LIEBHERR

Crawler crane with lattice mast

LR 1750

LR 1750-010

Operating instructions

BAL-No.: 12821-01-02

Pages: 2059

Works-Number	
Date	

ORIGINAL OPERATING MANUAL

The operating manual is part of the crane!

It must always be available within reach!

The regulations for crane operation must be observed!

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1 Crawler travel gear

1.1 Frame

In-house manufactured, distortion-resistant welded structure made from high-strength, close-grained structural steel.
The crawler carriers can be removed and can be installed / removed with the crane.

1.2 Tracks

Maintenance free, dirt protected crawler track with flat track pads.
Pad width: 1.5 m
Pad width: 2 m *
Track width: 8.8 m

1.3 Central ballast

45 t, consisting of two ballast plates each with 10.0 t and two ballast plates with each 12.5 t.

1.4 Drive

Hydraulic travel drives with planetary gears.
The crawler chains can be controlled independently and in the opposite direction.
There is no preferred travel direction.

1.5 Travel power

Stepless speed from 0 km/h to 1.75 km/h.

2 Crane superstructure

2.1 Frame

In-house manufactured, distortion-resistant welded structure made from high-strength, close-grained structural steel.
Connection to crawler travel gear via 3-row roller rotary connection, slewable by 360°.

2.2 Diesel engine

- Number of cylinders: 8
- Make: LIEBHERR
- Water cooled

Note

▶ Depending on one of the respective crane configurations, one of the following engine types is installed on the crane, see also separate Diesel engine operating instructions!

2.2.1 Engine type D 9508 A7

Performance: 400 KW at 1800 rpm
Maximum torque: 2546 Nm at 1500 rpm

2.2.2 Engine type D 9508 A7 SCR

Performance: 450 KW at 1800 rpm
Maximum torque: 2671 Nm at 1500 rpm

1.23 S-intermediate section 7.0 m, 2826.20

See illustration **21**

Component	Weight	Width
S-intermediate section complete	6.9 t	3.00 m
S-intermediate section	5.6 t	
S- and WA-bracket 2 guy rods	1.3 t	

1.24 S-intermediate section 7.0 m, 2826.30

See illustration **22**

Component	Weight	Width
S-intermediate section complete	7.5 t	3.00 m
S-intermediate section	6.2 t	
S- and WA-bracket 2 guy rods	1.3 t	

1.25 S-intermediate section 14.0 m, 2826.20

See illustration **23**

Component	Weight	Width
S-intermediate section complete	12.5 t	3.00 m
S-intermediate section	10.0 t	
S- and WA-bracket 2 guy rods	2.5 t	

1.26 S-intermediate section 14.0 m, 2826.20 reinforced

See illustration **24**

Note

▶ Reinforced version for flying assembly!

Component	Weight	Width
S-intermediate section complete	12.8 t	3.00 m
S-intermediate section	10.3 t	
S- and WA-bracket 2 guy rods	2.5 t	

2.00 Safety

blank page!

15 Supporting

DANGER
The crane can topple over!
When actuating the supports with attached load and / or at loaded derrick ballast guying, the incline and the force conditions of the entire boom system change!
There is **no** shut off by the LICCON overload system!
The crane can topple over!
Personnel can be severely injured or killed!
- ▶ When a load is suspended, it is prohibited to actuate the support!
- ▶ When the derrick ballast guying is loaded, it is prohibited to actuate the support!

It is absolutely essential that the crane be supported exactly in accordance with the load charts to ensure safe crane operation.
The match of the sliding beams placement surfaces must be observed to ensure proper force transfer between the sliding beams.
The crane may only be supported in these extension conditions.

WARNING
Danger of tipping over!
If only the load side sliding beams are extended, the crane can tip over when turning or setting down the load!
- ▶ Move all 4 sliding beams and support cylinders out according to the data in the load chart!
- ▶ In intermediate positions between the support bases supporting is prohibited!
- ▶ Pin the sliding beams to support base according to the load chart!
- ▶ Fully insert and secure the pins!

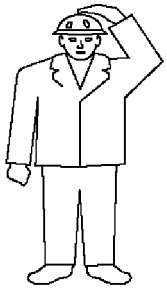
WARNING
Risk of toppling the crane due to incorrect extension of the sliding beams!
The load suspended on the hook causes tension and deformation of the hoist rope and telescopic boom. The same applies for operation with lattice jib and guy ropes. If the load is dropped from the fastening ropes or if the fastening or hoist rope breaks in this situation, a sudden relief occurs. The boom snaps back quickly. This can cause the crane to topple over.
Despite previous assumption, it might become necessary to swing the load to the opposite side. This can cause the crane to topple over.
The telescopic boom or counterweight momentum may cause the crane to topple when slewing from the longitudinal vehicle position.
- ▶ Move all 4 sliding beams and support cylinders out according to the data in the load chart!

15.1 Aligning the crane

In addition to the proper foundation for the supports, the horizontal alignment of the crane is of utmost importance for safe crane operation.

DANGER
The crane can topple over due to the incline position!
If the crane is positioned at an incline and if the boom is turned towards the slope, then the boom radius is increased as a result!
It is possible that the slewing gear can no longer hold the crane superstructure and, in extreme cases, the crane can topple over!
Personnel can be severely injured or killed!
- ▶ Align the crane horizontally before starting crane operation!

If the horizontal alignment of the crane has to be readjusted:
- ▶ Set the load down on the ground before readjusting the crane!

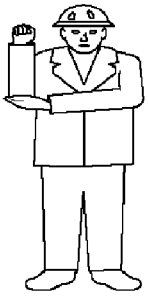


Place on hand on your head and hold the other arm on the side of the body.
After this signal all other hand signals apply only for the main winch.

Note

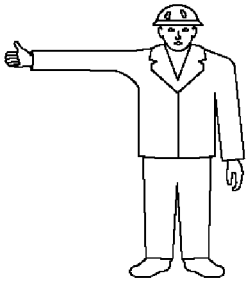
- If two or more main winches are present, then the signaller can show the number of the crane by pointing to it or signal with one finger.

22.4.2 Lift with auxiliary winch



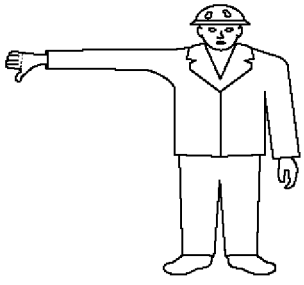
Hold one forearm vertically with closed hand and touch the elbow of this arm with the other hand.
After this signal all other hand signals apply only for the auxiliary winch.

22.4.3 Lift the boom

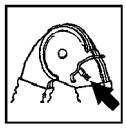
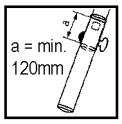
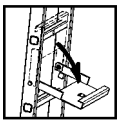


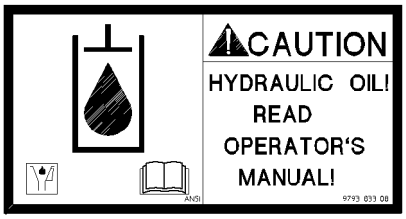
Hold one arm horizontally with thumb directed upward.

22.4.4 Lower the boom



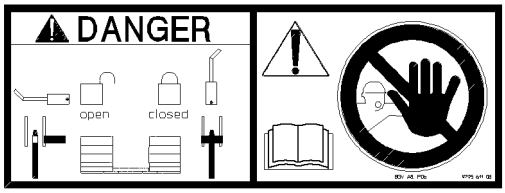
Hold one arm horizontally with thumb directed downward.

Sign	Explanation
	Objects, which are to be transported when accessing a ladder should not be heavy and easy to handle.
	Make sure that the linkages engage safely.
	Tighten the base extension (4 Nm to 5 Nm).
	Adhere to a minimum overlap of the base extension of 120 mm .
	Fold the safety bridge open.
	The ladder must be hung on the vehicle.



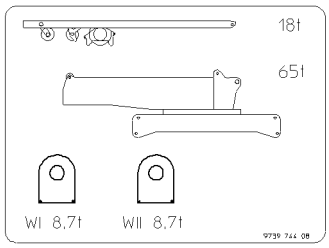
CAUTION
Property damage through oil change!
If the oil specified in the operating instructions is not used during the oil change, it can lead to damage!
▶ See Crane operating instructions, chapter 7.07!

1.56 979561108 - Counterweight

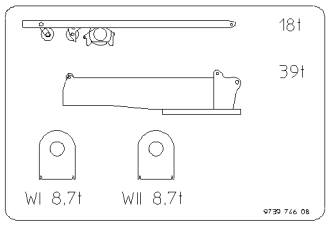


WARNING
Counterweight can fall down!
If the auxiliary crane is removed on the counterweight before the counterweight is locked on both sides with the turntable, then the counterweight will fall down and can fatally injure assembly personnel!
▶ Do not remove the auxiliary crane until the counterweight is locked and secured on both sides with the turntable! See Crane operating instructions, chapter 4.07.

1.57 973974408 - Permissible transport weights of the components



1.58 973974608 - Permissible transport weights of the components



5.2 Retaining ropes

5.2.1 Retaining ropes on the S- and D-pivot section

On the lattice sections, on the upper left and right hand side, are retaining ropes **1** assembled as fall arrest equipment.

NOTICE
Danger of damage!
By hanging loads or other objects on the retaining ropes, they can be damaged and fail in case of an emergency!
- ▶ Never hang loads or objects on the retaining ropes **1**!

WARNING
Risk of falling!
During assembly / disassembly, inspection and maintenance work, personnel must be secured with appropriate aids to prevent them from falling!
If this is not observed, assembly personnel can fall and suffer life-threatening or fatal injuries!
- ▶ Any work, where there is a danger of falling must be carried out with suitable aids (for example: lifting platforms, scaffoldings, ladders, auxiliary crane)!
- ▶ If the work cannot be carried out with such aids nor from the ground, then the assembly personnel must secure themselves with the fall arrest system **4** to avoid falling, see Crane operating instructions chapter 2.04!
- ▶ The assembly personnel must hook themselves for all installation / removal work, maintenance and inspection work on the lattice mast boom with approved fall arrest systems **4** on the retaining ropes **1** on the left and right hand side with both snap hooks **2** and secure themselves to prevent them from falling (For example: Fall arrester with self-actuating blocking function and an automatic tension and pull in device for the connectors)!
- ▶ The connector must be set to a length as short as possible so that is it impossible to hit the ground in case of a fall!
- ▶ Fall absorbers may not be used, because they stretch too much in case of a fall!
- ▶ On the retaining ropes **1** on the left and right hand side, no more than **maximum two persons** may hook themselves with the snap hooks **2** and secure themselves to prevent falls, see sign **5**!
- ▶ Changing the snap hooks **2** over is only permissible on the connecting points from lattice section to lattice section!
- ▶ When changing the snap hook **2** from lattice section to lattice section, one snap hook **2** must always be hooked on one retaining rope **1**!
- ▶ Never release both snap hooks **2** simultaneously from the retaining ropes **1**!
- ▶ Before any assembly / disassembly work, maintenance and inspection work it must be ensured that all obstacles below the work place have been removed and that there is sufficient clearance in case of a fall!
- ▶ During all assembly / disassembly work, maintenance work and inspections, travel or crane operation is prohibited!

Note

- The maximum permissible wind speed (v_{max}) and the maximum permissible wind speed according to the load chart (v_{max_TAB}) always refers to the 3 second wind gust speed, which is present in the maximum hoist height.
- Instead of the 3 second wind gust speed, weather information services often report a wind speed, which is averaged within a time period of 10 minutes (socalled 10 minute average). It refers to the wind force on the Beaufort scale, normally to the medium value of the wind speed, which is determined within a time from of 10 minutes at a height of 10 m above ground or above sea level.
- The determining factor for the calculation of the 3 second wind gust speed in maximum height is significantly higher than the medium value of the wind speed, which is determined over a time of 10 minutes at a height of 10 m above ground!

Crane operation is generally permissible up to the maximum wind speed (v_{max_TAB}) specified in the respective load chart for the current boom length.
Prerequisite for that is:

– The wind exposure surface (A_W) of the hoist load is not more than 1.2 m^2/t

DANGER

Danger of tipping and overload of load carrying components!

- The maximum permissible wind speed according to the load chart (v_{max_TAB}) may not be exceeded, even if the wind exposure surfaces (A_W) of the hoist load is smaller than 1.2 m^2/t!
- If the wind exposure surface (A_W) of the hoist load is more than 1.2 m^2/t, then the maximum permissible wind speed (v_{max}) must be redetermined for the load case!

1.3.1 Determination of maximum permissible wind speed

The maximum permissible wind speed can be determined with the following methods:

1.) Calculation with formula
2.) Determination with wind force diagrams

1.3.2 Calculation of maximum permissible wind speed with formula

$$V_{max} = V_{max\_TAB} \times \sqrt{\frac{1{,}2\,\frac{m^2}{t} \times m_H}{A_W}}$$

Formula for the calculation of the maximum permissible wind speed

The following data is required for the calculation:

– Maximum permissible wind speed according to load chart (v_{max_TAB})
– Hoist load (m_H)
– Projection surface of hoist load (A_P)
– Wind resistance coefficient (c_W)

Description of procedure:

1.) Calculation of wind exposure surface ($A_W = A_P \times c_W$)
2.) Check if the wind exposure surface A_W exceeds the limit value of 1.2 m^2/t
3.) Calculation of maximum permissible wind speed (v_{max})

Example for the calculation of the maximum permissible wind speed

Data for calculation of load case:

v_{max_TAB} = 9.0 m/s
m_H = 50.0 t
A_P = 70.0 m^2
c_W = 1.4

3.3 Installing the assembly supports

- ▶ Attach the tackle on the four attachment brackets **A**.
- ▶ Lift the crawler center section **3** with the auxiliary crane and set it onto the support **28**.

The swinging out and locking procedure of the assembly support is the same for all four assembly supports and is therefore described only once.

- ▶ Release the transport retainer support beam: Remove the spring retainer **22** and unpin the pin **23**, point **D**.

WARNING
Swinging out assembly support!
If any personnel is within the swing range of the assembly support, they can be severely injured or killed!

- ▶ Make sure that no persons are within the swing range of the assembly support!

- ▶ Swing the support beam **3** out.
- ▶ Remove the brace **33** from the transport position **P**: Remove the spring retainer **39** on both sides and unpin the pins **40**.
- ▶ Pin the strut **33** on the crawler center section **3** and on the support beam **37**: Insert pins **34** on points **E** and secure with spring retainers **35**.

WARNING
Risk of accidents due to improper support!
If the support plates are not properly supported from below, they can sink into the ground and severely injure personnel!

- ▶ The supporting base must be able to safely take on the weight of the crawler center section, the turntable and the crawler carrier!
- ▶ The supporting base must be made large enough for the ground conditions, with solid materials, such as wood, steel or concrete slabs, see Crane operating instructions, chapter 2.04!

- ▶ Take the support plates **36** from the transport retainer **B** and place them on the supporting bases **24**.
- ▶ Align the support plates **36** to the hydraulic cylinders **18**.

Note

▶ For function assignment of hand levers to move the support cylinders in / out, see section “Lifting the crawler center section”!

Note

▶ For disassembly on supports, the SA-frame must be positioned vertically!

Make sure that the following prerequisites are met:

– The crane must be aligned horizontally.
– The placement location must be level and have adequate load-bearing capacity.
– Suitable material must be available for the supporting base of the assembly supports.
– The support plates are installed.
– The crane engine is running.
– The set up button **D** is pressed: The assembly icon **11** appears in the LICCON monitor.
– The key button “Crawler assembly” **115** is actuated: The indicator light “Crawler assembly” **114** lights up.

Make sure that the following prerequisites are met:
– The crane must be aligned horizontally.
– The placement location must be level and have adequate load-bearing capacity.
– The maximum height of the transport vehicle **4** may not exceed 1000 mm and a maximum width of 3000 mm, see illustration **44**.
– Suitable material must be available for the supporting base of the assembly supports.
– The support plates are installed.

5.2.1 Removing the first crawler carrier

See illustration **45**.
Make sure that the following prerequisites are met:
– The crane engine is running.
– The set up button **D** is pressed: The assembly icon **11** appears in the LICCON monitor.
– The key button “Crawler assembly” **115** is actuated: The indicator light “Crawler assembly” **114** lights up.

Preparing the crawler carrier for disassembly

NOTICE
Damage to the crawler carrier!
If the track pads are not secured with the transport retainers to prevent them from sagging, the crawler carrier can be severely damaged!
▶ Secure the track pads **12** before assembly of the crawler carrier **9** with the chains **10** to prevent them from sagging!

▶ Hang the chains **10** with the bars **11** on the track pads **12**, see illustration **44**.

Note
▶ The lugs **8** must be swung between the track pads **12**, “upward”!

▶ Swing the lugs **8** “up”.
▶ Pin the fastening ropes **7** on the assembly device **31** and secure.
▶ Luff the SA-frame **29** up until the assembly cylinder **30** is centered above the crawler carrier **9**.
▶ Move the assembly cylinder **30** out: Actuate master switch 2.
▶ Pin the fastening ropes **7** on the lugs **8** and secure.
▶ Make sure that the pins **15** are completely unpinned on both sides on the crawler carrier.

2.1 Lifting the turntable from the flatbed trailer

Make sure that the following prerequisite is met:

– The brackets **20** are pinned on the receptacle points for the pivot section, points **P1**.

▶ Attach the tackle on the receptacle points, points **P1** and points **P2**.

▶ Bring the tackle to “tension”.

▶ Release and remove the transport retainers on the turntable.

WARNING

Falling components!

When lifting the turntable from the flatbed trailer, components or the turntable can fall down!

Personnel can be severely injured or killed!

▶ Make sure that there are no persons within the danger zone!

▶ Lift the turntable with the auxiliary crane from the flatbed trailer.

4 Installing the central ballast

WARNING
Danger of slipping / falling during assembly / disassembly work!
During assembly and disassembly work, personnel must be secured with appropriate antifall guards to prevent them from falling!
Weather influences, such as wetness, wind, snow, frost increase the slipping / falling danger!
Personnel can be severely injured or killed!
- ▶ All assembly / disassembly work must be carried out using suitable aids (lifting platforms, scaffolding, ladders, auxiliary crane, etc.)!
- ▶ If work cannot be carried out on the ground or using such aids, then assembly personnel must be secured with the personal fall arrest system (see Crane operating instructions, chapter 2.04) to protect against falling!
- ▶ Hang in the personal antifall system in the corresponding attachment points on the crane (see Crane operating instructions, chapter 2.06)!
- ▶ If railings are present on the components, then they must be brought into the corresponding position and secured for assembly / disassembly work!
- ▶ Step on aids and fall arresters only with clean shoes!
- ▶ Keep aids and fall arresters clean and free from snow and ice!

WARNING
Falling components and central ballast plates!
At assembly / disassembly, the components and central ballast plates can fall down!
Personnel can be severely injured or killed!
- ▶ Make sure that no persons or objects are within the danger zone!

WARNING
Incorrect handling of the attachment equipment!
If attachment equipment cannot be attached correctly and if it is not secured sufficiently to prevent it from loosening up, loads can fall down! Personnel can be severely injured or killed!
- ▶ Make sure that the attachment equipment is correctly attached on the attachment points and that it is secured sufficiently to prevent it from loosening up!

WARNING
Danger of impact / crushing!
If anyone remains within the assembly / disassembly area of the ballast, they would be exposed to a danger of impact / crushing!
Personnel can be severely injured or killed!
- ▶ Make sure that there are no persons between the components which are to be assembled / disassembled on the components and the crawler travel gear!

Note
- ▶ The assembly procedure varies, depending in the equipment configuration!

The following three equipment configurations are possible and they differ in assembly steps:
- – Crane operation on crawler carriers **5**, see illustration **1**
- – Crane operation on crane support **6** installed on crawler carriers **5**, see illustration **2**
- – Crane operation on crane support **6** installed on crawler center section **1**, see illustration **3**

Before the receptacle stud **16** is guided into the central ballast plates **2** Variation **V1**, it must be ensured that the insertion length **a** of the receptacle stud **16** is set correctly.
The insertion length **a** of the receptacle stud **16** for central ballast plates **2** Variation **V1** can be adjusted by hand.

- ▶ If the insertion length **a** of the receptacle stud **16** is to be adjusted:
  Release and unpin the pins **16.1**.
- ▶ Adjust the insertion length **a** by moving the guide sleeve **16.2** to the desired insertion length **a**, observe the stages in illustration **4**.
- ▶ Insert and secure the pin **16.1**.

Result:

– The receptacle stud **16** is adjusted.

Note

▶ The receptacle stud **16** in illustration **4** is set to 5 t!

- ▶ Attach the receptacle stud **16** on the auxiliary crane and guide it into the central ballast plate(s) **2**.
- ▶ Pull up the lever **16.3** and fold it down.
- ▶ Turn the receptacle stud **16** with the lever **16.3** by 60° until it points to the symbol “Locked” **2.1** of the central ballast plate **2**, see illustration **6**.

Note

▶ The receptacle stud **16** is locked by lifting the central ballast plate(s) **2**.

- ▶ Lift the central ballast plate(s) **2** with the receptacle stud **16** from the base plate **3** and place them on a suitable storage location.
- ▶ When the central ballast plate(s) **2** are placed down:
  Turn the receptacle stud **16** with the lever **16.3** by 60° to the stop in direction of the symbol “unlocked” **2.2**, see illustration **7**.

Result:

– The receptacle stud **16** is unlocked.

- ▶ Carefully pull the receptacle stud **16** from the central ballast plate.

1 Component overview Crane support

1 Support beams
2 Support cylinder
3 Support plates
4 Swing unit
4.1 Swing cylinder
4.2 Guide tube
4.3 Scale for support base
6 Pinning top
7 Pinning bottom
8 Eyehooks
9 Rigging eyehooks for transport
10 Retaining pin
11 Spring retainer

1.1 Dimensions and weights

Note
▶ See Crane operating instructions, chapter 1.03!

4.2.1 Supporting and aligning the crane manually in horizontal direction

Extend the support cylinders individually by pressing the respective buttons and support the crane.

▶ Left support control unit: Press button **251**, button **253**, button **259**, button **261**.

or

■ Right support control unit: Press button **281**, button **283**, button **289**, button **291**.

Result:

– The support cylinders extend.

Note

▶ The maximum permissible deviation from the horizontal position of the crane is ± 0.5% (± 0.3°)!

WARNING

The crane can tip over!

If the crane is not aligned horizontally, it can tip over!

Personnel can be severely injured or killed!

▶ Make sure that the crane is horizontally aligned!

▶ Align the crane in horizontal direction by retracting and extending the individual support cylinders **2** until the innermost LED on the incline indictor lights up.

4.2.2 Supporting and aligning the crane automatically in horizontal direction

Extend all four support cylinders **2** automatically.

▶ Left support control unit: Press the button **272**.

or

■ Right support control unit: Press the button **272**.

Result:

– The support cylinders extend.

– The crane is automatically aligned in horizontal direction.

Note

▶ The maximum permissible deviation from the horizontal position of the crane is ± 0.5% (± 0.3°)!

WARNING

The crane can tip over!

If the crane is not aligned horizontally, it can tip over!

Personnel can be severely injured or killed!

▶ Make sure that the crane is horizontally aligned!

▶ Check the horizontal position of the crane.

When the innermost LED on the incline indicator lights up:

▶ End the support procedure.

5.4 Retracting support cylinders from crane operator's cab

Make sure that the following prerequisite is met:
– The engine is running.

Note
▶ Any desired support cylinder can be retracted simultaneously!

WARNING
Danger of crushing!
When moving the support cylinders **2** in and out, make sure that there are no persons or objects within the danger zone!
Personnel can be crushed and severely injured or killed as a result!
▶ Make sure that personnel cannot be caught by components!

5.4.1 Retracting support cylinders manually from crane operator's cab

In the numeric keypad, the respective support cylinder or the respective support cylinder combination can be selected or deselected with buttons 1 to 4.
▶ Select the desired support cylinder.
Result:
– A double arrow appears on the selected support.

Retract the preselected support cylinder or support cylinder combination.
▶ Press function key “F4”.
Result:
– The support cylinders retract.

▶ Move the support cylinders in completely.

5.4.2 Retracting support cylinders automatically from crane operator's cab

Retract all four support cylinders automatically.
▶ Press the key combination “SHIFT” + “F4”.
Result:
– The support cylinders retract simultaneously.

▶ Move the support cylinders in completely.

3.1 Lifting winch 1 from the flatbed trailer

Make sure that the following prerequisites are met:
- The installation of the turntable is completed.
- The crane is aligned in horizontal direction.
- An auxiliary crane with sufficient load carrying capacity is available.

WARNING
Danger of accident due to incorrect attachment!
Life-threatening situations can arise if the winch 1 is incorrectly or improperly attached!
Personnel can be severely injured or killed!
- ▶ Winch 1 must be attached on the intended receptacle point, point **P1**!
- ▶ Make sure that the tackle is correctly attached on winch 1 and that it is secured sufficiently to prevent it from loosening up!

- ▶ Attach the tackle on the receptacle points, point **P1**.
- ▶ Bring the tackle to “tension”.
- ▶ Release and remove the transport retainers on the flatbed trailer.

WARNING
Falling components!
When lifting winch 1 from the flatbed trailer, components or winch 1 can fall down!
Personnel can be severely injured or killed!
- ▶ Make sure that there are no persons within the danger zone!

- ▶ Lift winch 1 with the auxiliary crane from the flatbed trailer.

3.3 Pin intake gear winch 4 on turntable

Make sure that the following prerequisites are met:
- align pin points **o** between intake gear winch 4 **3** and turntable **10**,
- align pin points **p** between intake gear winch 4 **3** and turntable **10**,
- intake gear winch 4 **3** lies with pins **49** and stop **43** on turntable frame **44** up.

▶ Pin in the socket pins **42** at the pin points **o** and secure with retaining pins **46**.
▶ Secure the retaining pins **46** on both sides with cotter pins **45**.
▶ Secure socket pins **47** at the pin points **p** and pin with retaining pins **48**.
▶ Separate intake gear winch 4 **3** from SA-frame **1**: Remove pin points **m** on both sides spring retainer **41** and unpin stick pins **40**.

3.4 Establishing the electrical connections

Note
▶ For production of the electrical connections on the SA-frame, the separate electrical diagram is to be employed!

▶ Establish electric connections between turntable and SA-frame.
▶ Establish electrical connections between turntable and intake gear winch 4.

3.5 Establish the hydraulic connections

When hydraulic lines are connected and disconnected with quick-release couplings, make sure that the coupling procedure is carried out correctly.

DANGER
Risk of accident due to loss of pressure or leakage!
Incorrectly coupled or self-loosening quick-release couplings (particularly return lines) as well as self-loosening of quick-release couplings can result in serious injury due to component failure!
▶ Check that the quick-release couplings have been properly connected before using the crane!

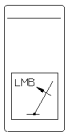
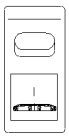
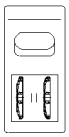
Note
▶ To connect or loosen the hydraulic lines with quick couplers, see chapter 5.01 of the crane operating instructions!

▶ Release the pressure in the hydraulic system before connecting and disconnecting. Turn the engine off and wait for short time.
▶ Assembling coupling components (sleeve and connector) by using hand-tightened nut.
▶ Combine coupling components.

Monitor with keypad

440	TFT monitor	
441	Button “MODE”	• By pressing the button “MODE” the system changes between the individual display modes: – Single display mode. – Split display mode – Tripled or quadrupled display mode
442	“Camera selection” button	• By pressing the button “Camera selection” the system changes between the cameras: – Single display mode: Change between camera 1 and camera 2 – Split display mode: Change between cameras 1/2, 2/3, 3/4 and camera 4/1 – Tripled or quadrupled display mode: This button has no function.
443	Menu button	• By pressing the “Menu” button, menus for various adjustments are called up and changed over, in the following order: – Color: Adjustment of color saturation – Brightness: Brightness adjustment – Contrast: Contrast adjustment – Standard: Reset to default settings – Volume: Volume adjustment – Language: Language adjustment (English, French, German, Spanish, Italian, Portuguese, Polish) – Reflection: Reflection of camera view Return to the main menu with “Enter”. End menu with “End”.
444	“Minus” button	• By pressing the “Minus” key, the value of a setting is reduced.
445	“Plus” button	• By pressing the “Plus” key, the value of a setting is increased.
446	Button “Change between day / night”	• Press the button “Change over day / night” to match the brightness of the display to the time of day.
447	Button	• Monitor On / Off

Instruments **145** control console:

Position	Button / switch	Function	LED	Description
73			**DANGER!**	**The exceedance of the overload protection may only be carried out if the overload has been caused by luffing down at freely suspended load and the crane operator is absolutely certain that he can leave the overload range by luffing up!**
	Button “Luffing in with suspended load”	On		Pressing the button releases “Luffing in with suspended load” .
74			**Note:**	After crawler operation, you must switch back to crane operation.
	Switch Crawler operation		**DANGER!**	Damage of crane support! **If the crawler travel gear is turned on when using the crane support, the support will be severely damaged when actuating the pedals for the crawler travel gears! The crane can topple over! Personnel can be severely injured or killed!** When working with crane support: Turn crawler operation off!
		On		Releasing and actuating the switch activates the operating mode “Crawler operation” .
		Off		By actuating the switch: Position 0
78		On		Actuating the switch activates the operating mode “Rapid gear”
	Switch Crawler rapid gear	Off		By actuating the switch: Position 0
79		On		Actuating the switch activates the operating mode “Parallel driving” : The left and right tracks move at the same speed.
	Switch Crawler parallel travel	Off		By actuating the switch: Position 0

3 Operating elements of the LICCON computer system on monitor 0

The functions of the individual monitor operating elements are program-dependent and can differ, depending on the LICCON program which is currently running. This will be described in more detail in the description of the individual LICCON programs.

A	Keypad	
P	Program keys	• Selection of the individual LICCON programs
P0	Set up	• SHIFT **H** and program key **P0**: Engine monitoring
P1	Crane operation	
P2	Crane acceptance	• Correction coefficients (program blocked - for LIEBHERR service personnel only)
P3	Crane support	
P4	—	• Program key not assigned!
P5	Input window hook block weight	
P6	Control parameter	
P7	Working range limitation	
P8	Test system	• **Note:** Description Test system, see Diagnostics manual!
C	Input key ENTER	• Confirmation of changes
D	Set up key	• Zero position (not actuated): Normal operation • Touching: Function “Exceedance of shut off limits of LICCON overload protection” is released and / or the hoist limit switch is bypassed.

Note

Double function set up key!

If the crane has **no** CE-mark, when actuating the set up key **D**, the release for the “Emergency operation LICCON overload protection” is automatically engaged!

▶ Take into account, when actuating the set up key **D**, that the “Emergency operation LICCON overload protection” is automatically released!

Note

▶ By actuating the set up key **D**, all erection / take down procedures can be carried out within the erection / take down charts, for which no load charts are available!

F8 Confirmation key

- For confirmation of selected set up configuration
- **Prerequisites:**
  - The entry of the set up configuration must be completed all the way. A valid short code is shown and in the chart field are load values.
  - The external conditions for this set up configuration, if stipulated, must be met.
  - The crane may not be utilized by more than 20 % in the previous set up configuration or the load suspended on the hook may not be heavier then 0.5 t. Switching to the crane operation program can otherwise only be done with the program key **P1**. In that case, the newly entered set up configuration is not accepted.

Note

▶ Make sure that the selected set up configuration (short code) and the hoist rope reevings are taken over after switching into the operating screen!

Note

Display of operating errors from the set up program!

▶ Operating errors created in the set up program are displayed in the icon above the function key **F8** and are saved in the error stack for about 5 seconds!

▶ If the function key **F8** is pressed within 5 seconds, the program will switch automatically to the error determination screen in the test system and the error will be displayed documentarily!

▶ The operating error will not be saved!

▶ Operating errors are always placed on top in the error stack, see Diagnostics manual!

5.1.3 Dynamic utilization bar

3	"Dynamic utilization bar" icon	• In percent [%]
3.1	Organization number	• For internal Liebherr load chart administration
3.2	Short code	• Identifies the selected set up configuration
3.3	Utilization scale	• Marking from a utilization of 90 %: **Advance warning** • Marking at a utilization of 100 %: **STOP shut off**
3.4	Utilization bar	
3.4.1	Utilization bar of crane	• According to load chart and reeving • **Note:** The utilization bar is the measurement for the current utilization of the crane!

$$\text{Utilization of crane according to load chart and reeving} = \frac{\text{Current load on the boom head}}{\text{Maximum load according to load chart and reeving}}$$

3.4.2	Utilization bar boom nose*	• **Note:** Maximum load carrying capacity of the boom nose*: Load which can be lifted by the boom nose* alone! Prerequisite: Sufficiently high load capacity on the boom head!

$$\text{Utilization of the boom nose*} = \frac{\text{Current load carrying capacity of the boom nose*}}{\text{Maximum load carrying capacity of the boom nose*}}$$

3.5	Engine speed	• In [rpm] or [n/min] • **Note:** "????" is displayed in case of an error in rpm value for approximately 5 seconds! Then the nominal rpm for the diesel engine is set for the output regulation of the drives! The set nominal rpm is shown blinking! An error message is issued!
3.5.1	Engine rpm lock	• The engine rpm can be locked on the master switch. If the engine rpm has been locked, the icon "+" appears behind the rpm display.

5.2.4 Hoist top limit switch HES2 and HES3

4 “Hoist top on HES2 / HES3 ” icon

- In order to prevent the crane from being operated without hoist limit switches (HES), the minimum hoist limit switch configuration is continuously monitored. If a hoist limit switch required for a particular operating mode is not plugged in, therefore not active on the LSB bus system, a LMB STOP is triggered and an error message is also issued.

4.1 “Hoist top on HES2 (2A / 2B) ” * icon

- Installation location HES2A: Auxiliary boom / accessory, left* Bus address: 27
- Installation location HES2B: Auxiliary boom / accessory, right* Bus address: 28
- The **“HES2”** icon appears if:
  - The hook block moves against the HES2A on the auxiliary boom / accessory.
  - HES2A is not active, although it must be present on the bus.
  - HES2A has an internal error.
  - The hook block moves against the HES2B on the auxiliary boom / accessory.
  - HES2B is not active, although it must be present on the bus.
  - HES2B has an internal error.
- **Note:**
  The crane movements spool the hoist winches up, luff the boom down as well as luff the derrick boom down are turned off!

Note

▶ HES2 must be present for all operating modes with auxiliary boom / accessory!

▶ If HES2 is missing despite having to be present, an “LMB STOP” is triggered! In addition, an error message is issued!

5.4.3 Wind speed

2 “Wind speed” icon
- The wind speeds are displayed in [m/sec.] or [ft/sec.] depending on the units of measurement shown in the load chart.

2.1 “Wind speed” unit
- [m/s] or [ft/s]

2.2 Current wind speed

Note
- ▶ Depending on the set up configuration of the crane, a certain number of wind sensors must be present on the LSB bus!
- ▶ If a wind sensor does not have to be present, then no display value appears in the “Wind speed” icon **2**!
- ▶ If no value can be determined for a wind sensor which must be present, then current wind speed “???” appears in the display!

2.2.1 Current wind speed

2.2.2 Current wind speed
- If several wind sensors are active, two values are shown.

WARNING
Crane operation without display value of wind speed!
If the current wind speed **2.2** “???” appears in the display, then a wind sensor which must be present is missing or there is an error in the wind sensor!
- ▶ Pay attention to the error message and remedy the error immediately!
- ▶ If an error cannot be remedied, then it must be ensured that the wind speed is monitored otherwise!

Note
- ▶ If several wind sensors are connected on the LSB bus, the location of the wind sensor determines the corresponding display in the “wind speed” icon!
- ▶ The priority depends on the installation location of the wind sensor, from “outside” (for example luffing jib) to “inside” (for example boom head). The wind speed of the “exterior” wind sensor is displayed in **2.2.1** and the wind speed of the “interior” wind sensor is displayed in **2.2.2**.
- ▶ The priority of wind sensor 2 is larger than that of wind sensor 3, this means: If both wind sensors are present, then the value of wind sensor 2 is shown!

5.7 Other operating elements

The following functions are assigned to the other operating elements of the display and operating unit of the LICCON computer system in the crane operation program.

A Keypad

- Keys “0” to “9” and “P” have no function in the crane operation program.
- Key “**.** ”, illustration **1**
  With the key “**.** ” the so-called test screen function is turned on and off. All existing icons appear with a test value on the LICCON monitor.
- **Note:**
  The monitored auxiliary functions must be opened in the desired page to appear in the test screen!
  The test screen display can be held by pressing the SHIFT key **H** and the key “**.** ”!
  By pressing the key “**.** ” again, the normal crane operating screen appears again!
  If the test screen is not held, then the normal crane operating screen appears after 10 seconds!

P Program keys

- The program keys are used to select individual programs. However, the appropriate program-specific features (for example, switching from set up to crane operation once with “O.K.”) must be noted.
- **Note:**
  A program currently running **cannot** be called again using its program key!
  The programs can only be called up with their program key when the set up key was not actuated before!

C Input key ENTER

- No function in crane operation program

7.4 Derrick ballast, weight and utilization

Note
- ▶ Ballast trailer*: Only optional for LR1750!
- ▶ In crane operation with ballast trailer* observe the respective chapters!

Test points derrick ballast guying A are:
- – Test point 4A = pressure sensor ring surface left F4A
- – Test point 5A = pressure sensor piston surface left F5A

Test points derrick ballast guying B are:
- – Test point 4B = pressure sensor ring surface right F4B
- – Test point 5B = pressure sensor piston surface right F5B

Position	Icons / display values	Type of display	Is shown
4	“Derrick ballast, weight and utilization” icon	Static	For operating modes with derrick ballast
4.1	“Derrick ballast” icon	Static	In operating modes with derrick ballast, depending on the type and the condition of the derrick ballast (see 4.1.1 - 4.1.4)

Note
- ▶ The view of the “derrick ballast” **4.1** icon changes depending on if the derrick ballast is set up as a suspended ballast or as a ballast trailer!
- ▶ During crane operation observe the respective chapters for suspended ballast or ballast trailer in the Crane operating instructions!

Position	Icons / display values	Type of display	Is shown
4.1.1	“Suspended ballast on the ground” icon	Static	Ground contact sensor reports “Suspended ballast **not suspended** ”
4.1.2	“Suspended ballast suspended” icon	Static	Ground contact sensor reports “Suspended ballast**suspended** ”
4.1.3	“Ballast trailer on the ground” icon	Static	Key button ballast trailer in position “Ballast trailer **not suspended** ”
4.1.4	“Ballast trailer suspended” icon	Static	Key button ballast trailer in position “Ballast trailer **suspended** ”

Position	Function / function key line	Type of display	Is shown
F5*	Ballast input value (BA_{edit})* = edited ballast value in function key icon of “F5”	Static	For **valid** ballast input value
		“???” blinking	For **invalid** ballast input value
F6	Not assigned		
F7	Not assigned		
F8	“Horn” icon - Turn off the acoustic signal “Horn” on monitor 1 by pressing the “F8” key.	Blinking	If the acoustic signal “Horn” sounds on monitor 1. See paragraph “Acoustic warning on monitor 1” .

9.2.1 Function key line

The function key line **7** is operated via the function key located below.

F1 Function key	• Selection of point 1 or 2 of selected edge A or B
F2 Function key	• Selection of edge A or B that is being programmed
F3 Function key	• The function selector is moved down by one limit function.
F4 Function key	• The limit function selected with the function selector changes its status. If previously active, it will now be inactive when the function key **F4** is pressed, and vice versa. An inactive limit function is identified by a crossed out icon. If the function selector shows a slewing limit to the left or the right, then both limits will always be switched. • **Note:** For the edge limit, only the preselected edge will be switched! The edge that is not displayed can be active or inactive at the same time!
F5 Function key	• All limit functions become inactive, icons crossed out - see illustration **1**
F6 Function key	• Not assigned in the working range limitation program
F7 Function key	• Not assigned in the working range limitation program
F8 Function key	• Exit the program and return to the crane operation program

9.3 Displays in the crane operation program

If a programmed working range limitation is activated, then this status is indicated in the “Crane operation” program by an alternative STOP icon **10** on the position of the normal LMB STOP icon **11**, see illustration **2**.

1.1 Checking the oil level and filters

- ▶ Check oil level on the crane engine.
- ▶ Check the oil level in the hydraulic tank.
- ▶ Check the filter on the hydraulic tank.

1.2 Checking the fuel level

Note
Fuel tank empty!
If the fuel tank has been run dry, then the fuel system must be bled!
▶ Refuel in time!

On the LICCON monitor, the amount of fuel left in the tank is shown in the form of a numerical display in percentages [%], see icon **20**.
▶ Check the tank contents on LICCON monitor.

1.3 Checking the coolant level

For detailed description of lubricants and fill quantities, see Crane operating instructions, chapter 7.06 and chapter 7.07.

WARNING
Danger of burns due to hot coolant!
Coolant at operating temperature is under pressure. If the cooling system is opened, there is the danger of scalding!
▶ Check the coolant level only when the engine is cold!

NOTICE
Property damage due to insufficient cooling!
▶ Check the coolant level!
If the coolant level of the coolant expansion tank falls below the overflow on the filler neck:
▶ Add coolant!

1.4 Checking the battery voltage

Note
The battery voltage must be checked in regular intervals, especially if the crane has been “out of service” for a longer period of time and users, such as the airplane warning lights - are checked and the battery must be recharged if necessary!
▶ Recharge the battery, see Crane operating instructions, chapter 7.05!

Note
Reduced battery performance requires greater power requirements!
▶ Ensure that batteries are well charged, particularly during the colder months!

▶ Check the battery voltage, see icon **26**.

4.4 After engine start: Checking the instruments on LICCON monitor

As soon as a stable voltage is present with the engine running, the electric crane control and the LICCON computer system are turned on automatically. A self-test of the microprocessor system follows and after a few seconds the set up screen appears on the monitor.

Note

▶ Do not put a full load on the engine until it is at operating temperature!

The following icons must turn off when the engine is running:

▶ Warning light **134** “Preheat the crane engine”.

▶ Warning light **136** “Charge indicator”.

Check the following icons when the engine is running:

▶ Check the icon **21** “Engine oil pressure” on the LICCON monitor.

Troubleshooting

The numerical display for the engine oil pressure in the icon **21** blinks after approximately 10 seconds or starts to blink during crane operation.

The engine oil pressure is too low. The engine can be damaged as a result of insufficient oil pressure.

▶ Turn the engine off immediately and determine the cause.

▶ Check the icon **22** for “Coolant temperature”.

Troubleshooting

The numerical display for the “Coolant temperature” in the icon **22** blinks during operation.

The coolant temperature is too high. Excessive coolant temperatures can lead to engine damage.

▶ Turn the engine off immediately.

▶ Check the icon **20** for “Fuel content”.

▶ Check the icon **23** for “Coolant level”.

▶ Check the icon **24** for “Air filter”.

▶ Check the icon **26** for “Battery voltage”.

▶ Check the icon **27** for “Hydraulic oil temperature”.

4.5 Engine monitoring

Note

▶ For a detailed description about engine monitoring, refer to the Crane operating instructions, chapter 4.02!

This could result in property damage!
- ▶ Before lifting a load, its weight and properties must be known to the crane operator!
- ▶ The crane operator must check with the load chart if the crane is able to carry out the work safely!

The LICCON computer system detects various values, which result in optical and acoustical warnings if exceeded:
Within the crane operator's cab:
- – Acoustic warning “Horn / short horn” on the LICCON monitor
- – Optical warning “blinking value / display” on the LICCON monitor

Outside the crane operator's cab:
- – Acoustic warning via the horn on the slewing platform
- – Optical warning via the warning light on the slewing platform

All warnings, even those which do not lead to an immediate shut off must be noted by the crane operator and personnel within the danger zone.
The overload protection can **not** detect (examples of cases):
- – The hooking of the load or the load suspension equipment.
- – Excessive retarding forces.
- – Loads falling onto the rope.
- – Angular pulling.
- – Driving the crane on ground with large slope.
- – Collapsing ground.

4.1.1 Failure of the overload protection

WARNING
Crane operation without overload protection!
If the LICCON overload protection is no longer functioning properly because of one or more errors, then there is a danger of accidents if crane operation is continued!
Due to operation of the crane with failed LICCON overload protection, the crane can be overloaded and collapse!
Personnel can be killed or seriously injured!
This could result in property damage!
- ▶ Crane operation without overload protection is prohibited!
- ▶ Do not take up crane operation again until the overload protection is functioning again!

A failed overload protection:
- – Must be repaired before the crane can be operated again.
- – May only be bypasses in emergency cases or emergency situations.

4.2 Bypass of overload protection

The overload protection can be bypassed in case of:
- – Failure of the overload protection.
- – In an emergency situation (according to EN 13000:2010).

4.2.1 Bypass of overload protection: Failure of the overload protection

Note
- ▶ Does **not** apply for cranes with CE-mark and configuration according to EN 13000:2010!

To bring the crane into safe condition after failure of a component required for the overload protection, it can be necessary that the overload protection has to be bypassed.

3 Carrying out crane movements

Make sure that the following prerequisites are met:
- The crane is supported.
  (Only in connection with crane support or for LG-cranes)
- The crane is aligned in horizontal direction.
- The counterweight is installed and secured according to the data in the load chart.
- The ground is able to carry the weight of the crane, the load and the load tackle.
- The hook block is correctly reeved as shown in reeving plan.
- The crawler operation is turned off: switch **74** in 0-position.
  (Only for LR-cranes)
- No bypass of the LICCON computer system or exceedance of overload protection is active.
- The LICCON computer system is in the normal operation.
- The engine is running.
- All safety devices have been adjusted according to the data in the load chart.
- There are no persons or objects in the danger zone.

WARNING
Risk of accident!
- ▶ In order to protect the crane and reduce the danger of accidents, always operate the master switch slowly and sensitively!
- ▶ Ensure that there are no obstacles in the working range of the crane and that there are no persons within the danger zone!
- ▶ Give a warning signal before initiating a crane movement!
- ▶ Observe the danger notes for crane operation, see Crane operating instructions, chapter 5.01!

3.1 Releasing the crane control

The crane control is stopped by a seat contact button **7** as soon as the crane operator gets up from his seat so that no inadvertent crane movements are carried out when entering or exiting the cab due to inadvertent movement of the master switch.

Note
- ▶ If the crane operator must work while standing up, then the seat contact button **7** can be bypassed by button **71**, button **86** and button **94** on the respective master switch!

3.5 Luffing the boom

DANGER
Risk of accident due to toppling crane!
If the LICCON overload protection turns off while trying to lift the load with the winch, then a subsequent luffing movement can cause the crane to topple over or damage it!
Personnel can be severely injured or killed!
▶ Do not lift the load by luffing up the boom, see Crane operating instructions, chapter 4.04!

The speed of crane movement “luffing” is controlled by the deflection of the corresponding master switch and the pedal **57**.

Note
▶ The operating modes are explained in the load chart manual!

Note
▶ Observe the pump - master switch assignment in the electric wiring diagram!

3.5.1 Luffing the main boom in operating mode S/SL

▶ Deflect the master switch 1 **80** in direction X-.
Result:
– The boom is luffed up.

▶ Deflect the master switch 1 **80** in direction X+.
Result:
– The boom is luffed down.

3.5.2 Luffing the main boom in operating mode SW

▶ Deflect master switch 3 **90** in direction Y-.
Result:
– The boom is luffed up.

▶ Deflect master switch 3 **90** in direction Y+.
Result:
– The boom is luffed down.

3.5.3 Luffing the main boom in operating mode SDW

▶ Deflect the master switch 3 **90** in direction X-.
Result:
– The boom is luffed up.

▶ Deflect the master switch 3 **90** in direction X+.
Result:
– The boom is luffed down.

3 Securing and removing the load hook*

3.1 Securing the load hook*

3.1.1 Assembling the load hook*

- ▶ Place the load hook under the pulley head of the boom.
- ▶ Release and unpin the rope retaining pipes on the back pulley and on the pulley head.

WARNING
Erroneous operation of crane function and danger of slipping on the boom!
If the following notes are not observed and adhered to, personnel can be severely injured or killed!
- ▶ Step on the boom only via the catwalks!
- ▶ The assembly personnel must secure themselves for all work on the lattice mast boom with approved antifall systems, on the safety ropes or on the lattice sections, with snap hook on both sides to prevent them from falling!
- ▶ Complete the assembly work from a stable location!
- ▶ Observe and adhere to the assembly guidelines in chapter 5.01 of the crane operating instructions!

- ▶ An assistant guides the hoist rope over the boom to the pulley head and at the same time, the crane operator spools the hoist winch out.
- ▶ Place the hoist rope over the back pulley.
- ▶ Insert the rope retaining pipes again and secure with spring retainers.
- ▶ Pin the rope lock **1** in the load hook **26** and secure with spring retainers.

3.1.2 Fastening the hoist rope

- ▶ Push the retaining pin **6** in on the rope lock **1**, move the lever **5** to the side and hold it in this position.

Result:
– The latch **4** is moved to the side.

- ▶ Fasten the rope end with the locking clamp **8** in the rope lock and pull the rope firmly in the direction of the arrow, until the locking clamp **8** contacts the cone **7**.

WARNING
Incorrectly secured locking clamp!
If the locking clamp **8** is hooked and secured incorrectly or insufficiently in the rope lock **1**, then the load and the hook block can fall down!
Personnel can be severely injured or killed!
- ▶ The locking clamp **8** must touch on the cone **7** after hanging it into the rope lock **1** and must be secured by the latch **4**!

- ▶ Release the lever **5**.

Result:
– The lever **5** returns to the initial position and is locked by the retaining pin **6**.

3 Permissible counterweight assemblies

WARNING
Overload fastening points counterweight plates!
If more than the permissible number of counterweight plates are lifted together, then the fastening points can be overloaded!
The counterweight plates and components can fall down!
Personnel can be severely injured or killed!
▶ Attach only the maximum permissible number of counterweight plates per lift!

WARNING
Incorrect set up of counterweight assemblies!
When lifting mixed weight counterweight assemblies, and the heavier counterweight plates are placed on top, the fastening points can be overloaded!
The counterweight plates and components can fall down!
Personnel can be severely injured or killed!
▶ Always stack the heavier counterweight plate on the bottom in the counterweight assembly!

Individual weight Counterweight plate	Maximum number of same counterweight plates per lift over	
	Twistlock	Bitt
5.0 t	2	1
7.5 t	2	2
10.0 t	2	2
12.5 t	1	2

5.2 Removing the counterweight plates

WARNING
Damaged counterweight plates!
Damage on the counterweight plates **2** can cause the fastening equipment to release!
The counterweight plates **2** and components can fall down!
Personnel can be severely injured or killed!
▶ Do not use damaged counterweight plates **2** and replace them immediately!

WARNING
Asymmetrical counterweight distribution!
If more than 25 t are asymmetrically placed / removed on the counterweight stacks **5**, the crane can topple over!
Personnel can be severely injured or killed!
▶ A weight difference between the right and left counterweight stack **5** of more than 25 t is prohibited!
▶ Place / remove the counterweight assemblies alternately symmetrically on the left and right on the counterweight stack **5**!

Note
▶ The counterweight plates are marked with their own weights!

Make sure that the following prerequisite is met:
– The retaining chains are removed.

4.6 Breaking away fixed loads

WARNING
The crane can topple over!
Ripping stuck loads free can destroy the crane or cause it to topple over!
Personnel can be severely injured or killed!
▶ Ripping stuck loads free is prohibited!

5 Crane operation

The maximum load capacity of the crane is not just limited by the stability, but in many cases a load-bearing component breaks when the crane is overloaded **before** the crane topples over. Components that are susceptible to buckling such as the telescopic boom may fail suddenly **without showing signs of distortion beforehand** if the crane is overloaded.

WARNING
Danger of accidents for cranes with luffing cylinders!
When the luffing cylinder is on block position, the overload protection is not functioning!
▶ Crane operation at block position of luffing cylinders is prohibited!

5.1 General

A suspended load must always be kept under control. A fundamental requirement for this is the safe and delicate control of the crane's functions.

WARNING
Risk of accident due to swaying loads!
A swaying load can damage the crane and cause it to topple!
▶ All crane movements must be executed slowly and delicately!
▶ Initiate all crane movements slowly!
▶ Apply the brakes slowly in all crane movements!
▶ Crane operation with swaying loads is prohibited!

NOTICE
Damage of rope pulleys!
▶ Place down hook blocks, booms, folding jibs, auxiliary booms and boom noses in such a way that the rope pulleys do not lie on the ground and are damaged!

5.2 Guiding the load

The use of guide ropes is recommended to help the crane operator to manage the load more precisely and to prevent the load from swaying. This will prevent undesirable movements of the load and consequent damage.

5.3 Danger of being crushed!

WARNING
Danger of fatal injury!
Extreme care is needed when lowering a load! Mortal danger exists for personnel in the immediate area of the load being lowered!
Personnel can be severely injured or killed!
▶ Standing under a suspended loads is strictly prohibited!

2.1 Operating elements for the crawler operation

2.1.1 Pedal carrier

	Pedal carrier (Pedal assignment, see opposite illustration)			
	 *Pedal*	 *Foot rocker **MS 4***	 *Foot rocker **MS 5***	 *Pedal*
Function:	Slewing gear brake	Crawler travel “left”	Crawler travel “right”	Engine regulation:
	Note: Refer also to chapter 4.01 and chapter 4.05 of the Crane operating instructions.			

2.1.2 Switch for crawler operation

	Control panel MS2		
	 *Switch “Crawler operation”* **or:**  *Switch “Crawler operation”*	 *Switch “Parallel travel”*	 *Switch “Rapid gear”*
Function:	On / Off	On / Off	On / Off
	Note: Also see Crane operating instructions, chapter 4.01.		

1 Reeving plans

Note

▶ See separate reeving plans!

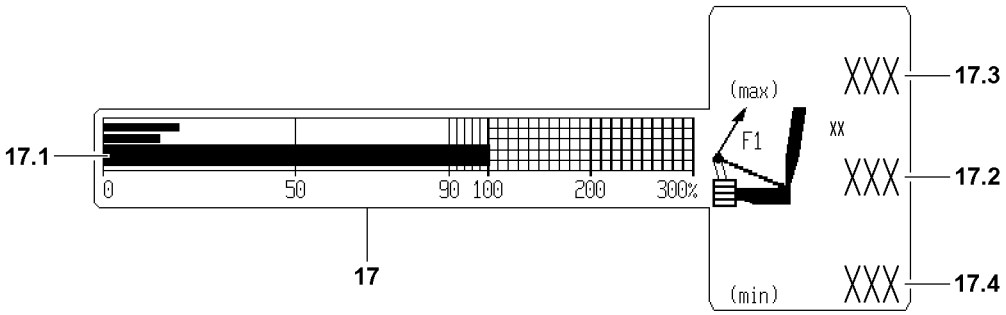
WARNING
Limited warning functions!
If one of the double version limit switches is not ok and the crane is continued to be operated, then the warning functions of the LICCON overload protection are limited!
▶ The crane can only be operated in an emergency after failure of a double version limit switch!

▶ Carry out crane movements in such a way that no repeated shut off by the LICCON overload protection occurs.

2.3.3 Shut off maximum / minimum value test point 1 (force F1)

Note
▶ The force determined on test point 1 is generally described as $F1_{actual}$ (actual value F1).
▶ In the icon **17** (F1-load display), the force relationship as well as the number values are shown in number values as well as a bar display (called F1-bar display).
▶ The value $F1_{max\text{-}operation}$ **17.3** corresponds to 100 % in the F1-bar display.
▶ The F1-utilization bar **17.1** shows the relationship $F1_{actual}$ **17.2** to $F1_{max\text{-}operation}$ **17.3**.
▶ In crane operation without derrick ballast, fewer values may be shown in the icon **17** (F1-load display).

Shut off maximum value F1 in crane operation



In the icon **17** (F1-load display) the F1-utilization bar **17.1** exceeds the 100 % mark and the LICCON overload protection has shut off the crane movement. The value $F1_{actual}$ **17.2** has exceeded the value $F1_{max\text{-}operation}$ **17.3**.
All further movements, which lead to an increase of the force F1(value $F1_{actual}$) are shut off.
▶ Reverse any crane movement which has caused the shut off.

or

■ Initiate an alternative crane movement, which lowers the force F1 (value $F1_{actual}$).

Result:
– Crane operation is possible again.

Troubleshooting
The crane operation is limited because the value $F1_{max\text{-}operation}$ apparently is being reached too early?
▶ Make sure that a valid configuration status has been entered on the LICCON computer system!
▶ Make sure that the crane is assembled according to the assembly drawings!
▶ Make sure that the actual configuration status and the entered configuration status of the crane match.
▶ Make sure that all attachment parts and guy rods on the boom system, which are not needed, have been removed (weight)!
▶ Make sure that the boom system is free of snow and ice (weight)!
▶ Make sure that the wind influence onto the boom is not too great!
▶ If no irregularities can be found:
Contact LIEBHERR Service.

2.5 Bypass of the hoist top shut off

WARNING
Improper use of the function “Bypass of hoist top shut off”!
- ▶ The function “Bypass of hoist top shut off” may never be used to increase the lifting height during crane operation!

WARNING
Property damage and falling load!
If the function “Bypass of hoist top shut off” is activated, there is the danger that the hook block or the load hook is pulled against the pulley head!
This danger exists especially when the hoist winch is continued to be spooled up and for crane movements which have an influence on the hoist rope, for example luffing the boom, the auxiliary boom / accessory or the derrick boom!
Property damage and falling load can result!
Personnel can be severely injured or killed!
- ▶ The function “Bypass of hoist top shut off” may only be carried out by an authorized person, along with a guide. The guide must be in direct contact with the crane operator and must continually monitor the distance between the hook block / load hook and the boom head!
- ▶ Carry out all crane movements with utmost caution!

Note
- ▶ The activation of the function “Bypass of hoist top shut off” is only possible if the hoist limit switch was touched and the hoist top shut off has occurred.
- ▶ If the hoist limit switch is triggered when the set up key **D** is actuated (function “Exceedance of shut off limits of the LICCON overload protection” is active, the assembly icon **30** or the assembly icon **31** appear), then a hoist top shut off occurs and the function “Exceedance of shut off limits of the LICCON overload protection” is deactivated.
- ▶ For assembly purposes or in emergency cases, if the activation of the function “Bypass of hoist top shut off” **and** activation of the function “Exceedance of shut off limits of the LICCON overload protection” is necessary, then the set up key **D** must be actuated until the icon **21** and assembly icon **30** or assembly icon **31** (assembly operation) appear.

Make sure that the following prerequisites are met:
- – A hoist top shut off has occurred, the hoist top icon **20** appears in the LICCON monitor.
- – Either the seat contact button **29** or one of the buttons **1** of the master switches (MS1, MS2, MS3) is actuated.
- – All master switches (MS1, MS2, MS3) are in zero position (not deflected).
- – The radio operation* is not active.

3.2.3 Acoustic / visual warnings outside the crane operator's cab

Note
▶ Description of individual case numbers, see chart “Overview of case numbers”!

Warning light 12.1					
Case number	**At utilization of crane**	**Acoustic warning**	**Visual warning**		
		Signal turntable	**Green**	**Yellow**	**Red**
Case 001	From 0 % to 89 %		O^1		
Case 002	From 90 % to 100 %			O^1	
Case 003	Above 100 %	X^1			O^1
Case 004	-				O^1
Case 005	From 0 % to 89 %		O^1		
Case 005	From 90 % to 100 %			O^1	
Case 005	Above 100 %	X^1			O^2
Case 006	-			O^2	
Case 010	From 0 % to 89 %		O^1		
Case 010	From 90 % to 100 %			O^1	
Case 010	Above 100 %	O			O^2
Case 011	From 0% to 100 %			O^2	
Case 011	Above 100 %	O			O^2
Case 016	Up to 90 %		O^1		
Case 016	Above 90 % to 100 %			O^1	
Case 016	Above 100 %	O			O^2
Case 018	No value available			O^2	
Case 020	No value available			O^2	

O = cannot be turned off
O^1 = warning light **12.1** lights up
O^2 = warning light **12.1** blinks
X^1 = can be turned off by actuating (right touching) the key button **35** on the LICCON monitor with the derrick operating screen (illustration **4**), effective after at least 5 seconds

3.4.2 Exceedance of the maximum permissible load moment

If the maximum permissible load moment is exceeded, the LICCON overload protection turns off all crane movements that increase the load moment.
In the icon **22** (load moment display) the utilization bar **22.1** has exceeded the 100 % mark and in the LICCON monitor appears the icon **19**.
This shut off can be exceeded by the configuration button **D** in the “right touching” position.

WARNING
Shut off safety device!
If the function “Exceedance of shut off limits of LICCON overload protection” is activated by actuating the set up key **D** then it is possible to exceed the maximum permissible load moment! The function “Exceedance of maximum value test point 1” is automatically activated too. Thus there is no shut off when exceeding the maximum value test point 1!

- ▶ All notes regarding the function “Exceedance of shut off limits of LICCON overload protection” must be observed!
- ▶ The utilization bar $F1_{actual}$ **17.1** of the F1 load display must be observed!

Note

- ▶ In emergency situations, the function “Exceedance of shut off limits of the LICCON overload protection” can be activated with the set up key **D** and the maximum permissible load moment of 100 % can be exceeded.

The set up key **D** on the LICCON monitor has two positions:
– Operating position (not pressed): Crane is in normal operation.
– Position to right (touching): The function “Exceedance of shut off limits of the LICCON overload protection” is activated, the assembly icon **30** appears in the LICCON monitor.

Make sure that the following prerequisites are met:
– With the button **5** “Luffing in with suspended load” no normal operating condition (utilization below 100 % and no active shut off) can be reached.
– All master switches (MS1, MS2, MS3) are in zero position (not deflected).
– Either the seat contact button **29** or one of the buttons **1** of the master switches (MS1, MS2, MS3) is actuated.
– Radio operation* is not active.

- ▶ Turn the set up key **D** to the right (touching).

Result:
– The LICCON overload protection is inactive.
– The assembly icon **30** appears in the LICCON monitor.

3.6.3 Danger of exceeding $F1_{max\ assembly}$

Note

▶ $F1_{max\text{-}assembly}$ **17.7** might only appear when 90 % of its nominal value is exceeded!

DANGER

The crane can topple over!

There is **no** shut off of the luff down movement after reaching the limit value $F1_{max\ assembly}$ **17.7**!

If the warnings by the LICCON overload protection are ignored, then the crane will be overloaded or topples over!

Personnel can be severely injured or killed!

▶ The luff down movement must be stopped before the value $F1_{actual}$ **17.2** exceeds the limit value $F1_{max\ assembly}$ **17.7**!

In the icon **17** (F1-load display), the value $F1_{actual}$ **17.2** has reached the upper limit value $F1_{max\text{-}assembly}$ **17.7**.

▶ Check if a crane movement, which can lower the force F1 (value $F1_{actual}$ **17.2**) can be initiated, for example setting down the hook block / load hook.

▶ Check if the correct set up configuration has been entered on the LICCON computer system.

▶ Check if the actual set up configuration matches the entered set up configuration.

▶ Check if the correct hook block weight has been entered.

▶ Check if the respective hook block / load hook is installed.

▶ Check if all attachment parts and guy rods on the boom system, which are not needed, have been removed.

▶ Check if environmental influences (wind, snow or ice) on the crane are not too great.

Note

▶ Hook block weight entry and correction of weighing errors, see Crane operating instructions, chapter 4.02.

12.2.2 Disassembly of lattice sections for guyed auxiliary boom with an auxiliary crane

The illustrations serve as examples. The illustrations may differ depending on the crane.

WARNING
Risk of fatal injury when disassembling auxiliary booms!
If the pins are not unpinned in the given sequence, lattice sections may suddenly fold down or even fall down. This can result in life-threatening injuries to personnel.
▶ Pins must be unpinned in the order specified!

- ▶ Luff the auxiliary boom down until the end section touches the ground slightly, illustration **1**.
- ▶ Release and unpin the pins at both sides (level **B**) at point **1**, illustration **1**.
- ▶ Completely remove the lattice sections, illustration **2**.
- ▶ Lift the end section with the auxiliary crane, illustration **2**.
- ▶ Release and unpin the pins at both sides (level **B**) at point **2**, illustration **2**.
- ▶ Release and unpin the pins at both sides (level **A**) at point **3**, illustration **3**.
- ▶ Release and unpin the pins at both sides (level **B**) at point **4**, illustration **3**.
- ▶ Release and unpin the pins at both sides (level **A**) at point **5**, illustration **3**.
- ▶ Release and unpin the pins at both sides (level **A**) at point **6**, illustration **3**.

Unpinning the lattice components

WARNING
Risk of fatal injury when disassembling booms!
If the pins are not unpinned in the given sequence, lattice sections may suddenly fold down or even fall down. This can result in life-threatening injuries to personnel.
- ▶ Pins must be unpinned in the order specified!

- ▶ Release and unpin the pins at both sides (level **B**) at point **1**, illustration **1**.
- ▶ Release and unpin the pins at both sides (level **A**) at point **2**, illustration **2**.
- ▶ Release and unpin the pins at both sides (level **B**) at point **3**, illustration **3**.
- ▶ Release and unpin the pins at both sides (level **A**) at point **4**, illustration **4**.

1 Components and fastening points

1.1 D-pivot section

The D-pivot section consists of:

Position	Component	Weight[1)]
1	D-pivot section without rods	6.3 t
2	D-relapse cylinder - 2x	1.8 t
3	Winch 3 with rope	8.8 t
4	D-pulley blocks	4.5 t

1) The stated weights are approximate

1.2 D-intermediate section

Position	Component	Weight[1)]
5	D-intermediate section 10 m	7.0 t
6	D-intermediate section 14 m	8.6 t

1) The stated weights are approximate

1.3 D-end section

Position	Component	Weight[1)]
7	D-end section	12.0 t

1) The stated weights are approximate

1.4 Fastening points D-pivot section

WARNING
Danger of accident due to incorrect attachment!
Life-threatening situations can arise due to improper or incorrect attachment of the corresponding components!
Personnel can be severely injured or killed!
▶ Attach the components on the intended fastening points **P1**!

2.2 Establishing the electrical connections

Make sure that the following prerequisite is met:
– The D-boom is completely assembled.

Note
▶ To establish the electrical connections, see Electric wiring diagram!

▶ Establish the electrical connections.
▶ Make sure that all electrical connections on the boom are established.

2.3 Establishing the hydraulic connections

The hydraulic connections are made with quick-release couplings.

When connecting hydraulic lines with quick-release couplings, make sure that the coupling procedure is carried out correctly.

WARNING
Pressure in the hydraulic lines!
If the pressure supply is not interrupted before connecting / releasing the hydraulic lines, the hydraulic oil can escape with high pressure!
Personnel can be severely injured or killed!
▶ Release the pressure in the hydraulic system before connecting / disconnecting: Interrupt the pressure supply and wait for a short time!

WARNING
Loss of pressure or leakage!
Incorrectly coupled or self-loosening quick-release couplings (particularly return lines) can result in serious accidents due to component failure!
▶ Check that the quick-release couplings have been properly connected before using the crane!

▶ Connect the coupling components (sleeve and connector) and screw together with the hand-tightened nut.
▶ Tighten the hydraulic coupling by hand. Rotate the hand-tightened nut until it reaches a tangible, fixed stop position.
▶ Establish the electrical connection to the D-relapse cylinders.

3.1.9 “Open” the D-boom and place it down

Make sure that the following prerequisites are met:

– The guy rods are placed in the transport retainers and secured.
– The pulley block is pinned and secured in the transport retainer.
– The D-relapse cylinders are retracted.
– The support **U** is positioned under the D-pivot section.

▶ Luff the SA-frame down to the front, see Crane operating instructions, chapter 5.02.
▶ Connect the guy rods **15** from the SA-frame on the assembly bracket **16** on the D-pivot section, point **P5**:
Insert the pin **17** and secure with spring retainer **18**.
▶ Luff the SA-frame up until the guying between the SA-frame and the D-pivot section is tensioned.

WARNING
Falling D-boom!
When unpinning the D-boom on the D-pivot section, the D-boom can fall down!
Personnel can be severely injured or killed!
▶ It is prohibited for anyone to remain under the D-boom during the unpinning procedure!
▶ Make sure that the D-boom is safely held by the guying!

▶ Unpin the D-pivot section and the D-intermediate section: Release and unpin the pins **19** on both sides “on the bottom”.
▶ Luff the SA-frame down and place the D-pivot section carefully on the support **U**, see illustration **26**.
▶ Fasten the D-boom on the auxiliary crane.
▶ When the D-boom is safely held by the auxiliary crane:
Release and unpin the pins **19** on both sides “on top”.
▶ Place the D-boom carefully on the ground, see illustration **28**.

WARNING
Tipping lattice sections!
When the lattice sections are unpinned, they can tip over, depending on the ground or the support!
Personnel can be severely injured or killed!
▶ The lattice sections must be safely held by the auxiliary crane before unpinning them!
▶ The tackle must be tensioned before unpinning!

▶ Disassemble the D-end section and the D-intermediate section, point **P8**, see illustration **28**.

See illustration **10**.

Note

- While spooling out the W-control rope, the WA-frame 1 **50** is lifted up with the auxiliary crane in order to prevent slack rope formation!

- Fasten the second rope **61**, which is attached on point **P16** onto the auxiliary crane.
- Spool out the W-control rope **35** and simultaneously lift the WA-frame 2 **25** with auxiliary crane to approximately 45°.
- Tension the hoist rope **58** until the WA-frame 2 **25** is held by the hoist rope.

See illustration **11**.

- Lower the rope **61** with the auxiliary crane.
- Offset the auxiliary crane so that the WA-frame 2 can be pulled back, see illustration.
- Spool the W-control rope **35** out and pull the WA-frame 2 **25** back at the same time with the hoist rope until the W-guy rods move away from the WA-frame 2 and hang down vertically.
- Remove the auxiliary crane.
- Spool the W-control rope **35** out and simultaneously pull back the WA-frame 2 **25** with the hoist rope until the guy rods **53** and the W-guy rods **57** can be pinned together on point **P17**.
- Pin the W-guy rods **53** on the W-guy rods **57**: Insert the pin **63** on both sides at point **P17** from the “inside” to the “outside” and secure with spring retainer **62**.

4.10.2 Erecting the boom

Make sure that the following prerequisite is met:

– The weight of the hook block has been entered into the LICCON computer system.

DANGER

The crane can topple over!

In crane operation with exceeded LICCON overload protection, the crane can topple over.

▶ Personnel can be severely injured or killed!

▶ The radii listed in the load chart may not be exceeded or fallen below, even if there is no load on the hook!

WARNING

Unutilized guy rods on boom!

If guy rods are on the lattice sections which are not used for operation, then there is a risk of accidents!

Personnel can be severely injured or killed!

Guy rods can loosen up and fall down!

The load chart is invalid!

The load display of the LICCON computer system shows the incorrect value!

The weight of the boom is too large for erection!

▶ Disassembly and remove unutilized guy rods on the transport retainers before erecting the boom!

NOTICE

Damage to the hoist rope!

If the hoist rope **85** are reeved on the hook block and redirected over the small guard rollers **86**, the hoist gear may no longer be driven. During spooling up or spooling out, the hoist rope can become damaged!

▶ Do not spool up or spool out the hoist rope **85**, if the angle between the S-boom and the W-lattice jib is less than 90°, illustration **18**!

Note

▶ When the lowest operating position of the W-lattice jib is reached, the LICCON overload protection is activated!

▶ In the maximum load icon appears a load number in “t” instead of the display “???”!

▶ Luff the boom up to the lowest operating position.

▶ When the boom has reached the lowest operating position:
Make sure that the assembly icon **11** on the LICCON monitor turns off.

Result:

– The LICCON overload protection is active.

6.6 Unreeving the W-control rope

NOTICE
Slack rope formation!
The control rope can be damaged if the ropes are slack!
- ▶ Do not allow slack rope formation while spooling the W-control rope up!
- ▶ When spooling the W-control rope up, keep the rope tight!

Note
- ▶ Before unreeving in the W-control rope, the rope retaining pins of the rope pulley **42**, pulley set **44** and pullet set **45** must be released and unpinned, see illustration **13**!

6.6.1 Unreeving the W-control rope on the pulley sets

Make sure that the following prerequisite is met:
– The intake rope for the pulley sets is available.

See illustration **12**.
- ▶ Unhook the W-control rope **35** on point **P13** on the lock **47**.

See illustration **13**.
- ▶ Pull the intake rope **40** to point **P14**.
- ▶ Connect the intake rope **40** and the W-control rope **35** on point **P14**.
- ▶ Spool the W-control rope **35** up and pull the intake rope in on the pulley set **44** and on the pulley set **45**.
- ▶ Hook the intake rope **40** on the lock **47**.
- ▶ Separate the W-control rope **35** on the pulley set **44** from the intake rope **40**.
- ▶ Pin and secure the rope retaining pins on the pulley sets.

6.6.2 Pulling the W-control rope from the WA-frame 2

Make sure that the following prerequisite is met:
– The intake rope for the WA-frame 2 is available.

See illustration **14**.
- ▶ Pull the W-control rope **35** from the WA-frame 2 **25** and spool onto winch 5.
- ▶ Pin and secure the rope retaining pins on the rope pulley **42**.

Result:
– The W-assembly units can be disassembled.

Make sure that the following prerequisites are met:
- The WV-lattice jib is fully assembled.
- No personnel is within the danger zone.
- The crane is supported.
  (only in connection with crane support or for LG-cranes)
- The crane is aligned in horizontal direction.
- All electrical connections have been established.
- All limit switches are functioning.
- The counterweight has been installed to the turntable according to the load chart.
- The derrick ballast is placed according to the data in the erection and take down charts.
- All pin connections have been secured.
- The hoist rope has been correctly placed in the rope pulleys and is prevented from jumping out with the rope retaining pins.
- There are no loose parts on the boom or the lattice jib.
- The boom, lattice jib and safety devices are free from snow and ice.
- The LICCON overload protection has been set according to the data in the load chart.
- The LICCON overload protection settings have been compared with the actual crane configuration.
- The LICCON overload protection is exceeded.
- The assembly icon **11** is visible on the LICCON monitor.

WARNING
Falling hoist rope!
If the hoist rope is not properly secured with a corresponding length on the WV-lattice jib before the erection procedure, then it can fall backward due to its own weight!
Personnel can be severely injured or killed!
- ▶ Reeve in the hoist rope with sufficient length on the WV-lattice jib before the erection procedure!
- ▶ The hoist rope must be constantly monitored during erection!
- ▶ Do not step into the danger zone!

WARNING
The crane can topple over!
If the S-relapse cylinders are not extended before erecting the boom, then the boom can fall down towards the rear during crane operation and the crane can topple over!
Personnel can be severely injured or killed!
- ▶ Extend the S-relapse cylinder before erecting the boom, see Crane operating instructions, chapter 5.07!

- ▶ Luff the S-boom down until the hook block can be reeved.
- ▶ Reeve in the hook block properly and secure the hoist rope on the rope fixed point, for reeving, see separate reeving plans.
- ▶ Attach the hoist limit switch weight.

See illustration **2**.
- ▶ Luff the S-boom up to 15 °.

Note

- The respective boom combination, in connection with the boom nose 60 t, must be assembled according to the supplied rod plans!
- Assembling the boom combination, see Crane operating instructions, chapter 5.38 or chapter 5.39 or chapter 5.07 or chapter 5.08!

1.2 Variations of boom nose and their use

Note

- The boom nose 60 t **1** is available in two variations!
- The boom nose variation of the S-end section can **not** be installed on the L-, W or WV-end section, see illustration **1**!
- The boom nose variation for the L-end section can be installed on the W- as well as on the W-adapter, see illustration **2**!

	Use of boom nose 60 t	
	Variation 1 (illustration 1)	**Variation 2 (illustration 2)**
S-end section	X	
L-end section		X
W-end section		X
W-adapter		X

1.3 Assembly prerequisites for boom nose(s)

WARNING

Assembly with bypassed / exceeded LICCON overload protection!

With bypassed / exceeded LICCON overload protection, the crane can collapse due to overload, the boom can break off or the crane can topple over!

Personnel can be severely injured or killed!

This could result in high property damage!

- The LICCON overload protection may only be bypassed / exceeded by persons who are aware of the consequences of a bypass!
- Bypass / exceed the LICCON overload protection only when the set up status of the crane has been correctly entered into the LICCON computer system!
- Observe the erection / take down charts!
- Crane operation with bypassed / exceeded LICCON overload protection is strictly prohibited!

Make sure that the following prerequisites are met:

– The crane is supported.
(only in connection with crane support or for LG-cranes)
– The crane is aligned in horizontal direction.
– The boom including the respective end section **1** are installed.
– The boom is placed on a load-bearing support.
– The counterweight has been installed on the turntable according to the load chart.
– The LICCON overload protection has been set according to the data in the load chart.
– The LICCON overload protection is exceeded.
– The assembly icon is visible on the LICCON monitor.
– An auxiliary crane is available.

10 Disassembling the 60 t boom nose

WARNING
Risk of falling!
During assembly / disassembly work, personnel must be secured with appropriate aids to prevent them from falling. If this is not observed, assembly personnel can fall and suffer life-threatening or fatal injuries!
- ▶ Any work, where there is a danger of falling must be carried out with suitable aids (for example lifting platform, scaffolding, ladder, auxiliary crane)!
- ▶ If the work cannot be carried out with such aids nor from the ground, then the assembly personnel must secure themselves with approved fall arrest systems to avoid falling, see Crane operating instructions, chapter 2.04!
- ▶ Approved fall arrest systems must be hung into the respective fastening points on the crane, see Crane operating instructions, chapter 2.06!
- ▶ If railings are present on the components, then they must be brought into the corresponding position and secured for assembly / disassembly work!
- ▶ Step on aids and fall protection equipment only with clean shoes!
- ▶ Keep aids and fall protection equipment clean and free from snow and ice!
- ▶ During all assembly and disassembly work, maintenance work and inspections, travel and crane operation is prohibited!

WARNING
The lattice sections can fall down!
If the lattice sections are not pinned and secured correctly, then they can fall down and fatally injure personnel!
- ▶ Pin or unpin both pins at the same horizontal level, i.e. **left and right**!
- ▶ Do not stand under the booms or within the entire danger zone during the boom pinning and unpinning procedure!
- ▶ Safely secure the pins in the bearing points as well as receptacles!
- ▶ It is prohibited to lean the ladder against the component being disassembled!

WARNING
Danger of crushing!
When assembling crane components, limbs can be crushed or even severed due to oscillation of components!
- ▶ Make sure that the components do not swing back and forth during assembly!

DANGER
The components can fall down!
If the corresponding components are disengaged from the auxiliary crane before the corresponding component is pinned, the corresponding component can fall down and fatally injure personnel!
- ▶ Do not disengage the auxiliary crane until the corresponding component is pinned and secured!

4.1.2 Installing the auxiliary weights

Note

▶ Each auxiliary weight's own weight is marked on the auxiliary weight!

WARNING

Toppling of hook block!

If the auxiliary weights are installed one-sided, the hook block can topple over!

Personnel can be severely injured or killed!

▶ The auxiliary weights may only be installed **individually** and alternating left and right on the pulley block!

▶ When the required auxiliary weight is installed on the hook block, the difference between the left and right side may never be more than one auxiliary weight!

▶ Asymmetrical installation of auxiliary weights is prohibited!

▶ Do not exceed the maximum permissible own weight of the hook block! The maximum permissible own weight is engraved on ballastable hook blocks. See “Engraving WT max.”.

Make sure that the following prerequisites are met:

– The hook block is placed on the ground.

– The pulley block **4** is properly installed and secured.

– The retaining pin **7** is pinned and secured at point **U**.

WARNING

Falling auxiliary weights!

If the auxiliary weights are not properly installed on the pulley block, then they can fall down during installation or in crane operation!

Personnel can be severely injured or killed!

▶ Standing under a suspended auxiliary weight is prohibited!

▶ Make sure that the auxiliary weights are properly installed and secured!

▶ Crane operation with insufficiently secured auxiliary weights is prohibited!

▶ Attach the auxiliary weight **10** on the ring screw **14** on the auxiliary crane, illustration **5**.

WARNING

Danger of crushing!

When swinging the auxiliary weights to the pulley block, personnel can be severely injured or killed!

Fingers, hands and arms can be crushed or severed!

▶ It is prohibited for anyone to remain between the pulley block and the auxiliary weight!

▶ Swing auxiliary weights in to the pulley block with utmost caution and at the least possible speed!

6 Single hook blocks

6.1 Installing the single blocks

6.1.1 Installing the auxiliary weights

Note

▶ Each auxiliary weight's own weight is marked on the auxiliary weight!

WARNING

Toppling of hook block!

If the auxiliary weights are installed one-sided, the hook block can topple over!

Personnel can be severely injured or killed!

▶ The auxiliary weights may only be installed **individually** and alternately on the left and right on the hook block!

▶ When the required auxiliary weight is installed on the hook block, the difference between the left and right side may never be more than one auxiliary weight!

▶ Asymmetrical installation of auxiliary weights is prohibited!

▶ Do not exceed the maximum permissible own weight of the hook block! The maximum permissible own weight is engraved on ballastable hook blocks. See “Engraving WT max.”.

Make sure that the following prerequisite is met:

– The hook block is placed on the ground.

WARNING

Falling auxiliary weights!

If the auxiliary weights are not properly installed on the hook block, then they can fall down during installation or in crane operation!

Personnel can be severely injured or killed!

▶ Standing under a suspended auxiliary weight is prohibited!

▶ Make sure that the auxiliary weights are properly installed and secured!

▶ Crane operation with insufficiently secured auxiliary weights is prohibited!

▶ Attach the auxiliary weight **10** on the ring screw **14** on the auxiliary crane.

WARNING

Danger of crushing!

When swinging the auxiliary weights to the hook block, personnel can be severely injured or killed!

Fingers, hands and arms can be crushed or severed!

▶ It is prohibited for anyone to remain between the hook block and the auxiliary weight!

▶ Swing auxiliary weights in to the hook block with utmost caution and at the least possible speed!

3 Assembling the ballast trailer

WARNING
Risk of falling!
During assembly and disassembly, personnel must be secured with appropriate aids to prevent them from falling. If this is not observed, assembly personnel can fall and suffer life-threatening or fatal injuries!
- ▶ Any work, where there is a danger of falling must be carried out with suitable aids (for example: lifting platforms, scaffoldings, ladders, auxiliary crane)!
- ▶ If the work cannot be carried out with such aids nor from the ground, then the assembly personnel must secure themselves with approved fall arrest systems to avoid falling, see Crane operating instructions chapter 2.04!
- ▶ If railings are present on the components, then they must be brought into the corresponding position and secured for assembly / disassembly work!
- ▶ Step on aids and fall protection equipment only with clean shoes!
- ▶ Keep aids and fall protection equipment clean and free from snow and ice!
- ▶ During all assembly and disassembly work, maintenance work and inspections, travel or crane operation is prohibited!

WARNING
Danger of tipping the ballast trailer!
Due to improperly carried out assembly or improper assembly conditions, the ballast trailer can tip over!
Personnel can be severely injured or killed!
- ▶ The assembly of the ballast trailer may only be carried out by authorized personnel!
- ▶ Carry out the assembly of the ballast trailer only on level ground of sufficient load bearing capacity!
- ▶ The ballast trailer has **no** brake system! The ballast trailer must be supported with the support cylinders if it is **not** pinned on the turntable!

Make sure that the following prerequisites are met:
- – The placement location must be level and have adequate load bearing capacity.
- – An auxiliary crane is available.

Placing the centering plates* on the ballast trailer

When using the 10.0 t ballast plates, the centering plates **20** and the centering plates **21** and the centering plate **22** must be used.
The centering plates are used to take up the 10.0 t ballast plates securely in order to prevent slipping during crane operation.

WARNING
The crane can topple over!
Through improperly placed centering plates, individual ballast plates or the ballast stacks can slip or fall down and cause the crane to topple over!
Personnel can be severely injured or killed!
- ▶ Place the centering plates properly on the ballast trailer, visual inspection!
- ▶ Crane operation with improperly placed centering plates is prohibited!

Placing the center centering plate

Make sure that the following prerequisite is met:
– The two centering plates **20** for the 10.0 t ballast plates are installed, see illustration **9**.

▶ Attach the centering plate **22** on the auxiliary crane.

Note
- ▶ Observe correct installation position of the centering plate **22**, see illustration **9**!
- ▶ The centerings **22.1** and the centering plate **22** must be positioned in the centerings **20.2** of the centering plates **20** according to illustration **9**, visual inspection!

- ▶ Position the centering plate **22** in the centerings **20.2** of the centering plates **20**, see illustration **9**.
- ▶ Place the centering plate **22** in the centerings **22.2**.
- ▶ When the centering plate **22** is seated flat on the centering plates **20**:
  Remove the auxiliary crane.

Placing the outer centering plates

Note
- ▶ Placing of the two outside-lying centering plates **21** on the ballast trailer **3** is identical and is only described on the basis of a centering plate!

▶ Attach the centering plate **21** on the auxiliary crane.

Note
- ▶ Observe the correct installation position of the centering plate **21**, see illustration **8** and illustration **9**!
- ▶ The centerings **21.1** must be positioned according to illustration **9** on the frame of the ballast trailer **3**, visual inspection!

- ▶ Position the centering plate **21** on the frame.
- ▶ Lower the centering plate **21** on the frame of the ballast trailer **3**.
- ▶ If the centering plate lays flat on the frame of the ballast trailer:
  Remove the auxiliary crane.

5 Steering programs

The ballast trailer has the following computer controlled steering programs:
– Towing, illustration **2**
– Circular driving, illustration **3**
– Parallel driving, illustration **4**
– Corrective steering, illustration **5**

The steering programs “Towing”, “Circular driving” and “Parallel driving” can only be actuated from the crane operator's cab.

WARNING
Danger when moving the wheel sets on the ballast trailer!
When moving the wheel sets on the ballast trailer, personnel can be severely injured or killed!
▶ The crane operator as well as any operating personnel must make sure that there are no persons within the danger zone - between the wheel sets!
▶ It is prohibited for anyone to remain between the wheel sets for all setting / adjustment work on the ballast trailer!
▶ It is prohibited to anyone to remain between the wheel sets when selecting the various steering programs!

6.2 Safety guidelines for travel operation

6.2.1 Relapse cylinder

When the steepest operating position of the main boom is reached, luffing up is turned off by the LICCON overload protection in all operating modes.

Note

▶ However, there are cases when the relapse cylinders move mechanically to stop position, due to a movement of the entire crane system to the rear!

6.2.2 Block position relapse cylinders

NOTICE

Damage to the relapse cylinder and the boom!

Through level difference between the ballast trailer and crane route, the boom can suddenly be pulled backward and the relapse cylinder can go into the block position!

The relapse cylinder or the boom can be damaged!

▶ Make sure before taking up the driving mode, or before turning the crane superstructure, that the crane driving track or the ballast trailer circular path is even and capable of supporting the load!

In normal crane operation without bypass of the LICCON overload protection, a block position is not possible. Should a block position still occur, the movement is turned off and the boom limitation symbol shown on the operating screen indicates which block position has been started up.

With this boom limitation icon it is to be determined which limit switch on which relapse cylinder has been actuated. Reverse the last movement which was carried out until the corresponding limit switch is released again.

6.2.3 Case 1

Note

▶ Refer to illustration **1**!

When driving or turning the crane with steeply positioned boom, the ballast trailer can be lowered, due to the level differences. This causes the whole boom system to be pulled backward and there is a risk of reaching the block position in the relapse cylinders. The same risk applies when turning if the ballast trailer sinks due to level differences.

Note

▶ By the signals “Main boom relapse cylinder on block” or “Derrick relapse cylinder on block” the drive and turn movements of the “Crawler driving” and “Turning” are automatically turned off!

7.4 Overload monitoring in operating mode with derrick ballast

In operating modes with derrick ballast, the “Maximum load for the current crane condition” is monitored two ways:

1.) Monitoring of maximum load on the LICCON monitor 0.
2.) Monitoring of test point 1-operational maximum force LICCON monitor 1.

7.4.1 Monitoring of maximum load on the LICCON monitor 0.

It monitors the “Maximum load according to load chart and reeving”.
In operating modes with derrick ballast, this is the maximum load of the current crane condition. It is shown on LICCON monitor 0. The current utilization of the crane results from the load utilization bar (1) on LICCON monitor 0.
If the load utilization bar reaches 90 %, an advance warning is given in the form of a “Caution icon” and a “SHORT HORN” on LICCON monitor 0.
At 100 % on the load utilization bar, the shut off of all load moment increasing movements with the “Stop icon” and the acoustical warning “HORN” occurs on LICCON monitor 0.

Note

▶ The “Maximum load for the current crane condition” can then no longer be increased!

7.4.2 Monitoring of test point 1-operational maximum force (= F1 $_{max}$ operation)

It is shown on LICCON monitor 1. When F1 is greater than $F1_{max\text{-}shut\ off\ value}$ shut off of all movements which could increase load moment with the stop icon and the acoustic warning “HORN” by LICCON monitor 1.

Note

▶ The maximum load can be safely monitored by the “LICCON overload protection” itself!
▶ At 90 % “$F1_{max}$-utilization” an advance warning is given in the form of a caution icon and a “HORN” on LICCON monitor 1!
▶ At 100 % “$F1_{max}$-utilization” a shut off occurs of all load moment increasing movements with the stop icon and the acoustic warning “HORN” on LICCON monitor 1!
▶ If the “Maximum load according to the load chart and the reeving” is not reached (utilization bar **1**), then the maximum load of the current crane condition can still be increased!

If the “Maximum load according to the load chart and the reeving” is not reached (utilization bar **1**), then the maximum load of the current crane condition can still be increased by:

– Pulling up the derrick ballast, if the derrick ballast is not already suspended and the currently pulled ballast is still smaller than the optimum ballast.
– Telescoping out the derrick ballast if the added ballast is still lower than the optimum ballast.
– Increasing the derrick ballast by adding additional ballast plates if the placed ballast is still smaller than the optimum ballast.

8.3 Supporting the ballast trailer

The ballast trailer must be supported before unpinning it from the turntable.
Before supporting the ballast trailer, the locking pin **5** must be pinned and secured on the strut **4**.
Make sure that the following prerequisites are met:

– The ballast plates and the guy rods are disassembled.
– The ballast trailer guide is fully moved in.
– The crane is aligned in horizontal direction.

8.3.1 Pinning the strut on the ballast trailer

WARNING
Risk of tipping the ballast trailer!
If the strut **31** is not pinned before ballast trailer disassembly with point **C** the ballast trailer can tip over!
Personnel can be severely injured or killed!
▶ Always pin the strut **31** before disassembly of the ballast trailer!

▶ Release and unpin the locking pin **32** from the transport receptacle **D**.
▶ Pin locking pin **32** into operating position **C** and secure with spring retainer **33**.

8.3.2 Moving the support cylinders out

Move the front and rear support cylinders out:
▶ Press the button **124** and button **126** in the crane operator's cab.

or

■ Press the button **209** and button **211** on the control panel **-S10**.
▶ Check the moved out support cylinder visually.

11.3.2 Changing the oil

Note

▶ On the slewing gear as desired, the gear oil at the oil drain plug **41** or at the oil drain plug **42** or be released from both oil drain plugs at the same time!

Make sure that the following prerequisites are met:
– The ballast trailer is in horizontal position.
– The slewing gear is warm.

▶ Open the oil filler port by unscrewing the dipstick **40**.
▶ Remove the oil drain plug **41** and oil drain plug **42** and drain the oil completely with the seal ring loosened.
▶ Clean the oil drain plug **41** and sealing surface on the housing.
▶ Clean the oil drain plug **42** and sealing surface on the housing.
▶ Reinstall the oil drain plug **41** and the oil drain plug **42** with a new seal and tighten.
▶ Add oil as specified in the lubricant chart at the oil filler port until the oil level is between the minimum and maximum mark on the dipstick **40**.
▶ Close the oil filler port by screwing in the dipstick **40**.
▶ Check the oil level as described in the section “Checking the oil level”.

11.4 Central lubrication system

Note

▶ See Crane operating instructions, chapter 7.05!

12 Fill quantities

12.1 Fill quantities for ballast trailer

The specified fill quantities (change quantities) are orientation values. The markings on the dipsticks, inspection ports or sight gauges are decisive for filling.

NOTICE
Danger of property damage!
▶ Do not mix synthetic oils with mineral oils!

Position	Components	Fill quantity
1	Slewing gear	4.4 l
2	Central lubrication system	2.5 kg

3.7 Functional control before lifting the derrick ballast

Make sure that the following prerequisites are met:

– The hydraulic connections from the derrick ballast and the turntable are established.
– The electrical connections from the derrick ballast to the turntable are established.
– The ground contact rollers must move easily.

WARNING

Risk of fatal injury if the derrick ballast touches the ground!

If the crane movements “Turn turntable” and “Driving the crawler” are not switched off when the derrick ballast is on the ground, the ballast stacks or individual ballast plates can fall down!

Personnel can be severely injured or killed!

▶ Make sure that at least one ground contact switch is actuated if the derrick ballast touches the ground and the crane movement “Turntable turn” and “Driving the crawler” turns off, visual inspection!

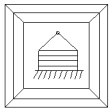
▶ There may be no persons, objects or obstacles within the slewing range of the derrick ballast!

3.7.1 Limit switch “Derrick ballast on ground”

▶ Manually actuate the ground contact switch individually.

Result:

– “Turntable turning” switch off.
– “Driving the crawler” turns off.
– The warning light lights up.



Warning lights “Derrick ballast on ground”

Placing 12.5 t ballast plates, attachment points: Bitt

WARNING
Overloaded ballast plates!
If more than the permissible loads are lifted, the bitts **50.1** are overloaded!
The ballast plates can be damaged and fall down!
Personnel can be severely injured or killed!
▶ Observe the section “Permissible ballast assemblies” in this chapter!

WARNING
Incorrect handling of the fastening equipment!
If tackle cannot be attached correctly and / or if it is not secured sufficiently to prevent it from loosening up, the ballast plate can fall down!
Personnel can be severely injured or killed!
▶ Make sure that the fastening equipment is correctly attached on the bitts **50.1** and that it is secured sufficiently to prevent it from loosening up!

▶ Attach the ballast plate, see illustration **17** on the auxiliary crane.
▶ Lift the ballast plate and place it carefully on the centerings on the ballast pallet or on another ballast plate in the ballast assembly.

4.9 Checking the length sensor value on the derrick ballast

CAUTION
Risk of accident!
If the derrick ballast radius is measured incorrectly, due to the incorrect radius, a maximum load capacity and a F1-operational-max load force which are too large will be calculated!
The crane will be overloaded unnoticed and can topple!
Personnel can be severely injured or killed!

- ▶ The crane driver may not rely blindly on the derrick ballast radius measurement, but he must think for himself and check, if the measurement is still working correctly!
- ▶ With completely telescoped in / out derrick ballast, the display “Derrick ballast radius” must approximately show the corresponding end position!

Note

- ▶ When telescoping the suspended ballast guide, the indicator must change the display “Derrick ballast radius” on the LICCON monitor corresponding to the movement of the derrick ballast! If this is not the case, the crane operator can immediately notice if the length sensor rope drum jams when spooling in or out!

- ▶ When telescoping the derrick ballast in and out, the “Derrick ballast radius” display must be observed carefully on the LICCON monitor.

6.4 Disconnecting electrical connection from the ballast pallet to the guide frame

Note

▶ Release the electrical connections only when the ballast trailer is completely unpinned on the turntable, which means both pins **19** must be unpinned!

Make sure that the following prerequisite is met:

– The ballast pallet is completely unpinned on the guide frame.

▶ Disconnect the electrical connections and store cable properly.

6.5 Disconnecting electrical connection from the ballast pallet to the guide frame

When hydraulic lines are connected and disconnected with quick-release couplings, make ensure that the coupling procedure is being performed correctly.

DANGER

Risk of accident from pressure loss or leakage!

Incorrectly coupled or incompletely coupled quick-release couplings (particularly return lines) as well as self-loosening of quick-release couplings can result in serious injury due to component failure!

▶ Check that the quick-release couplings have been properly connected before using the crane!

▶ Release the pressure in the hydraulic system before connecting and disconnecting. Turn the engine off and wait several minutes.

▶ Install the coupling components (sleeve and connector) with the hand-tightened nut.

▶ Disconnect the coupling sections.

▶ Store hydraulic hoses on the guide frame correctly.

▶ Install protective caps on the coupling components to protect them from contamination and damage.

Closing the boom

WARNING
The crane can topple over!
If the following conditions are not met, the crane can topple over or be significantly damaged!
Personnel can be severely injured or killed!

- ▶ The end section of the corresponding S/SL-boom combination may **not** lift off the ground during the “Closing procedure”!
- ▶ Boom combinations only to a certain system length may be closed with the SA-frame, see the following chart!

Crane	Boom system	Maximum system length	Equipment
LR	S	84 m	- with S- and WA-frame II guy rods - base support on S-pivot section and on S-end section
	SL	98 m	- with S-guy rods - base support on S-pivot section and on L-end section
LG	S	91 m	- with S- and WA-frame II guy rods - base support on S-pivot section and on S-end section
	SL	98 m	- with S-guy rods
			- base support on S-pivot section and on L-end section
	SL	105 m	- with S-guy rods - base support on S-pivot section, on L-end section and on the end of the reducer section

3.7 Establishing the electrical connections

NOTICE
Damage to the electrical connection on the cable drum!
If the electrical connection from the cable drum on the S-pivot section to the terminal box on the S-pivot section is established first before the connection to the terminal box on the S-end section, the electrical connection can be damaged when spooling out the cable drum!
▶ Establish first the electrical connection from the cable drum in the S-pivot section to the terminal box on the S-end section and then the electrical connection from the terminal box in the S-pivot section to the cable drum!

Note
▶ To establish the electrical connections on the S-boom, see Electric wiring diagram!

Make sure that the following prerequisites are met:
– The S-boom is completely assembled.
– The airplane warning light and the wind speed sensor are assembled.

▶ Establish the electrical connections.
▶ Make sure that all electrical connections on the boom are established.

3.8 Establishing the hydraulic connections to the boom

When connecting hydraulic lines with quick-release couplings, make sure that the coupling procedure is carried out correctly.

WARNING
Pressure in the hydraulic lines!
If the pressure supply is not interrupted before connecting / releasing the hydraulic lines, the hydraulic oil can escape with high pressure!
Personnel can be severely injured or killed!
▶ Release the pressure in the hydraulic system before connecting / disconnecting: Interrupt the pressure supply and wait for a short time!

WARNING
Loss of pressure or leakage!
Incorrectly coupled or self-loosening quick-release couplings (particularly return lines) can result in serious accidents due to component failure!
▶ Check that the quick couplings have been properly connected before using the crane!

▶ Connect the coupling components (sleeve and connector) and screw together with the hand-tightened nut.
▶ Tighten the hydraulic coupling by hand. Rotate the hand-tightened nut until it reaches a tangible, fixed stop position.
▶ Establish the hydraulic connections.

5.2.3 Spooling the hoist rope up

NOTICE
Overspooled winch!
If the rope is pulled under the winch when spooling up, the settings of the cam limit switch are not longer correct and there is an increased danger of accidents!
As a result, extensive adjustment work on the cam limit switch is required!
- ▶ All rope retaining pins / pipes on the S-boom are removed!
- ▶ Slowly spool up the hoist rope over the rope pulleys back to the winch!
- ▶ Stop the winch in time, with sufficient rope reserve!
- ▶ Do not overspool the winch!

▶ Spool the hoist rope up.

5.3 Disconnecting the electrical connections on the boom

Make sure that the following prerequisite is met:
– The S-boom has been placed down.

NOTICE
Damage to cable drum or cable!
If the cable of the cable drum is not properly spooled up on the cable drum after unplugging the S-end section, then the cable drum or the cable can be significantly damaged!
- ▶ Spool the cable drum up after unplugging!

- ▶ Spool the cable drum up and secure it to prevent inadvertent spooling out.
- ▶ Make sure that all electrical connections on the S-boom have been disconnected.

5.4 Disconnecting the hydraulic connection on the boom

When releasing hydraulic lines with quick-release couplings, make sure that the coupling procedure is carried out correctly.

WARNING
Pressure in the hydraulic lines!
If the pressure supply is not interrupted before connecting / releasing the hydraulic lines, the hydraulic oil can escape with high pressure!
Personnel can be severely injured or killed!
- ▶ Release the pressure in the hydraulic system before connecting / disconnecting: Interrupt the pressure supply and wait for a short time!

- ▶ Install the coupling components (sleeve and connector) with the hand-tightened nut.
- ▶ Disconnect the hydraulic connections.
- ▶ Install dust caps on the quick-release couplings.

3.2.1 S-pivot section without winches

Make sure that the following prerequisite is met:
– The catwalks are in the transport receptacles.

Remove the catwalks with the auxiliary crane from the transport receptacles and installed them individually in operating position.
▶ Remove the catwalk **27** and catwalk **28** with the auxiliary crane from the transport receptacle.
▶ Install and secure the catwalks in operating position - over the installation opening of the respective winch.

3.2.2 S-pivot section before installation of winches

Make sure that the following prerequisites are met:
– Winch 5 is in transport position.
– Winch 6 is in transport position.
– The catwalk **27** and catwalk **28** are pinned and secured in operating position.

▶ Fasten the respective catwalk on the auxiliary crane.
▶ Release the catwalk on the centering pins: Remove the linch pin **8**.
▶ Lift the catwalk with the auxiliary crane from the operating position.
▶ Place the catwalk with the auxiliary crane in transport position **P6** or in transport position **P7** and secure with linch pin **8**.

Result:
– The respective winch can be installed.

3.3 Assembling the winch(es) on the S-pivot section

Make sure that the following prerequisite is met:
– The catwalks are in the transport receptacles.

▶ Fasten the required winch on the auxiliary crane.
▶ Bring the winch into operating position with the auxiliary crane, pin and secure.
▶ When the winch is pinned and secured:
Remove the auxiliary crane.
▶ Establish the electrical connections from the terminal box in the S-pivot section to the winches.
▶ Establish the hydraulic connections to the winches.

3.6 Assembling the SL/S-boom 84 m and 91 m in flying mode

If spatial prerequisites on the job site are limited for the assembly of the S-boom, or if they are limited by buildings or similar, then the S-boom can be installed in flying mode.

WARNING
General danger notes!
- ▶ Support the S-boom during assembly with suitable materials!
- ▶ All pins are to be secured after assembly with the intended safety elements!
- ▶ The guy rods must be inspected regularly, see Crane operating instructions, chapter 8.15!

Note
- ▶ Weights of the individual lattice sections, see Crane operating instructions, chapter 1.03!

WARNING
The crane can topple over!
If the following conditions are not met, the crane can topple over or be significantly damaged!
Personnel can be severely injured or killed!
- ▶ For the flying boom assembly, the maximum permissible total force on the test point **MS1** (F1) may **not** be exceeded. The “Actual force” is shown on LICCON monitor 1!
- ▶ The flying boom assembly is only permissible up to a certain system length, observe the following charts!
- ▶ The data in the erection and take down charts as well as the load charts must be observed!

Make sure that the following prerequisites are met:
- – The crane is supported.
  (only in connection with crane support or for LG-cranes)
- – The crane is aligned in horizontal direction.
- – The S-pivot section is pinned and secured on the turntable.
- – The S-pivot section is horizontally tensioned.
- – The counterweight is placed according to the specifications.
- – The central ballast is placed according to the specifications.
- – An auxiliary crane is available.

WARNING
Overload of crane!
If the guy rods and the rope of winch 3 **W III** are tensioned when luffing up the derrick boom into operating position, then the crane can be overloaded!
- ▶ Make sure, when luffing up the derrick boom into operating position, that the guy rods and the rope of winch 3 **W III** always sag slightly!
- ▶ Make sure that no slack rope forms!

- ▶ Luff the derrick into operating position, 115° to 118°.

Note
- ▶ The S-intermediate section for flying assembly **30** as compared to standard intermediate sections weighs approximately 1.4 t more!
- ▶ The additional weight of the S-intermediate sections for flying assembly **30** is not taken into account in the load charts and must therefore be added to the load to be lifted, as applicable!

- ▶ Spool up winch 3 **W III** until the guying between the upper pulley block **20.2** and the S-intermediate section for flying assembly **30** is tensioned and the auxiliary crane is relieved.
- ▶ Pay attention to the horizontal alignment of the boom.
- ▶ When the boom is tensioned horizontally:
  Remove the auxiliary crane.

Install the additional S-/L-intermediate sections and the respective end section, depending on the permissible boom length, individually or fully preassembled on the S-intermediate section for flying assembly **30**.

Note
- ▶ Note and observe the maximum permissible boom lengths for flying assembly!
- ▶ The required support (U_{min}) for erection of the boom systems must be adhered to!

- ▶ Assemble the S-intermediate sections or L-intermediate sections on the S-intermediate section for flying assembly **30**: Use pin **22** and spring retainer **23**.

3.13 Erecting the boom

WARNING
The crane can topple over!
In crane operation with exceeded LICCON overload protection, the crane can topple over! Personnel can be severely injured or killed!
- ▶ The radii listed in the load chart may not be exceeded or fallen below, even if there is no load on the hook!

If required in the erection and take down chart:
- ▶ Carry the hook block along with the auxiliary crane!

WARNING
The crane can topple over!
If the following conditions are not met before erecting the boom, the crane can topple over!
Personnel can be severely injured or killed!
- ▶ Observe the safety technical notes, see Crane operating instructions, chapter 5.01!
- ▶ Extend the S-relapse cylinders before erecting the boom combination!
- ▶ Do not allow slack cable to build up on the control winch!

WARNING
Falling hoist rope!
If the hoist rope is not reeved with the respective length over the S-boom before the erection procedure, then it can fall backward due to its own weight!
Personnel can be severely injured or killed!
- ▶ Reeve in the hoist rope with sufficient length on the S-boom before the erection process!
- ▶ The hoist rope must be constantly monitored during erection!
- ▶ Do not step into the danger zone!

NOTICE
Overload of boom!
If the SL-boom is not supported before the erection procedure, then the boom will be overloaded!
The crane will be damaged during erection!
- ▶ Carry out the support for the different boom lengths always according to the specifications!
- ▶ Support the boom with suitable material of sufficient load bearing capacity!

NOTICE
Danger of property damage!
If the maximum permissible total forces is not observed when lifting the boom system for disassembly, then crane components can be severely damaged!
- ▶ Reassemble long booms to the required length for flying disassembly on the ground!
- ▶ Do not exceed the maximum permissible total forces!

- ▶ Lift the S-boom from the supporting base or off the ground by spooling up winch 3.
- ▶ When the S-boom has been lifted off the ground and is safely held by winch 3:
  Unpin the S-pivot section **1** and S-intermediate section **25** at point **P12** on both sides: Remove the linch pin **23** and unpin the pin **22**.
- ▶ When the pins **22** are unpinned at point **P12**:
  Carefully place the S-boom on the ground.
- ▶ When the S-boom is laying on the ground:
  Unpin the S-pivot section **1** and S-intermediate section **25** at point **P11** on both sides: Remove the linch pin **23** and unpin the pin **22**.
- ▶ Remove the S-intermediate section **25** with the auxiliary crane.
- ▶ Unpin the upper pulley block **20.2** on the guy rods **3**: Remove the spring retainer **10** and unpin the pin **9**.
- ▶ Place and secure the guy rods **3** in the transport receptacles on the S-pivot section.

3 Operating the crane

3.1 Preparing for crane operation with HS-operating modes

WARNING
The crane can topple over!
- ▶ Check the horizontal position of the crane before and during operation!
- ▶ Make sure to observe the data in the load charts.
- ▶ If the crane operator leaves the cab, even for a short time, the operating mode setting must be checked and reset if necessary before resuming crane operation!
- ▶ If winch 2 **WII** is reeved with small reevings, steep boom positions and small radii of the SL-boom, then the load on the load hook is larger than is shown on the LICCON. The load moment limiter recognized an overload of the crane too late.

Note
- ▶ In HS-operating modes, the hoist rope from winch 1 **WI** must be reeved on the auxiliary jib **HS**, see illustration **14**.
- ▶ For crane operation with reeved in adapter for the auxiliary jib **HS**, reeve in winch 1 **WI**.
- ▶ For two hook operation, winch1 **WI** must be reeved on the adapter for the auxiliary jib and winch 2 **WII** on the auxiliary jib HS **2**, see illustration **16**.
- ▶ The hoist limit switch **10** on the adapter for the auxiliary jib must always be connected on the LICCON computer system, see illustration **17** and illustration **X**.
- ▶ If no hoist rope is reeved on the adapter for the auxiliary jib in HS-operation modest, then the hoist limit switch **10** must be released on the adapter, see illustration **17** and illustration **X**.
- ▶ Attach the hoist limit switch rope **20** with hook lock **21** under tension and release the hoist limit switch **10**, see illustration **X**.

Make sure that the following prerequisites are met:
- – The LICCON overload protection has been set according to the data in the load chart.
- – The respective operating mode has been set and confirmed on the LICCON.
- – The hoist limit switch **10** on the adapter for the auxiliary jib is connected on the LICCON computer system.

3.2 Checking the settings

- ▶ Check the function of the overload protection by running against the operating positions “on top” and “bottom”.
- ▶ Check the hoist limit switch by running against the hoist limit switch weight.
- ▶ Check the function of the limit switches on the relapse cylinders.

2.5 Erecting the KA-frame

Make sure that the following prerequisites are met:
– The hoist rope is reeved, pinned and secured.
– The K-guy rods are pinned and secured.

▶ Attach the fastening rope **17** on the auxiliary crane.

NOTICE
Danger of slack rope formation!
▶ When erecting the KA-frame, watch for slap rope formation of the hoist winch!

▶ Spool the hoist winch up at the same time and lift the KA- frame **8** with the auxiliary crane to approximately 45°, see illustration **3**.

WARNING
KA-frame folding downward!
If KA-frame is not held with the auxiliary crane while pulling it back, it can fold downward!
Personnel can be severely injured or killed!
▶ Hold the KA-frame with the auxiliary crane until the guy rods are tensioned!

▶ Pull the KA- frame **8** back with the auxiliary crane while spooling up the hoist winch at the same time.

Result:
– The guy rods are tensioned, see illustration **4**.

▶ Remove the auxiliary crane.

WARNING
Assembly with turned on set up key!
When the set up key is engaged, the LICCON overload protection is exceeded!
In the event of deliberate improper use, the crane could collapse, the boom can break off or the crane can topple over!
Personnel can be severely injured or killed!
This could result in high property damage!
- ▶ The set up key **D** may only be actuated by persons who know the effects of a bypass!
- ▶ Press the set up key **D** only when the set up status was correctly entered into the LICCON computer system!
- ▶ Observe the erection / take down charts!
- ▶ Crane operation with the set up key **D** turned on is strictly prohibited!

▶ When the SLK-boom has reached the “lowest” operating position:
Turn the set up key **D** to the right.

Result:
– The LICCON overload protection is deactivated.
– The assembly icon **11** appears on the LICCON monitor.

▶ Luff the K-lattice jib down until an angle of approximately 70° is reached between the SL-boom and the K-lattice jib, illustration **2**.

NOTICE
Release of K-lattice jib!
- ▶ The release to luff down the K-lattice jib is given when the SL-boom is luffed down to 70° to the horizontal!
- ▶ At a SL-boom angle of more than 72°, the winch 5 **W V** cannot be spooled out any longer and the K-lattice jib cannot be luffed down!

NOTICE
Collision of hook block!
- ▶ When luffing down the boom system, the hoist winch must be spooled out at the same time to prevent a collision of the hook block with the pulley head of the boom nose 120 t **50**!

- ▶ At the same time, spool the hoist winch out and continue to luff the SLK-boom down until the hook block touches the ground.
- ▶ Disassemble hoisting limit switch weight.
- ▶ Unreeve the hook block.

1 Heating the crane operator's cab

The cab can be heated with two heaters, which are independent of each other:
– Engine-dependent heater.
– Engine-independent auxiliary heater, for outside temperatures of up to -40 °C, WEBASTO; Thermo 90 S.*

The individual adjustment of the heater (for both engine-dependent and engine-independent auxiliary heaters*) is carried out with the control elements under the crane operator's seat as well as via switches and indicator lights on the instrument panel.

NOTICE
Risk of damage to the heater control units* when carrying out electrical welding work on the crane!
▶ Disconnect the negative and positive cables from the batteries and connect the positive cables to the vehicle ground.

1.1 Heater operation

1.1.1 Adjusting the temperature

The cab is heated with the engine coolant.
▶ Set the knob **16**.

1.1.2 Adjusting the ventilation

▶ Set the blower with the 3-stage rotary switch **15**.

Result:
– The air volume will be regulated.

1.1.3 Adjusting the recirculated air / fresh air

▶ Actuate the changeover switch **14**.

3 Emergency operation of slewing gear(s) with assembly plate Variation 1 (V1)

WARNING
Danger due to hydraulic pressure!
If the hydraulic lines are pressurized when releasing the connections, it can lead to severe injuries to assembly personnel!
▶ Relieve the pressure in the hydraulic lines before releasing!

Note
▶ For each crane type, the installation position of the ball valves for emergency operation of the slewing gear on the turntable varies!
▶ Possible installation positions of the ball valve: Point **X** or point **Y**!

3.1 Establishing the hydraulic connection to the slewing gears

Make sure that the following prerequisite is met:
– The pressure in the hydraulic system has been relieved.

Note
▶ Observe the numbering of the hydraulic lines!

▶ Establish the hydraulic connections of the assembly plate **6** (connection **1**, connection **2** and brake **3**) to the “Ball valves” on the turntable.

3.2 Turning the turntable to the left

▶ Set the ball valve **9** into emergency operation position.
▶ Set the ball valve **10** into emergency operation position.
▶ Set the ball valve **11** into emergency operation position.
▶ Set the ball valve **6.2** for the assembly plate **6** on “turn left”.
▶ Move the manual lever **6.1** carefully.

Result:
– The turntable turns to the left.

6.1.2 Spooling the winch out

▶ See section: “Emergency operation with assembly plate Variation 1 (V1)”

or

■ See section: “Emergency operation with assembly plate Variation 2 (V2)”

6.1.3 Spooling the winch up

▶ See section: “Emergency operation with assembly plate Variation 1 (V1)”

or

■ See section: “Emergency operation with assembly plate Variation 2 (V2)”

6.2 Disconnecting the hydraulic connections

Make sure that the following prerequisites are met:

– The emergency operation is completed.
– The pressure in the hydraulic system has been relieved.

▶ Disconnect the hydraulic connections from the winch 4 to the assembly plate.
▶ Remove the reducer sections (adapter).
▶ Close off the hydraulic connections of the winch 4 **W IV** with dust caps.

or

■ Reconnect the winch 4 **W IV** onto the hydraulic system of the crane.
▶ Disconnect the hydraulic hose **354** at point **P3**.
▶ Bring the hydraulic hose **354** in parking position: Install the fitting **354.1** onto the plug **188**.

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1 Servicing the travel gear

Note
- ▶ Use service items and lubricants according to the chart, see Crane operating instructions, chapter 7.07!
- ▶ Observe the maintenance intervals, see Crane operating instructions, chapter 7.02!

The travel gear consists of:
– Miter gear with brake, illustration **1**
– Planetary gear, illustration **2**

WARNING
Danger of burns during maintenance and inspection work!
Severe burns can results due to the travel gear and oils at operating temperatures!
- ▶ Avoid direct body contact to heated components and fluids!

NOTICE
Dirt in travel gear!
If any dirt gets into the inside of the travel gear, gear damage can occur!
- ▶ Make sure that no dirt gets into the inside of the travel gear during maintenance work!

The following maintenance openings are on the miter gear with brake, see fig. **1**:

1 Oil filler plug, oil filler port
2 Oil level plug, oil level port
3 Oil drain plug, oil drain port
4 Grease lubrication miter gear

The following maintenance openings are on the planetary gear, see fig. **2**:

5 Oil level plug, oil level port
6 Oil drain plug, oil drain port
7 Grease lubrication planetary gear

Note
- ▶ No separate oil filler port is located on the planetary gear, the oil level port is used for this purpose!
- ▶ Oil level ports on planetary gears and miter gears can be constructed differently!
- ▶ The planetary gear and the miter gear have separate, different sized oil chambers! The oil levels in gears must be checked independently of each other!

3.2 Checking wear on the track chain

WARNING
Track chain can be ripped off!
If the wear limit on the track pads **21**, bolts **22** or track rollers **23** is exceeded, then the track chain can break off during crawler operation!
The crane can topple over and personnel can be severely injured or killed!
- ▶ Random checks of the track pads **21**, bolts **22** and track rollers **23** must be carried out within the specified intervals!
- ▶ During the random inspection of the track rollers, the first and last track roller on the crawler carrier must be included in the inspection!
- ▶ If a wear limit on the component is reached, then the component must be replaced or remachined!

NOTICE
Significant wear of crawler travel gear!
If an individual track pad **21** must be replaced then it may not be replaced with a track pad **21** which shows a much lower degree of wear!
Significant height differences between the individual track pads **21**, see illustration **Y2**, lead to an increased mechanical stress on the track pads **21** and the track rollers **23** of the crawler carrier!
- ▶ Replace a defective track pad **21** with a track pad **21** which shows a similar degree of wear, see illustration **Y3**!

Note
- ▶ Due to the break-in period of the components toward each other, a larger stretch of the track chains occurs on a new crawler travel gear. For that reason, it may be necessary to remove a track pad **21** earlier to be able to tension the track chain correctly!

The wear of the track pad **21**, bolts **22** and track rollers **23** depends a various factors:
- – Length of travel route
- – Frequency of driving in curves
- – Friction ratios track pad **21** - ground
- – Evenness of the ground
- – Type of ground
- – Load bearing capacity of the ground / base
- – Position of the total center of gravity
- – Load on the hook
- – Placed ballast on the crane

5 Hydraulic system

When adding oil, observe utmost cleanliness.

5.1 Hydraulic oil tank / auxiliary oil tank*

5.1.1 Checking the oil level

NOTICE
Damage to the hydraulic oil tank!
If the hydraulic cylinders are not completely retracted when checking the oil level, there is a danger of overfilling!
When retracting the hydraulic cylinders, excess oil is discharged via the tank breather!
If the hydraulic cylinders are retracted too quickly, the hydraulic oil tank can be destroyed!
▶ Make sure that all hydraulic cylinders are completely retracted before checking the oil!

Make sure that the following prerequisites are met:
– The crane is in horizontal position.
– All hydraulic cylinders are fully retracted.

The oil level must be in the center of the oil level sight gauge **3**.
▶ Check the oil level on the oil level sight gauge **3** of hydraulic oil tanks.

Troubleshooting
No oil is visible in the oil level sight gauge **3**?
▶ Add oil as specified in the lubrication chart with a fine mesh filter until the oil level on the hydraulic oil tank **1** is visible in the center of the oil level sight gauges **3**.

Note
▶ After adding oil, wait for approx. two minutes until the oil is distributed evenly in the hydraulic oil tank **1** and in the auxiliary oil tank **2**!
▶ If necessary, check oil level again!

5.1.2 Checking the vent / breather filter

▶ Open the cover on the hydraulic oil tank **1** and on the auxiliary oil tank **2** with the turn lock.
▶ Check the filter **4** for impurities (visual inspection).
▶ In the event of heavy contamination:
Replace the filter **4**.
▶ Close the cover with the turn lock again.

10 Slewing gear

Maintain utmost cleanliness during all work to prevent any dirt from entering the inside of the gear.

10.1 Checking the oil level

Make sure that the following prerequisites are met:
- The crane is in horizontal position.
- The slewing gear is inactive.
- The slewing gear is warm.

Note
▶ The oil level must be in the center of the oil level sight gauge **3**!

▶ Check the oil level on the oil level sight gauge **3**.

NOTICE
Danger of gear damage!
If the oil level on the oil level sight has dropped to the point that it is no longer recognizable, then oil as specified on the lubrication chart must be added until the oil level is again in the center of the oil level sight gauge!
▶ Add oil and check again!

▶ Check the oil level on the oil level sight gauge **3**.

10.2 Changing the oil

Make sure that the following prerequisites are met:
- The crane is in horizontal position.
- The slewing gear is inactive.
- The gear is warm.

▶ Remove the oil filler plug / breather screw **1**.
▶ Remove the oil drain plug **2** with the seal ring and drain the oil.
▶ Clean the oil drain plug **2** and sealing surface on the housing.
▶ Install the oil drain plug **2** with new seal ring and tighten.
▶ Add oil as specified on the lubrication chart on the oil filler port **1** until the oil is in the center of the oil level sight gauge **3**.
▶ Install the oil filler plug / breather screw **1**.
▶ Check the oil level as described above.

1.1 Overview of displays and component groups for error diagnostics

Various displays and component groups allow the crane driver:
- To localize errors.
- To prepare quicker and more precise communication with Liebherr Service.
- To diagnose and remedy errors with the help of the “Diagnostics operating instructions”.

Note

▶ If separate Operating instructions have been provided by the supplier as part of the scope of delivery for the crane, then it must be observed!

Position	Crane operator's cab 1
2	LICCON monitor
2.1	LED-display power supply LICCON monitor
3	Ignition switch
4	Indicator light Engine preheating (heat flange)
5	Warning light Charge control
6	Warning light engine error (only LR 1400/2)
7	EMERGENCY STOP switch in crane operator's cab
8	Fuses (Installation location: in the side console - illustration exemplary)

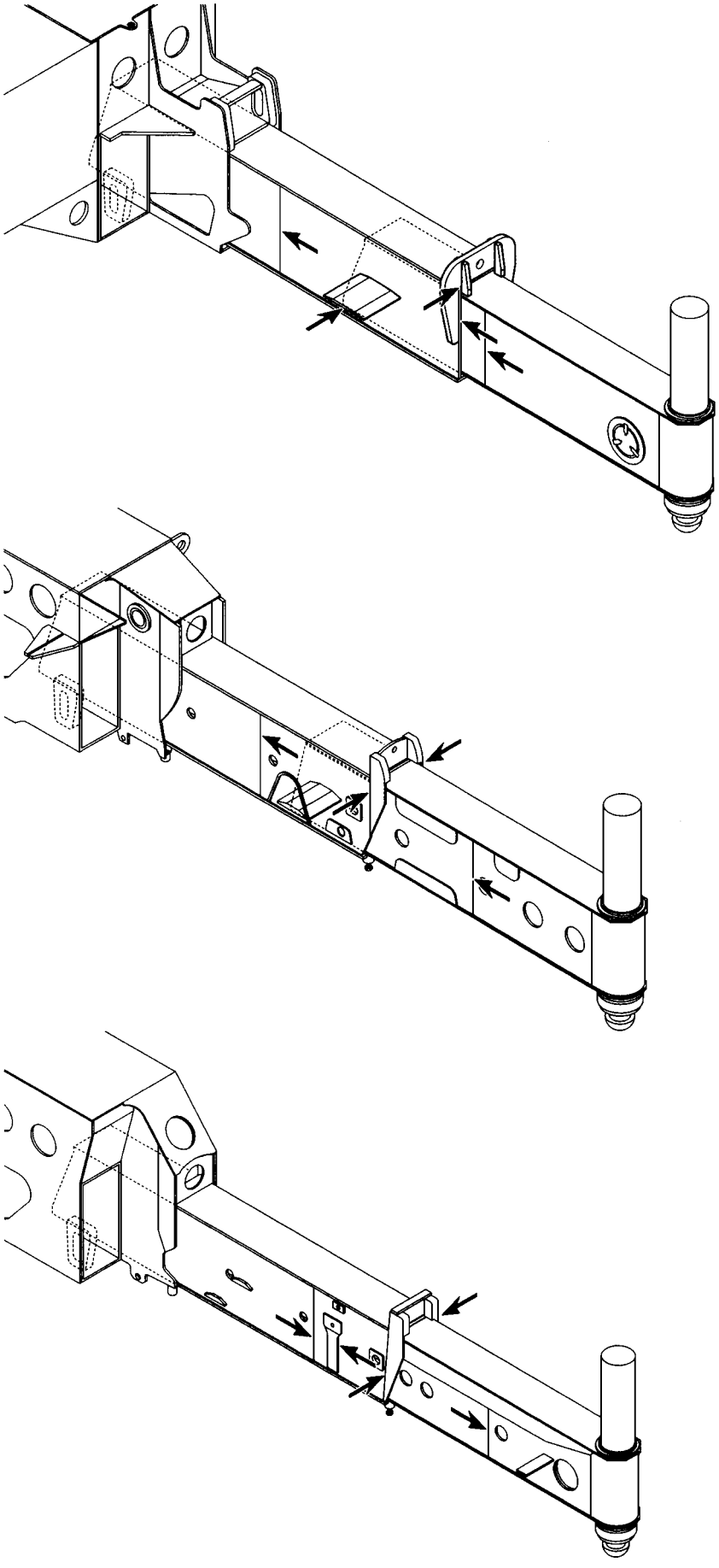
Position	Switch cabinet 10
EA	I / O module
15	LED display I / O module
NT	Power supply
CPU-5	CPU 0 to 5
20	LED display power supply
25–30	LED displays CPU0 to CPU5
40	Fuses Switch cabinet (illustration exemplary)

- ▶ The bypass of the overload protection is only permitted in emergency cases!
- ▶ The bypass may only be carried out by persons who are aware of the effects of their acts regarding the bypass of the overload protection!
- ▶ Bypassing the overload protection requires the presence of an authorized person and must be performed with utmost caution!
- ▶ Missing values must be monitored manually and must match the load chart.
- ▶ Crane operation with bypassed overload protection is prohibited!

WARNING
Bypassed overload protection!
If the overload protection is bypassed, crane movements are no longer monitored!
The crane can be overloaded and collapse!
Personnel can be killed or seriously injured!
This could result in property damage!
- ▶ Only carry out crane movements within the range of the load chart as well as the erection / take down charts!

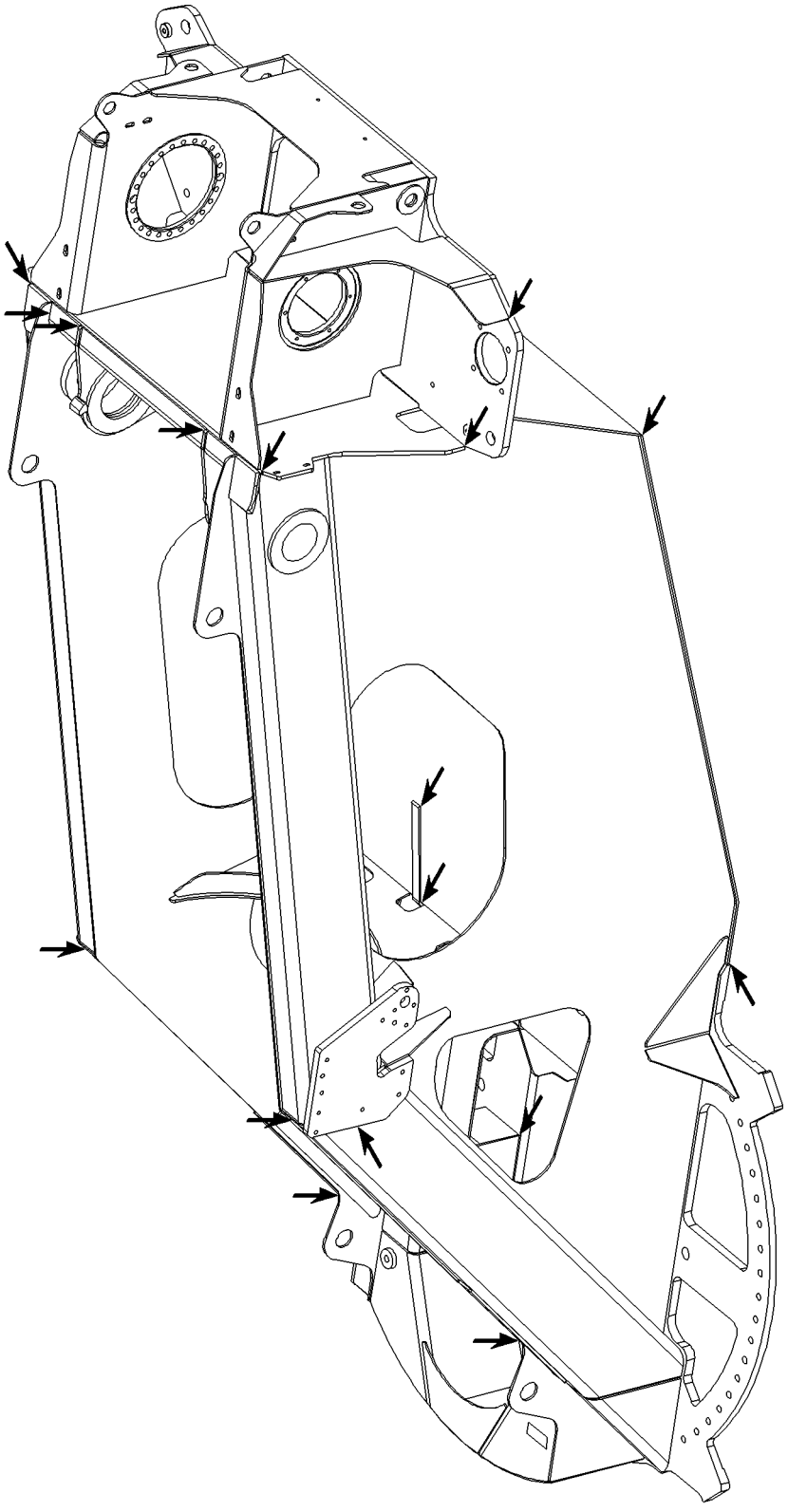
As a rule, all specifications in the load chart must be adhered to strictly:
- – The exact weight of the load, including load suspension equipment, must be known.
- – The boom status and the boom geometry must be known.
- – The boom length and boom radius must be measured manually.
- – All values must match the values in the respective load chart.

Note
- ▶ Depending on the configuration of the crane, the overload protection of the crane is bypassed various ways, see the following sections.

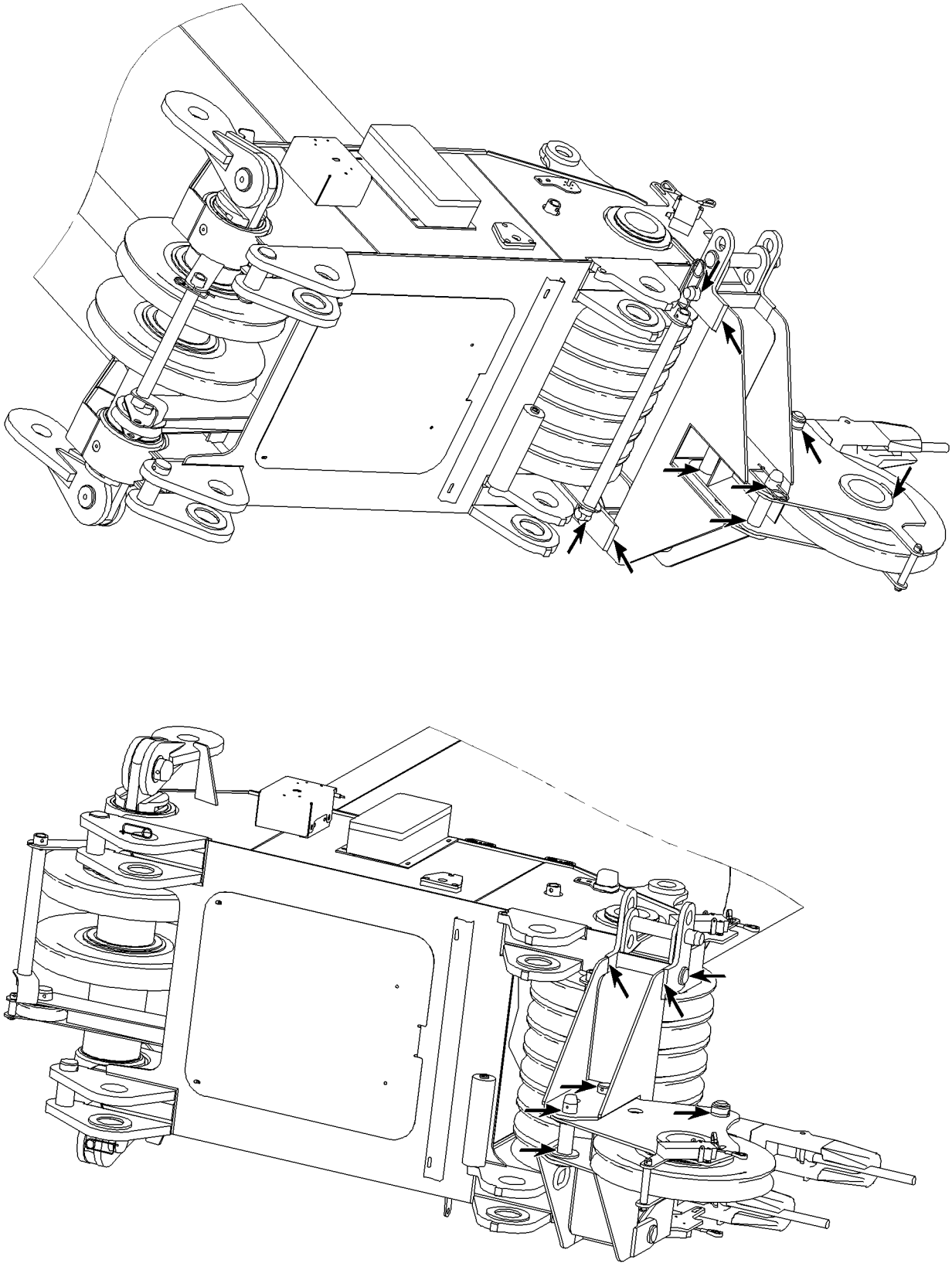


B185047

Example for sliding beam



B105701 *Example for turntable frame*



B105892 *Example for boom nose*

3 Inspection of tires and disk wheels

3.1 Inspection of tires

WARNING
Risk of accident if incorrect tires are used!
The use of improper tires and tires which do **not** meet the license permits may result in serious accidents with fatal injuries!
- ▶ Only tire types and sizes approved for this crane may be assembled on the crane.
- ▶ Regularly check the tires for damage, tread depth, foreign particles and tire pressures!
- ▶ Carefully remove any foreign particles stuck or wedged in the tire tread before starting to travel (for example: rocks)!

The tread depth of the tire may not fall below the legally specified minimum value.
- – Check the tread depth.
- – Check the tires for damage.
- – Make sure that the tire **3** is correctly seated on the disk wheel **1**. The tire bead must touch the inside and outside of the disk wheel evenly.

WARNING
Risk of fatal injury if the lock ring **2** is not properly seated!
Personnel can be severely injured or killed due to an incorrectly assembled lock ring **2**!
- ▶ Check to ensure that the lock ring is correctly seated!
- ▶ Consult with authorized and trained specialists if there is any doubt whether a lock ring **2** has been correctly assembled!

Indications of an incorrectly installed lock ring are present if:
- – The lock ring **2** is not completely seated with its entire circumference in the groove (point **X**) of the disk wheel, see illustration **A**.
- – The gap of the installed lock ring **2** is outside the permissible tolerance range of 3 mm to 12 mm.

3.2 Inspection of tire pressure

Make sure that the following prerequisites are met:
- – The tire **3** is correctly seated on the disk wheel.
- – The lock ring **2** correctly sits in the groove (point **X**) on the disk wheel, see illustration **A**.
- – The gap on the lock ring **2** is between 3 mm and 12 mm.

WARNING
Danger of fatal injury!
When checking the tire inflation pressure on the vehicle or after assembling tires, make sure that the lock ring **2** is correctly installed on the disk wheel.
If the tire pressure has dropped below 3 bar and the tires are improperly inflated, there is a risk of fatal injury if the lock ring **2** jumps off explosively.
- ▶ If the tire pressure is below 3 bar, the tire may only be inflated by authorized and trained specialists!
- ▶ If the lock ring **2** is not correctly seated on the disk wheel, it is essential that authorized and trained personnel are called in. Do **not** attempt to change the tire pressure yourself!
- ▶ Adhere to the specified tire pressure!

The tire pressure may not exceed or fall below the permitted range, otherwise the body of the tire could be damaged and tire failure may occur.

8.1.1 Retaining ropes on telescopic booms, illustration 1

The rope pretension is 800 N, if a sag (f) according to the chart is present on the retaining rope according to the rope length (L).

Rope pretension is 800 N if:					
Rope length (L)	1.0 m	1.5 m	2.0 m	2.5 m	3.5 m
Deflection (f)	15 mm	25 mm	30 mm	40 mm	55 mm

Rope pretension is 800 N if:					
Rope length (L)	5.5 m	7.5 m	9.5 m	11.5 m	13.5 m
Deflection (f)	85 mm	115 mm	145 mm	180 mm	215 mm

8.1.2 Retaining ropes on lattice sections, illustration 2

The rope pretension is 800 N, if a sag (f) according to the chart is present on the retaining rope according to the rope length (L).

Rope pretension is 800 N if:					
Rope length (L)	1.0 m	1.5 m	2.0 m	2.5 m	3.5 m
Deflection (f)	0	1 mm	2 mm	3 mm	6 mm

Rope pretension is 800 N if:					
Rope length (L)	5.5 m	7.5 m	9.5 m	11.5 m	13.5 m
Deflection (f)	15 mm	28 mm	45 mm	66 mm	90 mm

9 Inspection of membrane accumulator

Note

▶ The national regulations for pressurized container inspection must be observed!

The inspection of the membrane accumulators for specified gas pressure must be carried out by authorized and trained expert personnel, see Crane operating instructions, chapter 7.04, 7.05.