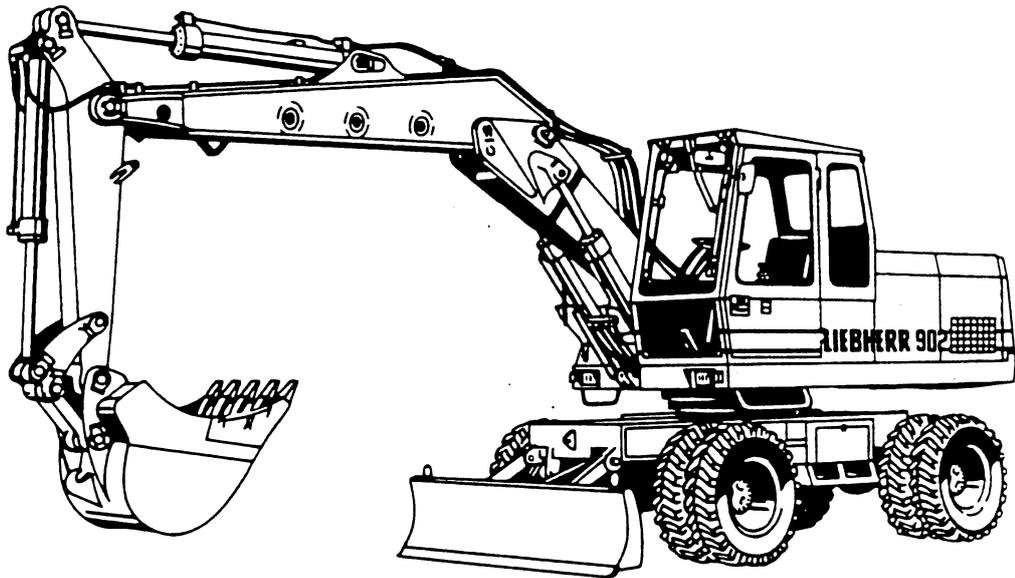


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Operation and Maintenance Manual

A 902

from Serial No. on 2001



Sample of manual. Download All 102 pages at:

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INTRODUCTION

This manual has been prepared to acquaint you with the operation and maintenance of your **LIEBHERR** machine. It contains important safety information, as well as valuable reference data such as capacities and tightening torques. Unless specific values are given, all threaded connections should be tightened according to the torque charts.

The descriptions in this manual are brief and precise. They are supported by photographs and drawings. All information is intended to simplify maintenance procedures.

WE URGE YOU TO READ THIS MANUAL CAREFULLY. Correct maintenance procedures will give the machine a long service life. Before starting a job, you must read the applicable section of the manual and know the maintenance procedure to be performed. It is essential to keep the machine, parts, tools and your working area clean and orderly. Following the recommendations in this manual will help make your **LIEBHERR** equipment profitable, safe and trouble-free.

To determine service intervals, use the hour meter. However, calendar intervals (daily, weekly, etc.) sometimes provide a more convenient method of scheduling required maintenance.

Under severe conditions such as extremely high or low temperatures, dusty or wet job sites, etc., more frequent maintenance than indicated by the schedule may be necessary.

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. All manuals are reviewed and updated periodically to include such design changes.

Should you have any questions regarding the information in this manual or your **LIEBHERR** machine, please contact your **LIEBHERR** dealer. He knows your equipment best and is interested in your complete satisfaction.

IMPORTANT SAFETY INFORMATION

Safety notes such as **DANGER**, **WARNING** and **CAUTION** are used throughout this manual to emphasize important or critical instructions. In this manual, **DANGER**, **WARNING** and **CAUTION** are defined as follows:



DANGER -

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



WARNING -

Denotes a hazard which could result in injury or death if proper precautions are not taken.



CAUTION -

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

The word **IMPORTANT** denotes a procedure which, if not followed, could cause damage to the machine or any of its components.

READ, UNDERSTAND AND OBSERVE ALL SAFETY NOTES, PRECAUTIONS AND REGULATIONS.

DO NOT operate or perform maintenance on this machine until you have read this manual.

This manual and the Safety Manual should remain with the machine as a maintenance and safety guide. Please contact your **LIEBHERR** dealer for additional copies.

Preventive maintenance is important to the safe and reliable operation of this machine. This manual outlines recommendations and methods.

Improper operation, lubrication or maintenance of this machine can be dangerous and result in bodily injury or death.

Your **LIEBHERR** machine is equipped with safety decals to identify specific hazards, as well as instruction decals to aid in the operation and maintenance of the machine.

ALWAYS replace missing and unreadable safety and instruction decals immediately.

It is impossible for **LIEBHERR** to anticipate every circumstance that might involve a hazard. The **DANGER**, **WARNING** and **CAUTION** notes in this manual, therefore, are not all-inclusive. If a procedure not specifically mentioned by **LIEBHERR** is used, you must satisfy yourself that it is safe for you and others. Also make sure that the machine is not damaged or made unsafe by the procedures you choose.

Obviously, the manufacturer has no direct control over machine application, operation or maintenance. This leaves it up to you - operator or mechanic - to use good safety practices.

A good way to start is to read this manual. It was written and illustrated by a group of people which has a great deal of heavy equipment experience. Read what they have to say.

We, and the people you work with, depend on you to operate and maintain this machine as safely as you can.

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ELECTRICAL SCHEMATIC

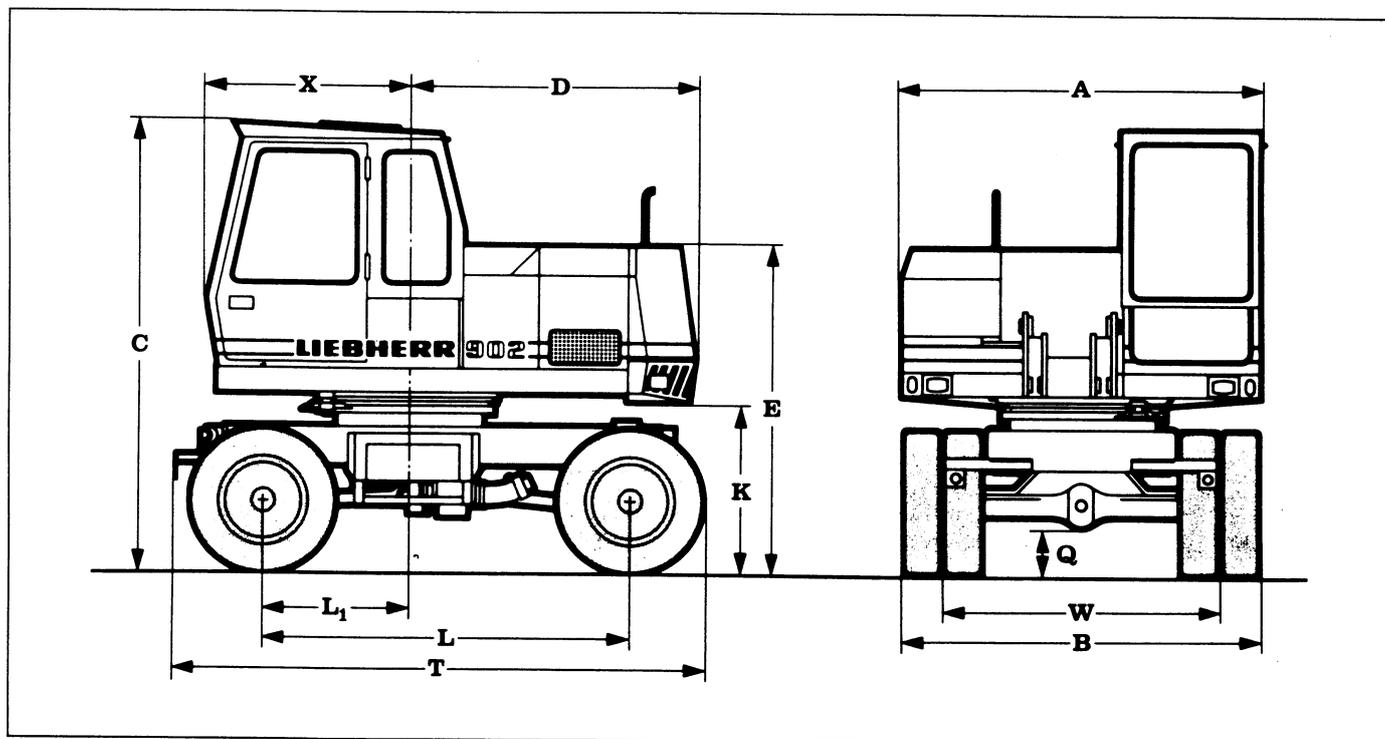
LUBRICATION CHART

Technical Data

Hydraulic Excavator

A902

Basic machine



Dimensions (equipped with 10.00-20 tires) ft-in /mm

	ft-in	/mm		ft-in	/mm		
A	Width of machinery deck	8' 0"	2440	L	Wheel base	8' 2"	2500
B	Width of undercarriage	8' 2"	2496	L ₁	Distance machine center - rear axle	3' 3"	1000
C	Height of basic machine	10' 3"	3118	Q	Ground clearance	1' 2"	343
D	Tail reach	7' 1"	2160	T	Length of undercarriage	12' 4"	3752
	Tail swing	7' 4"	2250	W	Tread width	6' 3"	1915
E	Height without cab	7' 5"	2263	X	Axis of rotation to front of cab	4' 6"	1372
K	Clearance under counterweight	4' 0"	1203				

To order

- Basic machine with LIEBHERR Diesel engine for DEUTZ Diesel engine
- DEUTZ Diesel engine F 5 L 912
- Tires - as applicable
 - 8 tires 9.00-20
 - 8 tires 10.00-20
 - 4 high flotation 18.00-19,5

Id. No.

9130783
9132278
9133710

Operating Weight

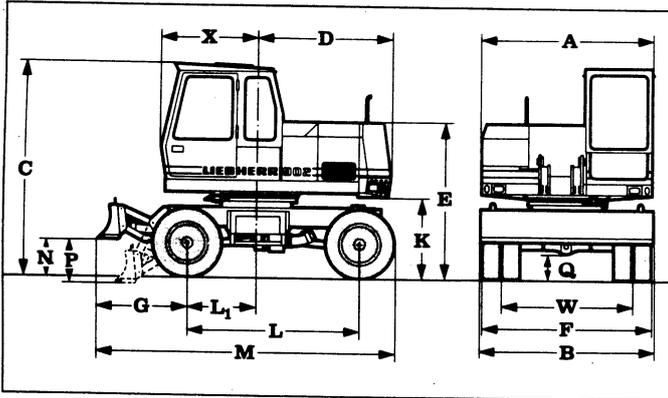
Operating weight includes basic machine with two-piece boom 11'2"/3400 mm stick 5'3"/1600 mm and bucket

without stabilization	28,445 lb/12900 kg
with dozer blade	29,990 lb/13600 kg
with rear outriggers	30,650 lb/13900 kg
with front and rear outriggers	34,400 lb/15600 kg

Optional Chassis

A 902

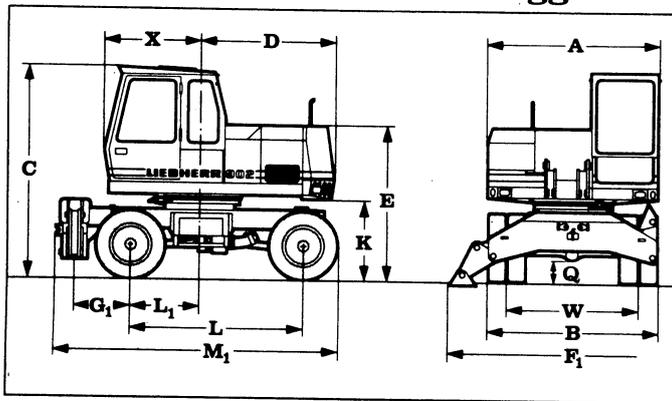
Basic machine with rear dozer blade



To order

- | | |
|---|---------|
| | Id. No. |
| ● Basic machine with LIEBHERR Diesel engine | 9130783 |
| ● for DEUTZ Diesel engine | 9132278 |
| ● DEUTZ Diesel engine F 5 L 912 | 9133710 |
| ● Tires - as applicable | |
| 8 tires 9.00-20 | |
| 8 tires 10.00-20 | |
| 4 high flotation 18.00-19,5 | |
| ● rear dozer blade | 9166377 |

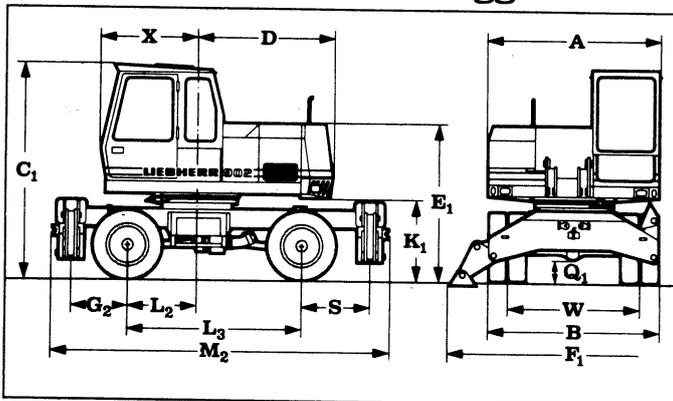
Basic machine with rear outriggers



To order

- | | |
|---|---------|
| | Id. No. |
| ● Basic machine with LIEBHERR Diesel engine | 9130783 |
| ● for DEUTZ Diesel engine | 9132278 |
| ● DEUTZ Diesel engine F 5 L 912 | 9133710 |
| ● Tires - as applicable | |
| 8 tires 9.00-20 | |
| 8 tires 10.00-20 | |
| 4 high flotation 18.00-19,5 | |
| ● rear outriggers | |

Basic machine with 4 outriggers



To order

- | | |
|---|---------|
| | Id. No. |
| ● Basic machine with LIEBHERR Diesel engine | 9147630 |
| ● for DEUTZ Diesel engine | 9132279 |
| ● DEUTZ Diesel engine F 5 L 912 | 9133710 |
| ● Tires - as applicable | |
| 8 tires 9.00-20 | |
| 8 tires 10.00-20 | |
| 4 high flotation 18.00-19,5 | |

Dimensions (equipped with 10.00-20 tires) ft-in /mm

A	Width of machinery deck	8' 0"/2440
B	Width of undercarriage	8' 2"/2496
C	Height of basic machine	10' 3"/3118
C ₁	Height with 4 outriggers	10' 4"/3138
D	Tail reach	7' 1"/2160
	Tail swing	7' 4"/2250
E	Height without cab	7' 5"/2263
E ₁	Height with 4 outriggers	7' 6"/2283
F	Width over dozer blade	8' 0"/2440
F ₁	Width over outriggers	11' 9"/3593
G	Distance rear axle - dozer blade	4' 1"/1250
G ₁	Distance rear axle - outriggers	2' 7"/800
G ₂	Distance rear axle - outriggers on basic machine with 4 outriggers	2' 8"/820
K	Clearance under counterweight	3' 11"/1203
K ₁	Clearance under counterweight on basic machine with 4 outriggers	4' 0"/1223

L	Wheel base	8' 2"/2500
L ₁	Distance machine center - rear axle	3' 3"/1000
L ₂	Wheel base on basic machine with 4 outriggers	8' 6"/2600
L ₃	Distance machine center - rear axle on basic machine with 4 outriggers	3' 7"/1100
M	Length of undercarriage with dozer blade	14' 5"/4392
M ₁	Length of undercarriage with rear outriggers	13' 10"/4219
M ₂	Length of undercarriage with 4 outriggers	16' 3"/4944
N	Clearance under dozer blade	1' 10"/570
P	Total blade lift	2' 2"/668
Q	Ground clearance	1' 2"/343
Q ₁	Ground clearance of basic machine with 4 outriggers	1' 1"/335
S	Distance front axle - outriggers	3' 2"/970
W	Tread width	6' 3"/1915
X	Axis of rotation to front of cab	4' 6"/1372

Transport Dimensions

A902

For transportation on a low boy

with two-piece boom
and

stick size 5' 3"/1600 7' 3"/2200 9' 2"/2800 11'10"/3600

A	ft-in/mm	26'10"/8190	27' 0"/8230	27' 0"/8230	25' 9"/7860
C	ft-in/mm	10' 3"/3118*	10' 3"/3118*	10' 3"/3118*	10' 3"/3118*
H	ft-in/mm	8' 9"/2680	8' 4"/2550	9' 8"/2940	12' 4"/3760
U	ft-in/mm	28'10"/8780	28'11"/8820	28'11"/8820	27' 9"/8450
V	ft-in/mm	14' 5"/4400	11'10"/3600	11' 0"/3350	10' 4"/3150

* with front and rear outriggers C = 10'4"/3138 mm

Boom mounted in upper hole of basic boom

with gooseneck boom
and

stick size 5' 3"/1600 7' 3"/2200 9' 2"/2800 11'10"/3600

A	ft-in/mm	26' 3"/8000	26' 1"/7950	26' 1"/7950	24' 5"/7450
C	ft-in/mm	10' 3"/3118*	10' 3"/3118*	10' 3"/3118*	10' 3"/3118*
H	ft-in/mm	9' 9"/2980	9' 9"/2980	10'11"/3330	13' 5"/4100
U	ft-in/mm	28'10"/8800	28' 8"/8750	28' 8"/8750	27' 1"/8250
V	ft-in/mm	14' 5"/4400	11'10"/3600	11' 0"/3350	10' 4"/3150

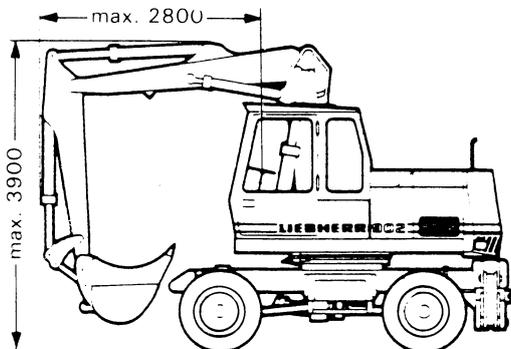
* with front and rear outriggers C = 10'4"/3138 mm

Highway traveling position

A ft-in/mm 11' 2"/3400
H ft-in/mm 11'10"/3600

Boom mounted in upper hole of basic boom

Traveling position with road travel attachment





GENERAL TECHNICAL DATA

ENGINE (MAKE)	LIEBHERR diesel	Optional engine: DEUTZ diesel
Engine model	D 904 NA	F 5 L 912
Displacement	5600 cm ³ (341 cu.in)	4710 cm ³ (287 cu.in)
No.of cylinders	4	5
Output	60 kW (81 BHP)	58 kW (79 BHP)
(per DIN 6271 at 2000 RPM)		
 Oil consumption	 max. 1% of fuel cons.	 max. 1% of fuel cons.
Max. machine inclination :		
- uphill/downhill:	45° continuous	45° continuous
- left/right:	45° continuous	45° continuous
 Engine air intake system	 dry type air filters	 dry type air filter
Type	FHG 12	FHG 08
 Coupling	 elastic	 elastic
 Radiator (cooling) (LIEBHERR engine only)	 liquid	

HYDRAULIC SYSTEM

Hydraulic pump	Two variable displacement, axial piston pumps with swashplate design and summation horsepower control.	
Pump output max.	2 x 86 L/min. (23 GPM)	
System pressure max.	320 bar (4640 PSI)	
 Control valves	Hydraulically operated, with integrated spool valves and primary relief valves and bolt on secondary relief valves. Independent control of all functions, simultaneously with swing and travel function.	
 Servo control	Proportional hydraulic control of the swing and all attachment functions with two pilot (servo) valves. Floor mounted (pedal) pilot (servo) valve is used for travel functions.	
 Servo pump	Dual gear pump	
Pump output max.	9 L/min. (2.4 GPM)	
System pressure max.	30 bar (435 PSI)	
Pump out put max.-steering	41 L/min. (10.8 GPM)	32 L/min. (8.45 GPM)
System pressure max.	130 bar (1885 PSI)	
 Hydraulic tank	Closed and pressurized	
Hydraulic tank capacity, approx.	180 Ltr. (48 gal)	
 Hydraulic oil cooling	Aluminium - air cooled	
Cooler fan drive	Electric motor	
Cooler fan RPM - max.	3100 RPM	

Hydraulic oil filters (see page 4)

- return oil filter magnetic rod, replaceable filter element
- servo oil filter magnet, replaceable filter element

COMPRESSED AIR SYSTEM Single cylinder air compressor supplies air to the brake, hydraulic tank and swing ring lubrication system.

SWING GEAR

- Type Two stage spur gear unit
- Swing drive Hydraulic via axial piston motor
- Swing speed 0 to 10 min. (RPM) variable
- Swing ring 2-piece, internal teeth
- Swing brake hydraulic drum brake - non-adjustable

ELECTRICAL SYSTEM

- Batteries 2 x 12 V, 110 Ah
- Starter 24 V, 4 kW, 5.4 hp
- Alternator 28 V, 27 A

HEATING SYSTEM with **LIEBHERR** engine with **DEUTZ** engine

- | | | |
|----------------------|----------------------------|----------------------------|
| Type | Coolant heater | engine oil heater |
| Output max. | 25070 kJ/h (23760 BTU) | 31350 kJ/h (30000 BTU) |
| Heater fan | 2-speed (radial) fan motor | 2-speed (radial) fan motor |

FUEL SYSTEM

- Fuel tank Capacity 200 l (53 gal)

ROTARY CONNECTION Connection to transfer oil from upper to undercarriage

TRAVEL DRIVE

- Gear box Two-speed spur gear unit
- Travel drive Hydraulic - variable flow piston motor with integrated brake valve
- Steering/rear axle Differential with planetary gears
- Travel brake Air over hydraulic, self adjusting, 4-wheel drum type travel and digging brake
- Parking brake Air type, adjustment-free drum brake at the two-speed gear box. Applied automatically with loss of air pressure.

TIRES 9.00-20/12 PR; 10.00-20/14 PR; 18-19.5/16 PR

TRAVEL SPEEDS Off road/low gear: 0-6,8 km/h (0-4.2 mph) forward/reverse
On road/high gear: 0-20,0 km/h (0-12.4 mph) forward/reverse

CAPACITIES

LIEBHERR engine	Engine oil	25 l (6.6 gal)
	Cooling system (incl.radiator)	26 l (6.9 gal)
DEUTZ engine	Engine oil	15 l (4,0 gal)
Swing gear	SAE 80 (API-GL-4-80)	8.5 l (2.2 gal)
Two-speed gear box	SAE 80 (API-GL-4-80)	7.2 l (7.6 qts)
Steering axle differential	SAE 90 LS (API-GL-5-90)	6.0 l (6.3 qts)
Rear axle differential	SAE 90 LS (API-GL-5-90)	7.0 l (7.4 qts)
Planetary gear hub both axles each	SAE 90 LS (API-GL-5-90)	1.4 l (1.5 qts)
Hydraulic system	System capacity	250 l (66 gal)
	Hydraulic tank capacity	180 l (48 gal)
Fuel tank	Diesel fuel	200 l (53 gal)
Antifreeze pump	Denatured alcohol	0.25 l (8 fl.oz.)
Grease container	Swing ring lubrication (see lubrication chart)	1.8 kg (3.9 lbs)
Swing brake	Brake fluid	0.05 l (1.6 fl.oz.)
Travel brake	Brake fluid	2 x 0.3 l (10 fl.oz.)

FILTER ELEMENTS

ENGINE

1. Dual-stage fuel filter	LIEBHERR	DEUTZ
Fuel filter element - stage 1	7008776	7008776
Fuel filter element - stage 2	7008775	7008775
2. Oil filter		
Main filter element	5502096	5502096
3. Air filter		
Air filter primary element	7009285	7000524
Air filter safety element	7009286	7000230

HYDRAULIC SYSTEM

1. Servo circuit (pressure filter)		
Servo filter element	7362910	7362910
2. Hydraulic tank		
Filter element	7002504	7002504

V-BELTS

Air compressor		7261100
Cooling fan		7005321
Alternator	7008713	7361377

GENERAL MACHINE DESCRIPTION

The **A 902** is a fully hydrostatic excavator with a 360° continuous swing capability and a tail reach of 2160 mm (7' 1'').

The 4-cylinder **LIEBHERR** engine, as well as the optional Deutz engine, is transversely mounted to the upper carriage with shock-absorbing engine mounts.

The **LIEBHERR** engine develops 60 kW (81 bhp) at 2000 RPM, as per DIN 6271.

NOTE: The optional Deutz engine develops 58 kW (79 bhp) at 2000 RPM, as per DIN 6271.

The large dry-type air filter cyclone precleaner and safety element protects the engine reliably against dust. At the same time, the air cleaner system features extended service intervals.

The radiator is installed with shock absorbing mounts. Air is drawn through the radiator by the engine fan.

The cooling system setup guarantees coolant temperatures which do not exceed specified limits, even at extreme climatic conditions.

NOTE: On the Deutz engine the cooling air for the engine is drawn in by the fan via an air duct at the side of the machine. From there it flows by the cylinders and exhausts through a duct in the machine's counterweight.

The double pump with summation horsepower control is connected directly to the engine. The system pressure is adjusted to 320 bar (4640 PSI).

The pump is driven via an elastic coupling by the flywheel of the diesel engine. The coupling protects the pump against engine vibrations.

The counterweight extends over the entire rear section of the upper carriage and protects components from external damage during the working phase of the excavator.

HYDRAULIC SYSTEM

The pumps draw hydraulic fluid from the 180 liter (53 gallons) tank. They deliver oil via the control valves to the individual end users. Oil is then returned through the oil cooler and the magnetic rod/return oil filter to the hydraulic tank.

Pilot (servo) control valves in the cab activate the control valves. This servo circuit is supplied with oil by a gear pump mounted to the diesel engine.

To ensure trouble-free operation, the circuit incorporates a highly efficient pressure (servo) filter.

Should the engine stop running during the working phase of the excavator, an accumulator in the servo circuit allows a limited number of attachment functions-attachment can be lowered.

HYDRAULIC OIL COOLING

Hydraulic oil is cooled very efficiently by an aluminum (air cooled) oil cooler. The thermostatically controlled cooler fan is driven by an electric motor.

FUEL SYSTEM

The diesel engine draws fuel from a tank holding 200 liters (53 gallons).

SWING SYSTEM

An axial piston oil motor, supplied with oil by the hydraulic pump, drives the 2-piece, internal teeth swing ring via a swing gear.

The air-over-hydraulic drum brake, attached to the swing gear, serves as an operating, as well as a holding brake.

The swing ring teeth are lubricated from within the cab by means of a turn switch.

COMPRESSED AIR SYSTEM

The main components operated by the compressed air system are: swing brake, travel brake, swing ring lubrication, hydraulic tank pressurization and oscillating axle lock.

The compressor is driven directly by the diesel engine and requires no regular maintenance.

STEERING SYSTEM

The hydrostatic steering system is supplied with oil by a gear pump which is mounted directly to the diesel engine. During steering, oil is supplied to the steering cylinders in the undercarriage through a power-assist valve (servo-stat). The turning angle of the wheels is proportional to the rotation of the steering wheel.

When steering oil pressure is sufficient, an optical indication is given to the operator. When the diesel engine is started, a red indicator lamp in the console lights up. The steering system is ready for operation only after this lamp has gone off.

TRAVEL DRIVE

A variable flow oil motor provides power to the wheels via a 2-speed gear box and the front and rear axle.

With the pump summation horsepower control and the variable flow travel motor, the travel speed is infinitely variable within the below listed speed range.

Low gear (off road) 0 - 6.8 km/h (0 - 4.2 mph) forward/reverse.

High gear (on road) 0 - 20 km/h (0 - 12.4 mph) forward/reverse.

The travel drive system develops an enormous drawbar pull which gives the machine excellent maneuverability and climbing power.

TRAVEL BRAKES

The foot and/or hand operated service and holding brake is an air-over-hydraulic brake and acts on all four wheels. For downhill travel, an automatic brake valve, attached to the travel motor, prevents the machine from overspeeding.

This automatic brake valve works only in forward travel. When travelling, observe the following:

1. When travelling downhill on grades in excess of 12%, put the machine into low gear.
2. Travel speed can best be regulated by varying the RPM of the diesel engine.
3. To stop on a downhill grade, release the travel pedal slowly and depress the brake pedal of the service brake.

The parking brake is spring-applied and pneumatically released. Use the parking brake whenever maintenance/repair is performed or when parking the machine. Never use the parking brake as a digging brake.

OPERATOR'S CAB

The cab, resiliently mounted to the upper deck, is designed in accordance with internationally established guidelines.

An extra-wide, hinged door permits easy entry and exit. Large windows all around and a windshield that can be opened, ensure optimum visibility.

The seat has been constructed using the latest ergonomic studies and is extremely comfortable. It is fully adjustable (seating surface, backrest and spring rate) and offers a comfortable fit for the individual operator.

The joysticks for controlling work functions are located in special consoles below the armrests. Location and design of the joysticks ensure easy and smooth attachment control, cutting down on operator fatigue.

To prevent unintentional activation of a working function during entry or exit, the left joystick console can be tilted up. This automatically disengages all joystick functions.

Travel direction is elected with a switch, located at the steering column, while travel speed is controlled with a pedal on the cab floor.

The instrument panel is located in full view of the operator and contains all important indicators and gauges for the diesel engine, the hydraulic, the electrical, and the compressed air systems.

The gauges and the symbols used on the indicator lights conform to all applicable SAE standards.

If the machine will be operated in a quarry or in demolition work, the cab must be equipped with an optional rock protection package.

After removing a few screws, the upper part of the cab can be lifted off the machine.

HEATING AND VENTILATION

The heater keeps the temperature in the cab at a comfortable level. Heated water from the engine cooling system flows through a heat exchanger, located under the cab floor.

A fan draws air from the cab, as well as the outside. Air is blown back into the cab through the heat exchanger and two adjustable louvers. By moving a flap, the ratio of inside/outside air can be regulated.

With the warm water supply shut off, the blower motor can be used to ventilate the cab with fresh (outside) air.

NOTE: Machine equipped with Deutz engine: The heat exchanger on the Deutz engine is supplied with heated engine oil. Temperature and air flow is controlled the same way as on machines equipped with the Liebherr engine.

COVERS AND SOUND SUPPRESSION

The engine and pump compartments are completely enclosed by rugged doors and strong top covers. Because of the low-speed hydraulic oil cooler fan and the liberal application of sound suppression material, the **A 902** is one of the quietest machines on the market.

UPPER CARRIAGE (SWING) LOCK

For safety reasons, the upper carriage can be locked to the undercarriage mechanically. This should be done whenever the machine is transported, when traveling on the road, and whenever repair and maintenance work is carried out.

SAFETY INFORMATION

When operating or servicing the excavator, the following guidelines must be observed closely and at all times.

When working the machine, the operator must:

- never allow other persons on or near the machine,
- always remain seated,
- never allow other persons in the machine working range,
- always be watchful of his environment and closely observe the working area, soil conditions, truck loading area and possible obstructions,
- use a guide when working in tight quarters or under conditions where parts of the attachment are blocked from view,
- ask the truck driver to leave the cab during loading, even if the truck cab is equipped with a rock protection,
- locate the excavator, if possible, on level ground and at a safe distance from the bank to be removed,
- locate the machine with the attachment pointing down if the ground slopes to the side,
- air pressure -6,2 to 7,3 bar to be observed
- always make sure that the steering system is operational,
- closely observe all instruments and indicators,
- never come closer than 5 meter (15 feet) to high-voltage power lines.

When travelling, the operator must:

- never travel without the boom attached,
- lock the upper- to the undercarriage,
- if necessary, remove part of the attachment,
- use a guide when moving the machine in tight quarters,
- never travel down a hill if the slope exceeds maximum permissible inclination,
- if traveling down a steep hill, always keep the engine speed at maximum.

When hauling the machine, observe the following points:

- remove all snow, ice or mud from the machine running gear,
- use a guide to direct the operator on the ramp,
- make sure that the ramp does not incline more than 30° and that it is equipped with wooden planks,
- remove part of the attachment, if necessary,
- align the excavator with the loading ramp precisely,
- bring in the attachment as far as possible,
- drive up on the ramp.

After the machine has been placed on the loading platform, swing the uppercarriage to the rear and lower the attachment.

Shovel configuration: line up shovel bucket with loading vehicle and lower on platform.

Backhoe configuration: curl in stick and bucket.

- lock upper- to undercarriage,
- secure machine with chains and blocks.

DURING TRANSPORT

- carefully check out the transport route beforehand,
- be especially careful when transporting the machine through areas in which there are power lines, bridges and tunnels,

UNLOADING

- remove chains and blocks,
- start the Diesel engine and unlock the upper- from the undercarriage,
- lift the attachment and swing the upper to the front of the machine,
- carefully drive down the ramp while holding the attachment as low as possible.

PARKING THE MACHINE

- always park the machine on firm, level ground away from ditches or holes,
- apply parking brake,
- position the attachment lengthwise,
- fully retract hydraulic cylinders and put the bucket on the ground,
- lock upper- to undercarriage
- shut off the Diesel engine,
- bleed all pressure from the servo circuit,
- disable servo control functions by tilting up the left console, remove ignition switch key.
- mechanical parking brake (gear brake) to be actuated.

MACHINE MAINTENANCE

- keep all mirrors clean,
- open engine compartment only with the engine shut off,
- any repair work or service on both basic machine and/or attachment must be performed in accordance with **LIEBHERR** service instructions,
- check all hydraulic hoses regularly,
- use only original **LIEBHERR spare parts** when replacing items such as hoses, electrical wires, tubing, etc.,
- before attempting to perform any kind of repair, always release any residual hydraulic pressure by lowering the attachment to the ground and actuating all working functions with the Diesel engine shut off.
NOTE: the key must be in the ON position and the armrest flipped down.
- if the excavator has to be jacked up, support it with wood. Never use steel on steel.

CAUTION!

- never jack up the excavator with the attachment to perform any kind of maintenance or repair!
- when jacking up the excavator prior to supporting it, remember that the center of gravity of the machine will shift,
- check to see if the counterweight must be supported,
- all relief- or safety valves installed in the hydraulic- or compressed air system of the excavator must be adjusted by authorized **LIEBHERR service personnel** only. Otherwise, the warranty will be voided,
- steel members must be welded by authorized **LIEBHERR service personnel** only. Otherwise, the warranty will be voided,
- the upper deck of the excavator must be kept clean at all times.

SAFETY INFORMATION

This safety information is provided to operators and maintenance mechanics to ensure the safe operation and maintenance of the excavator.

It is essential that you read and familiarize yourself with this information, which explains safety requirements and precautions and specific hazards of which you should be aware. Careful adherence to these safety guidelines will permit safe operation and maintenance, and potentially prevent personal injury to yourself and others, and possible damage to the excavator.

GENERAL SAFETY INFORMATION

- **STUDY THE INSTRUCTION AND/OR OPERATION AND MAINTENANCE MANUALS** before operating or working on the excavator.
- **ALLOW ONLY AUTHORIZED PERSONNEL TO OPERATE, SERVICE OR REPAIR THE EXCAVATOR.**
- **WEAR PROPER WORK CLOTHING WHEN OPERATING OR WORKING ON THE EXCAVATOR.** Rings, watches, bracelets and loose clothing such as ties, scarves, unbuttoned or unzipped shirts and jackets are dangerous and could cause injury.
- **WEAR PROPER SAFETY EQUIPMENT.** When appropriate, utilize safety equipment such as a hard hat, safety shoes, safety glasses, ear protection, reflector vest or respirator.
- **CONSULT YOUR EMPLOYER OR SUPERVISOR** for specific safety equipment requirements.
- **KEEP OPERATOR'S CAB, CATWALKS, STEPS, HANDRAILS AND HANDLES CLEAN AND FREE FROM OIL, GREASE, MUD, SNOW AND ICE.** These precautions will minimize the danger of slipping, stumbling or falling.
- **IF NEEDED, USE THE FRONT WINDOW AS AN ESCAPE HATCH.**
- **NEVER JUMP OFF THE EXCAVATOR.**
- **DO NOT CARRY TOOLS, PARTS OR OTHER SUPPLIES WHILE CLIMBING ON OR OFF THE EXCAVATOR.**
- **NEVER USE THE STEERING COLUMN, CONTROL LEVERS, OR JOYSTICKS AS HANDHOLDS.** Climb on and off the excavator using only the steps, rails and handles provided. When climbing on or off the excavator, use both hands for support and face machine.
- **PROPERLY SECURE ALL LOOSE ITEMS THAT ARE NOT PART OF THE EXCAVATOR.**
- **EQUIP THE EXCAVATOR WITH PROPER PROTECTION** when utilizing it in demolition, land clearing, logging and crane applications.
- **BEFORE SERVICING THE EXCAVATOR ATTACH A "DO NOT OPERATE" TAG** to the starter switch.

- **PERFORM MAINTENANCE OR REPAIRS UTILIZING THE FOLLOWING PRECAUTIONS:**
 - * Park excavator on firm and level ground.
 - * Place all controls in a neutral position.
 - * Shut off engine.
 - * Turn ignition key to 0-position.
 - * Deactivate servo hydraulic by lifting up the left armrest.
- **NEVER ATTEMPT MAINTENANCE PROCEDURES OR REPAIRS YOU DO NOT UNDERSTAND.**
- **NEVER SERVICE THE EXCAVATOR WITH THE ENGINE RUNNING UNLESS OTHERWISE SPECIFIED IN THE INSTRUCTION AND/OR OPERATION AND MAINTENANCE MANUAL.**
- **ALLOW ONLY TRAINED AND AUTHORIZED PERSONNEL TO MAINTAIN, SERVICE OR REPAIR THE EXCAVATOR.**
- **USE ONLY ORIGINAL LIEBHERR SPARE PARTS** such as hoses, tubing, electrical wires, filters etc.
- **NEVER JACK UP THE EXCAVATOR WITH ITS ATTACHMENT TO PERFORM ANY MAINTENANCE OR REPAIR WORK.**
- **BLOCK AND SUPPORT THE EXCAVATOR PROPERLY.** Be aware that the center of gravity will shift if attachments or other major components are being removed.

CRUSHING AND BURN PREVENTION

- **NEVER WORK UNDERNEATH OR ON THE EXCAVATOR UNLESS IT IS PROPERLY BLOCKED AND SUPPORTED.**
- **ALWAYS PROPERLY SUPPORT THE ATTACHMENT WHEN CHANGING ANY PART OF IT SUCH AS BUCKETS, CLAM SHELLS, TEETH, CUTTING EDGES, OR WEAR SHROUDS, NEVER USE METAL ON METAL SUPPORT.**
- **NEVER USE DAMAGED OR INSUFFICIENT WIRE ROPES AND SLINGS.** Always wear gloves when handling wire ropes.
- **NEVER REACH INTO BORES DURING ATTACHMENT INSTALLATION OR REMOVAL.** Never align bores with your fingers or hands. Use proper alignment tools when installing, changing or servicing attachments.
- **KEEP OBJECTS AWAY FROM THE RADIATOR FAN.** Rotating fans will swirl and throw out objects, which can become very dangerous and cause severe injury to yourself and others.
- **AVOID CONTACT WITH 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 RADIATOR CAB IS COOL ENOUGH TO TOUCH.** Remove 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.
- **DO NOT DISCONNECT LINES OR HOSES, OR REMOVE FITTINGS, CAPS OR COVERS WHILE THE HYDRAULIC SYSTEM OR ENGINE FUEL AND COOLING SYSTEM IS PRESSURIZED. ALWAYS LOWER ATTACHMENT, SHUT OFF ENGINE, AND RELEASE ALL PRESSURES.** After servicing, be certain that all lines, hoses and fittings are properly connected and all caps and covers properly closed.
- **ALWAYS WEAR SAFETY GLASSES AND PROTECTIVE GLOVES** when handling batteries. Keep sparks or open flames away.
- **NEVER PERMIT ANYONE TO HAND-GUIDE** the bucket or grapple into position.
- **DISCONNECT THE BATTERIES BEFORE WORKING ON THE ELECTRICAL SYSTEM OR BEFORE PERFORMING ANY ARC-WELDING. ALWAYS DISCONNECT THE NEGATIVE TERMINAL FIRST, AND RECONNECT IT LAST.**

FIRE AND EXPLOSION PREVENTION

- **NEVER SMOKE OR ALLOW AN OPEN FLAME** in refueling areas or where batteries are being charged, or where batteries or flammable materials are stored.
- **ALWAYS SHUT OFF ENGINE DURING REFUELING.**
- **NEVER STORE FLAMMABLE FLUIDS ON THE MACHINE EXCEPT IN STORAGE TANKS INTENDED FOR THE EXCAVATOR'S OPERATION.**
- **ALWAYS USE PROPER ENGINE START OR JUMP START PROCEDURES.** Consult the Instruction and/or Operation and Maintenance Manual.
- **FREQUENTLY CHECK THE ELECTRICAL SYSTEM AND CORRECT ALL WIRING DEFECTS.**
- **DO NOT USE FLAMMABLE FLUIDS TO CLEAN THE EXCAVATOR.**
- **INSPECT ALL COMPONENTS, LINES, TUBES AND HOSES FOR OIL AND FUEL LEAKS OR DAMAGE. REPLACE OR REPAIR ANY DAMAGED COMPONENTS.**
- **NEVER CHECK FOR LEAKS WITH YOUR BARE HANDS.** Fluid escaping from a small hole can have enough force to penetrate the skin.
- **BE CERTAIN THAT ALL CLAMPS, GUARDS, AND HEAT SHIELDS ARE INSTALLED.** These components prevent vibration, rubbing and heat build-up. Install tie-raps to fasten hoses and wires as required.
- **USE ETHER ONLY IN VENTILATED AREAS AND AS DIRECTED.** Cold start ether is extremely flammable.
- **NEVER SMOKE WHILE HANDLING ETHER CANS OR CHANGING ETHER CYLINDERS.**
- **KNOW THE LOCATION OF THE EXCAVATOR'S FIRE EXTINGUISHER, AND BE FAMILIAR WITH ITS OPERATION.**

MACHINE START-UP SAFETY

- **BEFORE EXCAVATOR START-UP PERFORM A THOROUGH WALK-AROUND INSPECTION.**
- **VISUALLY INSPECT THE EXCAVATOR.** Look for loose bolts, cracks, wear, tire condition, any leaks and evidence of vandalism.
- **NEVER START OR OPERATE AN UNSAFE EXCAVATOR.**
- **REPORT ALL DEFECTS TO YOUR FOREMAN OR SUPERVISOR AND MAKE SURE THEY ARE CORRECTED.**
- **FAMILIARIZE YOURSELF WITH JOBSITE RULES.** Be informed about traffic, hand signals and safety signs. Ask who is responsible for signalling.
- **TAKE SIGNALS FROM ONLY ONE PERSON.** In tight quarters, on jobsites with limited visibility, or if necessary, have another person guide and signal you.
- **BE CERTAIN THAT THE AREA SURROUNDING THE EXCAVATOR IS FREE OF OTHER PERSONNEL.**
- **BE CERTAIN NO ONE IS WORKING ON OR UNDER THE EXCAVATOR.**
- **AFTER ENTERING THE EXCAVATOR, ADJUST THE OPERATOR'S SEAT AND CONTROLS, ADJUST MIRRORS, AND IF INSTALLED FASTEN AND ADJUST SEAT BELT.** Be certain that all controls can be reached.
- **CLEAN ALL WINDOWS AND SECURE SLIDING WINDOWS AND DOORS.**
- **ALERT NEARBY PERSONNEL THAT THE EXCAVATOR IS BEING STARTED.**

ENGINE START-UP AND OPERATION SAFETY

- **PLACE ALL CONTROLS IN NEUTRAL POSITION BEFORE STARTING THE ENGINE.**
- **FOLLOW THE ENGINE STARTING INSTRUCTIONS.** These instructions are outlined in the Instruction and/or Operation and Maintenance Manual.
- **CHECK ALL LIGHTS, INDICATORS, INSTRUMENTS AND CONTROLS FOR THEIR PROPER FUNCTION.**
- **START ENGINE AND CHECK INDICATORS, GAUGES, WARNING DEVICES AND CONTROLS FOR THEIR PROPER INDICATION.**
- **START AND OPERATE ENGINE ONLY IN A WELL-VENTILATED AREA.**
- **WARM UP ENGINE AND HYDRAULIC SYSTEM TO OPERATING TEMPERATURES.** Low engine and hydraulic oil temperatures cause the excavator to be unresponsive.
- **CHECK THAT ALL ATTACHMENT FUNCTIONS ARE PROPERLY OPERATING.**
- **MOVE THE EXCAVATOR SLOWLY INTO AN OPEN AREA AND CHECK ALL TRAVEL FUNCTIONS FOR THEIR PROPER OPERATION.**

MACHINE OPERATING SAFETY

- **OPERATE EXCAVATOR ONLY WHILE SEATED AND WITH THE SEAT BELT (IF INSTALLED) FASTENED.**
- **NEVER ALLOW OTHER PERSONNEL ON THE EXCAVATOR.**
- **REPORT PROBLEMS OR NEEDED REPAIRS TO YOUR FOREMAN OR SUPERVISOR.**
- **BE CERTAIN THAT NO ONE IS BEING ENDANGERED BY MOVING THE EXCAVATOR.**
- **CHECK THE BRAKE AND STEERING SYSTEM.** The proper operation of the brake and steering system is outlined in the Instruction and/or Operation and Maintenance Manual.
- **NEVER LEAVE THE EXCAVATOR WHILE THE ENGINE IS RUNNING OR IF THE EXCAVATOR IS IN MOTION.**
- **KEEP THE ATTACHMENT CLOSE TO THE GROUND.**
- **KEEP A SAFE DISTANCE FROM OVERHANGS, WALLS, DROP-OFFS AND UNSTABLE GROUND.**
- **NEVER TRAVEL WITHOUT THE BOOM ATTACHED TO THE EXCAVATOR.**
- **NEVER TRAVEL DOWNHILL AT FULL SPEED.**
- **NEVER TRAVEL ON SLOPES THAT EXCEED THE MAXIMUM PERMISSIBLE GRADE-ABILITY.**
- **ALWAYS MAINTAIN MAXIMUM ENGINE SPEED WHEN TRAVELING DOWNHILL.** Control your travel speed with the foot-pedal travel control.
- **IF THE EXCAVATOR BEGINS TO TIP OR SLIP ON A GRADE, IMMEDIATELY LOWER ATTACHMENT AND LOAD TO THE GROUND AND TURN THE EXCAVATOR DOWNHILL.**
- **NEVER DIG, LEFT OR LOAD SIDEWISE ON SLOPES. ALWAYS OPERATE THE EXCAVATOR WITH THE ATTACHMENT POSITIONED UPHILL OR DOWNHILL.**
- **ALWAYS TRAVEL SLOWLY ON ROUGH OR SLIPPERY GROUND AND ON SLOPES.**
- **BE ALERT TO CHANGING GROUND CONDITIONS, VISIBILITY AND WEATHER CONDITIONS.**
- **BE ALERT FOR UTILITY LINES.** Be aware of the location of underground cables, gas and water lines.
- **AVOID HIGH VOLTAGE ELECTRICAL LINES.**
 - * Keep at least 10 ' from lines with a voltage up to 57 000 volts.
 - * At least 17 ' from lines with a voltage above 57 000 volts.
- **ASK ABOUT FEDERAL, STATE AND LOCAL SAFETY REQUIREMENTS.**

- **ON RUBBER TIRE EXCAVATORS, DO NOT OPERATE THE FORWARD/REVERSE TRAVEL CONTROL UNTIL THE EXCAVATOR IS AT A STANDSTILL.**
- **DO NOT ALLOW THE GRAPPLE OR OTHER ATTACHMENTS TO SWING TOWARD THE CAB.** To avoid swinging, utilize the shortest sling or rope possible in order to handle the load with the attachment.
- **NEVER LOAD OVER AN OCCUPIED TRUCK CAB.** Request the truck driver to leave the cab.
- **IF IT IS NECESSARY TO TRAVEL WITH AN EXCAVATOR WITH A HOISTED LOAD, POSITION UPPER DECK IN TRAVEL DIRECTION. LOWER ATTACHMENT AND LOAD AS CLOSE TO THE GROUND AS POSSIBLE.** On rubber tire excavators, disengage the front axle locking device. Do not close the boom hoist cylinder shut-off valve (if installed).

ON-ROAD DRIVING SAFETY

- **BE CERTAIN THAT WORKING LIGHTS ARE SWITCHED OFF.**
- **PROPERLY SECURE ALL OUTRIGGERS AND DOZER BLADE, IF INSTALLED.**
- **PROPERLY SECURE THE UPPER CARRIAGE WITH THE HOUSE LOCK PIN.**
- **POSITION THE ATTACHMENT FOR ON-ROAD DRIVING.** Consult the Instruction and/or Operation and Maintenance Manual.
- **CLEAN THE TIRES BEFORE LEAVING THE JOBSITE.**
- **BE CERTAIN THAT THE FRONT AXLE LOCKING DEVICE IS DISENGAGED.**
- **CHECK THAT THERE IS ENOUGH CLEARANCE UNDERNEATH ALL BRIDGES AND UNDERPASSES BEFORE DRIVING ON ROAD.**

MACHINE TOWING SAFETY

- Consult the Towing Section of the Instruction and/or Operation and Maintenance Manual.
- **BE SURE ALL TOWING DEVICES SUCH AS CABLES, HOOKS AND COUPLERS ARE SAFE AND ADEQUATE.**
- **CONNECT CABLES TO THE APPROPRIATE TOWING HOOKS OR COUPLERS ONLY.**
- **NEVER ALLOW ANYONE TO STAND NEAR THE CABLE WHILE TOWING. KEEP CABLE TIGHT AND FREE OF KINKS.**
- **ENGAGE TRAVEL SLOWLY AND DO NOT JERK.** With a slack cable, the sudden impact of the load being towed could snap the cable.

MACHINE PARKING SAFETY

- **PARK EXCAVATOR ONLY ON FIRM AND LEVEL GROUND, AND ENGAGE THE PARKING BRAKE.** If it becomes necessary to park the machine on a grade, properly block and secure it.
- **NEVER LEAVE THE CAB OR THE EXCAVATOR UNATTENDED WITH THE ENGINE RUNNING.**
- **POSITION UPPER DECK IN TRAVEL DIRECTION AND SECURE IT WITH THE LOCK PIN IN CAB.**
- **ALWAYS LOWER THE ATTACHMENTS TO THE GROUND AND DEPRESSURIZE THE HYDRAULIC SYSTEM.**
- **RETURN ALL CONTROLS TO THE NEUTRAL POSITION AND ENGAGE THE PARKING BRAKE ON RUBBER TIRE EXCAVATORS.**
- **WHEN STOPPING THE ENGINE, ALWAYS FOLLOW THE PROCEDURES AS OUTLINED IN THE INSTRUCTION AND/OR OPERATION AND MAINTENANCE MANUAL.**
- **BEFORE LEAVING THE CAB, ALWAYS LIFT UP THE LEFT ARMREST TO DEACTIVATE THE SERVO CONTROLS.**
- **LOCK EXCAVATOR, REMOVE ALL KEYS, AND SECURE THE EXCAVATOR AGAINST VANDALISM AND UNAUTHORIZED USE.**

MACHINE TRANSPORTATION SAFETY

- **REMOVE ALL MUD, SNOW OR ICE FROM TRACK COMPONENTS OR TIRES.**
- **BE SURE THAT THE LOADING-RAMP INCLINE IS LESS THAN 30 DEGREES AND COVERED WITH WOODEN PLANKS.**
- **REMOVE BUCKET OR SHOVEL FROM THE EXCAVATOR ONLY IF NECESSARY.**
- **RETRACT THE ATTACHMENT AS FAR AS POSSIBLE.**
- **VERY CAUTIOUSLY DRIVE UP ON RAMP AND TRAILER.** Have another person guide and signal you.
- **ALIGN UPPER DECK WITH UNDERCARRIAGE AND SECURE IT WITH THE LOCK PIN IN CAB.**
- **RETRACT ATTACHMENT AS FAR AS POSSIBLE AND LOWER BUCKET/SHOVEL OR STICK ON TRAILER PLATFORM.**
- **SECURELY BLOCK AND CHAIN THE EXCAVATOR TO THE TRAILER.**
- **CAREFULLY CHECK OUT THE TRANSPORT ROUTE BEFOREHAND.** Check that there is enough clearance underneath all bridges and underpasses, utility lines, and in tunnels.
- **UNLOAD THE EXCAVATOR AS CAUTIOUSLY AS IT WAS LOADED.** Remove all chains and blocks. Start the engine as outlined in the Instruction and/or Operation and Maintenance Manual. Carefully drive off the trailer and down the ramp, holding the attachment as low as possible. Have another person guide and signal you.

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