LIEBHERR

Crawler crane with lattice mast

LR 1600/2

LR 1600-2-002

Operating instructions

BAL-No.: 18102-05-02

Pages: 1807

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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2.5 SDWBW/B // SDWVB/BW-boom combinations

S	Main boom	• Heavy version
D	Derrick boom	• Alone as assembly device or in connection with SD or SLD
W	Luffing jib	• Heavy version
V	Fixed jib	• Heavy version
B	Suspended ballast	• Derrick ballast
BW	Ballast trailer	• Derrick ballast

1.13 S-pivot section 10 m

See illustration **12**.

Component	Weight	Width
S-pivot section complete[1)]	25.5 t	3.0 m
S-pivot section complete[2)]	(26.5 t)	3.0 m
S-pivot section	11.8 t	
S-relapse retainer	1.1 t	
Winch 5 with rope	7.5 t	
Winch 6 with rope (rope diameter 25 mm)	4.6 t	
Winch 6 with rope (rope diameter 28 mm)	(5.6 t)	
Rods WA-frame	0.5 t	

1) Winch 6 with rope (rope diameter 25 mm)
2) Winch 6 with rope (rope diameter 28 mm)

1.14 S-intermediate section 6.0 m, 2825.20

See illustration **13**.

Component	Weight	Width
S-intermediate section without guy rods	3.7 t	3.0 m
S-intermediate section with S-guy rods	4.1 t	3.0 m
S-intermediate section with S- and W-guy rods	4.6 t	3.0 m

1.15 S-intermediate section 12.0 m, 2825.20

See illustration **14**.

Component	Weight	Width
S-intermediate section without guy rods	6.5 t	3.0 m
S-intermediate section with S-guy rods	7.4 t	3.0 m
S-intermediate section with S- and W-guy rods	8.3 t	3.0 m

1.47 Ballast trailer with wheel drive

See illustration **46**.

Component	Weight	Width
Ballast trailer with wheel drive	50.0 t	2.9 m

1.48 Guide with adapter complete, for ballast trailer

See illustration **47**.

Component	Weight	Width
Guide with adapter complete, for ballast trailer	15.9 t	3.0 m

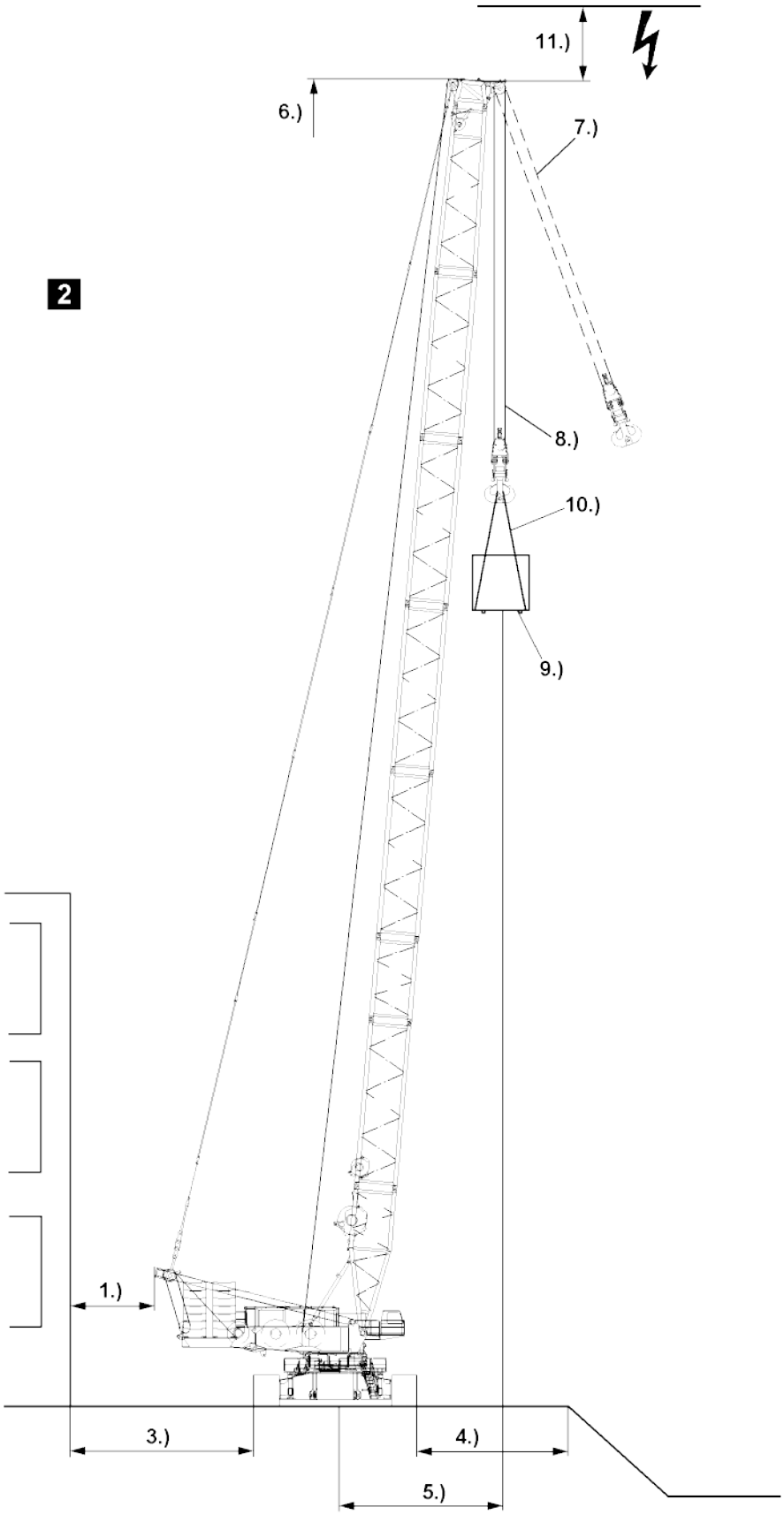
2 Emergency exit

2.1 Emergency exit - driver's cab

The driver's cab can be exited through the “left driver's door” or the “right passenger door”, see illustration **1**.

Note

▶ Exit the driver's cab through the “left driver's door” or the “right passenger door”, see illustration **1**: Pull and open the door handle **10** on the “left driver's door” or the “right passenger door”.



B104102 *Example for crawler crane with lattice mast boom*

Beaufort number	**3**	**4**	**5[a]**	**5**	**6**	**7[a]**	**7**	**8**	**9**	**10**
30	8.5	12.4	**15.8**	16.8	21.6	**22.4**	26.8	32.4	38.2	44.5
40	8.7	12.8	**16.3**	17.3	22.3	**23.1**	27.6	33.4	39.4	45.8
50	8.9	13.1	**16.7**	17.7	22.8	**23.6**	28.3	34.2	40.3	46.9
60	9.1	13.3	**17.0**	18.0	23.3	**24.1**	28.8	34.9	41.1	47.9
70	9.3	13.5	**17.3**	18.3	23.6	**24.5**	29.3	35.5	41.8	48.7
80	9.4	13.7	**17.6**	18.6	24.0	**24.8**	29.7	36.0	42.4	49.4
90	9.5	13.9	**17.8**	18.8	24.3	**25.1**	30.1	36.4	42.9	50.0
100	9.6	14.1	**18.0**	19.1	24.6	**25.4**	30.4	36.9	43.4	50.6
110	9.7	14.2	**18.2**	19.2	24.8	**25.7**	30.8	37.2	43.9	51.1
120	9.8	14.3	**18.3**	19.4	25.1	**25.9**	31.1	37.6	44.3	51.6
130	9.9	14.5	**18.5**	19.6	25.3	**26.2**	31.3	37.9	44.7	52.0
140	10.0	14.6	**18.7**	19.8	25.5	**26.4**	31.6	38.2	45.1	52.5
150	10.0	14.7	**18.8**	19.9	25.7	**26.6**	31.8	38.5	45.4	52.9
160	10.1	14.8	**18.9**	20.1	25.9	**26.8**	32.1	38.8	45.7	53.2
170	10.2	14.9	**19.1**	20.2	26.0	**27.0**	32.3	39.1	46.0	53.6
180	10.3	15.0	**19.2**	20.3	26.2	**27.1**	32.5	39.3	46.3	53.9
190	10.3	15.1	**19.3**	20.4	26.4	**27.3**	32.7	39.5	46.6	54.2
200	10.4	15.2	**19.4**	20.6	26.5	**27.4**	32.8	39.8	46.9	54.6

[a] Wind stages for the crane in operation:

1 light	v_m = 10.1 m/s	at z = 10 m	v(z) = 14.1 m/s	q(z) = 125 N/m^2
2 normal	v_m = 14.3 m/s	at z = 10 m	v(z) = 20.0 m/s	q(z) = 250 N/m^2

[b] Upper limit of Beaufort scale

Sign [Unit]	**Definition**
v_m [m/s]	Wind speed determined over 10 minutes at a height of 10 m (Upper limit of Beaufort Scale)
z [m]	Height above level ground
v(z) [m/s]	Speed effective at height z, decisive for the calculation of a 3 second gust
q(z) [N/m^2]	At a height z effective quasi-static back pressure, determined from v(z)

24.2.2 Prerequisites for crane equipment and accessories

Make sure that the following prerequisites are met:

- Before lifting personnel, the crane was inspected. No damage was found!
- The lifting cage (cherry picker) is utilized according to national laws and / or standards and according to intended purpose!
- Before lifting personnel, the lifting cage (cherry picker) was carefully inspected. No damage was found!
- Every emergency rescue device was inspected and its operational readiness was determined, if required by national laws!
- Any hooks in use must be equipped with a latch, which prevents the hook mouth to open. According to national laws, the latch must be manually closable or lockable or must automatically close via a spring!

24.2.3 Inspection before operation

Make sure that the following inspections are made before use of the lifting cage (cherry picker):

- On every new construction site and after every modification or repair: To ensure the operating safety of the lifting cage (cherry picker) and the lifting equipment, a test with 125 % of the nominal load carrying capacity of the lifting cage (cherry picker) without personnel must be carried out! During the test, the lifting cage (cherry picker) may only be lifted just above the ground!
- A test lift with loaded lifting cage (cherry picker) without personnel must be carried out! The weight in the lifting cage (cherry picker) for the test lift must be at least as large as the weight of the personnel and the weight with the work equipment carried along! For this test lift, the course of all planned movements of the lifting procedure must be simulated!
- This test lift must be carried out for every location on a construction site, where personnel must be carried!

24.2.4 Prerequisites for operation with lifting cage (cherry picker)

Make sure that the following prerequisites are met for operation with lifting cage (cherry picker):

- The personnel and technical prerequisites for safe use and operation of the emergency control of the crane are present!
- The emergency control for emergency rescue of the person in the lifting cage is functioning!
- The rope pull is limited to 50 % of the maximum rope pull!
- The crane is utilized with 50 % of its maximum load capacity of the valid load chart!

25 Crane operation in case of thunderstorms

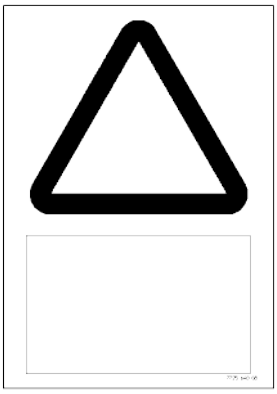
In weather conditions, which can include lightning:

- Stop work on the crane.
- If possible, place the load down.
- If possible, telescope the boom in or put it down and bring it into a safe condition.

If this is not possible, the crane cab must remain occupied by the crane operator to keep the crane and the load always under control.

WARNING
Danger of accidents due to lightning strikes!
▶ Make sure that there are no persons near the immediate area of the crane.

26 Safety notes for external power feed (100 V AC to 400 V AC)



Note

▶ Only for certain countries!

4 Fall arrest equipment on the crane superstructure

WARNING
When working aloft, there is a danger of falling!
If fall protection equipment (railings) is intended for winches, for example, or assembly units, then it must be properly assembled and secured!
▶ Properly assemble and secure all fall arrest equipment, such as catwalks, pedestals, ladders and railings on the crane superstructure!

Retaining elements for a railing **3**, see detail **X**:
– A pin **9** and a spring retainer **10** are installed with a rope on the railing **3**.
– A pin **9** and a spring retainer **10** are installed with a rope on the pedestal **5**.

4.1 Assembling pedestals and ladder

WARNING
Risk of falling!
Before any assembly / disassembly work, maintenance and inspections, the assembly personnel must wear approved fall arrest systems!
During assembly and disassembly, personnel must be secured with appropriate aids to prevent them from falling!
If this is not observed, assembly personnel could fall and suffer life-threatening or fatal injuries!
▶ For assembly / disassembly work, maintenance work and inspections, install all railings **3**, railings **20**, ladder **20**, pedestals **5** properly, swing into horizontal position and secure!
▶ Step on ladders only with “clean shoes”!
▶ Keep ladders clean and free of snow and ice!
▶ Replace damaged ladders immediately!
▶ Set up all ladders stable and safe to access!

▶ Fold all pedestals **5** horizontally and swing the supports **6** on retainers **7**, see illustration **1**.
▶ Pin all supports **6** on retainer **7**: Insert the pins **8** and secure with linch pins **16**.
▶ Unpin the pedestal **20** and fold into horizontal position.
▶ Pin the ladder **4** on the pedestal **20**: Insert the pins **40** and secure with spring retainers **41**.

4.2 Assembling the railings

▶ Insert the railing **3** in the pedestals **5**, see illustration **1**.
▶ Pin the railings **3** with pins **9** on the pedestals **5** and secure with spring retainers **10**.
▶ Insert both railings **1** on top on the turntable into the bores **18** and secure with linch pins **19**, illustration **2**.
▶ Pin both railings **1** on points **P1** with pins **11** and secure with linch pins **17**.

3 Installing the assembly supports

Make sure that the following prerequisites are met:
– an auxiliary crane with sufficient load carrying capacity is available,
– the placement location must be level and have adequate load-bearing capacity

3.1 Supporting the crawler center section

WARNING
Risk of accidents due to improper support!
If the crawler center section is not properly supported from below, it 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 chapter 2.04 in the crane operating instructions!

Ensure that the following prerequisite is met:
– suitable material must be available for the supporting base of the crawler center section

Note
▶ The supporting base **28** must be high enough so that the support pads **14** with supporting base **17** fit under the vertically positioned hydraulic cylinders **7**.
▶ Support the crawler center section **2** with hardwood timbers (or other suitable materials) from below!

▶ Attach the tackle on the four attachment brackets **A**.
▶ Lift the crawler center section **2** with the auxiliary crane and set it onto the support **28**.

4.2.2 Preparing the crawler carrier for disassembly

Note
▶ Attach **two** chains **15** per crawler carrier side!

The track pads **25** must be secured before removal of the crawler carriers with the chains **15** to prevent sag.
▶ Hang in the chains **15** with the bars **16** on the track pads.

Note
▶ The lugs **17** must be swung between the track pads **25**, “upward”!

▶ Swing the lugs **17** upwards.

4.2.3 Lift the crawler track

WARNING
Risk of accidents due to improper support!
If the assembly support is not properly supported from below, it can sink into the ground and severely injure personnel!
▶ The supporting base must take on the weight of the crawler center section safely!
▶ The supporting base must be made large enough for the ground conditions, with solid materials, such as wood, steel or concrete slabs, see chapter 2.04 in the crane operating instructions!

Make sure that the following prerequisites are met:
– the ball cock is set to “assembly support”,
– the hydraulic aggregate of the pin pulling device is turned on.

▶ Establish the hydraulic connections from the hydraulic aggregate of the pin pulling device to the hydraulic cylinders **7**.

Note
▶ Lift the crawler travel gear so that the crawler carriers can be removed without restriction!
▶ Move the hydraulic cylinders out evenly!

▶ Actuate the hand lever **H1**, hand lever **H2**, hand lever **H3** and hand lever **H4**.

Result:
– The four hydraulic cylinders **7** move out.

Removing the first crawler carrier

WARNING
Risk of accidents due to improper support!
If the assembly support is not properly supported from below, it can sink into the ground and severely injure personnel!
- ▶ The supporting base must take on the weight of the crawler center section safely!
- ▶ The supporting base must be made large enough for the ground conditions, with solid materials, such as wood, steel or concrete slabs, see chapter 2.04 in the crane operating instructions!

- ▶ Lift the first crawler carrier off the ground: Move the support cylinder **21** in until the angle between ground and crawler centre section is approx. 1.4°, see illustration **14**.
- ▶ Luff the SA-frame **2** down until the assembly cylinder **1** is centered above the crawler carrier **9**.

Note
- ▶ The assembly cylinder **1** may not be moved out all the way!
- ▶ If the assembly cylinder **1** is moved out all the way and the limit switch position is reached, an error display appears on the LICCON monitor and the LML-Stop!

- ▶ Move the assembly cylinder **1** out: Actuate master switch 2.
- ▶ Pin the attachment ropes **7** on the assembly device **6** and secure with linch pins, see illustration **13**.

NOTICE
Pin is not released!
If the pin **15** is secured with the retaining pin when unpinning it, the pin pulling device can be damaged!
- ▶ Secure the retaining pin **13** before unpinning in “up” position with spring retainer, see illustration **15**!

- ▶ Hang in the pin pulling cylinder on the screw **16** and retainer **17**.
- ▶ Unpin the pin **15** with the pin pulling cylinder.
- ▶ Hang in the pin pulling cylinder on the screw **16** and retainer **17**.
- ▶ Unpin the pins **15** with the pin pulling cylinder on the pin points **i**.
- ▶ Remove the pin pulling cylinder.
- ▶ Move the assembly cylinder **1** in until the fastening ropes **7** are tensioned: Actuate master switch 2.
- ▶ Lift the crawler carrier **9** with the assembly cylinder **1** and unhook on point **h**: Slowly move the assembly cylinder **1** in with master switch 2.
- ▶ Luff the SA-frame **2** carefully up and place the crawler carrier **9** on the transport device.
- ▶ Release the fastening ropes **7** from the lugs **8** on the crawler carrier **9**.

NOTICE
Damage to the lugs **8**!
- ▶ After removing the attachment equipment, the lugs **8** must be swung down!

- ▶ Swing the lugs **8** down.

1 Components

For the central ballast on the crawler center section **1**, the following components are required:
Central ballast plates **2**
Consoles central ballast **3**

1.1 Central ballast plates

Note
▶ The central ballast plates **2** and the consoles **3** are marked with their own weight.

Component	Weight
Central ballast plate **2**	7.5 t 10.0 t

1.2 Consoles central ballast

Component	Weight
Console central ballast **3**	2.5 t

5.1 Removing the central ballast plates

Note
- ▶ It is permissible to remove the consoles **3** under certain prerequisites with placed central ballast plates **2**!
- ▶ Observe section “Removing the consoles with placed central ballast plates” in this chapter!

5.1.1 Removing the central ballast plates, attachment system: “Twist lock”

WARNING
Overload of receptacle stud and central ballast plates!
If more than the permissible number of central ballast plates **2** are lifted with the receptacle stud **8**, the receptacle stud **8** and the central ballast plates **2** can be overloaded and damaged!
Central ballast plates **2** can fall down!
Personnel can be severely injured or killed!
- ▶ Observe the chart “Permissible central ballast assemblies” in this chapter!

WARNING
Damage of receptacle stud and central ballast plates!
If two central ballast plates **2** are lifted which do not lay correctly in their centerings, the receptacle stud **8** and the central ballast plates **2** can be damaged!
Damage can cause the central ballast plates **2** to fall down!
Personnel can be severely injured or killed!
- ▶ Make sure that the central ballast plates **2** to be lifted are placed correctly in the centerings!

WARNING
Twist lock system opens by itself!
If the receptacle stud **8** is not correctly locked, the Twist lock system can open by itself!
Central ballast plates **2** can fall down!
Personnel can be severely injured or killed!
- ▶ Make sure, when initiating a lift, that the lever **8.3** points directly on the symbol “Locked” **2.1** of the central ballast plates **2**!

Note
- ▶ During a lift, the locked Twist lock system cannot release by itself due to its gravitational retention!
- ▶ During a lift, the locked Twist lock system cannot be released by hand due to its gravitational retention!

3.3 Pin intake gear winch 4 on turntable

- Connect intake gear winch 4 **3** with turntable **10**: Pin locking pin **41** on the pinning points **k** and secure with spring retainers.
- Separate intake gear winch 4 **3** from SA-frame **1**: Remove spring retainers on the pinning points **i** and unpin locking pins **40**.
- Secure the locking pins **40** on both sides with spring retainers in the parking positions **h**.

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 Operating units in the cab

The following operating units are in the cab:

340 Monitors and displays
341 Operating and control unit
- BKE
342 Instrument panel
343 Control panel
344 Pedal carrier

3.4.1 Operating elements on control consoles

Control console, left

Master switch assignment MS 2:

460	Master switch left (MS 2)	• **Note:** For assignment of master switch to operating modes, see chart, chapter 4.05.
461	Button	• Bypass of the seat contact switch. **or** if the seat contact switch is actuated: Addition of the vibration sensor **462**.
462	Vibration sensor	• Turn sensor and winches
463	Button	• Engine rpm lock **Note:** By pressing the button **463** the engine rpm is locked in the current state.
464	Button	• Horn
465	Button	• Power Plus addition, crane operation

Instruments in the control console:

470	Instruments in the control console	
471	Switch with indicator light	• Crawler rapid gear On / Off
472	Button	• Increase engine rpm
473	Button	• Decrease engine rpm
474	Switch with indicator light	• Turn slewing gear brake slewing gear off / on **Note:** Indicator light lights up when the slewing gear brake is “on”.
476	Button	• Bypassing of overload protection, used to luff up at overload **DANGER** **The bypass may only be used if the overload was caused by luffing down at freely suspended load and the crane operator is absolutely certain that luffing up the load will take it out of the overload range.**
477	Switch with indicator light	• Crawler operation On / Off
478	Switch with indicator light	• Crawler parallel driving On / Off

E	Special function keys	• Monitor brightness adjustment • Key combination **E3** and **E1**: Turn background illumination on / off. • Key combination **E3** and **E2**: Brightness adjustment in three stages. • **Note:** Additional functions of the special function keys are program-dependent and are further explained in the description of the individual LICCON programs!
F	Function keys	• The function keys should always be viewed in conjunction with the function key icon line displayed on the monitor
G	Display	• Display of the individual programs (example: Crane operation program)
H	SHIFT key	• Change over key • Second-level key assignments, for example “Supervisory function”
I	LED display	• Monitor supply voltage present

Note

- For crane operating modes without derrick ballast, the slewing range icon crane superstructure appears at **F6**!
- For crane operating modes with derrick ballast, the derrick ballast radius icon appears at **F6**!

F6 Slewing range crane superstructure	• Slewing range icon 360° - Slewing range crane superstructure not restricted, illustration **7**
or	
F6 Derrick ballast radius	• See illustration **8** • Set the set up configuration derrick ballast radius **yy** in [m] or [ft] • Set the set up status derrick ballast weight **zz** in [t] or [lbs]
or	
F6 Slewing range crane superstructure	• **Note (only narrow track crawler track, illustration 9**): • The crane superstructure may not be turned (operating mode dependent)
F7 Hoist rope reeving	• Adjustment possibility for the **number of hoist rope strands on the boom** to obtain a certain load carrying capacity • Press the key: Reeving number on boom is increased by 1.
SHIFT and **F7**	• Press the key combination SHIFT **H** and program key **F7**: Reeving number on boom is reduced by 1.

Note

- The displayed number of hoist rope strands (reeving) in the icon will be increased with every keystroke by one counter, up to a fixed maximum value (depending on operating mode)! If the maximum value is exceeded, the counter starts again at the minimum value!
- If the set value is still within the minimum and maximum values when switching to another operating mode, it remains valid! Otherwise it will be set to the minimum value for the new operating mode!
- After a “cold start” (for example loss of data in the memory), the display of the hoist rope reeving is at “0”!

Note

Parallel operation of hoist winches!

- For parallel operation of hoist winches (1**II** 2), when reeving in the hoist rope, enter the total reeving of winch 1 and winch 2 on the LICCON computer system!
- **Example**: Winch 1 and winch 2 are each reeved 7ways, the total reeving is therefore n=14!
- The total reeving **must** always show an even number value in parallel operation!

5.2.2 Assigning winch(es)

WARNING
The crane can topple over!
Due to incorrect settings during the winch assignment, dangerous operating situations can occur, up to toppling the crane!
Personnel can be severely injured or killed!
- ▶ At winch assignment of winch 1 and winch 2 in parallel operation (1 / 2), turn the switch **494** (parallel operation) in the control console on the right on!
- ▶ At winch assignment of winch 1 and winch 2 in single operation, turn the switch **494** in the control console on the right **off**!

Note
- ▶ The winch selector **2.11** is coupled to the selector arrow **2.10** and moves automatically into the same column as the selector arrow **2.10**. The winch selector **2.11** “jumps” automatically to the selected winch (black background)!
- ▶ The winch required for crane operation is selected by pressing the function key **F1** and the function key **F2**. This selection is confirmed by pressing the ENTER **C** key!
- ▶ A winch which is already assigned to another pulley head is ignored and passed over when the function key is pressed. The winch selector **2.11** jumps automatically to the next “free” winch!
- ▶ One winch can only be assigned to one pulley head!

Note
- ▶ For pulley heads, which are not assembled, **or** which are assembled but no winch is to be assigned to them, instead of a winch, the sign “no winch selected” **2.5** must be assigned!

Make sure that the following prerequisite is met:
– The desired pulley head is selected.

6.1.4 Radius

According to the set up configuration, the following changes:
– The illustration of the icon.
– The position of values in the icon, see sample illustration **1**!

4 “Boom radius” icon

4.1 Radius
- In [m] or [ft]
  Denotes the horizontal distance of the load hook from the center of rotation of the crane superstructure, measured on the ground! This also takes into account the boom flexation due to its own weight and the suspended weight of the load!
- **Note:**
  “? ? ? . ?” is shown if the value cannot be calculated / determined!
  An error message is issued, see Diagnostics manual!

4.2 Main boom angle
- In [°]
- Displayed is the medium value of the angle sensor in the main boom pivot section and the angle sensor in the main boom pulley head.
- **Note:**
  “? ? ? . ?” is shown if the value cannot be calculated / determined!
  An error message is issued, see Diagnostics manual!

Note
▶ Main boom angle **4.2** (angle α): The angle of the main boom to the placement surface of the crane!

6.2.4 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.
- **Note:**
  HES2 (HES2A + HES2B) must be present for all operating modes with auxiliary boom / accessory!
  HES1 (HES2A + HES2B) turn the same functions off as the remaining hoist limit switches!
- **Note:**
  HES3 must be present for all operating modes with boom nose*!
  HES3 turn the same functions off as the remaining hoist limit switches!

4.1 HES2

- Installation location HES2A: Auxiliary boom / accessory*
  Bus address: 27
- Installation location HES2B: Auxiliary boom / accessory*
  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!

6.4.3 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 no value can be determined for a wind sensor which must be present, then current wind speed **2.2** “???” appears in the display!
- ▶ If a wind sensor does not have to be present and is not plugged in, then there is no display in the “Wind speed” icon **2**!

2.2.1 Current wind speed
- Wind sensor 2
- Wind sensor 3
- **Note:**
  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!

2.2.2 Current wind speed
- Wind sensor 1
- **Note:**
  If several wind sensors are attached on the LSB bus, then 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**.

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!
- ▶ Remedy the error immediately!
- ▶ If an error cannot be remedied, then it must be ensured that the wind speed is monitored otherwise!

6.6 The function key line in the Crane operation program

The function key line consists of function keys **F1** to **F8** and the function key icon bar above it. The function keys correspond to the various function key icons above them.
The function key icons may trigger a function or they change their appearance upon the push of a key (function keys) and thereby their definition.
Not all function keys have icons assigned to them. This depends on the “active” program selection.
Pressing a function key changes the appearance of the icon above, its meaning, or its textual content.

F1 Function key
- Zero point for hook path display, winch 2
- Pressing the function key **F1** causes the “Set winch display to zero” icon to appear, i.e. the winch 2 hook path display in the winch icon above is set to “000.00” when the key is pressed. The path measurement begins here.

F2 Function key
- Zero point for hook path display, winch 1
- Pressing the function key **F2** causes the “Set winch display to zero” icon to appear, i.e. the winch 1 hook path display in the winch icon above is set to “000.00” when the key is pressed. The path measurement begins here.
- **Note:**
  When winch 1 and winch 2 work in parallel operation, then the lengths displays of winch 1 and winch 2 can only be set together with the function key **F1** to “000.00”!
  Then the function key **F2** has no function, see illustration **1**!

F3 Function key
- Turn monitoring icons on / off
- The function key **F3** can be used to turn all the monitored auxiliary functions in the crane on or off.
- The appearance of the icon changes according to the status:
  - “Thick border” = auxiliary function icons turned off
  - “Thin border” = auxiliary function icons turned on
- **Note:**

F4 Function key
- Change monitoring page (if present)
  see also section “Monitored auxiliary functions for crane operation”

Note
- ▶ The monitoring of all auxiliary functions is always active, even if the monitoring icons are hidden!
- ▶ When a monitored limit is exceeded, then an acoustic warning (horn) sounds and the respective icon is shown!

Position	Icons / display values	Type of display	Is shown
1.8	F1-Min-warning bar = Ratio $F1_{min\text{-}warning\ value}$ to $F1_{max\text{-}operation}$ ($F1_{min\text{-}warning\ value} = F1_{min} + \Delta_{F1}$) No display (0 percent) at: $F1_{max\text{-}operation} = 0$ **or** No value **or** $F1_{max\text{-}operation}$ = invalid	Dynamic	In operating modes with derrick ballast (DB/DBW) Δ_{F1} = 15 t for cranes with max- load smaller than 1000 t
1.9	F1-Min-Stop bar = Ratio $F1_{min}$ to $F1_{max\text{-}operation}$ 0 percent [%] for: $F1_{max\text{-}operation} = 0$ **or** No value **or** $F1_{max\text{-}operation\ b}$ = invalid	Dynamic	In operating modes with derrick ballast (DB/DBW)
1.10	Measuring unit icon	Static	Always

8.6.2 Winch display

The winch 3 to 6 icons have the same meaning, which are explained for the “Winch 6” **10** icon.

Note

- If one of the winches is used as hoist winch according to the set operating mode (for example “winch 3” at derrick operation), then the **hook path** is shown in the winch icon. The value, which was tared by the corresponding function key is still shown unchanged, even after turning off and on or after an operating mode change!
- If one of the winches is used as a control winch, then **the current rope length on the winch drum** is shown, not the path of the hook block. Then taring is possible, but after turning on and off again or after an operating mode change, the original value “Rope length on the rope drum” is shown again!

Note

Display area winch displays!

- The “Completed path” display **1.1** has only three positions before the comma, any positions before that are cut off! The crane operator must evaluate for himself if, for example 200 m rope are spooled up on a winch or 1200 m. **The display in both cases would be identical with 200 m!**
- The hook path calculation only works accurately if the load is suspended freely and is not luffed during the lifting procedure! Not taken into account are flexation and rope expansion!
- The length display (hook path display) is only accurate and the layer jump is only taken into account correctly if the winch has been calibrated and no interruptions of the CPU power supply have occurred (cold start)!

Note

Error in winch path measurement!

- In case of an error in the winch path measurement, blinking “???” appear as display value **10.1**!
- If an error occurs and an error message is issued, see Diagnostics manual!

10 “Winch 6” icon

10.1	Completed hook path	• In [m] or [ft] From a zero point to be determined • **Note:** Is statically shown when the winch is calculated as **hoist winch** and a manually entered reeving must be assigned to this winch!

or

10.1	Rope length of the winch drum	• In [m] or [ft] • **Note:** Is statically shown when the winch is calculated as **control winch**!

9 The Control parameter program

The Control parameter program offers the following possibilities:
– Preselection of maximum slewing speed of slewing gear.
– Preselection of maximum rotation speed of individual winches.
– Activation / deactivation of individual winches.

During the Control parameter program, the exceedance of shut off limits of the LICCON overload protection may not be activated. Otherwise the system switches back immediately into the Crane operation program.

DANGER
Danger of accident!
▶ **Never** change the speeds or the activation / deactivation of the winches while actuating a crane movement!

9.1 Starting the program

▶ Press the program key **P6**.

10.2.3 Display current support forces

Note

▶ Display current support forces in crane operating screen, see “Monitored auxiliary functions for crane operation”!

The current support force values **4.5** are shown in the monitoring and control field **4**.

10.2.4 Remarks

Because of the option to determine limit values yourself, the LICCON support force monitoring can also be used as an advance warning device:

– Any trends in changes of the support forces during crane operation can be quickly recognized.
– Advance warning limits for the support forces can be individually programmed.

WARNING

Tolerances and erroneous operation of the support force monitoring

For technical reasons, a test deviation of up to ± 2% in relation to the maximum load capacity of the crane is possible!

If the support cylinders are moved on “block bottom” or “block top”, then the display of the support forces is erroneous!

▶ Make sure that there is no block position on the support cylinders!
▶ Take the tolerances in the display value into account!
▶ Take additional influences onto the tolerance field into account!

The tolerance field expands:

– In case of large support forces.
– In case of far extended support cylinders.
– When extending the support cylinders and up to 15 minutes afterwards.

13.2 Active stand-by operation / alarm

The operating programs and the monitor displays function exactly the same as in the turn-on procedure for the LICCON computer system with engine start (crane operation).

No crane movements are possible. If a crane movement is selected anyway, a message appears on the LICCON monitor.

Example: **Control turning shut off, the crane engine is not running.**

The duration of the stand-by operation is 15 minutes, of which 3 minutes are the stand-by alarm. Operating the LICCON computer system during stand-by operation automatically extends the stand-by time.

▶ In **Stand-by operation no** keys are pressed on the monitor.

Result:

– The stand-by alarm (horn) is reached after 12 minutes.
– This screen appears on the monitor: **STANDBY** (see illustration).

▶ Now press any key on the LICCON monitor.

Result:

– System switches back to the interrupted program.
– The stand-by time is extended by another 15 minutes.

▶ During the **stand-by alarm** (Duration: 3 minutes) **no** keys on the monitor are pressed.

Result:

– The LICCON computer system shuts completely off. The shut off is announced by acoustical signals 60 seconds in advance (short horn) and 30 seconds in advance (long horn). The power supply of the LICCON computer system turns off.
– This screen appears on the LICCON monitor: **CRT Selftest ERROR: Host Interface: Break!** (see illustration). This is not an error message from the LICCON computer system, the error message appears only on the monitor because the connection between the monitor and the CPU is broken.

13.3 Start prevention

Starting the engine again after complete shut down of the LICCON computer system:

▶ Return the ignition switch **402** first to position “0”.
▶ Turn the ignition switch **402** to position “I” (note the preheating time).
▶ Turn the ignition switch **402** briefly to position “II”.

Result:

– The engine starts.

3.3 Turning the heater and climate control on

The crane operator's cab can be heated or ventilated depending on the desired temperature, see Crane operating instructions, chapter 6.01.

3.4 Tilting the crane cab

To give the crane driver a better field of view, the cab can be tilted upward.

Note

▶ After ending crane operation: Set the cab to horizontal position

3.4.1 Tilting the cab upward

▶ Press the button **492**.

Result:

– The cab swings upward.

3.4.2 Setting the cab to horizontal position

▶ Press the button **493**.

Result:

– The cab swings downward.

6 Load weighing and load display

Included in the load capacities given in the load charts are the weights of the load carrier, load take up equipment and fastening equipment.

Note

- The weight of the hook block and the weights of the fastening equipment must be subtracted from the load given in the load chart.

Example:		
Maximum permissible load according to chart		200 t
Weight of the hook block	5t	- 5 t
Weight of the fastening rope	2t	- 2 t
Actual load capacity of the crane		= 193 t

In this case, the load to be lifted may not exceed **193 t** .

Note

- In the LMB calculation, the lever arm to the winch **2** is not used, but always the lever arm **L** to the winch **1**.
- For that reason, to ensure an exact load weighing to lift the load on the main boom and on the fixed accessories (for example the fixed jib), winch 1 must be used.

DANGER

Danger of accidents due to overload!

In case of inaccurate load weighing or load display, a danger exists due to unrecognized overload of the crane!

- The crane operator must know the weight, the center of gravity and the dimensions of the load to be lifted before operating the crane.
- The crane operator must check, before lifting the load, if he may even lift the load according to the data in the load chart.

10 Angle sensors

Component	Description - Angle sensor (WG)
S-pivot section	Main boom bottom
S/W-end section, if used on boom	Main boom top
S/W-end section, if used on luffing jib	Luffing jib up
W-pivot section	Luffing jib bottom
W-connector head	Main boom top
D-pivot section	Derrick bottom
D-end section	Derrick top
SA-frame	SA-frame

11 Test brackets (KMD = force test box)

The test brackets measure the force in the guying, which results from the load and the boom momentum.
The test brackets are located:

- **KMD 1**, in the boom guying, SA-frame to boom for all operating modes **without** derrick
- **KMD 1**, in the derrick guying, SA-frame to derrick for all operating modes **with** derrick
- **KMD 2**, in the lattice jib guying, WA-frame 1 to lattice jib end section
- **KMD 3**, in the boom guying, derrick to boom for all operating modes **with** derrick
- **KMD 6**, in the boom nose

3.1.5 “Power Plus”

Note
When “Power Plus” is turned on, observe the following:
- ▶ If a crane movement has reached its maximum speed due to the current utilization, then no speed increase is possible by adding the “Power Plus”.
- ▶ If the total power requirement of all actuated crane movements is larger than the available power, then those crane movements are reduced which require the most power.
- ▶ If another crane movement is added or taken back to one or more actuated crane movements then this has an influence on the other movements. For that reason we recommend in situations in which an interference of the individual crane movements is troublesome, not to add the “Power Plus” or to turn the “Power Plus” off.

Adding “Power Plus”

The speed of the “lift / lower” crane movement is increased with the button **465**, button **483** or button **503**.

WARNING
Danger of accidents in case of single to triple sheave reeving!
- ▶ Do **not** add “Power Plus” if the crane is utilized by more than 50 % of its maximum permissible load carrying capacity for the corresponding radius.

▶ Press the button **465**.

or

■ Press button **483** or button **503**.

Result:

– “Power Plus” is added.
The icon **b** appears on the LICCON monitor.

Turning the “Power Plus” off

▶ If the “Power Plus” is added:
Press the button **465** again.

or

■ Press button **485** or button **503** again.

Result:

– “Power Plus” is turned off.
The icon **b** turns off on the LICCON monitor.

3.5 Slowing down a slewing movement

This crane is equipped with a slewing gear in a closed hydraulic circuit.
Various braking functions are differentiated:

1.) Working with automatic slewing gear brake: The hydraulic system brakes the slewing movement, the slewing gear brake is applied after completion of the integration period.
2.) Working with manually opened slewing gear brake: The slewing gear brake can be opened and closed manually.
3.) Working in strong side wind with additional actuation of the slewing gear brake with the pedal.

3.5.1 Applying and releasing the slewing gear brake manually

Releasing the slewing gear brake manually.

DANGER
Danger of accident due to uncontrolled turning crane!
If the slewing brake is opened manually and the master switch 2 **460** is **not** deflected, the crane superstructure, as a result of external forces, such as wind, incline position of the crane, etc., can turn slowly due to leakage in the closed hydraulic circuit.
When the slewing brake is opened manually and the master switch 2 **460** is **not** deflected:
▶ Make sure that the crane is not turning uncontrolled.

Note
▶ Observe the data in section “Actuating the slewing gear brake with the pedal”!

The slewing gear brake closes automatically if:
– The crane operator gets up from the crane operator's seat.
– The engine is turned off.

The slewing gear **cannot** be opened at:
– Slewing gear shut off by the LICCON overload protection.
– Activated working range limitation.

▶ Actuate the switch **474**.
Result:
– The slewing gear brake is released.

– The indicator light **474** lights up.

Applying the slewing gear brake manually
▶ Press the button **474**.
Result:
– The slewing gear brake is applied.

– The indicator light **474** turns off.

3.2 Removing the load hook*

Make sure that the following prerequisites are met:
– the crane is aligned in horizontal direction,
– an assistant is present to guide the hoist rope,
– the ground is level and of sufficient load carrying capacity.

3.2.1 Lowering the load hook

WARNING
Crushing of hands!
When guiding the load hook by hand, hands or fingers can be crushed!
The load hook could roll away!
▶ Make sure the load hook is safely positioned!

▶ Place the load hook **28** on the ground.
▶ Remove the hoist limit switch weight, see section “Removing the hoist limit switch weight”.

3.2.2 Detaching 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 and the locking clamp **8** is released.

▶ Push the hoist rope in the direction of the load hook and detach the locking clamp **8**.
▶ Remove the rope retaining pipes on the pulley head and on the back pulley.
▶ Lift the hoist rope from the rope pulleys.
▶ Insert the rope retaining pipes again and secure with spring retainers.

2.2.1 Placing the counterweight plates, attachment system: “Twistlok”

WARNING
Risk of accident!
If more than the permissible two counterweight plates are lifted with the receptacle stud, the receptacle stud will be overloaded and can be damaged!
Personnel can be severely injured or killed!
- ▶ Make sure that the counterweight plates are laying correctly in the centerings!
- ▶ Replace damaged counterweight plates!

To stack the counterweight plate(s) **2**, use the receptacle stud **30**.
Before the receptacle stud **30** is guided into the counterweight plates, it must be ensured that the length of the receptacle stud **30** is set correctly. The length of the receptacle stud **30** can be adjusted with the pin **32**.

- ▶ If the length of the receptacle stud **30** is to be adjusted:
  Release and unpin the pin **32**.
- ▶ Adjust the length of the receptacle stud by moving the receptacle stud **30**.
- ▶ Pin in the pin **32** and secure with spring retainer.
- ▶ Attach the receptacle stud **30** on the auxiliary crane and guide it into the counterweight plate(s).
- ▶ Pull up the lever **31** and fold it down.
- ▶ Turn the lever **31** by 60° until the lever **31** points to the icon **40**. See illustration **8**.

Result:
– The receptacle stud **30** is locked with the counterweight plate.

- ▶ Lift the counterweight plate(s) with the receptacle stud **30** and place carefully onto the centerings on the console **1** or on another counterweight plate.
- ▶ When the counterweight plate(s) are placed on the console **1** or on another counterweight plate:
  Turn the lever **31** by 60° until the lever **31** points to the icon **41**. See illustration **7**.

Result:
– The receptacle stud **30** is unlocked.

- ▶ Carefully pull the receptacle stud **30** from the counterweight plate / the counterweight plates.
- ▶ Stack the counterweight plates according to the load chart.

1 Safety technical instructions for working with a load

For more information, see chapter 2.04.

WARNING
The crane can topple over!
For steep boom positions, for which no loads are specified in the load charts there is a risk of the crane superstructure toppling when turning “backward”, i.e. towards the counterweight side! There is a particular danger if the support base has been reduced and supported with the sliding beams retracted!
Personnel can be severely injured or killed!
▶ The radii specified in the load chart must be observed!

WARNING
Danger of accident due to erroneous operation!
If the reeving number on the pulley head is less than the reeving number set on the LICCON computer system and if the load is lifted with the luffing gear, it can result in an overload of the hoist rope, as a result, the hoist rope can rip, causing the load to drop!
Personnel can be severely injured or killed!
▶ Always comply with the reeving numbers specified in the load chart for maximum loads!
▶ The reeving on the pulley head and the reeving set on the LICCON computer system must match, otherwise crane operation is prohibited!

DANGER
Danger of fatal accidents due falling load!
If the number of three coils is fallen below (for example due to a technical defect), the hoist rope is ripped from the winch drum and the load falls down.
Personnel can be severely injured or killed!
▶ The crane operator must ensure that there are always at least three windings on the winch drum!

Always comply with the maximum loads specified in the load chart.
The weight of the hook block according the load chart must be taken into account.
For the lift, use the hook block which is suited best for the existing set up configuration in connection with the load chart.
Initiate all crane movements carefully. Also slow down the crane movements carefully. That way you can avoid a swinging or pendulum motion in the suspended load.

1.1.2 Center of gravity display

Position	Description
1	Center of gravity display
1.1	Core surface
1.2	Center of gravity

WARNING
Center of gravity of the crane is outside the core area!
If the center of gravity **1.2** of the crane is outside the core area **1.1**, then the crane can topple over!
Personnel can be severely injured or killed!
- ▶ To drive the crane, the center of gravity **1.2** must always be within the core area **1.1**!
- ▶ If the center of gravity is outside the core area, then it is prohibited to drive the crane!

Note
- ▶ If the center of gravity **1.2** of the crane is within the core area **1.1**, then the center of gravity **1.2** is shown in green!
- ▶ If the center of gravity **1.2** of the crane is outside the core area **1.1**, then the center of gravity **1.2** is shown in red!

1.1.3 Distribution of the ground pressure

Note
- ▶ The boom must be luffed down before driving until the load is even distributed on the tracks!
- ▶ If the counterweight on the turntable is large, then it is required to position the boom in such a way that a suitable distribution of ground pressure for driving is obtained!

Note
For all driving conditions, the ratio between the front and rear or the rear and the front ground pressures should be greater than 0.3!
- ▶ A : B should be greater than 0.3!

A = maximum ground pressure of the track which has the lower load of the two tracks
B = maximum ground pressure of the track which has the higher load of the two tracks

2.4.1 Changing the travel direction

Note

- ▶ At 0°, the crane superstructure is exactly in position “to the front”.
- ▶ At 180°, the crane superstructure is exactly in position “to the rear”.

The travel direction relates to the position of the crane superstructure:

– If the crane superstructure is turned past 90°, then the “forward / reverse” travel direction changes.

– If the crane superstructure with actuated foot rocker **MS 4** or foot rocker **MS 5** is turned past 90°, then the travel direction remains until the corresponding foot rocker / manual control lever is “returned” to neutral position.
  This means the new travel direction becomes active only if the corresponding foot rocker / manual control lever is no longer actuated.

1 Checking the retaining elements

Retaining elements are used to secure the pins. Due to mechanical damage / distortion, the function of the retaining elements can be compromised. In addition, the spring force of the retaining elements can be reduced significantly. Do not re-use retaining elements if there is insufficient spring force. The pin retainer must be secured with a correctly **functioning** retaining element.

WARNING
Failure of retaining element!
If the spring force of the retaining element is not sufficient or in case of mechanical damage / distortion, the retaining element can fail!
If the correct retention of the pin is no longer ensured, then the pin can unpin by itself! Accidents with bodily injuries / property damage can result!
▶ Use exclusively **functioning** retaining elements in proper condition.

2 Rope pulleys

WARNING
Danger of crushing due to rotating rope pulleys!
Arms and legs can be caught and crushed or severed between the rope pulley and the rope due to rotating rope pulleys!
▶ It is prohibited to touch the ropes or rope pulleys during operation!
▶ Adhere to the safety distance to ropes and rotating rope pulleys!

3 Checking the ropes

WARNING
Danger of accident!
▶ The ropes must be checked by an expert before assembly and checks must be performed at regular intervals in order to detect possible damage or wear and tear at an early stage. See Crane operating instructions, chapter 8.04.

The ropes must be removed immediately if any of the following damage is detected:
– Breakage of a strand
– Wire breaks
– Broken wire nests
– Reduction in the rope diameter by 10 % or more of the nominal size
– Rope deformations

3.1 Placing the hoist / control ropes

In order to guarantee safety and operating characteristics, only original Liebherr replacement parts or parts approved by Liebherr may be used.

NOTICE
Damage of hoist / control rope!
If a hoist / control rope is placed with worn rope pulleys, damage can occur!
▶ The rope pulleys must be checked before placing a rope. See Crane operating instructions, chapter 8.01!
▶ Replace worn or damaged rope pulleys!

14.5.2 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, then lattice sections may suddenly fold down or 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**.

Guying the pivot section in flying mode with the derrick boom

▶ Place the boom on the ground, see illustration **1**.

or

WARNING
Lattice section incorrectly attached!
If the fastening equipment is attached on the bitts **2** when securing the boom, then the bitts will be overloaded! The lattice section will be damaged. The boom can fall down! Personnel can be severely injured or killed!
If the auxiliary crane is used to secure the boom for flying disassembly:
▶ Do **not** fasten the lattice section on the bitts **2**, see illustration **2**!
▶ Attach the fastening equipment in the area of point **P1** on both sides on the lattice section, see detail **X**!
▶ Make sure that the long fastening equipment is used, so that the angle between the cross section of lattice section and guyed fastening equipment is at least 60°, see detail **Y**!

■ Secure the boom with the auxiliary crane, see illustration **3**.

or

WARNING
Falling boom!
If the boom is not properly supported from below, then the boom can fall down!
▶ Support the boom properly and safely with suitable material!

■ Support the boom, see illustration **4**.

Result:
– The guy rods can be disassembled.

▶ Place down, secure and disassemble the guy rods.
▶ Pin and secure the pulley block on the pivot section.
▶ Tighten the control rope until the boom is in horizontal position.

Result:
– Pivot section is guyed in flying mode with the SA-frame, see illustration **5**.
– The lattice sections can be disassembled in flying mode.

WARNING
Danger of fatal injury from SA-frame!
During the take down of the SA-frame, personnel can be severely injured or killed!
▶ Make sure that no persons or objects are within the danger zone.

WARNING
Independent lowering of the SA-frame!
Due to an incorrect ball valve position, the SA-frame can lower backward by itself!
Personnel can be severely injured or killed!
It can result in slack rope build up and to destruction of crane components!
▶ Ball valve **4** and ball valve **5** must be in position **B** during assembly and crane operation!
▶ The ball valve position **A** and ball valve position **C** are only permissible when lowering the SA-frame onto the turntable (transport position)!

▶ When the LICCON overload protection is exceeded:
Deflect the master switch MS1 in X-direction, see Crane operating instructions, chapter 4.02.

Result:
– Due to the own weight of the SA-frame **1** and by spooling up winch 4 **W IV** simultaneously, the SA-frame is lowered to the rear against the pressure in the erection cylinders **2**!

NOTICE
Damage to crane!
The ball valve position **C** and the ball valve position **A** are only permissible when lowering the SA-frame from 10° onto the turntable (transport position)!
▶ If this is not observed, parts of the crane will be destroyed.

▶ If the SA-frame is on approx.10°:
Do not actuate winch 4 any longer.
▶ Turn off / deactivate the function “Exceedance of shut off limits of the LICCON overload protection”.

Result:
– The LICCON overload protection is active.

▶ Lower the SA-frame **1** onto the turntable: Move the hand lever **8** to position **E**.

Result:
– The erection cylinders move in.
– The SA-frame **1** lowers.

▶ When the SA-frame **1** is lowered completely on the turntable:
Return the hand lever **8** to zero position **D** and set the ball valves, ball valve **4** and ball valve **5** to position **C** and secure.

2.1.7 “Closing” the D-boom

Make sure that the following prerequisites are met:
– the transport retainers for the guy rods on the SA-frame are released,
– the D-lattice sections are pinned and secured,
– the pulley block has been placed on the ground in sufficient distance to the D-end section.

▶ Lower the SA-frame to the front, see chapter 5.02 of the crane operating instructions.

Lower the SA-frame carefully to the placement **A** on the D-pivot section until the guy rods **14** can be pinned with the brackets **15** of the D-pivot section **1**.

▶ Pin the guy rods **14** with the lugs **15**: Pin in the pin **16** and secure with linch pin **17**.
▶ Erect the SA-frame **5** until the pin bores on the D-pivot section **1** and on the D-intermediate section **21** “on the bottom” (point **S**):
Pin in the pins **10** on both sides at point **S** and secure with linch pin **11**, illustration **11**.

NOTICE
Damage of control rope and the pulley block!
When lifting the D-boom, the control rope or the pulley block can be damaged!
▶ When lifting the D-boom, carefully spool out the winch 3 so that the pulley block remains on the ground!
▶ Check the rope run on the D-end section, carry out a visual inspection!

▶ When the pins are properly pinned and secured on all D-lattice sections:
Luff up the SA-frame until the D-end section lifts off the ground.
▶ Support the D-boom from below.
▶ Lower the D-boom on the support **U**.

2.1.8 Bringing the pull test brackets into operating position

WARNING
The pull test brackets can pose a mortal danger!
If the pull test brackets are not secure with an auxiliary crane during the swing procedure, they can swing forward with a large momentum due to their weight!
Personnel can be severely injured or killed!
▶ Swing the pull test brackets into operating position only with the aid of an auxiliary crane!
▶ Swinging the pull test brackets without an auxiliary crane is **prohibited**!

▶ Attach the pull test brackets onto the auxiliary crane.
▶ When the pull test brackets **22.4** are secured with the auxiliary crane:
Tension the tackle carefully.
▶ Remove the linch pin **22.6** on the transport retainer and unpin the retaining pin **22.5**.
▶ Swing the pull test bracket **22.4** forward with the auxiliary crane.
▶ When the pull test brackets **22.4** are swung forward completely:
Remove the auxiliary crane.
▶ Pin in the pin **22.5** in transport position and secure with linch pin **22.6**.

3.1 Disassembling the D-boom

WARNING
Falling boom!
If the D-boom is not properly supported before disassembly or held with an auxiliary crane, then the D-boom can fall down when it is unpinned!
Personnel can be severely injured or killed!
- ▶ Before supporting the D-boom, the ground condition must be checked regarding load bearing capability and level.

If the ground condition is not classified as sufficient:
- ▶ Support the D-boom properly and safely with suitable material!

3.1.1 Luffing the D-boom down

NOTICE
Damage to the pulley block!
If the D-boom is lowered too quickly “to the front”, significant damage can occur on the pulley block and on the D-end section!
- ▶ Lower the D-boom carefully to the front!

- ▶ Lower the D-boom to the front until the pulley block is just above the ground.

Note
▶ By supporting the components during assembly / disassembly, ground unevenness is compensated for and the material is protected.

Note
▶ The W-intermediate sections are pinned and unpinned with the aid of the pin pulling device, see chapter 5.30.

NOTICE
Property damage!
▶ Always pin in the pins of the guy rods from the “inside” to the “outside”.

Note
▶ The S-guy rods must be assembled and secured according to the separately supplied assembly drawings. The numbering on the assembly drawings must be identical to the numbering on the guy rods.

Note
▶ The boom combinations must be assembled according to the separately supplied rod and assembly plans!

The W-boom system can be assembled on the following basic configurations:
– S-operation, see illustration **1**.
– SDB-operation, see illustration **2**.

DANGER
Risk of fatal injury in crane operation with enabled assembly key button.
▶ The actuation of the assembly key button **450** is only permitted for assembly tasks!
▶ The assembly key button may only be operated by persons who are aware of the consequences of a bypass!
▶ If the assembly key button **450** is turned on, the hoist limit switch and the LICCON overload protection is bypassed!
▶ Crane operation with the assembly key button **450** turned on is strictly prohibited!
▶ The assembly key **450** must be removed immediately after carrying out the assembly work and handed to an authorized person!

Make sure that the following prerequisites are met:
– The crane is aligned in horizontal direction.
– The S-boom is assembled.
– In SDWB operation: The derrick boom and derrick ballast are assembled.
– The W-connector head is assembled on the S-boom.
– The counterweight is installed on the turntable and placed on the derrick ballast according to the load chart.
– The LICCON overload protection has been set according to the data in the load chart.
– The assembly key button **450** is pressed and the indicator light **431** lights up.
– The assembly icon **11** on the LICCON monitor blinks.
– An auxiliary crane is available.

3.7 Establishing the electrical connections

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

CAUTION
Damage to the electrical connection on the cable drum!
If the electrical connection from the cable drum to the terminal box on the W-pivot section is established first before the connection to the terminal box on the SW-end section, the electrical connection is damaged when spooling out the cable drum.
▶ Make the electrical connection from the cable drum in the W-pivot section to the terminal box on the SW-end section and then effect the electrical connection from the terminal box in the W-connector head to the cable drum!

Note
▶ For production of the electrical connections on the W-boom, the separate electrical diagram is to be employed.

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

3.8 Checking the function of the safety devices

WARNING
Non-functioning safety devices!
If the function of the safety devices is defective, personnel can be severely injured or killed.
▶ Crane operation with non-functioning safety devices is **prohibited**!

Note
▶ The function of the individual limit switches must be checked before erection!
▶ The function of the limit switch initiators must be checked in the test system, see separate “Diagnostics” manual.

Note
▶ If a function check on the limit switches or on the safety devices does not lead to the desired shut offs, then the plug connections on the connector boxes or the components itself must be checked. If no visible connection errors or component defects can be found, contact **LIEBHERR** Service.

Make sure that the following prerequisites are met:
– All electrical connections have been made.
– The crane engine is running.
– The corresponding operating mode is set on the LICCON monitor.

3.8.1 Checking the wind speed sensor

▶ Test the movement and the function of the wind speed sensor.

3.8.2 Checking the airplane warning light

▶ Turn on the airplane warning light on with the button **382**.
▶ Check the function visually.

5.1.1 Luffing the W-lattice jib down

Note

- ▶ The luff down movement is turned off as soon as the lowest operating position is reached.
- ▶ When the lowest operating position of the boom is reached, the load display in the “Maximum load” icon turns off and instead of the load display, the display “???” appears.
- ▶ In the crane operating screen appear alarm functions.

▶ Luff the W-lattice jib down to the “lowest” operating position.

Result: The following alarm functions become active:

– “STOP”
– “Horn” and acoustical signal

DANGER

Crane operation with added assembly key button!

- ▶ The actuation of the assembly key button **450** is only permitted for assembly tasks!
- ▶ The assembly key button **450** may only be operated by persons who are aware of the consequences of a bypass!
- ▶ If the assembly key button **450** is turned on, the hoist limit switch and the LICCON overload protection is bypassed!
- ▶ Crane operation with the assembly key button **450** turned on is strictly prohibited!
- ▶ The assembly key button **450** must be removed immediately after carrying out the assembly work and handed to an authorized person!

▶ When the W-lattice jib has reached the “lowest” operating position:
Turn the assembly key button **450** on.

Result:

– The LICCON overload protection is deactivated.
– The indicator light **431** lights up.
– The assembly icon **11** on the LICCON monitor blinks.
– The “STOP” icon on the LICCON monitor blinks.
– An acoustical signal sounds.
– The three color light lights up red and the warning light on the rear of the turntable lights up.

See illustration **23**.
The luff down procedure is carried out until:

– The S-boom und W-lattice jib form an angle of approximately 45° (switch position “W-lattice jib bottom”)
– **or** the hook block can be reeved out.

▶

2 Assembling the WV-boom system

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 could fall and suffer life-threatening or fatal injuries.

- ▶ All assembly work must be carried out using suitable aids (lifting platforms, scaffolding, ladder, auxiliary crane, etc.)!
- ▶ If work cannot be carried out on the ground or using such aids, the assembly personnel must be secured with suitable personal fall protection systems (see chapter 2.04) to protect against falling! The personal fall arrest system must be attached in the corresponding fastening points on the crane (see chapter 2.06).
- ▶ If railings are present on the components, then they must be brought into the corresponding position and secured for assembly / disassembly.
- ▶ Step on aids and fall protection equipment only with clean shoes!
- ▶ Keep aids and fall protection equipment clean and free from snow and ice!

WARNING
Falling components!
If unsecured or non-supported components are assembled or disassembled, they can fall down. Personnel can be killed or seriously injured.

- ▶ During pinning and unpinning of the lattice sections, it is prohibited for anyone to remain **under** or **on** the components as well as within the entire danger zone!
- ▶ Support the boom and components before pinning / unpinning!
- ▶ Pin or unpin both pins laying in a horizontal, i.e. **left** and **right**!
- ▶ Secure the pins in the bearing points and in the receptacles!
- ▶ Do not disengage the auxiliary crane until each component is pinned and secured!
- ▶ It is prohibited to lean a ladder against the component being disassembled!

WARNING
Danger of crushing!
Components can swing during assembling. Hands can be crushed or severed.

- ▶ Make sure that the components do not swing back and forth during assembly!

WARNING
Neglected inspection and maintenance on guy rods!
If the regular inspection and maintenance of the guy rods is not carried out or is carried out only in irregular intervals, then severe accidents can occur due to existing and unrecognized damage to the guy rods!
Personnel can be severely injured or killed!

- ▶ Inspect the guy rods before every assembly, see chapter 8.15.

4.1.1 Luffing the WV-lattice jib down

▶ Luff the S-boom down to 70°, see illustration **8**.

WARNING
The crane can topple over!
If the angle between the boom and the lattice jib is smaller than or equal to 30°, the mechanical relapse support will collide with the flap on the oscillating guard. The crane can topple over! Personnel can be severely injured or killed!
▶ Make sure that the angle between the S-boom and the WV-lattice jib is more than 30° during the complete erection procedure.
▶ The angle between the S-boom and the WV-lattice jib may not exceed 30° during the complete take-down procedure!
▶ Perform a visual inspection during erection.

▶ Luff the WV-lattice jib down to approx. 30° to the S-boom, see illustration **9**.

Note
▶ The luff down movement is turned off as soon as the lowest operating position is reached.
▶ When the lowest operating position of the WV-lattice jib is reached, the load display in the “Maximum load” icon turns off and instead of the load display, the display “???” appears.
▶ In the crane operating screen appear alarm functions.

▶ Luff the WV-lattice jib down to the “lowest” operating position.

Result: The following alarm functions become active:
– “STOP”
– “Horn” and acoustical signal

DANGER
Crane operation with added assembly key button!
▶ The actuation of the assembly key button **450** is only permitted for assembly tasks!
▶ The assembly key button **450** may only be operated by persons who are aware of the consequences of a bypass!
▶ If the assembly key button **450** is turned on, the hoist limit switch and the LICCON overload protection is bypassed!
▶ Crane operation with the assembly key button **450** turned on is strictly prohibited!
▶ The assembly key button **450** must be removed immediately after carrying out the assembly work and handed to an authorized person!

▶ When the WV-lattice jib has reached the “lowest” operating position:
Turn the assembly key button **450** on.

Result:
– The LICCON overload protection is deactivated.
– The indicator light **431** lights up.
– The assembly icon **11** on the LICCON monitor blinks.
– The “STOP” icon on the LICCON monitor blinks.
– An acoustical signal sounds.
– The three color light lights up red and the warning light on the rear of the turntable lights up.

5 Disassembling the 36 t boom nose

Note
▶ Observe the safety guidelines for disassembly in chapter 5.01.

5.1 Luffing the boom down

WARNING
The crane can topple over!
If the following conditions are not met before taking down the boom, the crane can topple over.
Personnel can be severely injured or killed!
▶ Observe the Safety technical guidelines in chapter 5.01!
▶ Observe the data in the erection and take down charts!

NOTICE
Hoist winch not spooled out!
If the hoist winch is not spooled out sufficiently when the boom is luffed down, then the hook block will collide with the boom nose.
When the boom is luffed down:
▶ Spool the hoist winch up simultaneously.

▶ Luff the boom down to the **lowest** operating position.

When the lowest operating position is reached the luff down movement is shut off.
The load value in the “maximum load” icon disappears and question marks appear (????).
The following alarm functions become active:
– “STOP”
– “Horn” and acoustical signal

▶ Actuate the assembly key button **450**.
Result:
– The LICCON overload protection is inactive.
– The assembly icon **17** on the LICCON monitor blinks.
– An acoustical signal sounds.
– The red beacon on the crane cab blinks.

2.3 Flying assembly of F-auxiliary jib (12 m)

Ensure that the following prerequisite is met:

– the pin **2** of the F-pivot section and the F-relapse retainer is on point **A** “Transport position”.

WARNING
Folding down of F-lattice jib!
If the pin **2** is unpinned during assembly, then the F-lattice jib folds down. Personnel can be severely injured or killed!

▶ The pin **2** of the F-pivot section and the F-relapse retainer must remain pinned during assembly on point **A** “Transport position”!

NOTICE
Damage of F-auxiliary jib!

▶ F-jib, which are longer than 12 m may not be assembled in flying mode!

▶ Release and unpin the pin **5** on the FA-frame relapse retainer, place the turnbuckle **6** on the F-pivot section **22**, see illustration **7**.

▶ Pull the flap **1** on the F-pivot section **22** down and affix the rope **30** on the hook lock at point **F**, see illustration **7**.

Note

▶ Before lifting the FA-frame **8**, the pins **18** between the F-guy ropes **15** and the brackets on the F-end section **23** must be released on points **H**, see illustration **6**.

▶ Hang in the FA-frame **8** with the attachment rope **25** on the auxiliary crane and lift, see illustration **7**.

▶ Reeve in the assembly winch rope **9** from the turntable into the rope pulleys on the F-pivot section **22** and pin on point **G** with pin **10** and secure with spring retainer **11**, see illustration **7**.

CAUTION
Danger of damage!
Before crane operation or before erecting or taking down the boom, both support frames **7** must be folded down.

▶ Unpin the support frames **7** on points **E** and fold them down, see illustration **8**.

▶ Carefully fold the FA-frame **8** with the auxiliary crane “in direction of the main boom” and “spool the assembly winch rope **9** out at the same time” until it can be pinned on point **D**, see illustration **8**.

▶ Pin the F-guy rods **12** on point **D** with pins **13** and secure with spring retainers **14**, see illustration **8**.

4.1 Taking the SLF-boom down

WARNING
The crane can topple over!
If the following conditions are not met before taking down the boom, the crane can topple over and fatally injure personnel!
- ▶ Observe the Safety technical guidelines in chapter 5.01!
- ▶ Observe the data in the erection and take down charts!

NOTICE
Damage of boom components!
Taking down the boom system can lead to a collision between the hook block and the pulley head. Boom components can be severely damaged.
- ▶ Luff the boom system down at the same time and spool the hoist winch out.

4.1.1 Luffing the SLF-boom down

Note
- ▶ The Luff down movement is turned off as soon as the lowest operating position is reached.
- ▶ When the lowest operating position of the boom is reached, the load display in the “Maximum load” icon turns off and instead of the load display appears the display “???”.
- ▶ In the crane operating screen appear alarm functions.

▶ Luff the S-boom down to the **lowest** operating position.

Result: The following alarm functions become active:
– “STOP”
– “Horn” and acoustical signal

DANGER
Crane operation with added assembly key button!
- ▶ The actuation of the assembly key button **450** is only permitted for assembly tasks!
- ▶ The assembly key button **450** may only be operated by persons who are aware of the consequences of a bypass!
- ▶ If the assembly key button **450** is turned on, the hoist limit switch and the LICCON overload protection is bypassed!
- ▶ Crane operation with the assembly key button **450** turned on is strictly prohibited!
- ▶ The assembly key button **450** must be removed immediately after carrying out the assembly work and handed to an authorized person!

▶ When the boom has reached the lowest operating position:
Turn the assembly key button **450** on: Press the button **431**.

Result:
– The LICCON overload protection is deactivated.
– The indicator light **431** lights up.
– The assembly icon **3** on the LICCON monitor blinks.
– The “STOP” icon on the LICCON monitor blinks.
– An acoustical signal sounds.
– The three color light lights up red and the warning light on the rear of the turntable lights up.

▶ At the same time, spool the hoist winch out and luff the S-boom down until the hook block touches the ground.

3.2 Disassembling the pulley set

Note

- The weight of the 320 t pulley set is 1.5 t.
- The weight of the 300 t pulley set is 1.4 t.

- Unreeve the hoist rope.
- Luff the boom down until the pulley set is laying on the ground.
- Remove the lock **15**.

Note

- For electrical connections on the SW-end section or the W-connector head, see chapter 5.38, 5.07.

- Disconnect the electrical connection to the hoist limit switch **10**.
- Remove the spring retainer **6** and unpin the pin **5**.
- Luff the boom up.

Result:

– The pulley set **4** is removed.

See illustration **5**.

- ▶ Loosen pulley cart **107** from SW-end section **106**: Uninstall the pulley cart, see chapter 5.15.
- ▶ Luff up boom until the hook block may reeve on the F-auxiliary jib.
- ▶ 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.
- ▶ The S-boom is not yet in operating position, (angle **x** amounts to 87°):
  Luff up the S-boom to the operating position.

DANGER

The crane can topple over!

In crane operation with bypassed safety devices, the crane can topple over. Personnel can be severely injured or killed!

- ▶ When the lowest operating position of the W-lattice jib is reached, immediately turn off the assembly key button **450**.
- ▶ The radii listed in the load chart may not be exceeded or fallen below, even if there is no load on the hook!

Note

- ▶ When the lowest operating position of the W-lattice jib is reached, the displays turn off.
- ▶ In the icon “Maximum load”, a load number in “t” appears instead of the display “???”!

- ▶ Luff up the F-auxiliary jib to the lowest operating position.
- ▶ When the W-lattice jib has reached the lowest operating position:
  Switch the assembly key switch **450** off.

Result:

- – The LICCON overload protection is active.
- – The indicator light **431** turns off.
- – The assembly symbol **11** on the LICCON monitor turns off.
- – The acoustical signal turns off.
- – The three color light lights up red and the warning light on the rear of the turntable lights up.

2.1.1 Spooling op loose hoist rope

▶ Spool up loose hoist rope between the boom head and the wind carefully onto the winch.

Note

▶ A slight rope slack must remain between the boom head and the winch!

2.1.2 Luffing the boom down

NOTICE

Danger of collision!

When luffing the boom down, the hoist rope length can shorten and pull the hook block against the boom head.

▶ Monitor the distance of the hook block to the boom head!

▶ Luff the boom down carefully.

Result:

– The hoist rope between the boom head and the winch is tensioned.

2.1.3 Lowering the hook block

▶ Lower the hook block carefully with the hoist gear.

- ▶ Align the auxiliary weight **10** on the pulley block **4**.
- ▶ Move the centering pin **10.1** of the auxiliary weight into the centering bores **Z** on the pulley block **4**, illustration **7**.

WARNING
Falling auxiliary weights!
If all mounting brackets **11** are removed simultaneously on an unsecured auxiliary weight, then the auxiliary weight can fall down!
Personnel can be severely injured or killed!
- ▶ Never remove all mounting brackets **11** of an unsecured auxiliary weight at the same time!
- ▶ Always install or remove the mounting brackets **11** alternately!

- ▶ Install the mounting brackets **11** on the side and connect the pulley block **4** with the auxiliary weight **10**, illustration **8**.
- ▶ Secure the mounting brackets **11** with screws **12** and lock nuts **13**, illustration **8**.

Note
- ▶ Additional auxiliary weights must be connected with the mounting brackets **11**!

WARNING
Falling auxiliary weights!
The auxiliary weights can fall down to the side when the auxiliary crane is removed!
Personnel can be severely injured or killed!
- ▶ Remove the auxiliary crane only when it is ensured that the auxiliary weight **10** is properly secured with the mounting brackets **11**!

- ▶ When the respective auxiliary weight is properly installed and secured:
  Remove the auxiliary crane.

5.1.4 Preparing the hook block for crane operation

Note
- ▶ The reeving of the hook blocks is described in chapter 4.06 of the Crane operating instructions!
- ▶ Observe the “permissible hook block weights” in the erection and take down charts!

- ▶ Reeve the hoist rope according to the instructions in chapter 4.06 of the Crane operating instructions and the reeving plans!

NOTICE
Retaining pins **7** pinned when lifting the load!
If the retaining pins **7** are not unpinned before the crane operation, then the retaining pins **7** may be shorn off when lifting the load!
- ▶ Unpin the retaining pin **7** from the hook block before crane operation!

- ▶ When the hook block is properly reeved and has been lifted off the ground:
  Unpin the retaining pin **7** and pin and secure into the transport receptacle (point **X**), illustration **9**.

1.2 Starting the aggregate

Note

▶ Observe the information in the Operating and Maintenance manual of the hydraulic aggregate!

Make sure that the following prerequisites are met:

– The lever **2** and lever **4** for motor start are set, see Operating and Maintenance manual of hydraulic aggregate.
– The lever **6** on the aggregate **1** is in **Position 0**.

▶ Start the motor with the hand crank **3**.
▶ When the motor is running:
Pull the hand crank **3** out.

1.3 Pinning and unpinning with pin pulling device

WARNING

Falling components!

If unsecured or non-supported crane sections are removed, they can fall down. Personnel can be killed or seriously injured!

▶ During the pinning and unpinning procedure it is prohibited for anyone to remain **under** or **on** the crane sections, as well within the entire danger zone!
▶ During the unpinning procedure, it is prohibited for anyone to remain **under** or **on** unsecured or non-supported crane section!
▶ Before unpinning: Support crane sections and boom.
▶ Do not lean the ladder against the crane part being disassembled!

The operating pressure can be set with the lever **6**:

– Position I: 30 bar
– Position II: 230 bar

NOTICE

Overheating of aggregate!

Continuous operation with operating pressure of 240 bar causes damage to the hydraulic pump and overheats the hydraulic oil.

▶ Set the lever **6** for no longer than maximum 10 min to Position II.

Note

▶ The operating pressure of 230 bar is required if the pin is tensioned or hard to move.
▶ The lever **6** has a spring return in Position II.

Both cylinders can be connected and operated simultaneously.

2.1.2 Bringing the guy rods on the ballast trailer into operating position

The guy rods **13** are folded down and secured in transport position on the side on the ballast frame, see illustration **1** and illustration **A**.
Make sure that the following prerequisites are met:

– The ballast trailer guide **2** is assembled and secured on the ballast frame **1**.
– The access to the ballast trailer is in operating position.
– The stability and tipping safety of the ballast trailer is ensured.

WARNING
Danger of falling!
If the following notes are not observed, the assembly personnel can fall of the ballast trailer and be severely injured or killed!

▶ Use only the access on the ballast trailer!
▶ Step on the access with utmost caution!

▶ Release and unpin the retaining pins **14**, see illustration **A**.
▶ Attach the guy rod **13** onto the auxiliary crane.
▶ Erect the guy rod **13** with the auxiliary crane to the vertical position.

DANGER
Tipping guy rod!
If the erected guy rod **13** is not secured on both sides with the retaining pin **14**, the guy rod will tip to the side when the auxiliary crane is removed!
If the erected guy rod **13** is not secured with the retaining pin **16**, the guy rod will tip to the side when the auxiliary crane is removed!
Personnel can be severely injured or killed!

▶ Make sure, before removing the auxiliary crane on the guy rod **13**, that both retaining pins **14** are always pinned and secured, **check visually**!
▶ Make sure, before removing the auxiliary crane on the guy rod **13**, that the retaining pin **16** is pinned and secured, **check visually**!

▶ When the guy rods is erected vertically:
Pin in the retaining pin **14** and secure with spring retainer **15**, see illustration **B**.
▶ When the retaining pin **14** and the retaining pin **16** are pinned and secured:
Remove the auxiliary crane.

2.5.2 Stacking the ballast plates on the ballast trailer, fastening points: Bitt

WARNING
Falling ballast plates!
If more than the permissible loads are lifted, then the bitts **3.1** are overloaded and the ballast plates can fall down!
Personnel can be severely injured or killed!
- ▶ Lift no more than maximum 20 t with the ropes, 3 fastening points!
- ▶ Replace damaged ballast plates immediately!

WARNING
Incorrect handling of the fastening equipment!
If fastening 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 fastening equipment is correctly attached on the bitts **50.1** and that it is secured sufficiently to prevent it from loosening up!

Note
- ▶ Place the ballast plates individually or as a ballast assembly, maximum 20 t!
- ▶ The weight difference between the outer ballast stacks no more than maximum 20 t!
- ▶ 20 t ballast assembly, see illustration **10**!

- ▶ Use the auxiliary crane to evenly distribute the ballast plates **50** on the ballast trailer and center them on the centering points.
- ▶ Stack the ballast plates according to the load chart.

4.5 Parallel driving

NOTICE
Danger of damage to the crane and the ballast trailer!
Due to steering movements on the crawler tracks while driving parallel, the crane and the ballast trailer can be significantly damaged!
- For parallel driving, steering the crawler track is **prohibited**!
- For parallel driving, the side tire distortion on the wheel sets must be observed by an instructed person over the entire travel route of the crane. If the tires distort by more than 100 mm, then the position of the wheel sets must be corrected!

Note
- Independently of whether the ballast trailer stands on the ground or is lifted from the ground, the wheel sets must always stand in a “Parallel driving” position!
- In deviating position for the wheel sets, the control turns itself off!
- To drive the crane in “Parallel driving”, the switch **478** on the left control panel is to be actuated!

Note
- The travel drive of the crawler is locked until the wheel sets are in parallel driving position!
- When driving the crawler, the slewing gear brake of the crane remains applied and the hydraulic coasting is opened!
- If the angles $ß_2$ and $ß_3$ deviate in relation to $ß_1$ by more than the permissible limit angle, the crawler track is stopped, the indicator light in the button **418** blinks!
- Only through renewed alignment of the wheel sets to the required specified angle can the crawler track be driven again!
- If the switch **478** “Crawler parallel driving” is turned on, the crawler moves straight forward on appropriate terrain! This simplifies driving the crane with the ballast trailer in steering program “Parallel driving”!

4.5.1 Lifting the ballast trailer with the support cylinders

Note
- See section Towing operation!

5.5 Defined ballast trailer operation

DANGER
Danger of accident!
If the ballast trailer is operated in an undefined condition, it can result in severe accidents up to toppling of the crane!
Personnel can be severely injured or killed!
- ▶ The ballast trailer must always be in a defined condition!
- ▶ Operation of the ballast trailer in an undefined state is prohibited!

The ballast trailer may not raised or set down when driving, rather this be done **before** driving off.

5.5.1 Ballast trailer lifted off

“Ballast trailer defined lifted from the ground” means:
The ballast trailer is lifted from the ground and the key button **448 “Ballast trailer lifted off”** is pressed. As a result, the slewing gear brake does **not** open during “Crawler driving” and the wind cannot turn the turntable during “Crawler driving”.
Make sure that the following prerequisites are met:
- – The ballast trailer has been completely lifted off the ground.
- – The key button **448** is pressed.
- – The warning light in the button **433** blinks.

5.5.2 Ballast trailer on the ground

“Ballast trailer defined on the ground” means:
That the ballast trailer and its residual load are resting on the ballast trailer tires and the key button **448** is **not** pressed. This residual load is large enough to prevent the wind from turning the turntable, if the slewing gear brake is opened when actuating “Crawler driving”.
Make sure that the following prerequisites are met:
- – The ballast trailer is sitting with a residual load on the ground.
- – The key button **448** is **not** pressed.
- – The warning light in the button **433** does **not** blink.

6.4.3 Utilization conditions

The current utilization of the crane results from the “utilization bar of the crane” **1** on the LICCON monitor 0.

Max. load carrying capacity:

– The “maximum load carrying capacity in current operating condition (**“max-load carrying capacity”**) ” is achieved, when the “utilization bar of the crane” **1** displays 100 percent.
This is the case when the “utilization of the crane according to the load chart and reeving” reaches 100 % (“Current load” is equal to the “Maximum load capacity”).
When the “max-load carrying capacity” is smaller or equal to the “max2-load carrying capacity”, then the “max-load carrying capacity” can be increased through:
  • Pulling up the derrick ballast, if the derrick ballast is not already suspended and the currently pulled derrick ballast is still smaller than the optimum derrick ballast.

Max2-load carrying capacity:

– The “maximum load carrying capacity of the current crane equipment ” (**“max2-load”**) is reached when the “crane utilization bar” **1** is at 100 % **and** the “derrick ballast utilization bar display” **BA** is greater than or equal to 100 % (the current derrick ballast is completely lifted off the ground), and the derrick ballast input value and the ballast weight are correct.
This is the case when the “current load” and the “max2-load” reaches 100 percent (“current load” is equal to the “max2-load”).
When the “max2-load” is smaller than the “max3-load”, then the “max-load ” can be increased through:
  • Increasing the derrick ballast by adding additional ballast plates if the placed ballast is still smaller than the optimum ballast.

Max3-load carrying capacity:

– The “maximum load carrying capacity of the current crane equipment with optimum derrick ballast” (**“max3-load”**) is reached when the “crane utilization bar” **1** is at 100 % **and** the “derrick ballast utilization bar display” **BA** is at 100 % (the optimal derrick ballast is completely lifted off the ground), and the derrick ballast input value and the ballast weight are correct.
This is the case when the “current load” and the “max3-load” reaches 100 percent (“current load” is equal to the “max3-load”).
Here, the optimal derrick ballast is already entirely pulled!
Further increasing the derrick ballast at this derrick ballast radius will not increase the load further than “max3-load”!

Note

▶ In some cases it may be possible to increase the load capacity, in some cases reducing the derrick ballast radius as well; refer to the load chart manual or LICCON job planner!

This also applies with:

– “Current load” equal to “max-load”.
– “Current load” equal to “max2-load”.

7.4 Unpinning the ballast trailer on the turntable

Make sure that the following prerequisites are met:
– The ballast trailer is supported.
– The electrical and hydraulic connections are present.

7.4.1 Unpinning procedure

NOTICE
Damage to the retaining pins!
If the retaining pins **25** are not unpinned before the unpinning procedure, the pin pulling device can be damaged!
▶ The retaining pins **25** must be released and unpinned on both sides before pinning the connector pins **23**!

▶ If the connector pins **25** are completely unpinned in on both sides:
Press the button **206** on the control panel **-A1210**.

Result:
– The pin pulling cylinders move in.
– The connector pins **23** are unpinned on the turntable.

NOTICE
Damage to the ballast trailer or to the turntable!
If through distortion upon unpinning of the ballast trailer on the turntable only a connector pin **23** unpins (signal “Ballast trailer installed” is no longer present), the crane steering is no longer recognized, although the ballast trailer is still connected with the second connector pins **23** with the turntable!
Due to the missing signal, “Ballast trailer installed”, it is possible to turn the turntable, to drive the crane or to telescope the ballast trailer guide out / in!
This could significantly damage both the crane and the ballast trailer!
▶ All crane movements are to be limited to a “minimum degree” and must be driven with extreme caution and the least possible speed!
▶ After unpinning of the second connector pin **23**, it must again be checked whether both connector pins are completely unpinned!

▶ Perform a visual inspection.
▶ If the ballast trailer guide has been telescoped out during the unpinning procedure:
Move the ballast trailer guide all the way in.

10.3.1 Checking for leaks

NOTICE
Leaky slewing gear!
If a leakage was found on one or several slewing gears during the visual inspection, it can result in a failure of the affected slewing gear / slewing gears!
The slewing gears can be damaged, resulting in high property damage!
▶ Take the crane out of serve, repair the leaky slewing gear / slewing gears and replace the slewing gear(s) if in doubt.

▶ Check visually to ensure that the slewing gears do not leak.

10.3.2 Checking the oil level

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

▶ Remove the dipstick **40** and wipe it off.
▶ Reinsert the dipstick **40** and pull it out again.

The oil level must be between the min. and max. mark on the dipstick **40**.
▶ Check the oil level.

NOTICE
Danger of gear damage!
If the oil level has dropped below the minimum mark, add oil as specified in the lubrication chart until the oil level is between the minimum and maximum mark!
If the required minimum mark is fallen below, the gear will be destroyed!
▶ Add oil, wait a short time and then check the oil level again!

▶ Reinsert the dipstick **40**.

2 Derrick radii

Note
- ▶ **No** guide is fitted between the turntable and the ballast pallet!
- ▶ The derrick ballast radius and the derrick boom radius are identical!

2.1 Derrick 30 m, illustration 1

The following radii are possible with the 30 m derrick: R10 m, R13 m and R15 m.

Note
- ▶ For the 30 m derrick there is only one operating mode with S-36 m, observe the load chart!

2.1.1 Derrick ballast lifting heights with respect to the base of the crawler

Radius R = 10 m	
Above base	+4050 mm
Below base	-950 mm

Radius R = 15 m	
Above base	+1550 mm
Below base	-3450 mm

2.2 Derrick 36 m, illustration 2

The following radii are possible with the 36 m derrick: R10 m, R13 m, R15 m and R18 m.

2.2.1 Derrick ballast lifting heights with respect to the base of the crawler

Radius R = 10 m	
Above base	+4410 mm
Below base	-590 mm

Radius R = 18 m	
Above base	+750 mm
Below base	-4250 mm

3.4.1 Raising derrick ballast

▶ Press the button **436**.

Result:

– The derrick ballast is raised.

3.4.2 Lower derrick ballast

▶ Press the button **445**.

Result:

– The derrick ballast is lowered.

3.4.3 Stopping the pull cylinder on the derrick ballast

▶ Press the button **437**.

Result:

– The pull cylinder (A) on the derrick ballast is stopped.

▶ Press the button **438**.

Result:

– The pull cylinder (B) on the derrick ballast is stopped.

The bypass of the maximum load according to the load chart and reeving (crane utilization bar 1 stands at 100 %) can be bypassed by the following measures:

1.) Bypass key button D on the LICCON monitor 0.
2.) Assembly key switch in the instrument panel.
3.) **Note:**
The test point 1-assembly - maximum force shut off (= F1 max-assembly) cannot be bypassed.

DANGER
The crane can topple over!
When the assembly key button is turned on, the LICCON overload protection is bypassed and is thereby no longer effective!
The crane can be overloaded unnoticed and topple over!
Personnel can be severely injured or killed!

- ▶ When the assembly key switch is turned on, it is only permitted to execute crane movements that reduce the load torque within certain operating and load ranges!
- ▶ Turn the assembly key button is immediately switched off after reaching the permissible load range!
- ▶ The crane operator alone is responsible completely for his actions during bypass of LICCON overload protection!

Note

- ▶ The movement “ballast up” or “ballast down” requires utmost attention by the crane operator!

1 Component overview S-pivot section

Position	Component	Weight
1	S-pivot section	12.0 t
2	S-relapse retainer	1.1 t
3	Winch VI including rope	4.6 t
4	Winch V including rope	8.0 t
5	Rods WA-frame	0.5 t
	S-pivot section complete	26.2 t

2 Attachment points

Attachment points	
A + C	For S-pivot section **without** winches
B + C	For S-pivot section **with** winches and rope

3.5.2 Install the S-guy rods

WARNING
Not carrying out inspection and maintenance on guy rods!
If the regular inspection and maintenance of the guy rods is not carried out or is carried out only in irregular intervals, then severe accidents can occur due to existing and unrecognized damage to the guy rods!
Personnel can be severely injured or killed!
▶ Check the guy rods before every assembly, see Chapter 8.15.

Note
▶ The S-guy rods must be assembled and secured according to the separately supplied assembly drawings. The numbering on the assembly drawings must be identical to the numbering on the guy rods.

Ensure that the following precondition is met:
– the fold platforms **50** on the SL reducer section are folded and secured “upwards”.

WARNING
Falling components!
If the intermediate sections are incompletely pinned, then components can fall down. Personnel can be severely injured or killed!
▶ Make sure that all components of the boom are completely pinned and secured.

▶ Relieve the guy rods between the SA-frame and the S-pivot section: Lower the SA-frame somewhat to the front.

Result:
– The guy rods between the SA-frame and the S-pivot section are relieved.

The guy rods are placed and secured for transport on the S-intermediate sections. Before assembly of the guy rods, remove the transport retainers.
▶ Release and unpin the transport retainers **31**.

NOTICE
Property damage!
▶ Always insert the pins of the guy rods from the “inside” to the “outside”.

Note
▶ The guy rods of the S-intermediate sections are pinned to each other starting from the fixed point on the end section of the boom.

▶ Pin the guy rods of all intermediate sections: insert the pins **45** from the “inside” to the “outside”.
▶ Secure the pin **45** with spring retainer **46**.
▶ When all guy rods on the boom system are pinned:
release and unpin the pins **37** on the assembly brackets **35**.
▶ Erect the SA-frame until the guy rods between the SA-frame and the S-end section tension.

3.9.2 Erecting the boom

DANGER
Crane can topple over!
- ▶ It is prohibited to turn the crane superstructure while erecting the boom!
- ▶ Observe the data in the erection and take down charts!

Reeving in the hook block

- ▶ Luff up the boom until the end section lifts off the ground.
- ▶ 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.

Erecting the boom

DANGER
Crane can topple over!
In crane operation with bypassed safety devices, the crane can topple over. Personnel can be severely injured or killed!
- ▶ When the lowest operating position of the boom is reached, turn off the assembly key button **450** immediately.
- ▶ The radii listed in the load chart may not be exceeded or fallen below, even if there is no load on the hook!

Note
- ▶ When the lowest operating position of the boom is reached, the displays turn off.
- ▶ 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:
  Turn the assembly keyed button **450** off: Press the button **431**.

Result:
- – The LICCON overload protection is active.
- – The indicator light **431** turns off.
- – The assembly symbol **11** on the LICCON monitor turns off.
- – The acoustical signal turns off.
- – The three-colored light illuminates in green.
- – The warning lights on the turntable are off.

3 Assembling the SLD/SD-boom

Note

▶ The assembly is described on the example of the S-boom!

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 could 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 catch systems to avoid falling, see “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.
- ▶ Only step on aids and antifall guards with clean shoes!
- ▶ Keep aids and antifall guards clean and free from snow and ice!
- ▶ During all assembly and disassembly work, maintenance work and inspections, travel or 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!

- ▶ Unpin or pin both pins at the same horizontal level, i.e. **left and right**!
- ▶ Do not stand under the lattice sections or within the complete danger zone during the pinning and unpinning procedure of the boom!
- ▶ 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 component do not swinging 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!

Note

- The actual forces of test point **MS1** and the test point **MS3** - which are used during the closing procedure of the S-boom system - are shown on LICCON monitor 1!
- Note the actual forces of test point **MS1** and test point **MS3** and keep it ready for the disassembly of the S-boom system!
- At boom disassembly, “tension” the control rope of winch 3 until the noted actual forces of test point **MS1** and test point **MS3** on the LICCON monitor are reached, so that the connector pins of the S-intermediate sections can be unpinned!

- When the SL/S-boom combination is assembled to the desired length:
  Lift the S-pivot section **1** with the upper pulley block **17** until the pin bores on the “bottom” align at point **C**, illustration **11**.
- Pin in the pin **22** from the inside to the outside and secure with linch pin **23**, illustration **11**.

WARNING

Mortal danger due to folding down of boom!

By unpinning the upper pulley block **17** on the assembly brackets **19**, the boom can suddenly fold down if the boom is not pinned at point **C** “on the bottom”.

Personnel can be severely injured or killed!

- It is prohibited for anyone to remain under the raised boom combination during the pinning / unpinning procedure!
- Unpin the upper pulley block **17** only when it is ensured that the S-pivot section **1** is pinned and secured “on top” and “bottom” with the S-intermediate section **25**.

- When the S-boom is “closed”:
  Unpin the lug **18** on the assembly bracket **19**: Release and unpin the pin **20**.
- Unpin the lug **18** on the upper pulley block **17**: Release and unpin the pin **20**.
- Pin and secure the lug **18** in transport position **T** on the upper pulley block **17**.

3.9.1 Extend the S-relapse cylinder

NOTICE
Damage of the relapse cylinder!
By extending the S-relapse cylinder, a collision with the D-relapse cylinders can occur!
This can result in severe damage on the relapse cylinders!
▶ Extend the S-relapse cylinders only when the D-boom is in operating position!

WARNING
The crane can topple over!
If the S-relapse cylinders are not extended before erecting the boom, then the boom can fall to the rear in crane operation and the crane can topple over!
Personnel can be severely injured or killed!
▶ Extend the S-relapse cylinders before erecting the S-boom!
▶ Secure the ball cock **42** during crane operation to prevent inadvertent actuation!

Ball cock positions	
2	Crane operation, extend the piston rod
1	Assembly, retract the piston rod
STOP	The piston rod cannot be retracted / extended

Ensure that the following prerequisite is met:
– all hydraulic connections have been made.

▶ Set the ball cock **42** to Position **2**.

Result:
– The piston rods of the S-relapse cylinders **40** extend.

Note
▶ The ball cock **42** is secured by closing the cabinet door and removing the key!

▶ When the piston rods of the S-relapse cylinders **40** are fully extended:
Close the cabinet door and pull the key.
▶ Hand the key to an authorized person.

Note

▶ Unpin the intermediate sections with the pin pulling device, see chapter 5.30.

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!

▶ Do not exceed the maximum permissible total forces!

- ▶ Lift the S-boom from the supporting base or off the ground by spooling up winch III.
- ▶ When the S-boom has been lifted off the ground and is safely held by winch III:
  Unpin the S-pivot section **1** and S-intermediate section **25** at point **C** on both sides: Remove the linch pin **23** and unpin the pin **22**.
- ▶ When the pins **22** are unpinned at point **C**:
  Carefully place the S-boom on the ground.
- ▶ Unpin the S-pivot section **1** on both sides at point **A**: Remove the linch pin **23** and unpin the pin **22**.
- ▶ Relieve the guying by lowering the upper pulley block **17**.
- ▶ Unpin the upper pulley block **17** on the assembly brackets **19**: Remove the linch pin **21** and unpin the pin **20**.
- ▶ Unpin the lug **18** on the upper pulley block **17** from the operating position **B** and pin it in the transport retainer **T** on the upper pulley block **17**.
- ▶ Unpin and disassemble all intermediate sections.

3 Erecting the SL-boom

3.1 Erection procedure

DANGER
The crane can topple over!
- ▶ It is prohibited to turn the crane superstructure while erecting the boom!
- ▶ Observe the data in the erection and take down charts!

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 the Crane operating instructions, chapter 5.01!
- ▶ Extend the S-relapse cylinder **7** before erecting the boom combinations!
- ▶ Do not allow slack cable to build up on the control winch!

WARNING
Falling hoist rope!
If the hoist rope is not reeved before the erection procedure with the corresponding length on the auxiliary jib “HS” **1**, then it can fall down backward due to its own weight!
Personnel can be severely injured or killed!
- ▶ Reeve the hoist rope with sufficient length on the auxiliary jib “HS” **1** before the erection procedure!
- ▶ The hoist rope must be constantly monitored during erection procedure!
- ▶ Do not step into the danger zone!

Make sure that the following prerequisites are met:
- – 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 data in the erection and take down chart.
- – 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.
- – The LICCON overload protection has been adjusted according to the data in the load chart.
- – The LICCON overload protection settings have been compared with the actual crane configuration.
- – The assembly key button **450** is actuated.
- – The indicator light **431** “assembly” lights up.
- – The assembly icon **11** on the LICCON monitor 0 lights up.

2 Installing / removing the pulley cart

2.1 Installing the pulley cart

– For illustration of a SW-end section with installed pulley set, see fig. **1**.
– For installation of the pulley cart on example of a SW-end section with two pulley sets, see fig. **2** and fig. **3**.

▶ Position the pulley cart **7** below the SW-end section **1** and secure the tires **5** with wedges **6**.
▶ Slowly lower the SW-lattice jib until the pulleys of the pulley set **9** in point **A** are laying in the receptacle **8** of the pulley cart.
▶ Plug in the retainer **3** and secure with spring retainer **4**.
▶ Remove the wedges **6**.

2.2 Removing the pulley cart

WARNING
Risk of accident!
▶ Observe and adhere to the data in the erection and take down charts.
▶ Observe chapter 5.07.

▶ Secure the pulley cart **7** with wedges **6**.
▶ Release the spring retainer **4** and pull the retainer **3**.
▶ Luff up boom combination.

▶ Select “heater **553** ” function by “touching”.

Result:

– The “Heater” icon is surrounded with a black border.
– In the status display **555** appears the current status of the “Heater”.

▶ Press the function key **F2**.

Result:

– Switch from heating mode “AUTO” to heating mode “MANUAL”.

▶ Press the function key **F3**.

Result:

– The “temperature stages” are reduced incrementally by one stage.
– The amount of heat supplied into the cab is reduced accordingly.

▶ Press the function key **F4**.

Result:

– The “temperature stages” are increased incrementally by one stage.
– The amount of heat supplied into the cab is increased.

Result:

– The engine is bled as soon as no more air bubbles rise.

▶ When no more air bubbles rise in the expansion tank:
Set the heater to “cold”.

Result:

– The heating circuit will be vented.

▶ Check the expansion tank for air bubbles.

Result:

– The heating circuit is vented as soon as no more air bubbles rise.

4 Emergency operation with assembly plate(s) Variation 2 (V2)

Note

▶ The procedure of the emergency operation - except winch 4 on the LR1600/2 and LR1600/2-W - is identical for all winches and is described on the example of one winch!

Exception LR1600/2 and LR1600/2-W:

▶ Before emergency operation of winch 4 **W IV** on the LR1600/2 and LR1600/2-W, in addition to the hydraulic connections to lift, lower and for the control pressure of the brake, a control line must be connected, see section: “Emergency operation of winch 4 **W IV** on the LR1600/2 and LR1600/2-W!”

To carry out the emergency operation, use an emergency operation aggregate **1**, a hydraulic transformer **4** and the assembly plate **12**. To carry out the emergency operation from winch 1 **W I** and winch 2 **W II** in parallel operation (1II2), in addition to the assembly plate **12**, the assembly plate **13** is needed. Connect the assembly plate **12** with the assembly plate **13** hydraulically on hydraulic connections 4, 5 and 6.

4.1 Start the emergency operation aggregate

▶ Turn the crank **2** on the emergency operation aggregate* **1**.

▶ Switch the ball valve **3** to “horizontal” position.

Note

▶ The engine rpm on the emergency operation aggregate can be set via a separate speed regulator!

4.2 Emergency operation of winch 4 on the LR1600/2 and LR1600/2-W

WARNING

Emergency operation winch 4 **W IV**!

▶ Observe the section “Emergency operation of winch 4 (W IV) on the LR1600/2 and LR1600/2-W”!

6.3 Connection schematic for emergency operation, illustration 2

Note
▶ See also Hydraulic schematic!

Position	Connection / description
20	Control pressure SA-frame
50	Lifting
60	Lowering
80	Replenishing pressure brake

7 Ending emergency operation

7.1 Procedure

▶ Turn the emergency operation aggregate* **1** off.
▶ Close the ball valve **3**.
▶ Disconnect the hydraulic connections and close them off with dust plugs.

2 Ballast trailer maintenance and inspection schedule

First maintenance after	Operating hour intervals			Calendar intervals			Work to be carried out
	10 h	100 h	1000 h	Daily	Weekly	Annually	
Fall protection equipment							
						X	Check protection points
						X	Check safety ropes
						X	Check the ladders for technically immaculate condition
						X	Check railings, steps and pedestals for safe function
						X	Check catwalks and open mesh flooring for safe function
Ballast trailer surface							
					X		Check accessible surfaces for cleanliness
						X	Check accessible surfaces for completeness and slip resistance
						X	Check labels for completeness and legibility
Tires							
					X		Check for external damage and distortion
					X		Check the tire pressure
	X						Check lug nuts for tight seating, retighten if necessary
						Every 5 years	Replace tires; have further service life confirmed by a tire manufacturer expert
Axle link							
		250 h				X	Lubricate
Hydraulic cylinder							
					X		Check for leaks
Hydraulic hose lines							
				X			Check for leaks and damage
						X	Have safe working condition checked by expert
Slewing gear							

1.3 Changing the oil

NOTICE
Damage to the travel gear!
If seals are used repeatedly, it can result in loss of oil!
Due to loss of oil, the travel gears can wear significantly and / or be damaged!
▶ Use the seals on the maintenance ports only once!

1.3.1 Changing oil on the miter gear

Make sure that the following prerequisites are met:
– The crane is in horizontal position.
– The travel gear must be at a standstill.
– The travel gear is at operating temperature.
– A container to catch the used oil is available.

Note
▶ When selecting the container to catch the use oil, make sure that the container is sufficiently sized to be able to catch all the used oil!
▶ For fill quantity of miter gear, see Crane operating instructions, chapter 7.06!

▶ Remove the oil filler plug **1**.
▶ Remove the oil drain plug **3** and drain oil into a suitable container.

Note
▶ Allow the miter gear to empty completely!

▶ Clean the oil drain plug **3** and the sealing surface.
▶ Close off the oil drain port **3** tightly.
▶ Open the oil level port **2**.
▶ Add oil on the oil filler port **1** until it “stands” at the height of the fill level on point **P1** of the oil level port **2** or until it starts to run over.
▶ Clean the sealing surfaces.
▶ Close off the oil level port **2** tightly.
▶ Close off the oil fill port **1** tightly.

3.2.1 Checking the wear on the connections of the track pads

NOTICE
Damage to the sprocket!
If the wear limit on the connections to the track pads is achieved, it can lead to increased wear on the sprocket and on the transporting lugs of the track pads due to excessive chain stretch!
Expensive and extensive repairs can result!

- ▶ The random inspection of the bolt diameter must be made within the specified intervals!
- ▶ If one bolt **22** falls below the minimum permissible dimension, then it must be replaced with a new bolt **22**!
- ▶ The random inspection of the bore diameter must be made within the specified intervals!
- ▶ If the bore diameter exceeds the maximum permissible dimension, then the track pad **21** must be replaced!

The track pads **21** of the crawler track are connected by bolts **22**.

Wear limit bore track pad	
Initial diameter	48 mm
Maximum permissible upper limit	51 mm

Wear limit bolt	
Initial diameter	45 mm
Maximum permissible minimum dimension	44 mm

3.4.2 Examples of possible defects in hose lines

DANGER
Risk of fire or accident!
If problems are discovered during inspections, then they must be remedied immediately or suitable measures are to be taken. Failure to do this can result in serious injury to persons, death or damage to property!
▶ Remedy problems or take suitable measures!

- Damage to the outer layer as far as the intermediate later (e.g. chafing, cuts and cracks).
- Outer layer brittleness (crack formation of the hose material).
- Deformation that differs from the natural shape of the hose or hose line, in depressurized as well as in pressurized condition or in bends, for example layer separation, bubbling, crushing or kinking.
- Leaks.
- Failure to follow installation instructions.
- Damage or deformation of hose fittings that inhibit the function and strength of the fitting or the hose / fitting connection.
- Hose slipping out of fitting.
- Fitting corrosion that inhibits function and strength.
- Storage time or usage period exceeded.

3.4.3 Maintenance of hose lines

- We recommend to check all hoses, hose lines and screw fittings daily, but at least every two weeks for leaks and externally recognizable signs of damage.
- Damaged parts must be replaced immediately! Oil spray can lead to injuries and fires!
- Hydraulic lines and hoses may not be repaired!
- Hoses that have already been used as a part of a hose line may not be reinstalled in hose lines.
- Always use Original Liebherr spare parts when replacing hoses and hose lines.
- Always ensure that the hoses are routed free of torsion. If high pressure hoses are being used, attach the screws of half clamps or full flange at both ends of the hose and then tighten.
- When using high pressure hoses with a bent fitting, tighten the end with the bent fitting first when tightening the flanges, then the end with the straight fitting.
- Any mounting clamps in the hose center may be attached and tightened only thereafter.
- Route the hoses in such a way that chafing with other hoses or other structures is prevented. Maintain a minimum clearance of approximately ½ the outer diameter of the hose to other parts. The clearance may never be less than 10 to 15 mm.

3.4.4 Replacing the hose lines

DANGER
Risk of fire or accident!
Failure to replace hose lines at appropriate intervals can cause serious injury to persons, death or damage to property!
▶ Replace hose lines according to appropriate intervals!

This must be documented in the crane's log book by the **expert** or the **authorized inspector**.
The service life of a hose line may not exceed six years, including a storage period of a maximum of two years (pay attention to the manufacturing date on the hoses). The duration of use can also be defined by the **expert** or **authorized inspector** in accordance with existing test and empirical data in the individual application areas, taking the usage conditions into consideration.

8 Slewing gear

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

8.1 Checking the oil level

Make sure that the following prerequisite is met:
– The crane is in horizontal position.

▶ Remove the dipstick **1** and wipe it off.
▶ Reinsert the dipstick **1** and pull it out again.

The oil level must be between the two notches on the dipstick **1**.
▶ Check the oil level.

NOTICE
Danger of gear damage!
If the oil level has dropped below the lower notch, add oil as specified in the lubrication chart until the oil level is between the two notches!
▶ Add oil and check again!

▶ Reinsert the dipstick **1**.

8.2 Changing the oil

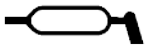
Make sure that the following prerequisites are met:
– The crane is in horizontal position.
– The gear is warm.

▶ Open the oil filler port by unscrewing the dipstick **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 in the lubrication chart on the oil filler port until the oil level is between the two notches on the dipstick **1**.
▶ Close the oil filler port by screwing in the dipstick **1**.
▶ Check the oil level as described above.

2.4.2 Rope pulley

Note

▶ The rope pulley shown in this chapter is only an example and can deviate in type and version from other rope pulleys. The lubrication schedule is generally valid for all rope pulleys.



Note

▶ The lube points are marked with this icon.

2.3 Did an alarm function occur?

Note

- ▶ For a detailed description of alarm functions, see Crane operating instructions, chapter 4.02!
- ▶ In case of an alarm function, an error message **3** with LICCON error code (LEC) appears at the same time!

The following alarm functions are indicated by blinking icons on the LICCON monitor 0:

- Boom limitation **41**
- Hoist top limit switch **42**
- Advance warning load **43** / Advance warning engine **44**
- Stop load **45** / Stop engine **46**

The limit ranges of the crane movements are monitored by:

- Hoist limit switch
- Angle sensors
- Pressure sensors
- Pull test brackets (force test boxes)
- Wind sensor
- Inductive sensors

If the limit ranges for these sensors are exceeded, the crane movements are turned off (LMB-STOP).
The load moment limiter (LML) is a program of the LICCON computer system to monitor the permissible load moment. If the permissible load moments of the load chart are exceeded, the LMB-STOP turns the crane movements off.

Note

- ▶ In case of certain shut offs, you can only continue to work by bypassing the safety devices!

WARNING

Risk of accident!
Personnel can be severely injured or killed!

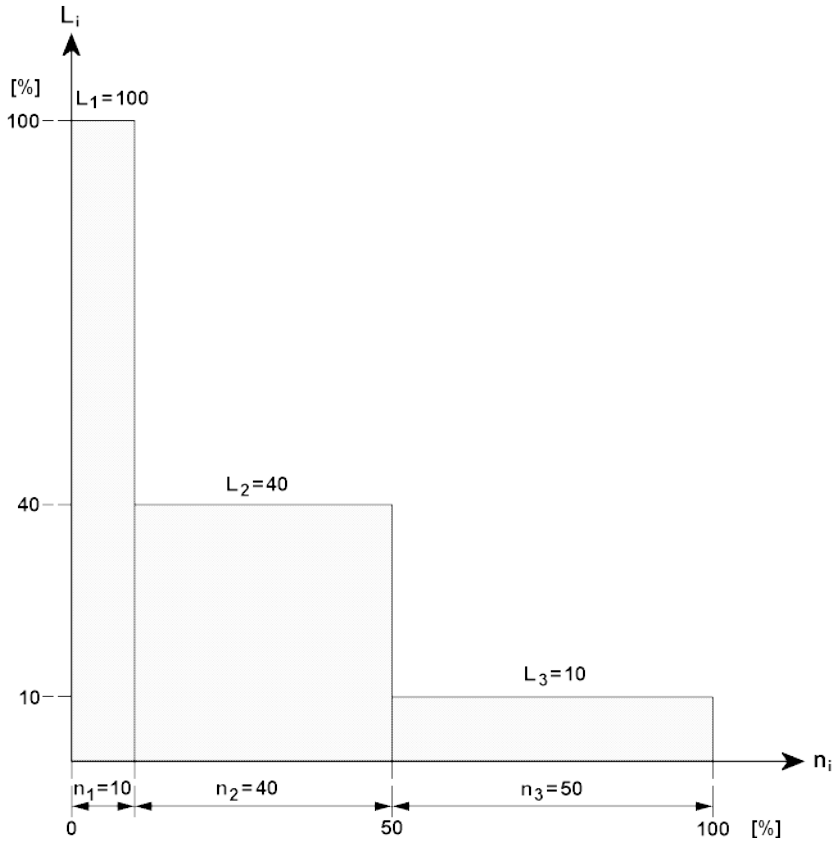
- ▶ All instructions and data in the Crane operating instructions, chapter 4.04 must be observed and adhered to!

DANGER

Bypassing the overload protection!
If the overload protection is bypassed, there is no further protection against crane overload!
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!

- ▶ It is only permitted to bypass the overload protection for assembly or in emergencies!
- ▶ 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 the crane supervisor and must be performed with utmost caution!
- ▶ Crane operation with bypassed overload protection is prohibited!
- ▶ Contact Liebherr Service to determine the cause of the problem and further procedure!

- ▶ If a LMB-STOP occurs due to boom limitation:
  Carry out load moment reducing crane movements.



L_i: Load proportion in relation to maximum load [%]
n_i: Load cycles in relation to maximum number [%]

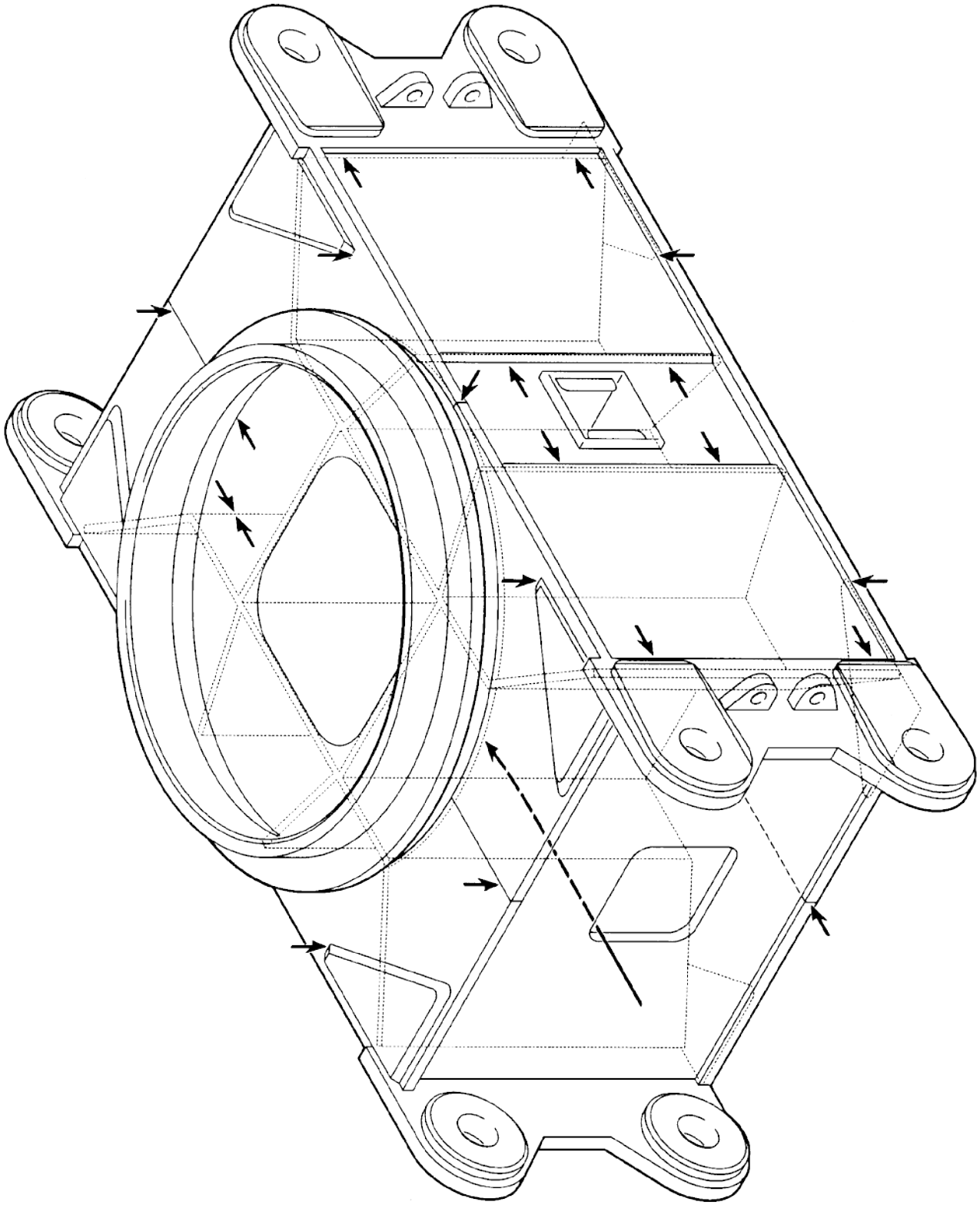
Note

- The service life of Liebherr mobile and crawler cranes can be drastically reduced, for example when used in magnet, grapple or material handling applications!
- Repeated inspection of crane structure, especially the steel structure and the welding seams must then be carried out in shorter intervals than specified.

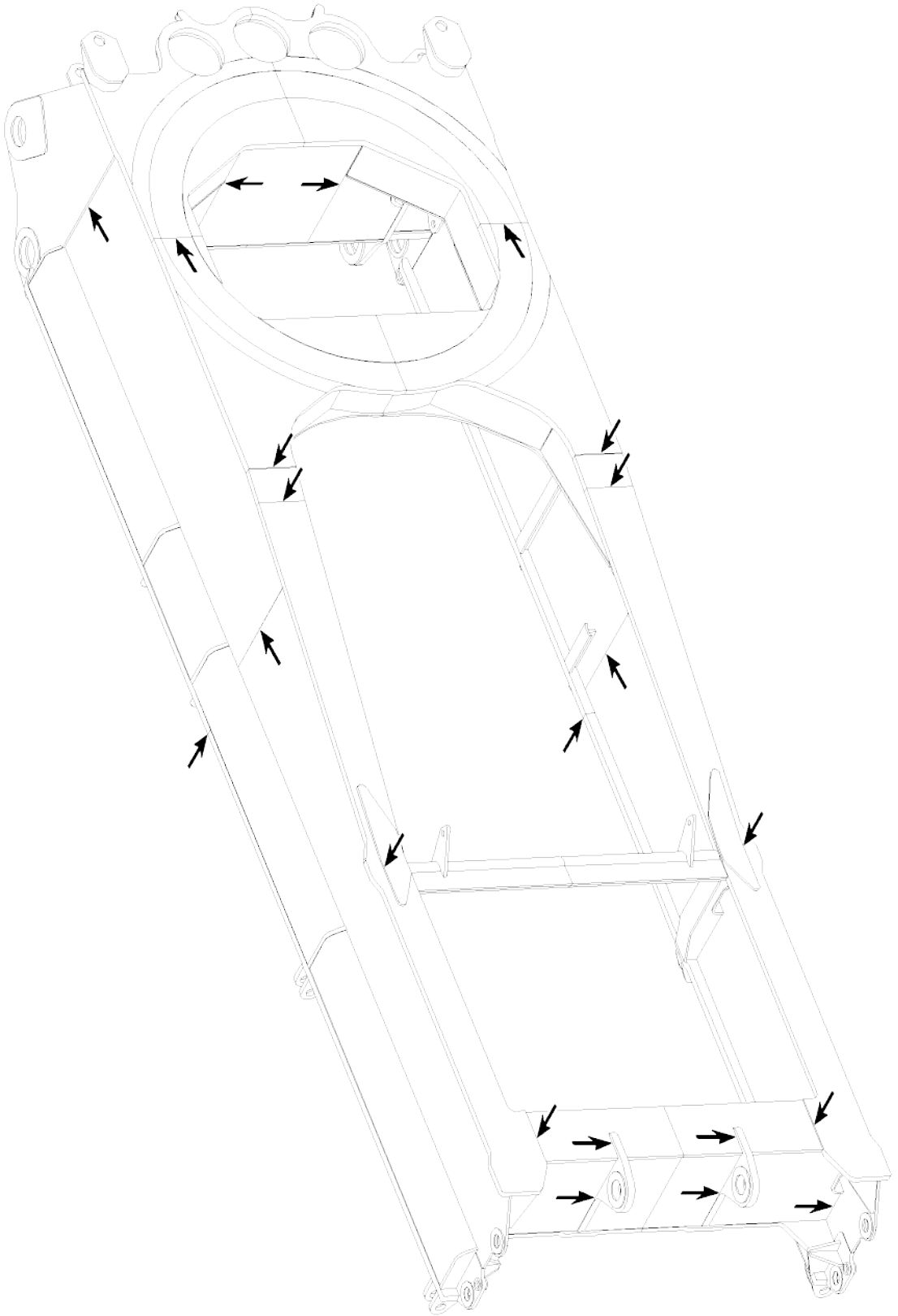
For that reason, the steel structures and the welding joints must be subjected to an visual intensive inspection by the expert during the specified periodic inspections.
If any damage (such as cracks or suspicion of cracks) are apparent on any part of the steel structure, the total extent of the damage must be determined by qualified specialists using appropriate material testing methods, such as magnetic crack detection, ultrasound or x-rays. Thereafter, the qualified personnel must determine whether or not the damaged area can be repaired by welding or by other means.
The following basic sketches are samples of the load-bearing welding structures. The welding joints or seams or steel structural zones that require inspection may be present more than once and in various forms. The joints or zones must be inspected all around at the locations identified by arrows.

Note

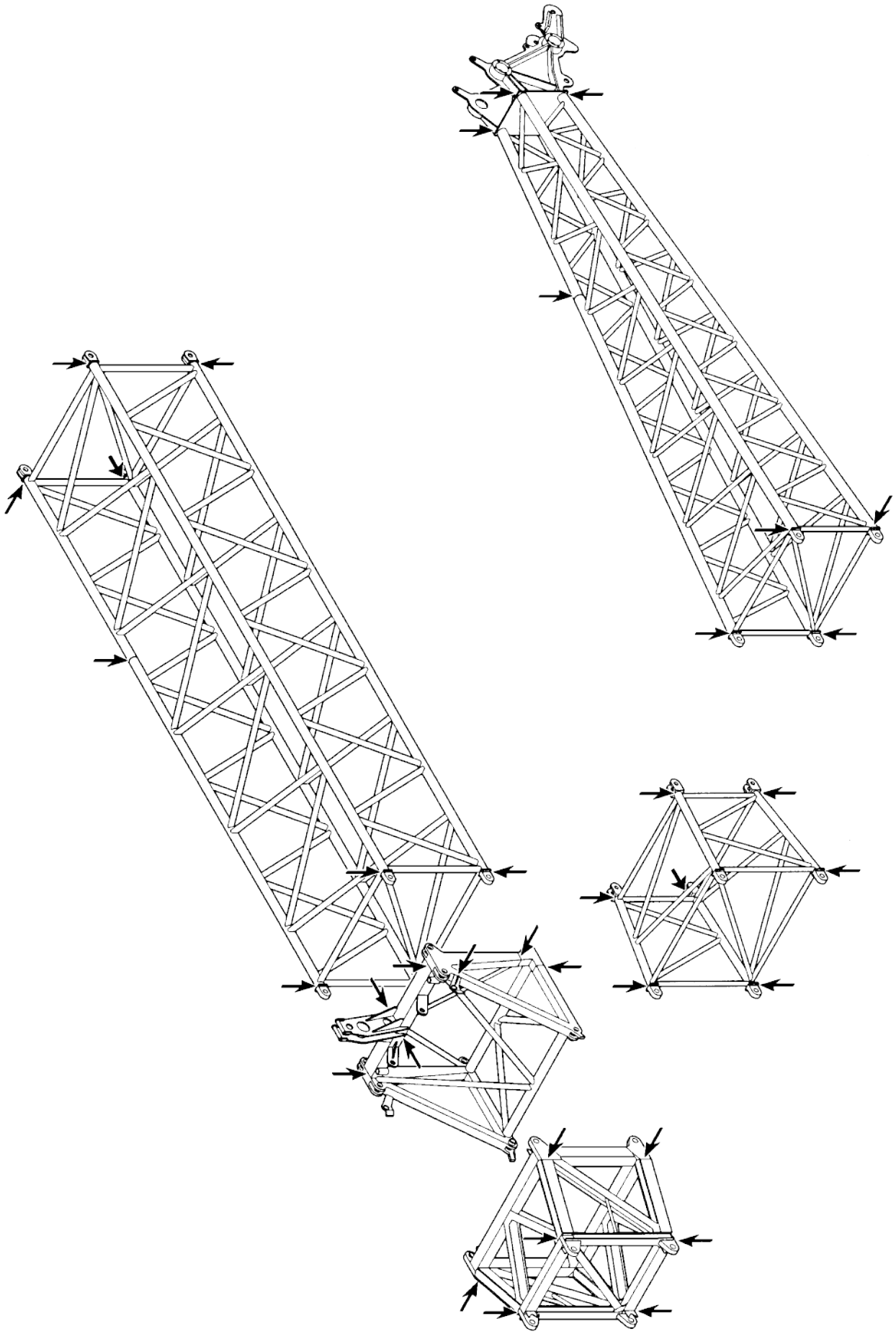
- The scope and extent of all inspections remain the sole responsibility of the inspectors!
- The scope and results of tests should be documented to permit reproducibility. This documentation forms part of the crane records and should be safely stored during the entire service life of the crane!
- The following basic sketches are provided to assist the inspector. The diagrams are only examples and are not necessarily 100 % complete!



B187347 *Example for crawler center section*



B105696 *Example for turntable frame*



B185051

Example for lattice jib

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 Inspection of retaining ropes and anchor points

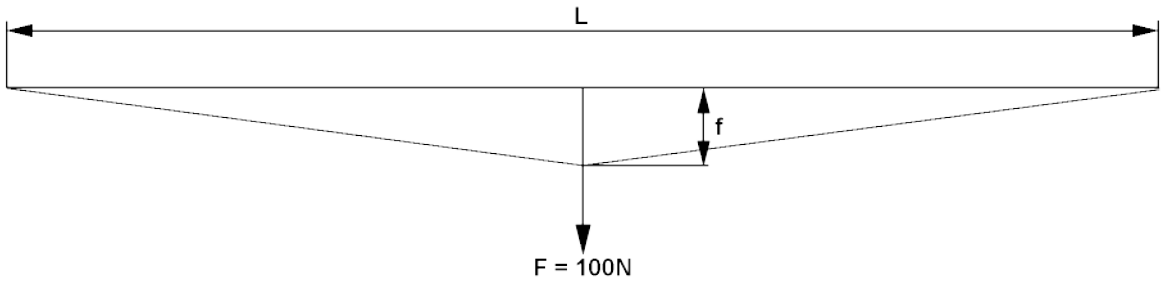
WARNING
Danger of falls due to damaged retaining ropes or anchor points!
The retaining ropes **1** and anchor points **3** must be checked **at least once a year** by **expert personnel** for safety and damage!
If any defects are found on the retaining ropes **1** or anchor points **3** during the inspections, then the retaining ropes **1** or anchor points **3** must be replaced immediately by **expert personnel**! If this is not observed, assembly personnel could be killed or fatally injured in a fall!

- ▶ The rope pretension on the retaining ropes must be 800 N!
- ▶ Have damaged retaining ropes **1** or anchor points **3** replaced immediately by **expert personnel**!

Note
Document the inspections in writing!

- ▶ The scope and results of tests should be documented to permit reproducibility. This documentation forms part of the crane records and should be safely stored during the entire service life of the crane.

8.1 Inspection of rope pretension



The rope pretension must be 800 N. This can be checked with the aid of a spring balance, which is pulled centered on the retaining rope. If the specified deflection (f) depending on the rope length (L) according to the following charts results for the raised load F = 100 N then the rope pretension of 800 N is set correctly.

1 Introduction

DANGER
Danger of fatal injury due to defective crane ropes!
▶ Please observe the following criteria.

The rope should be considered to be a wear part, which must be replaced if the inspection shows that its strength has reduced to such an extent that continued use may be dangerous.
Regular inspection of the rope is required in order to safely carry loads with correctly deployed equipment, meaning that the rope must be taken out of service at an appropriate point in time.
The take-down criteria with regard to wire breaks, wear, corrosion and deformation can be applied immediately under all application conditions. The different factors are dealt with in ISO 4309, which is intended to serve as a guideline to competent experts who are involved in the maintenance and inspection of cranes.
We recommend to carry out an annual inspection by an **expert** according to the following standard (ISO 4309).
The ropes should be inspected every 4 years by an **authorized inspector**.
The scope of the inspection and the inspection results must be traceably documented, see addendum 2. This documentation must be retained as part of the crane records!
The criteria that are covered here are intended to provide an appropriate safety margin for movement of loads with cranes until the rope is taken down.

2 Wire rope

2.1 Condition before installing

The rope is usually replaced with a rope that is of the same type as the original. If the spare part is of another type, the user must ensure that the rope characteristics are at least as good as those of the rope that was taken down.
Before installing a new wire rope, the grooves of the rope drums and pulleys must be checked in order to ensure that the spare ropes is placed correctly in the rope grooves (see section entitled “Inspection”).

2.2 Installation

When the rope is removed from the spool or unwound from a reel, it must be ensured that the rope is not twisted, otherwise loops, reverse bends or kinks could originate in the rope.
If the rope is looped over any part of the system when it is not under strain, these areas must be protected accordingly.
Before starting to use the rope on the system, the user must ensure that all components that are functionally associated with the wire rope in connection with the standing components have been set up in such a way that they will operate correctly.
To stabilize the wire rope, a few lifting procedures should be carried out at approximately 10 % of the normal load.

2.3 Maintenance

The maintenance of the wire ropes depends on the type of lifting device, its application, the environment as well as the type of rope that is used. If no other instructions from the crane or rope manufacturer are provided, the wire rope should be cleaned, if possible, and lubricated with grease or oil, particularly in areas in which the rope is subjected to bending when it runs over pulleys.
The kind of grease that is used must be suitable for steel ropes.
Lack of maintenance will reduce the service life of the rope, particularly if the crane is used in a corrosive environment and if re-lubricating is not possible because of the nature of the respective crane application.

10 Appendix 2

Typical example for an inspection log

1 Checking jib stop cylinder pressure

The jib stop cylinder pressure must be checked using the LICCON operation display before and after crane operation, “see diagnosis”.
The actual pressure displayed on the LICCON operation display must correspond with the target pressure in the table.

Note
- The specified target pressure depends on the outside temperature.
- The maximum permitted difference between the target pressure and the actual pressure is +/- 10 bar.

The jib stop cylinder pressure is checked as follows:
– Checking cylinder pressure with “jib stop extended to maximum limit”
– Checking cylinder pressure with “jib stop in test position”

1.1 Checking cylinder pressure with “jib stop extended to maximum limit”

– Set main boom and lattice jib to angles specified in table.
– Compare target pressure in table with actual pressure in LICCON operation display.

“Extend jib stop to maximum limit”								
Boom angle α	**Lattice jib angle β**	**Cylinder length**	**Stroke**	**Target pressure**				
				-40° C	**-20° C**	**0° C**	**20° C**	**40° C**
87°	42,9°	4600 mm	1100 mm	119,3 bar	129,5 bar	139,8 bar	150,0 bar	160,2 bar

1.2 Testing cylinder pressure with “jib stop in test position”

– Set main boom and lattice jib to angles specified in table.
– Compare target pressure in table with actual pressure in LICCON operation display.

“Jib stop in test position”								
Boom angle (α)	**Lattice jib angle (β)**	**Cylinder length mm**	**Stroke mm**	**Target pressure**				
				-40° C	**-20° C**	**0° C**	**20° C**	**40° C**
87°	60°	4074 mm	574 mm	172,5 bar	187,4 bar	202,1 bar	216,9 bar	231,8 bar