better Machine.

The decisive economical factors of the RL 52 Litronic:

1. The construction machine engine:

The heart of the RL 52 pipe layer is the Liebherr diesel engine, with reduced emissions, specially designed for construction site applications.

In addition to a high level of reliability, the engine also offers exemplary performance and it does so while achieving a low level of fuel consumption previously unattained.

The pipe layer's cooling system is specially adapted to high ambient temperatures. The cooler's extremely large distance between ribs provides for high reliability and longer periods between service intervals.

2. The hydrostatic travel drive:

The outstanding characteristic of the pipe layer is its modern drive concept. In contrast to conventional systems, this drive offers decisive advantages in pipeline construction, like e.g.

- Stepless speed regulation
- Single lever operation
- Constant drawbar force on both tracks preventing the machine from sinking on soft ground
- Exact positioning of the pipe due to the ability to turn on the spot
- Maximum drawbar force is available to the operator as soon as the machine starts travel
- Low operating costs due to wear-free brakes and a low number of drive components.

3. The innovative undercarriage:

The asymmetrical undercarriage makes it possible to work specially on the load side while ground pressure is reduced considerably. At the same time, the machine's off-centered center of gravity, provides the pipe layer unimagined lift force.

4. The simple and comfortable operation:

Operating elements, proven in on site experience, make the Liebherr pipe layer remarkable.

All travel functions, all boom functions as well as the load hook are controlled by one joystick respectively. Optimal for safe and easy handling of the machine.

5. The economical working attachments:

Above all, the pipe layer's working attachments are convincing due to their functionality with:

- the hydraulically driven winch
- the hydraulically adjustable boom
- the standard working hydraulics can be used to drive a pipe facing machine or a welding generator.



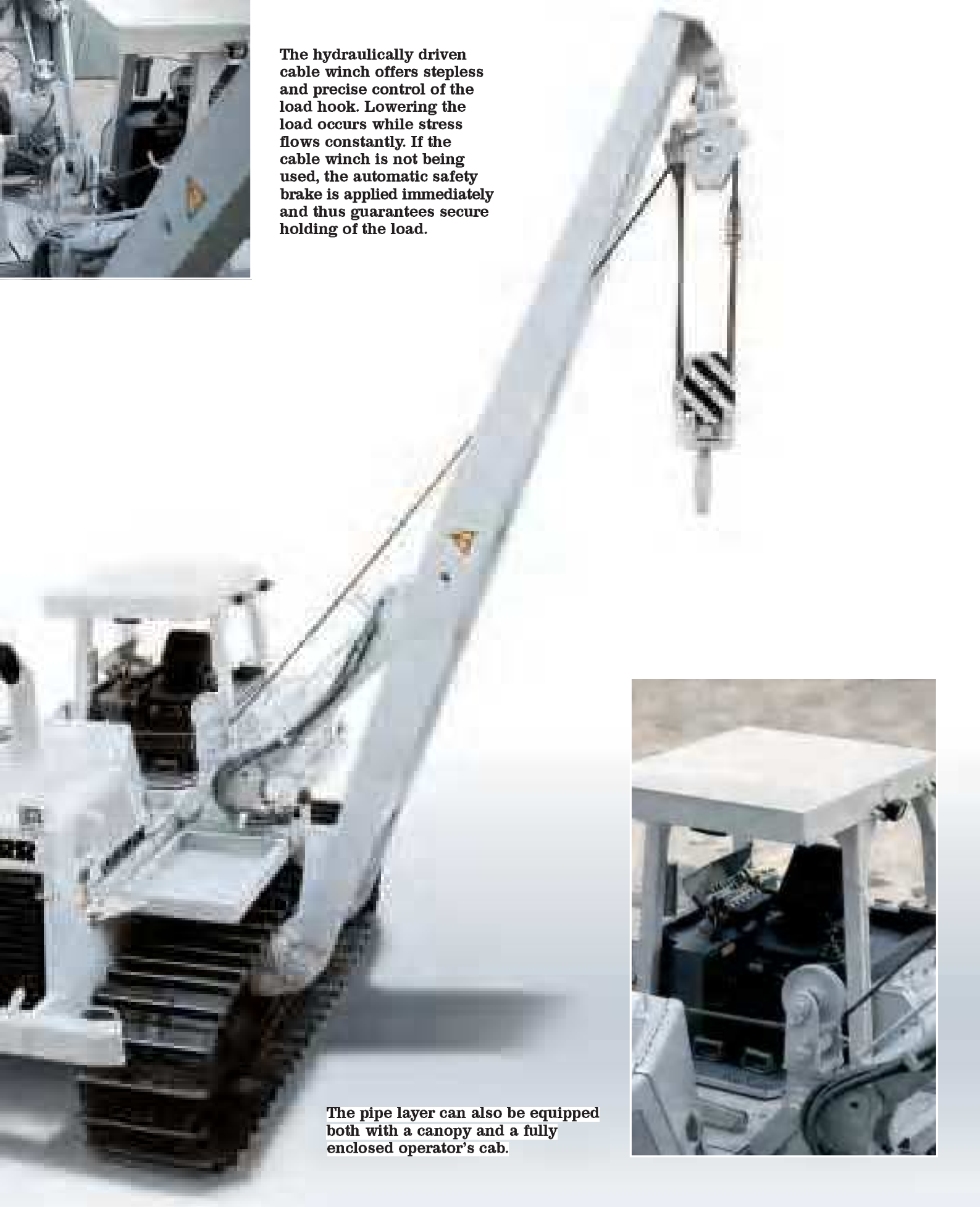
The boom can be adjusted precisely and without sudden jerks with a hydraulic cylinder.



The RL 52 Pipe Layer: Versatile, precise



The hydraulically driven cable winch offers stepless and precise control of the load hook. Lowering the load occurs while stress flows constantly. If the cable winch is not being used, the automatic safety brake is applied immediately and thus guarantees secure holding of the load.



The pipe layer can also be equipped both with a canopy and a fully enclosed operator's cab.



and economical.



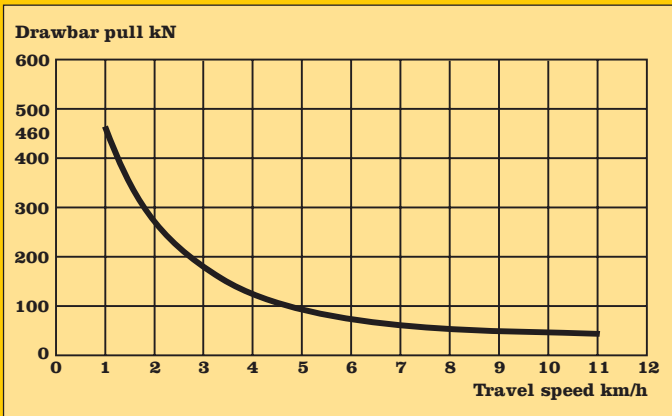
Diesel Engine

Liebherr-Diesel Engine	D 9406 TI-E
Rating per ISO 9249	243 kW (330 HP) at 1800 RPM
Displacement	13 l / 794 cu.in.
Bore/stroke	135/150 mm / 5.31"/5.91"
Design	6 cylinder V-engine, water-cooled, turbocharged, intercooled
Injection	direct fuel injection with in-line injection pump, mechanical governor
Fuel filter	pre-cleaner with water separator and fine filters
Lubrication	pressurized lube system with full flow filter and integrated oil cooler, deep oil pan for inclinations, engine lubrication to an inclination of up to 45° to each side
Operating voltage	24 V
Alternator	80 Amp.
Starter	9 kW (12 HP)
Central fuse box	40 A
Batterie	170 Ah



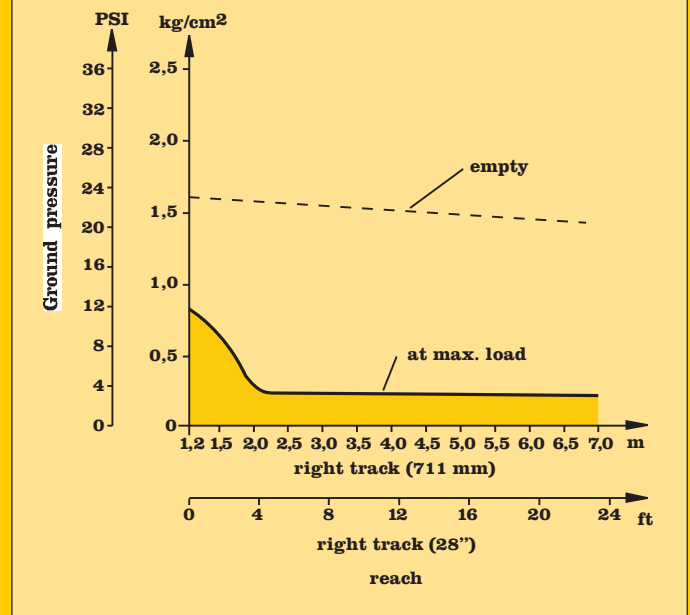
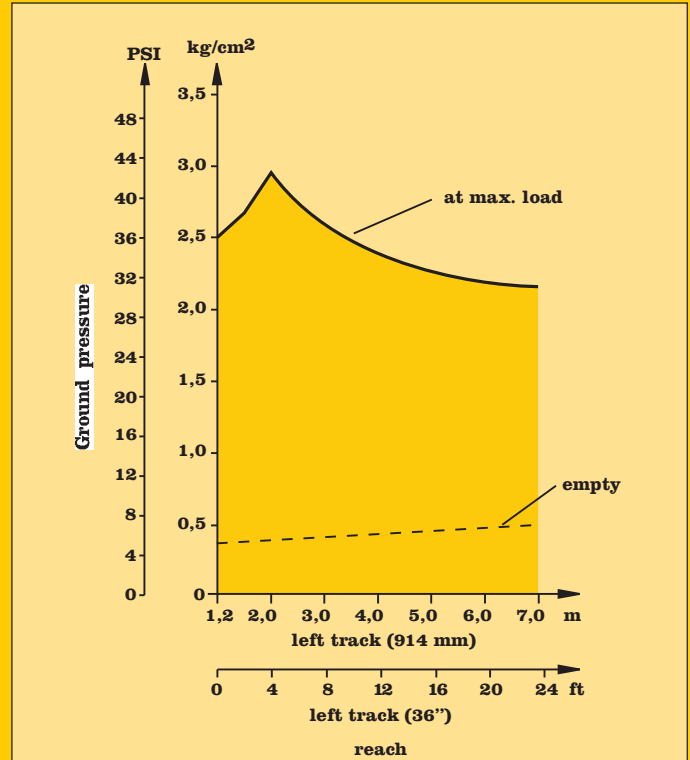
Travel Drive

Design	closed-loop hydrostatic drive, each track is driven by one variable flow swash plate-type pump and one variable displacement motor
Pump flow	max. 425 l/min / 112.2 gal/min
Max. pressure	adjusted to 420 bar / 6090 PSI
Travel speed	0-11 km/h / 0-6.8 mph infinitely variable, forward and reverse
Steering	hydrostatic
Service brake	hydrostatic
Parking/emergency brake	automatic multi disc brake in final drives
Cooling system	hydraulic oil cooler with separate cooling circuit with gear pump and front mounted cooler
Filter system	cartridge fine filters in the cooling circuit
Final drive	2-stage planetary reduction gear



Track Frame

Design	maintenance-free tractor-type track frames
Mount	elastic components at a separate pivot shaft
Chains	lubricated, track chain tension via grease tensioner, single grouser pads
Chain links	48
Sprockets	3 replaceable segments
Track rollers	8
Carrier rollers	2
Ground contact area	5,86 m ² / 3.083 sq.in.
Ground pressure	0.89 kg/cm ² / 12.66 PSI



Technical Data



Travel Control

1 Joystick lever	with electronic control for all travel functions: travel direction, speed, steering and counter-rotation
Speed range 1	0 - 4 km/h / 0 - 2.5 mph
Speed range 2	0 - 6.5 km/h / 0 - 4 mph
Speed range 3	0 - 11 km/h / 0 - 6.8 mph
Electronic engine speed sensing control	electronic regulation assures a constant balance between travel speed and necessary drawbar pull through engine speed sensing avoiding engine overload, even in partial load range
Straight line travel	electronically controlled
Parking/emergency brake	automatically applied after the joystick lever is put in neutral position
Safety lever	inactivates complete travel and working hydraulic circuit and automatically activates parking brake
Emergency shut off	push button on instrument panel immediately activates parking and emergency brake
Inch-/Brake pedal	for reduction of travel speed to 0 km/h with integrated braking function



Implement Hydraulic

Hydraulic system	on demand (load sensing) control, swash plate type variable displacement pump and pressure cut-off for hoist winch and adj. boom and counterweight cylinder drive
Max. pump flow	max. 292 l/min / 77.1 gal/min
Pressure limitation	adjusted to 280 bar / 4060 PSI
Control valve	3 spool segments
Filter system	return filter with magnetic rod in hydraulic tank
Control	single servo-assisted joystick lever for hoist winch, counter weight and adjustable boom cylinder, safety lever prevents inadvertent movement, free fall device makes it possible to lower the load in case of danger, single joystick lever for counterweight

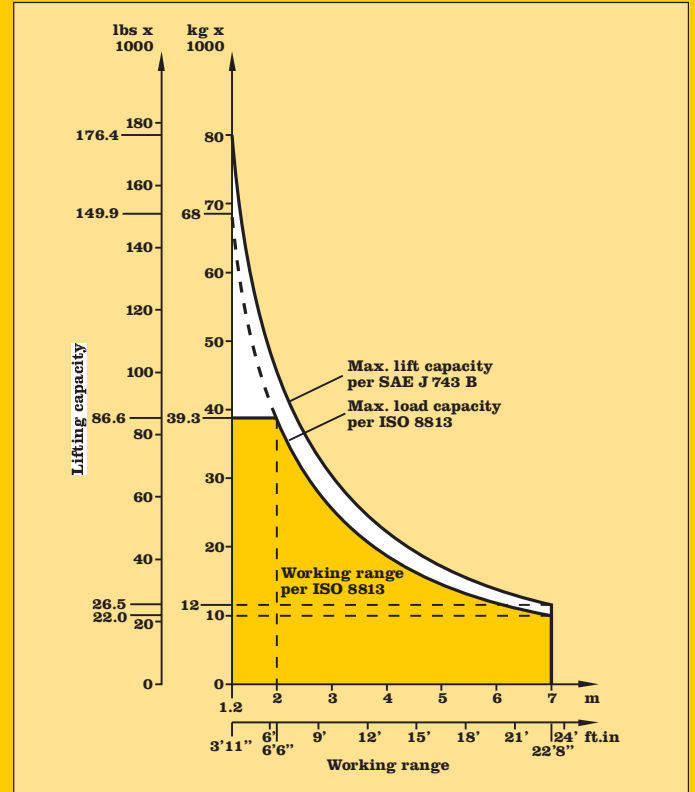


Working Attachment

Hoist winch	driven by variable flow hydraulic pump, control valve block and variable oil motor in open circuit. Brake valve helps to sensitively lower the load over total speed range, when the control lever is in neutral, a spring-loaded disk brake holds the load safely in any position
Drum diameter	305 mm / 12.01"
Drum length	254 mm / 10"
Flange diameter	566 mm / 1'10"
Cable diameter	20 mm / 0.79"
Cable length	65 m / 263'
Hook block	6 sheaves
Hook speed in	
1. cable position	up 0 - 16,6 m/min. / 0 - 55 ft/min stepless down 0 - 16,6 m/min. / 0 - 55 ft/min stepless
Safety device	free fall control
Adjustable boom control	through hydraulic cylinder, the lifting and lowering speed of the boom and the hook block can be changed steplessly, drives are fully independent and can be actuated at the same time. A check valve keeps the boom leakage free in any position and prevents uncontrolled boom drop in case of loss of pressure

Adjustable boom cylinder

Piston diameter	210 mm / 8.27"
Rod diameter	110 mm / 4.33"
Stroke	1460 mm / 4'9"
Boom Design	box-type welded structure made of highly resilient, grain refined steel
Fixed boom	length 7000 mm welded box sectioned installed on the right hand side of the machine, total weight extractable (12.193 kg / 26,999 lb) removable weight of 9,289 kg / 20,482 lb
Counterweight	



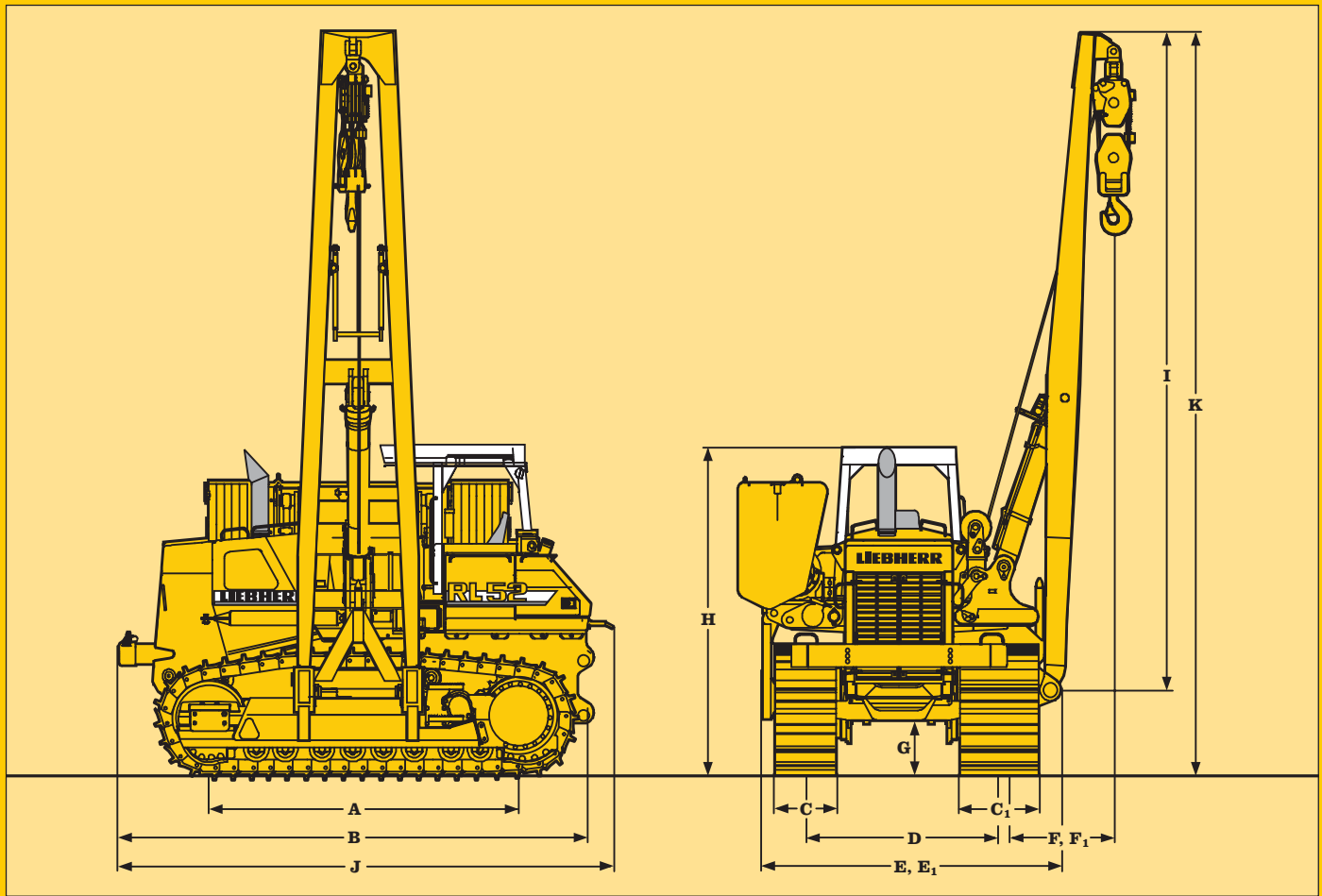
Operator's Platform

Mount	resiliently mounted
Operator's seat	fully adjustable swing seat, adjustable to operator weight
Canopy	resiliently mounted, can be tilted with hand pump to 40° to the rear for accessibility to machine components
Monitor	comprehensive instrument panel on the right hand side of the operator's seat



Refill Capacities

Fuel tank	610 l / 161 gal
Cooling system	68 l / 18 gal
Engine oil	24 l / 6.3 gal
Splitterbox	6 l / 1.6 gal
Hydraulic tank	210 l / 55.4 gal
Final drive, each	21 l / 5.5 gal

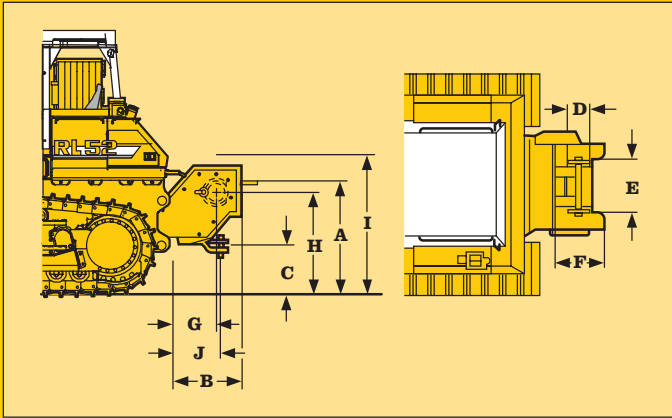


	mm / ft-in
A Track on ground	3605 / 11'10"
B Length to rear end of machine	5544 / 18'2"
C Ground pad width - right hand side	711 / 28"
C1 Ground pad width - left hand side	914 / 36"
D Track gauge	2260 / 7'5"
E Transport width	3755 / 12'4"
E1 Width counterweight extended	5509 / 18'1"

	mm / ft-in
F Boom overhang, min.	1200 / 3'11"
F1 Boom overhang, max.	7002 / 23"
G Ground clearance	625 / 2'1"
H Transport height	3640 / 11'11"
I Boom length	7000 / 23"
J Total length	5776 / 18'11"
K Total height	8070 / 26'6"

Dimensions

Winch

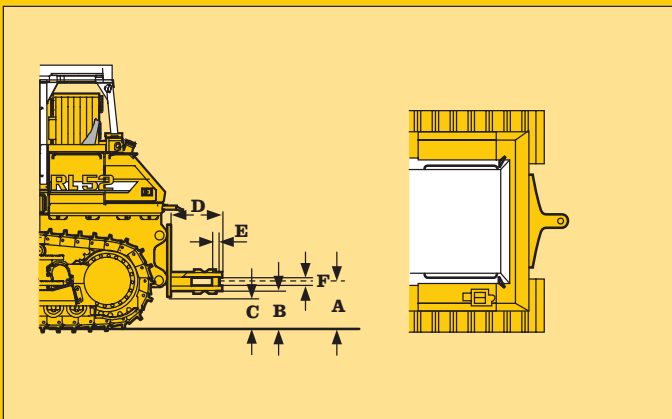


Max. line pull:	530 kN / 119,107 lbs
Max. line speed:	0-20 m/min / 21.87 yd/min
Cable size:	28 mm / 1.1"
Cable length:	60 m / 65.62 yd
Weight:	2588 kg / 5.707 lbs

Dimensions

	mm / ft-in
A Height, cable exit	1525 / 5'0"
B Overall length	1189 / 3'11"
C Height drawbar	801 / 2'8"
D Drum diameter	318 / 1'1"
E Coiling width	737 / 2'5"
F Flange diameter	610 / 2'0"
G Distance to center of drum	678 / 2'3"
H Height of drum center	1352 / 4'5"
I Total height	1801 / 5'11"
J Overall length of drawbar	919 / 3'0"

Swinging drawbar



Weight:	662 kg / 1460 lbs
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Dimensions

	mm / ft-in
A Height of drawbar	615 / 2'0"
B Ground clearance below drawbar	513 / 1'8"
C Ground clearance below drawbar suspension	463 / 1'6"
D Overall length	460 / 1'6"
E Pin diameter	60 / 2.36"
F Size of opening	105 / 4.13"

Attachments

Basic machine

	Standard	Option
Towing hitch rear	●	
Towing lug front	●	
Battery compartment lockable	●	
Filling with oil SAE 10		●
Filling with oil SAE 30		●
Refuelling pump electrical		●
Belly pans heavy duty	●	
Cold start device ether		●
Cold start device glow plug	●	
Radiator coarse mesh	●	
Radiator guard 2-piece, hinged	●	
Liebherr Diesel engine	●	
Fan - hydraulically driven	●	
Fan guard		●
Engine oil cooler	●	
Engine doors perforated		●
Engine doors hinged, lockable	●	
Lugs for crane lifting	●	
Bumper front	●	
Special paint		●
Fuel water separator	●	
Fuel water separator with electric heater		●
Air filter dry-type, dual step	●	
Precleaner with automatic dust ejector	●	
Preheater for engine electric		●
Tool kit in batteries compartment	●	

Travel drive

Parking brake automatic	●	
Function control automatic	●	
Control - single lever	●	
Load limit control electronic	●	
Travel control electronic	●	
Travel control 2-speed		
Travel control 3-speed	●	
Hydrostatic travel drive	●	
Emergency stop	●	
Oil cooler	●	
Final drives planetary gears	●	
Safety lever	●	

Undercarriage

Track shoes extreme service (ESS)	●	
Track frame closed	●	
Sprocket segments bolt-on	●	
Master link 2 piece	●	
Track guide center part		●
Tracks oil lubricated	●	
Undercarriage standard	●	
Pivot shaft separate	●	

Electric system

Starter motor 6,6 kW		
Starter motor 9 kW	●	
Working lights rear 2 units	●	
Working lights front 2 units	●	
Working lights side 2 units	●	
Battery main switch electric	●	
Batteries, heavy duty cold start	●	
On-board system 24 V	●	
Alternator 55 A		
Alternator 80 A	●	
Back-up alarm		●
Horn	●	

Operator's cab

	Standard	Option
Operator's seat 6-way adjustable	●	
Canopy	●	
Cab sound suppressed		●
Protective grid for canopy rear		●

Instruments - Indicators

Battery charging	●	
Hour meter	●	
Electronic control	●	
Speed range	●	
Engine oil pressure	●	
Water temperature	●	
Oil pressure cooling circuit	●	
Oil level final drives	●	
Fuel level	●	
Contamination hydraulic filter	●	
Contamination air filter	●	
Cold start Diesel engine	●	

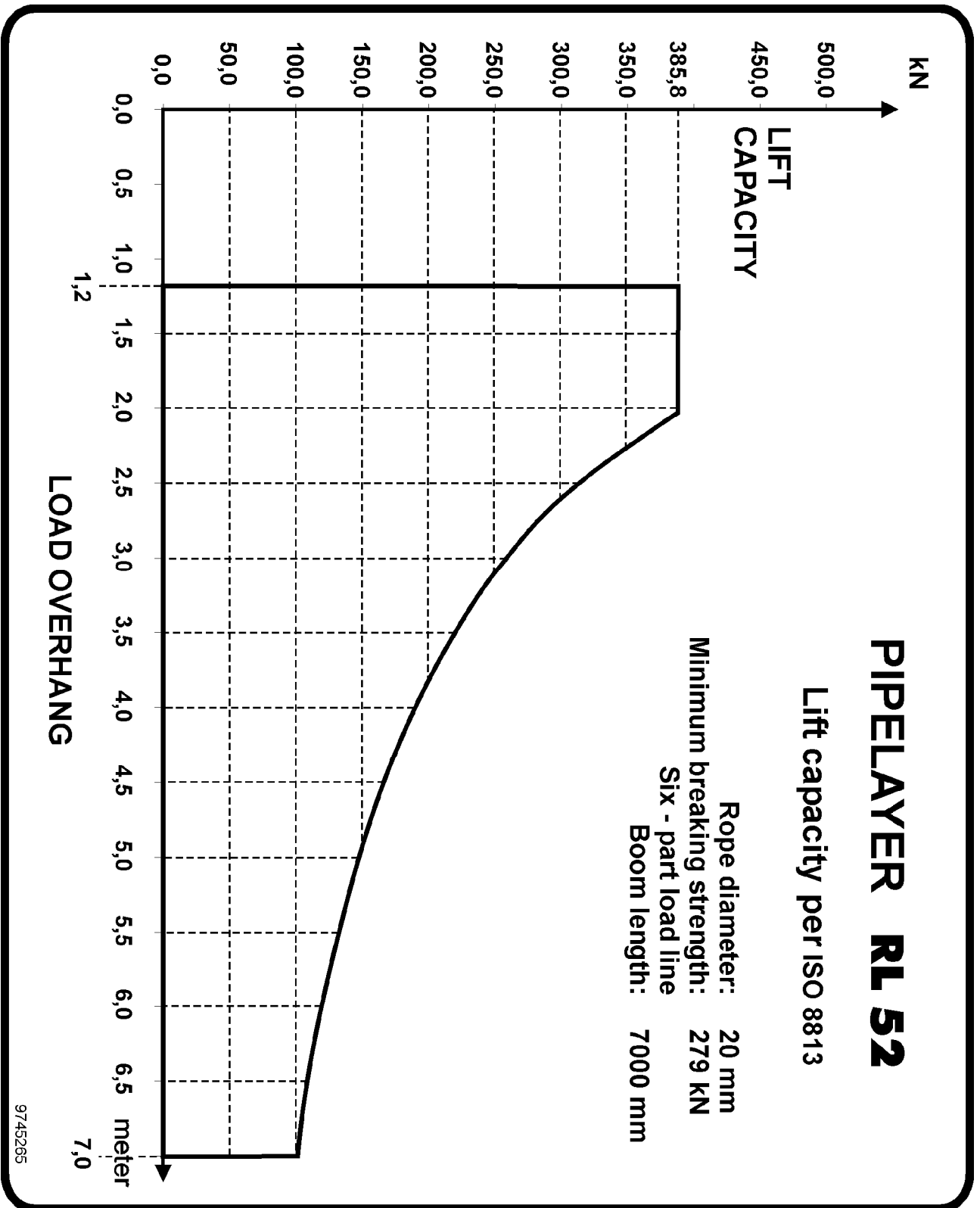
Implement hydraulic

Control group boom	●	
Control group hoist winch	●	
Control group rear winch		●
Control group generator 75 kVA		●
Control group generator + pipe facing		●
Variable flow pump, load sensing	●	
Oil filter with strainer in hydraulic tank	●	
Hydraulic servo control	●	

Attachments

Drawbar rear hinged		●
Drawbar rear rigid		●
Boom 2-piece foldable 4750 mm		
Boom single piece 4750 mm		
Boom single piece 6000 mm		●
Boom single piece 7000 mm		●
Boom single piece 7320 mm		
Boom jib		
Counter weight rear		●
Rear winch		●

1.2 LIFTING POWER DIAGRAM



2. GENERAL SAFETY INFORMATION

Working with earth moving machinery can be dangerous, it could result in injury or death if proper precautions are not taken by you, the operator and/or maintenance personnel. We urge you to read these safety notes repeatedly and carefully, and to observe them to prevent danger and accidents.

This is especially important for any personnel that works on the machine only occasionally, such as during set up and / or maintenance.

Careful adherence to the below listed safety information will insure safe operation and maintenance and potentially prevent personal injury to yourself and others and possible damage to your machine.

Important safety notes are used throughout this manual, such as **DANGER**, **CAUTION** or **NOTE**.

In this Operation and Maintenance Manual, these safety notes are defined as follows:

DANGER

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

CAUTION

Denotes a reminder of safety practices or directs attention to unsafe practices if proper precaution are not taken, which could result in personal injury and / or damage or destruction of the machine.



NOTE

This symbol is used to describe operational or maintenance procedures which should be followed to keep our machine operational and to insure long service life and /or to facilitate certain operating procedures.

In addition to these instructions you must follow the safety regulations applicable to your work environment and job site, any federal, state and local laws governing travel on public roads and highways, and any guidelines issued by trade or professional associations.

2.0.1 PROPER AND DESTINED USE

With the standard pipe layer attachment, the machine may only be used to lift and place pipes and pipe assemblies as well as to lift machinery, which is to be used during construction of a pipe line. For these procedures, suitable and tested attachment elements must be used. In addition, this machine may be used to pull devices and equipment used during normal pipe laying construction tasks.

Any other use above and beyond the destined use is not considered to be destined use. The manufacturer/ dealer will not be responsible for any damage resulting from such or any other unauthorized use and the user alone must carry those risks.

Machines used in special applications are subject to additional special conditions and guidelines and, among other things, must be equipped with special safety devices.

Proper and destined use also includes observance of Operation and Maintenance Manual Guidelines issued in this Operation and Maintenance Manual and careful adherence to inspection and maintenance schedules and guidelines.

2.1 GENERAL SAFETY GUIDELINES

- Study the Operation and Maintenance Manual before operating or working on the machine.
 - Make certain that you have additional information for the special attachments of your machine, read it and make sure you understand it.
- Only trained and authorized personnel may operate, maintain, service or repair this machine.
 - Make sure you are aware of the minimum permissible operator age, as stated by law.
- Utilize only trained or specially instructed personnel, make sure that everybody is aware of the person / persons responsible for the operation, installation of attachments, maintenance and repair of the machine.
- Determine the responsibility of the operator (to include adherence to traffic regulations) and permit him to refuse to carry out unsafe instructions or practices give by a third person.
- Do not allow any personnel, either still to be trained or already in training, to work on the machine unless that person is under the constant supervision of an experienced instructor or operator.
- Periodicaly, check to see if all persons observe all safety guidelines and work cautiously, as noted in the Operation and Maintenance Manual.
- Always wear proper clothing when operating or working on the machine.
 - Avoid wearing rings, watches, bracelets, ties, scarves, open jackets, loose clothing such as an unbuttoned or unzipped jackets, etc. They are dangerous, could get caught in the machinery and could cause serious injury.
 - Wear the proper safety equipment for certain work, such as safety glasses, safety shoes, hard hats, gloves, reflective vests, ear protection. . .
- Consult your employer or supervisor for specific safety equipment requirements and safety regulations applicable to the job site.
- Never use the safety lever, control levers or joysticks as handholds when entering or leaving the machine. This could trigger an inadvertent movement of the machine and cause a serious accident.
- Never jump off the machine! Climb on and off the machine only by using the steps, rails and handles provided. When climbing on or off the machine, use both hands for support and face the machine.
- Keep operators cab, steps, handrails and handles clean of oil, grease, mud, snow and ice. These precautions will minimize the danger of slipping, stumbling or falling.
- If no other instructions were given, proceed as follows for maintenance and repairs.
 - Park the machine on firm and level ground and lower the attachment to the ground.
 - Bring all operating and control levers into neutral position.

- Turn the engine off and leave the ignition key in contact position.
 - Actuate the operating levers / joysticks several times to relieve pressure in the hydraulic lines.
 - Bring all operating and control levers into neutral position.
 - Place the safety lever in the full down position before leaving the machine.
 - Remove the ignition key.
- Before any work on the hydraulic circuit, you must also - with the ignition key in contact position - actuate all servo controls (joysticks and foot pedals) in both directions to relieve the pressure in the servo and hydraulic circuits. Then relieve the internal hydraulic tank pressure.
 - The safety lever must always be placed in the full down position before leaving the cab.
 - Properly secure all loose parts on the machine.
 - Never operate the machine until you have performed a complete walk around inspection. Also check if all warning decals are on the machine and if all of them are legible.
 - Check and follow all instructions given on the warning and safety decals.
 - For special applications, the machine must be equipped with specific safety devices. Do not operate the machine unless they are installed and functioning properly.
 - Never change, add or modify anything on the machine which could influence the safety of the machine without explicit written permission from the manufacturer. This also applies to the installation and adjustment of safety devices and valves as well as for any welding on load carrying machine parts or sections.
 - The windows in the driver's cab are made of safety glass. A damaged or broken window pane must be replaced immediately!
Only Original Liebherr cab window panes made of safety glass may be used!
 - Never install any attachments or parts LIEBHERRs explicit permission.

2.2 CRUSHING AND BURN PREVENTION

- Never work underneath the attachment, unless it is safely placed on the ground or properly blocked and supported.
- Never use damaged or insufficient load carrying devices, such as chains, ropes, ... Always wear gloves when handling wire ropes or cables.
- When working on the attachment, never align bores with your fingers, always use proper alignment tools when installing, changing or servicing attachments.
- When the engine is running, make sure that no objects touch the radiator fan. Rotating fans will swirl and throw out objects which can become very dangerous, and in addition to damaging the fan, they can cause severe injury to yourself and others.
- Avoid contact with components containing coolant. At or near operating temperature, the engine coolant is hot and under pressure and could cause severe burns.
- Check 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. Make sure there are no sparks and open flames in the vicinity.
- Never permit anyone to hand-guide the attachment to its proper position.
- Secure the engine compartment doors in open position to avoid unwanted closing.
- Insure that all engine and battery compartment doors are closed and locked before operating the machine.

- Never work underneath the machine unless the machine is properly blocked and supported.

2.3 FIRE AND EXPLOSION PREVENTION

- Always shut off the engine before refueling.
 - In addition, the heater must also be turned off before refueling.
- Never smoke or allow an open flame in refueling areas and / or where batteries or flammable material are being charged or stored.
- Always use the proper engine starting procedure, as described in the Operation and Maintenance Manual.
- Check the electrical system frequently. Correct any defects, such as loose connections, chafed wiring, or burnt out fuses and bulbs immediately.
- Never store or carry any flammable fluids on the machine, except in the storage tank intended for machine operation.
- Regularly check all components, lines, tubes, and hoses for oil and fuel leaks and/ or damage. Replace or repair damaged components immediately. Oil and fuel leaks can cause fires!
- Be certain that all clamps, guards and heat shields are installed. These components prevent vibration, rubbing and heat build up. Install tie wraps to fasten hoses and wires as required.
- Cold start ether is extremely flammable! Never use cold start ether near heat sources, open flames, or near anyone who is smoking cigarettes! Use only in well ventilated areas and as directed!
- Never use the flame glow plug or preheat system when you use an ether cold start aid. Danger of explosion!
- Know the location of the fire extinguishers, make sure you know how to use them properly. Check out the location of where to report a fire and inform yourself about fire fighting capabilities on the job site before you start to work.

2.4 MACHINE START UP SAFETY

- Before starting the machine, perform a thorough walk around inspection.
- Visually check the machine for loose bolts, cracks, wear, leaks and any evidence of vandalism.
- Never start or operation an unsafe or damaged machine.
- Be certain that all defects are taken care of immediately.
- Make sure that all covers and doors are closed and locked. Check if all warning and safety decals are on the machine and make sure that all of them are legible.
- Clean all windows and mirrors, secure doors and windows to prevent any inadvertent movement.
- Always enter and leave the cab through from the left over the chain. Always use the appropriate handles.
- Make sure that no one is on or under the machine. Warn all personnel in the surrounding area on the job site, before operating the machine.
- After entering the cab, adjust the operators seat, the rear view mirror, the arms rests and the seat belt as well as set belt tethers. Be certain that all controls can be reached, so you can work comfortably.
- All noise level protection devices on the machine must be operational when operating the machine.

- Never operate the machine without a cab or canopy.

2.5 ENGINE START UP SAFETY

- Before starting the engine, check all indicator lights and instruments for proper function. Place all operating and control levers into neutral position.
- Before you start the engine, warn any personnel in the surrounding area by sounding the horn .
- Start the machine only while seated in the operators seat, and with the seat belt secured.
- If no other instructions were given, follow the engine starting instructions as outlined in the **Operation and Maintenance Manual**.
- Start the engine and check all indicator lights, gauges, instruments and controls.
- Start the engine only in a well ventilated area. If necessary, open doors and windows to assure sufficient fresh air supply. Warm up the engine and hydraulic system to bring engine and hydraulic oil to operating temperature, as low oil temperatures cause the machine to be unresponsive.
- Check that all attachment functions are operating properly.
- Move the machine slowly and carefully into an open area and check all travel and brake functions, the steering function as well as the turn signals and lights.

2.6 MACHINE OPERATING SAFETY

- Make sure you are aware of any special circumstances on the job site, make sure you are familiar with any special guidelines and warning signals. Familiarize yourself with the job site before starting to work, any special hindrances and obstacles influencing operation or movement, the ground conditions, and any special protection required to secure the job site from public highway traffic.
- Always keep a safe distance from overhangs, walls, drop offs, and unstable ground.
- Make sure you are especially aware of changing ground conditions, visibility or weather conditions.
- Make sure you know the location of utility lines. Be aware of underground cables, gas and water lines. You must e especially careful when working near supply lines. If necessary, contact the appropriate utility company for information and location of utility lines.
- Keep sufficient distance from electrical lines with the attachment. Avoid working near high voltage electrical lines.
 - **DANGER OF LOSS OF LIFE!**
 - You must inform yourself of proper distances to assure your safety while working.
- If you do touch an electrical line with the attachment or machine, proceed as follows:
 - DO NOT leave the machine!
 - If possible, move the machine a sufficient distance away from the danger area.
 - Warn all personnel in the surrounding area not to come close to the machine and/ or touch the machine.
 - Instruct somebody to turn the electrical power off.
 - Do not leave the machine until you are assured that the electrical line which has been touched or damaged is no longer energized, and the power has been turned off!
- Before moving or working, make sure you always check that the attachments can be operated safely.
- When moving on public highways, roads or areas, make sure you observe all applicable rules and regulations for on road travel. If necessary, bring the machine to proper operating condition.
- Always turn on the lights if visibility is poor or as dusk approaches.
- Never all another person to ride along on the machine.

2. GENERAL SAFETY INFORMATION

- Always work while seated in the operators seat, with the seat belt secured.
- In the event the machine should tip, remain in the operators seat, with the seat belt securely fastened. Experience has shown that it is safer to remain in the cab in the event of an overturn.
- Report any functional problems or defects immediately, and make sure that all necessary repairs are completed before resuming operation.
- Be certain that no one is endangered by moving the machine.
- Do not get up from the operators seat as long as the machine is still moving.
- Never leave the machine unattended, with the engine running.
- When traveling, make sure that the attachment is in transport position and keep the load as close to the ground as possible.
- Avoid any working movement which could cause the machine to tip or overturn. However if the machine does begin to top or slide or slip on a grade, immediately lower the attachment and load to the ground and turn the machine downhill. If possible, work downhill or uphill, never sideways on a slope.
- Always move slowly on rocky, rough or slippery ground or on a slope.
- Always adapt the travel speed to working conditions.
- Never travel on slopes that exceed the maximum permissible gradeability of the machine.
- Never travel downhill at maximum speed, always at low speed to prevent loss of control. The engine must be at nominal speed and the speed must be reduced by preselecting the low speed range. Always change to the low speed range before reaching the slope. Never move into a slope and then change the speed.
- Always have another person guide you if visibility is restricted. Always take signals from one person only.
- Utilize only experienced personnel to attach loads and direct operators. The person giving signals must be visible to the operator or be equipped with two way radios.
- When using a two way radio or Citizens Band radio (CB), the safety lever must be in the full down position.

2.7 MACHINE PARKING SAFETY

- Park the machine only on firm and level ground. If it becomes necessary to park the machine on a grade, it must be properly blocked with wedges to secure it and prevent any unintentional movement.
- Bring all operating levers and controls into neutral position, place the safety lever in full down position, and turn the engine off, as outlined in the Operation and Maintenance Manual, before you leave the operators seat.
- Lock the machine, remove all keys and secure the machine against vandalism and unauthorized use.
- Never park the machine in such a way as to block access to entrances, exits, ramps, fire hydrants, etc.

2.8 MACHINE TRANSPORTING SAFETY

- The boom must be folded in for transport.
- Use only safe transportation and tackle with adequate carrying capacity.
- If necessary, remove part of the attachment for transport.

- Never use a ramp that is steeper than 30° to move the machine onto a transporting vehicle, the ramp should be covered with wooden planks to prevent slipping.
- Before moving onto the ramp, remove any snow, ice or mud from chains or wheels.
- Align the machine with the ramp.
- Use another person as a guide to signal you, the operator. Move very slowly and carefully towards the ramp and the transport vehicle.
- Secure the machine and all remaining parts with chains and wedges to prevent slipping or movement during transport.
- Relieve pressures from hydraulic lines and hoses, remove the ignition key, lock the cab and all covers before leaving the machine.
- Carefully check out the transporting route beforehand. Check any regulations regarding width, height and weight.
- Make sure there is enough clearance underneath all bridges and underpasses, utility lines and tunnels.
- during off loading, use the same care and caution as during the loading procedure. Remove all chains, wedges and blocks. Start the engine as noted in the Operation and Maintenance Manual. Carefully move the machine from the trailer platform down the ramp. Use a guide to signal you.

2.9 MACHINE TOWING SAFETY

- Always follow the correct procedure: Refer to the Operation and Maintenance Manual section Towing the machine.
- Tow the machine only in exceptional cases, such as removing the machine from a dangerous area.
- Be sure that all towing and pulling devices, such as cables, hooks etc. are safe and adequate.
- The cable or towing bar, which is used to tow the machine must be adequate to pull the machine and must be connected to the appropriate bores and couplers. Any damage or accident which is the direct result of towing this machine is expressly excluded from the manufacturer's and/or LIEBHERR's warranty.
- Never allow anyone to stand near the cable or on the machine while pulling or towing.
- Keep the cable tight and free of kinks.
- Carefully pull the cable tight, do not jerk! A sudden jerk can cause a slack cable to snap.
- When towing, keep the machine straight and maintain, permissible speed and route.
- When returning the machine to operation, proceed as stated in the Operation and Maintenance Manual.
- After the towing the machine, and before continuing operation, be certain to return the machine to a safe operating condition.

2.10 MACHINE MAINTENANCE SAFETY

- Never perform any maintenance or repairs for which you are not qualified or you do not understand.
- Any maintenance / inspection should be performed in the intervals noted in the Operation and Maintenance Manual. To perform any repairs, make sure you have the proper tools.
- Maintenance work should be performed according to the chart at the end of this Operation and Maintenance Manual. It is also noted who should or may perform what type of work. The operator

2. GENERAL SAFETY INFORMATION

should only perform items marked OM on the Maintenance and Inspection schedule. The remaining work should only be performed by trained personnel.

- All spare parts must conform to the technical requirements set forth by the manufacturer. This is only assured by using Original Liebherr spare parts.
- Always wear proper and safe work clothing. For certain jobs, in addition to hard hats and safety shoes, additional safety equipment is required, such as safety glasses and / or gloves.
- Keep unauthorized personnel from the machine during maintenance and repair work.
- Secure the maintenance area, as necessary.
- Inform service personnel if any special task or maintenance work is required. Appoint a supervisory person to assure that this work has been done properly.
- Perform all maintenance work with the machine parked on firm and level ground and with the engine turned off, unless otherwise specified in the Operation and Maintenance Manual.
- The cab may be raised only if the machine is parked and the engine is turned off! Before raising the cab, make sure that no personnel is within the proximity of the cab. always secure the raised cab with the safety bar before working under the raised cab. The machine may **NEVER** be moved when the cab is raised! The safety lever must remain in the full down position!
- After any maintenance and repair work on the machine, make sure that all screw connections or fittings, which had to be loosed, are retightened.
- If it becomes necessary to remove any safety devices during set up, maintenance and repair, the safety devices which were removed, must be reinstalled immediately and then be inspected for proper function.
- Before servicing the machine, especially when working underneath the machine, attach an easily visible warning sign **DO NOT OPERATE** to the ignition switch. Remove the ignition key.
- Before any maintenance or repair, clean off any oil, fuel or service fluids from connections and couplings. Do not use any harsh cleaning fluids. Use only lintfree cloths.
- Never use flammable fluids to clean the machine.
- Before any welding, cutting or grinding, clean the machine and surrounding area of dust and assure adequate ventilation.
 - Otherwise there is a **DANGER OF EXPLOSION!**
- Before cleaning the machine with water, steam (high pressure cleaning systems), or other cleaning fluids, cover or tape all openings, make sure no water, steam or cleaning fluids enters these openings for safety and functional reasons. Electric motors, switch boxes, and battery compartments are especially vulnerable.
 - Make sure that during the cleaning work, the temperature sensor of the fire warning system and sprinkler system do not come in contact with the hot cleaning fluid, or the sprinkler system could be actuated.
 - After cleaning the machine, remove all covers and tape.
 - After cleaning the machine, check all fuel, engine oil and hydraulic lines for leaks, for loose connections, for chafed or damaged areas.
 - All problems must be remedied immediately.
- Adhere to the product safety instructions issued for handling of oils, greases, and other chemical substances.
- Make sure to dispose of any operating and service fluids as well as replacement parts property, and in an environmentally sound manner.
- Be careful when handling any hot service or operating fluids (danger of burns and scalding!)
- Use combustion motors and fuel operated heaters only in areas with adequate ventilation. Before start up, make sure that the ventilation is adequate. Follow and adhere to any local guidelines and instructions pertaining to the present job site.
- Perform any welding, cutting or grinding work on the machine only if this work has been explicitly authorized, there can be a danger of fire or explosion.

- Do not try to lift heavy parts. Always use appropriate lifting aids and devices with sufficient carrying capacity.
 - To lift spare parts and component assemblies for replacement on the machine, they must be securely mounted and secured onto the lifting devices, to prevent accidents. Use only suitable and flawless lifting devices, as well as hooks, ropes, slings, shackles, etc. with sufficient load carrying capacity.
 - **Do not allow anybody to work or remain underneath a suspended / raised load!**
- Do not use damaged or insufficiently strong ropes. Always wear gloves when handling wire ropes.
- Only experienced personnel may attach loads and signal the operator. The person used as guide must be visible by the operator or must be in direct voice contact with the operator via a two way radio.
- When installing parts higher up or when working overhead, always use safe scaffolding or ladders suited for this purpose. do not step on any parts on the machine to get closer to the working area. You must wear safety belts or similar safety equipment when working higher up. Make sure all handles, steps, walkways, catwalks, and ladders etc. are always free of dirt, snow and ice.
- When working on or changing any part of the attachment, make sure that the attachment is properly supported. Never use metal on metal supports.
- Never work underneath the machine unless it is properly supported with wooden supports.
- Always block the machine in such a way that any change in the center of gravity will not endanger its stability. Never use metal on metal supports.
- Only authorized, trained personnel may work on the travel gear, brake and steering system.
- If the machine must be repaired while parked on a slope, the track chains or wheels must be blocked with wedges to prevent any movement. The attachment must be brought into proper maintenance position.
- Only experienced, authorized personnel who have received specialized training may work on the hydraulic system.
- Always wear gloves when checking for leaks. Never check for leaks with your bare hands. A thin stream of fluid escaping from a small hole can have enough force to penetrate the skin.
- Never loosen any hydraulic lines or connections until the attachment has been lowered and the engine has been turned off. Then, with the ignition key in contact position, acute all servo controls(joysticks and foot pedals) in both directions to release any servo pressure and to release all pressures in the working circuit. Release the tank pressure by slowly opening the bleeder valve.
- Regularly check all hydraulic lines, hoses and connections for any leaks and damage. Any defects must be repaired immediately. Any escaping fluid can cause serious injuries and fire.
- Before starting any repairs, you also must make sure that all air pressures are relieved in any of the systems you need to gain access to: to be certain, refer to description of various components and groups and assemblies.
- Route and install all hydraulic and air pressure lines properly. Mark and check all connections to prevent any mix ups. All fittings, including length and quality or type of hoses used must match the requirements set forth by the manufacturer.
 - **For that reason, use only Original LIEBHERR spare parts.**
- Replace hydraulic hoses and lines in regular intervals, as stated, even if no defects can be seen.
- Work on electrical components of the machine may only be performed by a certified electrician or by a person working under the guidance and direct supervision of such an electrician, and according to electro-technical procedures, rules and regulations.
- When working on the electrical system or before any arc welding on the machine, the battery cables must be disconnected. Always disconnect the negative terminal first and reconnect it last.
 - In addition, before any welding, always remove the electronic box.
- Use only Original fuses with the same amperage. In case of problems in or with the electrical power supply, turn the machine off immediately.

- Inspect / check the electronic components of the machine regularly. Repair any problems or defects, such as loose connections or chafed wires and replace any burnt out fuses and bulbs immediately.
- If any work is necessary on energized, voltage carrying parts, a second person must be utilized to disconnect the main battery switch or emergency switch in case a problem should arise. Rope off the working area with a red and white safety chain and a warning sign. Use only insulated tools.
- When working on high voltage carrying components or sections, turn off the power supply, then connect the supply cable to the ground wire and use the grounding rod to ground these parts, such as the condenser, for example.
- Check the disconnected parts first to see if they are really voltage free, ground them and then close them off; insulate the neighboring, voltage carrying parts.

2.11 SAFETY GUIDELINES TO BE OBSERVED WHEN WORKING ON THE ATTACHMENT

- Never work underneath or on the attachment unless it is securely placed on the ground or it is properly blocked and supported to keep it from drifting or falling.
- Never try to lift heavy parts. Always select and use appropriate lifting devices with sufficient lifting capacity.
- When handling wire ropes or cables, always wear gloves!
- Do not disconnect any lines or hoses or remove fittings, caps or covers while the hydraulic system is pressurized. Always lower the attachment, shut the engine off and release all pressured - with the ignition key in contact position, move all servo controls (joysticks and foot pedals) into both directions to release the servo pressure and any pressure remaining in the hydraulic circuit, then release the tank pressure by turning the bleeder screw.
- After completion of all maintenance and repairs, make sure all lines, hoses and fittings are properly connected and retightened.
- Removing or installing steel pins with a hammer can be very dangerous. Metal chips can cause injury. Always wear gloves and safety glasses.
- Always use the appropriate tools for the job (such as punches, pin pullers).

2.12 SAFETY REGULATIONS FOR LOADING A MACHINE WITH A CRANE

- Remove the boom or bring it to transport position.
- Bring all control levers into neutral position.
- Turn the engine off, according to the Operation and Maintenance Manual, and move the safety lever in the down position, before leaving the operators seat.
- Close all doors, covers and hoods.
- Only experienced, specially trained personnel may attach loads and signal the operator. The guide must be within the visibility of the operator or be in direct voice contact via a two way radio.
- Attach the lifting devices only to the brackets / bores on the machine, which have been installed for this purpose.
- Make sure the lifting devices are long enough.
- Lift the machine carefully!
- **CAUTION! Make sure that nobody is underneath the raised machine. This is strictly prohibited!**

- When putting the machine back in service, proceed as described in the Operation and Maintenance Manual.

2.13 SAFETY GUIDELINES HYDRAULIC LINES AND HOSES

- Hydraulic lines and hoses may never be repaired!
- All hoses, lines and fittings must be checked regularly, but at least 1 x per year for leaks and any externally visible damage! 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.

The service life of a hose may not exceed six years, including a storage period of not more than 2 years (always check the manufacturer's date on the hoses).

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:
 - Damage on the external layer into the inner layer (such as chaffings, 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;
 - 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;
 - Storage or service life has been exceeded;

When replacing hoses or lines, always use Original replacement parts.

- Route or install the hoses and lines properly. Do not mix up the connections!

2.14 SAFETY NOTES WHEN WORKING WITH THE MACHINE

- Never permit a passenger on the machine. This is strictly prohibited!
- Never permit anybody to remain underneath the raised load!
- Loads must be attached in such a way that they cannot slip or fall out.
- Before attaching a load, you must check if the load can be lifted without restrictions.
- A load may only be attached by a person who is experienced and trained in this task.
- Any auxiliary personnel used to help guide the load or attach the load must remain within the visibility of the machine operator. They may not be positioned near a tensioned cable or rope. A safe distance of at least 1½ cable lengths must be observed.
- To attach the load, the person who is attaching the load may only approach from the side to the boom after the operator has given his approval. The operator may only approve this action, if the machine is at a standstill and the working attachment is not being moved.
- The operator may not move any loads over any persons on the ground.

2. GENERAL SAFETY INFORMATION

- The person attaching the load and any accompanying persons or helpers must wear appropriate protective gear (such as hard hat, protective gloves, ...).
- The operator must guide the load as close as possible to the ground to prevent it from swinging.
- The machine may only be driven with the suspended load if the travel route is level.
- Any shocks / jerks or sudden dropping of the load must be prevented. These movements could cause stress loads which could exceed the nominal load, affecting the safety of the attachment.
- A worn or damaged winch cable must always be replaced immediately with a new cable.
- Only stress tested tackle may be used for the lifting procedure.
- The hook block must be lowered to the ground or must be attached safely before the winch may be maintained, adjusted or repaired.
- Never use the machine to pull any loads which are stuck, even if the weight of the non-moving load would not exceed the permissible load capacity.

2.15 SAFETY GUIDELINES TO BE OBSERVED WHEN WORKING NEAR ELECTRICAL OVERHEAD WIRES

- When working in the vicinity of electrical overhead wires and power cables, a safe distance, depending on the rated voltage of the power cables, must be maintained between the electrical cables and the working attachments, to prevent a flashover.
This also applies to the distance between these lines and attachments as well as attached loads.

The following safe distances must be maintained:

Rated voltage (Volt)	Minimum clearance (in meters)
Up to 1000 V	1.0 m
over 1 kV to 110 kV	3.0 m
over 110 kV to 220 kV	4.0 m
over 220 kV to 380 kV	5.0 m
or if rated voltage is not known	5.0 m

- When approaching electrical overhead wires, all working movements of earthmoving machinery must be taken into account, for example boom positions, the swing movement of cables and the dimensions of attached loads. Also any uneven ground conditions, which could cause the machine to stand at an incline or side slope and therefore closer to the power cables must be noted!
- Be aware that in windy conditions, overhead wires as well as working attachments can swing out and reduce the distance.
- If sufficient distance to electrical overhead wires and power cables cannot be retained, then the contractors must consult with the owner or operator of the power lines to carry out other safety measures to prevent a flashover.

Other safety measures to prevent a flashover include the following, for example:

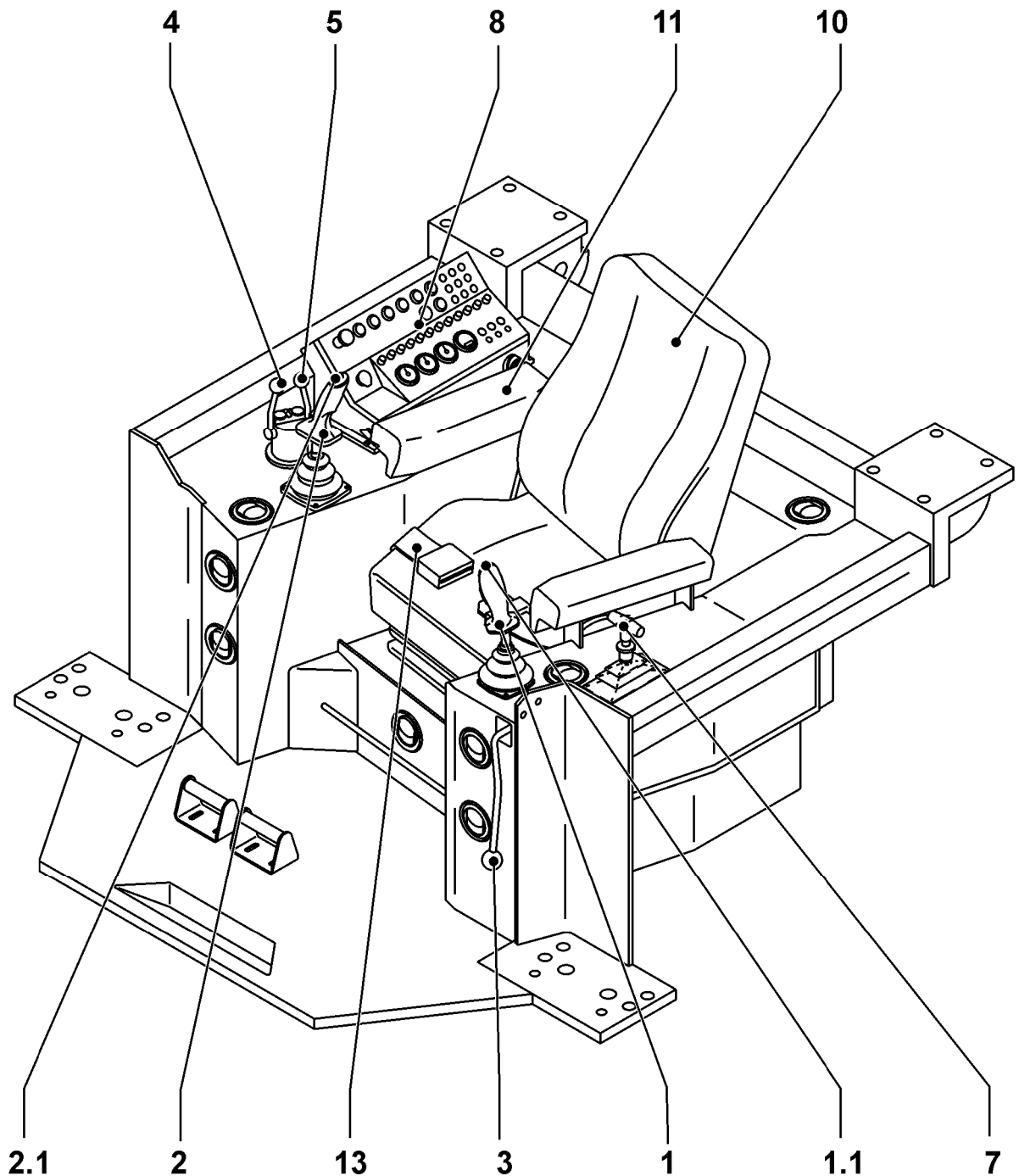
- Turning off the current,
- rerouting the lines or wires,
- wiring,
- limitation of working range of earthmoving machines.
- If, despite all precautions, a flashover occurs, then the machine operator must move the machine from the danger zone by raising or lowering the attachment or by driving out or swinging the attachment out of the danger zone.
If this is not possible, the operator should do the following:
 - Do not leave the cab;
 - Warn those around the machine not to move and not to touch the machine;
 - Ask to have the current turned off!

2.16 ROLL OVER PROTECTION (ROPS) AND FALLING OBJECTS PROTECTION (FOPS)

- These protective devices are integrated in the operator's cab.
- Consult your Liebherr dealer before making any changes to prevent a possible reduction of the roll over or falling objects protection.
 - Do not install fire extinguishers, First Aid kits, floodlights or similar items!
 - Welding of mounting brackets or drilling of installation bore holes could weaken the structure.
- Always contact your Liebherr dealer for such work.
- Any changes, which have not been explicitly approved by Liebherr will render the approval of the ROPS and FOPS protection invalid.
Damage to the structure can also be caused by a roll over accident, falling objects, etc.

3. CONTROLS AND INSTRUMENTATION

3.1 ROLL OVER PROTECTIVE STRUCTURE (ROPS)



- 1 Travel lever (joystick)
- 1.1 Push button for counter rotation
- 2 Boom - hoist winch control lever
- 2.1 Push button Free fall device
- 3 Safety lever
- 4 Counterweight control lever
- 5 Rear winch control lever

- 7 Throttle control lever
- 8 Instrument panel
- 10 Operator's seat
- 11 Armrest
- 13 Seat belt

**33 HOUR METER**

The hour meter indicates the numbers of hours the machine has been operated. Use the numbers of hours to schedule maintenance and inspections.

**35 INDICATOR LIGHT - REPLENISHING OIL PRESSURE (red)**

Should the light come on while the engine is running, stop the engine immediately and check for and correct the problem.

**37 INDICATOR LIGHT - PARKING BRAKE (yellow)**

Lights up when the safety lever is in the down position, if the parking brake is applied and in case of loss of replenishing pressure.

**38 CHARGE INDICATOR LIGHT (red)**

Must turn off one the engine is started. Should the light come on while the engine is running, stop the engine immediately and check for and correct the problem.

**39 INDICATOR LIGHT - VACUUM INDICATOR (yellow)**

If the indicator light lights up, turn the engine off. Clean or replace the main air filter element.

**40 INDICATOR LIGHT - RETURN FILTER (yellow)**

Replace the return filter element, if the indicator light lights up, when the hydraulic oil is at operating temperature.

**41 INDICATOR LIGHT - PREGLOW SYSTEM (yellow)**

With the key in preheat position 50.2, the indicator light turns off after approx. 20 seconds. After the indicator lights has turned off, continue to turn the ignition key to starting position 50.3 to start the engine.

**42 INDICATOR LIGHT - HI / LOW TRAVEL SPEED (yellow)**

Lights up when the low travel speed is selected.
The travel speed is reduced by changing the switch on the joystick to positions II or I.

**43 INDICATOR LIGHT - ELECTRONIC (red)**

Lights up if there is a problem in the electronic system.

**44 FUSES**

Location and size of fuses are described later in this manual.

**45 ELECTRICAL OUTLET 24 V**

Current is only available in contact position 50.1.

**46 INDICATOR LIGHT - HYDRAULIC OIL TEMPERATURE (red)**

If the indicator light lights up, turn the engine off immediately and find and fix the problem (for example: clean the hydraulic oil cooler.)



47 INDICATOR LIGHT - SLIP RING SEAL (red)

Lights up if the oil level is too low.

If the indicator light lights up:

- Turn the machine off.
- Check the travel gear externally for leaks.
- Check the travel gear oil level.
- Contact Liebherr Service.

Bring the oil levels to normal levels for intermediate use.



48 INDICATOR LIGHT - WINCH RELEASE (yellow)

Lights up if winch release is activated.

3.3 CONTROLS ON THE INSTRUMENT PANEL

50 STARTER SWITCH



50.0 Off position



50.1 Contact position



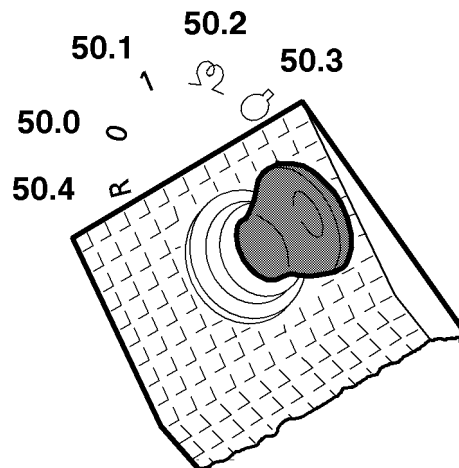
50.2 Preglow position

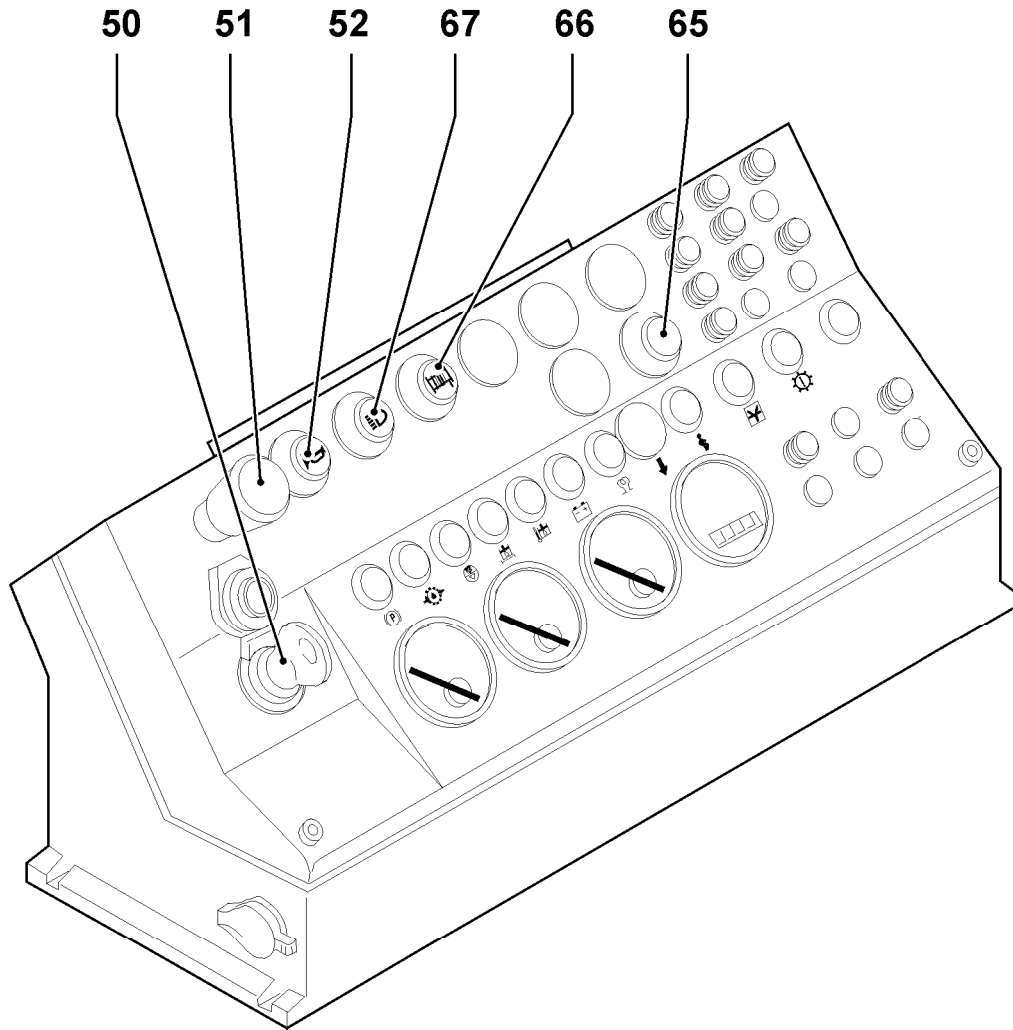


50.3 Starting position



50.4 Parking position





51 EMERGENCY SHUT OFF BUTTON

The machine stops immediately if this button is pressed; the attachment remains operational.



52 HORN

Push the button to sound the horn.

65 BUTTON - HOIST LIMIT SWITCH

If the hook block has been raised too far, the limit switch is actuated and turns the movement off. Press the button again to lower the hook block again.



66 REAR WINCH RELEASE

Push the switch to release the rear winch.

CAUTION:

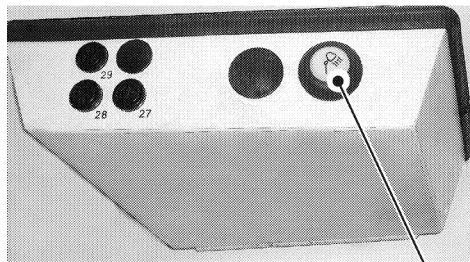
- Never shift under load!
- Actuate only when the cable is relieved and the winch drum is at a standstill - otherwise the winch gear will be damaged!



67 ADDED FLOODLIGHT

Turn on / off

3.4 CONTROLS AND INDICATORS IN THE ROOF CONSOLE

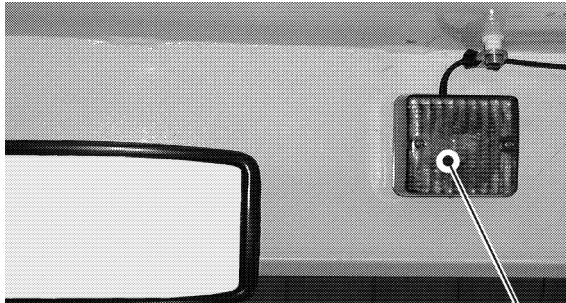


59



59 WORKING FLOODLIGHT

Turn on / off



70

70 WARNING LIGHT - ROLL OVER PROTECTIVE CAB

The warning light lights up:

- at increased coolant temperature
- at low engine oil pressure
- at low replenishing pressure
- if the ignition is turned on as long as the engine is not running.

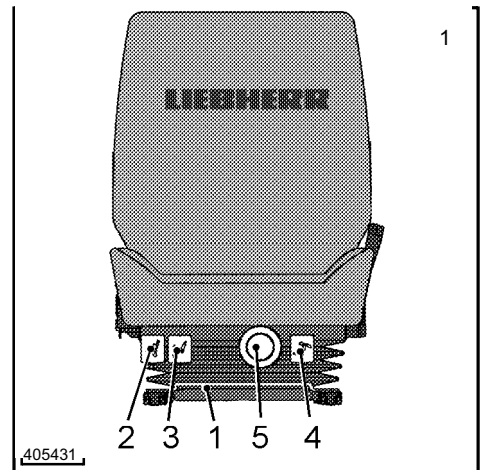


NOTE

If the warning light lights up, turn the engine off and remedy the problem.

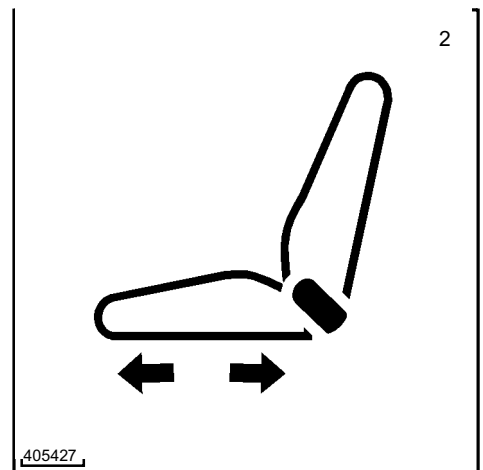
3.5 OPERATOR'S SEAT

A few minutes spent on seat adjustment will contribute greatly to operator comfort.



3.5.1 HORIZONTAL SEAT ADJUSTMENT

Lift the lever (1) and bring the seat into the desired position (fig. 2).



3.5.2 VERTICAL SEAT ADJUSTMENT

Pull the handles (2+3) at the same time and raise the seat to the desired height (fig. 3).

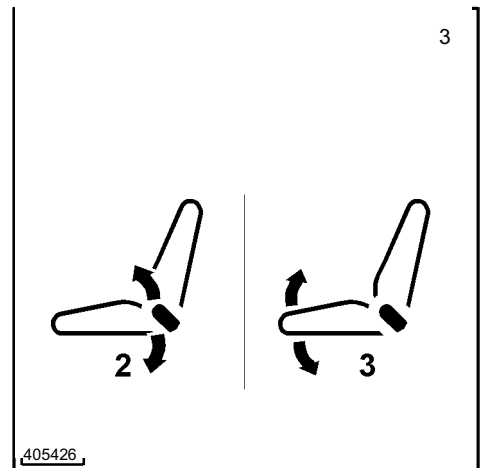
3.5.3 SEAT CUSHION ADJUSTMENT

To lower the seat in the rear

Raise the handle (2) and change the seat incline to the rear (fig. 3).

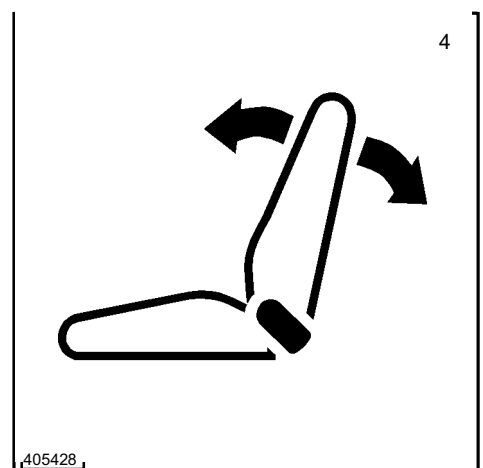
To lower the seat in the front

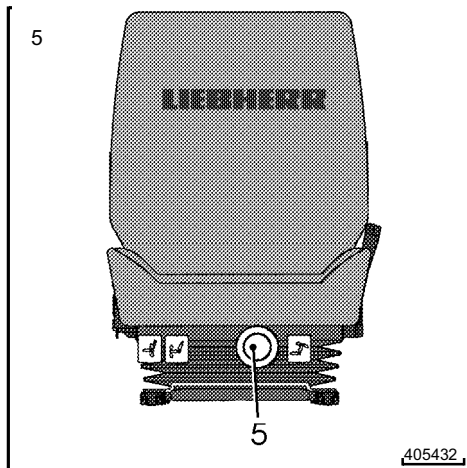
Raise the handle (3) and change the seat incline to the front (fig. 3).



3.5.4 BACK REST ADJUSTMENT

Raise the handle (4) and bring the backrest to the desired position (fig. 4).



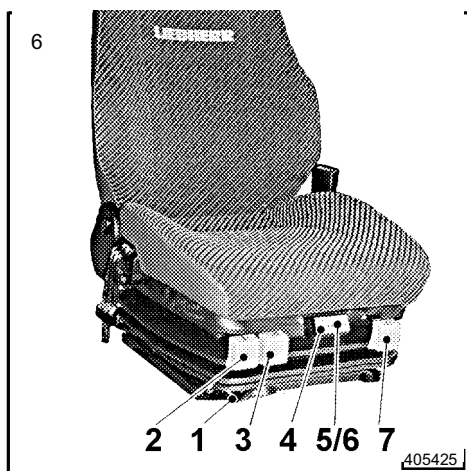


3.5.5 SEAT SUSPENSION ADJUSTMENT

Turn the knob (5) to adjust the seat suspension to the weight of the operator.

The knob (5) shows the adjusted weight in kg (fig. 5).

When this earthmoving machine is used in certain job applications and these operator's seats, which conform to ISO 7096, are used, it is assured that the measured vibration accelerations a_{zw} (measured according to ISO 2631 part 1), meet the requirements for total body protection from vibrations.

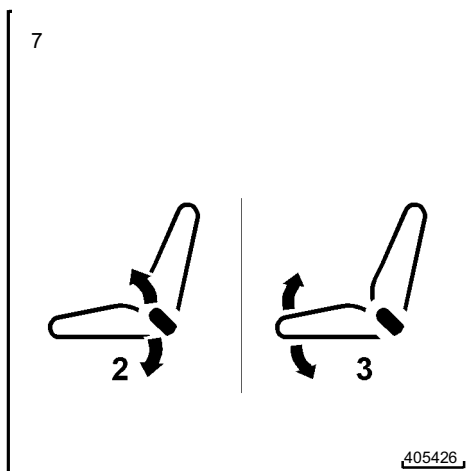


3.6 AIR CUSHIONED OPERATOR'S SEAT

(Optional equipment)

3.6.1 HORIZONTAL SEAT ADJUSTMENT

- Raise the lever (1) on the front of the operator's seat and bring the seat to the desired position (fig. 6).



3.6.2 VERTICAL SEAT ADJUSTMENT

- Raise the levers (2+3) at the same time and bring the seat to the desired position (fig. 7).

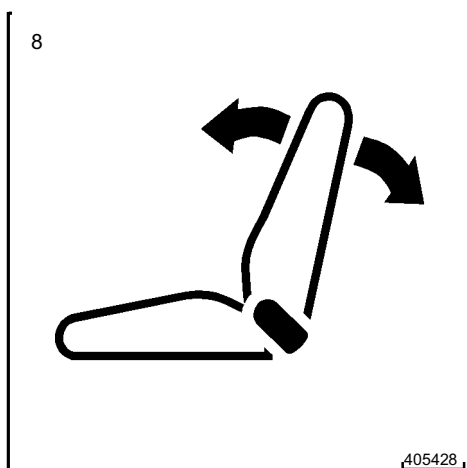
3.6.3 SEAT CUSHION ADJUSTMENT

To lower the seat cushion in the rear

- Raise the handle (2) and change the seat incline to the rear (fig. 7).

To lower the seat cushion in the front

- Raise the handle (3) and change the seat incline to the front (fig. 7).

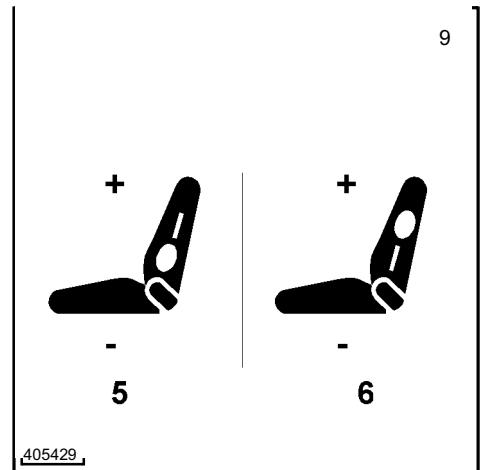


3.6.4 BACKREST ADJUSTMENT

- Raise the handle (7) and bring the backrest to the desired position (fig. 8).

3.6.5 BACK SUPPORT ADJUSTMENT

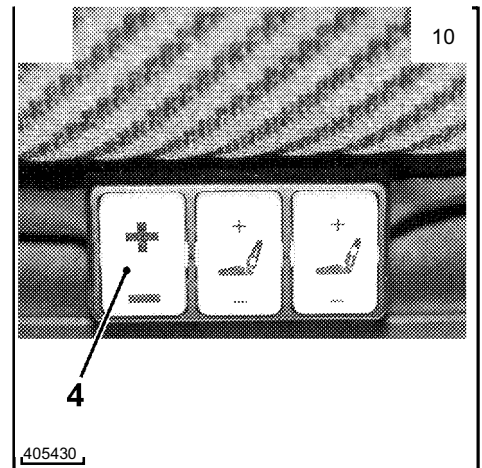
- Push the two buttons (5 + 6) to adjust the back support (fig. 9).



3.6.6 SEAT SUSPENSION ADJUSTMENT

- Press the button (4) on the '+' or '-' side until the seat is set to the most comfortable suspension (fig. 10).

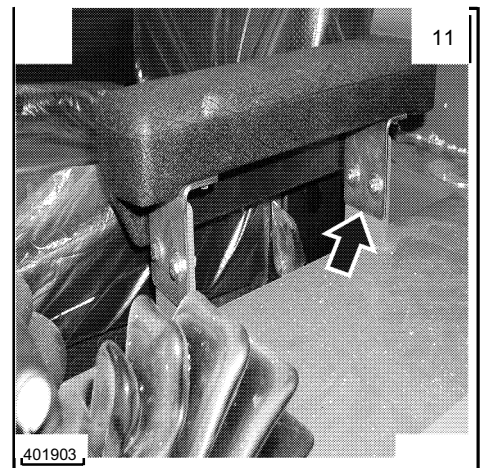
When this earthmoving machine is used in certain job applications and these operator's seats, which conform to ISO 7096, are used, it is assured that the measured vibration accelerations a_{zw} (measured according to ISO 2631 part 1), meet the requirements for total body protection from vibrations.



3.7 ARM RESTS

The arm rests should be adjusted in such a way that the operator can optimally control the joysticks of the machine with his arms resting on the arm rests.

- Loosen the mounting screws of the arm rest to set them to the desired height (fig. 11).



3.8 SEATBELT

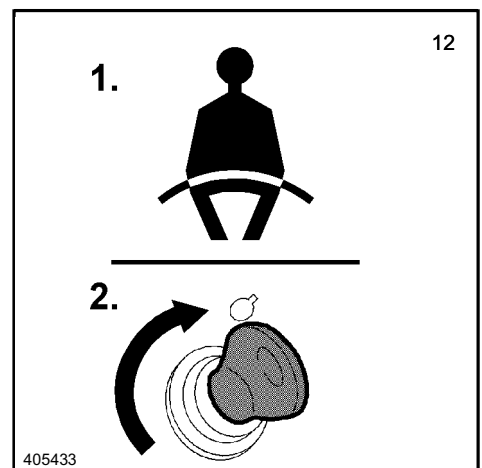


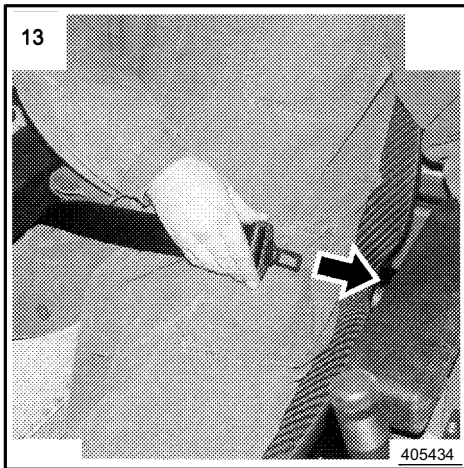
The operator must always fasten the seatbelt before operating the machine.

To ensure safety, check condition, function and mounting of the belt frequently and replace worn, damaged or defective parts immediately.

Make sure that the seatbelt is not twisted when in use.

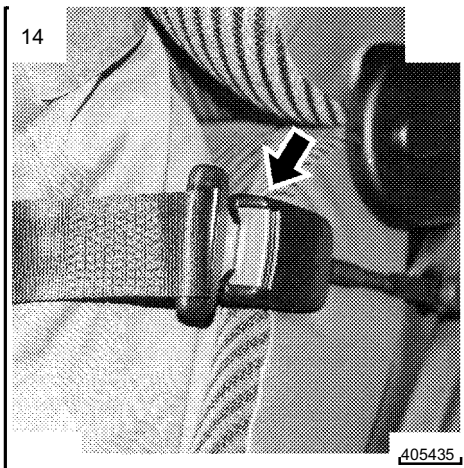
The seatbelt is adjusted automatically to the correct length.





3.8.1 TO APPLY THE SEATBELT

- Pull the seatbelt from the automatic housing on the right hand side of the seat (fig. 13).

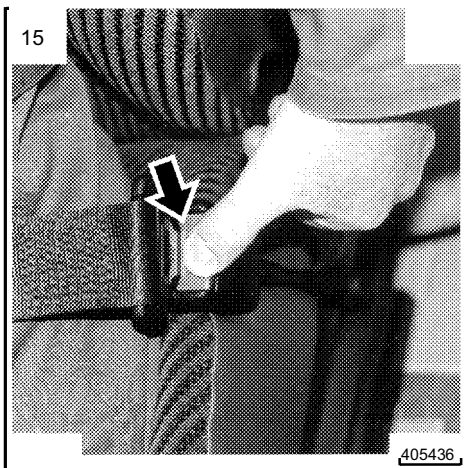


- Pull the seatbelt over your lap and engage it into the lock on the left hand side of the seat to fasten (fig. 14).
- Pull the belt to make sure it is locked.



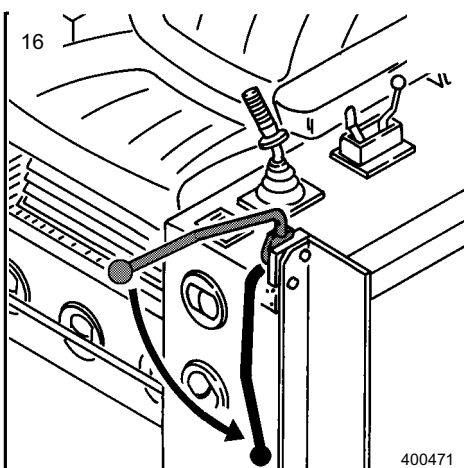
NOTE

Pull the seatbelt slowly from the automatic housing, or the lock mechanism will be triggered.



3.8.2 TO RELEASE THE SEATBELT

- To release the seatbelt, push the orange button on the lock downward (fig. 15).
- Let the seatbelt retract slowly in its housing to prevent it from getting stuck or becoming dirty.



3.9 EMERGENCY EXIT



CAUTION

Always enter and leave the cab on the left side. The emergency exit may only be used in true emergencies! Before leaving the cab, always move the safety lever in the full down position (fig. 16).

3.9.1 EMERGENCY EXIT - ROLL OVER PROTECTIVE CAB

If the roll over protective cab roof is installed, use the left side of the machine as the emergency exit!

3.10 ENTERING AND LEAVING THE CAB

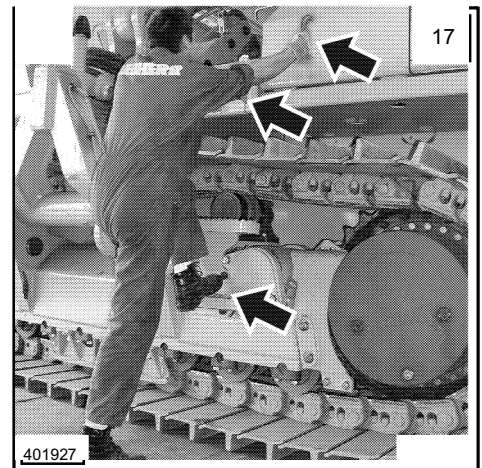
Always use the steps, rails and handles provided to enter and leave the cab.

- Make sure to clean steps and chain before entering or leaving the cab.



**Make sure the steps and chains are clean before stepping on them.
Always grasp the handles with both hands when stepping on or off the machine (fig. 17).**

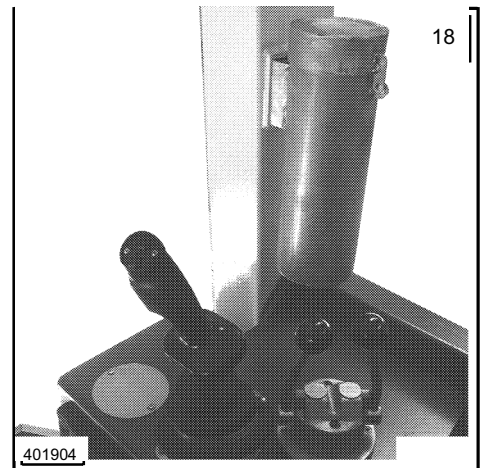
NEVER JUMP OFF THE MACHINE!



3.11 COMPARTMENT FOR OPERATION AND MAINTENANCE MANUAL

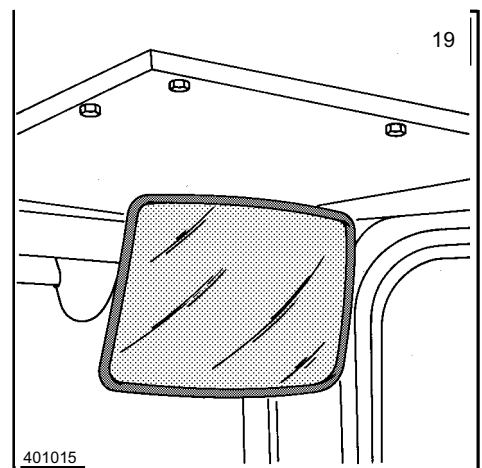
Always keep a copy of the Operation and Maintenance manual in the storage tube on the right ROPS bar (fig. 18).

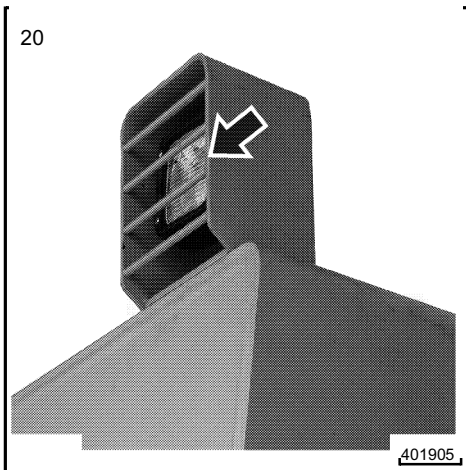
The Operation and Maintenance Manual is part of the machine!



3.12 REAR VIEW MIRROR

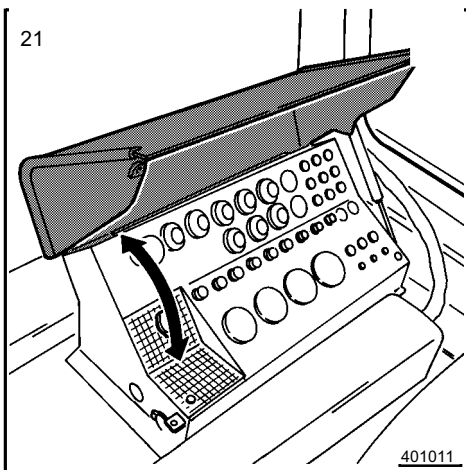
A rear view mirror is standard equipment in every cab. Before start up, the mirror should be adjusted so the operator can see the complete rear area, while seated. (Fig. 19).





3.13 FLOODLIGHTS

The floodlights must be set in such a way that the working range in front and behind the machine is always sufficiently illuminated (fig. 20).



3.14 VANDALISM PROTECTION

The vandalism protection hood can be locked to protect from unauthorized access or vandalism. Flip the hood upward to gain access to the instrument panel (fig. 21).

3.15 FIRE EXTINGUISHER (Optional equipment)

A mounting bracket for the fire extinguisher has been placed on the left hand side behind the operator's seat.

Contact your Liebherr dealer to obtain the fire extinguisher installation kit.

3.16 BEACON (Optional equipment)

Your machine has been prepared at the factory for the installation of a beacon.

For Id. No. and retrofit installation, contact your Liebherr dealer or service center.

3.17 BACK-UP ALARM

(Optional equipment)

The back up alarm sounds when the travel lever is moved into position for "reverse travel".

The sound of the horn alerts any persons behind the machine that the machine will be backing up.

The back up alarm is located in the rear of the machine. The sound level is set automatically.

4. OPERATION

4.1 WALK AROUND INSPECTION



CAUTION

Read and observe the safety guidelines in chapter 2 of this Operation and Maintenance Manual.



NOTE

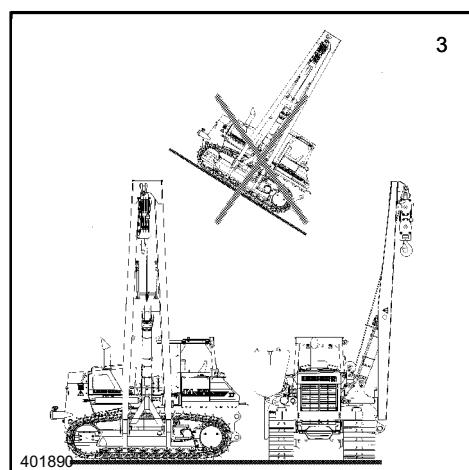
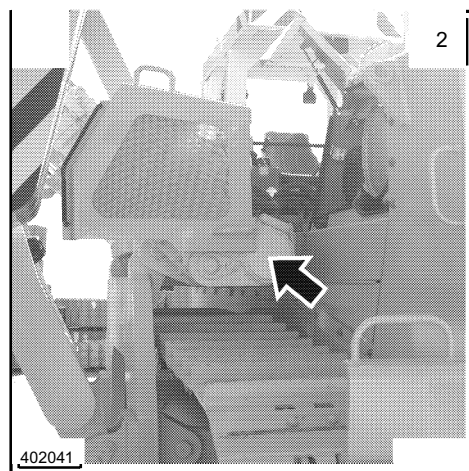
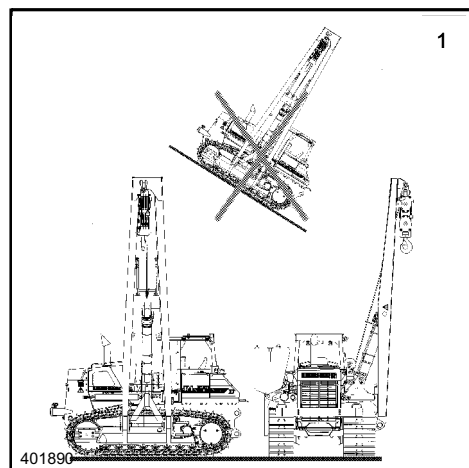
Keep the cab area, steps and handles free of cable grease and contamination, if necessary, clean with a rag before operation.

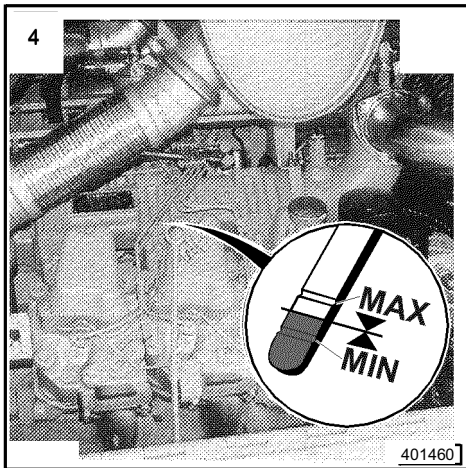
- The engine compartment door must be removed for maintenance work on the right side of the machine.
- Extend the counterweight completely.
- Open the engine compartment door and remove it via the handles, which have been installed for this purpose.
- Reinstall the engine compartment door into the retainers on the counterweight - frame (fig. 2).

4.1.1 ENGINE OIL LEVEL

Check the engine oil level with the machine on level ground and in horizontal position (fig. 3).

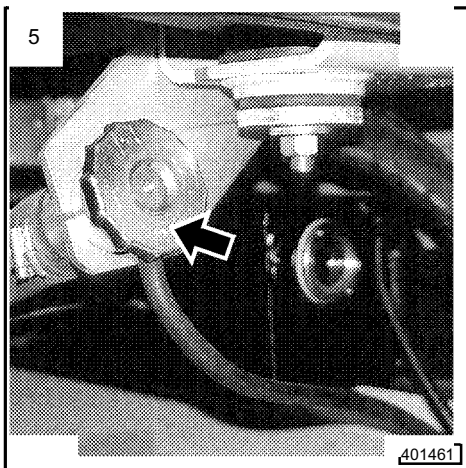
Turn the engine off and wait for a few minutes for the oil to collect in the oil pan.





The oil level must be between the MIN and the MAX mark on the dipstick (fig. 4).

Do not overfill the engine past the MAX mark. The oil quantity between the MIN and the MAX mark is 15 l.

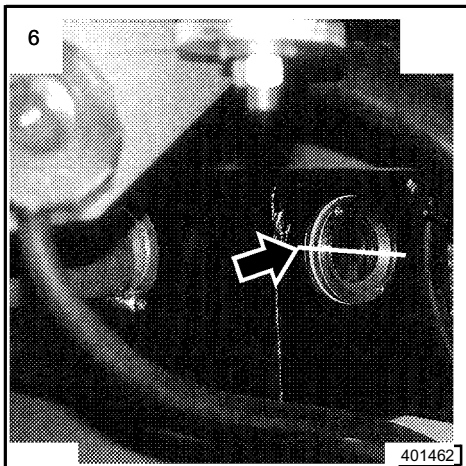


4.1.2 COOLANT LEVEL

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 the coolant only after the radiator cap is cool enough to touch (fig. 5). Turn the radiator cap slowly to relieve pressure.



- The coolant must be visible in the center of the sight gauge (fig. 6).

Check the radiator, fan and engine for damage and contamination, clean as necessary.

After refilling or adding to the cooling system, let the engine run for a short time with the heater turned on. Recheck the coolant level.



NOTE

The cooling system must be filled year round with anti-freeze and corrosion inhibitor and DCA4.

The machine is filled at the factory with a coolant mixture of approx. 50% antifreeze, protecting the system to -36°C. For quantities and mixing ratio, refer to the lubrication chart.

4.1.3 FUEL SYSTEM

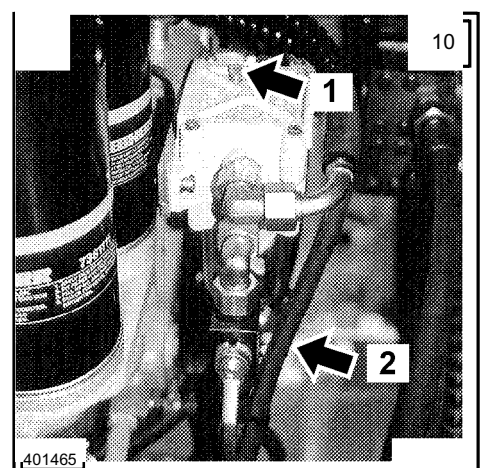
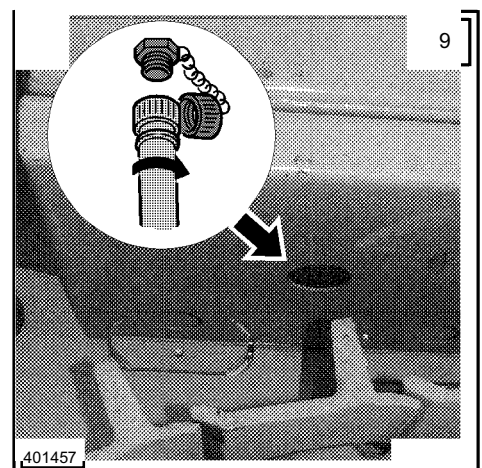
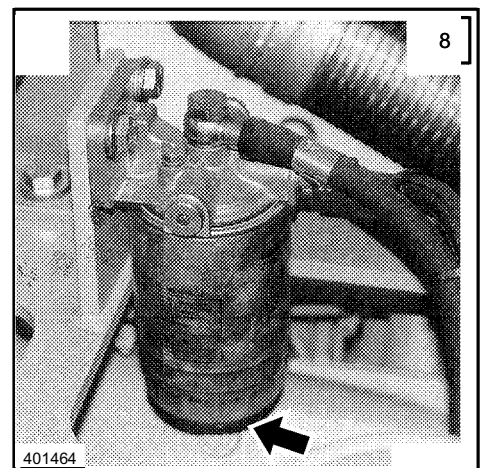
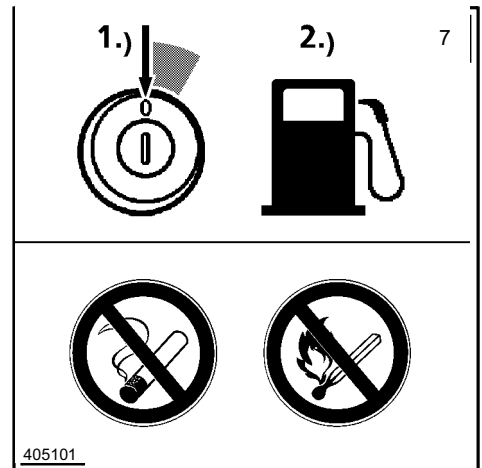


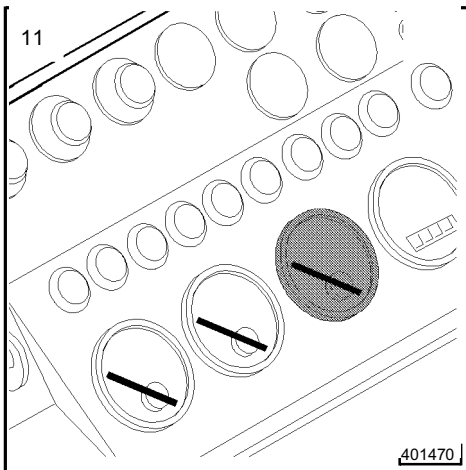
Do not store fuel on the machine or in glass containers. Do not refuel in a closed area.

Never smoke or allow an open flame in refueling areas.

Drain water and sediments daily from the fuel filter on the fuel tank on from the water separator:

- Place a suitable container under the drains.
- Open the valve on the fuel filter (fig. 8),
- Carefully open the host on the drain valve on the fuel tank until clean fuel emerges (fig. 9).
- Open the bleeder screw on top of the water separator (fig. 10, pos. 1).
- Open the drain valve on the water separator until clean fuel emerges (fig. 10, pos. 2).
- Close the bleeder screw and the drain valve again or remove the drain hose.





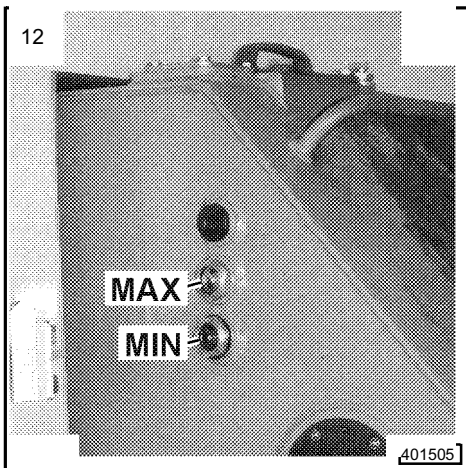
Note:

The fuel gauge on the instrument panel shows the fuel reserves in the fuel tank. (fig. 11)



NOTE

To reduce corrosion in the tank, always maintain a high fuel level.



4.1.4 CHECK THE OIL LEVEL IN THE HYDRAULIC TANK

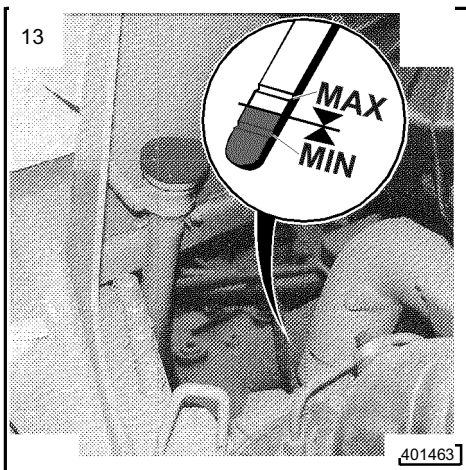
With the machine on level ground and the hydraulic cylinders retracted, the oil level may not exceed the center of the upper sight gauge (fig. 12, MAX.)

With the machine on level ground and the hydraulic cylinders extended, the oil level may not drop below the center of the lower sight gauge (fig. 12, MIN.)



NOTE

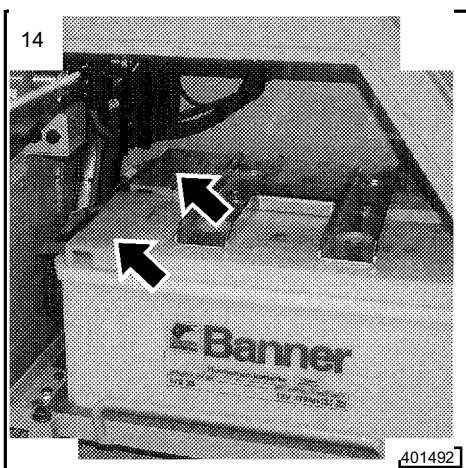
Add hydraulic oil only via the return filter. Refer to chapter 5 in this Operation and Maintenance Manual for oil specifications.



4.1.5 CHECK THE SPLITTERBOX OIL LEVEL

Check the oil level in the splitterbox with a dipstick (fig. 13). The oil level must be between the MAX. and the MIN. mark on the dipstick.

Refer to chapter 5 in this Operation and Maintenance Manual for oil specifications.

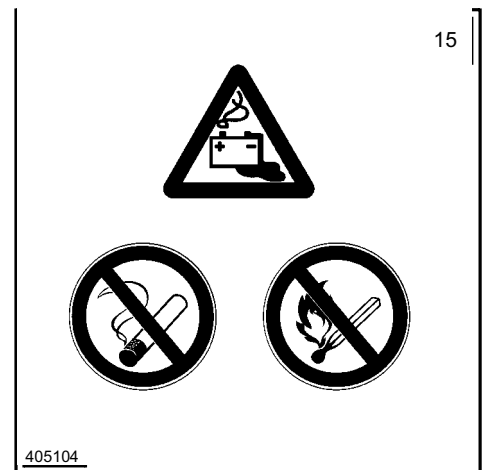


4.1.6 ELECTRICAL SYSTEM

Check all switch functions, indicators and gauges, lights, fuses as well as battery condition and installation (fig. 14).


CAUTION

When working on the battery, always wear gloves and safety glasses. Do not smoke or keep an open flame near this area.



4.2 MACHINE START UP SAFETY

- Before starting the machine, perform a thorough walk around inspection.
- Visually check the machine for loose bolts, cracks, wear, leaks and any evidence of vandalism.
- Never start or operation an unsafe or damaged machine.
- Be certain that all defects are taken care of immediately.
- Make sure that all covers and doors are closed and locked. Check if all warning and safety decals are on the machine and make sure that all of them are legible.
- Clean all windows and mirrors, secure doors and windows to prevent any inadvertent movement.
- Always enter and leave the cab through from the left over the chain. Always use the appropriate handles.
- Make sure that no one is on or under the machine. Warn all personnel in the surrounding area on the job site, before operating the machine.
- After entering the cab, adjust the operators seat, the rear view mirror, the arms rests and the seat belt as well as set belt tethers. Be certain that all controls can be reached, so you can work comfortably.
- All noise level protection devices on the machine must be operational when operating the machine.
- Never operate the machine without a cab or canopy.

4.3 ENGINE START UP SAFETY

- Before starting the engine, check all indicator lights and instruments for proper function. Place all operating and control levers into neutral position.
- Before you start the engine, warn any personnel in the surrounding area by sounding the horn .
- Start the machine only while seated in the operators seat, and with the seat belt secured.
- If no other instructions were given, follow the engine starting instructions as outlined in the **Operation and Maintenance Manual**.
- Start the engine and check all indicator lights, gauges, instruments and controls.
- Start the engine only in a well ventilated area. If necessary, open doors and windows to assure sufficient fresh air supply. Warm up the engine and hydraulic system to bring engine and hydraulic oil to operating temperature, as low oil temperatures cause the machine to be unresponsive.
- Check that all attachment functions are operating properly.

- Move the machine slowly and carefully into an open area and check all travel and brake functions, the steering function as well as the turn signals and lights.

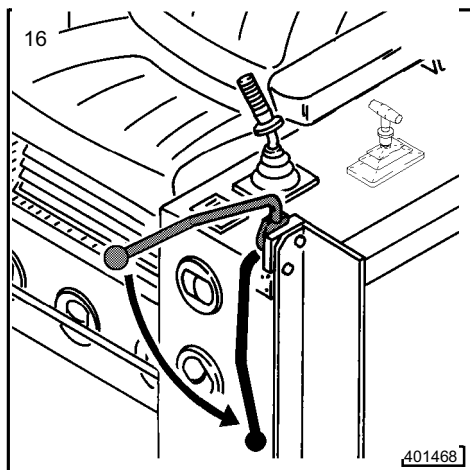
4.4 STARTING THE DIESEL ENGINE



NOTE

Do not operate the machine unless you have read and understood the instructions given in this Operation and Maintenance Manual.

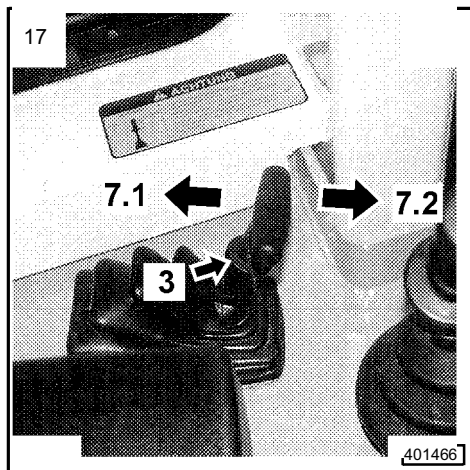
Due to the hydrostatic drive, the engine cannot be started by pushing or by towing the machine.



CAUTION

The engine can only be started with the safety lever in the full down position (fig. 16)

Should it be possible to start the engine with the safety lever in any other position, check and correct the defect.



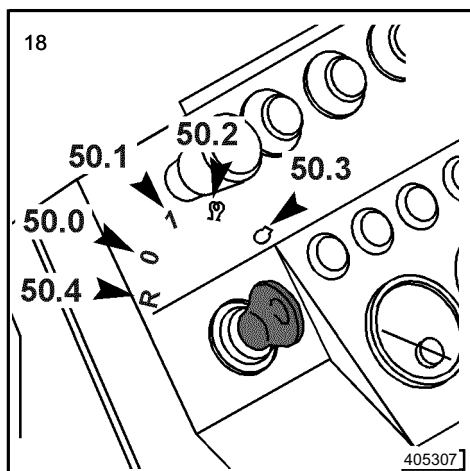
4.4.1 STARTING PROCEDURE AT AMBIENT TEMPERATURES TO - 12 C (10 F)

- Check the position of the travel lever (joystick).
- It must be in neutral position.
- Set the throttle control lever to high idle position (fig. 17, pos. 7.1).
When moving the throttle control lever, raise the knob, pos. 3.

- Turn the ignition key to position 50.1 (fig. 18) to energize the electrical system.

The following indicators and warning devices must come on:

- Indicator light - travel brake
- Indicator light - replenishing pressure
- Charge indicator light
- Indicator light - electronic
- Warning light - operators cab
- Turn the ignition key, without preheating, to position 50.3 (fig. 18) and hold it in this position until the engine starts.



As soon as the engine is running, release the ignition key - it returns automatically to operating position (50.1).

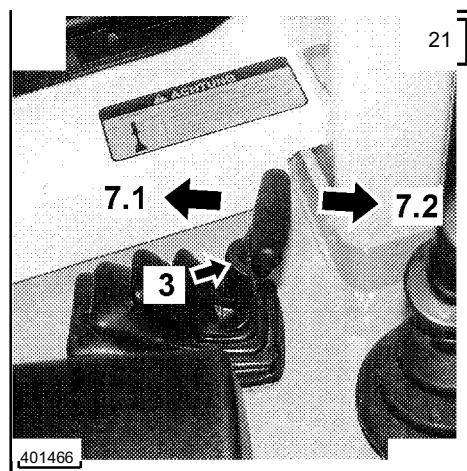
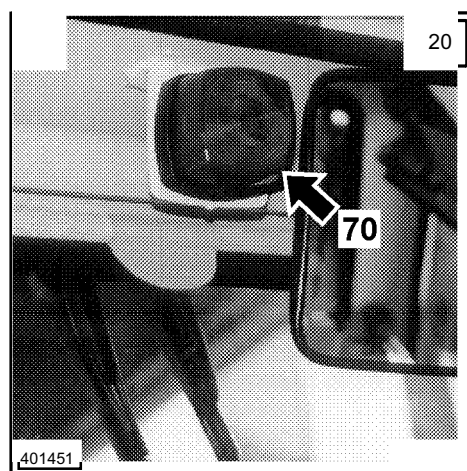
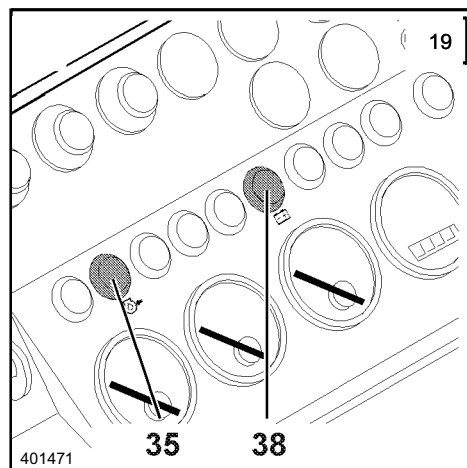
Note: Do not crank the starter for more than 10 seconds. If the engine does not start, repeat the starting procedure at 2 minute intervals.

As soon as the engine starts, the following indicators and warning devices must turn off :(fig. 19/ 20)

- Indicator light - replenishing pressure (pos. 35)
- Charge indicator light (pos. 38)
- Warning light - operators cab (pos. 70)

If the indicators and warning devices do not turn off immediately, turn the engine off and correct the problem.

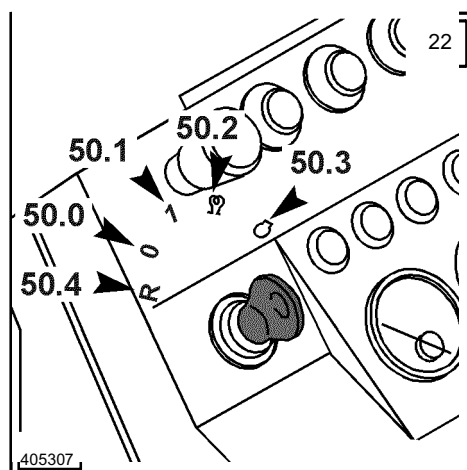
Move the throttle control lever to low idle position (fig. 21, pos. 7.2). Avoid full engine load until the system is at operating temperature.

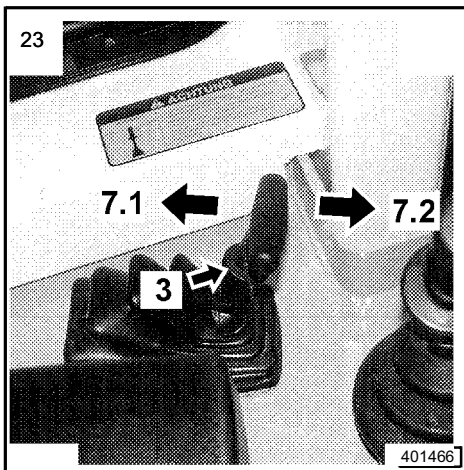


4.4.2 STARTING PROCEDURE AT AMBIENT TEMPERATURES BELOW - 12 C (10 F)

At low ambient temperatures the engine should be started with the glow plug (preheated) to improve the starting behavior.

- Check the position of the travel lever (joystick).
- It must be in neutral position.
- Bring the ignition key to position 50.1 and check the electrical system.





- Bring the ignition key to preglow position (fig. 22, pos. 50.2) and hold it in this position. As soon as the indicator light turns off, continue to turn the key to position 50.3 to start the engine.
- If the engine does not start, release the ignition key, it will automatically return to operating position (50.1).
- Set the throttle control lever to low idle (fig. 23, pos. 7.2). Avoid full engine load until the system is at operating temperature.

Note: Do not crank the starter for longer than 10 seconds. If the engine does not start, repeat the starting procedure in two minute intervals to allow the starter to cool off.

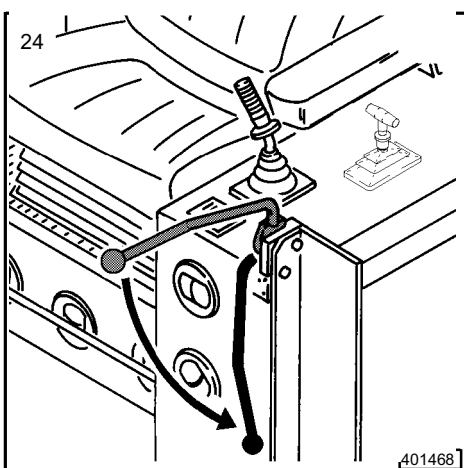


CAUTION

Do not use the preheat system if the engine is at or near operating temperature. Do not use an ether starting aid when using the preglow system (Danger of Explosion!)

4.5 MACHINE PARKING SAFETY

- Park the machine only on firm and level ground. If it becomes necessary to park the machine on a grade, it must be properly blocked with wedges to secure it and prevent any unintentional movement.
- Bring all operating levers and controls into neutral position, place the safety lever in full down position, and turn the engine off, as outlined in the Operation and Maintenance Manual, before you leave the operators seat.
- Lock the machine, remove all keys and secure the machine against vandalism and unauthorized use.
- Never park the machine in such a way as to block access to entrances, exits, ramps, fire hydrants, etc.



4.6 MACHINE SHUT DOWN

4.6.1 TURN OFF THE ENGINE

Reduce the engine speed to low idle (fig. 23, pos. 7.2) and let the engine run for a short time to lower the temperatures and to give the turbocharger time to run out.

Move the safety lever down (fig. 24), the indicator light - travel brake must light up.



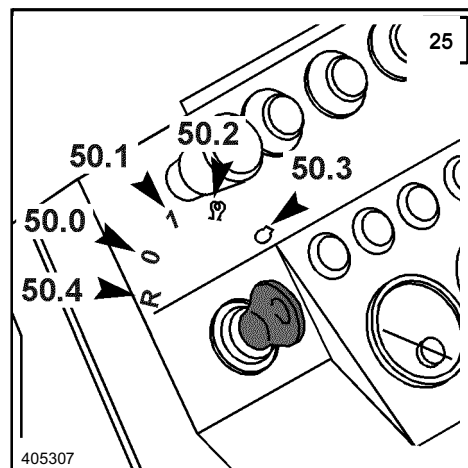
NOTE

Turn off all electrical components before turning off the ignition switch.

Turn the ignition key to position 50.0 (fig. 25) and pull it off.

All indicators and warning devices must be off.

The radio and interior lights can be used by moving the ignition key to position 50.4 (fig. 25).



4.6.2 EMERGENCY OFF BUTTON

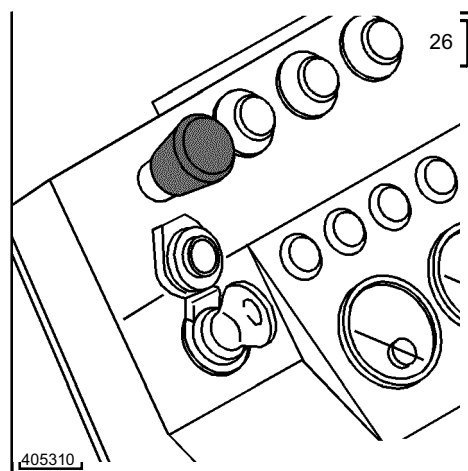


The machine stops suddenly.

To stop travel

In dangerous situations or emergencies, the machine can be stopped by pushing the emergency off button (fig. 26).

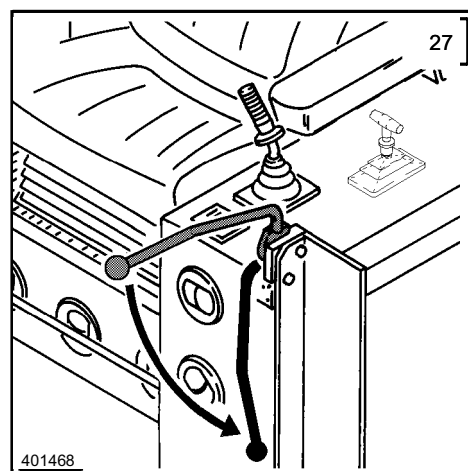
The engine continues to run, the attachment can still be operated.



To continue travel operation

Bring the joystick to neutral position. Move the safety lever in the full down position (fig. 27).

Lift the button until it engages, raise the safety lever, deflect the travel joystick to release the brake and continue travel operation.



4.7 MACHINE OPERATING SAFETY

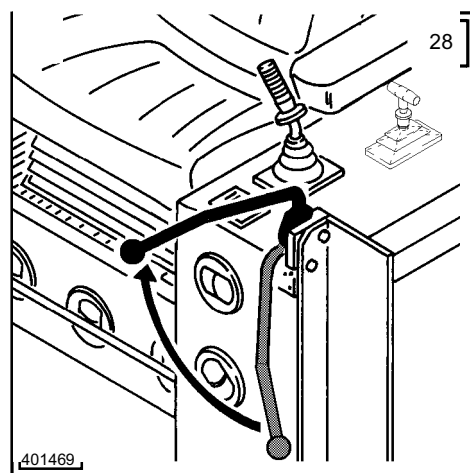
- Make sure you are aware of any special circumstances on the job site, make sure you are familiar with any special guidelines and warning signals. Familiarize yourself with the job site before starting to work, any special hindrances and obstacles influencing operation or movement, the ground conditions, and any special protection required to secure the job site from public highway traffic.
- Always keep a safe distance from overhangs, walls, drop offs, and unstable ground.
- Make sure you are especially aware of changing ground conditions, visibility or weather conditions.

4. OPERATION

- Make sure you know the location of utility lines. Be aware of underground cables, gas and water lines. You must be especially careful when working near supply lines. If necessary, contact the appropriate utility company for information and location of utility lines.
- Keep sufficient distance from electrical lines with the attachment. Avoid working near high voltage electrical lines.
 - **DANGER OF LOSS OF LIFE!**
 - You must inform yourself of proper distances to assure your safety while working.
- If you do touch an electrical line with the attachment or machine, proceed as follows:
 - DO NOT leave the machine!
 - If possible, move the machine a sufficient distance away from the danger area.
 - Warn all personnel in the surrounding area not to come close to the machine and/ or touch the machine.
 - Instruct somebody to turn the electrical power off.
 - Do not leave the machine until you are assured that the electrical line which has been touched or damaged is no longer energized, and the power has been turned off!
- Before moving or working, make sure you always check that the attachments can be operated safely.
- When moving on public highways, roads or areas, make sure you observe all applicable rules and regulations for on road travel. If necessary, bring the machine to proper operating condition.
- Always turn on the lights if visibility is poor or as dusk approaches.
- Never allow another person to ride along on the machine.
- Always work while seated in the operators seat, with the seat belt secured.
- In the event the machine should tip, remain in the operators seat, with the seat belt securely fastened. Experience has shown that it is safer to remain in the cab in the event of an overturn.
- Report any functional problems or defects immediately, and make sure that all necessary repairs are completed before resuming operation.
- Be certain that no one is endangered by moving the machine.
- Do not get up from the operators seat as long as the machine is still moving.
- Never leave the machine unattended, with the engine running.
- When traveling, make sure that the attachment is in transport position and keep the load as close to the ground as possible.
- Avoid any working movement which could cause the machine to tip or overturn. However if the machine does begin to top or slide or slip on a grade, immediately lower the attachment and load to the ground and turn the machine downhill. If possible, work downhill or uphill, never sideways on a slope.
- Always move slowly on rocky, rough or slippery ground or on a slope.
- Always adapt the travel speed to working conditions.
- Never travel on slopes that exceed the maximum permissible gradeability of the machine.
- Never travel downhill at maximum speed, always at low speed to prevent loss of control. The engine must be at nominal speed and the speed must be reduced by preselecting the low speed range. Always change to the low speed range before reaching the slope. Never move into a slope and then change the speed.
- Always have another person guide you if visibility is restricted. Always take signals from one person only.
- Utilize only experienced personnel to attach loads and direct operators. The person giving signals must be visible to the operator or be equipped with two way radios.
- When using a two way radio or Citizens Band radio (CB), the safety lever must be in the full down position.

4.8 TRAVEL FUNCTIONS

Raise the safety lever (fig. 28).

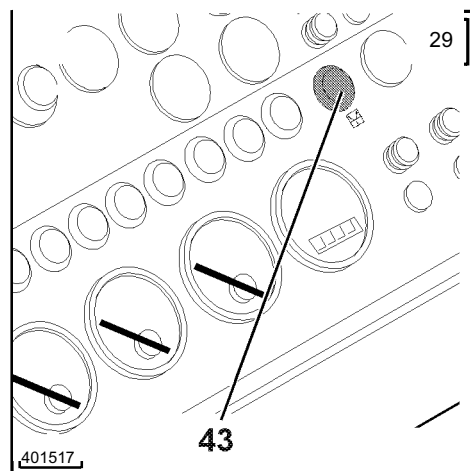


- After approx. 3 seconds, the indicator light electronic will light up for a short time (fig. 29, pos. 43). The electronic system has run through a self-test.



NOTE

Do not deflect the travel joystick until after the indicator light electronic has come on.

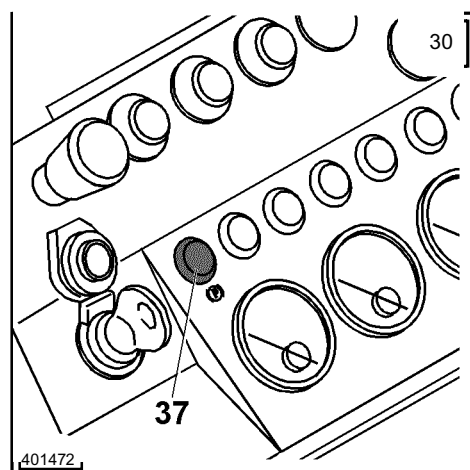


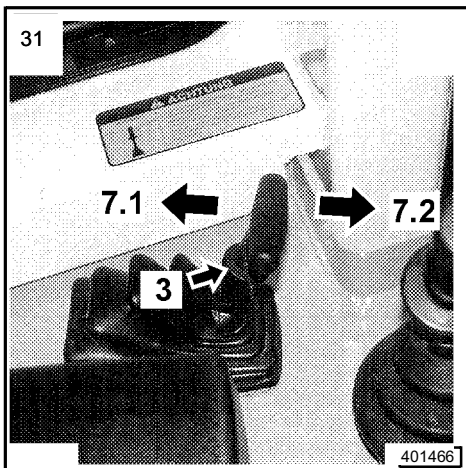
The machine is ready to travel. By deflecting the travel joystick, the parking brake is released and the indicator light must turn off (fig. 30, pos. 37).



NOTE

Certain wave lengths could cause interference with the travel operation of the machine. Before operating a two way or Citizens Band (CB) radio on the machine, turn the travel joystick to neutral position and place the safety lever in the full down position.





CAUTION

In case of an emergency or loss of machine control, immediately lower the attachment, then the safety lever.

Important:

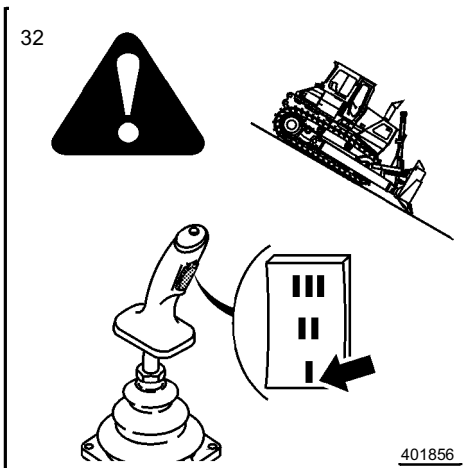
- Warm up the engine and the hydraulic system to operating temperature. Actuate all hydraulic functions to ensure that all components are heated up to operating temperature.



NOTE

As a basic rule, the machine should always be operating with the engine running at full RPM (fig. 31, pos. 7.1).

In isolated cases, the machine may be operated at reduced engine RPM.



4.8.1 PRESELECTION OF SPEED RANGES

CAUTION

When constantly pushing heavy loads, when working on inclines and slopes, the low travel speed (position I) must be pre-selected (fig. 32).

The machine is equipped with a rocker switch on the travel joystick to pre-select the travel speed. By switching to position II and position I, the full travel speed can be reduced.

The travel speed ranges can also be selected while traveling.

The machine is hydrostatically slowed down when shifting back from the full travel speed range.

Full speed range

- Rocker switch pressed on top - (fig. 33) Position III
Speed 0 to 11 km/hr. (0 to 6.8 mph)

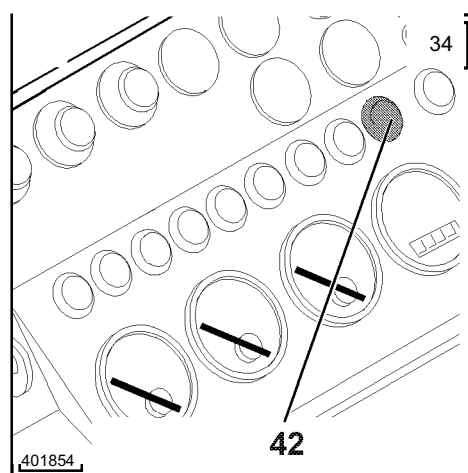
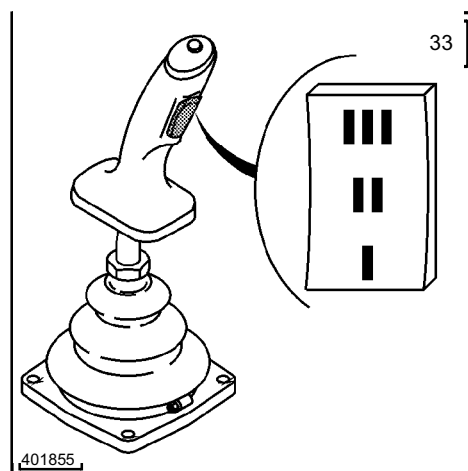
Medium speed range

- Rocker switch in center position - (fig. 33) Position II
Speed 0 to 6.5 km/hr. (0 to 4 mph)

Low speed range

- Rocker switch pressed on the bottom - (fig. 33) Position I
Speed 0 to 4 km/hr. (0 to 2.5 mph)

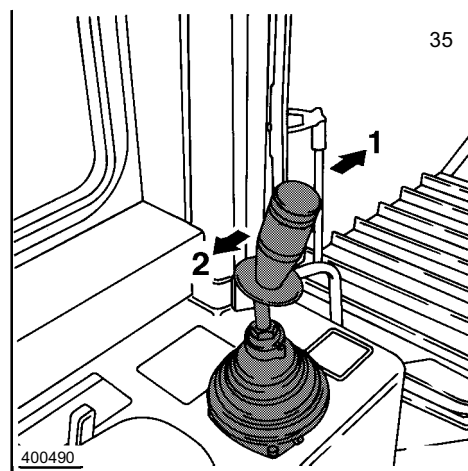
In low and medium speed range, the indicator light (reduced speed range) in the instrument panel (fig. 34, pos. 42) lights up.

**4.8.2 STRAIGHT TRAVEL****TRAVEL FORWARD**

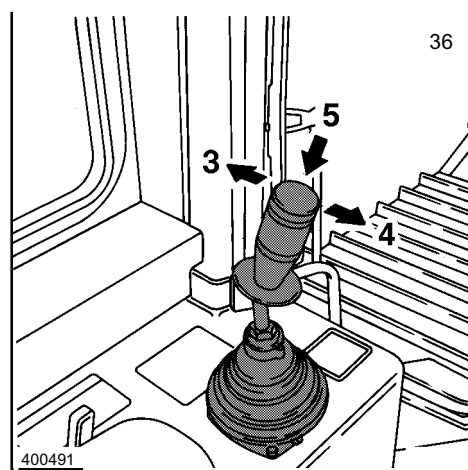
Push the travel joystick slowly forward. The more the lever is pushed forward, the higher the travel speed will be (fig. 35, pos. 1)

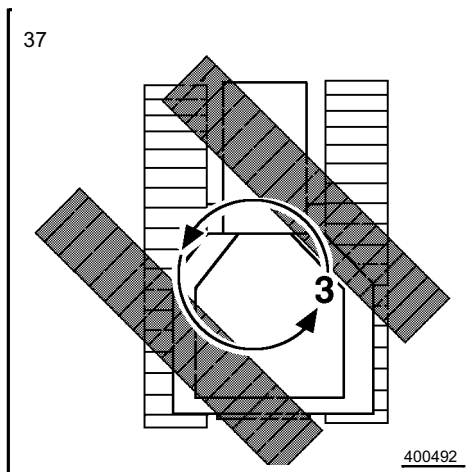
TRAVEL REVERSE

Pull the travel joystick slowly backward. The more the travel joystick is pulled back, the higher the travel speed will be (fig. 35, pos. 2)

**4.8.3 VARIOUS TRAVEL FUNCTIONS**

In addition to forward and reverse and counter-rotation, the operator can make any type of turn in forward and reverse, at various speeds (fig. 36).





4.8.4 COUNTERROTATION



NOTE

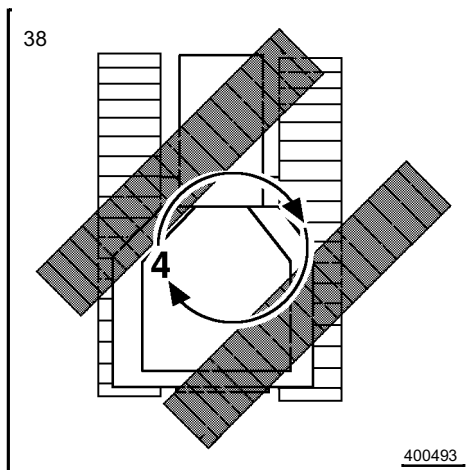
During counter-rotation, the two tracks turn in opposite direction.

The counter-rotation speed depends directly on the joystick deflection.

Counterclockwise (left hand) turn

Press the button on the travel joystick (fig. 36, pos. 5) and push the travel joystick to the left at the same time (fig. 36 / 37, pos. 3).

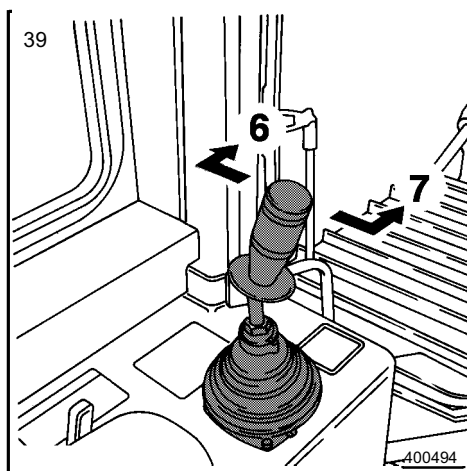
The more the joystick is moved to the left, the faster the machine will counter-rotate to the left.



Clockwise (right hand) turn

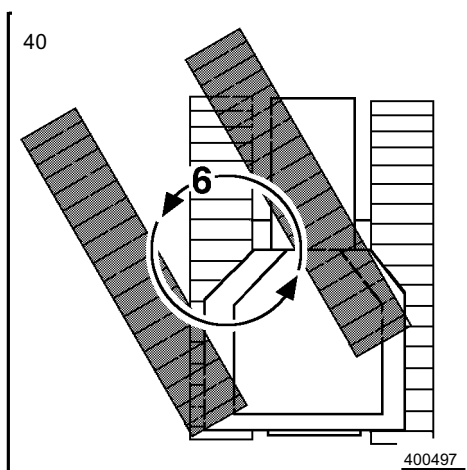
Press the button on the travel joystick (fig. 36, pos. 5) and push the travel joystick to the right at the same time (fig. 36 / 38, pos. 4).

The more the joystick is moved to the right, the faster the machine will counter-rotate to the right.



4.8.5 PIVOT TURN

In addition to forward, reverse and counter-rotation, the operator can make any turn in forward and return.



Pivot turn - left forward

Push the travel joystick to the left and slowly forward (fig. 39 / 40, pos. 6)

Pivot turn - right forward

Push the travel joystick to the right and slowly forward (fig. 39 / 41, pos. 7)

4.8.6 TURNING - POWER TURN**Power turn - left forward**

Move the travel joystick forward and slowly to the left. The machine will now travel forward with a slight left hand turn, both tracks are turning. The further the joystick is deflected to the left, the sharper the turn will be (fig. 42).

Power turn - right forward

Move the travel joystick forward and slowly to the right. The machine will now travel forward with a slight right hand turn, both tracks are turning. The further the joystick is deflected to the right, the sharper the turn will be (fig. 42).

4.8.7 BRAKES

The hydrostatic travel drive is also an operating brake. By moving the travel joystick towards the direction of neutral position, the travel speed will be reduced in the same ratio.

By placing the travel joystick into neutral position, the hydrostatic drive will keep the machine from rolling off.

If the travel joystick is in neutral position, the parking brake is automatically applied after approx. 5 seconds. The attachment functions remain operational.

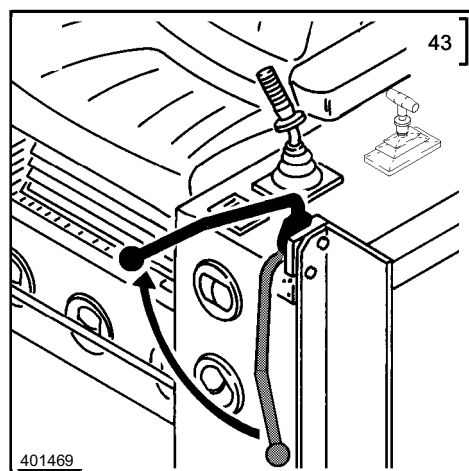
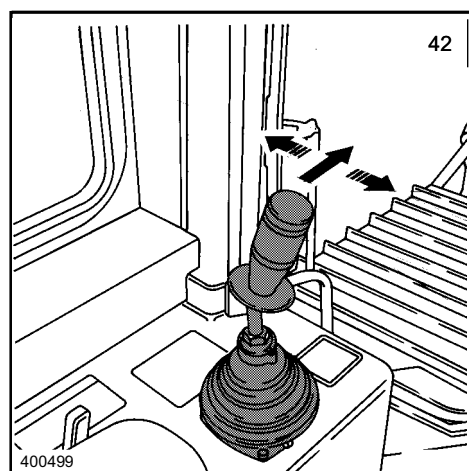
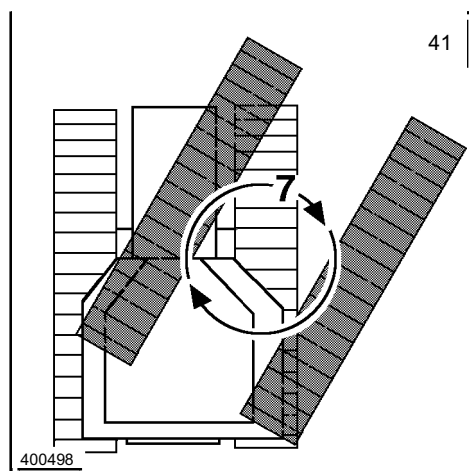


Moving the travel joystick into neutral position too fast during travel causes the machine to stop suddenly and abruptly.

The parking brake is applied:

- by placing the safety lever in the full down position.
- if the travel joystick remains in neutral position for more than 5 seconds.
- if the travel joystick is in neutral position and the chains continue to turn another 2 cm.

The parking brake is released by raising the safety lever - with the engine running - and then deflecting the travel joystick (fig. 43).



 CAUTION

The safety lever must always be in the full down position when the engine is not running. If the engine has been turned off inadvertently, place the travel joystick in neutral position and bring the safety lever in the full down position to apply the parking brake.

4.9 WORKING WITH THE ATTACHMENT

 DANGER

Never work or allow work underneath or on the attachment unless it is properly supported or placed on the ground. Never remain or allow anyone to remain under a suspended load! This is strictly prohibited!

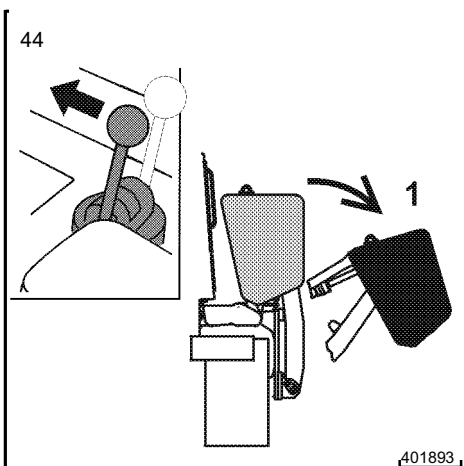
Note: All attachment functions are servo controlled for easy, comfortable and precise operation.

To operate the attachments, the safety lever must be raised.



NOTE

Before operating the rear winch, the operator's cab must be secured with a protective grill.



4.9.1 EXTEND / RETRACT THE COUNTERWEIGHT

Depending on the lever deflection, the counterweight can be extended or retracted by moving the counterweight control lever.

To extend:

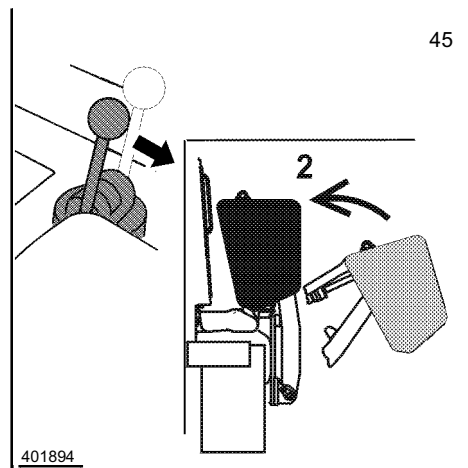
- Move the lever to the front (fig. 44, pos. 1).

To retract:

- Move the lever to the rear (fig. 45, pos. 2).

⚠ DANGER

Before lifting a load, make sure that the counterweight is fully extended.



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4.9.2 LIFT / LOWER THE BOOM

By moving the boom control lever sideways, the boom can be raised or lowered at various speeds.

To lift the boom:

Push the boom control lever to the right (fig. 46 / 47, pos. 1).

To lower the boom:

Push the boom control lever to the left (fig. 46 / 47, pos. 2).

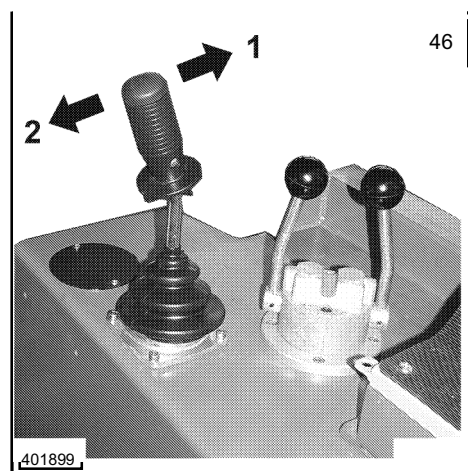
Depending on the lever deflection, the boom can be returned to the desired working position at various speeds.

**NOTE**

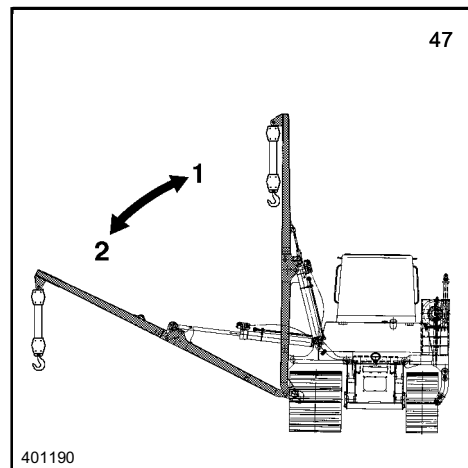
When the boom control lever is released, it returned automatically to the neutral position. The boom remains in the preset working position.

The uppermost position of the hook block is secured via a limit switch. When the boom is lowered, the hook block is raised and the limit switch can be actuated.

The working cycle can be continued by lowering the hook block.



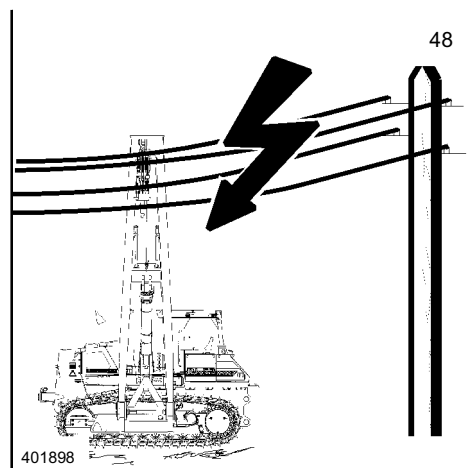
46



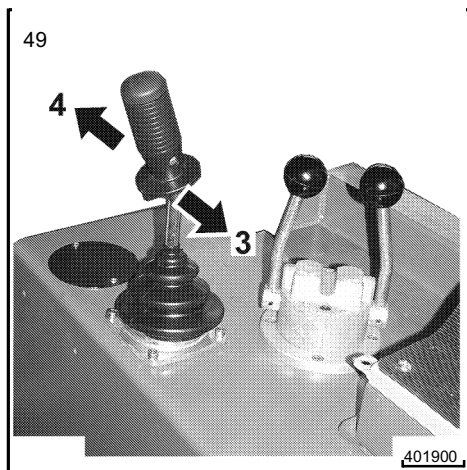
47

⚠ DANGER

When the boom is raised, make sure there is sufficient distance to overhead wires.



48



4.9.3 RAISE / LOWER THE HOOK BLOCK

By moving the boom control lever to the front or to the rear, the hook block is raised or lowered, the speed depends on the lever deflection.

The top position of the hook block (hook block on top) is secured by a limit switch.

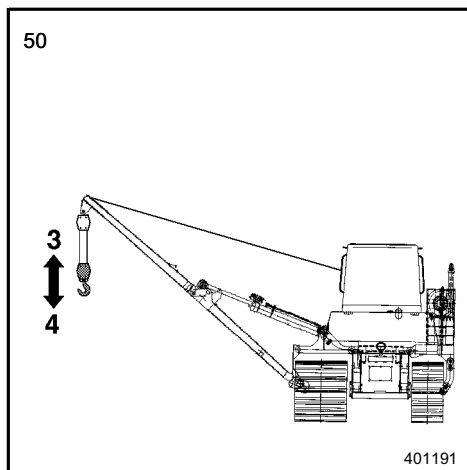
Raise the hook block

- Pull the boom control lever to the rear (fig. 49/ 50, pos. 3).

Lower the hook block



For safety reasons, the hook block may only be lowered to the point where at least five coils of cable remain on the cable drum.



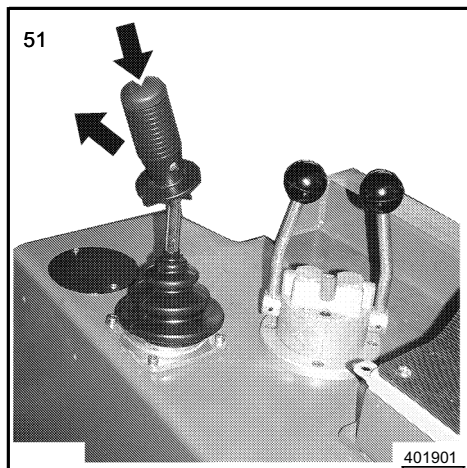
- Push the boom control lever to the front to lower the hook block (fig. 49/ 50, pos. 4).

4.9.4 FREE FALL DEVICE

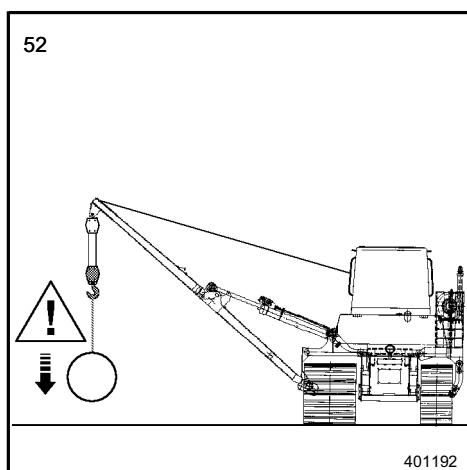
As a safety device to prevent the machine from tipping over, the hoist winch includes a free fall device.



The free fall device may only be used in an emergency, to be able to quickly lower a raised load.

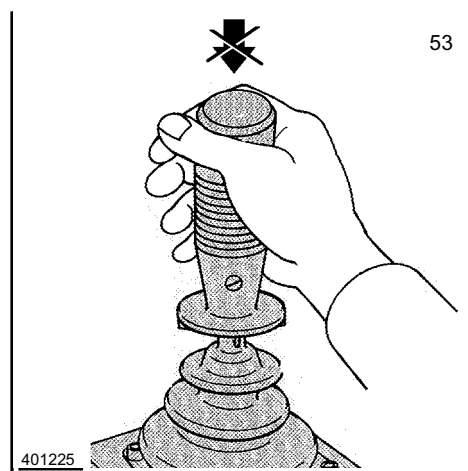


- Press the button on the boom control lever and move the boom control lever all the way to the front in direction 'hook block down' (fig. 51/ 52). A raised load will drop freely to the ground.

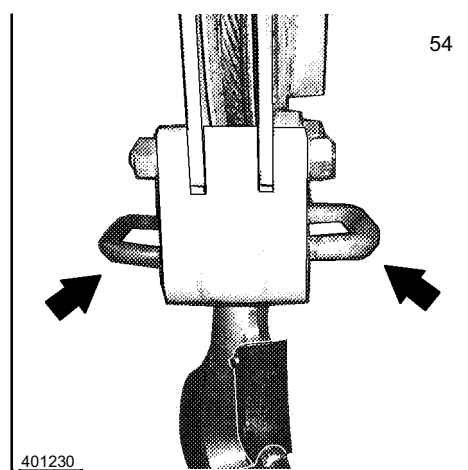


! DANGER

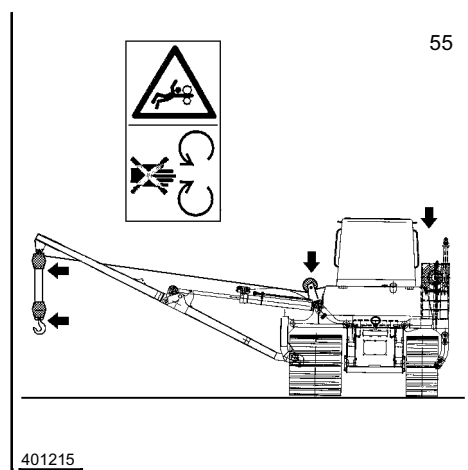
To prevent inadvertent actuation of the free fall button, always keep your hand around the boom control lever when working (fig. 53).

**4.9.5 ATTACHING LOADS**

Two handles are installed to guide the hook block when attaching loads. The hook block may only be brought into position with the two handles (fig. 54).

**! DANGER**

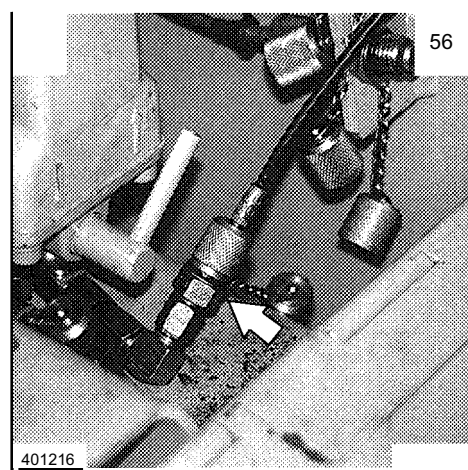
When working, make sure not to get your fingers or loose clothing into the intake areas (fig. 55). This could result in serious injuries!

**4.9.6 SET DOWN A LOAD IN AN EMERGENCY**

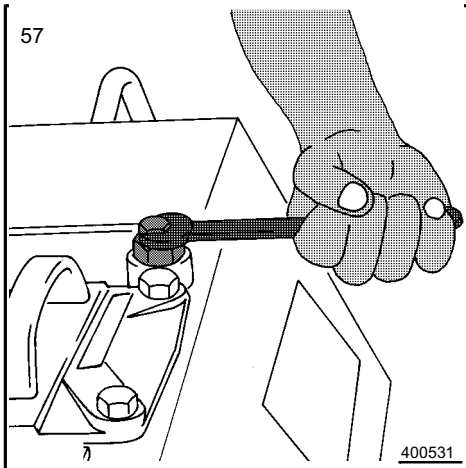
In case of failure of the Diesel engine or a drop in replenishing pressure, a load suspended from the hook can be lowered with auxiliary tools supplied in your tool box.

Procedure:

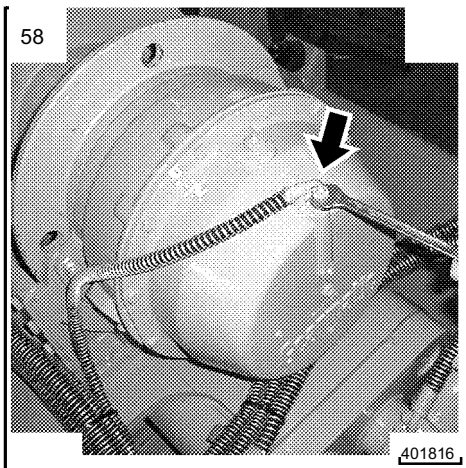
- Take the mini test line and fittings from the tool box.
- Open the battery box and connect the mini test line on the 'RAISE' connection on the hand pump (fig. 56).



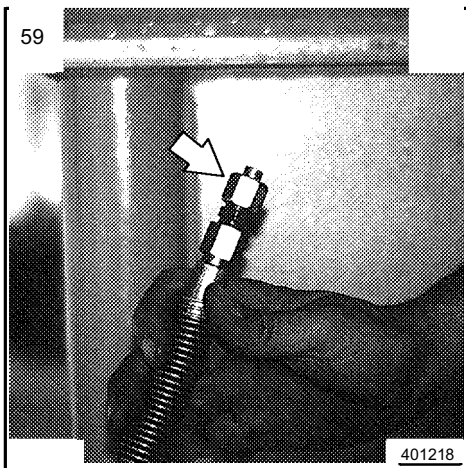
4. OPERATION



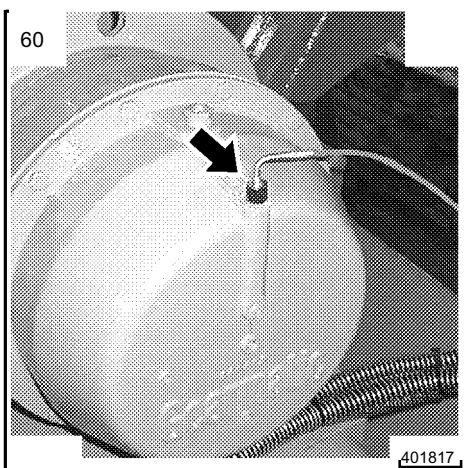
- Relieve the pressure in the hydraulic tank by opening the bleeder valve by one turn (fig. 57).



- Remove the hydraulic line for the free fall device on the cable winch (fig. 58).



- With the screw plug fitting, close off the hydraulic line (fig. 59).



- Install the fitting on the connection, which is now free, and connect the mini test line (fig. 60).

- From the tool box, remove the extension pipe. Set the lever on the hand pump to 'RAISE' (fig. 61, pos. 1).

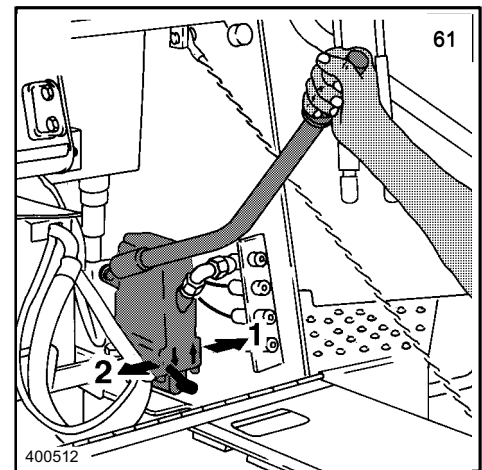
⚠ DANGER

DANGER OF ACCIDENTS! The load will suddenly drop!

- Actuate the hand pump until the load starts to drop.

⚠ CAUTION

Before putting the machine back into service, check if the installed parts for the lowering procedure have been removed again and the machine is again in series condition.



4.10 CRUSHING AND BURN PREVENTION

- Never work underneath the attachment, unless it is safely placed on the ground or properly blocked and supported.
- Never use damaged or insufficient load carrying devices, such as chains, ropes, ... Always wear gloves when handling wire ropes or cables.
- When working on the attachment, never align bores with your fingers, always use proper alignment tools when installing, changing or servicing attachments.
- When the engine is running, make sure that no objects touch the radiator fan. Rotating fans will swirl and throw out objects which can become very dangerous, and in addition to damaging the fan, they can cause severe injury to yourself and others.
- Avoid contact with components containing coolant. At or near operating temperature, the engine coolant is hot and under pressure and could cause severe burns.
- Check 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. Make sure there are no sparks and open flames in the vicinity.
- Never permit anyone to hand-guide the attachment to its proper position.
- Secure the engine compartment doors in open position to avoid unwanted closing.
- Insure that all engine and battery compartment doors are closed and locked before operating the machine.

- Never work underneath the machine unless the machine is properly blocked and supported.

4.11 MACHINE TOWING SAFETY

- Always follow the correct procedure: Refer to the Operation and Maintenance Manual section Towing the machine.
- Tow the machine only in exceptional cases, such as removing the machine from a dangerous area.
- Be sure that all towing and pulling devices, such as cables, hooks etc. are safe and adequate.
- The cable or towing bar, which is used to tow the machine must be adequate to pull the machine and must be connected to the appropriate bores and couplers. Any damage or accident which is the direct result of towing this machine is expressly excluded from the manufacturer's and/or LIEBHERR's warranty.
- Never allow anyone to stand near the cable or on the machine while pulling or towing.
- Keep the cable tight and free of kinks.
- Carefully pull the cable tight, do not jerk! A sudden jerk can cause a slack cable to snap.
- When towing, keep the machine straight and maintain, permissible speed and route.
- When returning the machine to operation, proceed as stated in the Operation and Maintenance Manual.
- After the towing the machine, and before continuing operation, be certain to return the machine to a safe operating condition.

4.12 TOWING THE MACHINE

In case of a problem with the hydrostat, the machine should be repaired on site, and should only be towed if it is absolutely necessary to move the machine from a danger zone.



Improper towing of a disabled machine may be dangerous and could result in severe injury or death!

Always block and secure the machine to prevent it from moving before releasing the brakes!

When towing a machine, observe all safety rules and follow the recommended guidelines.



NOTE

Towing a machine is risky and the operator always bears the full responsibility.

Defects or accidents which may occur during the towing procedure are never covered by the manufacturer's warranty.

The following towing instructions should only be used in emergency situations, to move a disabled machine for a short distance, at a travel speed of no more than 2 km/hr. (1.2 mph), to a place where it can be repaired or hauled off.

Always haul a machine over long distances!

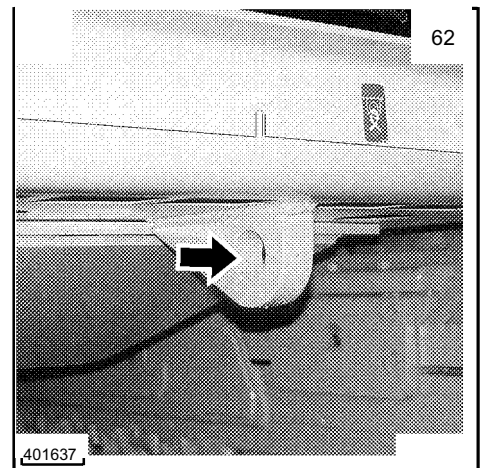
The machine is equipped with a parking brake, which is released with hydraulic pressure, the hydrostat acts as an operating brake. Should the machine become disabled, the parking brake is applied and the machine cannot be moved.

Before the machine is towed, observe the following safety rules:

- Never allow anyone to stand near or on the machine, which is being towed.
- Do not use chains for towing, chains may break and cause serious injury. Use only wire cables or a towing bar.
- Be certain that the operator of the towing machine is protected in case the cable snaps or the towing bar breaks.
- Check all towing devices, such as hook, towing cable and couplings for function and safety, make sure they are safe and adequate.

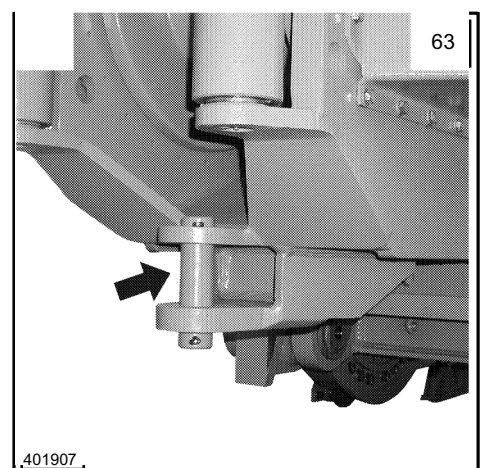
- Connect the towing cable only to the appropriate hooks or couplings.

- Towing device, front (fig. 62)

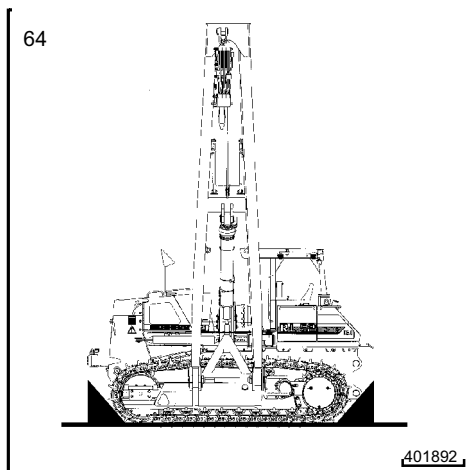


- Towing device, rear (fig. 63)

- The maximum permissible pull force on the towing device is 1.5 x the total weight of the machine (maximum permissible pull power = total weight of the machine x 1,5). For total weight, see Technical Data, chapter 1.
- All items used for the towing procedure (towing bar, cables, shackle, etc.) must also meet the pull force requirement of 1.5 x the total weight of the machine. Keep the towing cable or towing bar as short as possible.



- Keep the angle of the towing cable in relation to the machine to a minimum. The angle should never exceed 30° from the length axle.
- Move the machine slowly and evenly.
If the machine is moved unevenly, the towing cable or the towing rod may be overloaded and break.
- When towing the machine on a hill, the towing machine must be at least as large as the machine being towed.
Power, weight and brake force of the towing machine must be adequate to keep both machines under control.
If necessary, add a machine of the same size to the rear for braking purposes.



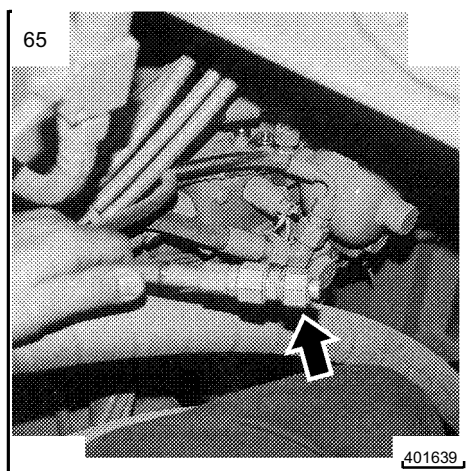
Prepare the machine for towing

In order to tow the machine, the hydrostat must be short circuited and the parking brake must be released.

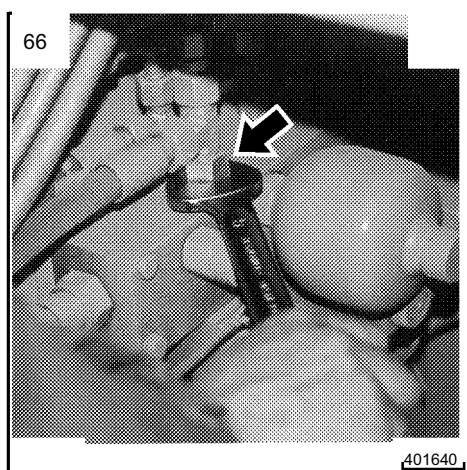
⚠ DANGER

Always block and secure the machine before disconnecting the brakes (fig. 64).

- Raise the cab, as described.

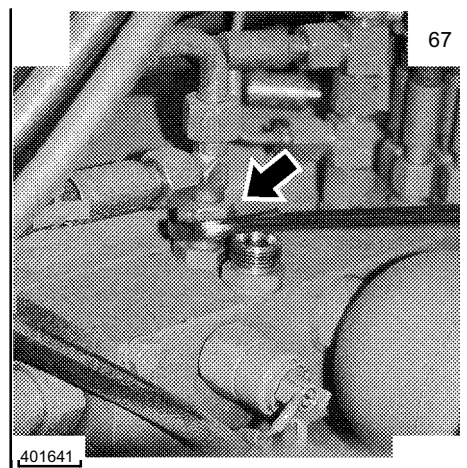


On the free hydraulic hose (connection 'A') on the hand pump, which is attached on the brake pressure hose, remove the union nut and the fitting (fig. 65).

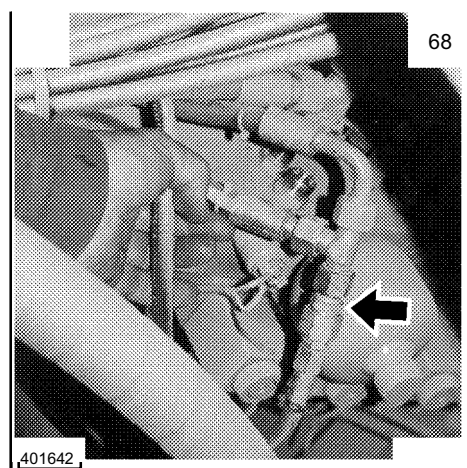


- To be able to remove the brake pressure hose, the hydraulic hose must be removed (fig. 66).

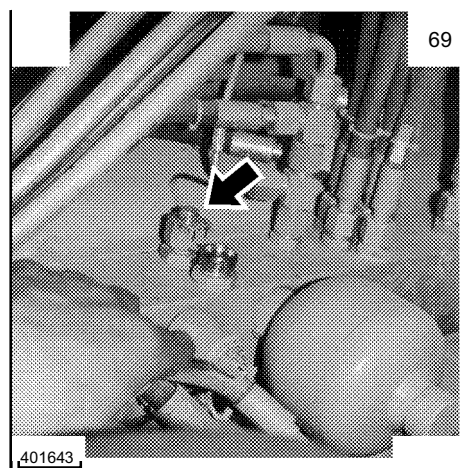
- Remove the brake pressure hose on the brake valve (fig. 67).



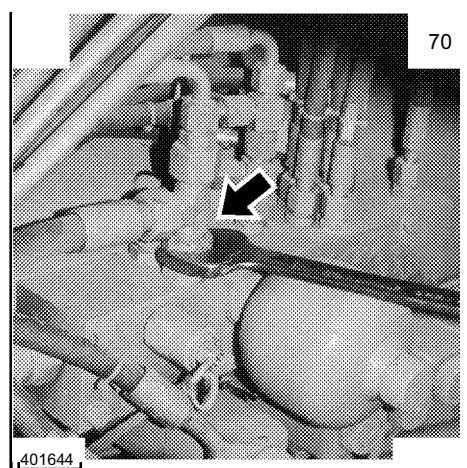
- Connect the brake pressure hose with the hydraulic hose on the hand pump (fig. 68).



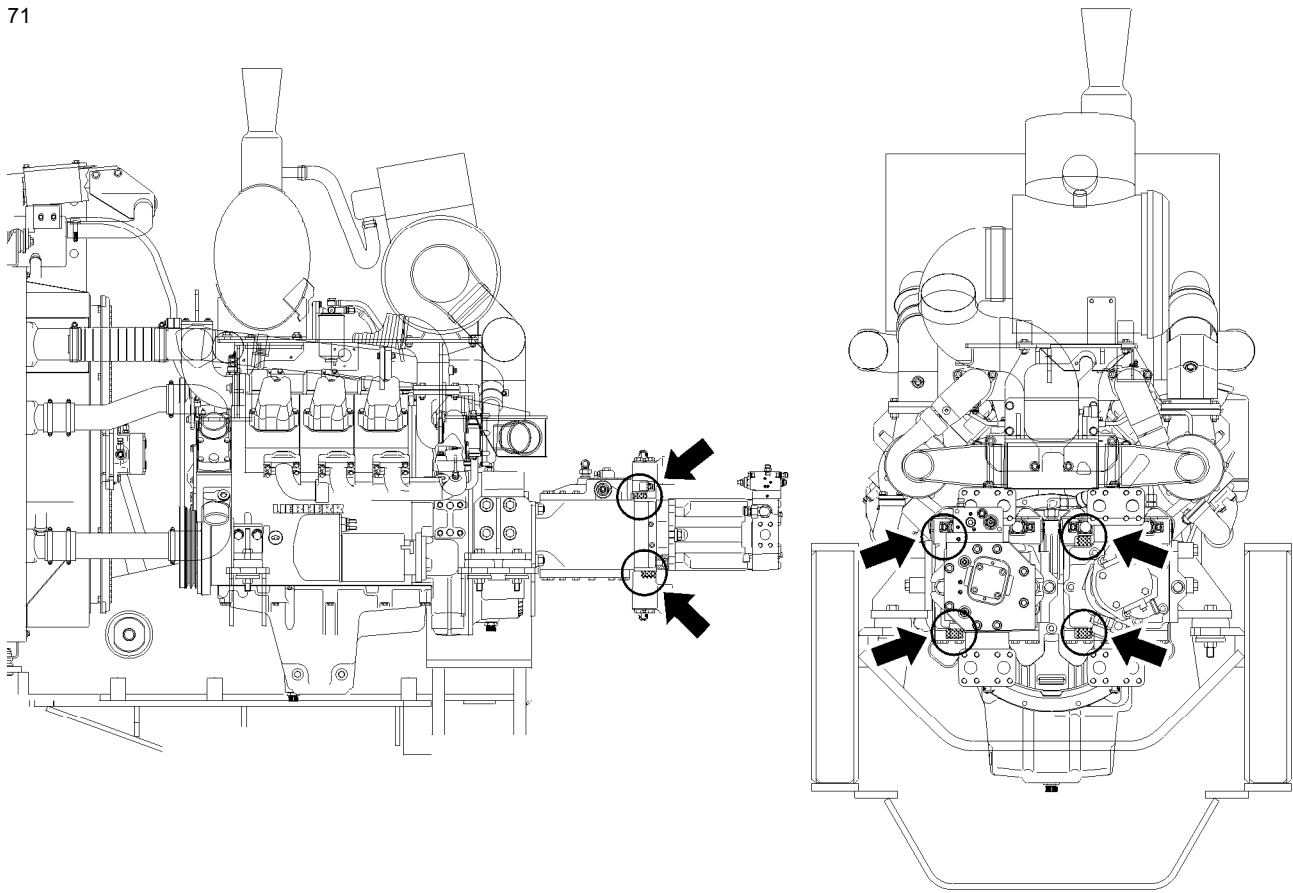
- Connect the now released connection on the brake valve (connection 'B') with the fitting and the union nut (fig. 69).



- Reinstall the hydraulic hose, which was removed for the removal of the brake pressure hose (fig. 70).

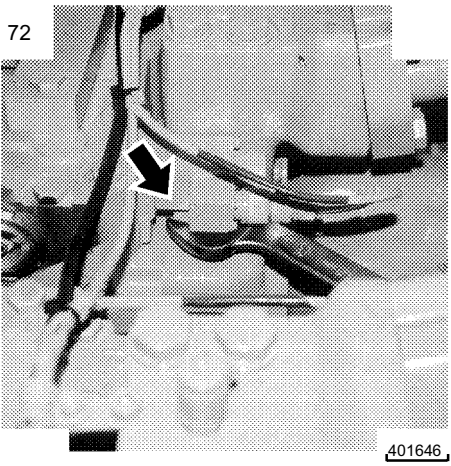


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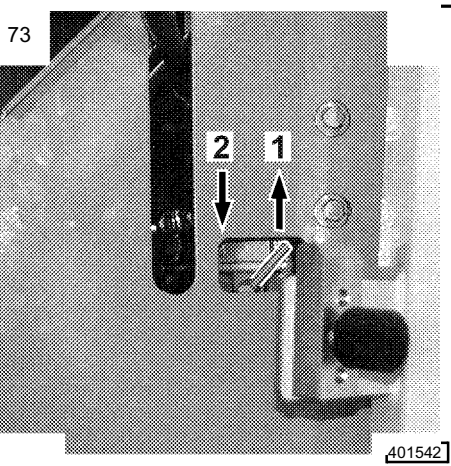
72



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- On the variable displacement pumps, open the high pressure valves (4 each) on the left and the right hand side by turning them (fig. 71).
- approx. 3 to 4 turns (use wrench size 32) (fig. 72)
- Lower the cab as described before, but **do not** attach on the carrier frame.
- Secure the machine to prevent it from rolling off.

73



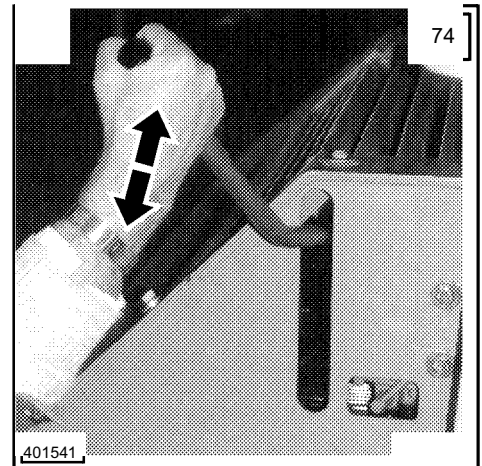
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- Set the lever on the hand pump to 'up'. (fig. 73, pos. 1). The parking brake is released by actuating the hand pump.

- Actuate the hand pump (fig. 74) until a noticeable pressure increase can be felt or until the cab starts to rise.

⚠ DANGER

The brake is now released and the machine can be towed. Observe all previously mentioned safety precautions!

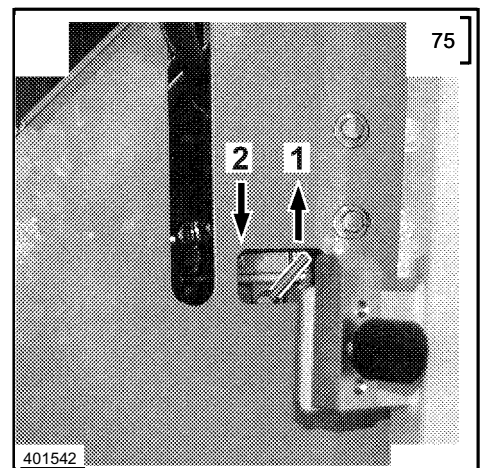


NOTE

After the towing procedure, move the lever on the hand pump to 'down' to apply the parking brake again (fig. 75, pos. 2).

⚠ CAUTION

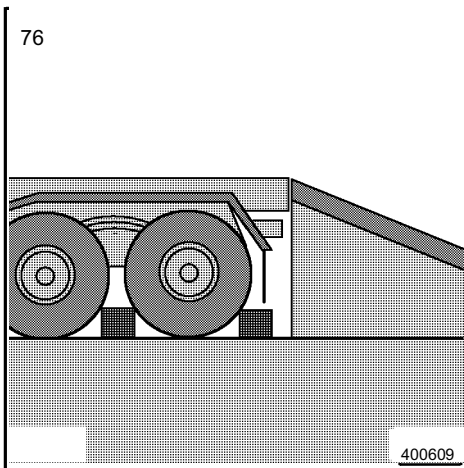
Before returning the machine to service, make sure that all items used for the towing procedure have been removed and that the machine has been returned to its original condition.



4.13 MACHINE TRANSPORTING SAFETY

- The boom must be folded in for transport.
- Use only safe transportation and tackle with adequate carrying capacity.
- If necessary, remove part of the attachment for transport.
- Never use a ramp that is steeper than 30° to move the machine onto a transporting vehicle, the ramp should be covered with wooden planks to prevent slipping.
- Before moving onto the ramp, remove any snow, ice or mud from chains or wheels.
- Align the machine with the ramp.

- Use another person as a guide to signal you, the operator. Move very slowly and carefully towards the ramp and the transport vehicle.
- Secure the machine and all remaining parts with chains and wedges to prevent slipping or movement during transport.
- Relieve pressures from hydraulic lines and hoses, remove the ignition key, lock the cab and all covers before leaving the machine.
- Carefully check out the transporting route beforehand. Check any regulations regarding width, height and weight.
- Make sure there is enough clearance underneath all bridges and underpasses, utility lines and tunnels.
- during off loading, use the same care and caution as during the loading procedure. Remove all chains, wedges and blocks. Start the engine as noted in the Operation and Maintenance Manual. Carefully move the machine from the trailer platform down the ramp. Use a guide to signal you.



4.14 TRANSPORTING THE MACHINE ON A TRAILER OR RAILCAR

4.14.1 LOADING THE MACHINE

If necessary, remove part of the attachments on the machine for transport.

Secure the transporting vehicle (trailer, low boy, railcar, etc.) to prevent it from rolling off (fig. 76).

The loading ramp incline should not exceed 30° and should be covered with wooden planks, to prevent the machine from sliding.

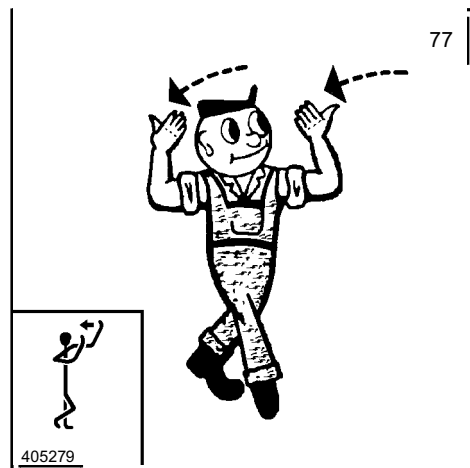


Be certain the loading ramp is positioned on firm and level ground and is rated for the weight of the machine. Make sure no one is endangered in case the machine should slide or fall of the ramp.

Do not perform steering or turning movements on the ramp.

- Remove all mud, snow and ice from the track components before moving onto the ramp.

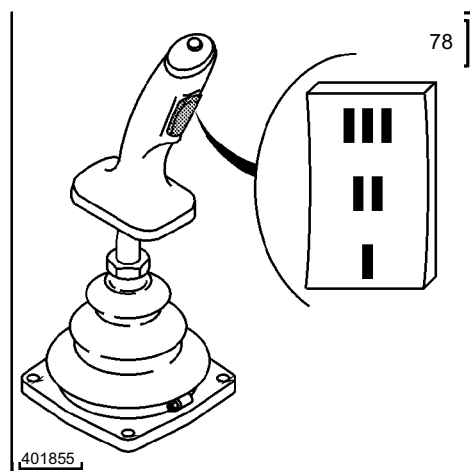
- The machine may be loaded in forward or reverse. In any case, always have another person guide and signal you (fig. 77).



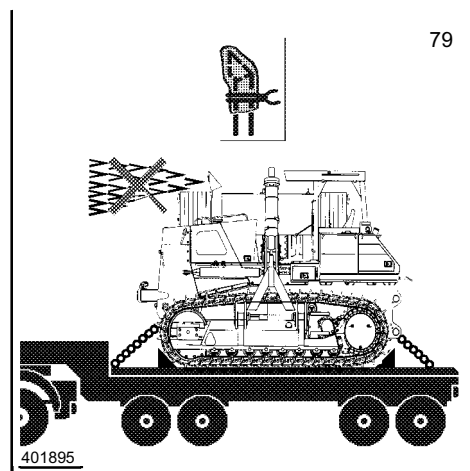
NOTE

Select the low travel speed range to drive onto the ramp and transport vehicle (fig. 78, pos. I).

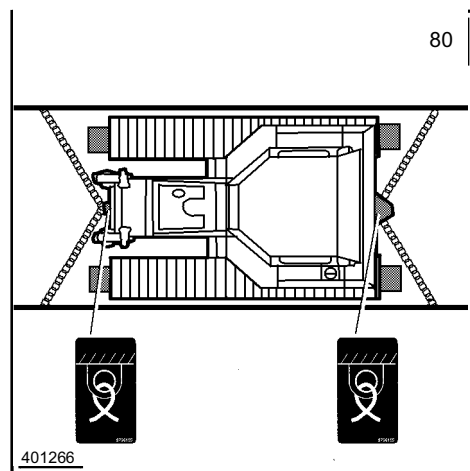
- On the transport vehicle, park the machine properly.
- Close and lock all doors, covers, hoods and windows on the machine.



- Cover the exhaust (fig. 79)!



- Rig the machine on the intended tackle points and the rigging bars on the transport vehicle, use chains in crosswise direction to secure the machine. Place wedges before and behind the tracks to prevent the machine from slipping (fig. 80)



CAUTION

Be certain the machine is properly secured on the transport vehicle to prevent it from rolling, sliding or tipping!

4.14.2 TRANSPORTING

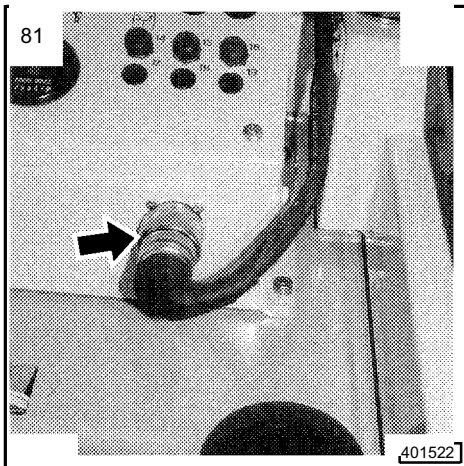
Observe all traffic regulations and other laws in regard to weight, width and length of the machine to be transported!

Carefully check out the transporting route beforehand. Check that there is enough clearance underneath all bridges and underpasses, utility lines and tunnels. Be aware of weight, height and width restrictions. If necessary, obtain special permits.

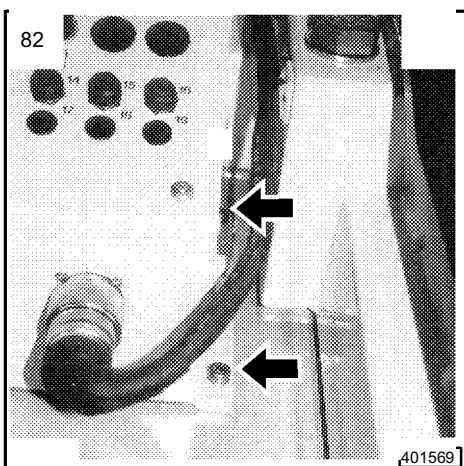
In case the height of the machine has to be reduced, the smoke stack or the cab / canopy can be removed.

**NOTE**

For Technical Data, dimensions and weights, see chapter 1.

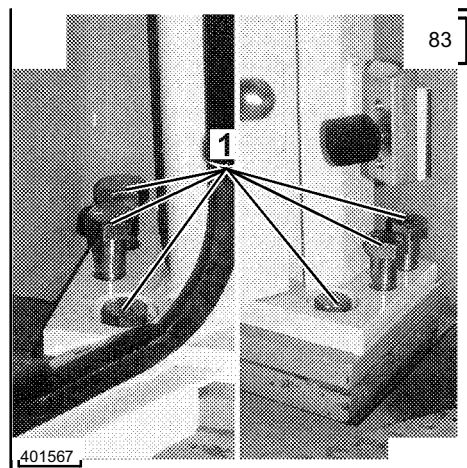
**4.14.3 REDUCING HEIGHT FOR TRANSPORT
REMOVING THE CAB / CANOPY**

- Disconnect the wiring harness for the cab from the instrument panel by disconnecting the screw fitting.

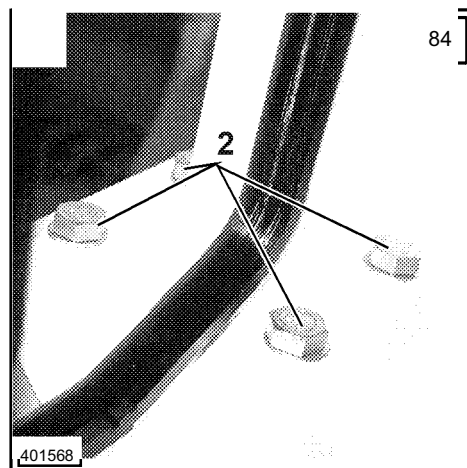


- Remove the four screws on the instrument panel (fig. 82) and slide the panel slightly towards the seat so that the panel is not damaged when raising the cab / canopy.

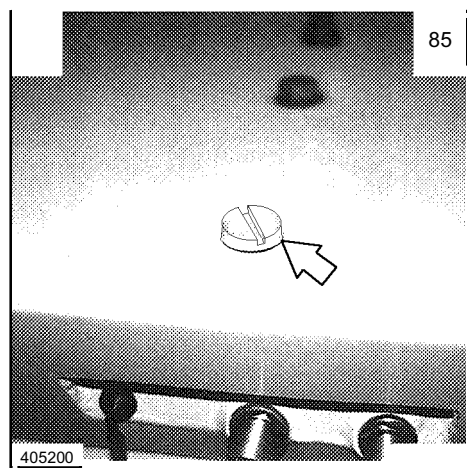
- Remove the mounting screws for the cab on the left and right front (fig. 83, pos. 1).



- Remove the mounting screws for the cab on the rear, inside and outside (fig. 84, pos. 2).



- Remove the screw plug from the roof of the cab (fig. 85).
- Remove lifting eye bolt from the tool box and screw into the cab roof.
- Carefully lift the cab on the intended tackle points.
- Set the cab down carefully and secure it to prevent it from tipping over.

**NOTE**

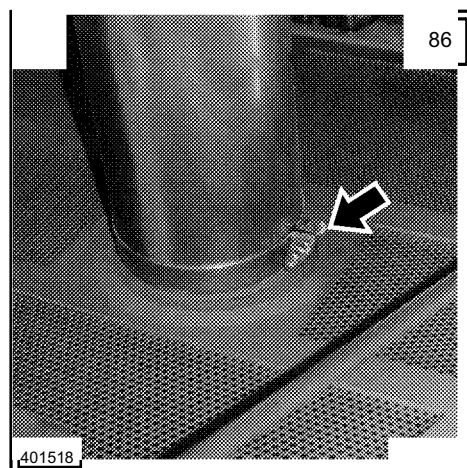
Protect the cab as well as the exposed operator's platform from exposure to the elements (rain, snow, etc.).
Install in reverse order.

REMOVE THE SMOKE STACK

Loosen the lock screw on the smoke stack and remove it from the engine cover by turning it slightly to the left and right (fig. 86).

**NOTE**

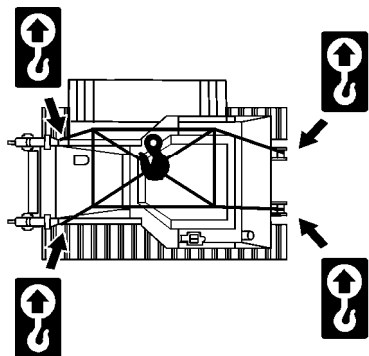
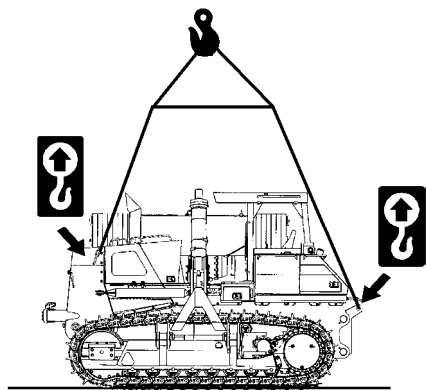
As soon as the smoke stack is removed, cover the opening to prevent moisture infiltration.



4.15 SAFETY REGULATIONS FOR LOADING A MACHINE WITH A CRANE

- Remove the boom or bring it to transport position.
- Bring all control levers into neutral position.
- Turn the engine off, according to the Operation and Maintenance Manual, and move the safety lever in the down position, before leaving the operators seat.
- Close all doors, covers and hoods.
- Only experienced, specially trained personnel may attach loads and signal the operator. The guide must be within the visibility of the operator or be in direct voice contact via a two way radio.
- Attach the lifting devices only to the brackets / bores on the machine, which have been installed for this purpose.
- Make sure the lifting devices are long enough.
- Lift the machine carefully!
- **CAUTION! Make sure that nobody is underneath the raised machine. This is strictly prohibited!**
- When putting the machine back in service, proceed as described in the Operation and Maintenance Manual.

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4.16 LOADING THE MACHINE WITH A CRANE

Be sure that the lifting devices used to load the machine are of sufficient load carrying capacity.

To lift the machine, attach the hoist cables on the eye hooks installed for this purpose (fig. 87).

**DANGER**

Never step or stand underneath the suspended load / raised machine.

When loading, rigging or lifting the machine, always use the intended rigging points.

The machine may only be lifted if the special equipment eye hooks are installed (fig. 87).

For retrofit installation, contact your Liebherr dealer or company for eye hooks, welding plate and welding instructions.

**NOTE**

After the machine is loaded, check the piston rods to ensure they are protected from corrosion.

For specifications / technical data, refer to chapter 1.

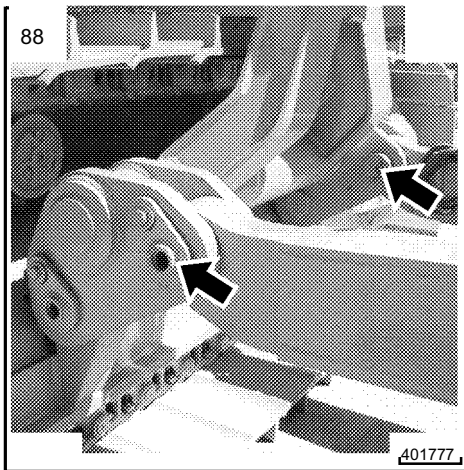
4.17 SAFETY GUIDELINES TO BE OBSERVED WHEN WORKING ON THE ATTACHMENT

- Never work underneath or on the attachment unless it is securely placed on the ground or it is properly blocked and supported to keep it from drifting or falling.
- When replacing or changing any part of the attachment, such as blade, cutting edges, teeth ..., never use metal on metal supports.
- Never try to lift any heavy parts. Always select and use appropriate lifting devices with sufficient lifting capacity.
- When handling wire ropes, always wear gloves!
- Do not disconnect any lines or hoses or remove fittings, caps or covers while the hydraulic system is pressurized. Always lower the attachment, shut the engine off and release all pressures: with the ignition key in contact position, move all servo controls (joysticks and foot pedals) into both directions to release the servo pressure and any pressure remaining in the hydraulic circuit, then release the tank pressure by turning the bleeder screw.
- After completion of all maintenance and repairs, make sure that all lines and hoses and fittings are properly connected and retightened.
- Removing or installing steel pins with a hammer can be very dangerous. Metal chips can cause injury. Always wear gloves and safety glasses!
- Always use the appropriate tools for the job (such as pin pullers, punches, etc. ...)

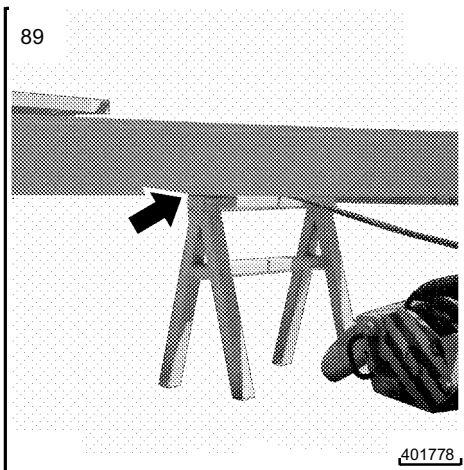
4.18 ATTACHMENT INSTALLATION / REMOVAL GUIDELINES

4.18.1 BOOM INSTALLATION / REMOVAL

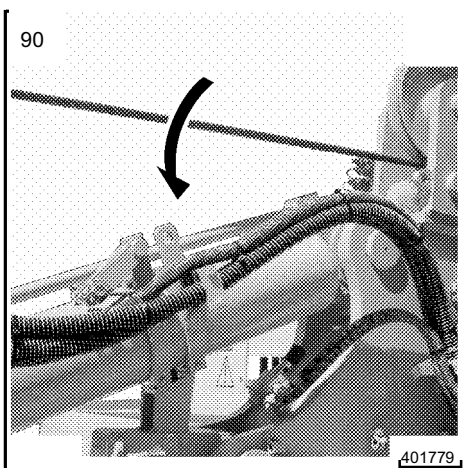
- to install and remove the attachment, a suitable lifting device is needed.
- Clean all bearing points, pins, threads and similar and check for damage.



- Using a suitable lifting device, bring the boom into position on the side of the machine and install with pins. Secure the pins with washer and hex head screw (fig. 88).

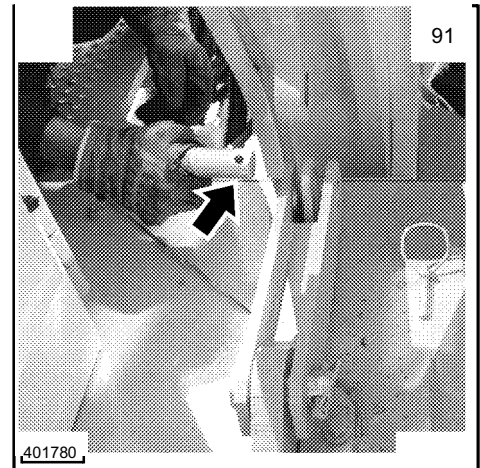


- Support the boom jib safely (fig. 89).

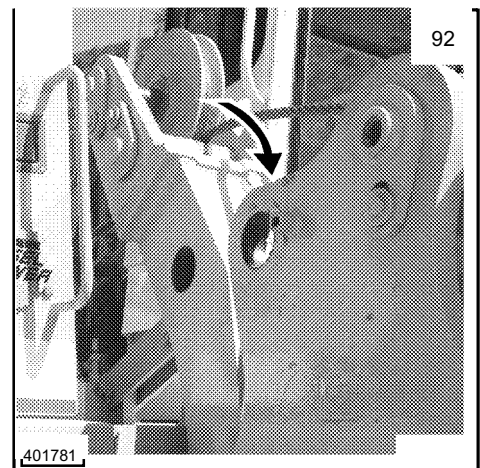


- Use a suitable lifting device to take on the hoist cylinder, unpin the transport retainer, swing the cylinder out on the side and place it on the support bracket (fig. 90).

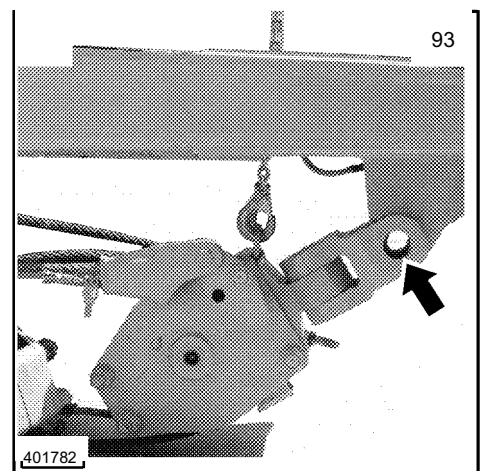
- Unpin the transport retainer on the change over pulley block (fig. 91).



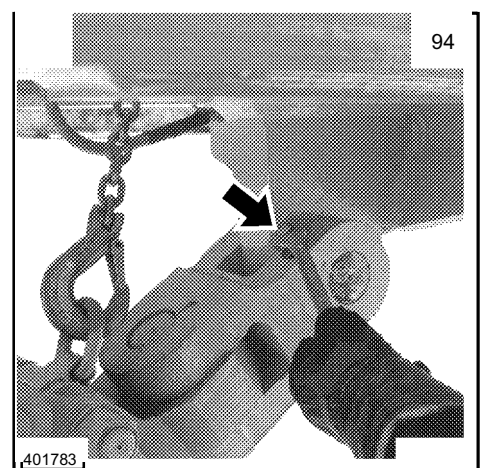
- Swing the change over pulley block to the outside and pin (fig. 92).

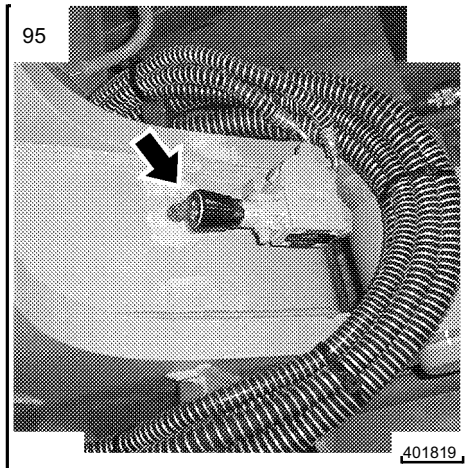


- Raise the cable pulley block on the tackle lifting points, which have been installed for this purpose, until the bore hole of the cable pulley block aligns with the bore hole on the boom (fig. 93).

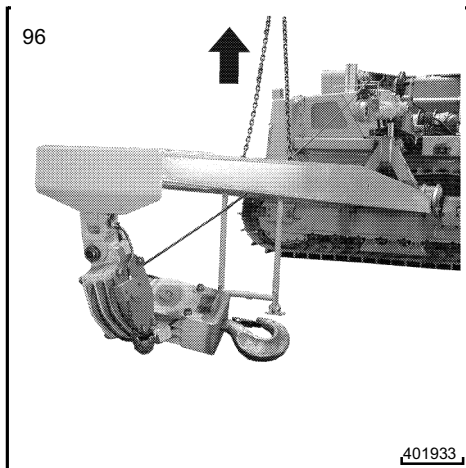


- Install the cable pulley block with pins.
- Secure the pin with lock screw (fig. 94).





- Set the change over valve to position "0" (red area on the right) (fig. 95).

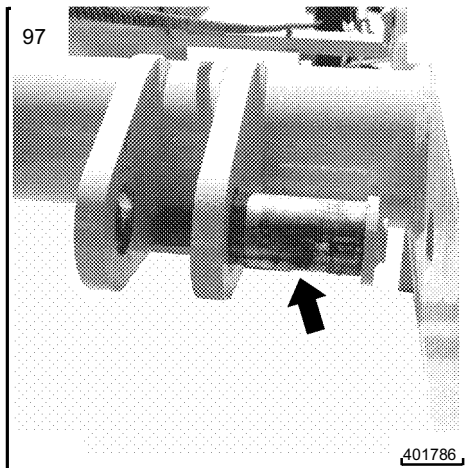


- Lift the boom with a suitable lifting device (fig. 96) (tip of boom approx. 3.5 m above the ground).

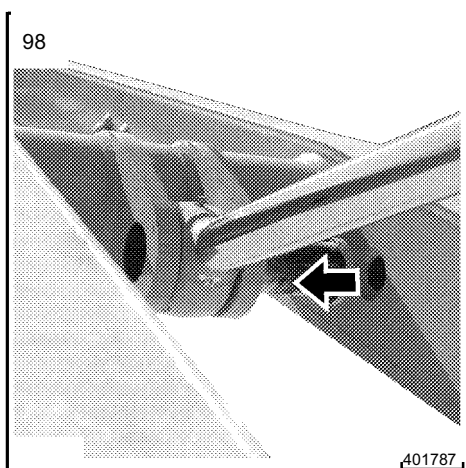


DANGER

Never step or stand under a suspended load.

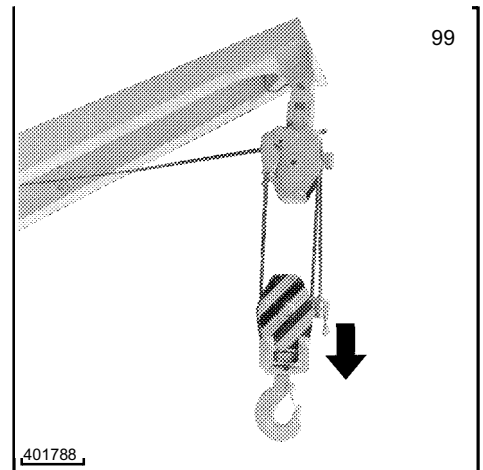


- Grease the pin lightly and set onto the boom (fig. 97).
 - The pin may not protrude to the inside!

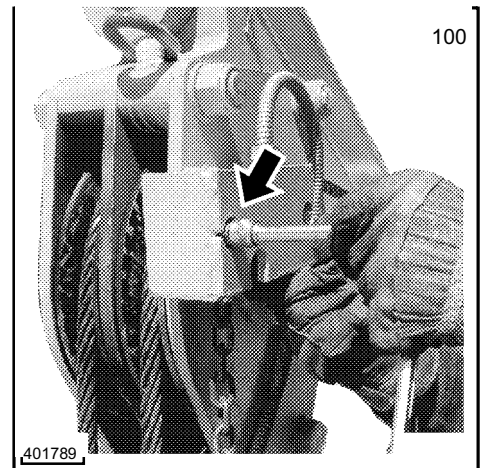


- Raise the hoist cylinder with the lifting device, carefully push the boom control lever to the left, the piston rod extends. Install the piston rod on the boom with pins (fig. 98).

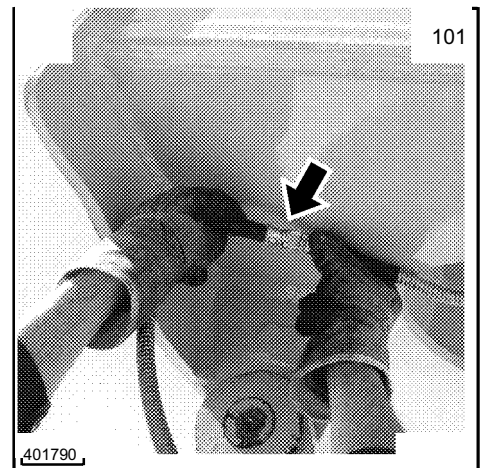
- Lower the hook block approx. 0.5 m (fig. 99).



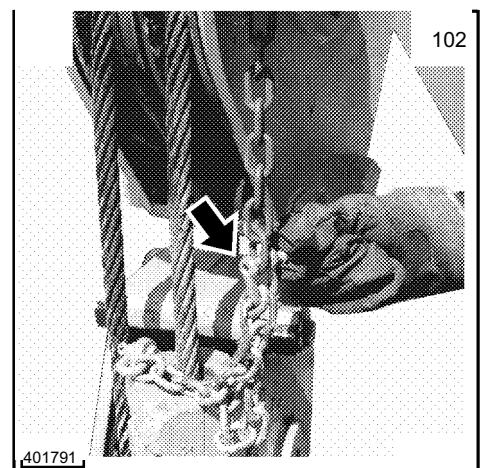
- Use a safe and suitable support to install the limit switch on the upper hook block (fig. 100).

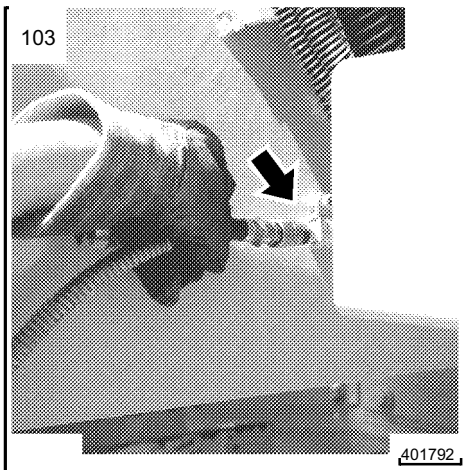


- Connect the limit switch line to the plug connection (fig. 101).
 - Attach the cable with cable clamps to the eye hooks, which were installed for this purpose.



- Attach the limit switch weight with shackle to the chain (fig. 102).





- Connect the limit switch line on the machine with the plug connection (fig. 103).

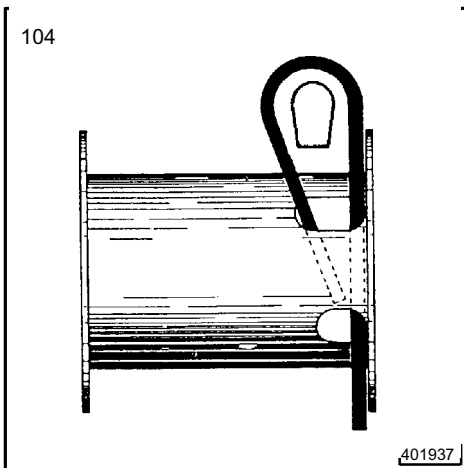
4.18.2 PLACE THE HOIST CABLE



CAUTION

Do not use damaged cables!

- Damaged cables must be replaced immediately.
- When handling wire cables, always wear protective gloves!

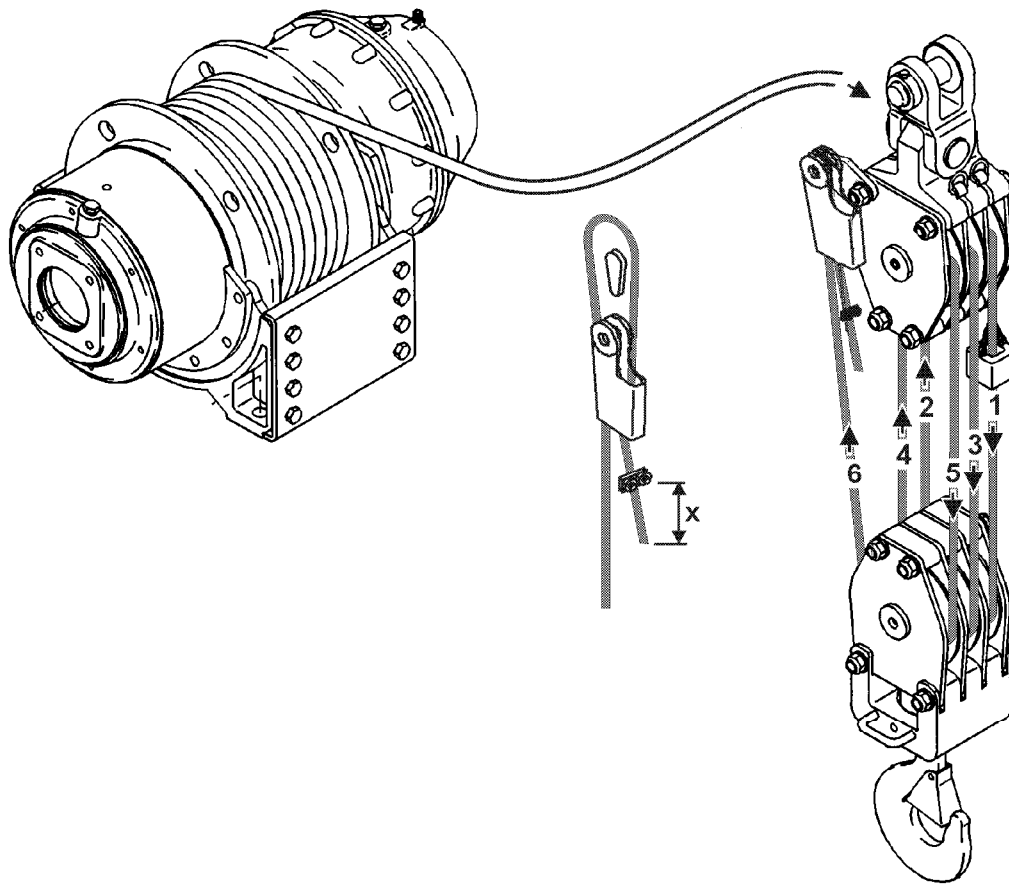


- Guide the free end of the cable through the narrow opening of the cable wedge receptacle. Bend the cable and guide the free end back through the opening about 3/4 of the way.
Install the wedge with the small end to the winch (fig. 104) and pull the cable tight. The wedge will then slide into the opening and will secure the cable in the drum.

- Spool the cable onto the winch drum. See chapter 7, paragraph "Crane cables".

To guide the cable into the hookblock, use a suitable access ladder.

- Start the machine and spool out sufficient cable from the drum.
- Park the machine properly.



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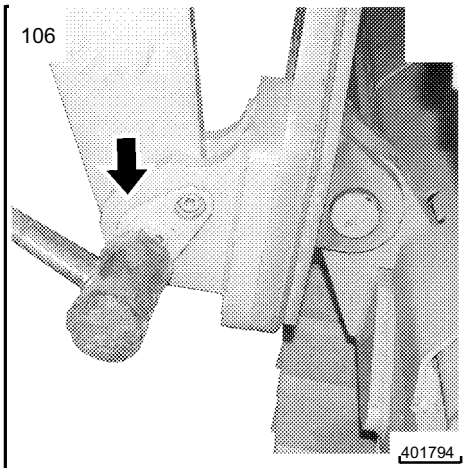
- Place the cable over the cable pulley and hookblock, as shown on the illustration.
- Guide the end of the cable through the wedge clamp.
 - Place the cable into the cable clamp.
 - Let the end of the cable stick out approx. 130 to 150 mm (measure X) on the cable clamp.
- Secure the loose end of the cable with the cable clamp.



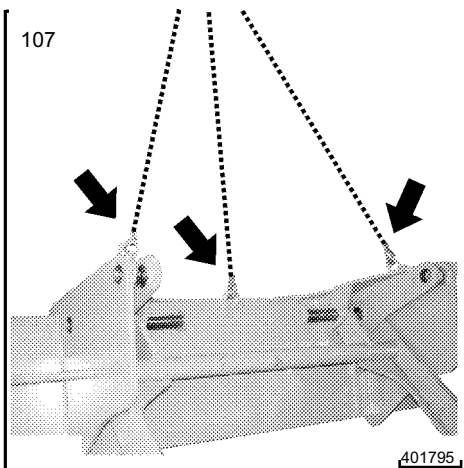
Attach the cable clamp only to the loose end of the cable!

4.18.3 INSTALLATION AND REMOVAL OF COUNTERWEIGHT

- To install and remove the attachment, a suitable lifting device is needed.
- Clean all bearing points, pins, threads and similar and check for damage.
- Install the bearing eyes with hex head screws on the support plate.



- With a suitable lifting device, raise the frame on the side to the machine and pin (fig. 106), secure the frame securely.



- Lift the segment carrier frame by the intended lifting points to the frame and attach with pins (fig. 107).

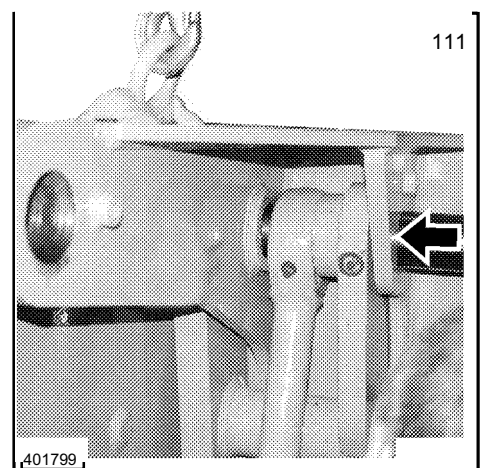
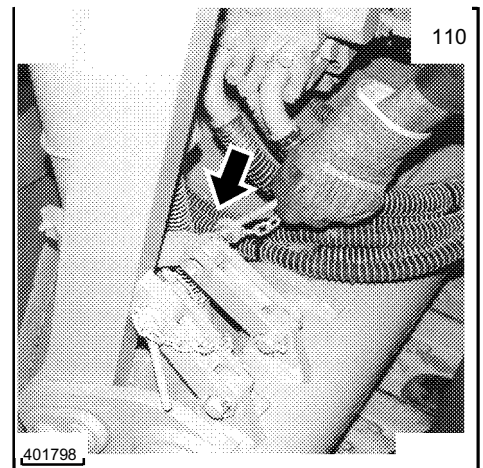
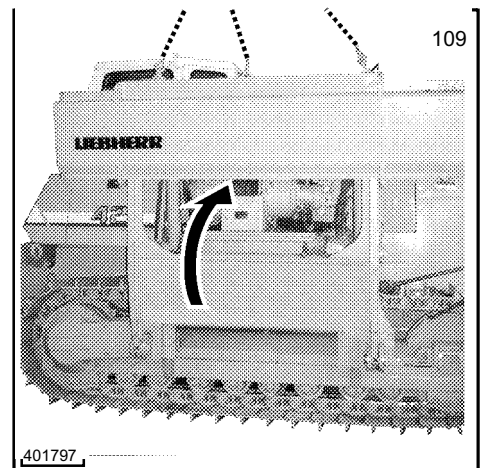
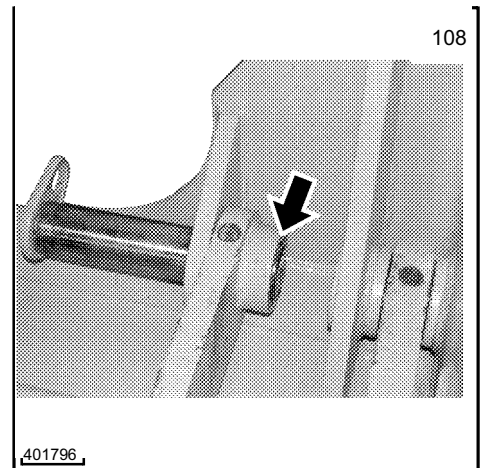
**NOTE**

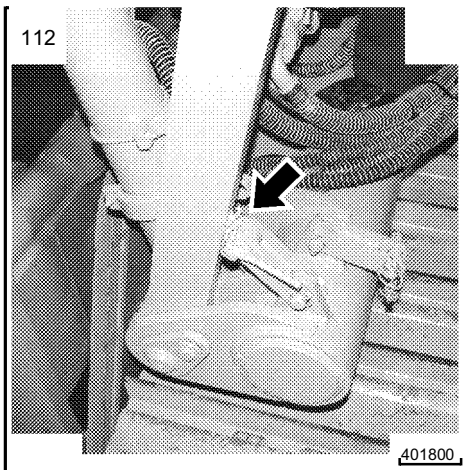
Knock the pin in only to the point where the bearing fork for the hydraulic cylinder still remain free (fig. 108).

- Swing up the frame connector with the lifting device (fig. 109).

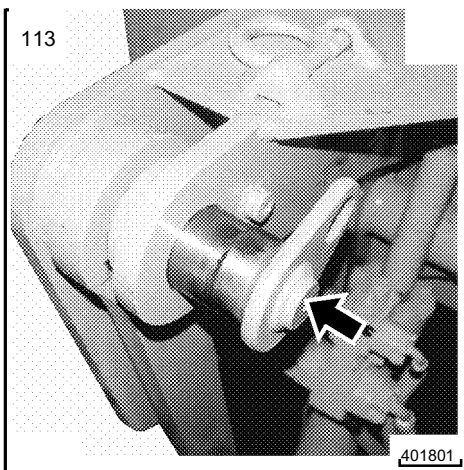
- Remove the transport retainer from the hydraulic cylinder (fig. 110). Swing the cylinder out.
- Start the machine.

- Carefully push the counterweight control lever to the front. Extend the cylinders until the bore holes of the cylinders align with the bore holes on the frame.
- Knock in the pins and secure with washer and hex head screw (fig. 111).
- Turn the machine off properly.

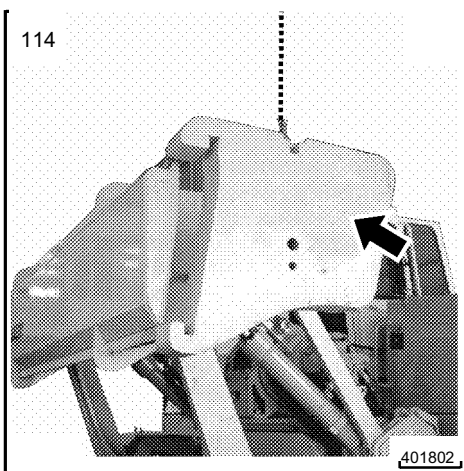




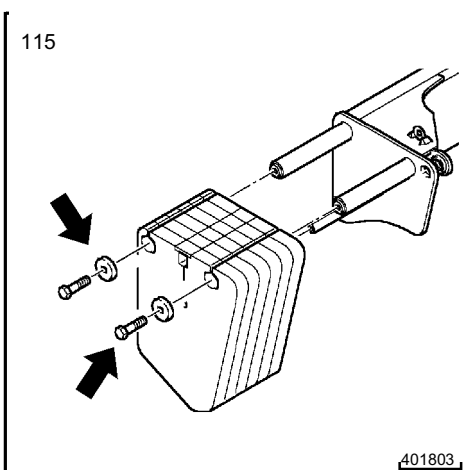
- Remove the transport retainers on the struts (fig. 112).



- Bring the struts into position and connect with pins to the segment carrier frame (fig. 113).
 - If necessary, raise the frame connector in the center so that the struts can be pinned.
- Start the machine and move the counterweight in all the way.

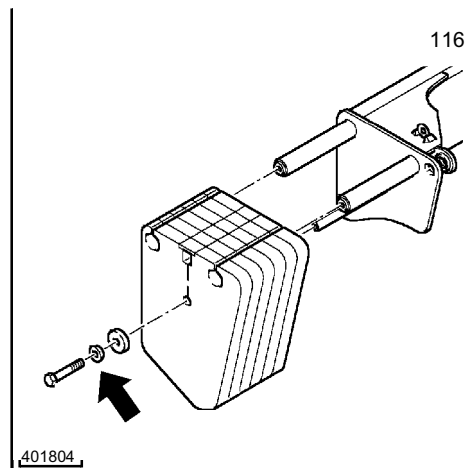


- Install the weight segments with a suitable lifting device onto the segment carrier frame (fig. 114).
 - Pay attention to the sequence of the segments.
 - Push the plates in completely.



- Insert the retaining screws (fig. 115).

- Install the retention screw with washer (fig. 116).

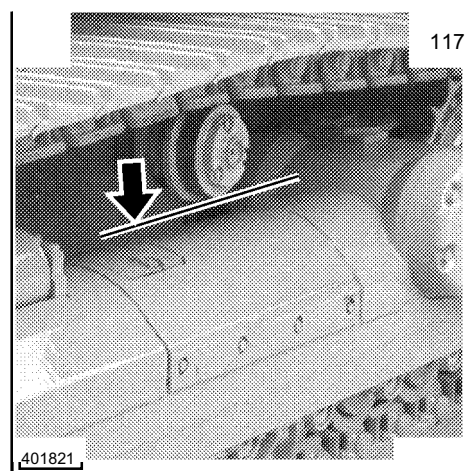


4.19 NOTES FOR PASSING THROUGH AND WORKING IN WATER

When it is necessary to drive through water or to work in water, the maximum fording depth (lower edge of the carrier roller) may not be exceeded (fig. 117). After working in water, make sure to lubricate / grease all lube points.



- Be especially careful, danger of fan damage!
- If the maximum fording height is being exceeded, the fan will be destroyed.
- Never exceed the maximum fording depth (lower edge of the carrier roller).



4.20 MACHINE OPERATION IN VERY LOW AMBIENT TEMPERATURES

Your machine can be operated to an ambient temperature of -22°C without additional optional equipment.

If the ambient temperatures are always below -22°C , special optional equipment must be installed to ensure proper operation.

If you intend to operate the machine at temperatures below -22°C , contact your Liebherr Service Dept.

5. LUBRICANTS AND SERVICE FLUIDS

GENERAL INFORMATION

The conscientious adherence to the guidelines given for lubrication, fluid level check and changing of service fluids guarantees increased dependability and life expectancy of the machine .

It is particularly important that the various oil changes be performed regularly and within the recommended intervals and that the specified lubricants are used.

The quantities stated in this manual are theoretical. The dipstick or fluid level mark is always the deciding factor when adding service fluids.



DANGER

When checking or changing service fluids, always observe the following guidelines:

Always perform the particular work only with the machine parked on firm and level ground and with the engine turned off, unless specified otherwise.

When working in the engine compartment, always secure the engine cover and the side doors to prevent them from accidentally moving or closing.

Always turn the engine off before refueling.

Never smoke or allow an open flame during refueling.

Cleanliness is of the utmost importance when changing the engine oil, gear or hydraulic oil. Before removing fittings, filler caps and covers, clean the parts and surrounding area carefully.



NOTE

Be certain to drain all oil into a suitable container and dispose of the oil and filter cartridges properly.

5.1 LUBRICANTS AND SERVICE FLUID CHART

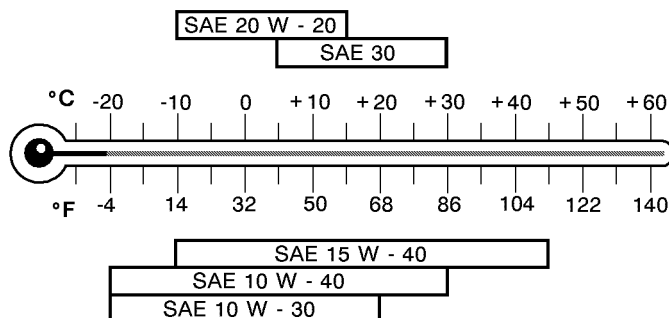
QUANTITIES	SERVICE FLUIDS	SPECIFICATION	BI *
DIESEL ENGINE (Turbo)			

24 l
(6.3 US gal.)



Lube oil

Viscosity per SAE



API CF-4, CF, CE
ACEA D4, D5
SHPD

MIL-L-2104 E
= CF-4, CF, CE, D4

EO 20
EO 30

EO 1540B
EO 1040B

Various external circumstances can influence the maintenance intervals:

		Intervals in operating hours with the following oil quality	
Ambient temperature	Sulfur content in fuel	CF-4, CF CE, D4	SHPD D5
up to -10°C	up to 0.5% above 0.5%	250 hrs. 125 hrs.	500 hrs. 250 hrs.
below -10°C	up to 0.5% above 0.5%	125 hrs. -	250 hrs. 125 hrs.

Lube oil viscosity

The selection of the lube oil viscosity must be made according to SAE classification (Society of Automotive Engineers).

The ambient temperature is the deciding factor for the correct selection of the SAE classification.

The selection of the SAE classification provides no information regarding the quality of the lubricant.


If the viscosity is too high, it can cause starting problems, if the viscosity is too low, the lubrication efficiency can be endangered.

The temperature ranges shown in the chart are guidelines and can be exceeded or fallen below for a short time.

Oil change intervals

First oil and filter change at 30-60 operating hours. Additional filter changes every 500 operating hours and oil change depending on climate zone, sulfur content in fuel and oil quality according to chart.

If the stated operating hours are not reached, change the engine oil and filters once a year.

QUANTITIES	SERVICE FLUIDS	SPECIFICATION	BI *
FUEL SYSTEM			
610 I (161 US gal.) 	Diesel fuel Use commercially available Diesel fuels with a sulfur content of less than 0.5 %. Higher sulfur content affects oil change intervals and engine service life.	DIN EN 590 NATO Codes F 54, F 75 BS 2869 : A1 and A2 ASTM D 975-88: 1 D and 2 D	

Diesel fuels for very low temperatures

In ambient temperatures below 0°C, the flow properties in warm temperature Diesel fuel can become insufficient due to paraffin excretion. The same applies to cold temperature Diesel fuels in temperatures below -12°C. In order to prevent operating problems in even lower temperatures, mix Diesel fuel with normal gasoline or petroleum. Addition of normal gasoline is a makeshift measure and may not exceed **30 %** . Mixing fuel can diminish engine performance, for that reason, keep the added fuel as low as possible, depending on the ambient temperatures. For safety reasons, mix fuel only in the fuel tank. When refueling, add the lighter additive before the Diesel fuel. Then let the engine run until the mixture has been distributed throughout the fuel system.

Diesel fuels - mixing ratio (Vol. %)


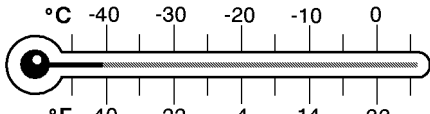
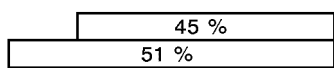
Ambient temperature °C	Summer Diesel fuel %	Additive %	Winter Diesel fuel %	Additive %
0 to -10	70	30	100	--
-10 to -15	50	50	100	--
-15 to -20	--	--	70	30
-20 to -25	--	--	50 *	50

* If an addition of more than 50% is necessary, use only petroleum (no normal gasoline).

Additives to Diesel fuel (flow improvers)

Commercially available flow improvers can also improve Diesel fuel properties in cold temperatures. Always read and observe manufacturer's user guidelines and quantities.

5. LUBRICANTS AND SERVICE FLUIDS

QUANTITIES	SERVICE FLUIDS	SPECIFICATION	BI *
COOLANT SYSTEM			
68 l (18 US gal.) 	Coolant Antifreeze protection to  Percentage (%) of antifreeze fluid 	Corrosion inhibitor / anti-freeze according to chart	SP-C

The cooling system must be filled with a mixture of at least 50 % anti-corrosion/ antifreeze fluids and 0.3 - 0.8 units of DCA4 (DCA4 = Diesel coolant Additives). Do not use more than 60 % anti-corrosion / antifreeze fluids, since a higher percentage would actually reduce the cooling effect and antifreeze protection.

When refilling the coolant, make sure not to fall below the minimum percentage.

Always check the mixing ratio of the coolant when performing maintenance.

The DCA4 concentration must be between 0.3 and 0.8 units per liter. To check the concentration, use the Fleetguard test kit CC2602 M.

Observe the stated change intervals of 2 years!

To fill the cooling system:

For initial filling of the cooling system, DCA4 must be added to the coolant in liquid form (see chart), in addition to the DCA4 concentration, which is already in the filter. Premix the coolant in a suitable container.

Mixing ratio:

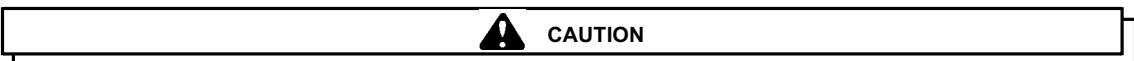
Machine type	Quantity	Part water	Part anti corrosion / antifreeze fluid	Part DCA liquid
RL 52	approx. 68 l	33 l	33 l	2.5 l

Use of DCA4 without anticorrosion / antifreeze fluids:

In **exceptional cases** and where the ambient temperatures are always **above freezing** , for example in tropical regions, where **definitely no anticorrosion / antifreeze fluids are available**, water and DCA4 may be used as coolant.

To protect the cooling system from corrosion, use approximately twice as much DCA4 as compared to the mixing ratio of anticorrosion / antifreeze fluid and DCA4 . DCA4 concentration must be between 0.6 and 1.06 units per liter.

The coolant must be changed **annually** .



When using water and DCA4, use no coolant refiners (anti-corrosion oils).

Fresh water guidelines:


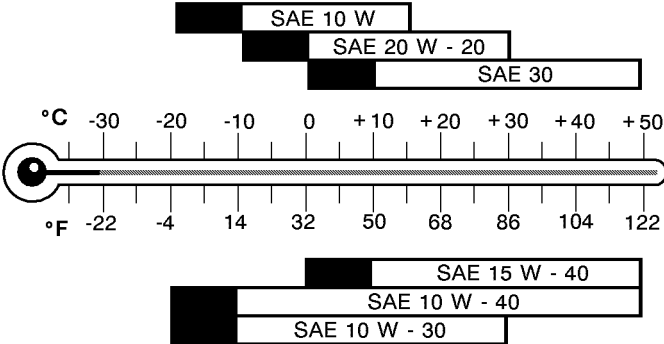



To mix coolant fluid, use clean water which is not too hard. Often, but not always, regular tap water may be used. Sea water, brackish water, brine or industrial waste water is not suitable.


Fresh water quality:

Sum of alkaline earths (water hardness):	0.9 to 2.7 mmol/l (5 to 15° d)
ph-value at 20 °C :	6.5 to 8.0
Chlorine content:	max. 80 mg/l
Sum of chlorides and sulfates:	max. 160 mg/l

Approved anticorrosion / antifreeze fluids:

Brand	Manufacturer
Agip Antifreeze Plus	Agip Deutschland AG, München
Agip Langzeit-Frostschutz	Autol-Werke GmbH, Würzburg
Antigel DB 486	Sotragal SA, St. Priest/France
Aral Kühlerfrostschutz A	Aral AG, Bochum
Avia - Antifreeze - APN	Deutsche Avia-Mineral-Öl Ges.mbH, München
BP anti-frost X 2270 A	Deutsche BP AG, Hamburg
BP Nappel C 2270/1	BP Chemicals Ltd., London/England
Caltex Engine Coolant DB	Caltex (UK) Ltd., London/England
Castrol Anti Freeze O	Deutsche Castrol Vertriebsges.mbH, Hamburg
Century F.L.Antifreeze	Century Oils, Hanley, Stoke-on-Trent/England
Deutz Kühlschutzmittel 0101 1490	Deutz Service International GmbH, Cologne
Esso Kühlerfrostschutz	Esso AG, Hamburg
Fricofin	Fuchs Mineralölwerke GmbH, Mannheim
Frostschutz Motorex (G 48-00)	Bucher + Cie AG, Langenthal/Switzerland
Frostschutz 500	Mobil Oil AG, Hamburg
Glacelf	Elf Mineralöl GmbH, Düsseldorf
Glycoshell AF 405	Shell
Glycoshell N	Shell
Glysantin (G 48-00)	Basf AG, Ludwigshafen
Igol Antigel Type DB	Igol France, Paris/France
Labo FP 100	Labo Industrie, Nanterre/France
Motul Anti Freeze	Motul SA, Aubervilliers Cedex/France
OEMV- Frostschutzmittel	OEMV-AG, Schwechat/Austria
OZO Frostschutz S	Total Deutschland GmbH, Düsseldorf
Total Antigel S-MB 486	Total Deutschland GmbH, Düsseldorf
Total Frostfrei	Deutsche Total GmbH, Düsseldorf
Veedol Antifreeze O	Deutsche Veedol GmbH, Hamburg
Wintershall Kühlerschutz	Wintershall Mineralöl GmbH, Düsseldorf

QUANTITIES	SERVICE FLUIDS	SPECIFICATION	BI *
HYDRAULIC SYSTEM			
230 l (61 US gal.) 	<p>Hydraulic oil</p> <p>Viscosity per SAE Use engine oil according to Mercedes-Benz service fluid recommendations.</p>  <p>WARMING UP THE HYDRAULIC SYSTEM</p> <ol style="list-style-type: none"> For temperatures to 10°C below the given limit: Run the engine at half speed after starting it. Warm up the hydraulic system by fully actuating the hydraulic cylinders and motors for short periods. Warm up time approx. 10 minutes. At even lower temperatures: Preheat the hydraulic oil in the tank before starting the engine. 	<p>Page No. 226.0 and 227.0 for single grade oils API CC/SF, CD/SF, CE/SF</p> <p>Page No. 227.1 and 228.1 for multi grade oils CD/SF, CE/SF, CD+ API CC/SF (MIL-L-46152 B) CD/SF, CE/SF (MIL-L-2104 D) CD/SF (MIL-L-2104 D) CE/SF, CD+ (MIL-L-46152 B)</p>	<p>HYD10 HYD20 HYD30</p> <p>HYD1040 HYD1030</p>
SPLITTERBOX			
6 l (6.3 quarts) 	<p>Gear oil</p> <p>Viscosity per SAE SAE 90 EP SAE 80 W - 90 EP SAE 85 W - 140 EP</p>	<p>API GL-5 and MIL-L-2105 B,C or D</p>	<p>GO 90 GO 140</p>
TRAVEL GEAR			
2 x 21 l (5.5 US gal.) 	<p>Gear oil</p> <p>Viscosity per SAE SAE 85 W - 140 EP</p>	<p>API GL-5 and MIL-L-2105 B,C or D</p>	<p>GO 140</p>
SLIPRING SEAL - TRAVEL GEAR			
9,4 l (10 quarts) 	<p>Hydraulic oil</p> <p>Viscosity per SAE See Hydraulic System (Use the same oil specification and viscosity as in the hydraulic system.)</p>		

QUANTITIES	SERVICE FLUIDS	SPECIFICATION	BI *
CABLE WINCH - HOIST WINCH			
<p>2,6l¹ (2.7 qt.)</p> <p>12l² (12.7 qt.)</p>	<p>Gear Engine oil SAE 10 W</p> <p>¹Primary side ²Secondary side</p>	<p>API CC, CF-4, CF, CE ACEA D4, D5 SHPD</p> <p>MIL-L-2104 B MIL-L-46152 B MIL-L-46152 D = CC</p> <p>MIL-L-2104 E = CF-4,CF, CE, D4</p>	
REAR WINCH			
<p>15 l (16 qt.)</p>	<p>Gear Viscosity per SAE</p> <div data-bbox="379 795 1066 985" style="border: 1px solid black; padding: 5px;"> <p>The chart shows four horizontal bars representing different SAE grades across a temperature range from -60°F to 110°F (and -50°C to 35°C). - A: SAE 0W-30 WT, MIL-L-2104C (range: -60°F to 60°C) - B: SAE 5W-30, MIL-L-2104C (range: -50°F to 60°C) - C: SAE 30 (range: -10°F to 60°C) - D: SAE 50 (range: 0°F to 60°C)</p> </div> <p>A = SAE 0W-30 WT, MIL-L-2104C B = SAE 5W-30, MIL-L-2104C C = SAE 30 D = SAE 50</p> <p>SAE 30 = filled at the factory and recommended for most application. DANGER! Cold start at ambient temperatures in the gray area require longer warm up of the attachment, to prevent a malfunction of coupling and brake. If this warm up phase is not observed, the machine can be damaged, leading to INJURY OR DEATH!</p>		
HOIST CABLE - WINCH CABLE			
	<p>See chapter 7 - Operating instructions for crane cables.</p>		
LUBE POINTS - ATTACHMENT AND CHAIN TENSIONER			
	<p>Grease Viscosity per SAE Consistency 2 of NLGI classification The grease must be lithium based, with a VKA value of at least 2300 N according to DIN 51350 or ASTM D 2596.</p>	<p>High pressure grease KP2k, Consistency 2 of NLGI classification per DIN 51818 and DIN 51825 or EP 2 per NF-T-60 132</p>	<p>MPG-A</p>

5. LUBRICANTS AND SERVICE FLUIDS

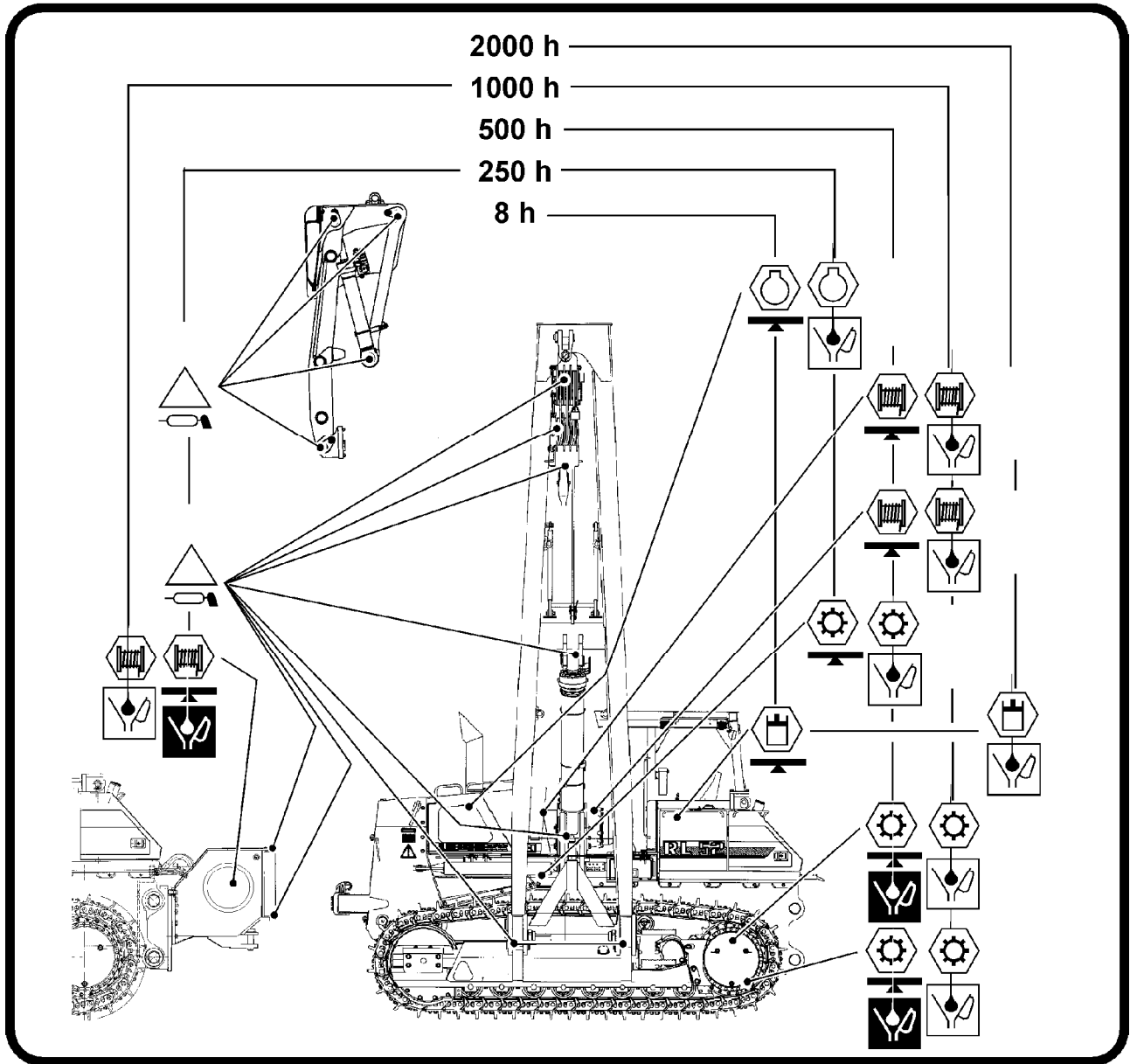
HINGES - JOINTS		
Engine oil Viscosity per SAE		
RUBBER SEAL ON DOORS AND COVERS		
Silicon spray or talcum powder		
CORROSION INHIBITOR		
Anti corrosion grease To protect exposed piston rods, cover them liberally with acid free corrosion grease.	such as LIEBHERR Anti corrosion grease CTK Id. No.861331301	

BI * STANDARD LUBRICANTS

for construction machinery and vehicles covered by the "Hauptverbandes der Deutschen Bauindustrie e. V. (BI) (see brochure issued by the Bauverlag GmbH- Wiesbaden and Berlin)

5.2 LUBRICATION CHART

For quantities, see chapter 5.1.



Diesel Engine



Hydraulic Tank



Splitter Box



Cable Winch



Travel Gear



Lubrication Point

h

Intervals in Operating Hours



Check Oil Level



First Oil Change



Change Oil



Lubricate

5.3 TIMELY OIL DIAGNOSTICS ANALYSIS

Oil is subjected to various influences. Oil is affected by temperature pressure, foreign matter, such as dust, metallic particles, water and air, and decomposes. For the long term, the risk of damage to the hydraulic system, the Diesel engine and the gear increases.

Unplanned repairs and down time can be prevented by taking oil samples; the results of the oil analysis will provide details about the condition of your machine.

When using this procedure, oil samples should be taken in certain time intervals for an oil analysis.

ADVANTAGES OF AN OIL DIAGNOSTICS ANALYSIS

- You will receive a complete report about the condition of your machine.
- Impending damage will be recognized in time.
- Unplanned repairs and down time will be prevented.
- Oil can be changed at the right point in time (only hydraulic system.)
- You will help your environment by disposing of less used oil (only hydraulic system.)



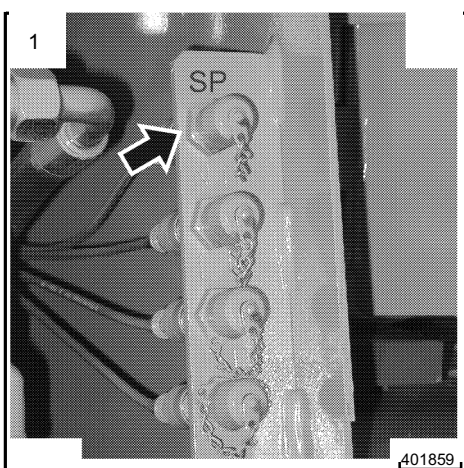
NOTE

An extension of the oil change intervals by taking oil samples is only permitted for hydraulic oil!

TAKING OIL SAMPLES

Take the oil sample:

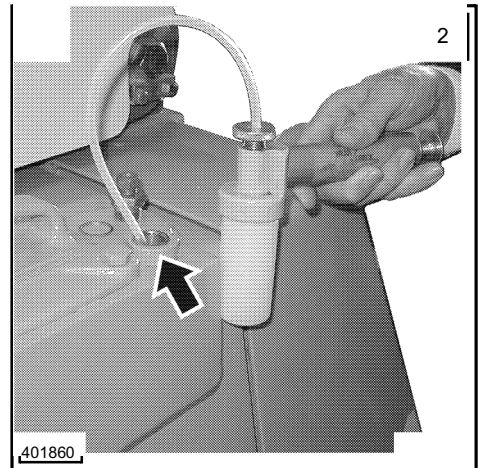
- Shortly after the machine comes to a standstill - at that point, dirt and wear particles and any condensation have not yet settled.
- At operating temperature - warm oil can be removed quicker.
- Always through the same method and at the same point.
- Never from the filter.
- Not shortly after an oil change or after adding large amounts of oil.
- Only in a clean and dry container.



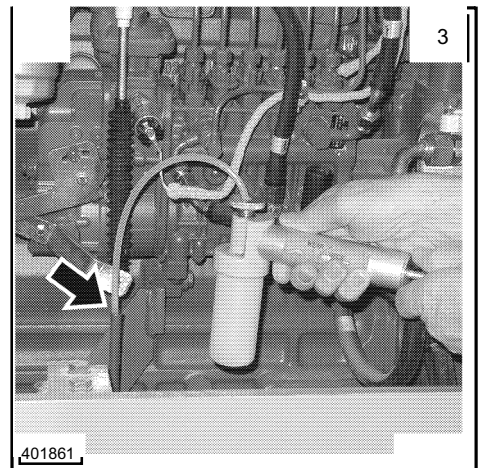
LOCATIONS TO TAKE OIL SAMPLES

- Hydraulic system:
 - a) At the SP- connection with mini test hose (recommended method) or

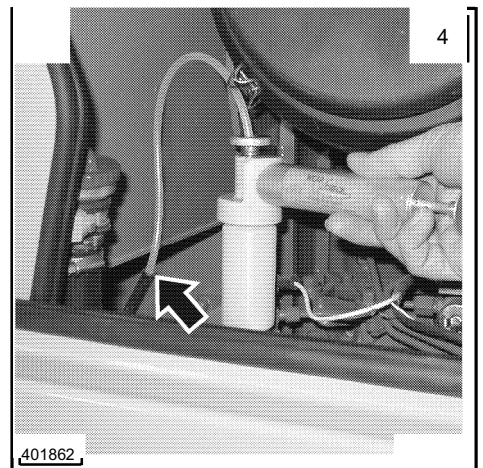
b) Remove the bleeder screw at hydraulic tank and take oil sample with suitable manual suction pump.



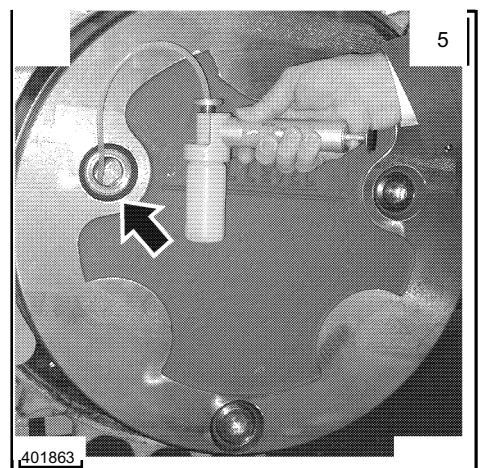
- Diesel engine
 - a) With manual suction pump via oil test tube or
 - b) take oil sample from the draining oil flow when changing oil.



- Pump distributor gear
 - a) With manual suction pump via oil test tube or
 - b) take oil sample from the draining oil flow when changing oil.



- Travel gear
 - with manual suction pump via oil filler port



OIL SAMPLE INTERVALS

Hydraulic system	Every 500 hrs.
Diesel engine	At every oil change
Pump distributor gear	At every oil change
Travel gear	At every oil change

OIL ANALYSIS

An oil analysis should contain at least the following data:

Method	Determination of
Atom Emissions Spectroscopy (AES)	wear metals, additives, contamination iron, chromium, tin, aluminum, nickel, copper, lead, molybdenum, silver, silicon, calcium, magnesium, borax, zinc, phosphorous, barium
FT Infrared spectroscopy (FT-IR),	Oil condition and contamination Oil oxidation, glycol, water, nitration, fuel, carbon
Viscosity	Viscosity test / viscosity at 40°C and 100°C, viscosity index Note about lubrication and mixing ability
Analex PQ-Index	Magnetic metallic particles Report about the quantity of the total magnetic metallic particles in the oil which are larger than 5 microns.

**NOTE**

Liebherr recommends send the oil samples to "Wear Check company" for oil analysis. A set with test bottles, hose, documentation and mailing pouch is available from LIEBHERR under the following Id. No.:

Id. No.: 70 18 369 (12 units)

Id. No.: 70 18 368 (6 units)

A hand pump to take the samples is necessary and can be ordered separately (Id. No.: 81 45 666).

5.4 CHANGE FROM MINERAL OIL TO ENVIRONMENTALLY FRIENDLY HYDRAULIC FLUIDS

For the operation of LIEBHERR crawlers with "environmentally friendly hydraulic fluids", we recommend **Panolin HLP Synth 46**.

**CAUTION**

Could cause damage to the machine's hydraulic system!

When mixing "environmentally friendly hydraulic fluids" with "Mineral oils", an aggressive reaction can occur, which in turn can cause damage to the hydraulic system.

Avoid mixing "environmentally friendly hydraulic fluids" with "Mineral oils".

- **Please** contact your LIEBHERR Service Department before changing your machine to "environmentally friendly hydraulic fluids"!

**NOTE**

Please request "instruction sheet" and the "change over guidelines" from LIEBHERR and observe them strictly!

6. MAINTENANCE

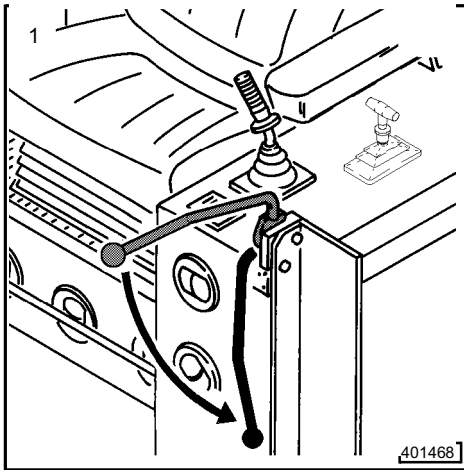
The listed maintenance and inspection intervals MAY NOT be extended, however, they may be shorted if required.

6.1 MACHINE MAINTENANCE SAFETY

- Never perform any maintenance or repairs for which you are not qualified or you do not understand.
- Any maintenance / inspection should be performed in the intervals noted in the Operation and Maintenance Manual. To perform any repairs, make sure you have the proper tools.
- Maintenance work should be performed according to the chart at the end of this Operation and Maintenance Manual. It is also noted who should or may perform what type of work. The operator should only perform items marked OM on the Maintenance and Inspection schedule. The remaining work should only be performed by trained personnel.
- All spare parts must conform to the technical requirements set forth by the manufacturer. This is only assured by using Original Liebherr spare parts.
- Always wear proper and safe work clothing. For certain jobs, in addition to hard hats and safety shoes, additional safety equipment is required, such as safety glasses and / or gloves.
- Keep unauthorized personnel from the machine during maintenance and repair work.
- Secure the maintenance area, as necessary.
- Inform service personnel if any special task or maintenance work is required. Appoint a supervisory person to assure that this work has been done properly.
- Perform all maintenance work with the machine parked on firm and level ground and with the engine turned off, unless otherwise specified in the Operation and Maintenance Manual.
- The cab may be raised only if the machine is parked and the engine is turned off! Before raising the cab, make sure that no personnel is within the proximity of the cab. always secure the raised cab with the safety bar before working under the raised cab. The machine may **NEVER** be moved when the cab is raised! The safety lever must remain in the full down position!
- After any maintenance and repair work on the machine, make sure that all screw connections or fittings, which had to be loosed, are retightened.
- If it becomes necessary to remove any safety devices during set up, maintenance and repair, the safety devices which were removed, must be reinstalled immediately and then be inspected for proper function.
- Before servicing the machine, especially when working underneath the machine, attach an easily visible warning sign **DO NOT OPERATE** to the ignition switch. Remove the ignition key.
- Before any maintenance or repair, clean off any oil, fuel or service fluids from connections and couplings. Do not use any harsh cleaning fluids. Use only lintfree cloths.
- Never use flammable fluids to clean the machine.
- Before any welding, cutting or grinding, clean the machine and surrounding area of dust and assure adequate ventilation.
 - Otherwise there is a **DANGER OF EXPLOSION!**
- Before cleaning the machine with water, steam (high pressure cleaning systems), or other cleaning fluids, cover or tape all openings, make sure no water, steam or cleaning fluids enters these openings for safety and functional reasons. Electric motors, switch boxes, and battery compartments are especially vulnerable.
 - Make sure that during the cleaning work, the temperature sensor of the fire warning system and sprinkler system do not come in contact with the hot cleaning fluid, or the sprinkler system could be actuated.

- After cleaning the machine, remove all covers and tape.
- After cleaning the machine, check all fuel, engine oil and hydraulic lines for leaks, for loose connections, for chafed or damaged areas.
- All problems must be remedied immediately.
- Adhere to the product safety instructions issued for handling of oils, greases, and other chemical substances.
- Make sure to dispose of any operating and service fluids as well as replacement parts property, and in an environmentally sound manner.
- Be careful when handling any hot service or operating fluids (danger of burns and scalding!)
- Use combustion motors and fuel operated heaters only in areas with adequate ventilation. Before start up, make sure that the ventilation is adequate. Follow and adhere to any local guidelines and instructions pertaining to the present job site.
- Perform any welding, cutting or grinding work on the machine only if this work has been explicitly authorized, there can be a danger of fire or explosion.
- Do not try to lift heavy parts. Always use appropriate lifting aids and devices with sufficient carrying capacity.
 - To lift spare parts and component assemblies for replacement on the machine, they must be securely mounted and secured onto the lifting devices, to prevent accidents. Use only suitable and flawless lifting devices, as well as hooks, ropes, slings, shackles, etc. with sufficient load carrying capacity.
 - **Do not allow anybody to work or remain underneath a suspended / raised load!**
- Do not use damaged or insufficiently strong ropes. Always wear gloves when handling wire ropes.
- Only experienced personnel may attach loads and signal the operator. The person used as guide must be visible by the operator or must be in direct voice contact with the operator via a two way radio.
- When installing parts higher up or when working overhead, always use safe scaffolding or ladders suited for this purpose. do not step on any parts on the machine to get closer to the working area. You must wear safety belts or similar safety equipment when working higher up. Make sure all handles, steps, walkways, catwalks, and ladders etc. are always free of dirt, snow and ice.
- When working on or changing any part of the attachment, make sure that the attachment is properly supported. Never use metal on metal supports.
- Never work underneath the machine unless it is properly supported with wooden supports.
- Always block the machine in such a way that any change in the center of gravity will not endanger its stability. Never use metal on metal supports.
- Only authorized, trained personnel may work on the travel gear, brake and steering system.
- If the machine must be repaired while parked on a slope, the track chains or wheels must be blocked with wedges to prevent any movement. The attachment must be brought into proper maintenance position.
- Only experienced, authorized personnel who have received specialized training may work on the hydraulic system.
- Always wear gloves when checking for leaks. Never check for leaks with your bare hands. A thin stream of fluid escaping from a small hole can have enough force to penetrate the skin.
- Never loosen any hydraulic lines or connections until the attachment has been lowered and the engine has been turned off. Then, with the ignition key in contact position, acute all servo controls(joysticks and foot pedals) in both directions to release any servo pressure and to release all pressures in the working circuit. Release the tank pressure by slowly opening the bleeder valve.
- Regularly check all hydraulic lines, hoses and connections for any leaks and damage. Any defects must be repaired immediately. Any escaping fluid can cause serious injuries and fire.
- Before starting any repairs, you also must make sure that all air pressures are relieved in any of the systems you need to gain access to: to be certain, refer to description of various components and groups and assemblies.

- Route and install all hydraulic and air pressure lines properly. Mark and check all connections to prevent any mix ups. All fittings, including length and quality or type of hoses used must match the requirements set forth by the manufacturer.
 - **For that reason, use only Original LIEBHERR spare parts.**
- Replace hydraulic hoses and lines in regular intervals, as stated, even if no defects can be seen.
- Work on electrical components of the machine may only be performed by a certified electrician or by a person working under the guidance and direct supervision of such an electrician, and according to electro-technical procedures, rules and regulations.
- When working on the electrical system or before any arc welding on the machine, the battery cables must be disconnected. Always disconnect the negative terminal first and reconnect it last.
 - In addition, before any welding, always remove the electronic box.
- Use only Original fuses with the same amperage. In case of problems in or with the electrical power supply, turn the machine off immediately.
- Inspect / check the electronic components of the machine regularly. Repair any problems or defects, such as loose connections or chafed wires and replace any burnt out fuses and bulbs immediately.
- If any work is necessary on energized, voltage carrying parts, a second person must be utilized to disconnect the main battery switch or emergency switch in case a problem should arise. Rope off the working area with a red and white safety chain and a warning sign. Use only insulated tools.
- When working on high voltage carrying components or sections, turn off the power supply, then connect the supply cable to the ground wire and use the grounding rod to ground these parts, such as the condenser, for example.
- Check the disconnected parts first to see if they are really voltage free, ground them and then close them off; insulate the neighboring, voltage carrying parts.



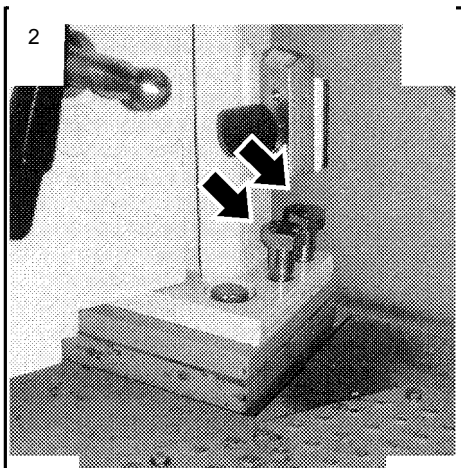
6.2 TILTING THE CAB

To simplify service and repair on components within the main frame, the operators platform with the cab can be tilted hydraulically.

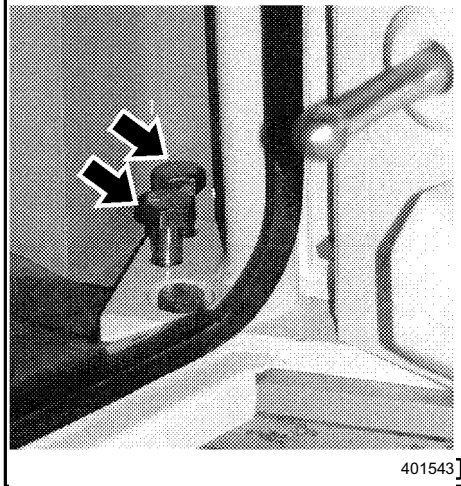
By actuating the hydraulic hand pump, the cab can be tilted to the rear.

6.2.1 TO RAISE THE CAB

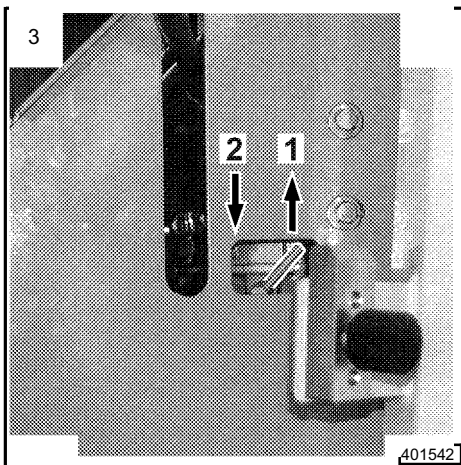
- Turn the engine off.
- Place the safety lever in the full down position (fig. 1).



- Remove 4 hex head screws on each side on the cab. (fig. 2)

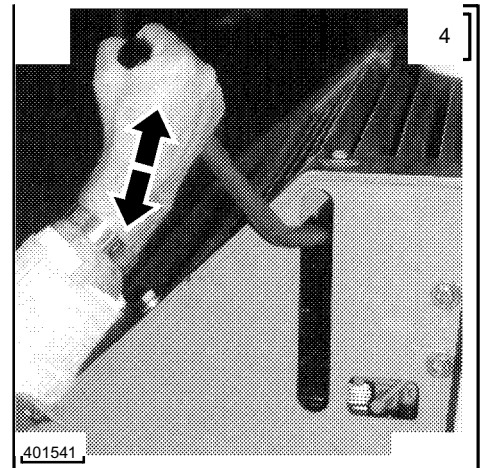


- Close both cab doors.



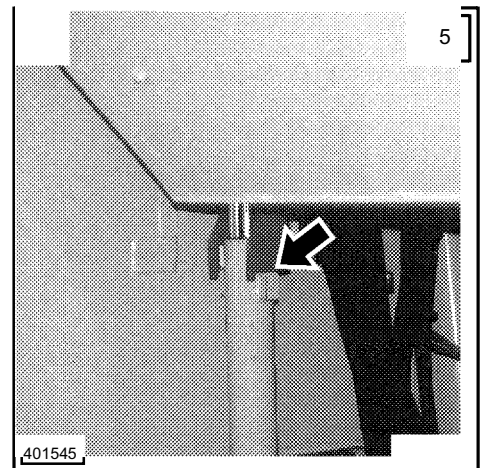
- Move the lever on the hand pump to raise . (fig. 3, pos. 1)
- Remove an extension pipe from the tool box.

- Actuate the hydraulic hand pump (fig. 4) until the piston bottoms out (Do not leave the cab in an intermediate position!).



- Insert the mechanical safety support bar at the hydraulic cylinder (fig. 5).
- Move the lever to the down position (fig. 3, pos. 2).

Lower the cab a little by actuating the hand pump until the cab is held in place by the mechanical safety support bar (fig. 4).

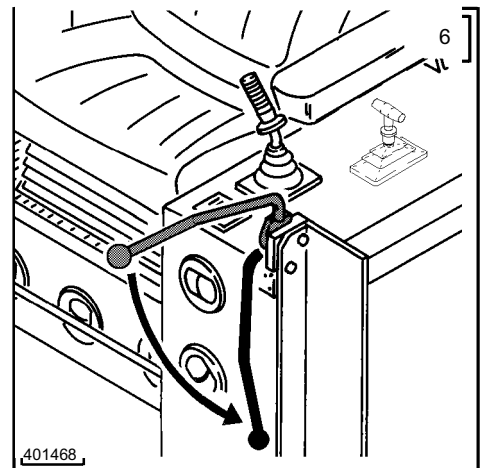


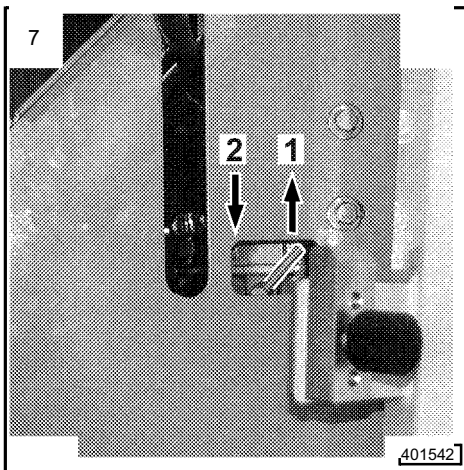
The cab may only be tilted when the machine is at a standstill.

Stay clear of the cab until completely raised or lowered and secured with the safety bar. Make sure that nobody is within the tilting range of the machine when tilting the cab in or out.

Do not work or allow work underneath or on the cab or canopy unless it is at a standstill, and properly secured by the safety bar.

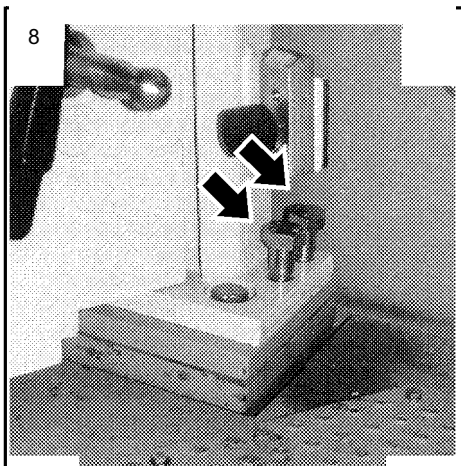
NEVER start the engine and operate the machine with a raised cab. The safety lever must remain in the full down position. (fig. 6).





6.2.2 LOWER THE CAB

- Move the pump lever to the up position (fig. 7, pos. 1). Actuate the hydraulic hand pump to raise the cab a little, then disengage the mechanical safety support bar.
- Move the lever to the down position (fig. 7, pos. 2). The cab is lowered by actuating the hydraulic hand pump.

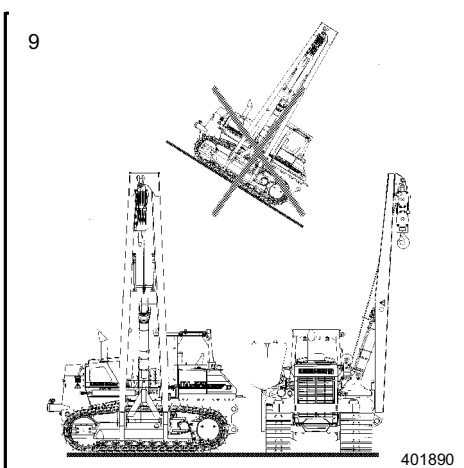
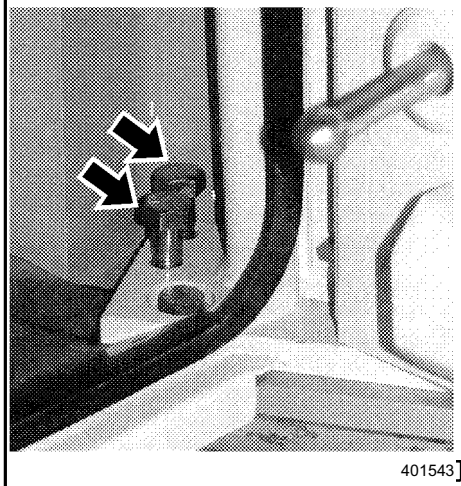


- Attach the cab with the four hex head screws on each side (fig. 8).
- The machine is now operational.



DANGER

DO NOT START the engine until the cab is lowered and secured.



6.3 ENGINE

6.3.1 CHECK THE ENGINE OIL LEVEL

Check the engine oil level with the machine on level ground (fig. 9). After engine shut down, wait for a few minutes for the oil to collect in the pan.

Pull out the dipstick, wipe it with a clean cloth, and reinsert it all the way.

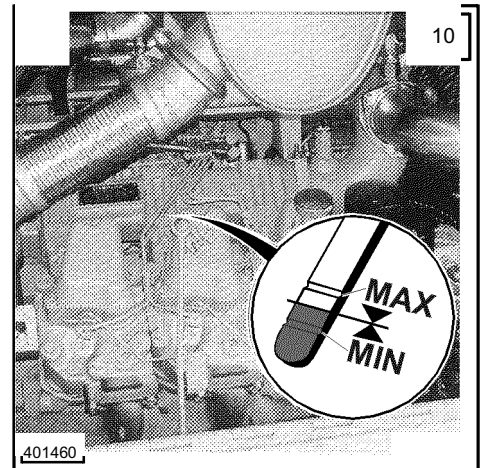
Pull the dipstick out again and check the oil level.

The oil level must be between the MIN. and the MAX. mark on the dipstick (fig. 10).



NOTE

Do not overfill the engine. The difference between MIN. and MAX. is 15 l (3.9 gal).



6.3.2 CHANGE ENGINE OIL

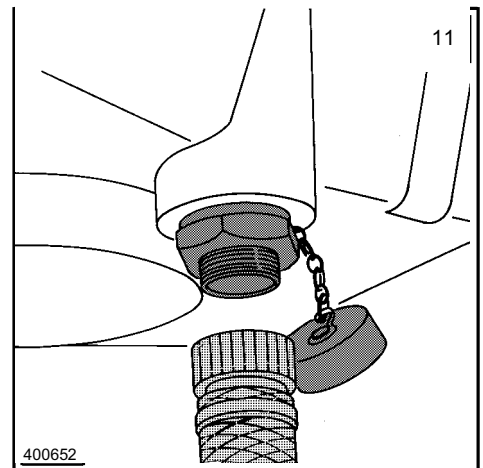


CAUTION

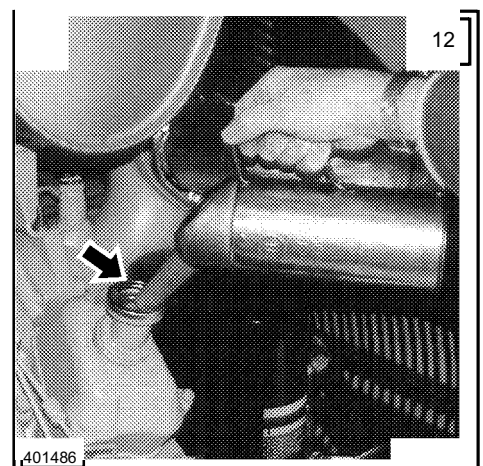
Hot engine oil can cause serious burns!

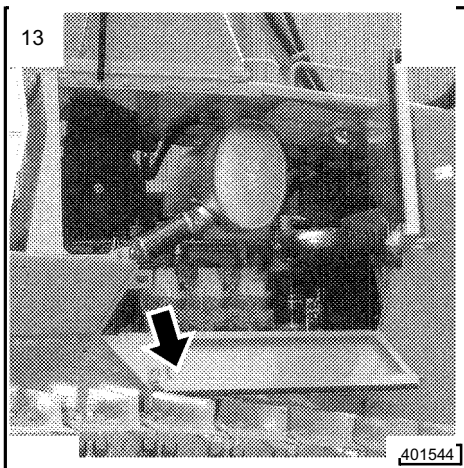
Change the oil with the engine at operating temperature.

- Remove the oil pan cover.
In case of contamination and heavy deposits in the oil pan, remove the oil pan and clean the pan.
- Remove the protective cap from the drain valve and connect the drain hose. Place a suitable container under the opening and drain the oil. Dispose of it properly (fig. 11).
- Remove the drain hose, reinstall the protective cap and cover.



- Fill engine with oil through the filler neck (fig. 12).
For quantity, quality and viscosity, refer to specifications given in this Operation and Maintenance Manual.



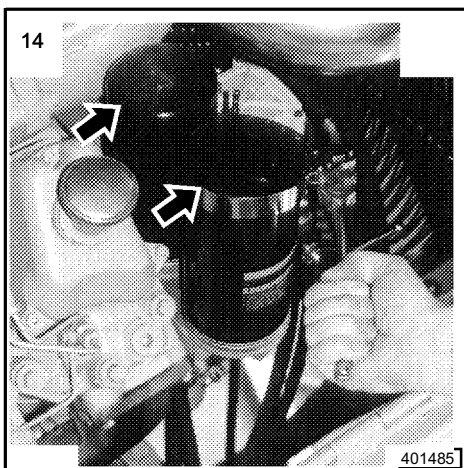


6.3.3 CHANGE THE ENGINE OIL FILTERS

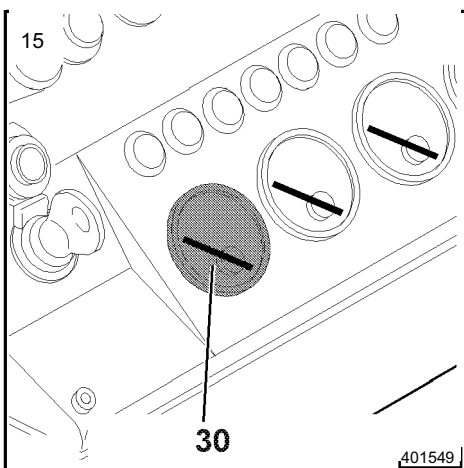
- Open the engine compartment doors.
- Fold down the right lower cover (fig. 13).
- Place a suitable container under the filters to catch any emerging oil.

CAUTION

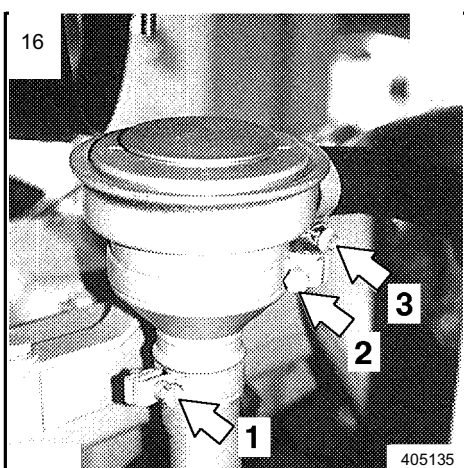
The exhaust pipe is hot! Danger of burns!



- Unscrew the filter and dispose of it properly (fig. 14). (There is still oil in the filter!)
- Clean the filter sealing surface on the filter base.
- Lubricate the seal rings of the new filter with clean oil.
- Reinstall the filter and tighten it by hand.



- Start the engine and check the oil pressure gauge (fig. 15).
- If no oil pressure builds up, turn the Diesel engine off and fix the problem.
- Recheck the oil level, add oil as necessary.



6.3.4 REMOVAL / INSTALLATION OF THE OIL SEPARATOR

REMOVAL

- Loosen the mounting clamp, pos. 1 and 2.
- Loosen the hose clamp, pos. 3, push the hose back and remove the oil separator (fig. 16)

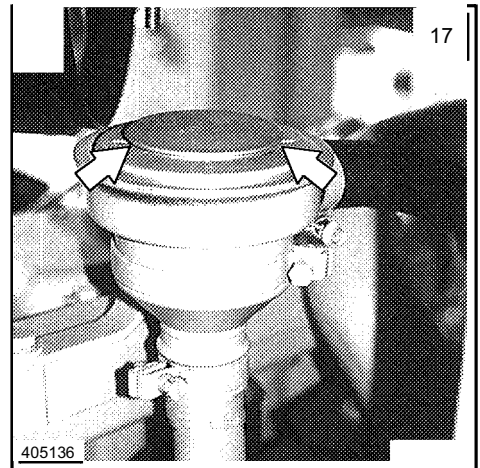
INSTALLATION

Insert a new O - ring into the oil separator, add the oil separator and tighten the mounting clamp. Push on the hose and tighten the hose clamp.

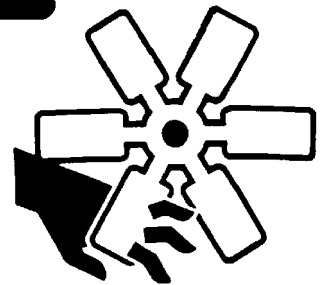
**NOTE**

Replace the oil separator if oil vapors emerge from the bleeder bores (fig. 17), and as stated on the Maintenance and Inspection Schedule.

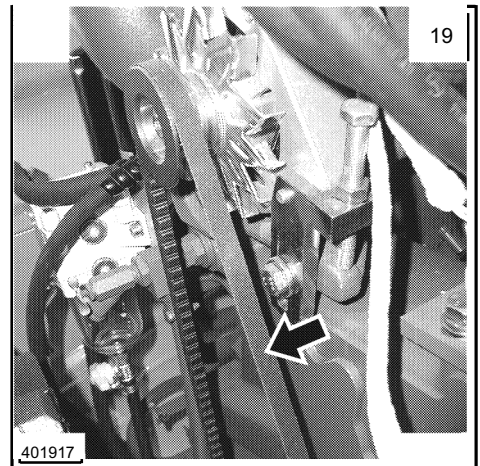
Make sure that no cleaning solutions (for example when cleaning the engine) get into the oil separator.

**6.4 ALTERNATOR****CAUTION**

Keep objects and hands away from fan and V-belt, Never touch the fan or fan belt when the engine is running. (fig. 18).

**6.4.1 CHECK V-BELT TENSION**

Correctly tensioned V-belts can be deflected in the middle approx. 10 mm (3/8) with moderate thumb pressure (fig. 19).

**6.4.2 TO ADJUST V-BELT TENSION**

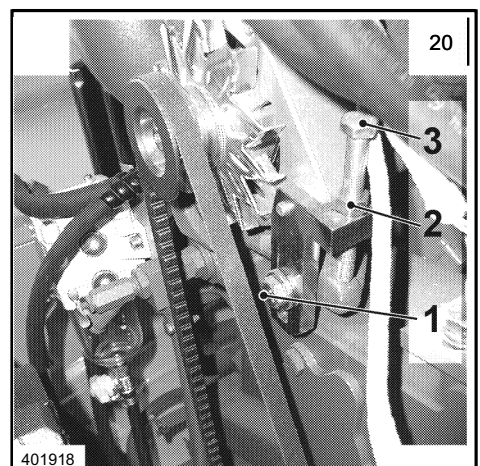
- Loosen the lock screw (pos. 1) and lock nut (pos. 2).
- Turn the adjustment screw (pos. 3) clock or counterclockwise until the V-belt tension is correct.
- Retighten the lock screw and lock nut (fig. 20).

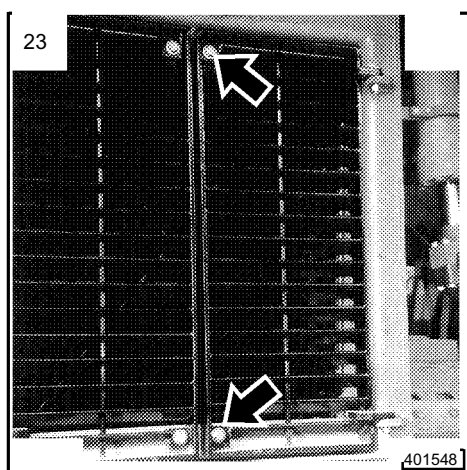
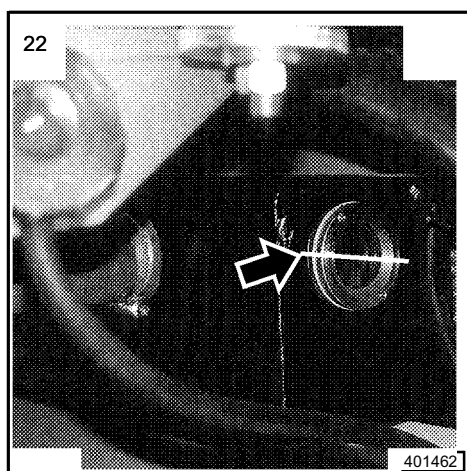
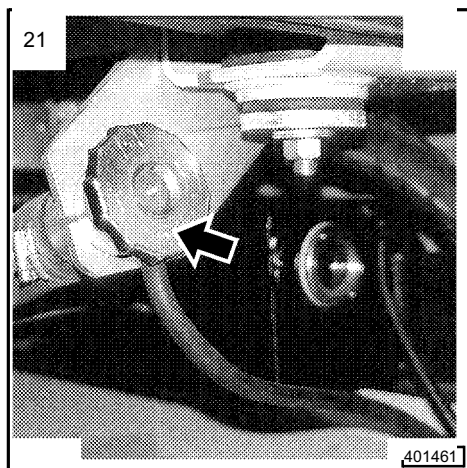
**NOTE**

Always replace broken or worn, greasy and cracked V-belts.

6.4.3 TO REPLACE THE V-BELT**To replace the V-belt:**

- Loosen lock screw (pos. 1) and the lock nut (pos. 2), turn the adjustment screw (pos. 3) counterclockwise (fig. 20).
- Push the alternator down and remove the V-belt.
- Install a new V-belt and adjust the tension as outlined.





6.5 COOLING SYSTEM

6.5.1 CHECK THE 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 the coolant level only after the radiator cap is cool enough to touch (fig. 21). Remove the radiator cap slowly to relieve pressure!

- The coolant level must be visible in the center of the sight gauge (fig. 22).

Check the engine, fan and radiator for damage, dirt and restrictions, clean as necessary.

After refilling or adding to the cooling system, let the engine run for a short time with the heater turned on. Recheck the coolant level.



NOTE

The cooling system must always be filled with a mixture of anti corrosion / antifreeze fluid and DCA4 to provide year round protection.

The machine is filled at the factory with a coolant mixture of approx. 50% antifreeze / 50% water to protect the system to -36 C . For quantities and mixing ratio, refer to the lubrication chart.

6.5.2 CHANGE THE COOLANT

Change the complete contents of the cooling system every two years.



NOTE

Change the coolant with the engine cold.

- Remove the screws on the radiator guard (fig. 23) and fold the radiator guard outward.

- Remove the cap on the drain valve and connect a drain hose (fig. 24).
- Collect coolant in a suitable container and dispose of it properly.
On machines with cab, open the shut off valves for the cab heater on the engine.
- Remove the drain screw on the oil cooler plate of the engine.
- To completely drain the engine, you also must drain the coolant pump.

TO ADD COOLANT



CAUTION

Make sure that you dont get any cooling fluid on your skin.

Observe the manufacturers safety guidelines! When mixing coolant, wear rubber gloves and safety glasses. In case of splashes in eyes or on skin, use lots of water to flush off any coolant residue.

- Reinsert the drain plugs on the cooler and engine.
- Open the heater valves (fig. 25)

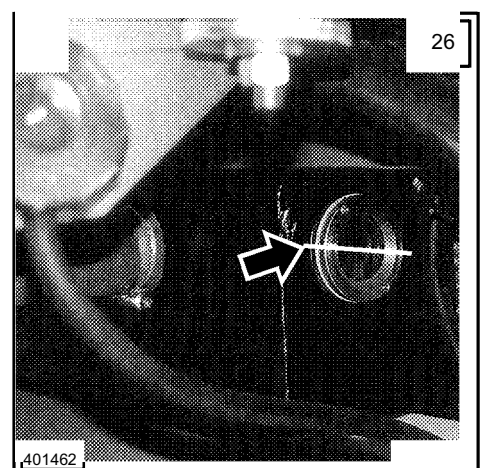
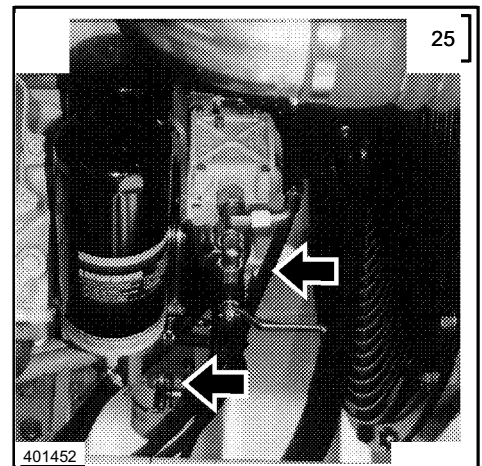
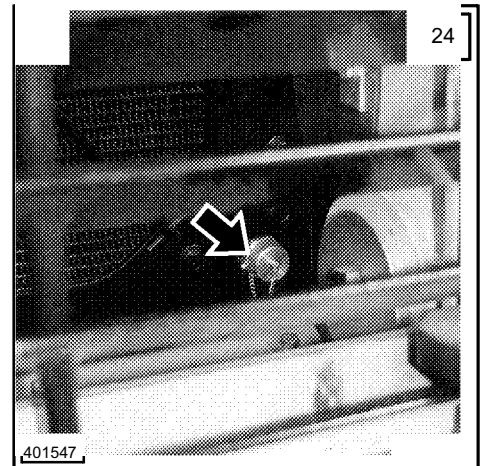
- Add coolant until it is visible at the center of the sight gauge (fig. 26).

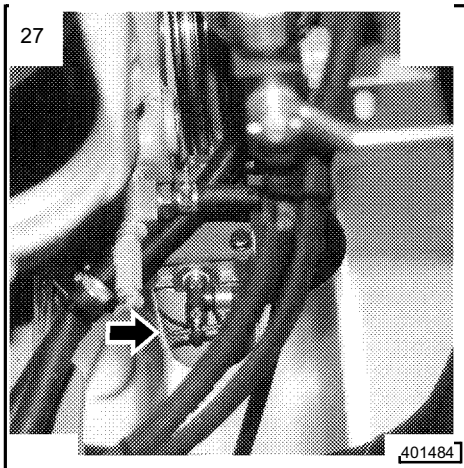
Set the heater knob to '+', let the engine run, then check the coolant level again and add more coolant, if necessary.



NOTE

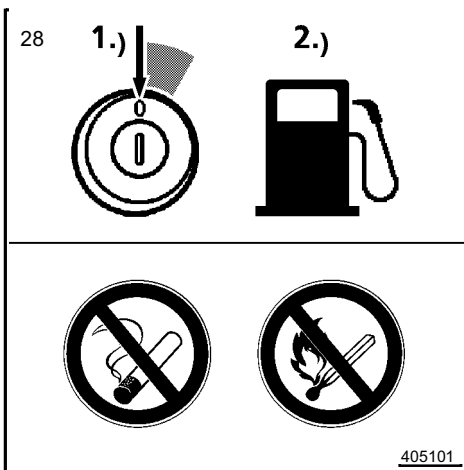
If the cooling system is contaminated, use a commercially available product to clean the complete cooling system.





6.5.3 CHANGE THE FILTER ELEMENT

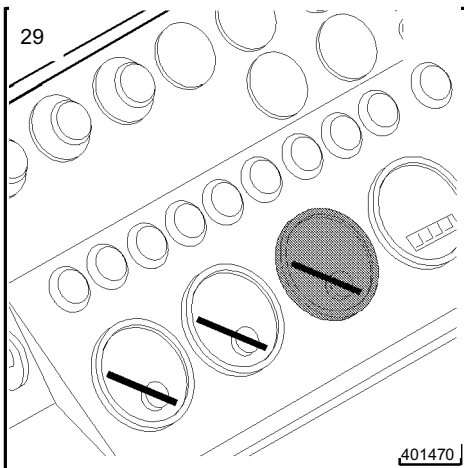
- Close the shut off valves on the water filter.
- Unscrew the filter element and dispose of it properly (fig. 27).
- Lightly oil the rubber seal ring on the new filter element, screw on a new element and tighten by hand.
- Open the shut off valves on the water filter.
- Check the coolant level again and add more coolant, if necessary.



6.6 FUEL SYSTEM

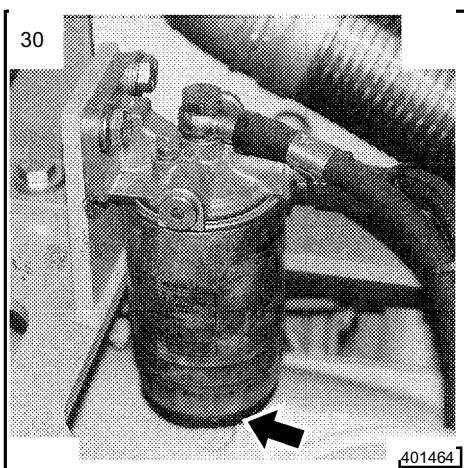
CAUTION

Do not add fuel in closed areas. Never smoke or allow an open flame in refueling areas. Always shut the engine off during refueling. **NEVER** drain fuel onto the ground, always collect it in a suitable container.



The fuel gauge in the instrument panel shows the fuel level in the fuel tank (fig. 29).

Maintain a high fuel level in the tank to reduce condensation and corrosion.



6.6.1 REPLACE THE FUEL FILTER ELEMENTS

- Remove the fuel filter element (fig. 30) and dispose of it properly.
- Lightly lubricate the seal ring of the new element with oil, screw on the new element and tighten by hand.

6.6.2 DRAIN THE WATER SEPARATOR ON THE FUEL FILTER

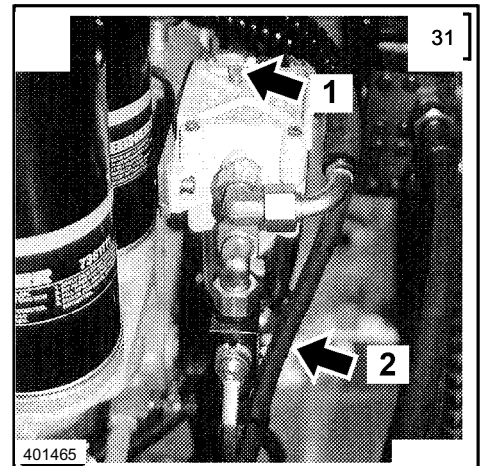
- Place a suitable container under the drain valve.

- Open the drain valve on the underside of the filter. Drain condensation until clean fuel emerges. Reinstall the drain valve (fig. 30).

6.6.3 TO EMPTY FUEL FILTER / WATER SEPARATOR

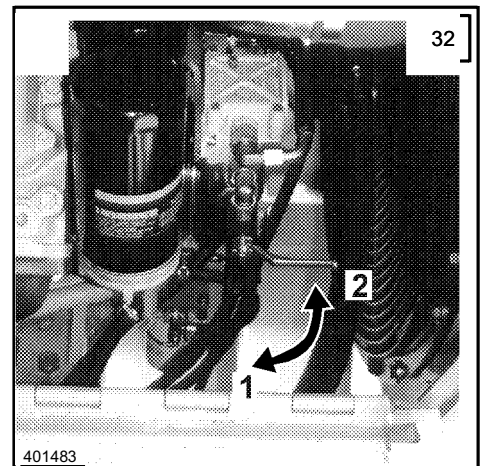
DRAIN WATER

- Place a suitable container under the water separator.
- Open the bleeder screw on top of the water separator (fig. 31, pos. 1).
- Open the drain valve until clean fuel emerges, close the drain valve and the bleeder screw again (fig. 31, pos. 2).

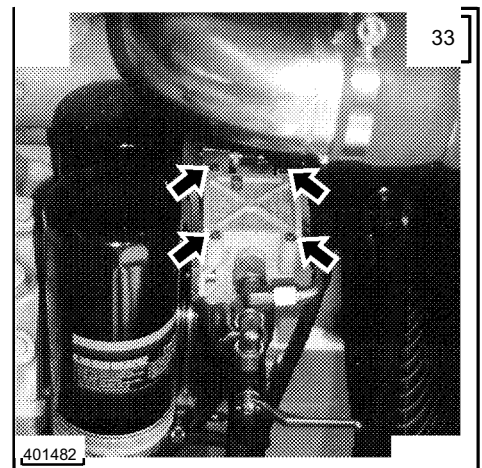


6.6.4 CLEAN FUEL FILTER / WATER SEPARATOR

- Close the shut off valve in the engine compartment (fig. 32, pos. 2).

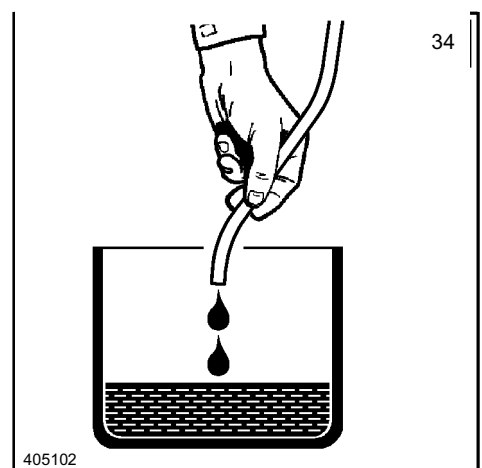


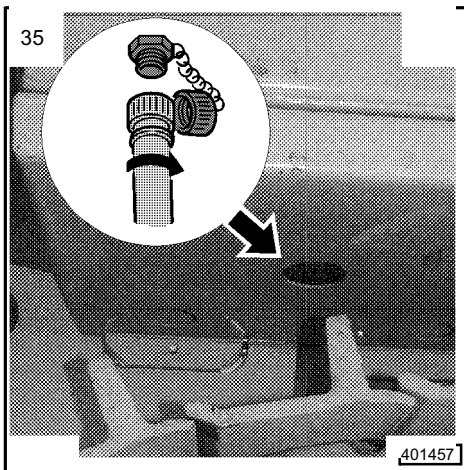
- Remove the four screws on the water separator (fig. 33), remove the cover with seal and screen insert. Clean the screen or replace it, check the seal and reassemble the water separator in reverse order.
- Open the shut off valve (fig. 32, pos. 1) and close the engine compartment doors.



6.6.5 DRAIN WATER AND SEDIMENTS FROM THE FUEL TANK

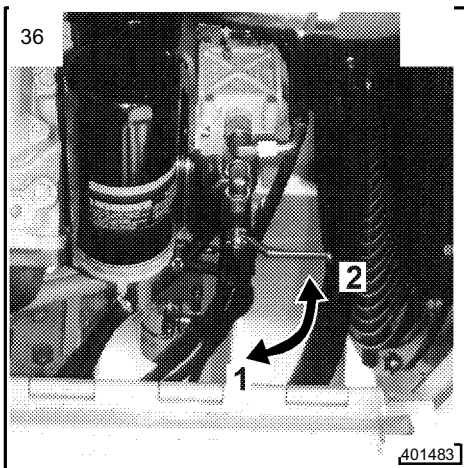
- Place a suitable container under the drain (fig. 34).



**NOTE**

The drain valve can only be opened by adding a drain hose (part of the tool kit) (fig. 35).

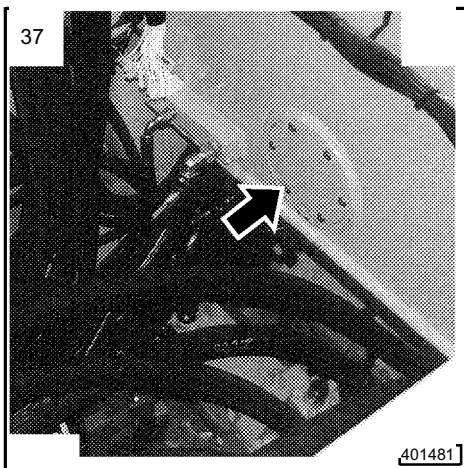
- Remove the cap on the drain valve.
- Connect the drain hose - as the drain hose is attached to the drain valve, fuel begins to flow. Drain the water and sediments until clean fuel emerges from the hose.
- Remove the hose and reinstall the cap on the drain valve.

**6.6.6 DRAIN THE FUEL TANK**

If the fuel filters have to be changed too often, it may be necessary to drain and clean the fuel tank.

- Close the shut off valve in the engine compartment (fig. 36, pos. 2).
- Remove the tank cover and cap on the drain valve, connect a drain hose (fig. 35). Drain fuel into a suitable container. Remove the strainer, check it and replace it, if necessary.

Check the fuel tank, clean it if necessary. If it does not require cleaning, remove the drain hose and reinstall the cap.

**6.6.7 CLEAN THE FUEL TANK**

- Raise the cab, as outlined.
- Empty the fuel tank completely.
- Remove the fuel tank inspection cover (fig. 37) and clean the fuel tank.
- Check the O-ring on the cover, replace it if necessary.
- Reinstall cover with O-ring and add fuel.
- Open the shut off valve in the engine compartment.

6.6.8 ADD FUEL TO THE FUEL TANK**CAUTION**

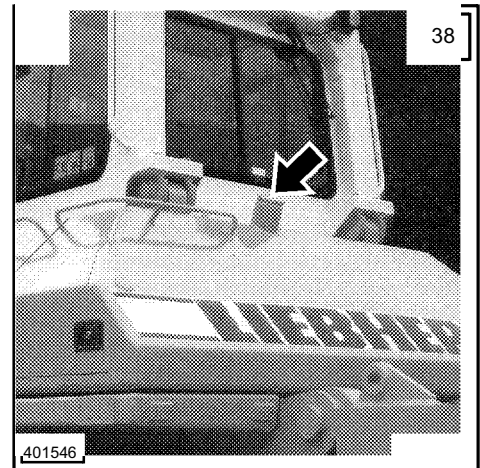
Turn the Diesel engine off.

- Open the fuel tank cap (fig. 38).

**NOTE**

Add fuel only through the strainer.
To reduce condensation in the tank, add fuel in the evening or after every shift change.
Check the fuel quality regularly.

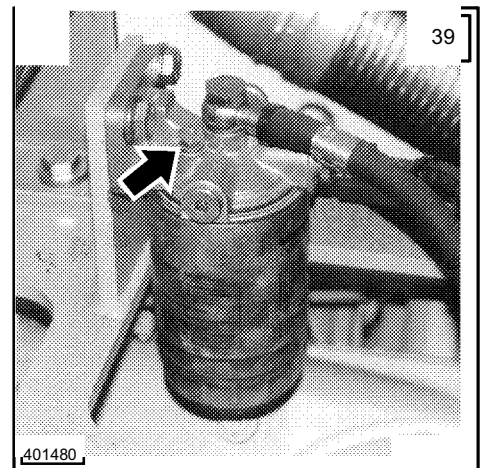
If fuel is added from a canister, be certain that you have proper support.

**6.6.9 BLEED THE FUEL SYSTEM**

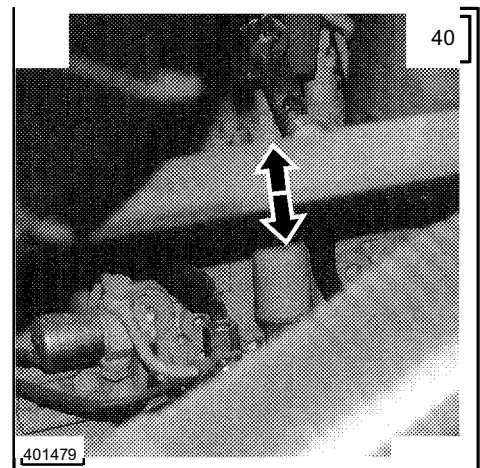
Loosen the bleeder screw on the fuel filter and turn it counterclockwise by 2-3 turns (fig. 39).

Always bleed the fuel system after the following service:

- Change of fuel filters.
- Cleaning of fuel tank.
- Repairs on fuel system.
- Draining the fuel tank or running out of fuel.

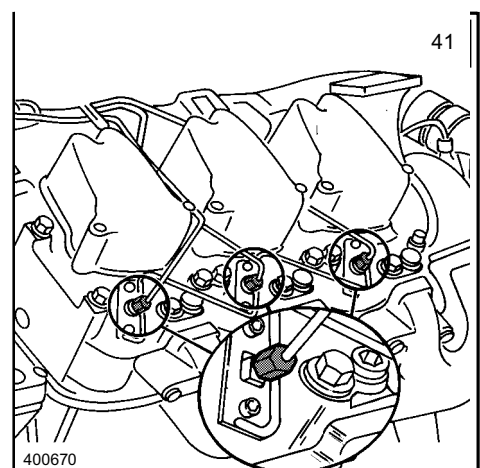


- Actuate the hand pump (fig. 40) until fuel free of air bubbles emerges on the bleeder screw. Retighten the bleeder screw.



- Loosen the union nuts on the fuel injectors, actuate the starter switch until fuel free of air bubbles appears. Reinstall the lines. (fig. 41).

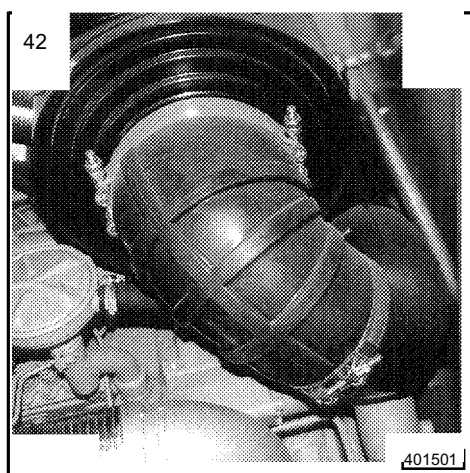
Start the engine, as outlined. If the engine does not start, repeat the bleeding procedure.



6.7 ENGINE AIR INTAKE SYSTEM

For maximum engine protection and service life, the air intake system must be checked and serviced at regular intervals.

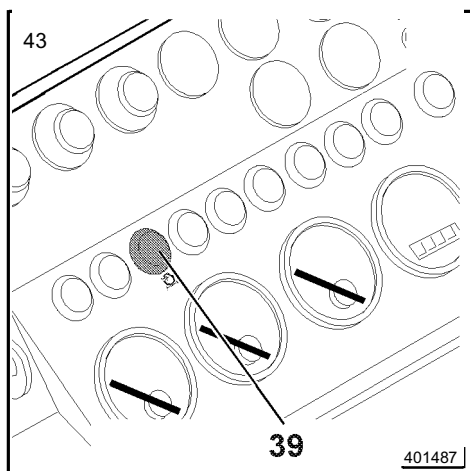
Not only air filter elements should be cleaned and / or changed, all connections, pipes, hoses and clamps in the air intake system should be checked at regular intervals, according to the Maintenance and Inspection Schedule. Defects must be repaired immediately.



Air is drawn into the engine via the air intake pipe and through the air filter, which consists of the primary filter element and the safety element (fig. 42).

Between the air intake pipe and the exhaust pipe, an automatic dust ejector is installed, which prevents dust from collecting in front of the filter.

After the filter, a vacuum gauge with electrical indicator is installed.



NOTE

When the maximum allowable restriction is reached, the vacuum indicator light in the cab will light up (fig. 43).

Turn the engine off and service the system.

NEVER run the engine without the air filter.

6.7.1 SERVICE THE PRIMARY FILTER ELEMENT

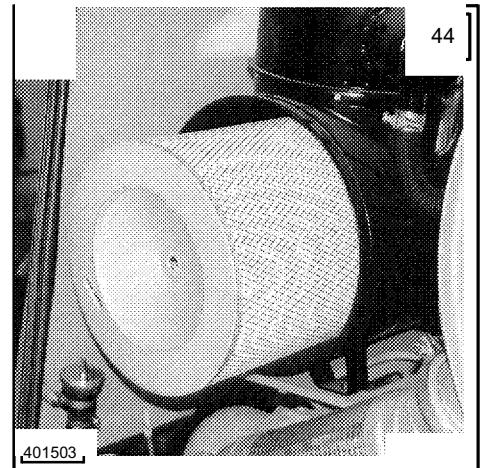
When the indicator light on the instrument panel (fig. 43) lights up, the filters should be cleaned or replaced.

The primary filter element should be replaced after it has been cleaned three times, or once a year.

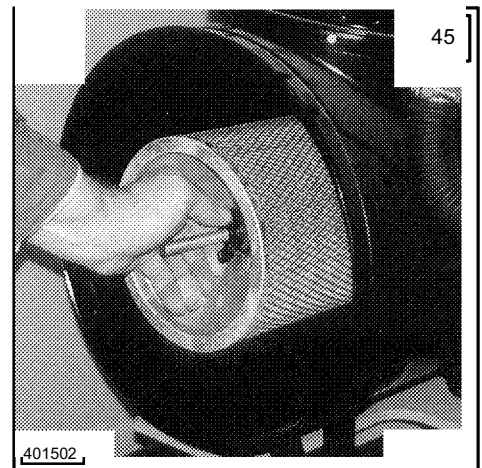
The primary filter element can be wet or dry cleaned. Wet cleaning is only necessary when the element is oily or sooty.

**NOTE**

Clean the primary filter element (fig. 44) only after the indicator light comes on.



The safety element (fig. 45) should not be cleaned, it should be changed after the primary filter element has been cleaned three times and every time the primary filter element is replaced.

**6.7.2 REMOVE THE PRIMARY FILTER ELEMENT**

- Remove the hex head screw with washer and remove the cover (fig. 46)
- Remove the primary filter element from the air filter housing.

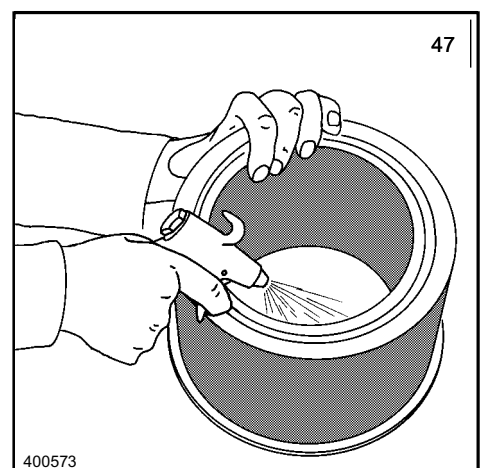
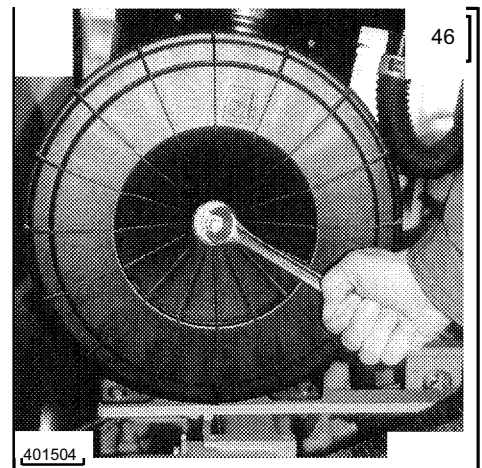
6.7.3 CLEAN THE PRIMARY FILTER ELEMENT**DRY CLEANING****NOTE**

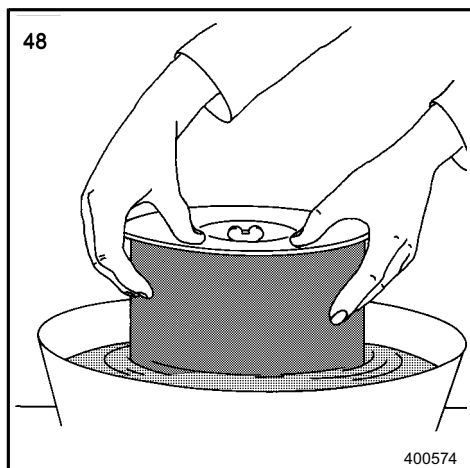
Never try to clean the primary filter element by hitting it. This will not clean the filter, but could damage it.

Wet cleaning is necessary when the element is oily or sooty.

Direct compressed air (maximum air pressure 100 PSI / 7 bar) through the primary element from the inside to the outside. Move the nozzle up and down while rotating the element. Keep at least 1 (2 cm) from the pleated paper. The cleaning is complete when no more dust escapes from the element (fig. 47).

Check the primary filter element as outlined above.





WET CLEANING

Dry clean the primary element, as outlined above.

Soak the element for about 15 minutes or more in water and cleaning solution (fig. 48).

Observe instructions given by the filter manufacturer.



Rinse the primary filter element in clean water (fig. 49), use a water hose without a nozzle (max. 3 bar water pressure).

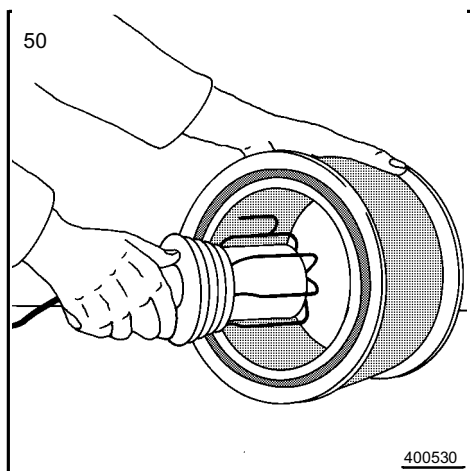
Air dry the filter element or use warm air flow (max. 50 C / 125 F).



NOTE

Do not use heat from a light bulb to dry the filter element.

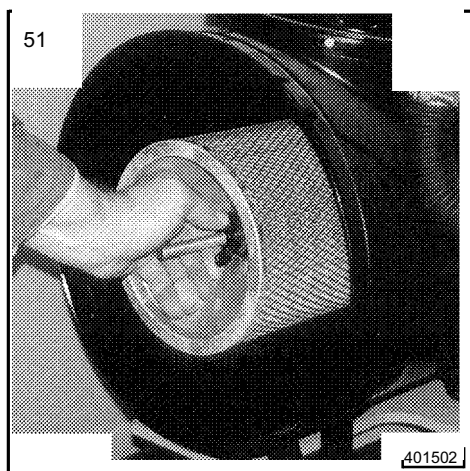
Never install wet filters.



6.7.4 INSPECT THE PRIMARY FILTER ELEMENT

Place a bright light inside the cleaned and dried primary filter element and rotate it slowly. (fig. 50).

Check for cracks or holes. Even small hoses show up as a light spot. Inspect seals for wear and damage. Replace faulty or damaged filter elements.



6.7.5 REPLACE THE SAFETY ELEMENT

The safety element (fig. 51) **MAY NOT BE CLEANED**. Replace the safety element after the primary filter element has been cleaned three times, or at least once a year.

Remove the primary filter element, as outlined.

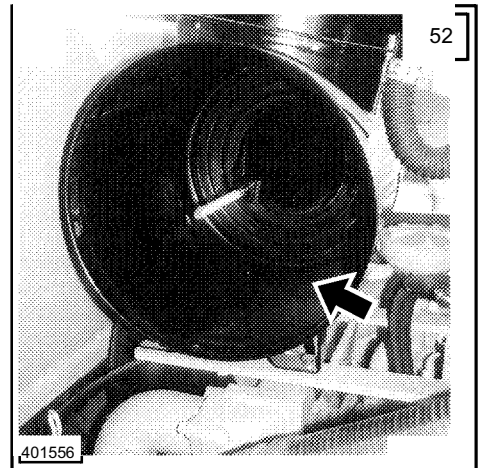
- Clean the filter housing with a damp cloth. Never use compressed air.
- Remove the wing nut and seal, remove the safety element.

Install new element in reverse order.



NOTE

Make sure the area you work in is dust free, dust should not enter the air intake system (fig. 52).

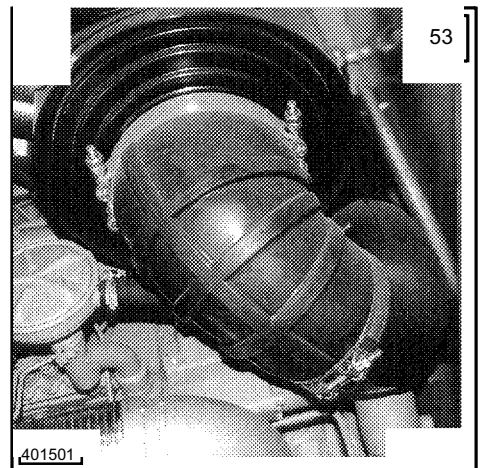


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6.7.6 INSPECTION OF AIR INTAKE SYSTEM

The connections and components of the air intake system as well as the dust ejector must be checked for wear, damage and leaks at regular intervals and every time the filter element is replaced (fig. 53).

Retighten the clamps. DO NOT operate the engine without air filters.



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6.8 HYDRAULIC SYSTEM



CAUTION

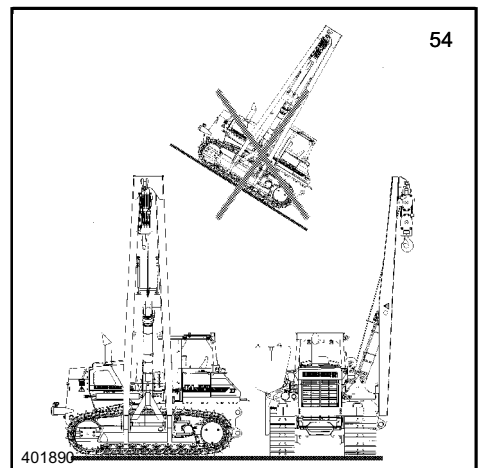
Before starting to perform any maintenance tasks, always lower the attachment to the ground. Turn the engine off and actuate all functions again to release pressure in all lines.



NOTE

Before removing filters, hoses, lines or fittings, clean all connections and surrounding area.

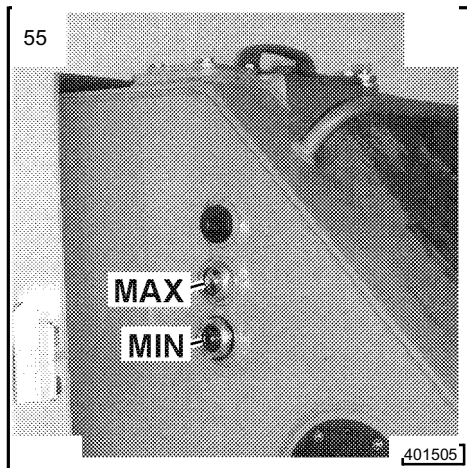
As soon as a component is disconnected, plug, tape or cap openings shut to prevent dirt from entering the hydraulic system.



54

6.8.1 CHECK HYDRAULIC OIL LEVEL

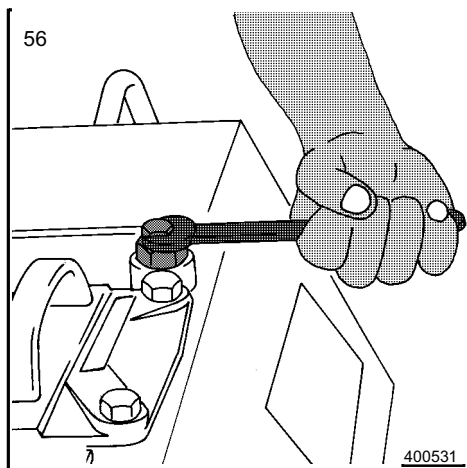
- Place the machine on level ground (fig. 54).
- Retract the hydraulic cylinders.



The oil level must not be above the center of the upper sight gauge (fig. 55, MAX.).

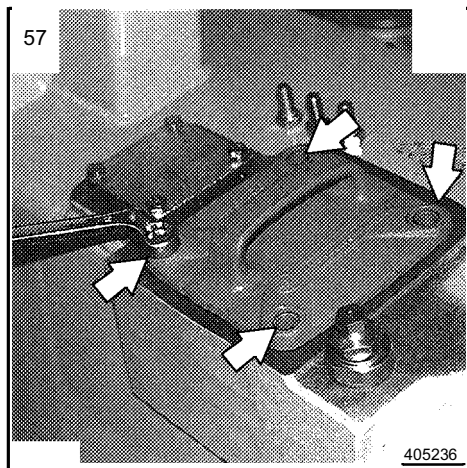
- Extend the hydraulic cylinders. The oil level may not drop below the center of the lower sight gauge (fig. 55, MIN)

Add hydraulic oil, if necessary.



6.8.2 ADD HYDRAULIC OIL

- Retract the hydraulic cylinders.
- Relieve the pressure in the hydraulic tank by turning the bleeder screw by one turn (fig. 56).



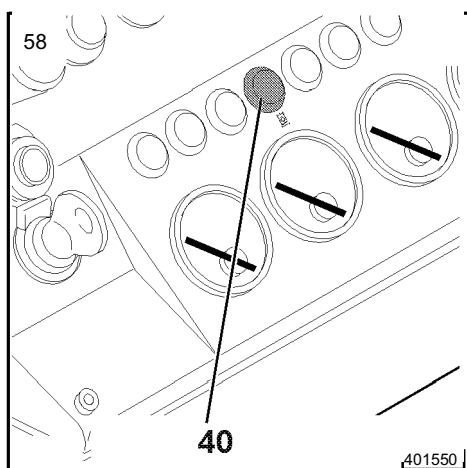
- Loosen the screws on the filter cover (fig. 57) and lift off the cover with the magnetic rod.
- Check and clean the magnetic rod, according to the data given in the Maintenance and Inspection Schedule.



NOTE

Add hydraulic oil only through the return oil filter (fig. 57).

- Check the O-ring and replace it, if necessary. Reinstall the cover, tighten the screws and close the bleeder screw.



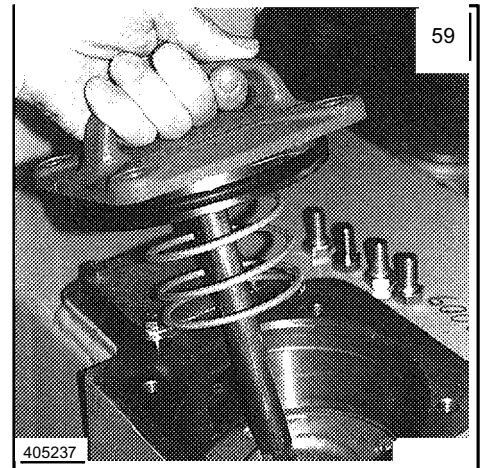
6.8.3 REPLACE THE HYDRAULIC TANK FILTER (RETURN FILTER)



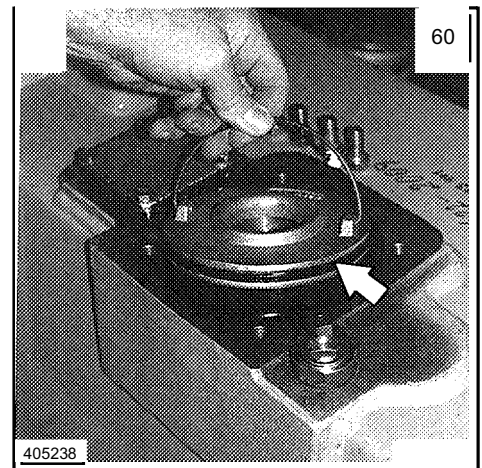
NOTE

Change the filter according to the Maintenance and Inspection Schedule or if the return filter indicator light lights up when the oil is at operating temperature (fig. 58).

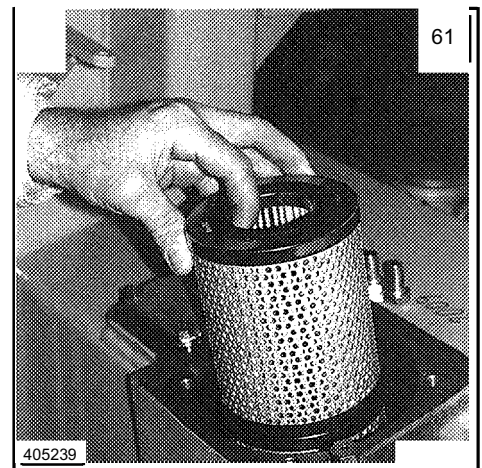
Remove the filter cover with spring and magnetic rod (fig. 59).



- Remove the pressure plate (fig. 60).
- Remove the filter and dispose of it properly.



- Carefully insert the new filter element (fig. 61). Check the O-ring, replace it if necessary.

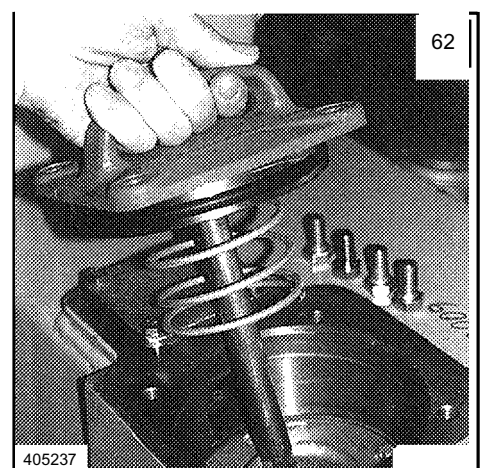


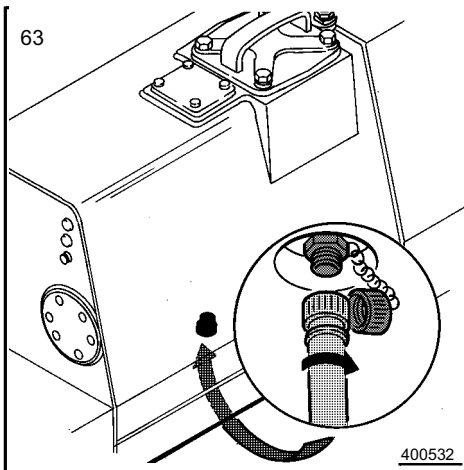
- Reinstall spring and pressure plate (fig. 62). Clean the magnetic rod and reinstall the cover.



NOTE

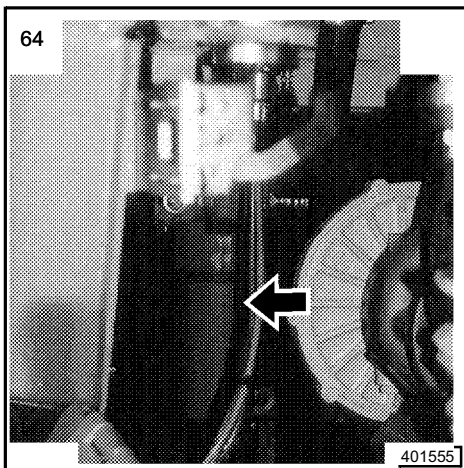
Do not clean or reuse old filters. Always replace the filters. Always keep spare O-rings on hand. Use only Original Liebherr replacement filters.





6.8.4 CHANGE HYDRAULIC OIL

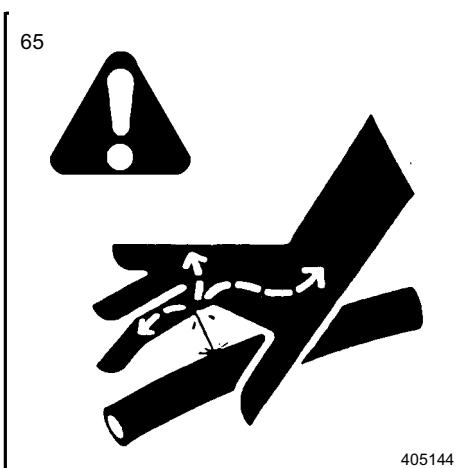
- Remove the hydraulic tank filter.
- Unscrew the cap at the bottom of the tank (fig. 63). Install drain hose and drain the oil into a suitable container, dispose of it properly.
- Remove the drain hose and reattach the cap.
- Insert new filter and add oil. Add hydraulic oil only through this filter.
For oil specification, refer to data in this Operation and Maintenance Manual.
- Insert the magnetic rod. Reinstall the cover and close the bleeder screw again.



6.8.5 REPLACE HYDRAULIC REPLENISHING OIL FILTER

- Clean surrounding area. Place a suitable container under the filter.
- Remove the filter housing and dispose of the filter element properly (fig. 64).
- Clean the sealing surface and threads on the filter mount.
- Lightly lubricate the threads and sealing surfaces on the filter as well as the seal ring of the new filter element with clean oil.
- Set the filter element on its receptacle.
- Screw in the filter housing by hand, then back it out by 1/4 turn. The sealing action will not be improved if it is tightened further!
- Check the filter for leaks.

Note: Observe the filter manufacturers guidelines also.



6.8.6 HYDRAULIC SYSTEM MAINTENANCE AND REPAIRS

Part of maintenance consists of checking the complete hydraulic system for leaks, loose connections, frayed, worn or damaged lines, tubes and hoses at regular intervals.

CAUTION

Never check for leaks with your bare hands. Fluid escaping from a small hole can have enough force to penetrate the skin (fig. 65).

Do not disconnect lines or hoses or remove fittings or caps as long as the hydraulic system is still pressurized. Lower the attachment, turn the engine off and release system pressure.

- Repair all defective hydraulic hoses immediately. Hose and tube assemblies must be installed free of distortion. Do not twist or kink hoses.
- In case of leakage on an SAE hose connection, replace the O-ring. Use only Original LIEBHERR O-rings (fig. 66).

- If the suction hose for the attachment pump has to be removed at the pump or hydraulic tank, close the shut off valves on the hydraulic tank first (fig. 67). Remove the hose at the pump and drain oil from the pump and the hose.
- Be certain to open the shut off valves on the hydraulic tank again after the repairs are completed.

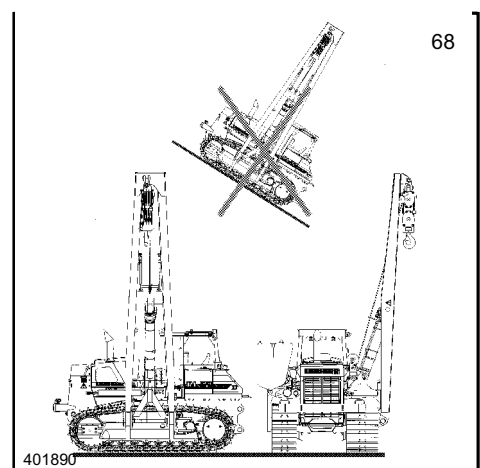
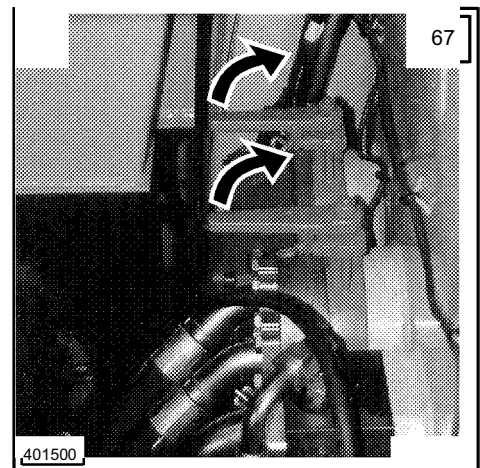
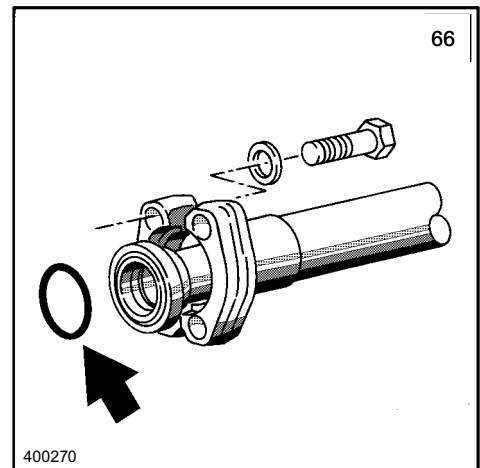
6.8.7 HYDRAULIC CYLINDERS

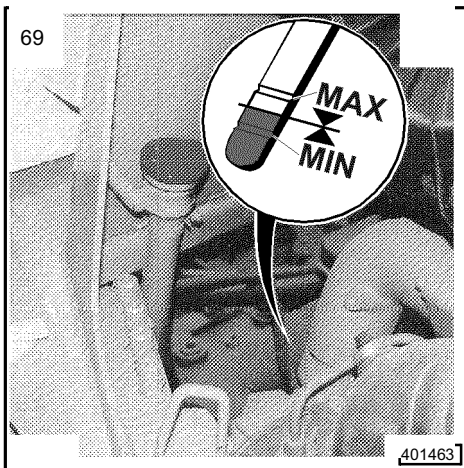
Before attempting to repair, replace or research hydraulic cylinders and other components, contact your LIEBHERR dealer.

6.9 SPLITTERBOX

6.9.1 CHECK SPLITTERBOX OIL LEVEL

- Park the machine on firm and level ground (fig. 68).
- Open the right engine compartment door.

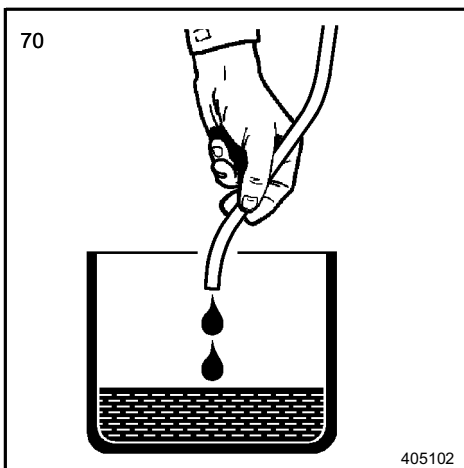




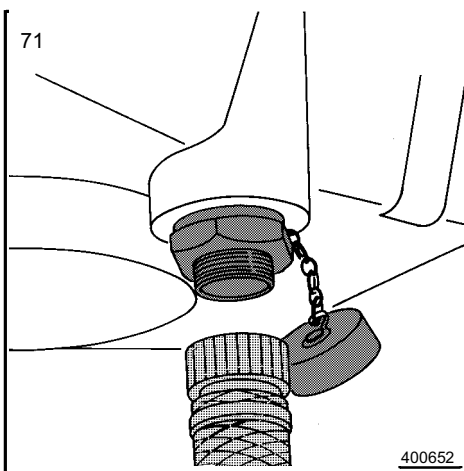
- Pull out the dipstick, wipe it off with a clean cloth and reinsert it all the way.
- Pull the dipstick out again and check the oil level. The oil level must be between the MIN. and MAX. mark on the dipstick (fig. 69).

6.9.2 CHANGE THE OIL

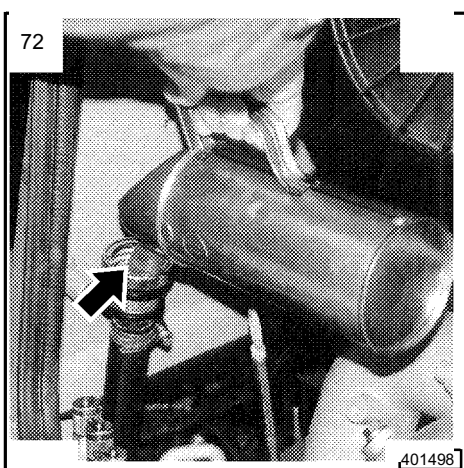
The oil in the splitterbox should be warm when changing the oil.



- Open the oil filler cover in the engine compartment.
- Remove the access cover on the pan.
- Place a suitable container under the drain (fig. 70).



- Remove the cap from the drain valve (fig. 71).
- Connect the drain hose - oil begins to flow. Check oil for contamination and dispose of it properly.
- Remove the drain hose, reinstall the cap and the cover.

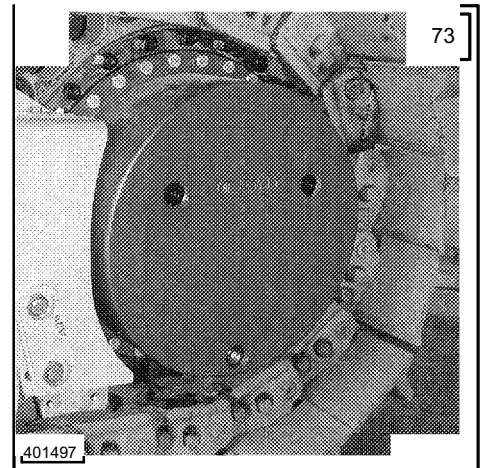


- Fill the splitterbox with oil (fig. 72) - do not exceed the MAX. mark. For quantities, refer to the Lubrication Chart.
- Recheck the oil level with the dipstick.
- Close the oil filler cover and the engine compartment doors.

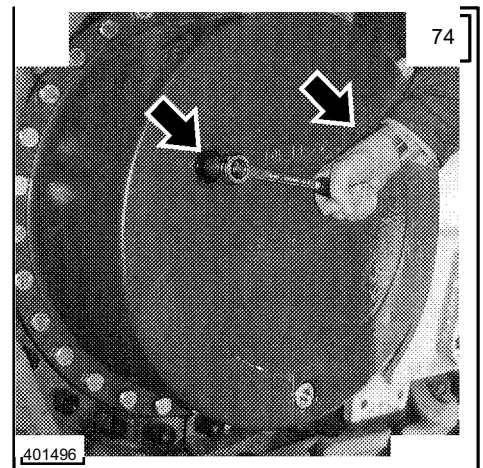
6.10 TRAVEL GEAR

6.10.1 CHECK THE OIL LEVEL

- Park the machine in such a way that the oil drain plug is at the bottom (fig. 73).
- Clean the area around the filler plug.



- Slowly remove the filler plug (fig. 74), the oil level should be up to the filler plug opening. Add oil as necessary.



6.10.2 CHANGE THE OIL

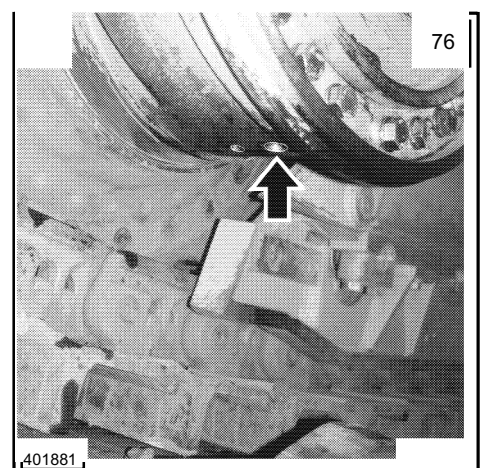
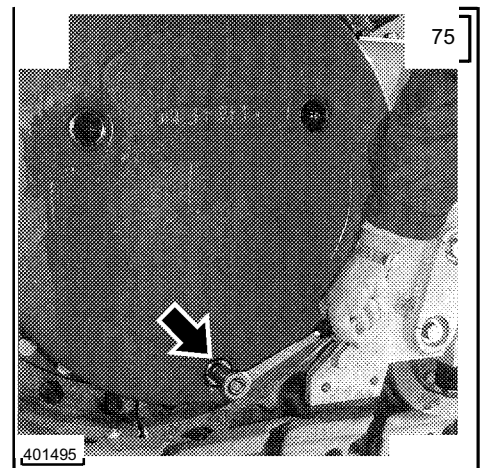
The oil of the travel gear should be warm when changing the oil.

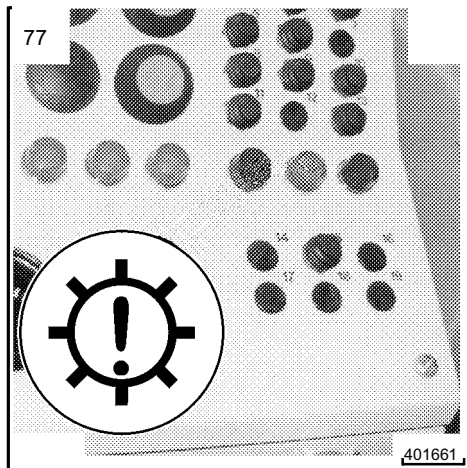
- Park the machine in such a way that the oil drain plug is at the bottom (fig. 75).

There are two oil drain plugs per side in the travel gear. When changing the oil, make sure to remove both drain plugs.

- Clean the area around the filler and drain plugs.
- Place a suitable container under the drain plug.
- Remove the oil filler and drain plug on the front of the gear (fig. 75).
- Remove the oil drain plug on the bottom of the gear (fig. 76).
- Check the oil for contaminating particles and dispose it properly.
- Reinstall the drain plugs and fill the gear with oil.
 - For quantity, see lubrication chart.
- Reinstall the oil filler plug.

Tighten the drain and filler plugs to approx. 160 Nm.





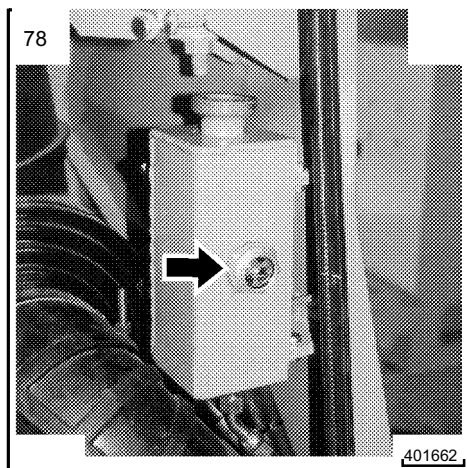
6.10.3 SLIP RING SEALS

If the oil level is too low, the indicator light in the instrument panel lights up (fig. 77).

If the indicator light lights up:

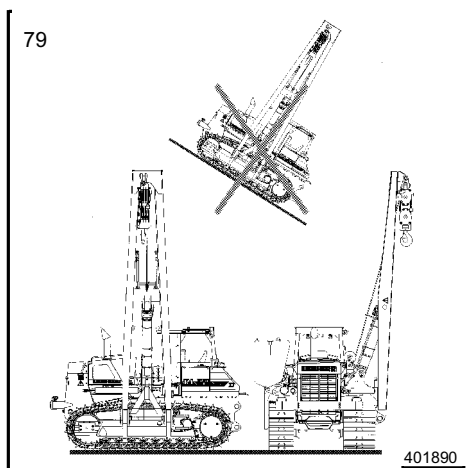
- Turn the machine off and park it on level ground.
- Check the travel gear externally for leaks.
- Check the oil level in the travel gear.
- Notify Liebherr Service.

To continue operation in the meantime, add oil to bring the oil level to normal levels.



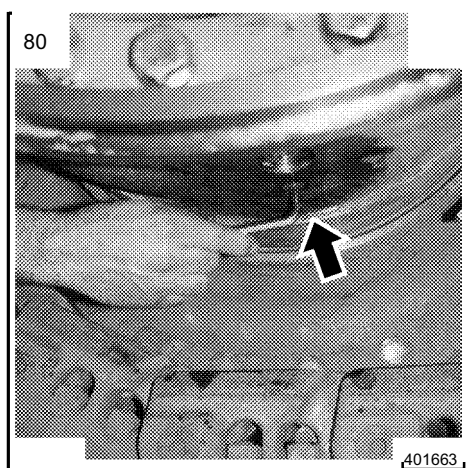
CHECK THE OIL LEVEL

- Park the machine on level ground.
The oil reservoir is installed in the left hand side of the engine compartment.
- The oil must be visible in the center of the sight gauge (fig. 78).
- Add oil as necessary.



CHANGE THE OIL

- Park the machine on level ground (fig. 79).

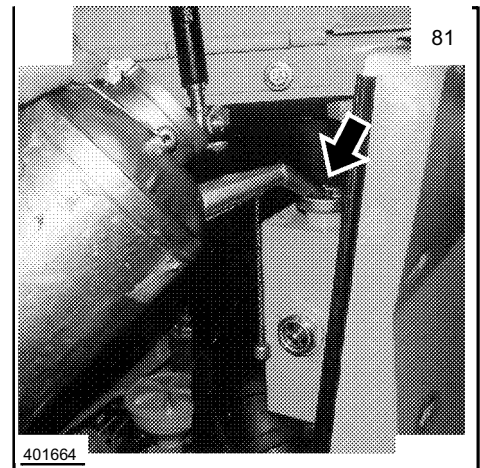


- Remove the cover on the oil reservoir.
- Place a suitable container under the drain.
- Remove the drain plug on the bottom of the travel gear (fig. 80).
- Drain the oil and dispose of it properly.

- Refill the oil reservoir with oil (fig. 81).
- For quantity, see lubrication chart

**NOTE**

Add the oil slowly and check the oil level several times.

**6.10.4 TRAVEL BRAKE****OPERATING BRAKE**

The hydrostatic travel drive is also an operating brake.

PARKING BRAKE

A wet disk brake integrated in the travel gear serves as the parking brake for the machine.

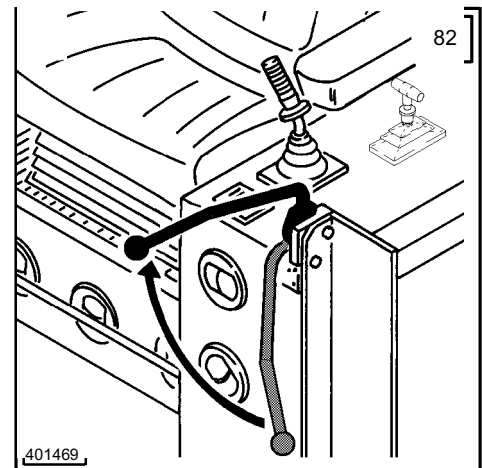
The parking brake is not released until the safety lever is raised, the engine is running and the travel joystick is deflected (fig. 82).

The disk brake is solely a parking brake and is wear and maintenance free.

6.10.5 CHECK THE CONDITION OF THE TRAVEL GEAR

Check the travel gear for leaks.

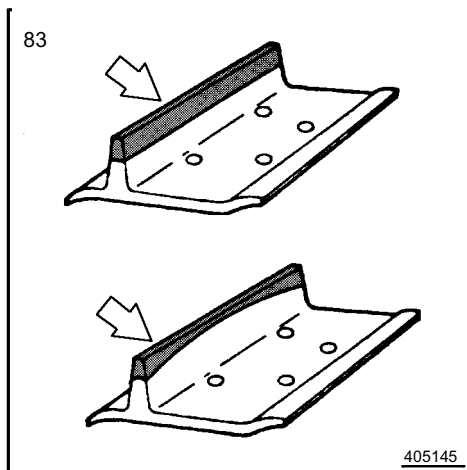
Check the travel gear housing. Cables, wires and ropes can damage the slip ring seals.

**6.11 TRACK COMPONENTS**

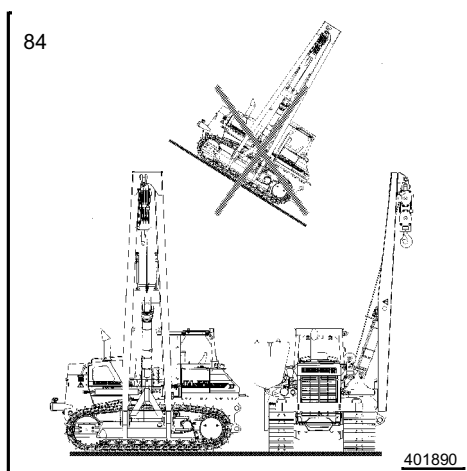
With the exception of wear, track components are virtually maintenance free.

Improper operation and disregard of track tolerances will accelerate the wear and tear of track components.

Visual inspections and wear checks of the track components should be made at regular intervals to determine the condition and degree of wear. Such inspections can help detect abnormal and premature wear. Some track components can be reconditioned, provided the wear limit is not exceeded.

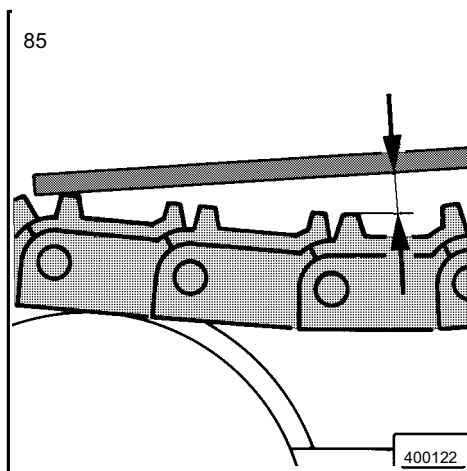
**CHECK THE FOLLOWING PARTS**

- Check idlers, track and carrier rollers for leaks and wear.
- Check chains, track guides, track pads and sprockets for wear (fig. 83).

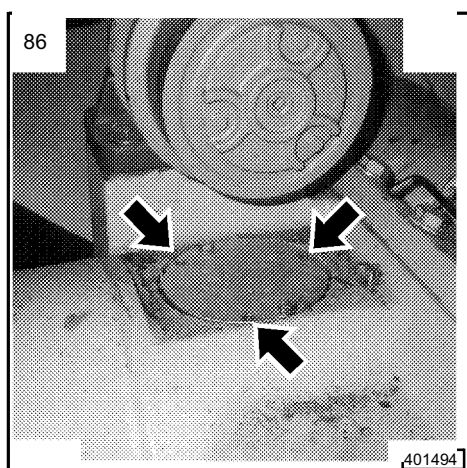
**6.11.1 CHECK TRACK CHAIN TENSION**

Due to wear of the track components, it is necessary to check the track tension regularly and to adjust the tension, as necessary.

- Park the machine on level ground (fig. 84).
When tightening the chain, do not remove any material that has built up on the track components during operation.
Conditions must be identical as they were during job applications.



The track chain tension is correct when the slack between the carrier roller and the idler is approx. 20-30 mm (fig. 85).

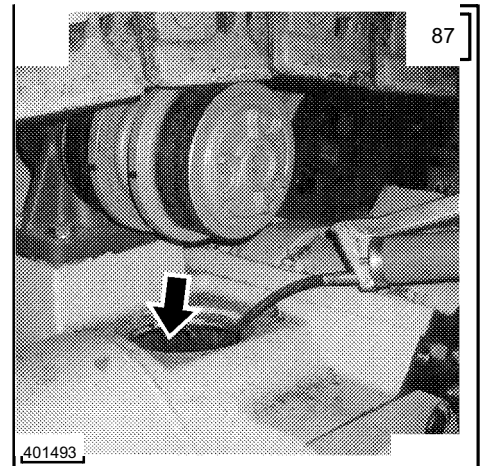
**TO TIGHTEN THE TRACK TENSION**

- Clean the surrounding area of the grease cylinders access cover on the roller frame.
- Remove the 3 hex head screws on the cover and remove the cover.

**NOTE**

If the cover is stuck or rusted on, remove the two screws and try to push the cover off by screwing in longer screws.

- Attach the rubber hose to the grease gun and connect to the grease fitting on the grease cylinder (fig. 87).
- Pump grease into the cylinder until the track chain is properly tensioned.

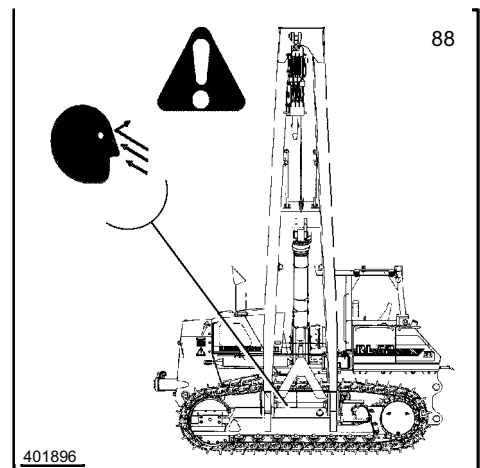


TO RELEASE TRACK TENSION



When adjusting the chain tension, keep your head clear of the access hole and roller frame. The grease cylinder is under high pressure and the chain will sag. Grease is under high pressure and might squirt out!

- To release track tension, carefully release the pressure in the grease cylinder by loosening and turning the grease fitting counterclockwise until grease emerges from the groove on the fitting.



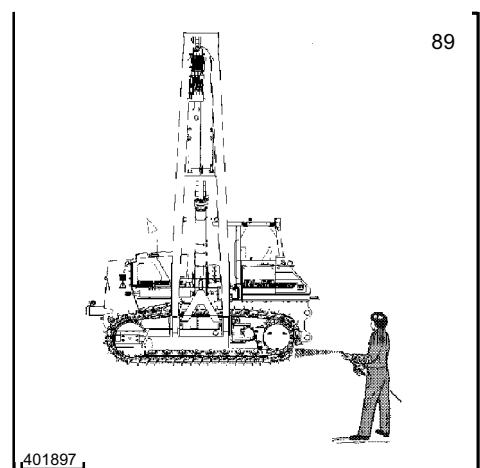
6.11.2 CLEANING THE TRACK COMPONENTS

At the end of the workday, the complete undercarriage should be checked and cleaned and repaired, if necessary.



NOTE:

DO NOT operate the machine if large rocks, pieces of wood or metal, wires or cables are wedged into the track components.

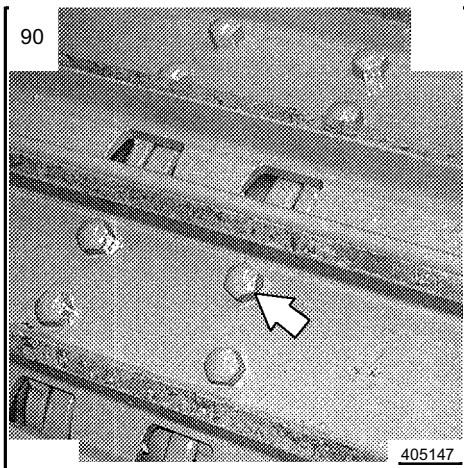


Do not allow mud, rocks, etc. to collect on track components. Dried or frozen mud as well as rocks or other debris in the track components can cause serious damage to the machine if operated, or if it is attempted to break the machine loose under engine power.

**NOTE**

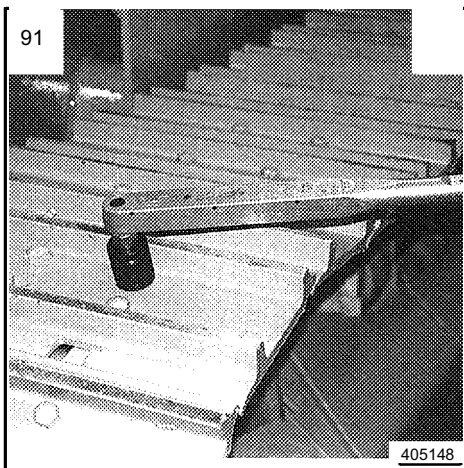
If the machine is frozen to the ground, heat the track pads to free the machine.

In freezing weather, always park the machine on wooden planks so that the machine will not freeze to the ground.



6.11.3 CHECK THE TIGHTNESS OF TRACK PADS AND SPROCKET SEGMENTS

- Visually check the track pads and sprocket segments for loose track pad and sprocket segment mounting screws (fig.90).



- Check the tightening torques as well (fig. 91).

Tightening torque for track pad bolts:

5/8" UNF: 180 Nm + 120°

3/4" UNF: 320 Nm + 120°

7/8" UNF / 11.9: 350 Nm +120°

7/8" UNF / 12.9: 370 Nm +120°

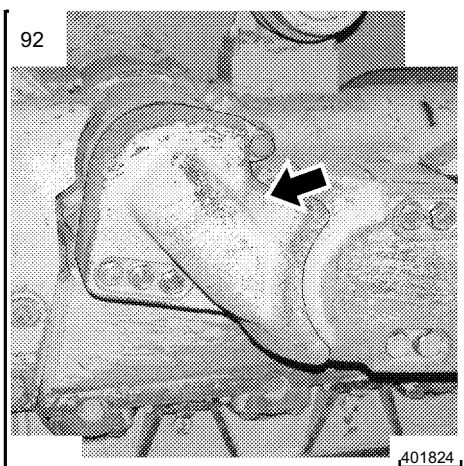
Tightening torque for sprocket segment mounting screws

5/8" UNF: 180 Nm + 120°

3/4" UNF: 320 Nm + 120°

7/8" UNF / 11.9: 350 Nm +120°

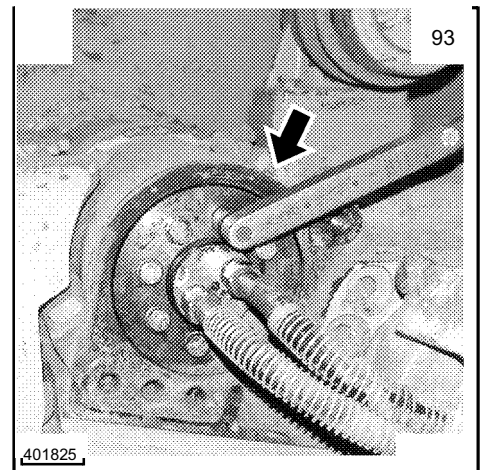
7/8" UNF / 12.9: 370 Nm +120°



6.11.4 CHECK TIGHTNESS OF SCREWS ON FRONT AXLE BEARING

- Remove the left and right side covers on the track roller frame (fig. 92).

- Check the screws with a torque wrench for tightness (fig. 93).
- For tightening torques, see torque chart.
- Reinstall the covers on the track roller frame.



6.11.5 CHECK THE IDLER GUIDES

The axial play between the roller frame and the side guides should be approx. 1 - 2 mm, the vertical play of the rubber springs should be approx. 3mm.

The play can increase due to wear of the wear plates, guide rails and guide plates.

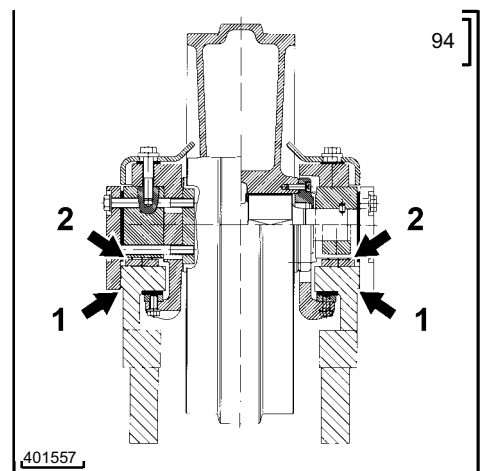
If the maximum permissible play is reached, then the play must be readjusted or the worn guide parts must be replaced.

New / repair dimension

- Side play min. 1 - 2 mm (fig. 94, pos. 1)
- Vertical play min. 3 mm (fig. 94, pos. 2)

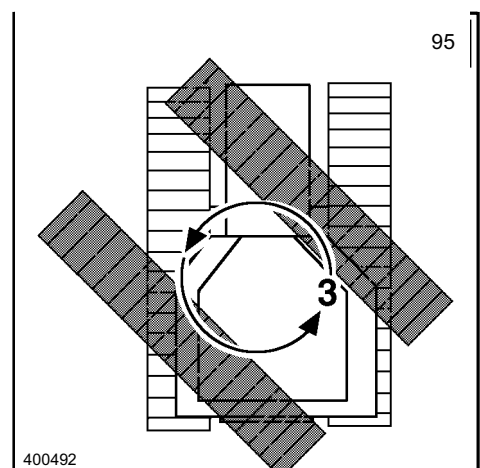
Maximum permissible

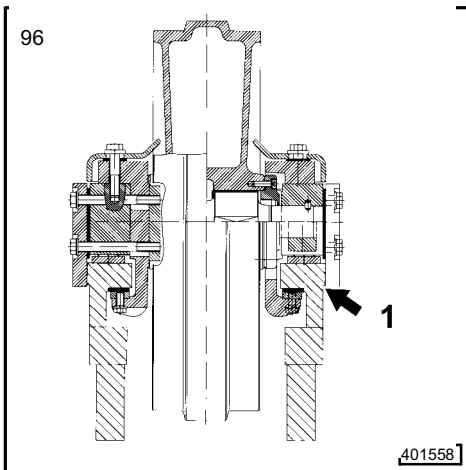
- Side play 5 mm
- Vertical play 6 mm



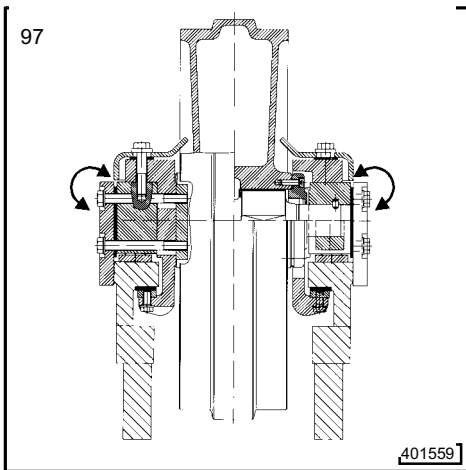
Check / adjust the side play

- Move the machine (for example by 'counter-rotation') until the inner guide plate touches the track roller frame (fig. 95).





- Measure the existing play between the track roller frame and the outer guide plate (fig. 96).



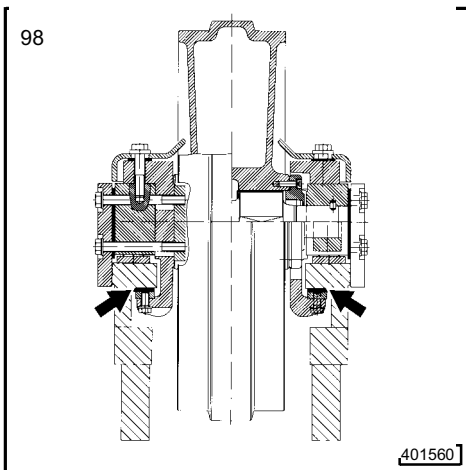
- If the maximum permissible play is exceeded, shims have to be removed in equal numbers on both sides (fig. 97).



NOTE

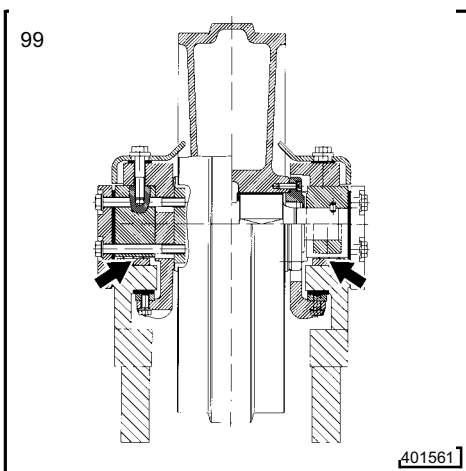
The number of inside shims should be equal to the number of outside shims, there should never be a difference of more than one.

If the play is no longer adjustable, because there are no more shims, then replace or recondition the guide plates to regain the new / repair dimension.



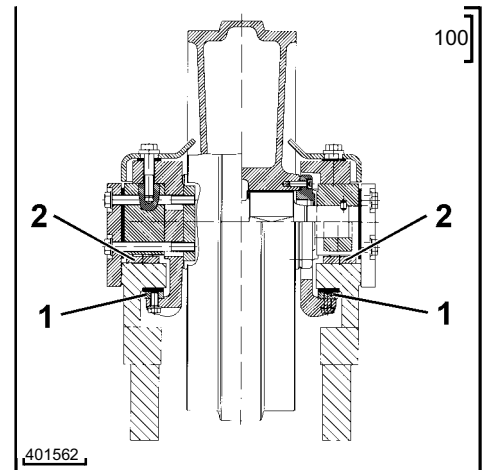
Check / adjust the vertical play

- Raise the idler, for example by driving onto a wooden board, until the claws touch the guide rails (fig. 98).

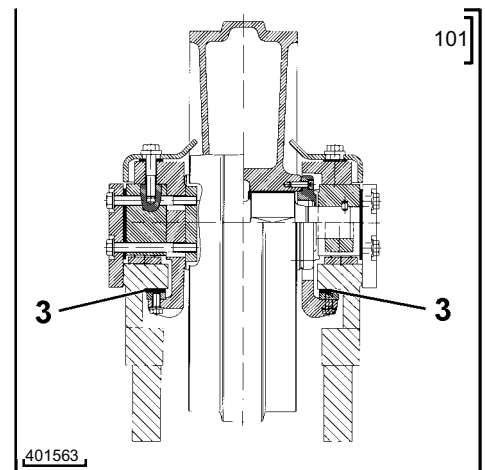


- Check the play between the wear strips and the bearing back (fig. 99).

- If play exceeds the permissible dimension, replace worn wear strips (fig. 100, pos. 1 and 2) in pairs.



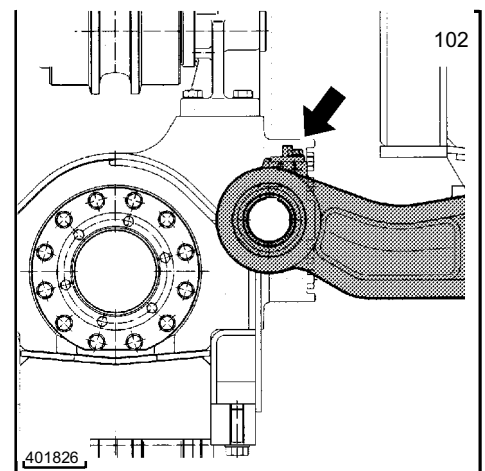
- When replacing the wear strips, check the welded on guide rails, if they are very worn, they should be replaced also (fig. 101, pos. 3).



6.11.6 LUBRICATE THE OSCILLATING AXLE BEARING

The outer oscillating axle bearings must be lubricated according to intervals noted in the Maintenance and Inspection schedule.

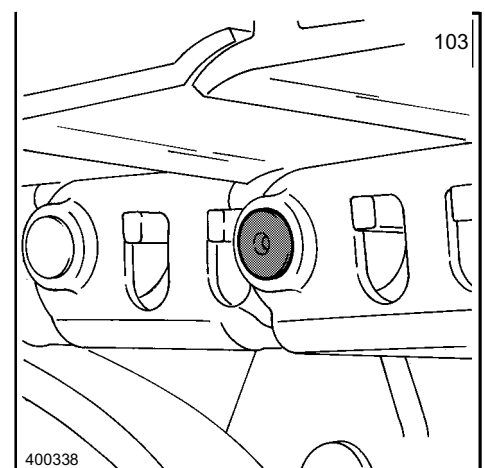
- Clean the area around the cover of the oscillating axle.
- Loosen the hex head screw and swing the cover to the side (fig. 102).
- With the grease gun, lubricate the lubrication points.
- Reposition the cover and tighten the hex head screw.



6.12 REPLACING THE TRACK CHAIN

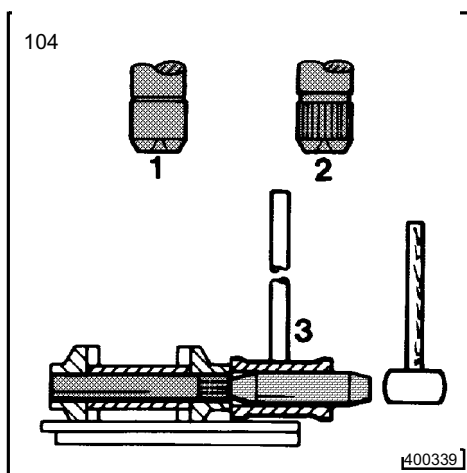
6.12.1 TO REMOVE A SEALED CHAIN

- Park the machine on firm and level ground in such a way that the master link pin is at one third height of the sprocket wheel.
- The master pin can be recognized by a large chamfered edge or a countersunk bore (fig. 103/104, pos. 1 and 2)
- Release the track tension carefully and push the idler assembly all the way in.



 **CAUTION**

Knocking the master pin in or out with a sledge hammer can be very dangerous due to material chipping off the pin, which could cause serious injuries. Always wear safety glasses and protective clothing. If possible, use a hydraulic press or proper pin removal tool to remove and install the pin.



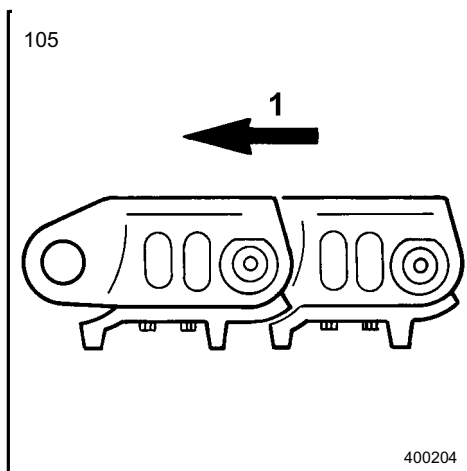
- Remove the master pin with a hydraulic press or suitable tool (fig. 104, pos. 3).

**NOTE**

The knurled master pins must be pressed in from the outside to the inside and pressed out from the inside to the outside. Knurled edge on the outside!
Master pins without knurled edge can be pressed in or out from the inside to the outside.

When knocking out the master pin, support the chain link on the other side.

- Carefully drive the machine forward until the complete chain rests on the ground.

**6.12.2 TO INSTALL A SEALED TRACK CHAIN**

- Drive backward on the old chain.
- Place the new chain in proper direction on the ground and connect it to the old track chain with the master link pin.
- Insert the master link pin from the inside to the outside.

**NOTE**

Make sure the new chain is installed in the correct direction (fig. 105) 1= travel direction.

- Align the chain to the track frame and move the machine carefully onto the new chain until you get to the end of the new chain.
- Release the new chain from the old chain and attach the end of the new chain with a wire to the sprocket wheel.
- Carefully drive the machine forward until the chain is on the sprocket on top.
- Release the wire from the chain and the sprocket wheel and continue to drive forward to bring the chain over the carrier roller and the idler. Stop the machine when the idler wheel approaches the last two track pads.

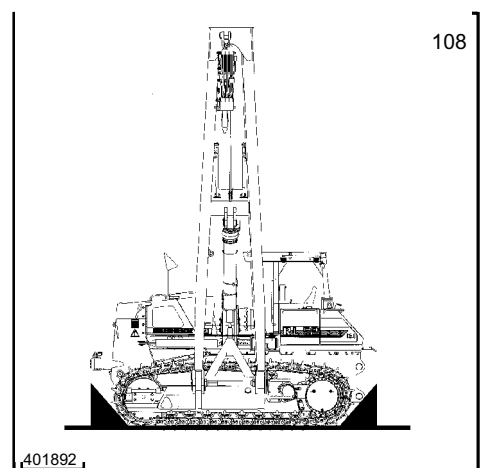
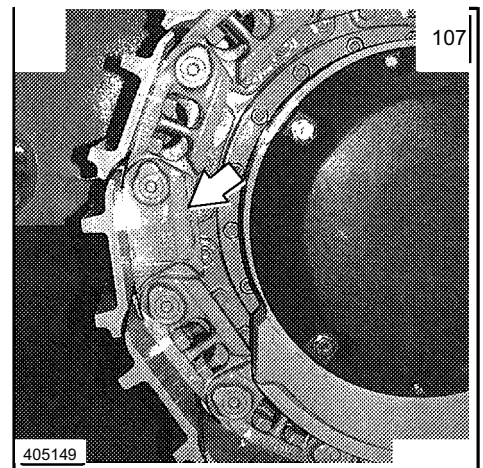
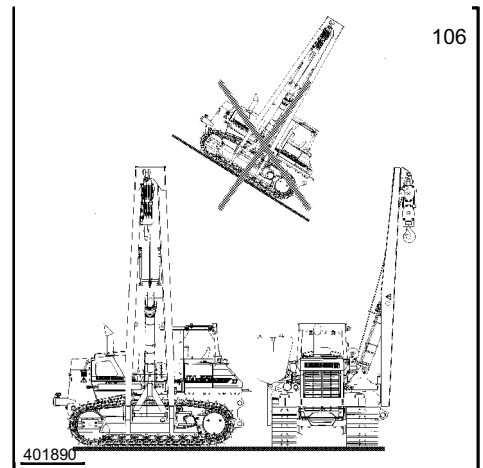
- Raise the last track pads, reinsert the spacer rings and press in or knock in the master pin from the outside to the inside.

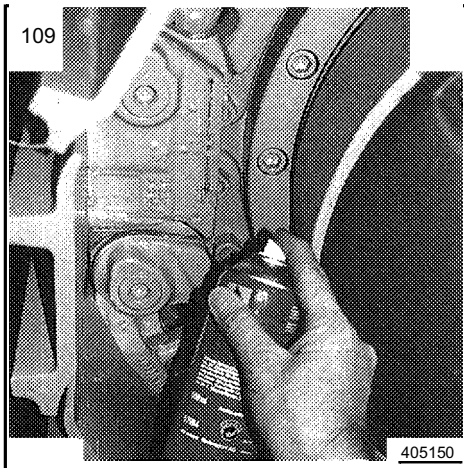
**NOTE**

When installing or removing the pin with a punch, support the chain link on the opposite side to create sufficient counter pressure.

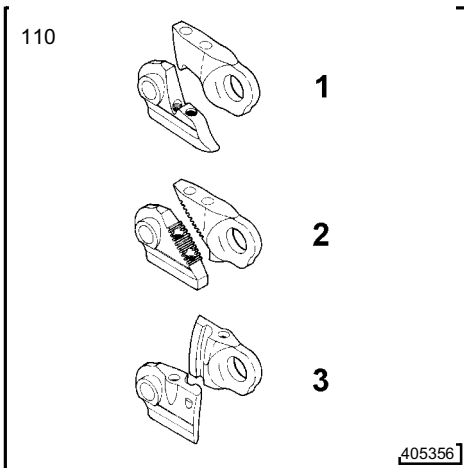
6.12.3 REMOVE A CHAIN WITH A SPLIT MASTER LINK

- Park the machine on firm and level ground (fig. 106).
- Release track tension.
- Slowly travel with the idler against a wooden block until the idler is pushed in all the way. Remove the block, travel with the machine until the master link and the center of the sprocket are at one height (fig. 107).
- Secure the chain in front of the idler and behind the sprocket with a wooden block to prevent it from moving (fig. 108).

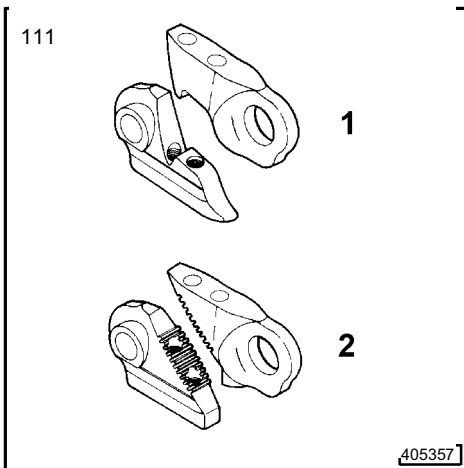




- Spray the teeth or mating surfaces of the master link with penetrating oil, help the oil to penetrate by hitting the master link lightly with a hammer (fig. 109).

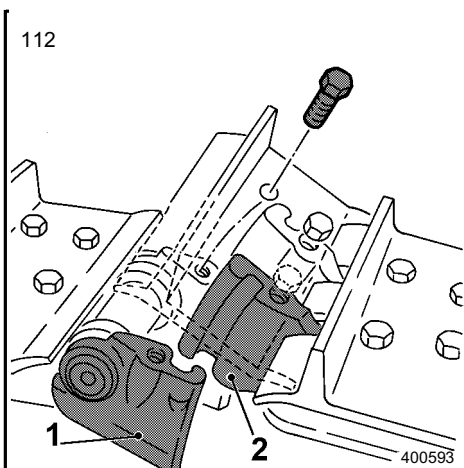


Various chains with split master links are used in Liebherr machines (fig. 110, pos. 1-3).



Model 1 + 2 (fig. 111)

- Remove the track pad screws, remove the track pad and hit the master link slightly with a hammer to loosen and separate the links. If necessary, apply more penetrating oil.



Model 3

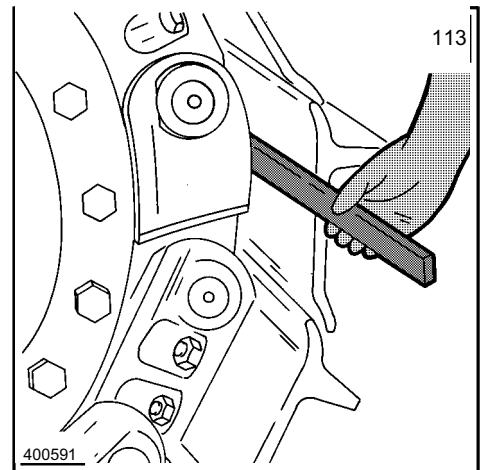
This model can be recognized as follows:

The pin section (fig. 112, pos. 1) is pressed to the pin, marked with the manufacturers name and the track pad screws are spaced further apart.

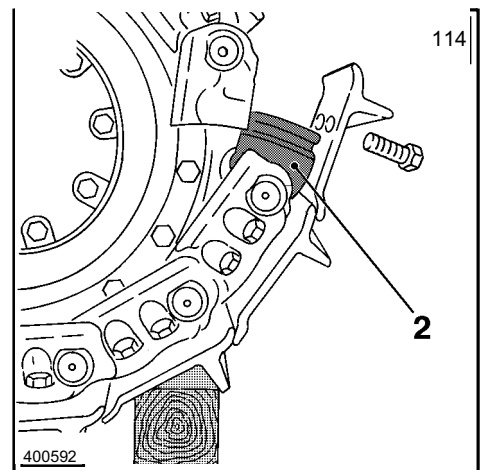
The bushing section (fig. 112, pos. 2) is pressed to the bushing, appears shorter from the outside and the track pad screws are spaced closer together.

- Remove only the track pad screws from the pin section (fig. 112, pos. 1).

- Use a steel wedge between the track pad and the pin section to drive out the bushing section (fig. 113). Support the drive action of the wedge by hitting the track pads lightly with a hammer.
- Remove the track pad.



- Only the bushing section (fig. 114, pos. 2) can be turned to the outside.
- Remove the track pad by carefully moving forward until the complete track chain is on the ground.



6.12.4 INSTALL A CHAIN WITH A SPLIT MASTER LINK

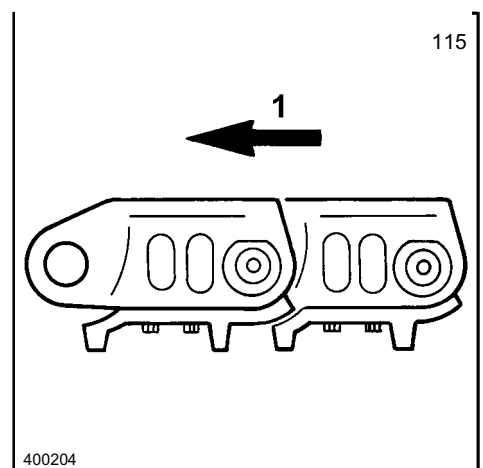
Track chains with master links can be easily installed on sprocket or idlers.

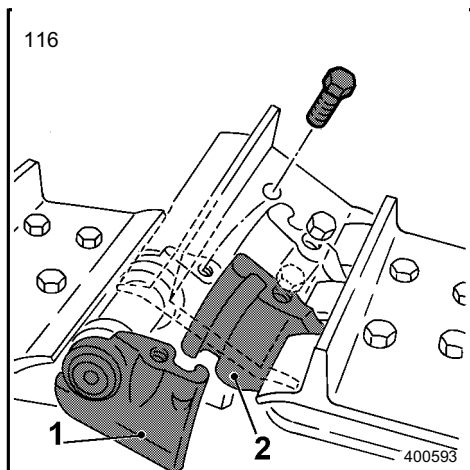
- Drive the machine back on the placed down chain.
- Care should be taken that the threads, teeth and mating surfaces of the new chain are clean, free of dirt, paint and burrs. coat the mating surfaces lightly with grease.
- Clean the bore holes, apply Never - Seize or grease to track pad screws (the threads should be clean enough so that the screws can be turned in by hand).



NOTE

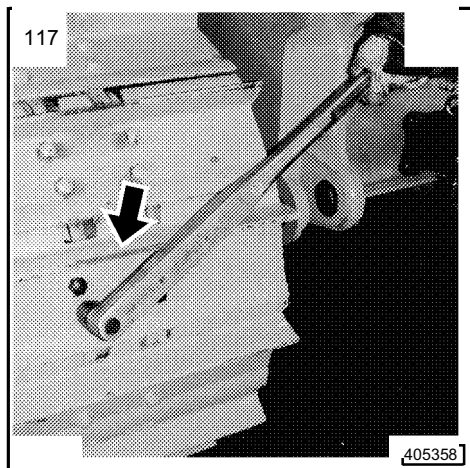
Make certain that the track chain is installed correctly (1= travel direction) (fig. 115).



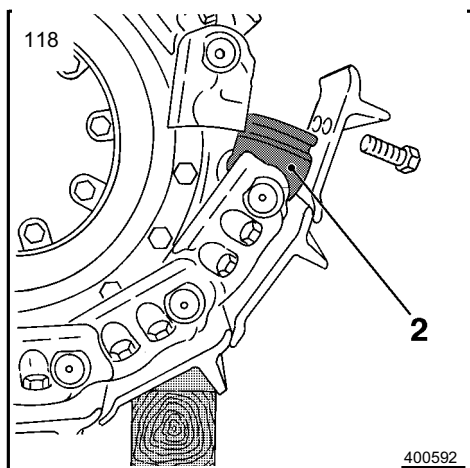


In case of model 3, the chain bracket with pin section must point to the sprocket, when the new chain is laid out behind the sprocket (fig. 116, pos. 1).

- Place the new chain on the ground and use a wire to connect it to the old chain.
- Align the track chain to the roller frame and carefully move the machine forward to the end of the new chain.
- Loosen the new chain from the old one and attach the new chain with the wire to the sprocket.
- Carefully drive the machine forward until the chain is on top of the sprocket.
- Loosen the wire from the chain and the sprocket, continue to drive forward to bring the chain over the carrier rollers and the idler. Stop the machine when the master link is at the same height as the center of the idler.
- Secure the chain in front of the idler and behind the sprocket with a wooden block.



- Connect the chain links.
Add the track pad, insert the screws and tighten to the correct tightening torque (fig. 117).
5/8" UNF: 180 Nm + 120°
3/4" UNF: 320 Nm + 120°
7/8" UNF / 11.9: 350 Nm + 120°
7/8" UNF / 12.9: 370 Nm + 120°

**NOTE**

For chain version 3, the track pads must be installed with the bushing section before the master link is connected (fig. 118).

- Push the pin section towards the center of the idler. Insert the bushing end and slide both parts together until the track pad makes contact. Only the bushing section can be inserted (fig. 118).

**NOTE**

DO NOT hit the mating surfaces with a hammer.

- Adjust track chain tension as outlined.

6.13 THE ELECTRICAL SYSTEM

To ensure trouble-free operation of your machine, the electrical system must always be in good condition.

The gauges and indicators and all components of the electrical system must be checked daily for proper function.



NOTE

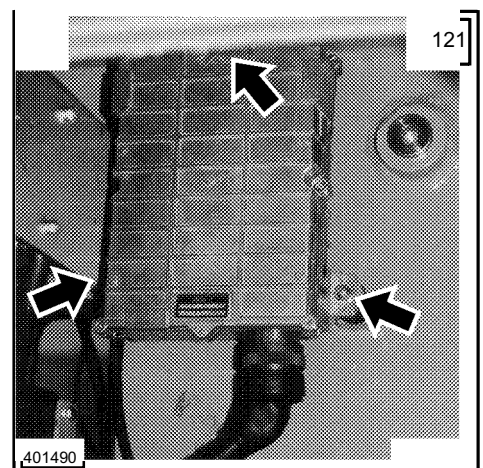
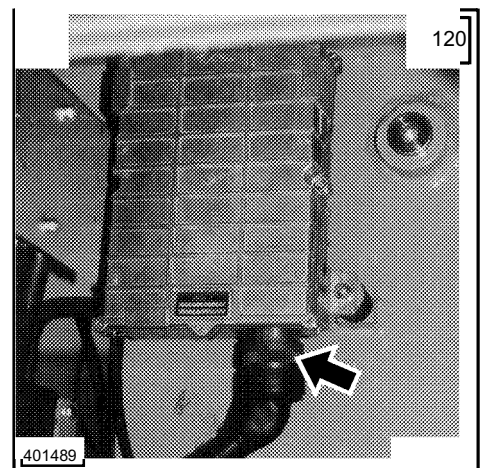
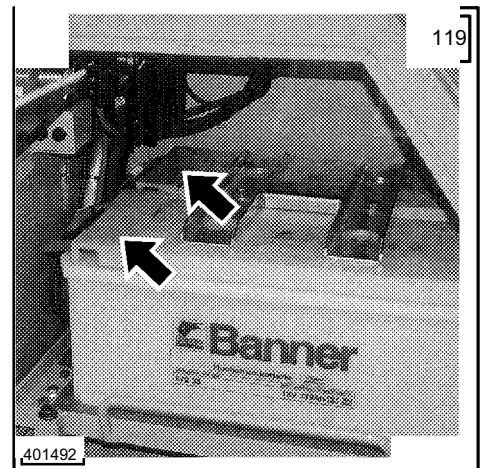
Before working on the electrical system and before any welding, always disconnect the battery. Disconnect the negative (-) terminal first, and reconnect it last (fig. 119).

Before any arc welding, disconnect the battery and remove the electronic box (fig. 120).

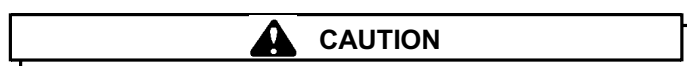
To remove the electronic box

- Unscrew the cable fitting on the bottom of the electronic box (fig. 120).

- Remove the mounting nuts (fig. 121) and remove the electronic box. Install in reverse order.



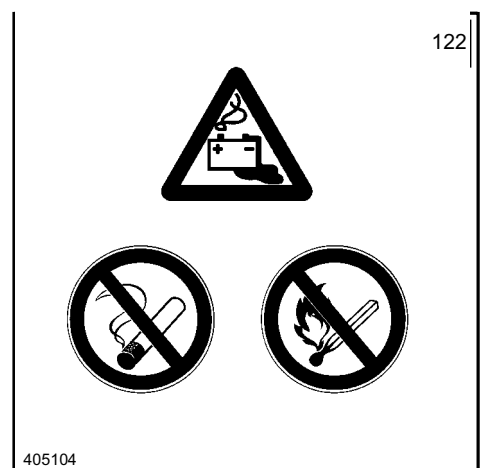
6.13.1 BATTERY

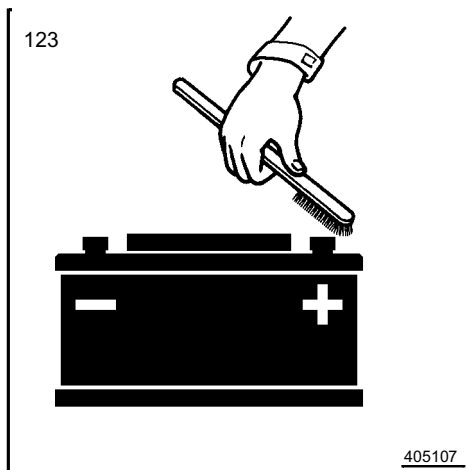


When working on the batteries, always wear protective gloves and safety glasses.

Battery acid can cause severe burns!

Keep sparks and open flames away from the battery (fig. 122).

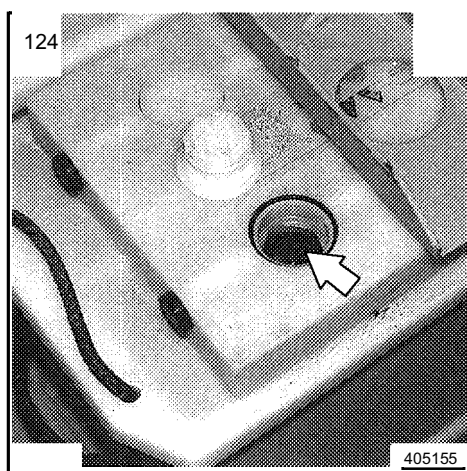




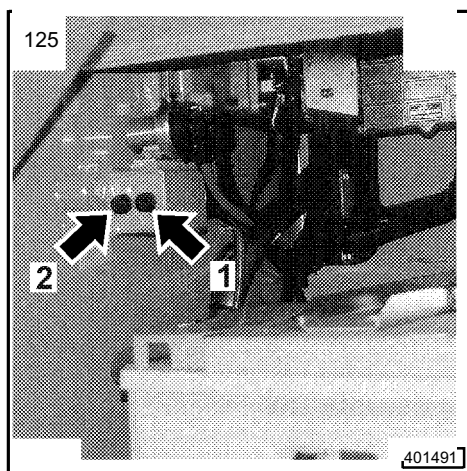
- In order for the battery to function properly, it is important to keep it clean at all times. The battery terminals and cable clamps should be cleaned regularly.

**CAUTION**

**Do not use metal brushes to clean the battery!
Danger of spark formation - explosion!**



- Coat the battery terminals and cable clamps with acid resistant grease.
- To check the electrolyte level, remove the retaining screws and pull the battery tray out.
- Unscrew the battery cell plug under the rubber cover (fig. 124). The fluid level should be at least 15 mm above the upper edge of the plates. If the fluid level is too low, add distilled water.
- Reinstall the battery cell plug, reattach the battery tray with the retaining screws.



6.13.2 FUSES IN BATTERY COMPARTMENT

The automatic circuit breaker in the battery compartment contains two fuses:

- Main fuse (45 A) for the complete electrical system of the machine (fig. 125, pos. 2).
- Fuses (45 A) for the flame glow system of the Diesel engine (fig. 125, pos. 1).

If the circuit breaker blows, then it is important to find the reason for the overload and to fix the problem.

Push the button on the automatic circuit breaker to reestablish the power supply for the machine.

6.13.3 FUSES IN THE OPERATOR'S CAB

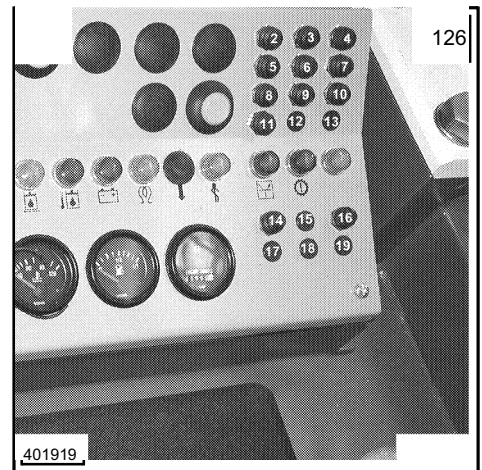
The remaining fuses are in the control panel on the right hand side of the operator's seat and in the roof console.

If the circuit breaker blows, then it is important to find the reason for the overload and to fix the problem.

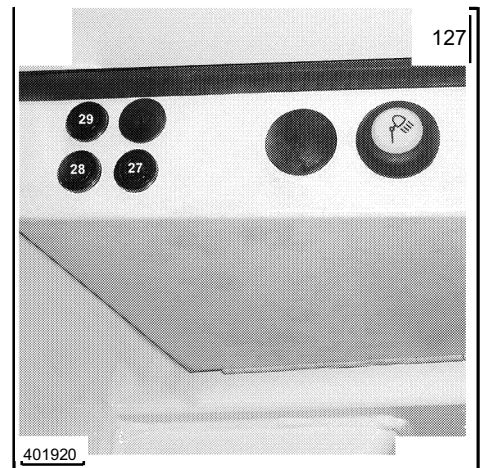
Push the button on the automatic circuit breaker to reestablish the power supply for the machine.

LOCATION OF FUSES(fig. 126/127)

2	3A	Glow plug relay
3	5A	Charge indicator, cab illumination, radio, backup alarm
4	8A	Electronic supply
5	10A	Electrical socket
6	5A	Gauges, indicator lights, temperature switch - coolant
7	8A	Added floodlight
8	25A	Power supply - roof console
9	20A	Shut off solenoid
10	5A	Hydraulic valves, temperature switch - hydraulic oil
11	10A	Winch release
12		(Optional equipment)
13		(Optional equipment)
14	3A	Free fall device
15		(Optional equipment)
16	3A	Hoist limit switch
17-19		(Optional equipment)



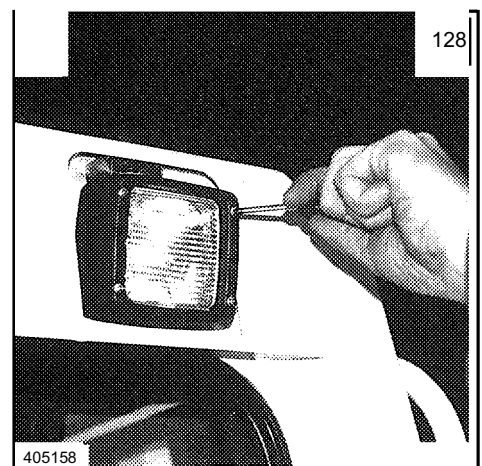
27	10A	Floodlight - Canopy, left front / right rear, instrument lighting
28	10A	Floodlight - Canopy, right front / left rear
29	2A	Warning light - Canopy

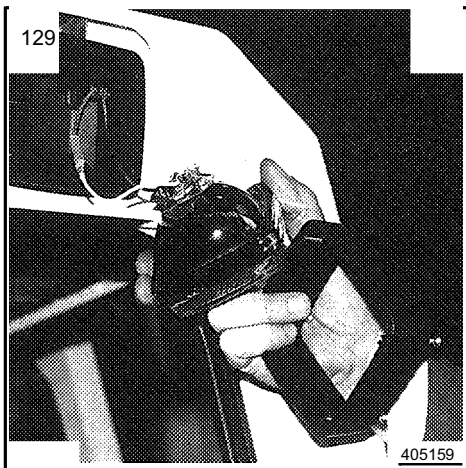
**CAUTION**

NEVER repair or short circuit fuses!
Never use a different size fuse than the original fuse.
This could cause a fire!

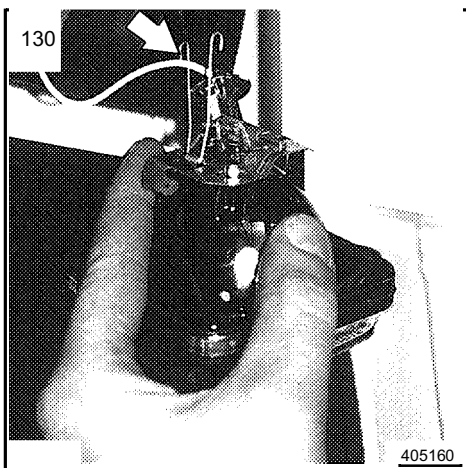
6.13.4 TO CHANGE THE BULBS IN HALOGEN LIGHTS

- Unscrew the four screws on the headlight frame (fig. 128).

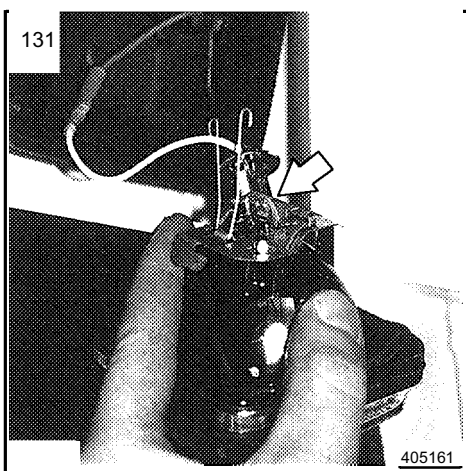




- Remove the frame with the glass (fig. 129).



- Loosen the spring bar and pull the lamp base out (fig. 130).



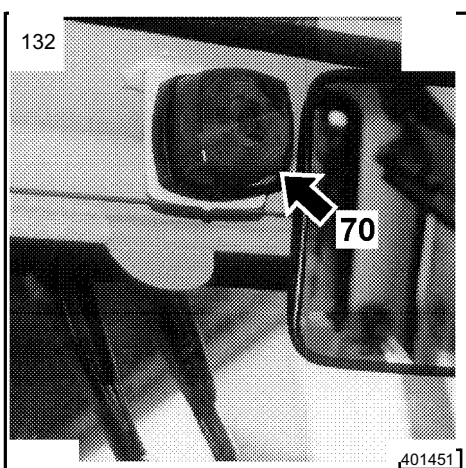
- Remove the halogen bulb from the base and replace it with a new one (fig. 131).



NOTE

Do not touch the halogen bulb with bare fingers, use a cloth to hold the bulb.

Install in reverse order.



6.13.5 TO CHANGE THE BULB FOR THE WARNING LIGHT - CANOPY

- Insert a screw driver in the recess on the bulb glass, push up and remove the glass. (fig. 132).
- Turn the bulb all the way to the left and remove it from the base.



NOTE

Do not touch the bulb with bare fingers, use a cloth to hold the bulb.

6.13.6 TO CHANGE THE BULBS IN THE INDICATOR LIGHTS

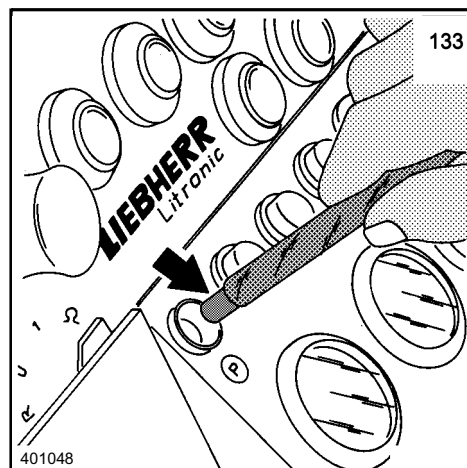
- Unscrew the cap on the affected indicator light and remove it.
- Turn the bulb to the left and remove it from the socket and change it.



NOTE

If necessary, use a short piece of hose with an inside diameter of 6-8 mm (fig. 133).

Do not touch the bulb with bare fingers, use a cloth to hold the bulb.
Install in reverse order.



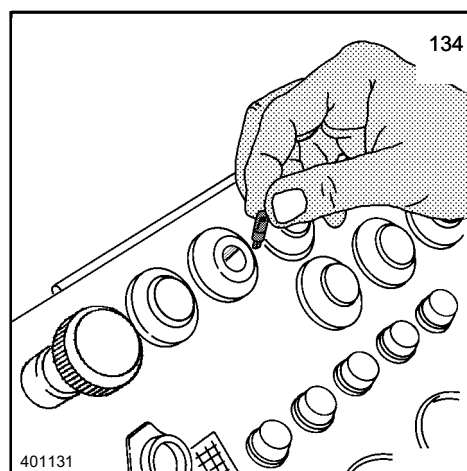
6.13.7 TO CHANGE THE BULBS IN THE SWITCHES

- Remove the symbol on the push button switch by turning it to the left.
- Pull the bulb from the switch (fig. 134).
- Insert a new bulb into the switch and turn in the cap.



NOTE

Do not touch the bulb with bare fingers, use a cloth to hold the bulb.



6.13.8 EXTERNALLY POWERED STARTING PROCEDURE

In case of starting problems due to old batteries, the machine can also be started with the aid of an external battery (24V).

Make sure that you have observed and carried out all the following safety measures.

ATTACH THE EXTERNAL BATTERY



DANGER

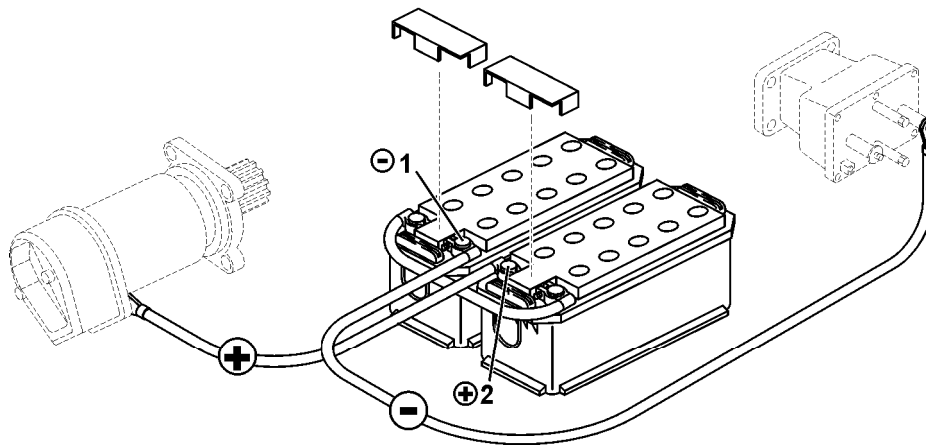
Danger of accidents due to incorrect or unsafe procedure when starting with external batteries!

When connecting the external batteries, increased gas formation may occur with old batteries. There is a "DANGER OF EXPLOSION"!

For that reason, keep sparks and open flames away from batteries.

Always wear safety glasses and protective gloves when handling batteries.

Use only external battery cables with sufficient diameter!



- 1 Negative terminal of discharged battery
- 2 Positive terminal of discharged battery

- Connect the external battery cable first to the positive terminal of the discharged battery 2 and then to the positive terminal of the external battery.
- Connect the second external battery cable first to the negative terminal of the discharged battery 1 and then to the negative terminal of the external battery.
- Start the Diesel engine. See "Start the Diesel engine."

DISCONNECT THE EXTERNAL BATTERY

Before removing the external battery cable, **make sure** to bring the Diesel engine to low idle. If necessary, turn on a large power user, such as the headlights, to prevent over voltage.

- Remove the external battery cable from the negative terminal of the external battery first and then from the negative terminal of the discharged battery 1.
- Then remove the second external battery cable from the positive terminal first and then from the positive terminal of the discharged battery 2.

6.14 ATTACHMENTS



CAUTION

Before the attachments are serviced, be sure to lower the attachments to the ground. Turn the engine off and actuate all functions again until the pressure is relieved in all lines.

Place the safety lever in the down position.

Do not work or allow work on or under the attachment unless it is properly supported.

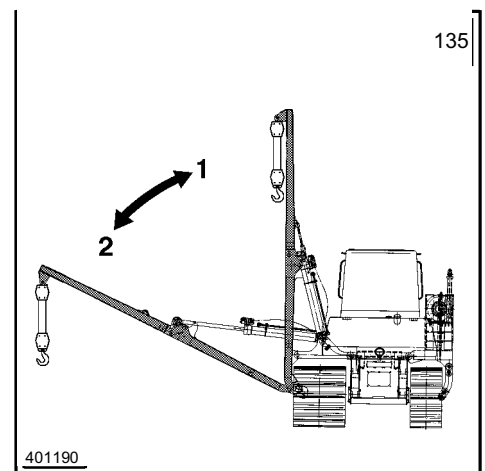
6.14.1 CHECK THE BOOM ATTACHMENT

Regularly check the condition of the boom attachment, hook block, cable guide pulleys, hoist cable and boom frame for damage and wear.

Check the mounting screws for tight seating.

6.14.2 LUBRICATE THE ATTACHMENT

- Lower the boom all the way (fig. 135, pos. 2).

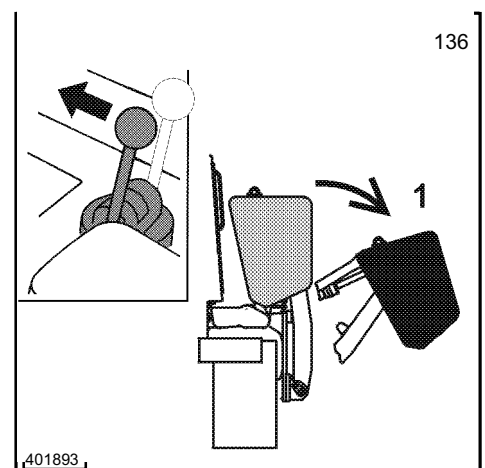


- Lower the complete counterweight (fig. 136).
- Clean the tapered grease fitting and lubricate according to the lubrication chart.

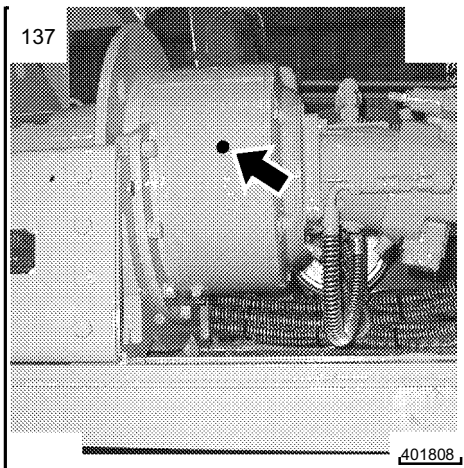
6.14.3 CABLE WINCH - HOIST WINCH

To ensure reliable winch operation, the cable winch must be serviced regularly.

- To ensure proper operation, observe the following points:
 - Change the oil regularly, according to the Maintenance and Inspection plan.



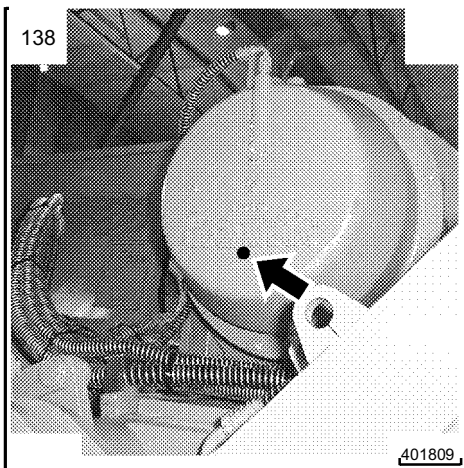
- Use the correct gear oil.
- Once a year, remove and inspect all wear items according to ANSI Specification B30.5c1987 and API RP 20, paragraph 3.



CHECK THE OIL LEVEL

Check the oil level with the machine in horizontal position.

- Remove the oil level screws, the oil must be visible at the lower edge of the oil level port. Add oil, as necessary.
 - Primary side (fig. 137)



- Secondary side (fig. 138)

CHANGE THE OIL

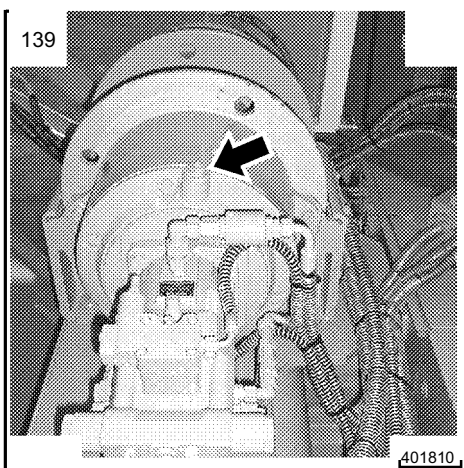


NOTE

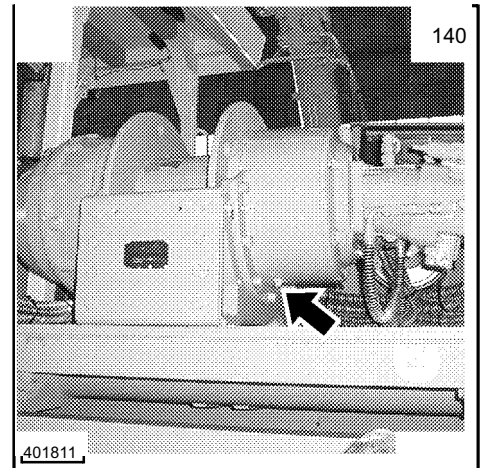
The gear oil must be changed to remove wear particles, which could influence reliable and safe operation of the brake couplings and affect bearings, gears and seals. If the oil is not changed in the recommended minimum intervals, it could cause brake slippage, which could lead to machine damage, injury and even death. Change the oil when the cable winch is at operating temperature. At low ambient temperatures, warm the new oil and flush the winch gear.

Primary side:

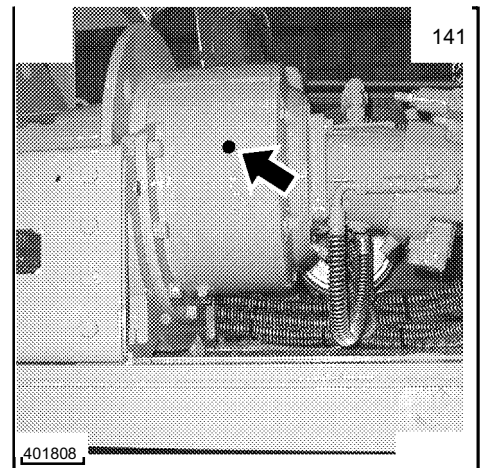
- Unscrew the oil filler plug (fig. 139).



- Remove the oil drain plug (fig. 140) and drain the oil into a suitable container.
- Reinstall the oil drain plug.

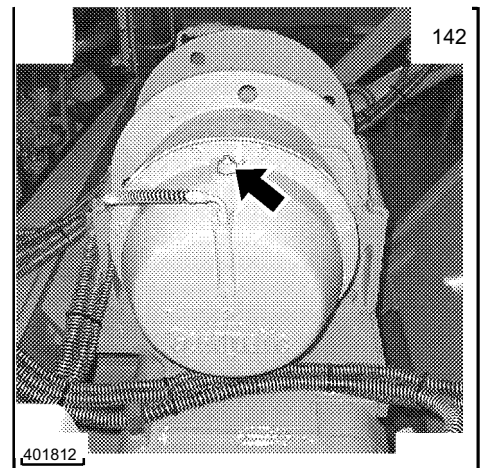


- Remove the oil level plug and add oil via the filler port on the winch until the oil reaches the oil level plug (fig. 141). Then wait for approx. 15 minutes until the oil is distributed in the drum area.
- Recheck the oil level and reinstall the oil level and filler plug.

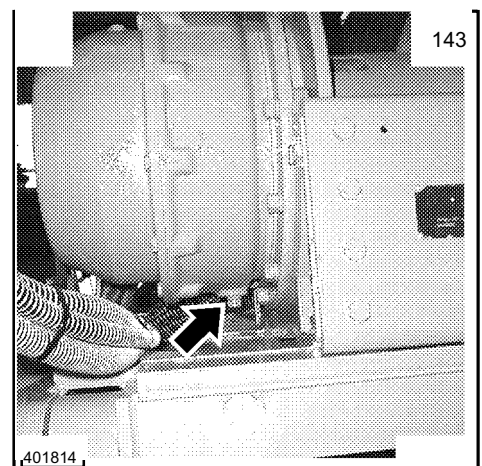


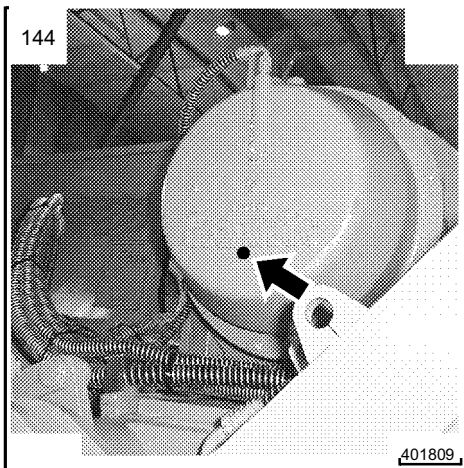
Secondary side:

- Remove the oil filler plug (fig. 142).

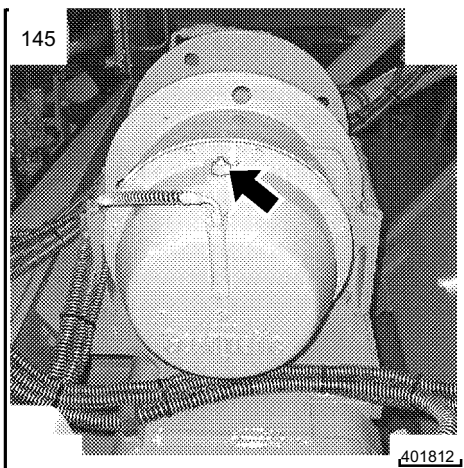


- Remove the oil drain plug (fig. 143) and drain the oil into a suitable container.
- Reinstall the oil drain plug.



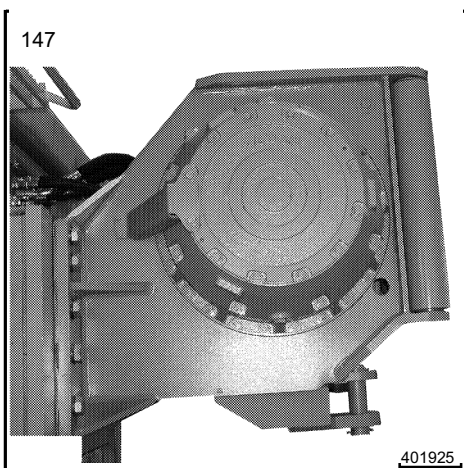
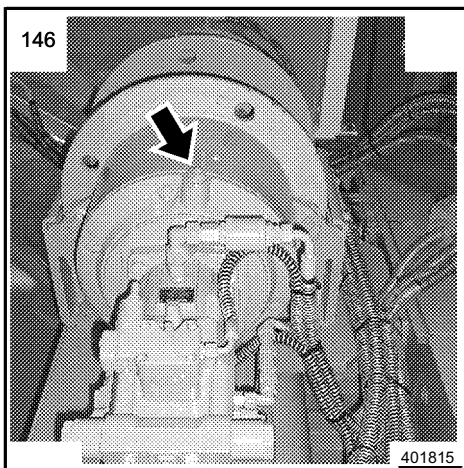


- Remove the oil level plug and add oil via the filler port on the winch until the oil reaches the oil level plug (fig. 144). Then wait for approx. 15 minutes until the oil is distributed in the drum area.
- Recheck the oil level and reinstall the oil level and filler plug.



BLEEDER SCREW - WINCH

The bleeder screws must always be clean and easily accessible (fig. 145/ 146). When changing the oil, remove the screw and clean it with a cleaner, then reinstall.



6.14.4 REAR WINCH

To ensure reliable winch operation, the rear winch must be serviced regularly.

- To ensure proper operation, observe the following points:
 - Change the oil regularly, according to the Maintenance and Inspection plan.
 - Use the specified gear oil.

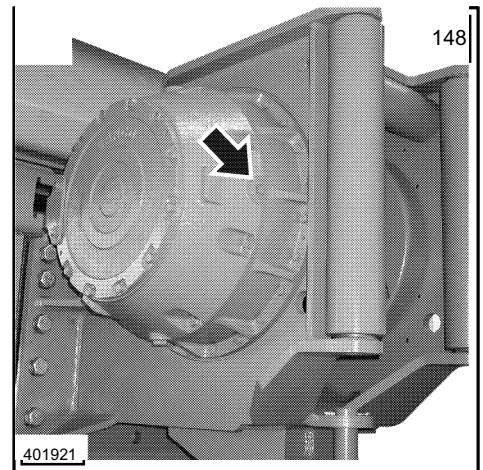
CHECK THE OIL LEVEL

Check the oil level with the machine in horizontal position.

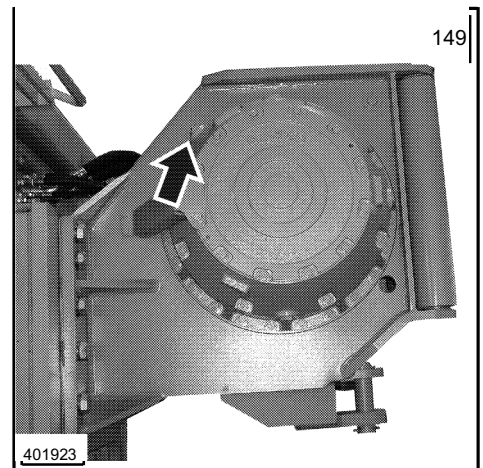
- Remove the oil level screw³, the oil must be visible at the lower edge of the oil level port. Add oil as necessary (fig. 148).

CHANGE THE OIL**NOTE**

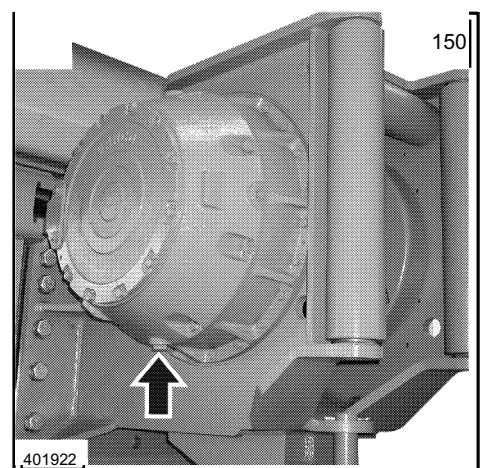
The gear oil must be changed to remove wear particles, which could influence reliable and safe operation of the brake couplings and affect bearings, gears and seals. If the oil is not changed in the recommended minimum intervals, it could cause brake slippage, which could lead to machine damage, injury and even death. Change the oil when the cable winch is at operating temperature. At low ambient temperatures, warm the new oil and flush the winch gear.

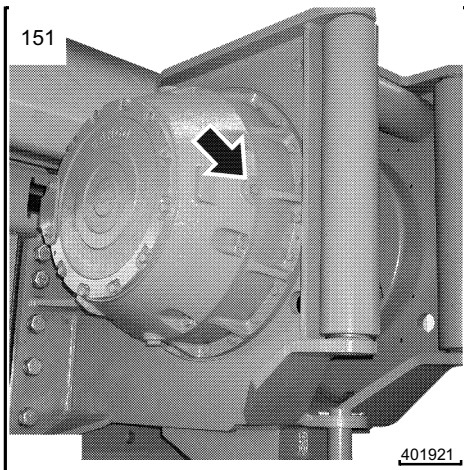


- Unscrew the oil filler plug (fig. 149).

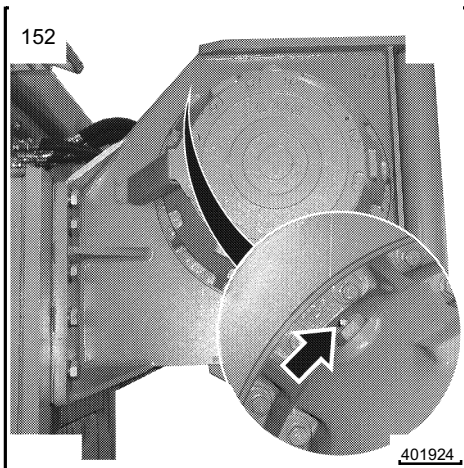


- Remove the oil drain plug (fig. 150) and drain the oil into a suitable container.
- Reinstall the oil drain plug.





- Remove the oil level plug and add oil via the filler port on the winch until the oil reaches the oil level plug (fig. 151). Then wait for approx. 15 minutes until the oil is distributed in the drum area.
- Recheck the oil level and reinstall the oil level and filler plug.



BLEEDER SCREW - WINCH

The bleeder screw must always be clean and easily accessible (fig. 152). When changing the oil, remove the screw and clean it with a cleaner, then reinstall.

6.14.5 WINCH CABLE

The winch cable must be checked and maintained regularly as noted in the cable manufacturer's Operation Manual (see chapter 7).

6.14.6 REPLACEMENT OF WEAR AND TEAR ITEMS

In addition to normal maintenance, which can be carried out at noted intervals, the operator may also make the following repairs:

Replace or repair track pads, track rollers or support rollers, idler unit.

(After completion, re-tension the chain as noted in the Operation Manual).

Replace hydraulic hoses, hydraulic lines, Ermeto fittings, SAE fittings or O-rings on these items.

Always use only original replacement parts!

This applies especially to hoses and hydraulic lines, which must be pre-assembled at the factory.

For all repairs, contact Liebherr service technicians and dealer personnel.

6.15 PISTON ROD PRESERVATION

If the machine is not being used or must be stored for a longer period of time, proceed as follows to prevent corrosion and damage to the piston rods.

- Park the machine in a way that the piston rods are retracted as much as possible.
- If the machine is not being used for an indefinite period, restart and operate it according to the Operation and Maintenance Manual at least once every two weeks.

Operate the engine and the hydraulic system until the recommended operating temperatures are reached. Activate all travel and hydraulic functions alternately. The piston rods must be fully extended and retracted several times. Check oil level, lubrication points and electrical system.

- If the machine is to be stored for longer than 4 weeks, clean the machine thoroughly on the inside and outside.

Lubricate all bearings, ball joints, hinges, exposed parts, and exposed cylinder rods with anti-corrosive acid free grease. Fill the fuel tank to reduce condensation.

Note:

If the machine is to be transported by ship, check the piston rods again after the machine has been loaded, since the anti-corrosive grease may have been removed by the wiper ring.



If the machine is put in storage for a longer period of time, contact your LIEBHERR Service Dept. for more information.

6.16 MAINTENANCE AND INSPECTION PLAN

Maintenance / Inspection at operating hours

WORK TO BE CARRIED OUT

at delivery	every 8 - 10	every 50	every 250	every 500	every 1000	every 2000	by maintenance personnel		by authorized trained personnel		Reference	
							<input type="checkbox"/> First and only maintenance interval	<input type="checkbox"/> Repeat maintenance interval	OM - Operation / Maintenance Manual			
DIESEL ENGINE												
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check the oil level and oil pressure	BA
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check the coolant level	OM
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check / clean engine, cooler assembly and oil pan for contamination	OM
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check fuel water separator / empty as necessary	OM
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Drain condensation and contaminants from fuel tank - at least 1x weekly	OM
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Change engine oil - at least 1x annually	OM
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Change lube oil filter - at least 1x annually	OM
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check radiator cap and fan	OM
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Replace coolant filter, check antifreeze and DCA4 ratio in coolant	OM
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check V-belt condition and tension	OM
<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check hydraulic oil, cooling and fuel system for leaks and condition	OM
<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check intake and exhaust system for mounting tightness and leaks	OM
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check mounting tightness of oil pan and engine mounts	OM
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check / adjust engine RPM	
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check / adjust valve play - with cold engine	
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check and service mechanical linkage for injection pump and potentiometer	OM
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check fuel prefilter element / clean as necessary	OM
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Change fuel filter element	OM
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Grease flywheel teeth	
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check flame glow system - before start of cold season	
											Replace air filter elements - as necessary / annually	OM
											Replace oil separator - every 2 years	
											Replace coolant with antifreeze and DCA4 - every 2 years	OM
											Check / adjust fuel injectors - as necessary / every 3000 hrs.	
HYDRAULIC SYSTEM												
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check oil level in hydraulic tank	OM
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Clean magnetic rod - up to 250 hrs. daily	OM
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Replace main return filter insert, check all flushing circuit return filter inserts (only by authorized personnel)	OM
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Replace filter (insert) - replenishing circuit	OM
<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check working and travel hydraulic system for function and leaks, check hose routing for chafing.	OM
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Hydraulic tank - drain condensation and contaminants - at least every 6 month	OM
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check / clean oil cooler for contamination / check fan	OM
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check / adjust all hydraulic pressures according to adjustment check list	
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Check mountings and screw fittings for tight seating	OM
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Replace oil in hydraulic system (fill via filter) ¹⁾ - when using 'environmentally safe hydraulic fluids' request / observe special guidelines - at least every 4 years	OM

Maintenance / inspection at operating hours

WORK TO BE CARRIED OUT

		■	by maintenance personnel			by authorized trained personnel			Refer- ence
		<input type="checkbox"/> First and only maintenance interval <input type="radio"/> Repeat maintenance interval				OM - Operation / Maintenance Manual			
At delivery	every 8 - 10	every 50	every 250	every 500	every 1000	every 2000			
SPLITTERBOX									
<input type="radio"/>			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check oil level		OM
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Change gear oil ¹⁾	- at least every 2 years	OM
ELECTRICAL SYSTEM									
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check system function incl. indicators and gauges		OM
<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check battery electrolyte level		OM
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check / clean / grease battery terminals		OM
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check cable routing and connections		OM
				<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	Check / adjust control system according to adjustment check list		
					<input type="radio"/>	<input type="radio"/>	Check battery charge	- before start of cold season	
HEATER / FRESH AIR SYSTEM									
<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check system for function and leaks		OM
							Replace fresh air filter	- as necessary	OM
TRAVEL GEAR									
<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check oil level - clean magnetic plugs / spark plugs		OM
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check screw fittings for tight seating		OM
				<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	Replace gear oil ¹⁾ - Clean magnetic plugs / spark plugs	- at least every 4 years	OM
				<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	Replace lube oil in slip ring chamber	- at least every 4 years	OM
TRACK COMPONENTS									
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check mounting screws and nuts of track components, especially track pad and chain segment screws for tight seating		OM
		<input type="checkbox"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check carrier rollers, idlers, for leaks		OM
			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lubricate outer oscillating axle bearing - Shorten interval as necessary		OM
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check / adjust idler guides, replace parts as necessary		OM
				<input type="checkbox"/>	<input type="radio"/>		Check screws on front axle bearing mounts for tight seating		OM
							Adjust chain tension to suit application - as necessary		OM
							Clean tracks	- as necessary	OM
							Check track wear	- as necessary	

WORK TO BE CARRIED OUT

Maintenance / inspection at operating hours

		by maintenance personnel	by authorized trained personnel		Refer- ence				
		<input type="checkbox"/> First and only maintenance interval	<input type="checkbox"/> Repeat maintenance interval	OM - Operation / Maintenance Manual					
at delivery	every 8 - 10	every 50	every 250	every 500	every 1000	every 2000			
ATTACHMENT - HOIST GEAR									
<input type="radio"/>			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lubricate all lube points		OM
		<input type="checkbox"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check screws, nuts and pin retainers for tight seating		OM
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check the complete length of the winch cable for damage - grease if necessary See Operating manual issued by the cable manufacturer		OM
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check attachment for intentional damage		OM
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check all bearing points play / wear		OM
<input type="radio"/>				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check cable winch oil level (2 separate oil chambers) (at least every 3 months)		OM
		<input type="checkbox"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Change cable winch oil - clean vent plug (at least every 6 month)		OM
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check the function of the free fall device always check after longer period of standstill		OM
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Cable winch - removal and basic inspection of all wear parts according to guidelines per ANSI - specification B30.5c and API RP2D, paragraph 3 (at least every 12 months)		OM
Retrieval winch (rear)									
			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check cable winch oil level (at least monthly)		OM
		<input type="checkbox"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Change cable winch oil - clean vent plug (at least every 6 month)		OM
GENERAL									
				<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Check complete machine for correct maintenance and proper condition		OM
							Lubricate door hinges (battery and oil cooler compartment) - as necessary		OM
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Maintenance and inspections for special attachments must be checked and carried out according to separately issued manufacturer's OM by the manufacturer		Sepa- rate OM
<input type="radio"/>							Explain machine literature, special operation manual / safety guidelines to operator and maintenance personnel		OM
							1) For oil quality and viscosity, refer to chapter 5 'Service fluids'		

6.17 TIGHTENING TORQUES

According to WN 4037B

Installation preload forces F_M and tightening torques M_A according to DIN 13 section 13, wrench sizes for hex head screws according to ISO 4014, for socket head screws according to DIN 912. Beginning with grade 10.9, using lock washers no longer provides safety.

For special screws, such as Durlock or Tensilock, the tightening torques given by the manufacturer should be observed.

When using impact wrenches, make sure that the torque values are not exceeded. (Check torque with torque wrench!).

The torque values shown in the following charts can only be achieved with the use of a torque wrench.

If tightening torques are shown in drawings or in descriptions, then these values must be observed.

6.17.1 TIGHTENING TORQUES FOR SCREWS WITH STANDARD METRIC THREAD

Screw type: "black" or "5 μ m white galvanized A2E"

Metric Standard Thread	Preload values F_M based on grades in N			Tightening torques M_A based on grades in Nm			Wrench size for			
	8.8	10.9	12.9	8.8	10.9	12.9	Hex head screws		Socket head screws	
							mm	Inch	mm	Inch
M 4 x 0,7	3 900	5 700	6 700	3,1	4,5	5,3	7	9/32	3	---
M 5 x 0,8	6 400	9 300	10 900	6,1	8,9	10,4	8	---	4	5/32
M 6 x 1	9 000	13 200	15 400	10,4	15,5	18	10	---	5	---
M 7 x 1	13 100	19 300	22 600	17	25	30	11	---	---	---
M 8 x 1,25	16 500	24 200	28 500	25	37	43	13	1/2	6	---
M 10 x 1,5	26 000	38 500	45 000	51	75	87	(17)16	(11/16)	8	---
M 12 x 1,75	38 500	56 000	66 000	87	130	150	(19) 18	(3/4)	10	---
M 14 x 2	53 000	77 000	90 000	140	205	240	(22) 21	(7/8)	12	---
M 16 x 2	72 000	106 000	124 000	215	310	370	24	61/64	14	9/16
M 18 x 2,5	91 000	129 000	151 000	300	430	510	27	1 - 1/16	14	9/16
M 20 x 2,5	117 000	166 000	194 000	430	620	720	30	1 - 3/16	17	43/64
M 22 x 2,5	146 000	208 000	243 000	580	970	830	(32) 34	1 - 9/92	17	43/64
M 24 x 3	168 000	239 000	280 000	740	1 060	1 240	36	1 - 7/16	19	3/4
M 27 x 3	221 000	315 000	370 000	1 100	1 550	1 850	41	1 - 5/8	19	3/4
M 30 x 3,5	270 000	385 000	450 000	1 500	2 100	2 500	46	1 - 13/16	22	7/8
M 33 x 3,5	335 000	480 000	560 000	2 000	2 800	3 400	50	2	24	61/64
M 36 x 4	395 000	560 000	660 000	2 600	3 700	4 300	55	2 - 3/16	27	1 - 1/16
M 39 x 4	475 000	670 000	790 000	3 400	4 800	5 600	60	2 - 3/8	27	1 - 1/16



NOTE:

Preload forces and tightening torques are based on lightly lubricated screws and nuts (corresponds to medium friction $\mu_G=0.14$).

Wrench size (x) = wrench size according to DIN 931

6.17.2 TIGHTENING TORQUES FOR SCREWS WITH FINE METRIC THREADS

Fine metric threads	Preload values F_M based on grades in N			Tightening torques M_A based on grades in Nm			Wrench size for			
	8.8	10.9	12.9	8.8	10.9	12.9	Hex head screws		Socket head screws	
							mm	Inch	mm	Inch
M 8 x 1	18 100	26 500	31 000	27	40	47	13	1/2	6	---
M 9 x 1	23 800	35 000	41 000	40	58	68	---	---	---	---
M 10 x 1	30 500	44 500	52 000	57	84	98	17	11/16	8	---
M 10 x 1,25	28 500	41 500	48 500	54	79	93	17	11/16	8	---
M 12 x 1,25	43 000	64 000	74 000	96	140	165	19	3/4	10	---
M 12 x 1,5	40 500	60 000	70 000	92	135	155	19	3/4	10	---
M 14 x 1,5	58 000	86 000	100 000	150	220	260	22	7/8	12	---
M 16 x 1,5	79 000	116 000	136 000	230	340	390	24	61/64	14	9/16
M 18 x 1,5	106 000	152 000	177 000	350	490	580	27	1 - 1/16	14	9/16
M 18 x 2	98 000	140 000	164 000	330	460	540	27	1 - 1/16	14	9/16
M 20 x 1,5	134 000	191 000	224 000	480	690	800	30	1 - 3/16	17	43/63
M 22 x 1,5	166 000	236 000	275 000	640	920	1 070	32	1 - 9/92	17	43/64
M 24 x 1,5	200 000	285 000	333 000	830	1 180	1 380	36	1 - 7/16	19	3/4
M 24 x 2	189 000	270 000	315 000	810	1 160	1 350	36	1 - 7/16	19	3/4
M 27 x 1,5	258 000	367 000	430 000	1 200	1 710	2 000	41	1 - 5/8	19	3/4
M 27 x 2	245 000	350 000	410 000	1 190	1 700	2 000	41	1 - 5/8	19	3/4
M 30 x 1,5	323 000	460 000	538 000	1 670	2 370	2 780	46	1 - 13/16	22	7/8
M 30 x 2	309 000	440 000	515 000	1 610	2 300	2 690	46	1 - 13/16	22	7/8
M 33 x 1,5	396 000	563 000	659 000	2 220	3 170	3 710	50	2	24	61/64
M 33 x 2	380 000	540 000	630 000	2 250	3 200	3 700	50	2	24	61/64
M 36 x 1,5	475 000	677 000	792 000	2 910	4 140	4 850	55	2 - 3/16	27	1 - 1/16
M 36 x 3	425 000	610 000	710 000	2 800	3 900	4 600	55	2 - 3/16	27	1 - 1/16
M 39 x 1,5	562 000	801 000	937 000	3 720	5 300	6 200	60	2 - 3/8	27	1 - 1/16
M 39 x 3	510 000	720 000	850 000	3 600	5 100	5 900	60	2 - 3/8	27	1 - 1/16

**NOTE:**

Preload forces and tightening torques are based on lightly lubricated screws and nuts (corresponds to medium friction $\mu G=0.14$).

Expanded standard WN 4037B according to Roloff Matek

6.17.3 TIGHTENING TORQUES FOR SCREWS WITH STANDARD METRIC THREADS

Screw type: "8 µm galvanized, yellow chromatised A3C"

Standard metric thread	Preload values F_M based on grades in N			Tightening torques M_A based on grades in Nm			Wrench size for			
	8.8	10.9	12.9	8.8	10.9	12.9	Hex head screws		Socket head screws	
							mm	Inch	mm	Inch
M 4 x 0,7							7	9/32	3	---
M 5 x 0,8	6 900	9 700		4,9	7,0		8	---	4	5/32
M 6 x 1	9 750	13 700		8,0	12,0		10	---	5	---
M 7 x 1							11	---	---	---
M 8 x 1,25	17 900	25 100		20	28		13	1/2	6	---
M 10 x 1,5	28 400	40 000		40	56		(17)16	(11/16)	8	---
M 12 x 1,75	41 500	58 500		69	98		(19) 18	(3/4)	10	---
M 14 x 2	56 500	80 000		110	155		(22) 21	(7/8)	12	---
M 16 x 2	78 500	110 000		170	240		24	---	14	9/16
M 18 x 2,5							27	1 - 1/16	14	9/16
M 20 x 2,5	122 000	172 000		330	465		30	1-3/16	17	43/64
M 22 x 2,5							(32) 34	1 - 9/32	17	43/64
M 24 x 3	176 000	248 000		570	800		36	1-7/16	19	3/4
M 27 x 3							41	1 - 5/8	19	3/4
M 30 x 3,5	282 000	397 000		1 150	1 600		46	1-13/16	22	7/8
M 33 x 3,5							50	2	24	---
M 36 x 4							55	2-3/16	27	1-1/16
M 39 x 4							60	2-3/8	27	1-1/16






NOTE:

Preload forces and tightening torques are based on lightly lubricated screws and nuts (corresponds to medium friction $\mu_G=0.10$).

Wrench size (x) = wrench size according to DIN 931

6.18 PROBLEMS AND REMEDIES

Diesel engine and fuel system




 Problem / Error	 Cause	 Remedy
Engine does not start	Safety lever is not in the uppermost position	Place safety lever down
	Engine shut off control is not in operating position (PR732B/742B/LR632)	Bring engine shut off control into operating position
	Fuel tank is almost or completely empty	Add fuel and bleed the fuel system
	Shut off valve in fuel line is closed	Open shut off valve
	Fuel filter displaced	Clean or change filter and bleed the system, drain the fuel / clean the tank
	Ambient temperature below 0°C	Control and operation for special climatic conditions, see Operation Manual
	Starter does not operate	Check the line connections
	Starter does not operate	Overhaul starter or change the starter ring (Inst)
	Battery capacity is low	Recharge / replace
Engine starts, but stops right away or runs irregular	Fuel tank is empty	Add fuel and bleed the system
	Fuel pre-cleaner is dirty	Clean and bleed the system
	Fuel filter is dirty	Clean or change filter and bleed the system (Tank)
	Especially in winter: engine oil is too viscous	Use engine oil recommended for the ambient temperature.
	Air filter is dirty	Clean or change main filter element
	Air in fuel system	Bleed the system
	Vent on fuel tank is plugged	Clean
	Fuel line is kinked	Check and fix line
Exhaust is gray or black	Air filter is dirty	Clean or replace the filter
Exhaust is white (vapor)	Water in combustion chamber	Call Service Dept.

!	?	✓
Engine does not reach full RPM	The throttle control lever is not set to full load	Set the throttle control lever to full load
	Dry air filter is dirty	Clean or replace the filter
	Bad fuel supply	Check fuel pre-cleaner, fuel filter, lines, drain tank
Engine is getting too hot	Not enough coolant	Add coolant, check for leaks
	Water pump is defective	Check for leaks / fix
	Thermostats are not working	Change thermostats
	Radiator is dirty	Clean radiator
Engine oil pressure is insufficient NOTE: Turn engine off immediately!	Oil level too low	Correct oil level
	Oil pressure gauge is defective	Change oil pressure gauge
Engine uses too much oil	External leak on the engine	Retighten screws, replace seals if necessary
Oil in coolant or coolant in oil		Call Service Dept.
Whistling noises on exhaust side	Exhaust system is not tight, leaks	Check / fix exhaust system




Hydraulic system

!	?	✓
Problem / Error	Cause	Remedy
Indicator light for replenishing pressure does not turn off after starting the engine NOTE: Turn engine off immediately	Increased leakage	Call Service Dept.
Abnormal noise on hydraulic pumps NOTE: Turn engine off immediately!	Shut off valve on hydraulic tank is closed	Open shut off valve
	Hydraulic pumps draw in air	Check oil level in hydraulic tank, check suction lines for leaks
No reaction if travel lever is deflected	Safety lever in down position or emergency OFF switch is pressed	Raise the safety lever / pull the emergency OFF switch
No reaction when actuating the blade up function	Float position is turned on	Turn off float position




Travel gear / track

 Problem / Error	 Cause	 Remedy
Oil emerges on track rollers, carrier rollers or idler	Seal is defective	Replace seal
Deficient chain guidance on idler	Idler guide on track roller frame has too much play	Adjust play of idler guide
Chain jumps off or over	Chain tension too low / sprocket is worn	Adjust / replace chain tension
Correctly tensioned chain loses tension quickly during operation	Chain tension cylinder is defective	Check chain tension cylinder, replace if necessary or reseal (only by authorized expert personnel)
Track roller or carrier roller is stuck	Track is extremely dirty	Clean

Electrical system

 Problem / Error	 Cause	 Remedy
Charge indicator light does not turn off	V-belt for alternator is loose or broken	Tension or replace V-belt
	Alternator is defective	Change alternator
Batteries are not or insufficiently charging	Batteries defective	Change batteries
	Battery terminals are dirty / corroded	Clean battery terminals
	Cable is loose or defective	Connect or replace cable
No function or erroneous function of an indicator light or gauge	Bulb is burnt out, gauge is defective	Replace defective part
Failure of some or all instrument panel functions	Plug connector is unplugged or defective, ground is interrupted, short circuit - fuse is defective	Connect plug connector or change plug, fix short circuit, replace fuse

Heating system

 Problem / Error	 Cause	 Remedy
Heater does not put out warm air	Shut off valves on coolant line on engine are closed	Open shut off valves
Heater fan is not running	Engine does not reach operating temperature	Bring engine to operating temperature
	No power supply	Check fuse and check wires / fix if defective

!	?	✓
	Blower motor is defective	Change blower motor
Insufficient fresh air in cab	Fresh air filter is dirty	Clean air intake openings, replace fresh air filter

Working attachment

!	Problem / Error	?	Cause	✓	Remedy
	Cylinder gives way under load		Piston seal in cylinder is defective		Overhaul cylinder
	PR- chain scrapes on push frame		Blade adjustment incorrect		Adjust correctly
	Increased bearing play on attachment		Bearing points worn		Replace bearing sections

NOTES:

7. SPECIAL ATTACHMENTS / OPTIONS

The components or functions outlined in section 7 are special attachments or options which deviate from the machines standard equipment.

It is therefore possible that one or more of the functions outlined in section 3 or 4 are replaced by functions as outlined in group 7.

No matter which factory option is installed in the machine, the Operation and Maintenance Guidelines in section 1 through 6 remain valid.

7.1 CRANE CABLES

7.1.1 CABLE SELECTION

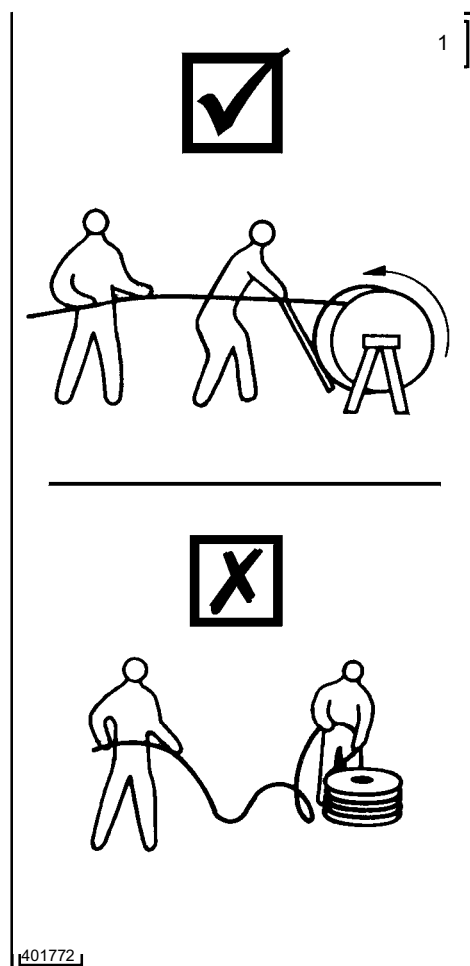
When changing the cables, make sure to use wire cables of the same type and strength as the original wire cable was when it was new. If you want to install another type of wire cable, you must first obtain the approval of the machine manufacturer.

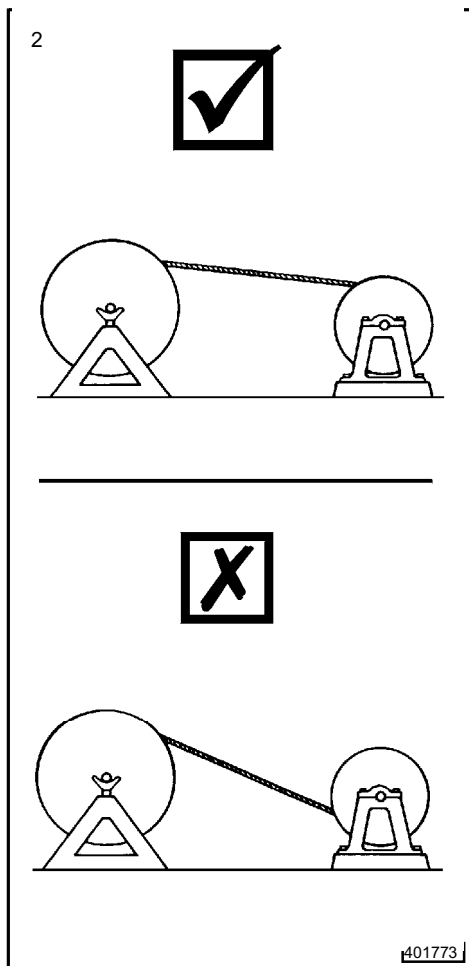
Place a right-handed cable on a left-handed drum and reverse. Even lay cables experience less wear in multi-layer coiling than cross lay cables.

7.1.2 TO PLACE A CABLE

Wire cables are very vulnerable to external damage. They must be transported and unloaded very carefully. Spare wire cables should always be stored in a clean, cool and dry area. Do not lay them directly on the ground.

Hoist cables can only work properly only if they are placed without being twisted and damaged externally. The cables must be pulled off the reel or ring in the coiling direction (fig. 1). Pulling them sideways creates a twist in the cable, up to destruction due loop formation.





The best way to spool the cable onto the drum is from a raised reel (fig. 2). Winding the cable in the same bending direction prevents additional tension in the cable and provides the best coiling contact on the drum. Cables may not be pulled over the ground and soiled.

In multi layer coiling, the lower layers must also be coiled tightly at a pretension of 1 - 2 % of the minimum break force of the cable. This pretension can be obtained by slowing down the cable reel rotation.

After placing the cable, run it in at first with several hoisting movements at low partial loads and then change to loaded and unloaded hook block. As a result, the cable will adapt more flexibly to the bending direction and the bending radii of pulleys and drums.

7.1.3 MAINTENANCE AND CARE

Regular cable care ensures the safety of crane operation and increases the service life of the cable significantly.

Wire cables must be lubricated in regular intervals, depending on the operating conditions, especially in the area of the bending zones on drums and pulleys. Tests have shown that well lubricated cables have 4 times as much bending fatigue strength as un-lubricated cables, under the same test conditions.

The subsequent lubricants must be compatible with the original cable lubricants.

We recommend the following lubricants:

- Generally commercially available lubricants, as recommended by the crane manufacturer for open gears.
- Special cable lubricants, such as
Texaco Novatex Grease EP2
Aral Aralub LFZ 1
- In especially severe utilization via multi layer coiling, use graphite based lubricants, such as
Reiner Ceplattyn KG 19
Texaco Novatex FK10

Dirty wire cables should be cleaned regularly, by brushing. If the lower cable layers on the drum are rarely or not at all used, then they should be uncoiled from time to time and replaced under pretension. A cable works the most economical if it is always utilized in its entire length. For that reason, we recommend to always use the proper cable length for extended crane hoisting tasks. If some sections of the cable are stressed differently, then the cable should be turned after a certain operating time. If the previously free end of the cable is now attached on the drum, then the previously unstressed cable sections will now be in less stressed zones, which in turn can significantly extend the service life of the cable.

7.1.4 MONITORING

Crane cables are designed to still provide sufficient safety to place the new cable when the first wire breaks occur.

The cables must be inspected regularly, especially during the initial time of placement; in addition to unusual strain, in case of suspected, non-visible damage or when the first signs of cable damage appear.

The operational safety of the cables can be evaluated according to the following criteria:

- Type and number of broken wires (see chart)
- Position and timing of broken wires
- Reduction of cable diameter during operating time
- Corrosion, abrasion, cable distortions
- Heat effects
- Total time of utilization

Beginning changes in cable behavior must be monitored especially careful.



CAUTION

As soon as the cable strands above the hook block collapse, there is the danger of serious cable damage. The cause is always additional torsional stress in the torsion-free hoist cable, which can be caused by a variety of influences and problems, but also due to special extension stress of the hoist cable in severe applications. The compensation of such additional torsional stress requires great care and expertise.

Turn out the hook block for non-rotating cable fixed point:

- Set down the hook block.
- Determine the turn-in direction.
- Loosen the cable on the fixed point.
- Carefully turn the free cable end by 180 - 360 degrees in such a way to compensate for the turn-in of the hook block. The correct turning direction can possibly be determined by simulating it with a string.
- Reattach the cable on the fixed point.
- Carefully raise the hook block and run it without a load with the hook block and possibly with an available trolley.
- Repeat the procedure, if necessary.

Make sure that the twist is made in a free, especially long cable section. By running it without a load, the twist should be distributed to the entire cable length. Under no circumstances turn the cable by force over a short cable length, this could permanently destroy the cable structure.

The cable end connections and the cable suspensions must be checked for proper condition. The individual elements of cable drive, cable drum and pulleys must be able to turn easily in their bearings, and may not show a depression of the cable profile in the base groove. The groove radius on drums and pulleys should be at least 0.53 x nominal cable diameter.

7.1.5 DISCARD TIME OF WIRE CABLES DUE TO BROKEN WIRES

Number of carrying wires in outer strands of wire cable ³⁾ n	Number of visible broken wires at wear limit							
	Driving mechanism groups 1E _m , 1D _m , 1C _m , 1B _m , 1A _m				Driving mechanism groups 2 _m , 3 _m , 4 _m , 5 _m			
	Cross lay		Even lay		Cross lay		Even lay	
	At a length of		At a length of		At a length of		At a length of	
6 d	30 d	6 d	30 d	6 d	30 d	6 d	30 d	
to 50	2	4	1	2	4	8	2	4
51 to 75	3	6	2	3	6	12	3	6
76 to 100	4	8	2	4	8	16	4	8
101 to 120	5	10	2	5	10	19	5	10
121 to 140	6	11	3	6	11	22	6	11
141 to 160	6	13	3	6	13	26	6	13
161 to 180	7	14	4	7	14	29	7	14
181 to 200	8	16	4	8	16	32	8	16
201 to 220	9	18	4	9	18	35	9	18
221 to 240	10	19	5	10	19	38	10	19
241 to 260	10	21	5	10	21	42	10	21
261 to 280	11	22	6	11	22	45	11	22
281 to 300	12	24	6	12	24	48	12	24
above 300 ⁴⁾	0,04 · n	0,08 · n	0,02 · n	0,04 · n	0,08 · n	0,16 · n	0,04 · n	0,08 · n

For cables with especially thick wires in the outer layers of the outer strands, such as round stranded cables 6x19 Seale according to DIN 3058 or round stranded cables 8x19 Seale according to DIN 3062, the number of visible broken wires at wear limit is 2 lines less than stated on the chart values.
Driving mechanism groups according to DIN 15 020, page 1

d Wire cable diameter
Filler wires are not considered as load carrying.

3) For wire cables with several layers, only the strands in the outermost layer are considered „outer strands“. For wire cables with steel insert, the insert should be viewed as an inner strand.

4) The calculated numbers must be rounded up.

7.1.6 DISCARD TIME

**DANGER**

For safety reasons, crane cables must be discarded in time if one of the following criteria is present (fig. 3)

- Broken strand
- Formation of broken wire clusters
- When the number of broken wires, as shown on the chart, is reached
- Corkscrew type distortion by more than 1/3 of the cable diameter
- Basket formation
- Hair pin shaped protrusion of wires or wire strands from the cable
- Reduction of cable diameter by more than 15 % of the nominal diameter or by 10 % with simultaneous corrosion and / or abrasion
- Loosening of the cable structure
- Constriction
- Sharp bends and compressions
- Kinked sections or permanent distortions

If any of the above damages are discovered, find the cause and take care of it before placing a new cable. Damages and cable marks on the construction components can be useful in determining the reasons for these damages.

If there is any doubt about the operational safety of a crane cable, then it should be removed or an expert should be called in for further evaluation.

