LIEBHERR

Crawler crane with telescopic boom

LTR 1100

LTR 1100-004

Operating instructions

BAL-No.: 17504-01-02

Pages: 806

Werk-Number	
Date	

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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Foreword

General

This crane was built according to the state of technology and recognized safety technical regulations. Despite that, dangers to body and life for the user and/or third persons or damage to the crane and/or other material assets can occur.
This crane may only be used in flawless technical condition and according to its mission as well as with constant awareness of safety and dangers. Any problems, which could affect safety must be fixed immediately.
Modifications on the crane may only be made with written approval by Liebherr-Werk Ehingen GmbH.

Warning notes

The terms **DANGER**, **WARNING**, **CAUTION** and **NOTICE** used in these operating instructions are intended to point out certain rules of conduct to all persons working with the crane.

Warning signs	Signal word	Explanation
	**DANGER**	Designates a dangerous situation which will lead to death or serious injury if it is not prevented.
	**WARNING**	Designates a dangerous situation, which can lead to death or serious injury if it is not prevented.
	**CAUTION**	Designates a dangerous situation, which can lead to slight or medium-grade injuries if it is not prevented.
	NOTICE	Designates a dangerous situation, which can lead to property damage if it is not prevented.

Additional notes

The term **Note** is used in these operating instructions to indicate useful information and tips to all persons working with the crane.

Symbol	Signal word	Explanation
	**Note**	Designates useful information and tips.

Operating instructions

These operating instructions are intended to put you in a position to operate the crane safely and utilize the reliable usage options that it provides. The instructions also provide information about the function of important components and systems.
Certain expressions are used in these operating instructions. In order to avoid misunderstandings, the same expressions should always be used.
These operating instructions have been translated to be best of one's knowledge. Liebherr-Werk Ehingen GmbH assumes no liability for translation errors. The German version of these operating instructions is solely applicable for factual accuracy. If you find any errors or if any misunderstandings arise when reading these operating instructions, please contact Liebherr-Werk Ehingen GmbH immediately.

DANGER
Risk of fatal injury if operated incorrectly!
Incorrect operation of the crane can result in death or serious injuries!
▶ Only authorised and trained expert personnel are permitted to work on the crane!

The operating instructions and on-site regulations and specifications (such as accident prevention regulations) must be followed.
The use of these operating instructions:
– **makes it easier** to become familiar with the crane
– **avoids** problems due to improper operation

Observing these operating instructions:
– **increases** reliability in use
– **extends** the service life of your crane
– **reduces** repair costs and downtime

Always keep these operating instructions handy in the driver's or crane cab.
The operating manual is part of the crane!
Only operate the crane if you are well familiarized with the equipment, and always follow these operating instructions.

Note
▶ If you have received additional information about the crane from us, such as technical information bulletins, instructions and/or supplements to these operating instructions, then this information must also be followed and kept with the operating instructions.

If there is anything in the operating instructions or the individual chapters that you do not understand, please contact us before starting the relevant work.

All accident prevention guidelines, operating instructions, etc. are based on destined use of the crane.

Destined use

The destined use of the crane consists solely in vertical lifting and lowering of free and non-adhered loads, whose weight and center of gravity are known.
To do so, a hook or hook block approved by Liebherr must be reeved on the hoist rope and it may only be operated within the permissible crane configurations.
Driving with the crane, with or without an attached load is only permissible if a corresponding driving or load chart is available. The crane configurations intended for it and the safety conditions must be observed according to the corresponding operating instructions.
Any other use or any other exceeding utilization is **not** destined use.
Part of destined use is also adherence of required safety regulations, conditions, preconditions, crane configurations and working steps as noted in the crane documentation (operating instructions, load chart, job planner).
The manufacturer is **not** liable for damages, which are caused by non-destined use or improper use of the crane. Any associated risk it is carried solely by the owner, the operator and the user of the crane.

Non-destined use

Non -destined use is:

– Working outside the permissible crane configurations according to the load chart.
– Working outside the permissible projection radii and slewing ranges according to the load chart.
– Selecting load values, which do not correspond to the actual crane configuration.
– Selecting LMB-Codes, which do not match the actual crane configuration.
– Working with bypassed load moment limiter or bypassed hoist limit switch.
– Increasing the projection radius of the lifted load after a LMB shut off, for example by diagonally pulling the load.
– Using the support pressure display as a safety function against tipping over.
– Using equipment or attachment parts which are not approved for the crane.
– Using the crane at sports and recreational events, especially for 'Bungee' jumps.
– Driving on a public road in non-permissible driving condition (axle load, dimension).
– Driving with the equipment in place in a non-permissible driving condition.
– Pushing, pulling or lifting loads with the leveling regulation, the sliding beams or the support cylinders.
– Pushing, pulling or lifting loads by actuating the slewing gear, the luffing gear or the telescoping gear.
– Ripping stuck objects loose with the crane.
– Utilizing the crane for a longer period of time for material handling tasks.
– Releasing the crane suddenly (grapple or dumping operation).
– Utilizing the crane when the weight of the load, which its suspended load on the crane, is changed, for example by filling a container suspended on the load hook.

The crane may **not** be used for:

– attaching a stuck load for which the weight and center of gravity are not known and which is released first, for example with a cutting torch
– letting persons drive along outside the driver's cab
– transporting personnel in the crane cab while driving
– transporting personnel with the lifting equipment and on the load
– transporting personnel with containers (cherry pickers), if no written approval of the corresponding job safety board has been issued
– transporting loads on the chassis
– two hook operation without auxiliary equipment
– extended material handling operation

The operating instructions must be read and used by all persons who are involved in the usage, operation, assembly and maintenance of the crane.

Safety systems

Special attention must be paid to the safety equipment built into the crane. The functionality of the safety equipment must be monitored at all times. The crane may not be operated if the safety equipment is not working or not working correctly.

Note
Your motto must always be!
▶ **Safety first!**

The crane had been built in accordance with the applicable crane operating and driving regulations and have been approved by the relevant authorities.

Attachment and spare parts

DANGER
Danger to life if original attachment parts are **not** used!
If the crane is operated with attachment parts, which are **not** original, then the crane can fail and cause fatal accidents!
Crane components can be damaged!
- ▶ Operate the crane only with original attachment parts!
- ▶ Crane operation with attachment parts, which do **not** belong to the crane is prohibited!

DANGER
The crane permit and the manufacturer's warranty will become void!
If any original installed parts are modified, manipulated or replaced (e.g. removal of parts, installation of non-Original Liebherr parts), both the crane permit and the manufacturer's warranty will become void.
- ▶ Leave installed original parts unchanged!
- ▶ Do not remove installed original parts!
- ▶ Use only Original Liebherr spare parts!

Definition of directional data

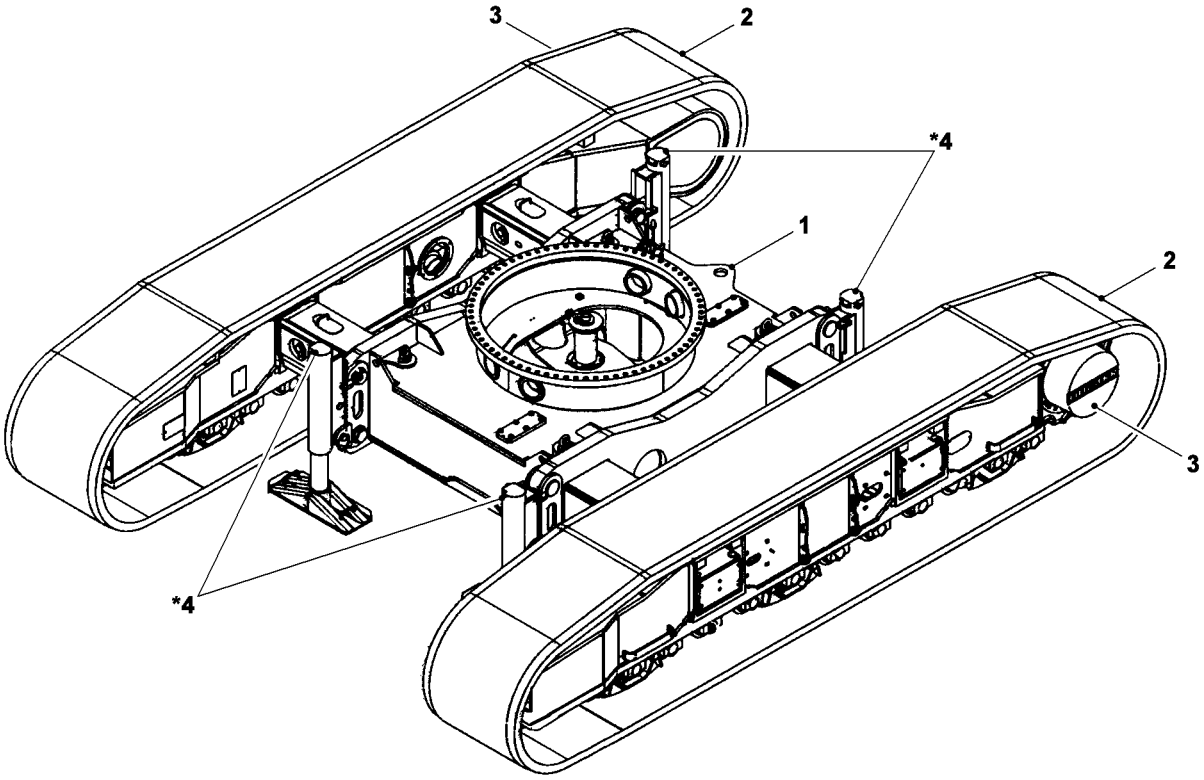
Forward driving means driving with the driver's cab on the front.
Reverse driving means driving with the tail lights of the chassis on the front.
Front, **rear**, **right**, **left** on the **crane** refer to the condition, that the driver's cab and the boom point in the same direction. Front is always in direction of the driver's cab.
Front, **rear**, **right**, **left** in the **driver's cab** refer to the crane chassis. The driver's cab is always in the front.
Front, **rear**, **right**, **left** in the **crane operator's cab** refer to the superstructure. Front is always in direction of the boom.

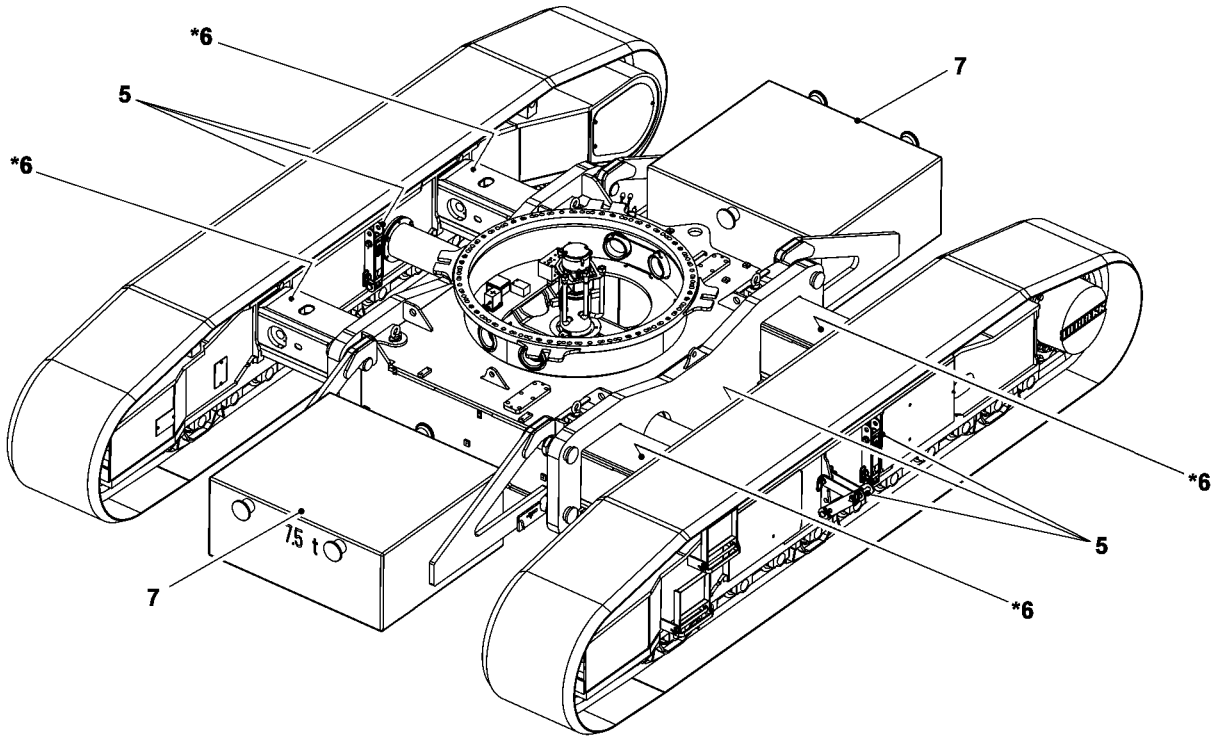
Optional

Customer-specific equipment is marked with *****.

Contents

1.00 Description of crane





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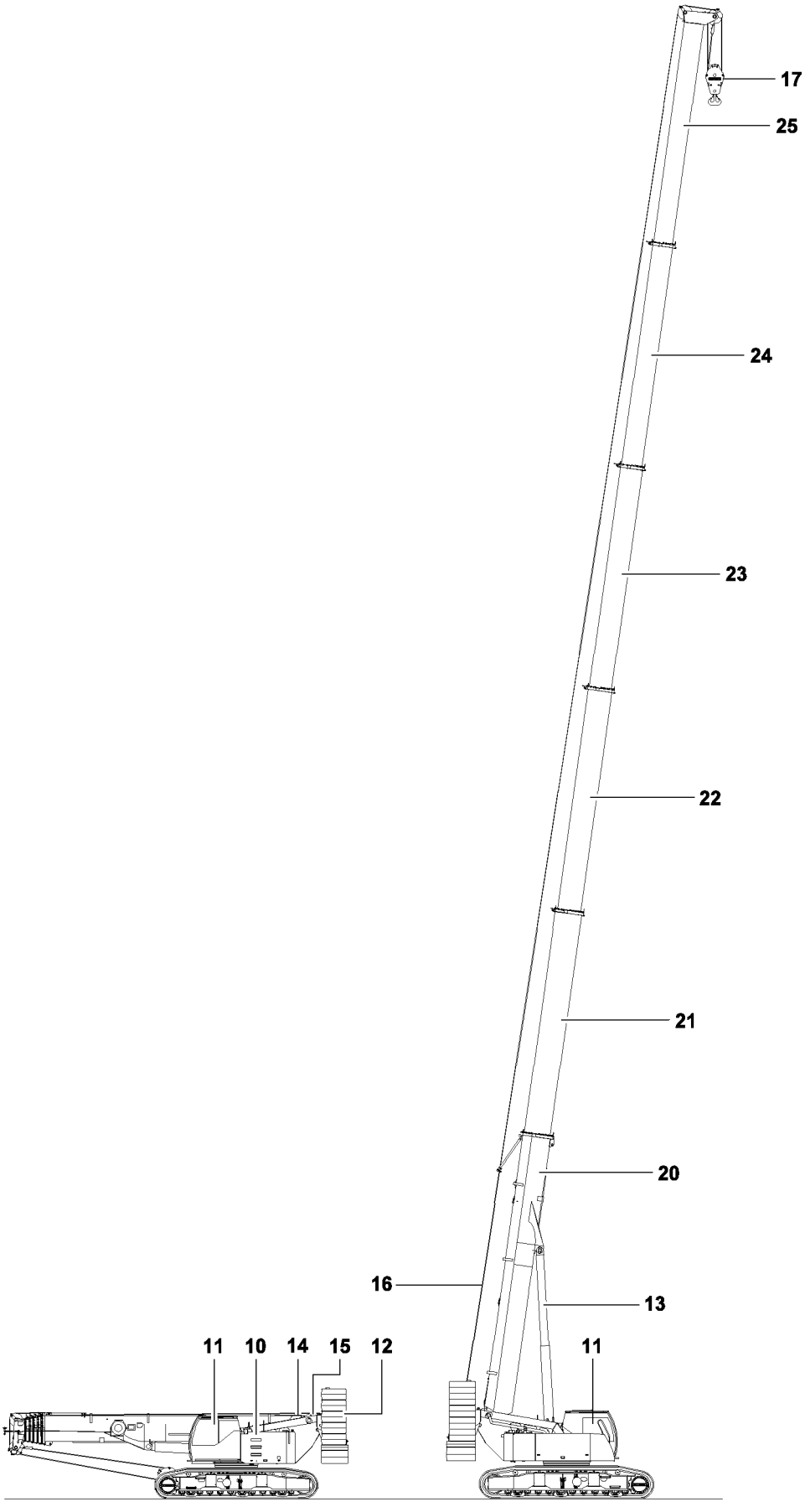
1 Crane components

1.1 Crawler travel gear

1 Crawler center section
2 Crawler carrier
3 Travelling gear transmission
4 Hydraulic assembly support*
5 Transport retainers*
6 Beams for track adjustment*
7 Central ballast



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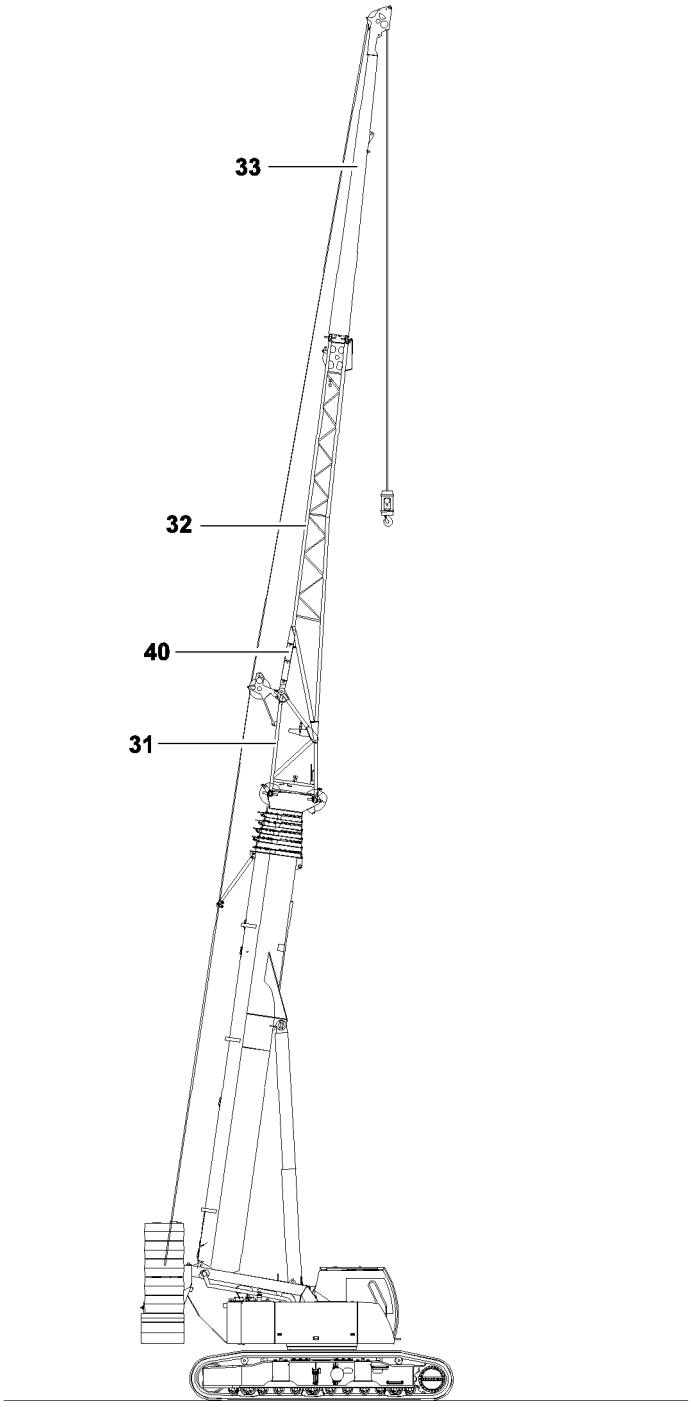
1.2 Crane superstructure

10 Crane engine
11 Crane cab
12 Counterweight
13 Luffing cylinder • for telescopic boom adjustment
14 Winch 1
15 Winch 2*
16 Hoist rope
17 Hook block

1.3 Telescopic boom (T)

20 Articulated piece
21 Telescopic section 1
22 Telescopic section 2
23 Telescopic section 3
24 Telescopic section 4
25 Telescopic section 5



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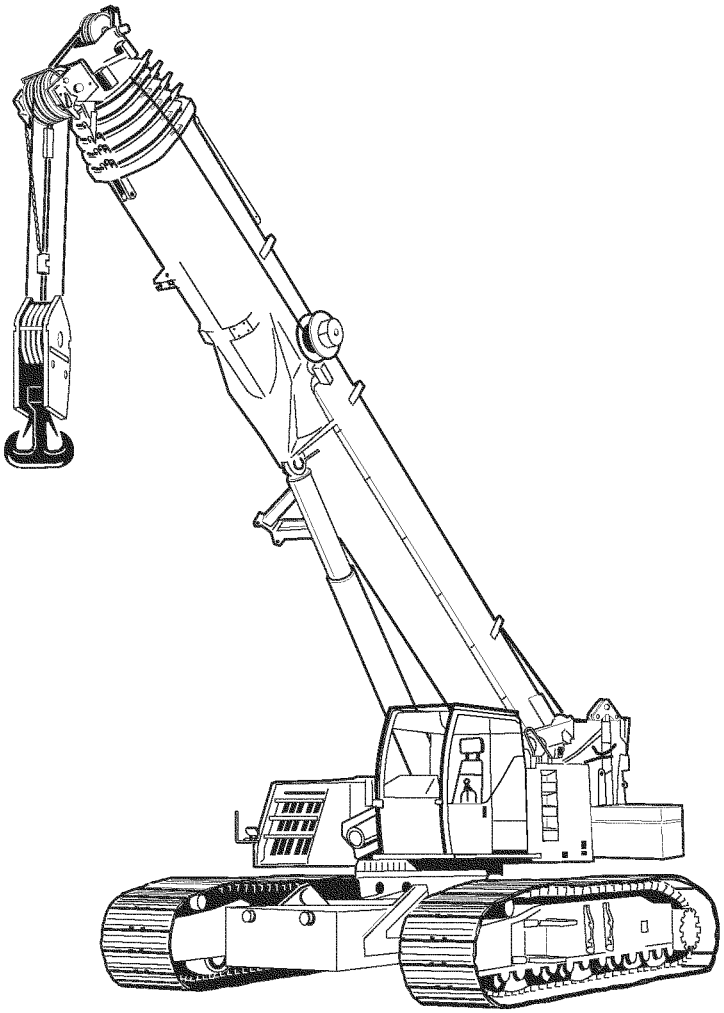
2 Auxiliary boom

2.1 Folding jib (TK)*

31 Adapter
32 Articulated piece
33 Head piece

2.2 Hydraulically adjustable folding jib (TNZK)*

31 Adapter
32 Articulated piece
33 Head piece
40 Adjusting cylinder



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1 Crawler travel gear

1.1 Frame

Torsion resistant box construction, consisting of crawler center section and two crawler carriers. The crawler carriers can be removed from the telescoping beams. Hydraulic track width adjustment.

1.2 Hydraulic track width adjustment

The track width adjustment is made via two independent, hydraulic cylinders. They are actuated via two manually actuated directional valves, which are installed on the crawler chassis.

1.3 Tracks

Maintenance free crawler travel gear with 900 mm wide triple grouser track pads.

1.4 Travel drive

Per crawler carrier, a hydraulic travel drive consisting of an axial piston motor, planetary gear with spring-loaded hydraulically-releasable travel brake. The crawler chains can be controlled synchronously as well as independently and counterrotating.
Travel speed: 0 - 2.8 km/hr

1.5 Central ballast

15.0 t, attachment blocks each 7.5 t, mounting on crawler center section.

2 Crane superstructure

2.1 Frame

In-house manufactured, weight-optimised and distortion-resistant welded structure made from high-strength, close-grained structural steel. A 3-row roller slewing ring is used as the connecting element to the crawler chassis, providing unlimited rotation.

2.2 Travel / crane engine

4-cylinder Diesel engine, manufactured by Liebherr, model D 934 S A6, water-cooled.
Performance: 145 kW (197 HP) at 1800 rpm
Maximum torque: 920 Nm at 1100 rpm to 1500 rpm
exhaust emissions according to guidelines per 97/68/EG Stage 3 and EPA/CARB Tier 3
Fuel tank: 727 l

2.3 Crane drive

Diesel hydraulic with 2 axial piston adjustment pumps with servo control and power control.
1 gear double pump, open, regulated oil circuits.
Hydraulic power system in a compact design is flanged directly onto the diesel engine, complete drive assembly encased for noise reduction.

2.4 Control

Electric “Load-Sensing” control, 4 working movements simultaneously controllable.
2 self-centring 4-way manual control levers.
The crawler travel gear is actuated via 2 two-way controllable foot pedals.
Crawler travel gear and crane superstructure can be driven at the same time.

2.5 Hoist gear

Axial piston fixed displacement motor.
Liebherr cable winch with built-in planetary gearbox and spring-loaded stop brake.

2.6 Luffing gear

1 differential cylinder with safety non-return valves.

2.7 Slewing gear

Axial piston fixed displacement motor, planetary gearbox, spring-loaded stop brake.

2.8 Crane driver's cab

Steel construction, fully galvanized, powder-coated, with safety glass, operating and control elements, luxury equipment.
Crane cab can be tilted backwards.

2.9 Safety equipment

LICCON overload system, testing system, hoist limit switch, safety valves to prevent pipe and hose breakage.

2.10 Telescopic boom

Dent and distortion-resistant design made from high-strength, close-grained structural steel with oval boom section, 1 articulated piece and 5 telescopic sections. All telescopic sections are hydraulically extendable independently of each other. Rapid-cycle telescoping system “Telematik”.
Boom length: 11.5 m to 52.0 m

2.11 Counterweight

Counterweight 26 t

2.12 Electrical system

Modern data bus technology

3 Auxiliary equipment

3.1 Folding jib

10.8 m to 19.0 m long, can be attached below 0°, 20° or 40° in relation to telescopic boom.
Hydraulic cylinder for stepless adjustment of folding jib from 0° to 40°.

3.2 Auxiliary boom

2.9 m

3.3 Winch 2

For double hook operation or during operations with folding jib if main hoist rope is to remain reeved.

3.4 Additional counterweight

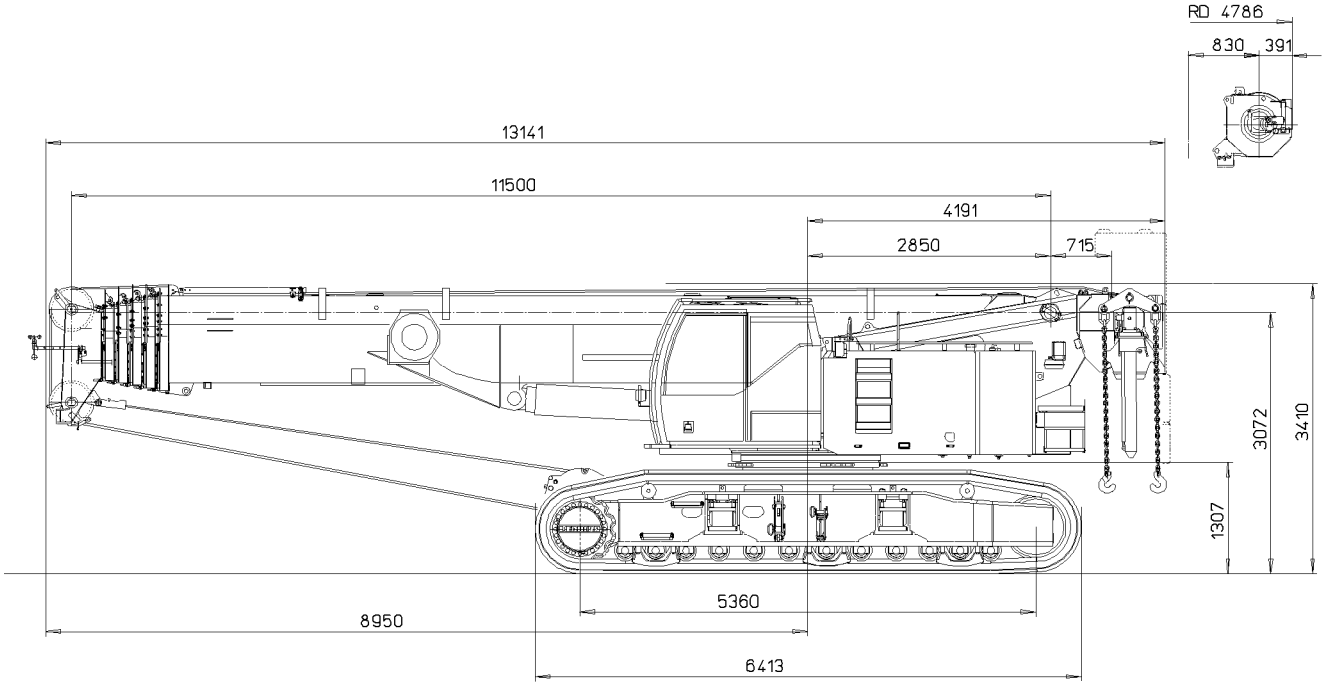
6.0 t for a total counterweight of 32 t.

3.5 Jack-up cylinder

For crawler removal
Flatbed vertical height: 1.1 m
Flatbed width: 3.0 m

3.6 Base plates

900 mm flat bottom plates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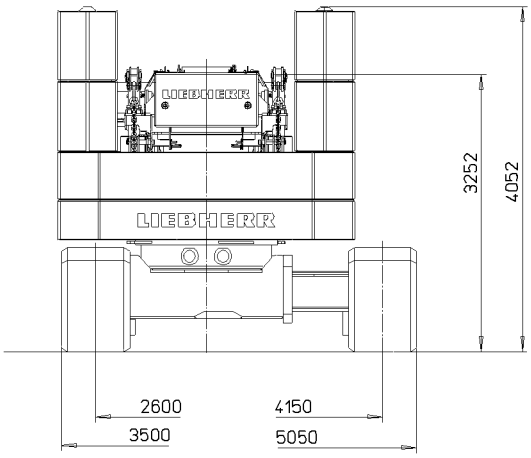
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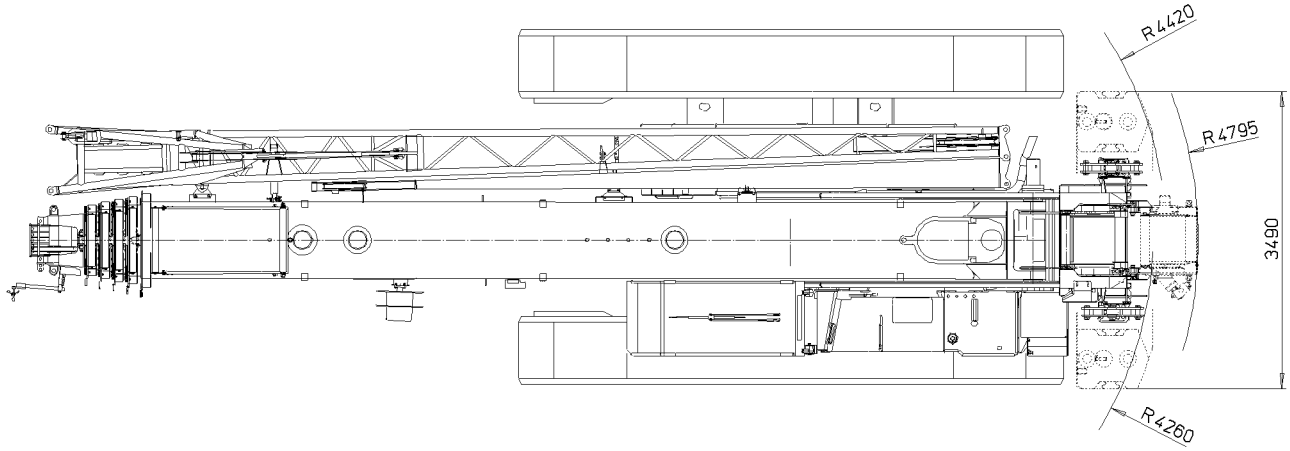
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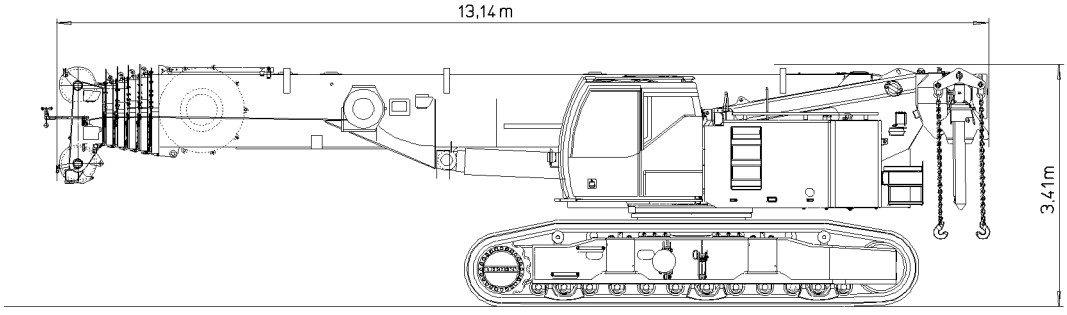
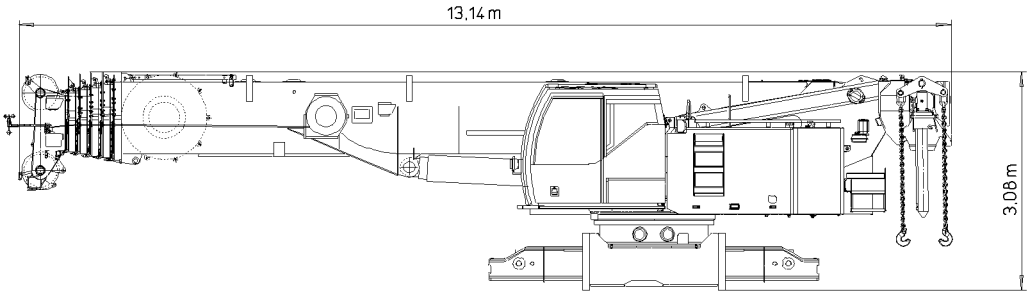
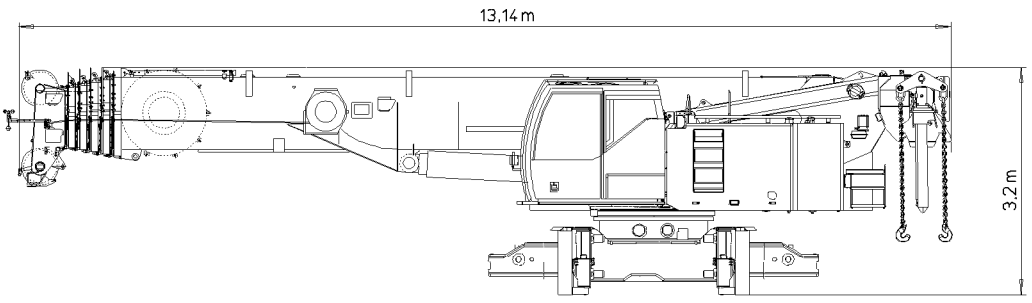
52,6 t



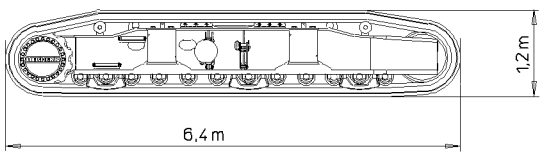
35,2 t

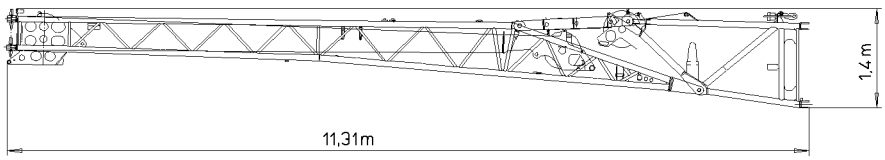


36,6 t

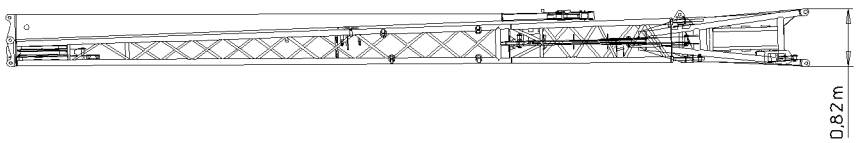


8,7 t (8,9 t)





1,67 t (1,8 t)



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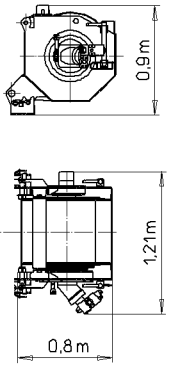
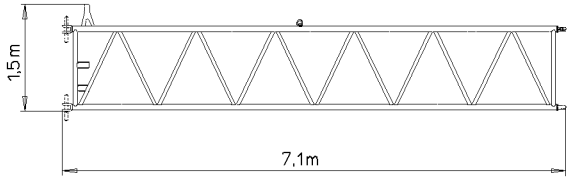
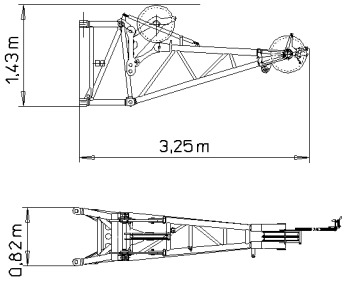
1,3 t



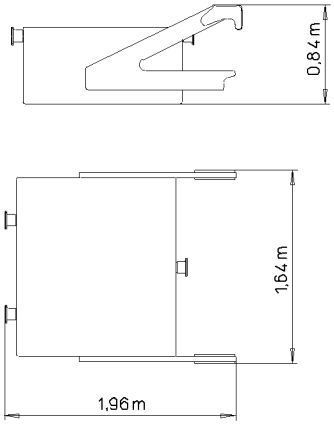
2x 6, 75 t (6,85 t)



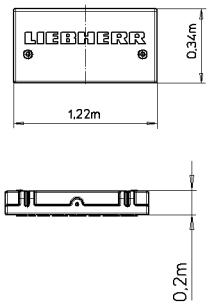
0,6 t



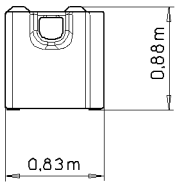
2x 7,5 t



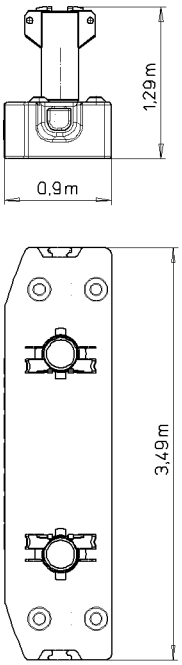
0,9 t



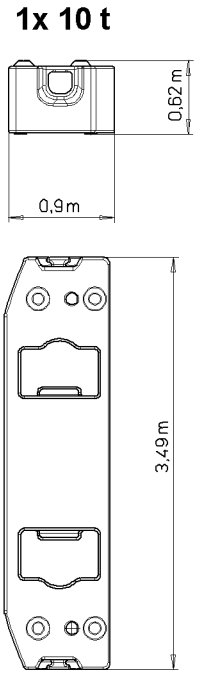
2x 3 t

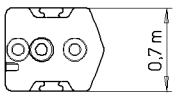


1x 10 t

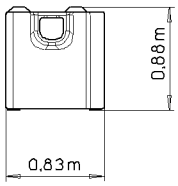


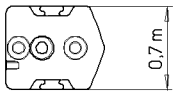
1x 10 t





2x 3 t





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1 Dimensions

See figures.

2 Weights

2.1 Crane

Quantity	Component	Weight
	Turntable with telescopic boom **and** crawlers	52.6 t
	Turntable with telescopic boom **without** crawlers **without** “Jack-up System* ”	35.2 t
	Turntable with telescopic boom **without** crawlers **with** “Jack-up System* ”	36.6 t
2	Crawlers with 3-bar	8.7 t
2	Crawlers with flat bottom pads	8.9 t
1	Folding jib mechanical*	1.67 t
1	Folding jib hydraulic*	1.8 t
2	Telescopic boom extension mechanical*	6.75 t
2	Telescopic boom extension hydraulic*	6.85 t
1	Winch 2*	1.3 t
1	Auxiliary boom*	0.6 t
2	Central ballast	7.5 t
1	Replacement ballast for winch 2	0.9 t
1	Base plate	10 t
1	Counterweight plate	10 t
4	Counterweight plates	3 t

2.2 Lifting equipment

Load	Pulleys	Strands	Net weight
100 t	7	14	1.2 t
90 t	5	11	0.7 t
59 t	3	7	0.5 t
26 t	1	3	0.45 t
8.8 t	-	1	0.25 t

3 Crane data

Crane data	
Total propelling force	660 kN
Maximum ground pressure with nominal load	1 550 kN/m^2
Total weight with 32 t counter weight, 15 t central ballast and hook block - 3-roller	approx: 102 t

4 Speeds

4.1 Travel speeds

Gear	Speed
Creeper gear	0 - 1 km/h
Fast mode (Rapid gear)	0 - 2.8 km/h

4.2 Crane speeds

Drives	Infinitely variable	Rope / rope length
Hoist gear 1	0 m/min - 110 m/min for single strand	21 mm / 200 m
Hoist gear 2	0 m/min - 110 m/min for single strand	21 mm / 200 m
Slewing gear	0 RPM - 1.8 RPM	
Luffing gear	approx. 60 s -2° to 82° boom position	
Telescoping	approx. 360 s for boom length 11.5 m - 52 m	

5 Rope diameter

Type of rope	Rope diameter
Hoist rope 1	21 mm
Hoist rope 2	21 mm

6 Lifting heights

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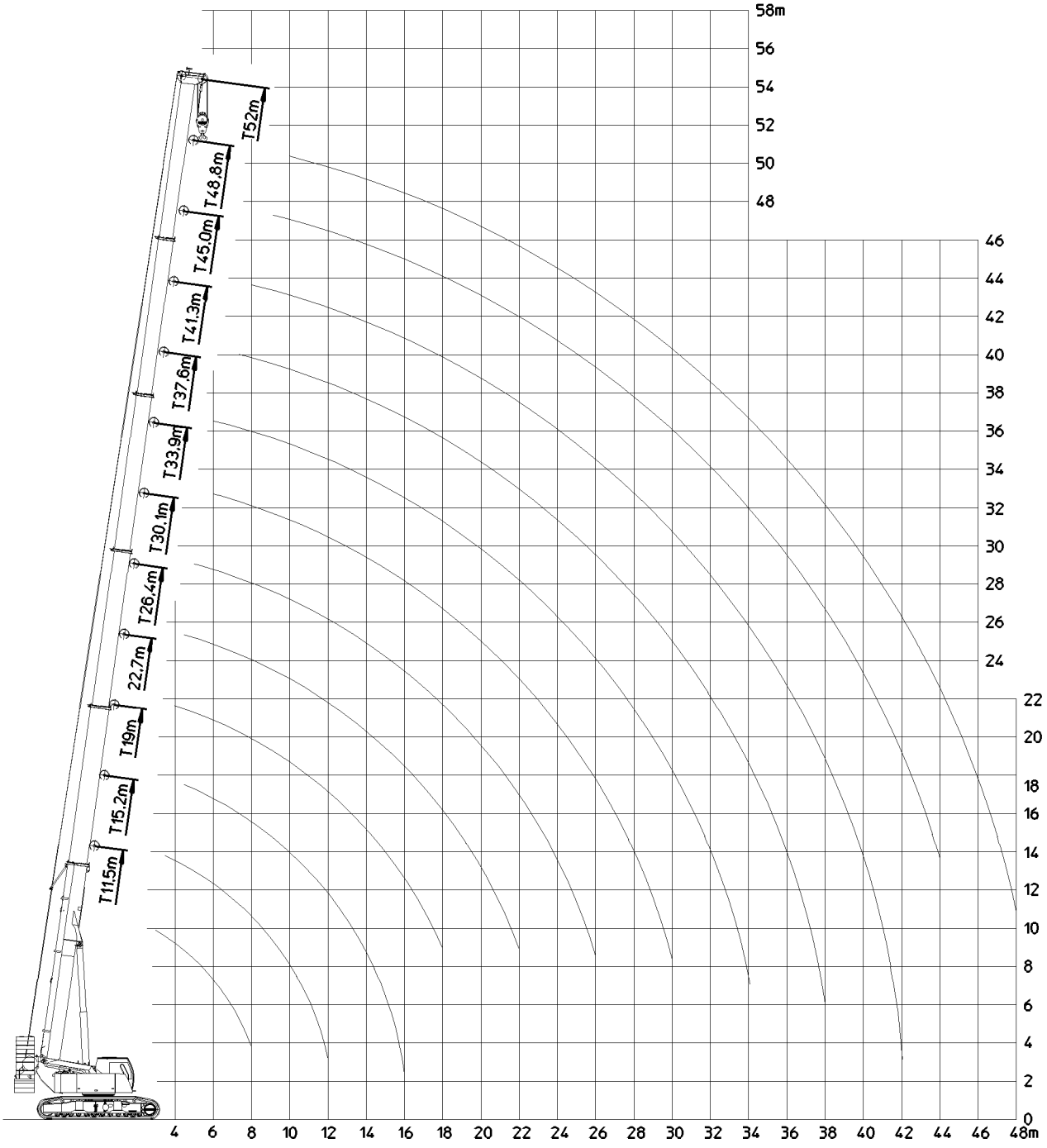

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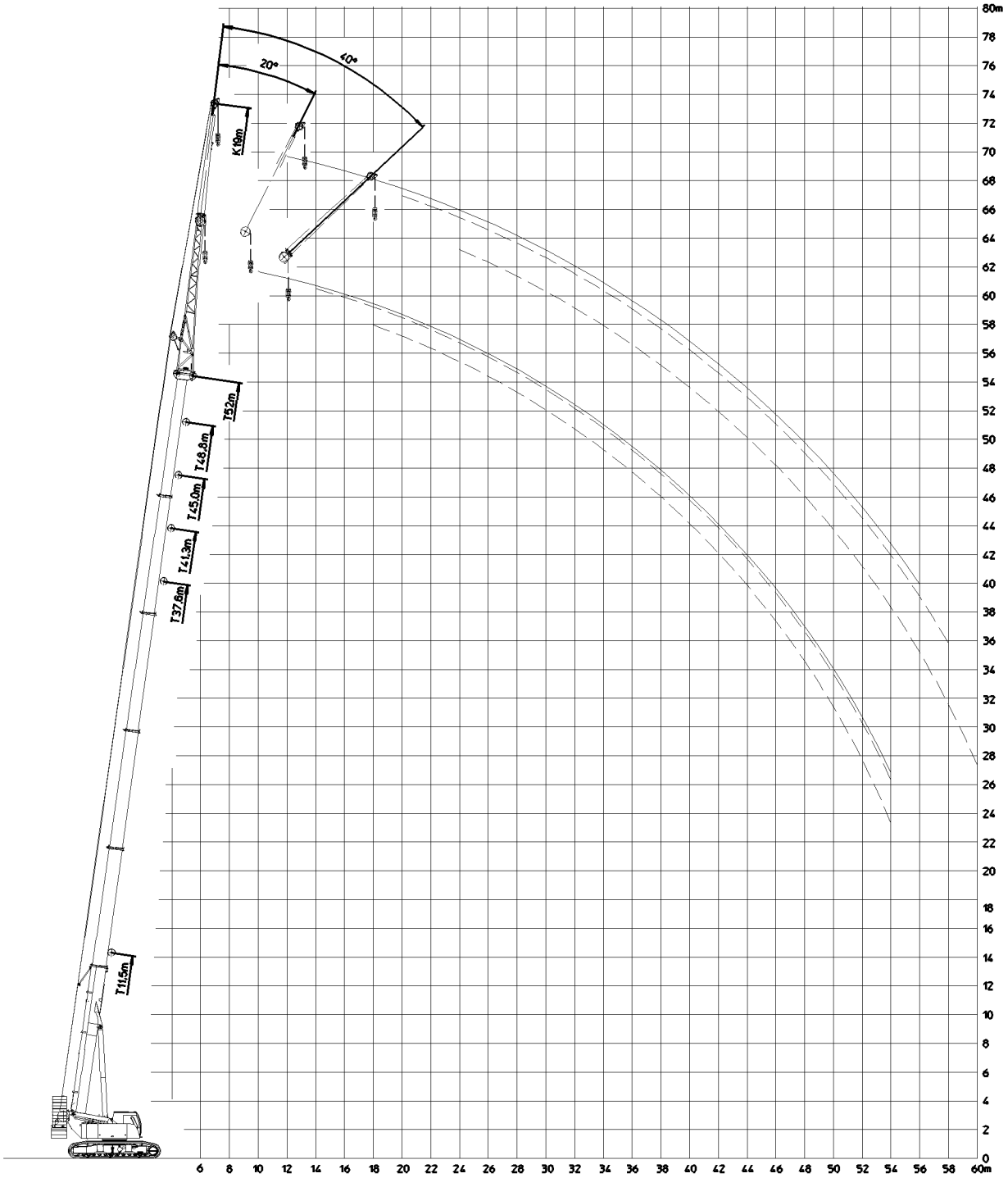
Telescopic boom (T)



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Telescopic boom with folding jib (TK)

2.00 Safety

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1 Crane operation planning

In addition to a perfectly working crane and a well-trained crew, **crane operation planning** is an important principle of safe crane operation.

DANGER
Missing information increases the risk of accidents!
Crane operation may not be possible or improvisation can result if a crane operator does not have all the required data.
▶ A crane operator must have exact data before starting any work!

The crane operator must obtain or receive the necessary information in a timely fashion before driving to the work site. In particular:
– type of crane operation
– height and width clearance measurements
– electrical transmission lines (including voltages)
– space restrictions at the work site
– movement restrictions caused by buildings
– weight and dimensions of the load(s) to be hoisted
– required hoisting height and boom projection
– ground bearing capacity at the work site

Based on the above information, the crane operator must assemble the equipment required to operate the crane:
– hook block / load hook
– auxiliary boom
– fastening equipment
– counterweight

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1 General

Note

▶ The illustrations in this chapter only serve as examples. The illustrations may differ depending on the crane model.

1.1 Exhaust systems and other hot components

WARNING

Danger of burns!

You can get severely injured on the surfaces of hot components!

This applies especially to exhaust systems, the engines and the respective gears in the crane chassis and in the crane superstructure!

▶ Let the components cool off before touching them!

▶ Be especially careful!

2 Crane operator responsibilities

2.1 General

The crane operator's primary responsibility is to use and operate the crane in a manner that is safe for both himself and others.

The following important safety guidelines will help you achieve this.

Many crane accidents are caused by incorrect crane operation.

WARNING

Risk due to incorrect crane operation!

▶ In the interest of both yourself and others, make sure you understand how your crane operates and familiarize yourself with all the risks associated with the work to be done.

The main **operating errors**, which are made again and again while operating or driving a crane, are as follows:

- Not paying careful attention while working, for example:
  - Slewing too quickly
  - Stopping the load too quickly
  - Angular pulling
  - Slack ropes
- Overload.
- Driving the load or equipment too quickly on uneven road surfaces.
- Attaching the load incorrectly.
- Unsuitable operation; especially angular pulling, breaking away stuck loads.
- Wind action on suspended loads.
- Problems when road driving without load e.g., engine or transmission overloaded.
- Crashing into bridges, roofs or high voltage wiring due to insufficient vertical clearance.
- Inadequate support, support base, bases for the support pads.
- Incorrectly assembly or disassembly of booms.

In many cases, crane damage is caused by improper maintenance:
– Insufficient oil, grease or antifreeze.
– Contamination.
– Broken cable wires, defective tires, worn parts.
– Emergency limit switch or load moment limiter (LMB) not operating properly.
– Brake and clutch failure.
– Hydraulic problems; e.g., cracked hoses.
– Loose screws.

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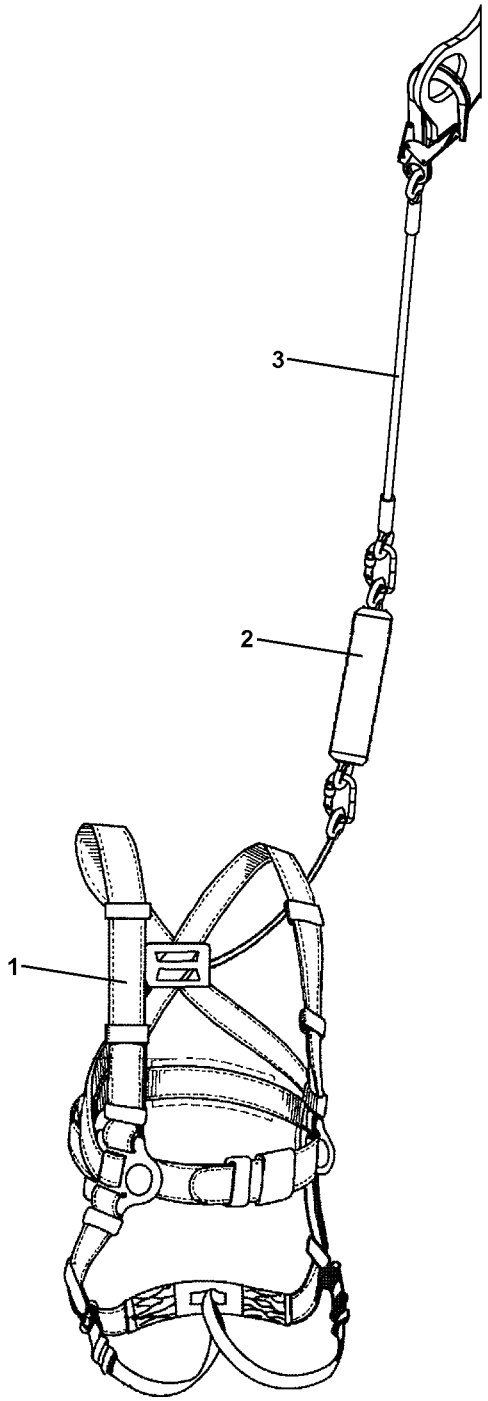

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2.2 Personal protective devices

WARNING
Danger of accidents or falling!
If protective devices are not worn, the crane operator or the auxiliary personnel can be killed or severely injured!

- ▶ 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 work cannot be carried out using these aids or from the ground, the crane operator and the assembly personnel must be protected from falling using approved antifall guard systems!
- ▶ **Only approved antifall guard systems (catch belt, fall absorbers, connectors) may be used! These antifall guard systems must meet the standards EN 361, EN 362 and EN 363 or national regulations.**
- ▶ The operating instructions of the manufacturer of the antifall guard systems must be observed and adhered to!
- ▶ The crane operating company must provide personal protective equipment to the crane operator and all auxiliary personnel!
- ▶ The crane operating company must ensure that the crane operator and auxiliary staff wear personal protective equipment!
- ▶ The crane operator and auxiliary personnel are obligated to carry personal protective equipment along and to wear it!
- ▶ Replace defective or damaged personal protective equipment!

Personal protective equipment includes the following items:

- Hard hat: Protection from falling parts at assembly and disassembly. Hitting the head at assembly and disassembly of lattice mast equipment.
- Safety gloves: As a rule, when working with cables, penetration safe safety gloves must be used.
- Catch systems (catch belt **1**, fall absorbers **2**, connecting devices **3**) against danger of falling.
- Safety shoes: Protection from falling parts at assembly and disassembly.
- Warning apparel.

WARNING
High accident risk!
Even personal protective equipment does not provide 100 % protection!
A hard hat protects against small falling items but not against falling loads.
Personnel could still be killed or seriously injured!

- ▶ Always remain vigilant and act in a safety-conscious manner!

WARNING
Danger of accidents due to fall subjected catch systems!
If fall subjected catch systems are not replaced after a fall, then the catch systems may fail in case of a new fall and personnel can be severely injured or killed!

- ▶ Replace fall subjected catch systems immediately!

2.3 Maintenance work on the crane superstructure or boom

WARNING
Danger of falling!
During maintenance work, maintenance personnel must be secured with appropriate antifall guards to prevent them from falling. If this is not observed, maintenance personnel could fall and suffer life-threatening or fatal injuries!

- ▶ Any maintenance work, where there is a danger of falling must be carried out with suitable aids (for example: lifting platforms, scaffoldings, ladders, auxiliary crane)!
- ▶ If work cannot be carried out using these aids or from the ground, then the maintenance personnel must be protected from falling using approved antifall guard systems!
- ▶ Only step on such aids with clean shoes!
- ▶ Keep aids clean and free of snow and ice!

2.4 Obligations of the crane operator

1.) Before starting to work, the crane operator must check the brake function and the emergency shut off devices. He must monitor the condition of the crane for obvious defects. On wireless controlled cranes, he must check the assignment of control unit and crane.
2.) The crane operator must cease crane operation in case of defects, which would endanger the safety.
3.) The crane operator must report all defects on the crane to the appropriate supervisor, also to his replacement in case of crane change. For mobile cranes, which are set up and taken down at their corresponding jobsite, he must enter any defects in the crane log book.
4.) The crane operator must make sure that:
   - all control devices are set to neutral or idle position before release of the energy supply to the drive components,
   - the control devices are set to neutral or idle position and the energy supply is shut off before leaving the control platform,
   - when taking down the control unit for wireless control, it is secured to prevent unauthorized operation.
5.) The crane operator must ensure that cranes subjected to wind are not operated past the limits which were set by the crane manufacturer, and that the boom is taken down at least when the critical wind speeds for the crane are reached and at the end of the work.
6.) The crane operator must monitor the load at all crane movements or the load tackle devices when moving the crane without a load, if they could cause a dangerous situation. If observation is not possible, then the crane operator may move the crane only with the aid of a guide.
7.) The crane operator must give warning signs when necessary.
8.) The crane operator may not move loads over personnel.
9.) Any loads attached by hand may only be moved by the crane operator after he received a clear sign from the person who attached the load, the guide or any other responsible party which was assigned to that task by the contractor. If signals must be used to communicate with the crane operator, then they must be agreed upon before use between the responsible party and the crane operator. If the crane operator determines that the loads are not properly attached, then he may not move them.
10.) As long as a load is suspended on the crane, the crane operator must keep the control devices within reach. This does not apply for towing of vehicles with towing cranes.
11.) The crane operator may not run up to end positions operationally, if they are limited by the emergency limit switches.
12.) After a load moment limiter was triggered, the crane operator may not take on an overload by pulling in / raising the boom.
13.) The crane operator may **not** bypass the overload protection to increase the hoisting power of the crane.

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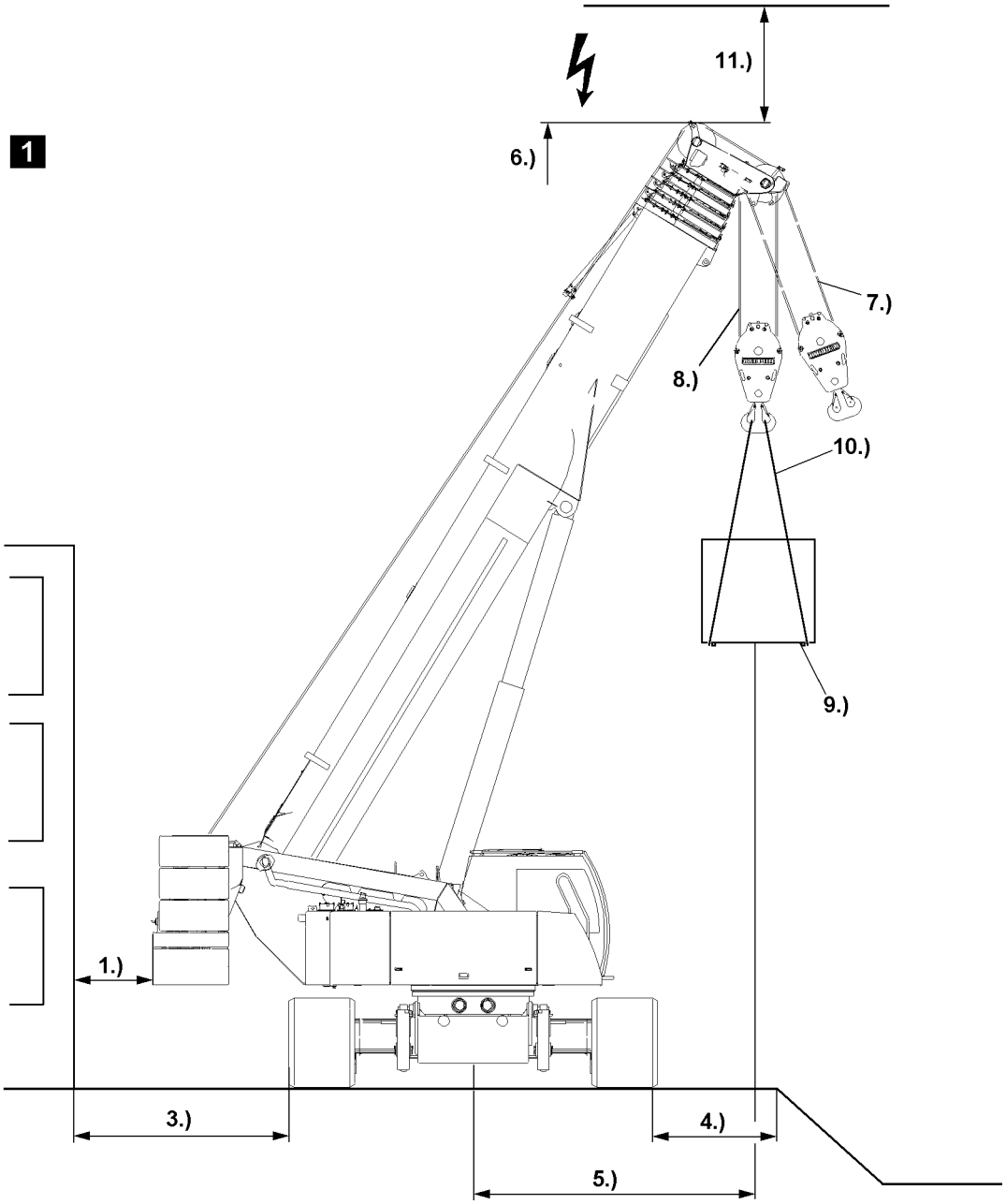
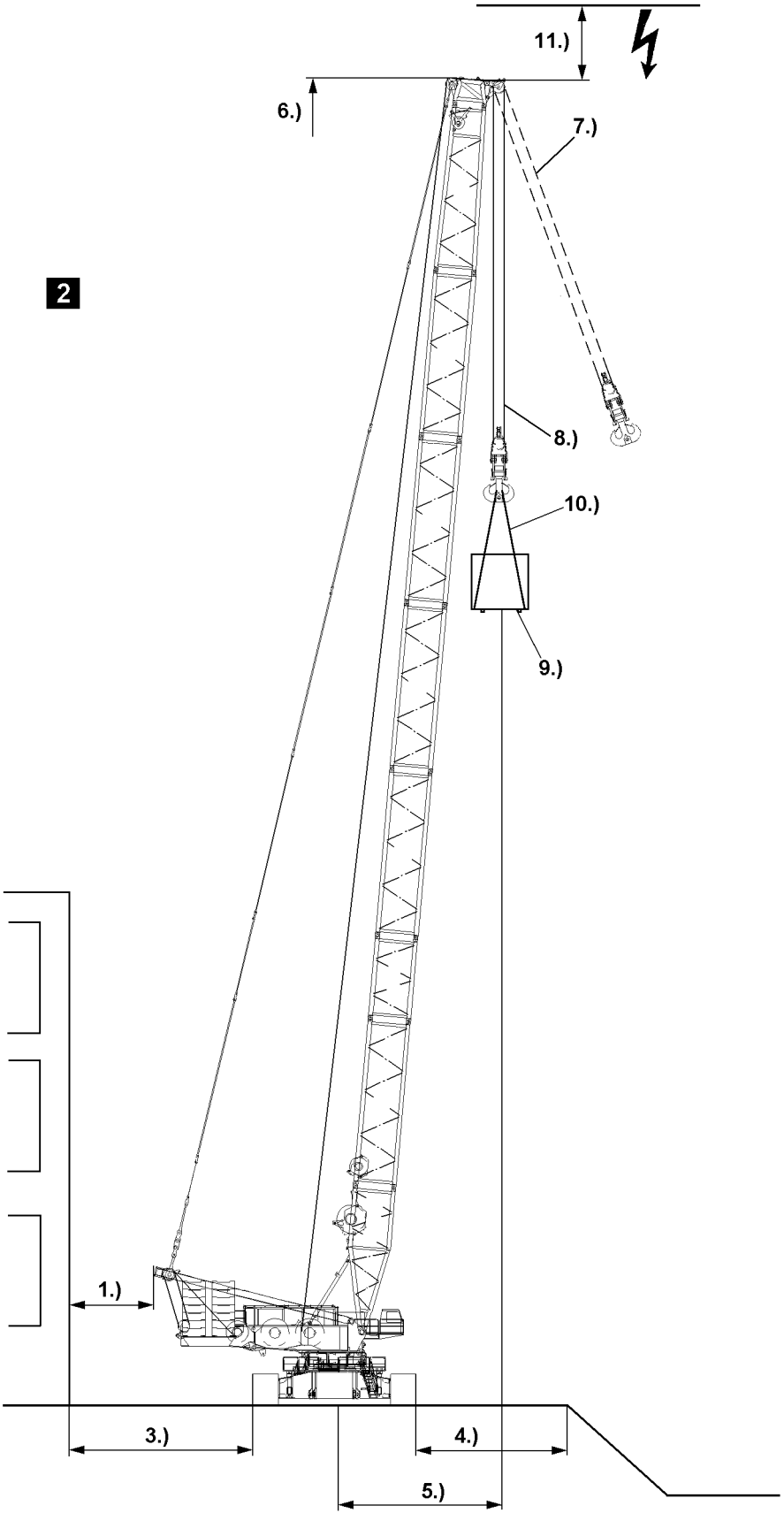
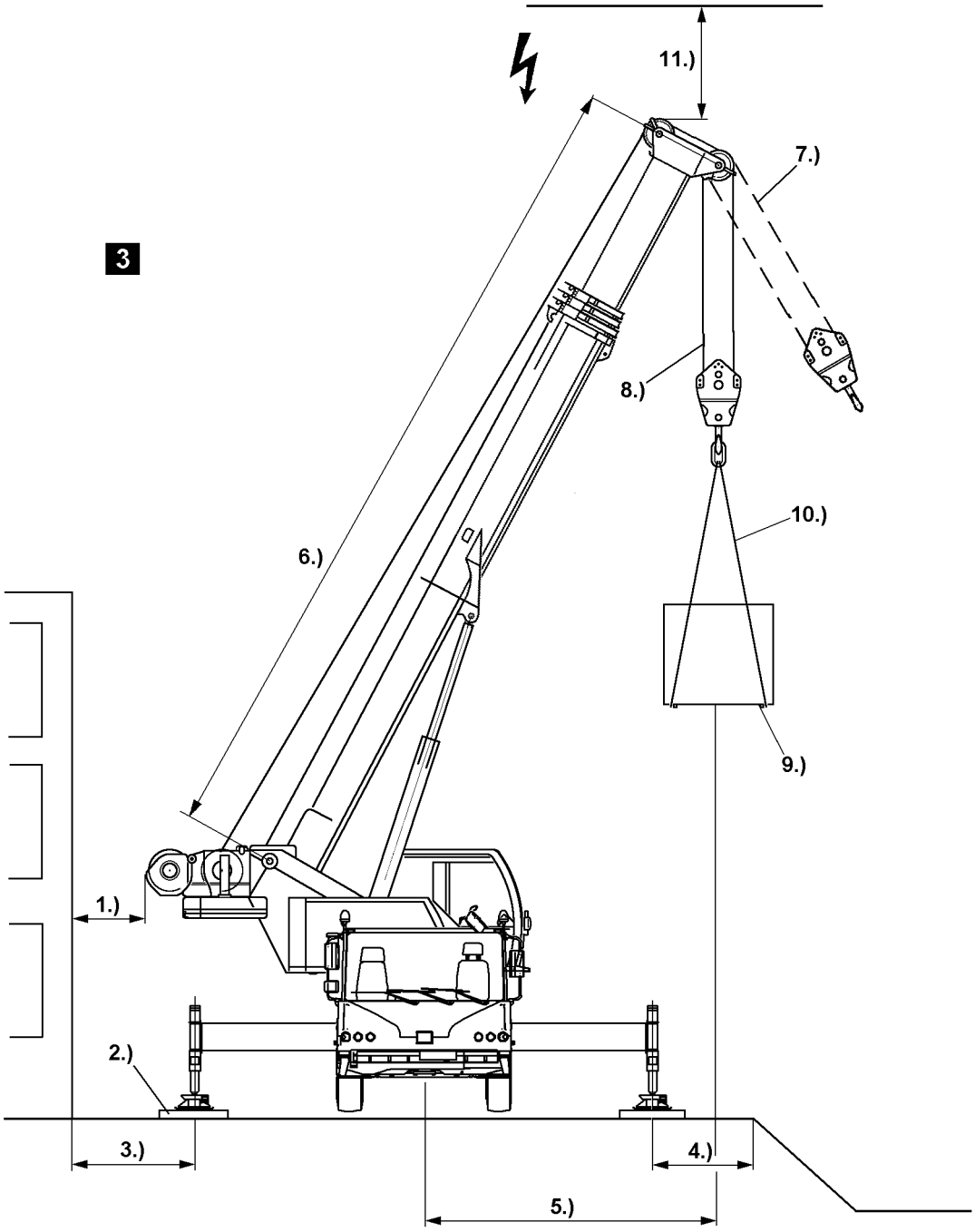


B104101 *Example for crawler crane with telescopic boom*



B104102 *Example for crawler crane with lattice mast boom*



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Example for mobile cranes

3 Selecting the location, fig. 1 to 3

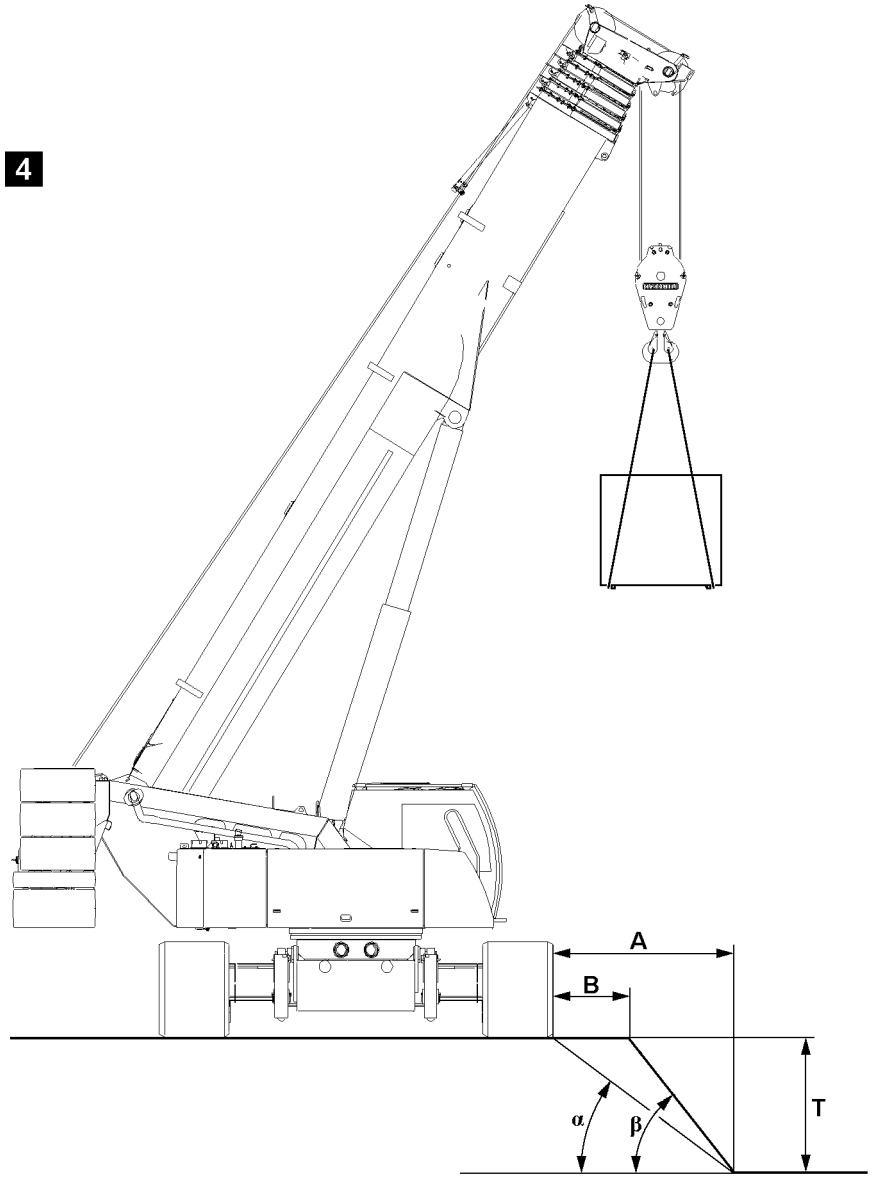
It is very important to choose an appropriate location for crane operation in order to minimize safety risks.

DANGER
Risk of accident increases when the bearing capacity of the ground is **not** adequate!
If the crane is supported or driven on ground with **insufficient** load bearing capacity, then the crane can topple over and kill personnel!

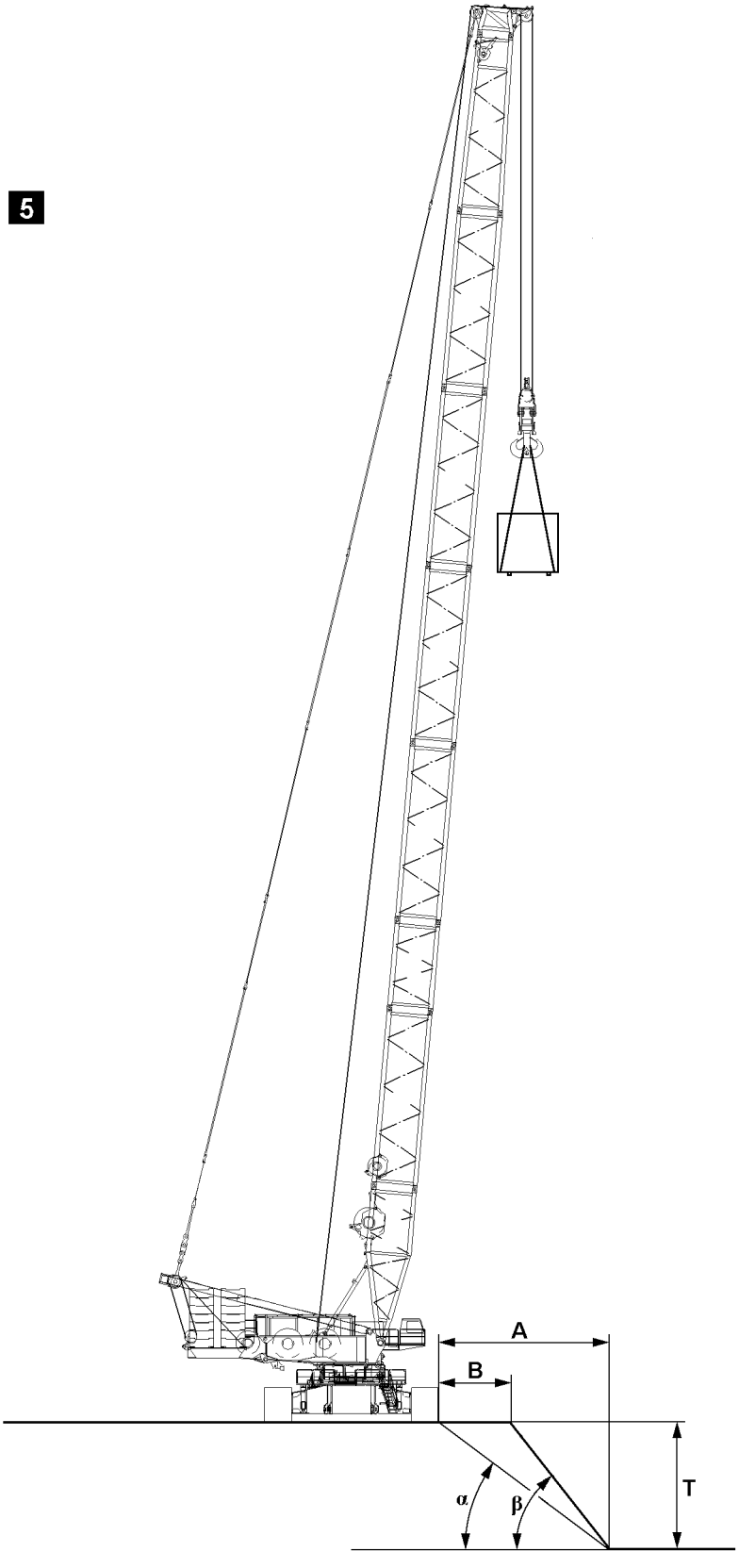
- ▶ Only support or drive the crane on ground with the required load-bearing capacity!
- ▶ Act responsibly when planning and selecting the crane location and route. If necessary, consult an expert.
- ▶ Note the following points!

When selecting the location for the crane, observe the following:

1.) Select the location in such a way that crane movements can be carried out without collision, and that outrigger supports can be extended to the support base stipulated in the load charts.
Make sure that no personnel is injured or killed!
Always keep a safety distance of 0.5 m. If this is not possible, secure the danger zone.
2.) On mobile cranes:
Support the crane correctly and support the support pads according to the load bearing capacity of the ground on the placement location.
3.) Keep a safety distance to basements or similar.
4.) Keep a safety distance to slopes or embankments or similar.
5.) Keep the radius to a minimum. **Never** utilize the crane 100 %.
6.) Select the correct boom length to the load case.
7.) Diagonal pulling is not permitted!
8.) Select the correct reeving of the hoist rope to the load case.
9.) Bear in mind the weight and the wind exposure surface of the load.
10.) Select tackle according to the weight of the load, the type of attachment and the incline angle.
11.) Keep sufficient distance to electrical overhead wiring.



B104104 *Example for crawler crane with telescopic boom*



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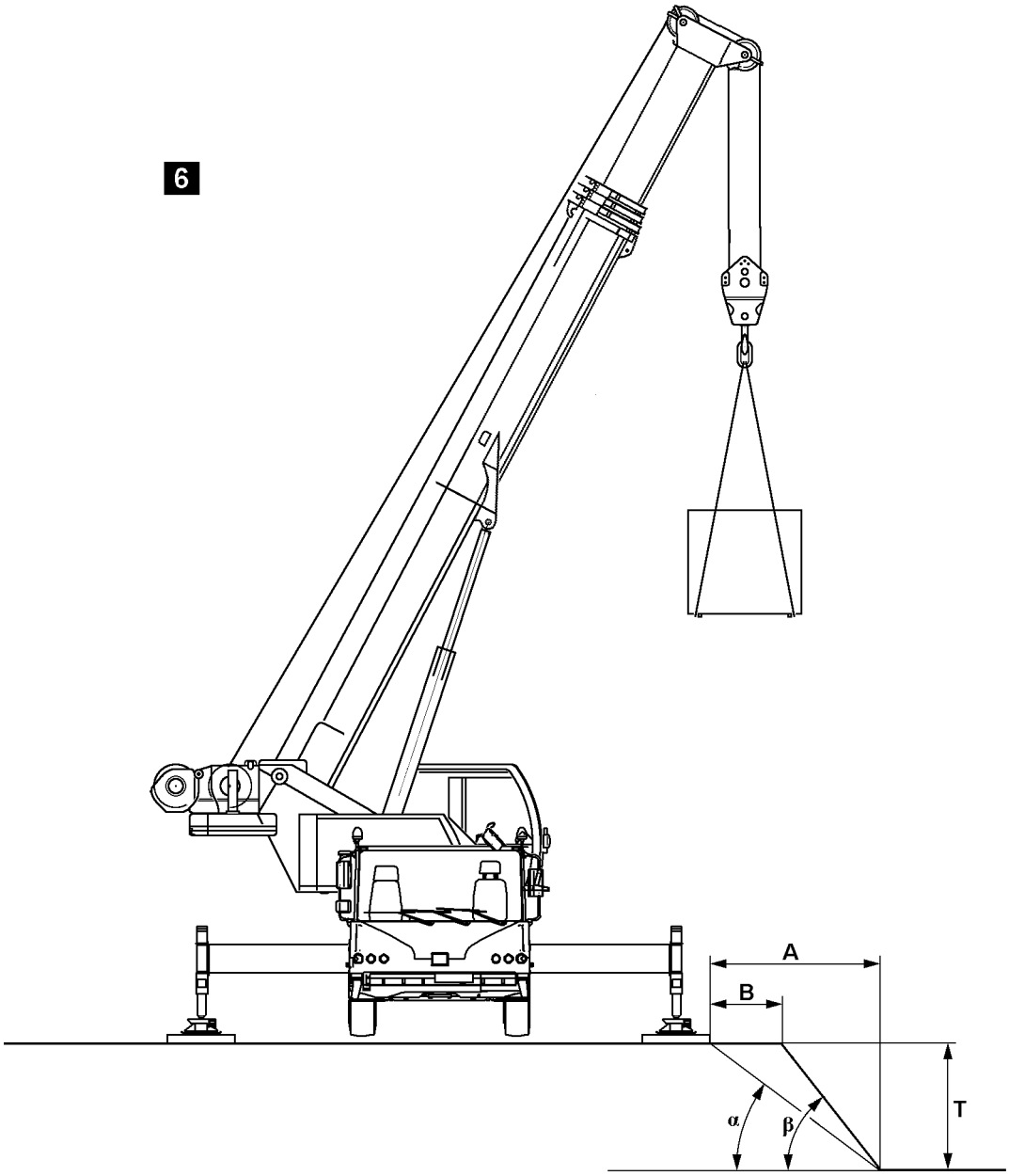
Example for crawler crane with lattice mast boom



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Example for mobile cranes

4 Slopes and excavations, fig. 4 to 6

The crane may not be set up too close to slopes or excavations. Depending on the type of ground, ensure an adequate safety clearance **A** and safety clearance **B** as well as a corresponding load entry angle **α** and slope angle **β**.

WARNING
Crane can topple over!
The edge of the slope or excavation can break in if safety distance **A** or safety distance **B** is too small. If the edge of the slope or excavation breaks in, the crane can topple over and kill personnel!

- ▶ An authorized and trained specialist should perform calculations to verify the load bearing capacity of the ground!
- ▶ Safety distance **A** and safety distance **B** should be calculated by an authorized and trained specialist!
- ▶ Always maintain the calculated safety distance **A** and safety distance **B**!
- ▶ Support the sides of the slope or excavation!

Abbreviation	Term
A	Distance to bottom of excavation
B	Distance to excavation
T	Depth of excavation
α	Load entry angle
β	Slope angle

5 Permissible ground pressures

Permissible ground pressures		
Soil type		**[N/cm²]**
1.	Organic ground:	
	Peat, sludge, muck	0
2.	Uncompacted fill:	
	Construction debris	0 to 10
3.	Non-cohesive ground:	
	Sand, gravel, rocks and mix	20
4.	Cohesive soil:	
	a) Clayed silt, mixed with topsoil	12
	b) Silt, consisting of poor clay and coarse clay	13
	c) Plastic clay, consisting of potter's clay and fill	
	Stiff	9
	Semi-solid	14
	Solid	20

Permissible ground pressures		
	d) Mixed granular ground, clay to sand, gravel and rocky areas	
	Stiff	15
	Semi-solid	22
	Solid	33
5.	Rock in evenly solid condition:	
	a) Brittle, with traces of decomposition	150
	b) Not brittle	400

If there is any doubt about the load bearing capability of the ground at the site, soil tests should be carried out by specialists using, for example, a penetrometer.

5.1 Permitted ground pressure for crawler cranes

During crane operation, significant forces are transferred to the ground. The ground must be able to safely withstand the pressure. If the crawler area is inadequate, then it must be supported from below according to the load bearing capacity of the ground.

WARNING
Crane can topple over!
If the crane is not properly supported, the crane can topple over and fatally injure personnel!
- ▶ The foundation support must be large enough for the ground conditions and constructed from solid materials, such as wood, steel or concrete slabs!

5.2 Permitted ground pressure for mobile cranes

When the crane is used with supports, the support cylinders transmit significant forces to the ground. In certain cases, a single support cylinder is used to transfer almost the entire weight of the crane, plus the load weight, onto the ground.
The ground must be able to safely withstand this pressure. If the support pad area is inadequate, then it must be supported from below according to the load bearing capacity of the ground.
The required support area can be calculated from the load bearing capability of the ground and the crane support force.

Note
- ▶ Consider that the support force, due to the counterweight, can be higher without a load than with a load.

WARNING
Crane can topple over!
If the crane is not properly supported, the crane can topple over and fatally injure personnel!
- ▶ Only strong materials may be used for the support pad bases; for example properly dimensioned wooden timbers!
- ▶ In order to ensure that pressure is evenly distributed across the base surface, the support pads shall be positioned at the center of the base!

Example: Calculation of specific support pressure	
Maximum support force according to chapter 1.03: 720 kN	720000 N
Surface of square support pad with 550 mm side length according to chapter 1.03: 302500 mm^2	3025 cm^2
80 % as carrying surface of support pad: 302500 mm^2 x 0.8 = 242000 mm^2	2420 cm^2
Specific support pressure = Support force / surface support pad	720000 N / 2420 cm^2 = 297.52 N/cm^2
Specific support pressure:	**298 N/cm^2**

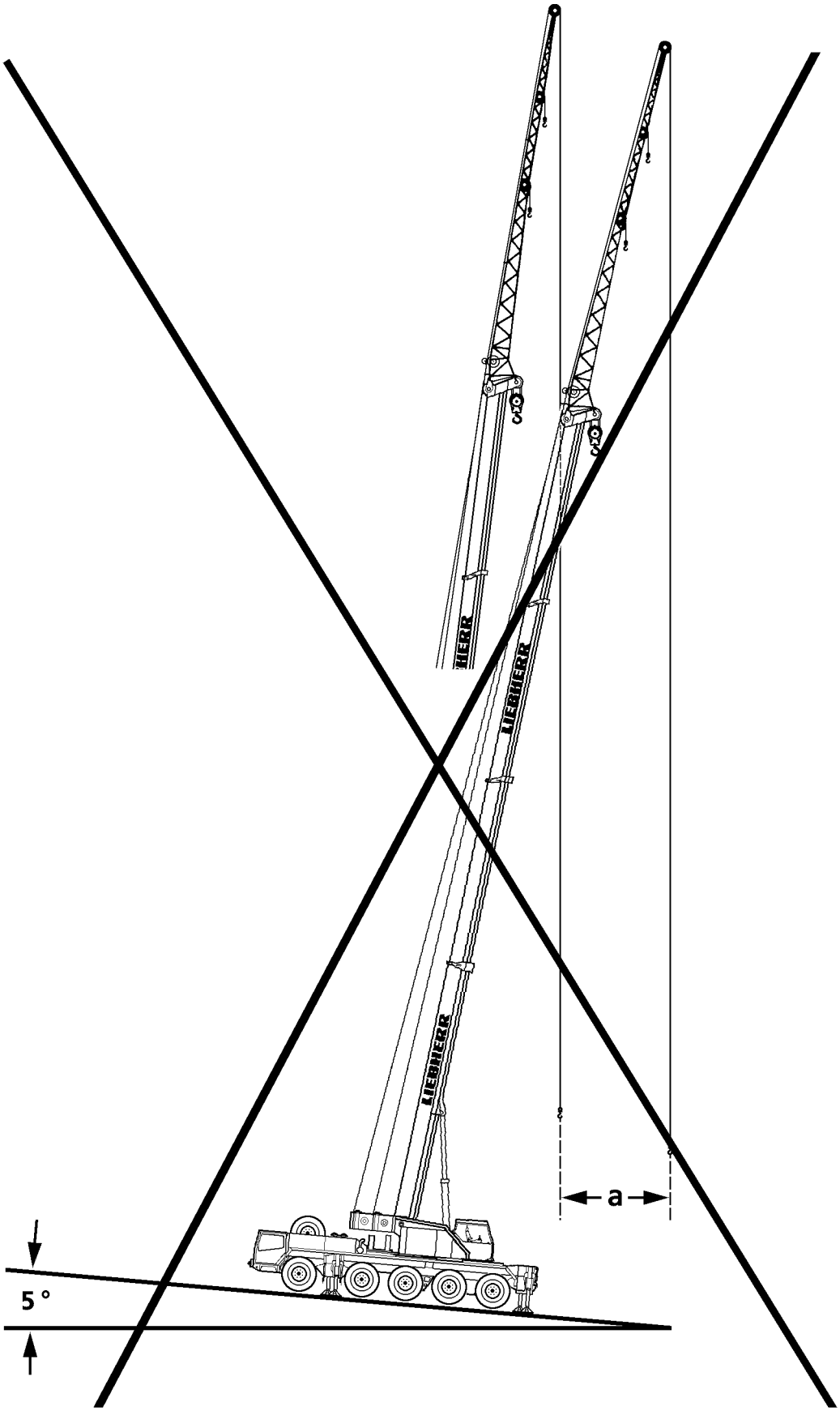
The value of the specific support pressure is far higher than the permissible ground pressure for all types of granular soil. If this crane is utilized on bedrock, type of ground gravel, permissible ground pressure 20 N/cm^2 , then the support surface must be increased.

Example: Calculation of required support surface	
Maximum support force according to chapter 1.03: 720 kN	720000 N
Permissible ground pressure: 20 N/mm^2	20 N/cm^2
Required support surface = Support force / permissible ground pressure	720000 N / 20 N/cm^2 = 36000 cm^2
Required support surface:	36000 cm^2 = **3.6 m^2**

The surface of the support for each support pad must be at least **3.6 m^2** .

Note

▶ The corresponding support forces can be determined with the crane job planer.



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General example

6 Supporting

It is absolutely essential that the crane be supported exactly in accordance with the load charts to ensure safe operation.
The sliding beams bearing surfaces must meet to ensure proper force transmission along the sliding beam sections.
The crane may only be supported in these sliding beam extensions.

DANGER
Crane can topple over!
Intermediate positions of the specified support bases may not be carried out, because the force transfer is only possible via the side placement surfaces and in intermediate positions, due to the lack of placement surfaces, an incorrect force transmission can occur on the upper chord.
- ▶ Pin the sliding beams to support base according to the load chart!
- ▶ Fully insert and secure the pins!

All 4 sliding beams and support cylinders must be extended according to the data in the load chart, also those on the counterweight side.
If only the load side sliding beams are extended, then the crane can topple over when turning or setting down the load.

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

6.1 Aligning the crane

In order to safely operate the crane, it is very important to level it and install a proper base for the support pads.

DANGER
The crane may topple if it leans!
If the crane is positioned at an incline, and if the boom is turned towards the slope, then the radius is increased as a result. It is possible that the slewing gear can no longer hold the crane superstructure and, in extreme cases, the crane can topple over.
- ▶ Be sure to level the crane!

Example: At a boom length of 50 m uneven adjustment of the crane by only 5° will cause a boom radius of 10 m to be increased by a = 4 m.

7 Checking safety measures

- The operating location has been selected so that the crane may be operated with minimum boom radius.
- The load bearing capacity of the ground is adequate.
- There is safe clearance to excavations and slopes.
- There are no live transmission wires within the working range of the crane.
- There are no obstacles that will hinder required crane movements.
- On mobile cranes:
  The axle suspension is blocked.
- On mobile cranes:
  All four sliding beams and support cylinders have been extended according to the load chart specifications.
- On mobile cranes:
  The sliding beams have been secured with pins to prevent them from moving.
- On mobile cranes:
  The support pads are secure.
- The crane is level.
- On mobile cranes:
  The axles are unloaded; i.e., tires do not touch the ground.

8 Crane operation with a load

Before beginning any work, the crane operator must be convinced that the crane is in safe operating condition. All safety systems, such as load moment limiter, hoist limit switches, brakes, etc., are in good working order.

- The load torque limiter must be adjusted according to the current crane configuration.
- The loads given in the load chart may not be exceeded.
- Crane loads may never exceed those specified in the load charts.
- The crane operator must know the weight, the center of gravity and the dimensions of the load before operating the crane.
- Load carriers, lifting equipment and tackle must be in accordance with specified requirements.
- Note that the weight of the hook block and the weight of the tackle must be subtracted from the load specified in the load chart.

Example:		
Maximum permissible load according to chart		30.000 t
Weight of the hook block	350 kg	- 0.350 t
Weight of the tackle rope	50 kg	- 0.050 t
Actual load capacity of the crane		= 29.600 t

In this case, the load to be lifted may not exceed **29.6 t** .

8.1 Counterweight

The counterweight required depends on the weight of the load to be lifted and the boom radius required to do the work. The deciding factor for the selection of the counterweight is the data in the corresponding load chart.

WARNING
Crane can topple over!
If the counterweight is not installed according to the load chart, then the crane can topple over and fatally injure personnel!
▶ Install the counterweight as specified on the respective load chart!

8.2 Hoist gear, hoist rope

The lifting capability of the crane depends on the pull force of the hoist gear and the number of possible hoist rope reevings. When working with a single strand, the crane can only lift as much of a load as the hoist gear is able to pull.
If the load to be lifted is heavier than the hoist gear is capable of lifting, the hoist rope must be configured using block and tackle principles by appropriate reeving between the pulley head and the hook block.
When reeving, carefully observe the load chart specifications and the operating instructions.

WARNING
Hoist rope failure!
If the maximum pull force of the hoist gear is exceeded, the hoist rope can break or the hoist gear can be damaged!
The load can fall and kill personnel!
▶ Never exceed the maximum pull force of the hoist gear!

8.3 Crane operation

DANGER
Not-observation of the following guidelines increases the risk of accident!
▶ It is imperative to comply with the following instructions.

High accident risk if:

1.) The load moment limiter is not set according to the current crane configuration and is therefore not able to provide proper protection.
2.) The load moment limiter is defective or turned off.
3.) The hoist limit switches are defective or turned off.
4.) On crawler cranes:
The angle sensor and the force test brackets are not functioning.
5.) On mobile cranes:
The hydraulic support sliding beams are not extended according to the requirements specified in the load chart.
6.) On crawler cranes:
The crawlers are not supported with stable materials large enough for the ground conditions.
7.) On mobile cranes:
The support pads are not supported with stable materials large enough for the ground conditions.
8.) Angular pulling is performed.
Angular pulling to the side is particularly dangerous, because the boom has only minimal lateral resistance momentum.
It is prohibited to pull a load at an angle.
9.) An excessively heavy load is attached during disassembly work, which then hangs freely on the crane when it is detached.
10.) The load hook is used to break away fixed loads.
Even if the weight of the fixed load does not exceed the permissible load capacity, the crane can tip backwards when the load suddenly breaks free due to the tension in the boom, which will snap back like a released bow.
11.) Working when the wind is excessively strong.
Comply with the load chart specifications.
12.) The crane is not levelled and the load is slewed in the direction of the slope.
13.) Improper crane movements cause the suspended load to swing like a pendulum.
14.) The loads and boom radii specified in the load charts are exceeded.
15.) Operating in the vicinity of electrical transmission lines that have not been de-energized by qualified electricians or where the dangerous area has not been covered or cordoned off.
If this is not possible, adequate clearance must be maintained:

Rated voltage	Minimum distance
up to 1 kV	1 m
above 1 kV to 110 kV	3 m
above 110 kV to 220 kV	4 m
above 220 kV to 380 kV	5 m
if rated voltage is unknown	5 m

WARNING
Risk current transfer to the crane!
If a current transfer occurs, despite having taken all necessary precautions, proceed as follows:
- ▶ Remain calm!
- ▶ Stay inside the crane cab!
- ▶ Warn anyone who is outside and advise them to remain stationary and not touch the crane!
- ▶ Move the crane out from the danger zone!

9 Lifting of personnel

Note
- ▶ The destined use of the crane is **lifting of loads**!
- ▶ **Lifting of personnel** is **not** considered to be destined use of the crane!
- ▶ In Germany, **lifting of personnel** under observation of the safety regulations for “liftable personnel lifting devices” of the trade associations (Berufsgenossenschaften) BGR 159 is permissible!

DANGER
Danger of accidents or falling!
When lifting personnel, the dangers of accidents and falling are significantly increased. Accidents which occur when lifting personnel often result in severe injuries or even death!
The company, the supervisor, the crane operator and auxiliary personnel must proceed especially carefully and safety conscious.
The following warning notes and safety regulations must be strictly observed!
- ▶ The job planning for crane operation, where personnel is to be lifted must be made especially carefully!
- ▶ Check the load bearing capacity of the ground especially carefully!
- ▶ Lifting personnel may only be carried out by authorized and trained expert personnel!
- ▶ Unauthorized persons must remain outside the danger zone!
- ▶ Carry out all crane movements especially carefully and smoothly!

Moving personnel and personnel lifting devices and working with these personnel lifting devices is approved and monitored by the national occupational heath and safety agencies, in Germany the trade association (Berufsgenossenschaft).
- ▶ Observe the safety regulations and guidelines of the national occupational health and safety agencies!
- ▶ In Germany, moving personnel and personal lifting devices and working with these personnel lifting devices is permissible if the company carries out “suitable safety measures” and informs the trade association (Berufsgenossenschaft) of its intention **in writing**. For personnel movements, notification of at least two weeks before the intended movement is required. The company must carry out the stated safety-technical measures. “Suitable safety measures” are the safety regulations for “liftable personnel lifting devices” of the trade associations (Berufsgenossenschaften) BGR 159.
- ▶ The **persons to be moved** must secure themselves with personal protective equipment (for example safety harnesses) to protect them from falling!
- ▶ Before using the safety devices of the crane, check them for proper function! This applies especially for the hoist limit switch and the load moment limitations! But all other crane functions must also be in proper condition!

- ▶ The crane must be equipped in such a way that personnel can exit the personnel lifting device without danger in case of a power failure or if the control of the personnel lifting device cannot be returned to the initial position!
- ▶ The **crane operator** may **not** move personnel with the load or the load tackle!
- ▶ Do **not** step on lifted loads or lifted tackle!

Additional obligations of the company:

– In Germany:
  Report the use of personnel lifting devices to the applicable trade association (Berufsgenossenschaft) in writing, within 14 days.
– Determination of supervisor.
– The operator of the lifting device must be familiar with the tasks.
– The company may not assign additional tasks to the operator of the lifting device and the guide.
– The company must make lifting devices with sufficient load carrying capacity available.
– The company must provide personal protective equipment (such as safety harnesses).
– Liftable personnel lifting devices must be inspected before the initial use and after significant changes by an expert before putting them back into service:
  • Carry out trial runs in the present of the supervisor
  • Regular inspections at least once a year
  • Record and save proof of inspections

10 Grounding

10.1 Grounding the crane

WARNING
Danger of fatal injury due to electrical shock!
There is a risk of electrical shock, if the crane is not properly grounded.
▶ Properly ground the crane!

The crane must be grounded before operation:
– Near transmitters (radio and TV transmitters, radio stations, etc.).
– Near high frequency switching systems.
– In case of severe possibility of thunderstorms or potential thunderstorms.

The crane can become electrostatically charged especially if the crane is equipped with synthetic support pads or if the support pads are placed on insulating materials (such as wooden planks).

WARNING
Danger of fatal injury due to electrical shock!
There is a risk of electrical shock, if the crane is not properly grounded.
▶ Prevent the crane from electrostatic charge!

To prevent the crane from electrostatic charge, the following is required:
– An electrically conductive grounding rod, approx. 2 m long, which is inserted into the ground.
– An electrically conductive cable with a diameter of at least 16 mm^2 .
– Ground connection on the crane, or a screw clamp, as is used for welding work.

The following applies:
– Always use a cross grounding rod as grounding rod.
– The grounding resistance must be less than 0.5 Ohm.
– The connection between the crane and the ground must always be a proper electrically conductive connection.

Connect one end of the grounding cable with a diameter of at least 16 mm^2 with the grounding rod, which is inserted into the ground.
Insert the grounding rod at least 1.5 m into the ground.
Moisten the soil around the metal rod for better conductivity.

Note

▶ The grounding resistance depends on the make up of the ground material and on the active contact surfaces of the grounding rod.

Connect the other end of the grounding cable with a cross-section of at least 16 mm^2 with the grounding connection on the crane, see chapter 3.01.

Note

▶ The connection between the crane and the ground must always be a proper electrically conductive connection.

If there is a possibility to connect a foundation or band ground with correspondingly smaller grounding resistance, then this grounding method should always be preferred.

WARNING
Danger of fatal injury due to electrical shock!
There is a risk of electrical shock, if the crane is not properly grounded!

▶ Make sure that the connection between the crane and the ground is a proper electrically conductive connection.

10.2 Grounding the load

WARNING
Danger of fatal injury due to electrical shock!
There is a risk of electrical shock, if the load is not properly grounded!

▶ Properly ground the load!

The load must be grounded before operation:
– Near transmitters (radio and TV transmitters, radio stations, etc.).
– Near high frequency switching systems.
– In case of severe possibility of thunderstorms or potential thunderstorms.

The load can become electrostatically charged, even if the crane is grounded. This applies in particular if a hook block with pulleys made of synthetic material and non-conductive fastening equipment (for example plastic or manila ropes) are used.

WARNING
Danger of fatal injury due to electrical shock!
There is a risk of electrical shock, if the load is not properly grounded!

▶ Prevent the load from electrostatic charge!
▶ The connection between the load and the ground must always have a proper electrically conductive connection!

To prevent the load from becoming electrostatically charged, the following is required:
– An electrically conductive grounding rod, approx. 2 m long, which is inserted into the ground.
– An electrically conductive cable with a diameter of at least 16 mm^2 .
– An electrically conductive metal rod with insulated handle to touch the load.

Connect one end of the grounding cable with a diameter of at least 16 mm^2 with the grounding rod, which is inserted into the ground.
Insert the grounding rod at least 1.5 m into the ground.
Moisten the soil around the metal rod for better conductivity.

Note

▶ The grounding resistance depends on the make up of the ground material and on the active contact surfaces of the grounding rod.

Connect the other end of the grounding cable with a diameter of at least 16 mm^2 with the metal rod with insulated handle.

DANGER

Danger of fatal injury due to electrical shock!

▶ The metal rod may only be held on the insulated handle!

Hold the metal rods on the insulated handle.
Touch the load with the metal rod before touching it with the hands.

11 Crane operation in case of thunderstorms

In weather conditions, which can include lightning:

– Stop work on the crane immediately.
– Always place down the load.
– If possible, telescope the boom in and bring it into a safe condition.
– Turn the crane engine off.

WARNING

Danger of accidents due to lightning!

▶ Make sure that there are no persons near the immediate area of the crane.

12 Welding work on the load

Note

▶ The load must also be grounded.

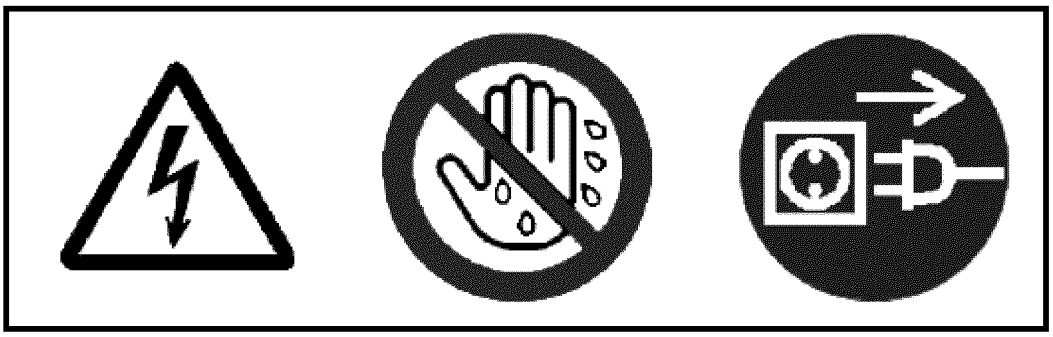
In case of welding work on the load, the screw clamp of the welding unit must be attached on the welding piece to avoid current flow via hoist rope, crane superstructure or crane chassis.

NOTICE

Damage to the heating control units!

▶ Disconnect the negative and positive cables from the batteries and connect the positive cables to the vehicle ground.

13 Safety instructions for external supplies (230 V AC)



A potential hazard exists when feeding a crane with an external supply from a low voltage distribution system (230 V AC).
In particular, the following conditions pose an electrical hazard: touching a crane with open grounds (caused by the mechanical stress on flexible supply cables or the service connection), loose terminal connections, wire or contact resistance too high, interchanged cable connections or defective or missing protective equipment (fault interrupters).

WARNING
Danger of fatal injury if the body conducts current!
Water and / or defective devices can cause hazardous stray voltages when touched. Subject to lethal currents.
▶ External supply cable must be in good working order!

Make sure that the external flexible supply line is in good working order.
Where applicable, we recommend the use of a power isolating transformer.

WARNING
Risk of electric shock!
▶ To check the protective measures and to decide if the crane can be supplied with power form the general distribution network, always use a qualified electricians with the appropriate measuring equipment in accordance with VDE.

14 Endangering air traffic

When working with crane, heights are reached which could endanger air traffic. This applies especially to areas near airports.

WARNING
Endangering air traffic!
If no protective measures are taken, this can result in endangerment to air traffic!
▶ Get the approval from agency responsible for air traffic!
▶ Install the airplane warning light on the boom head and turn it on!

15 Combined lifting of a load using multiple cranes

When using several cranes to lift a load, the contractor or authorized party should first define the procedure and be present during its execution.
Apply particular caution in the following cases:

– The part being lifted has an irregular shape or the position of its center of gravity is unknown. If necessary, only utilize 75 % of the permissible load!
– Dynamic effects are likely to occur when releasing the load.
– The cranes have different rated load capacities.

Note

▶ If the cranes have different rated load capacities, attach the load so that each crane is not lifting more than its permissible load capacity.

WARNING

High accident risk during tandem lifting!
Individual cranes could be overloaded and topple over when raising or lowering the load!
Personnel could be killed or seriously injured!

▶ Ensure that each crane is not lifting more than its permissible load capacity!
▶ Diagonal pulling is not permitted!

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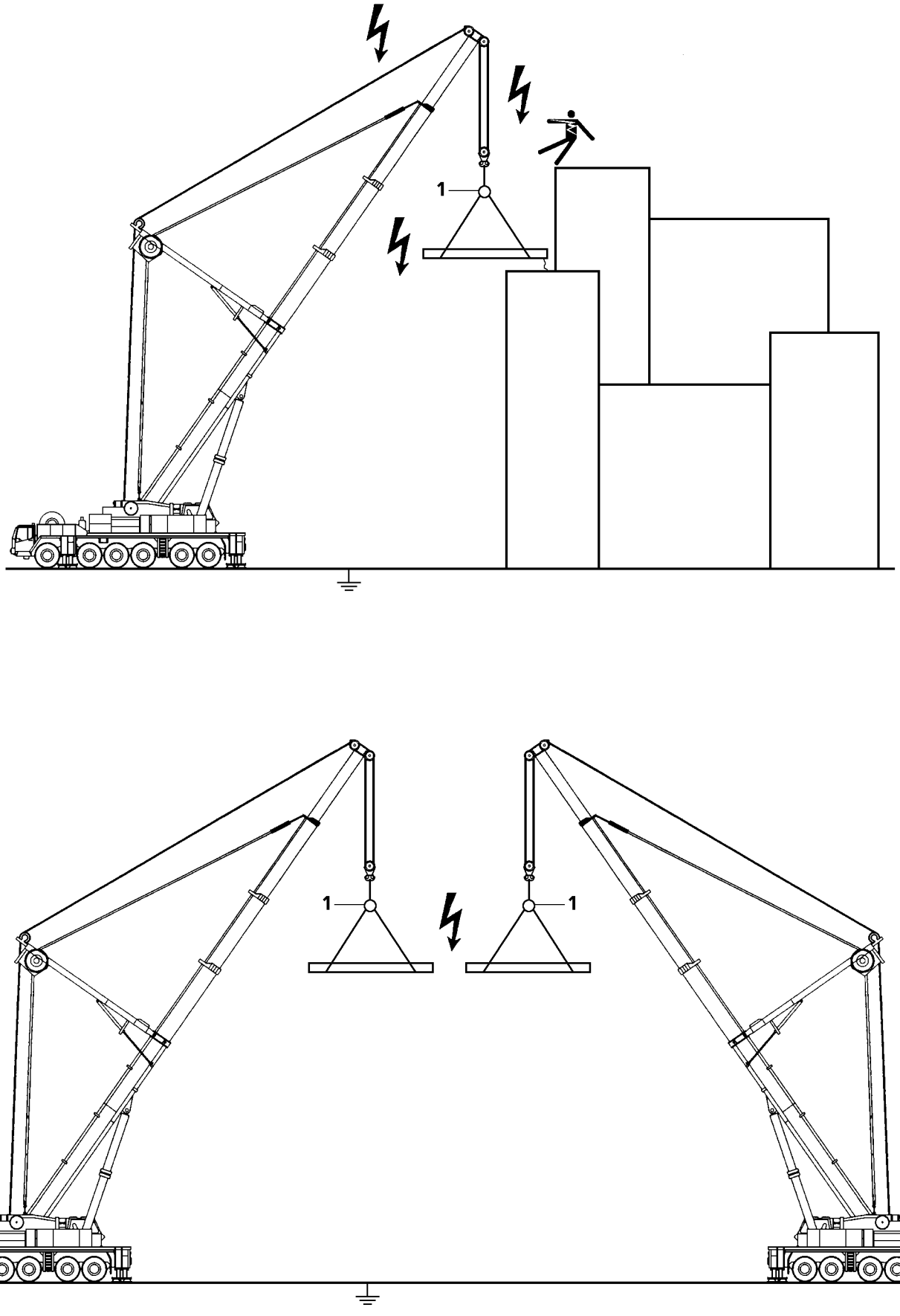

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General example

16 Working in the vicinity of transmitters

Strong electromagnetic fields are likely to be present if the site is close to a transmitter.
These electromagnetic fields can pose direct or indirect danger to persons or objects, for example:

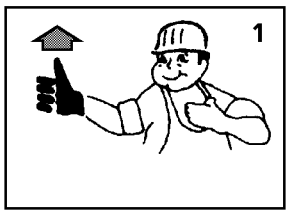
– Raising the temperature of human organs.
– Combustion and ignition caused by temperature increases.
– Sparks or arcing.

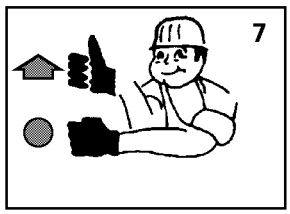
DANGER
Risk due to electromagnetic fields!

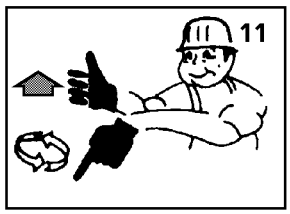
▶ Before operating a crane in the vicinity of transmitters, be sure to consult with LIEBHERR!
▶ Also consult a high frequency specialist!

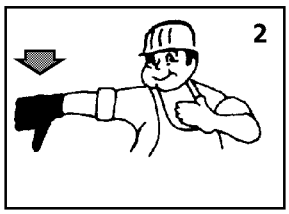
High frequency (HF) radiation from a transmitter demands supplementary work safety procedures and special environment specifications regarding crane operators and signs:

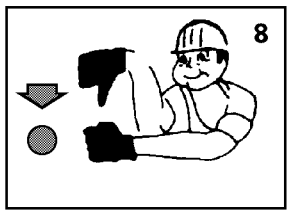
1.) Every crane must have a “continuous” ground. Check visually or with a simple tester to ensure that ladder, cab and cable pulleys are grounded.
2.) All personnel working on the crane or with large metal objects must protect themselves from burns by wearing non-conductive synthetic gloves and suitable clothing while working.
3.) There is no need to panic if you detect a warming of the hand. Always work under the assumption that the respective workpiece, structural steel member or support is “hot”.
4.) The temperature of objects affected by high frequency radiation is a function of their “size”. Cranes, carriers and coverings, for example, are “hotter”.
5.) Contact with other crane loads is not permitted when operating the crane (arcing). Since defects caused by burns considerably reduce cable carrying capacity, any such occurrences must be reported immediately to the machinery supervisor so that the cables can be inspected.
6.) An insulator **1** is required at all times between the crane load hook and fastening equipment. This insulator **1** may not be removed under any circumstances.
7.) Do not touch the rope above the insulator **1**.
8.) Loads that are attached to the crane may not be touched by any unprotected parts of the body after the load has been lifted or set down.
9.) Do not work with a bare upper torso or in short pants.
10.) To minimize absorption of high-frequency radiation, larger loads should be transported horizontally if possible.
11.) Loads must be grounded, or additional insulation used (rubber material between the object and gloves) when manual work is required.
12.) Use a suitable measuring instrument to check the “temperature” of the object.
If, for example 500 V can be measured on a tool at a distance of 1 cm to - 2 cm, then the tool may not be touched with bare hands.
The object voltage increases with distance:
At a distance of 10 cm, the voltage is approx. 600 V, at a distance of 30 cm, the voltage is approx. 2000 V.
13.) To avoid secondary accidents, use a safety belt when working on structures that are high off the ground.
14.) Handling explosive matter (such as refuelling) may only be done at least 6 m away from the place where sparks could form due to handling of larger metal parts. Use only conductive rubber hoses to refuel.
15.) Any accidents and unexpected events must immediately be reported to the local construction supervisor and the safety engineer.

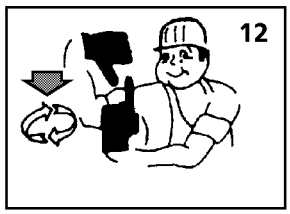


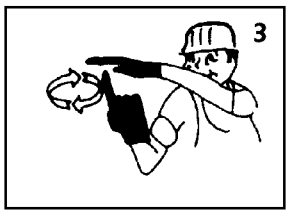


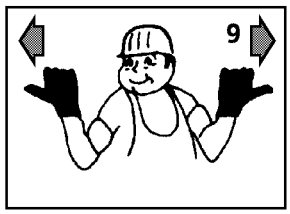


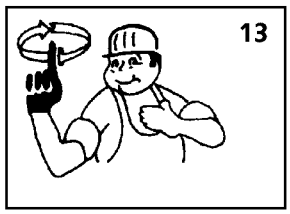


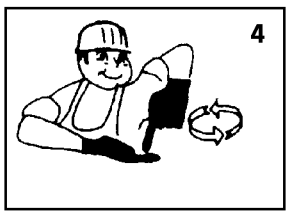


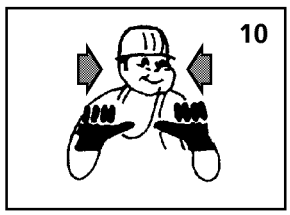


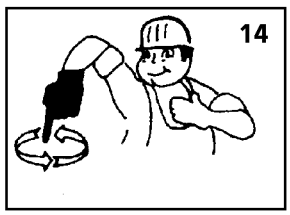


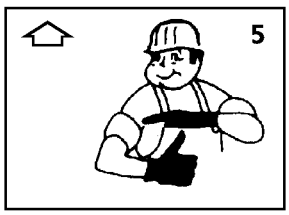


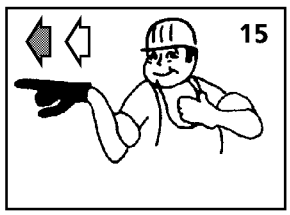


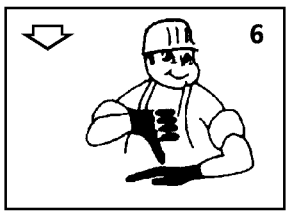


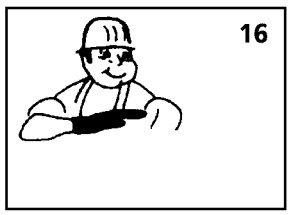


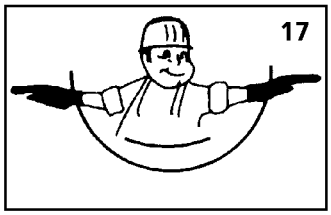












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17 Hand signals for guidance

The crane operator must always keep the load, as well as the crane hook or lifting equipment when the crane is not loaded, in his field of vision.

WARNING
Risk of accident if standing under suspended loads!
▶ Always keep loads in sight!
▶ Standing under suspended loads is prohibited!

If this is not possible, the crane operator may only operate the crane if he is guided by a dedicated guide.
The operator may be guided by hand signals or a two-way radio. It must be ensured that there are no misunderstandings.

WARNING
Danger of accident caused by misunderstood hand signals!
▶ Hand signals must be mutually agreed upon and clearly executed!

We recommend using the hand signals described on the previous page.
In any case, **national regulations** must be observed when abroad.
Hand signal explanation:
Luff up boom **1**
Luffing the boom down **2**
Lift load slowly **3**
Lower load slowly **4**
Luff up boom slowly **5**
Luff down boom slowly **6**
Luff up boom and hold load steady **7**
Luff down boom and hold load steady **8**
Telescope out boom **9**
Telescope in boom **10**
Luff up boom and lower load **11**
Luff down boom and lift load **12**
Lift load **13**
Lower load **14**
Turn load in this direction **15**
Shut down all systems **16**
Stop! **17**

18 Consideration of wind conditions

It is imperative to observe the permissible wind speed data given in the load charts:
– for the equipped crane,
– for crane operation.

WARNING
Crane can topple over!
▶ It is prohibited to erect the crane to measure the wind speed!

The crane operator must check appropriate information sources for expected wind speeds, at:
1.) The start of crane operation
2.) Interruption of crane operation
3.) Taking up crane operation again

WARNING
Crane can topple over!
If the crane is operated at wind speeds which are larger than the maximum permissible wind speeds according to the load charts, then it can topple over and kill personnel!

- ▶ If wind speeds are expected which are larger than the maximum permissible wind speeds for the equipped crane, then the attachments and the boom must be taken down!
- ▶ If wind speeds are expected which are larger than the maximum permissible winds speeds for the crane operation, then it is prohibited to lift a load!

Wind force		Wind speed		Effect of the wind
Beaufort	Description	[m/s]	[km/h]	in the inland
0	Calm	0 - 0,2	1	No wind, smoke rises straight up
1	Slight air (draft)	0,3 - 1,5	1 - 5	Wind direction is shown only by observing the trail of smoke, not by the wind sock
2	Light breeze	1,6 - 3,3	6 - 11	Wind can be felt on the face, the leaves rustle, wind sock moves slightly
3	Gentle breeze	3,4 - 5,4	12 - 19	Leaves and thin twigs move. Wind extends a small breeze flag
4	Moderate breeze	5,5 - 7,9	20 - 28	Swirls up dust and loose paper, moves twigs and thin branches
5	Fresh breeze	8,0 - 10,7	29 - 38	Small deciduous trees begin to sway, foam forms at sea
6	Strong breeze	10,8 - 13,8	39 - 49	Thicker branches move; telephone lines begin to whistle, umbrellas are difficult to use
7	Stiff wind	13,9 - 17,1	50 - 61	Entire trees swaying; difficult to walk into wind
8	Gale force wind	17,2 - 20,7	62 - 74	Breaks twigs off trees, walking becomes difficult
9	Gale	20,8 - 24,4	75 - 88	Minor damage to property (chimney tops and roofing tile are blown off)
10	Severe gale	24,5 - 28,4	89 - 102	Trees are uprooted, significant damage to property
11	Violent storm	28,5 - 32,6	103 - 117	Extensive, widespread storm damage
12	Hurricane	32.7 and more	118 and more	Major destruction

19 Interruption of crane operation

19.1 Interruption of crane operation

If the crane operator leaves the equipped crane, then it must be ensured that no danger to crane or surrounding area can occur in case of an unforeseen event.

WARNING
Danger of fatal injury!
Situations may occur which could cause the crane to become unsafe if left unsupervised.
This could cause the crane to topple over, resulting in major personal injury and material damages.
▶ Full control of the crane must be maintained at all times!

Incidents which could occur (for example):
– The ground giving way due to severe rain.
– Melting ice under the supports.
– Bad weather, storms, thunderstorms.
– Landslides.
– Wash outs.
– On mobile cranes:
  Support cylinder failure.
– On cranes with telescopic booms:
  Luffing cylinder failure.
– Vandalism.

Ensure that the following prerequisites are met:
– There is no load on the hook.
– The crane poses no traffic obstacle.

Note
▶ If crane work must be interrupted if the crane is equipped, then it must be ensured that measures are initiated in time by trained, qualified personnel, to bring the crane into a safe condition in case something happens.

DANGER
Risk of accident!
▶ If it is not possible to maintain full control over a rigged crane, the machinery and boom must be taken down.

20 Taking up crane operation again

20.1 Taking up crane operation again

Upon resumption of crane operation, the crane operator is required to check the state of the crane and its safety systems.

WARNING
Risk of accident!
▶ If the crane operator leaves the cab, even for a short time, the operating mode setting must be checked and reset if necessary before resuming crane operation.

▶ Check operating mode settings and reset, if necessary.

21 Ending crane operation

21.1 Ending crane operation

Before the crane operator may leave the crane, the following prerequisites must be met:

- ▶ Place the load on the ground and detach from the crane hook.
- ▶ On cranes with telescopic booms:
  Telescope the telescopic boom all the way in and place the boom down.
- ▶ On cranes with lattice mast booms:
  Set down the lattice mast boom and dismantle if necessary.
- ▶ Bring the control lever (master switch) to 0-position.
- ▶ Turn the heater off.
- ▶ Apply the parking brake on the crane chassis.
- ▶ Turn the engine off and pull the ignition key.
- ▶ On mobile cranes:
  Secure the vehicle to prevent unauthorized use. Ensure the crane operator's cab and driver cab are not occupied. Lock the crane operator's cab and driver cab.
- ▶ On mobile cranes:
  Secure the crane to prevent it from rolling off. See paragraph “Parking the vehicle”.

22 Stopping the vehicle

Note

- ▶ Paragraph “Parking the vehicle” only applies to mobile cranes!

WARNING

Danger of accidents if the vehicle rolls away!

If the following points are not observed by the crane operator, personnel can be killed.

- ▶ It is prohibited to park the vehicle on a slope or incline of more than 18 %.
- ▶ The parking brake must always be applied when parking the vehicle.
- ▶ The ground where the vehicle is parked must be of sufficient load carrying capacity and level, so that the wedges will not slip away under load or be pushed into the soil.

Ensure that the following prerequisites are met:

– The vehicle is standing on level ground of sufficient load carrying capacity.
– The parking brake is applied.

Under the following conditions, the vehicle must be secured against rolling away by using the specified number of wheel chocks or wedges - in addition to the parking brake:

– The vehicle is being parked on an uphill or downhill slope.
– The vehicle is being parked and not guarded.
– The vehicle is defective, especially if the brake system is defective.

WARNING

Vehicle rolling uncontrollably away!

The vehicle may roll away uncontrollably if all the specified chocks are not placed directly behind the wheels. This may result in fatal injuries.

- ▶ Fit all the specified chocks so that they counter the downhill-slope force!
- ▶ Fit all the specified chocks directly underneath the wheels (as close as possible)!
- ▶ All chocks should be fitted as close as possible to provide an immediate braking effect and hold the vehicle in its parked position!

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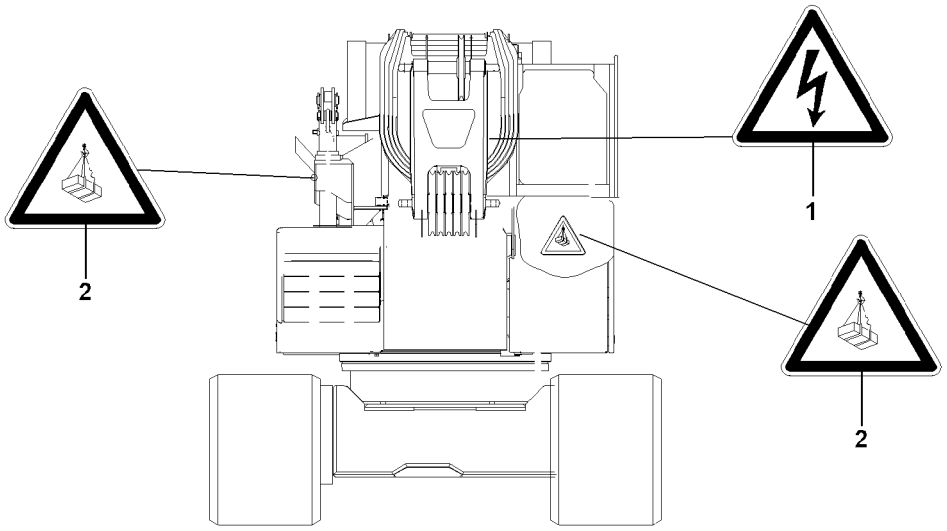

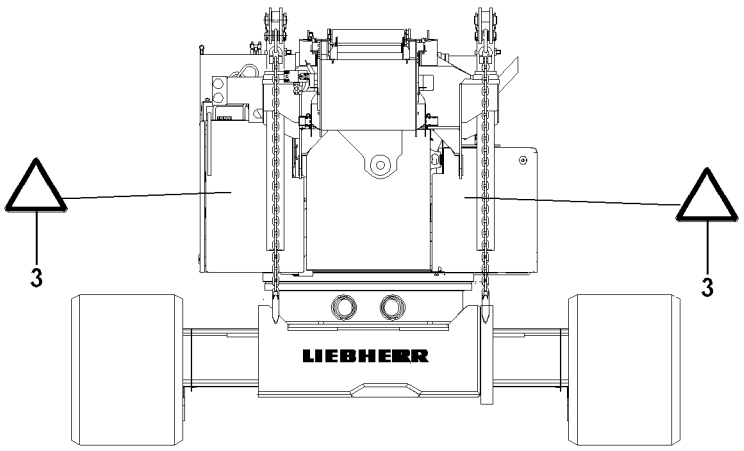

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1 Warning signs

1.1 Configuration of warning signs

The shape is a triangle, the border and the sign are black. The base is yellow.

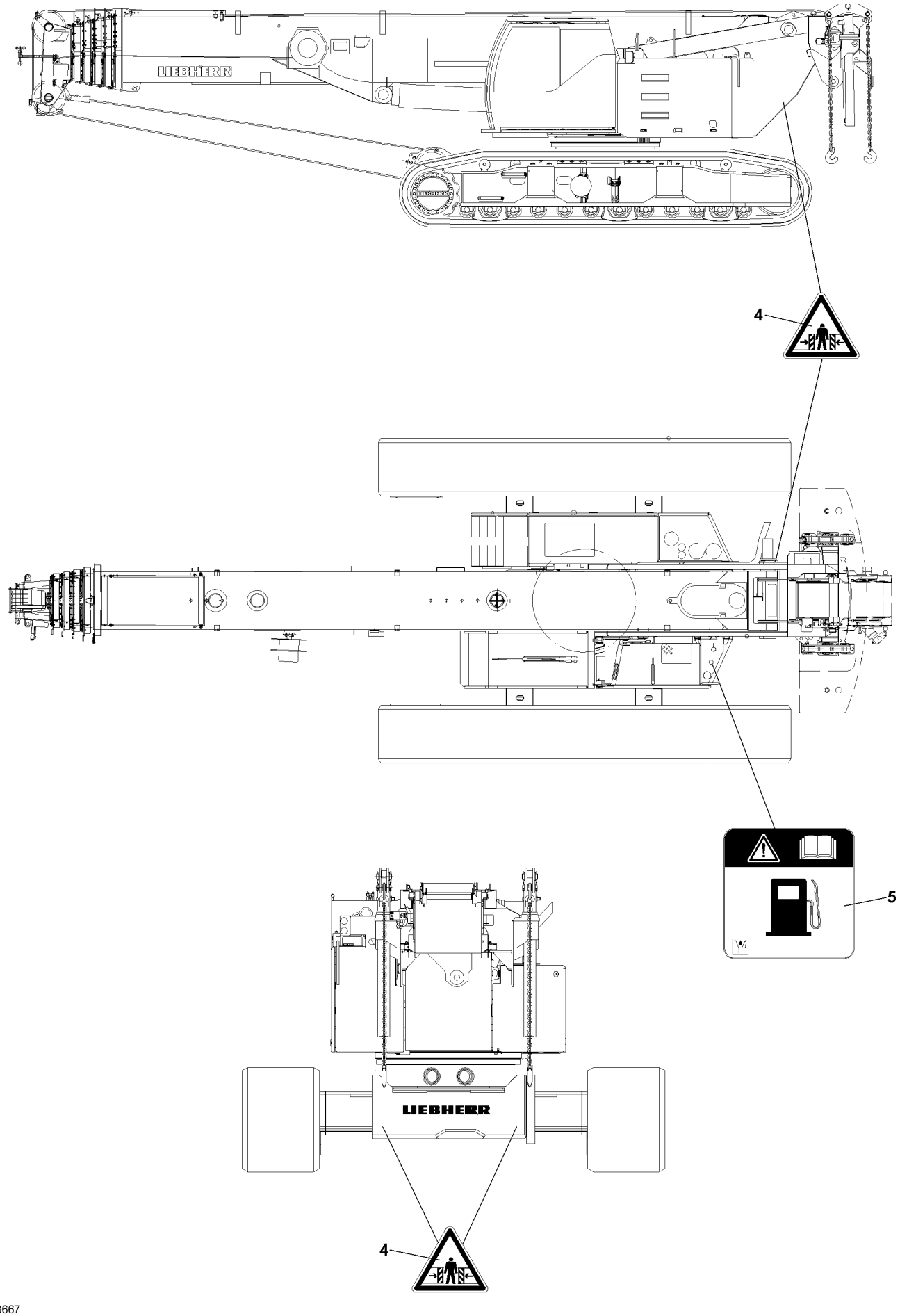
Note

- ▶ Warning signs are safety signs, which warn of a risk or danger.
- ▶ For that reason, all warning signs on the crane must be complete and always legible.

1.2 Warning signs on the crane

The following warning signs are installed on the crane:

- – Warning sign **1**, “Warning of dangerous electric current”, valid only for certain countries*
- – Warning sign **2**, “Warning of suspended load”
- – Warning sign **3**, “Slewing range”, valid only for certain countries*



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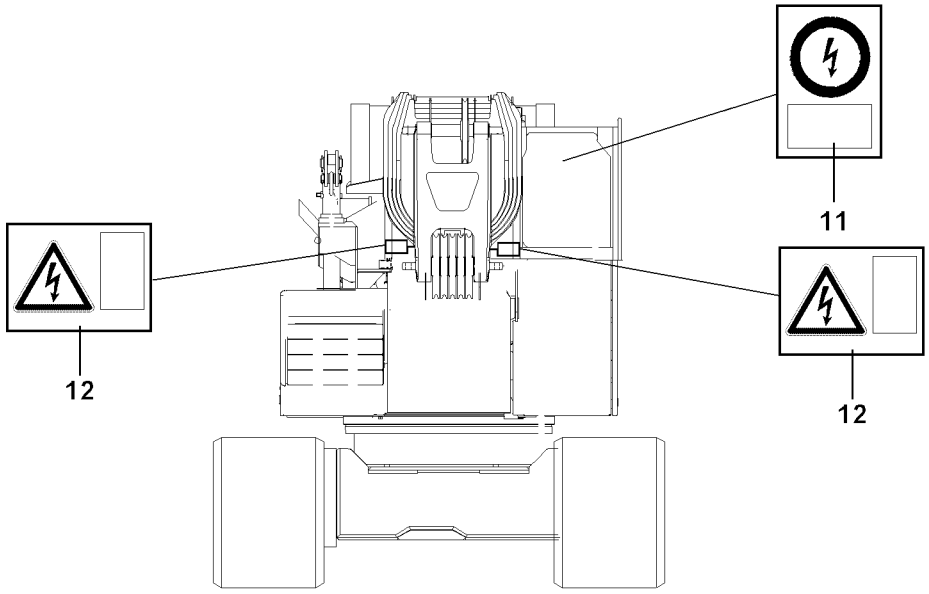
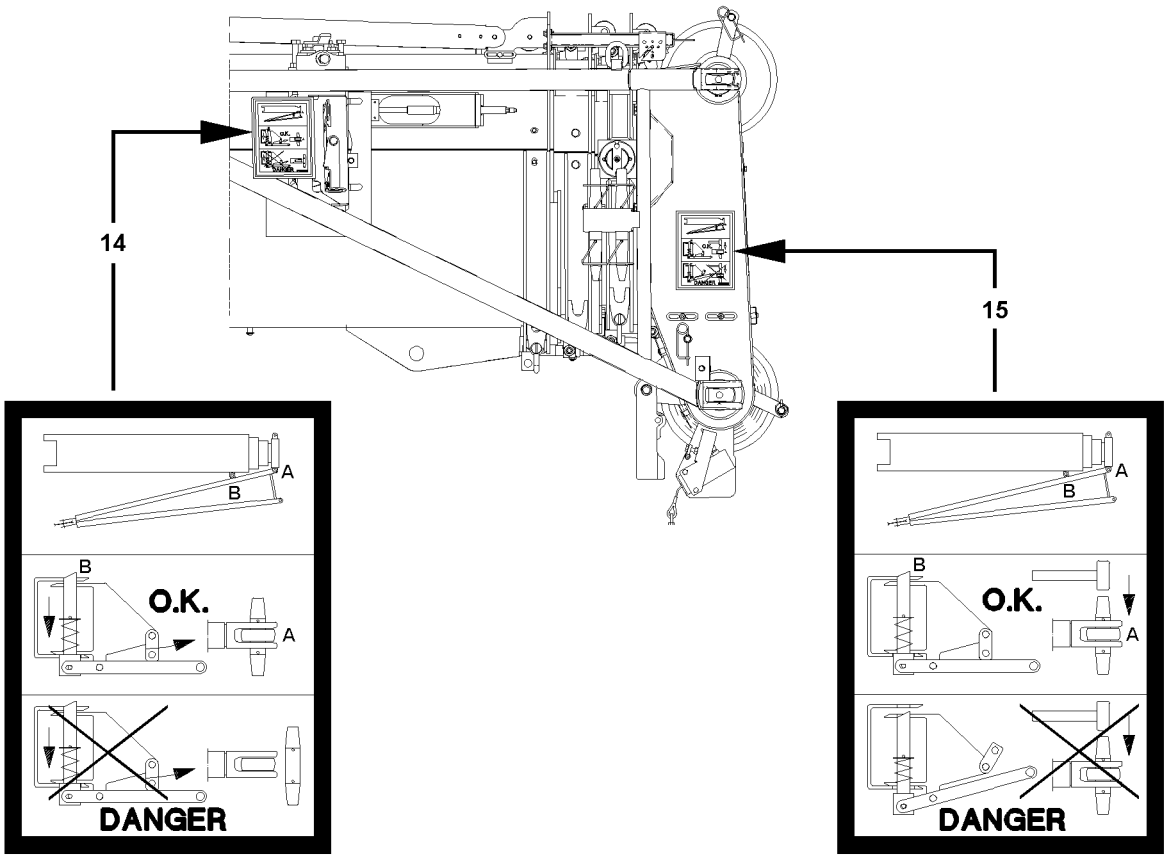
– Warning sign **4**, “Danger of crushing”
– Warning sign **5**, “Only fill with diesel fuel”





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2 Warning notes

2.1 Configuration of warning notes

The shape is rectangular. The border, the lettering and the symbols are black. The base is yellow.

Note

- ▶ Warning notes are safety signs with text, which warn of a risk or danger.
- ▶ For that reason, all warning notes on the crane and the folding jib must be complete and always legible.

2.2 Warning notes on the crane

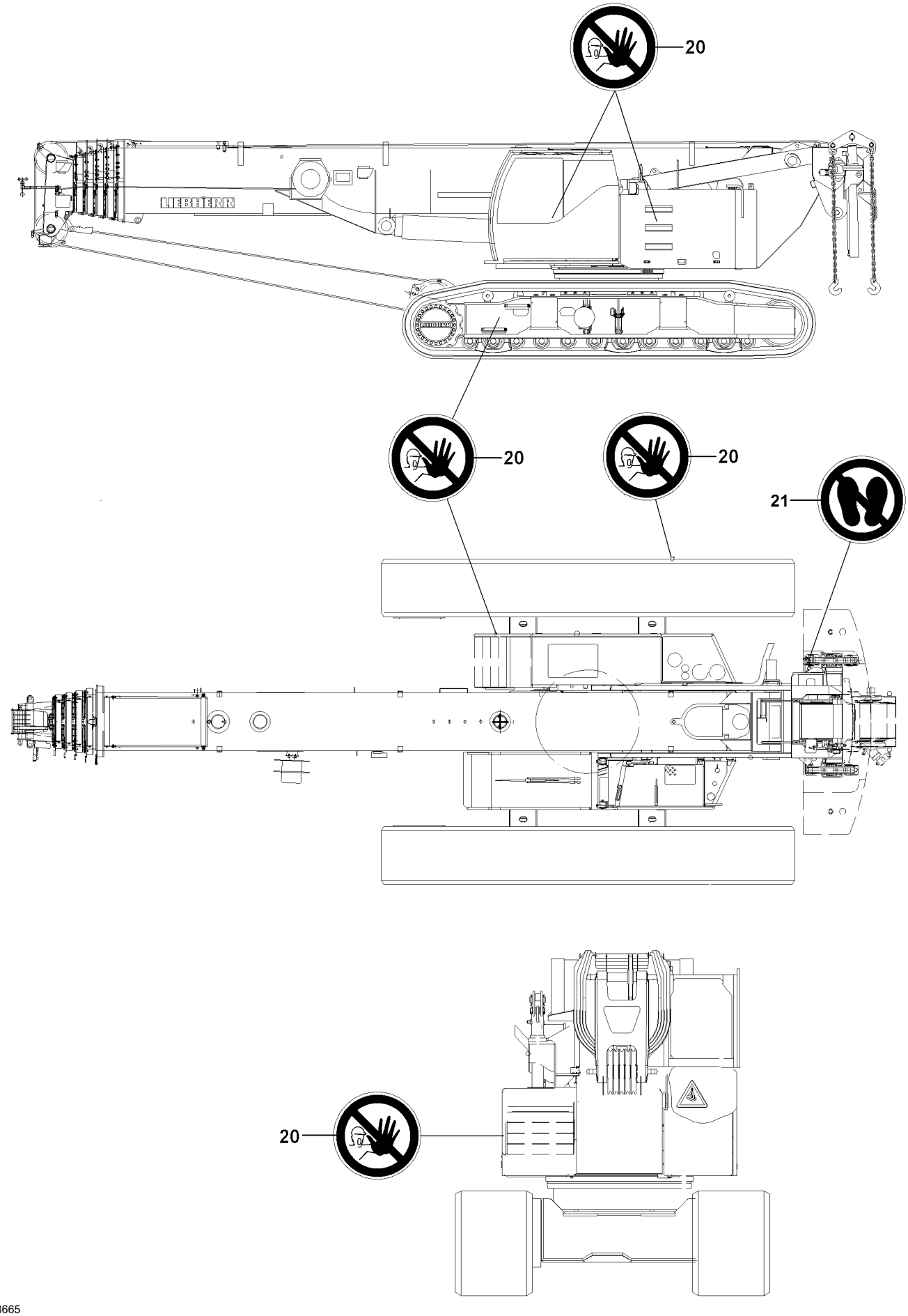
The following warning notes are installed on the crane:

– Warning note **11**, “Warning of high voltage”, valid only for certain countries*
– Warning notes **12**, “Warning of dangerous electric current”, valid only for certain countries*

2.3 Warning notes on the auxiliary boom

The following warning notes are installed on the auxiliary boom:

– Warning note **14**
– Warning note **15**



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3 Command / prohibition signs

3.1 Configuration of command signs

The shape is round and the base is blue.
The surface of the sign is bordered by a bright edge.

Note

- ▶ Command signs are safety signs, which dictate a certain behavior.
- ▶ For that reason, all command signs on the crane must be complete and always legible.

3.2 Configuration of prohibition signs

The shape is a round, the border is red, and the symbol is black. A red crossbar is drawn through the symbol. The base is white.

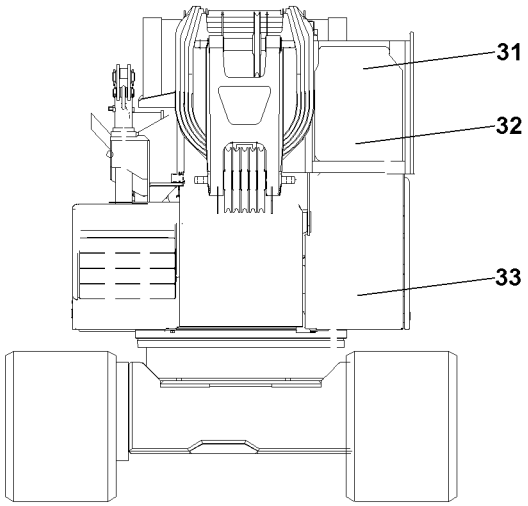
Note

- ▶ Prohibition signs are safety signs, which prohibit a behavior, which can result in danger.
- ▶ For that reason, all prohibition signs on the crane must be complete and always legible.

3.3 Command / prohibition signs on the crane

The following command / prohibition signs are installed on the crane:

– Prohibition sign **20**, “Access for unauthorized personnel prohibited”
– Prohibition sign **21**, “Walking on the area is forbidden”



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4 Notice signs

4.1 Configuration of notice signs

The shape is rectangular and the lettering is black. The base is yellow.

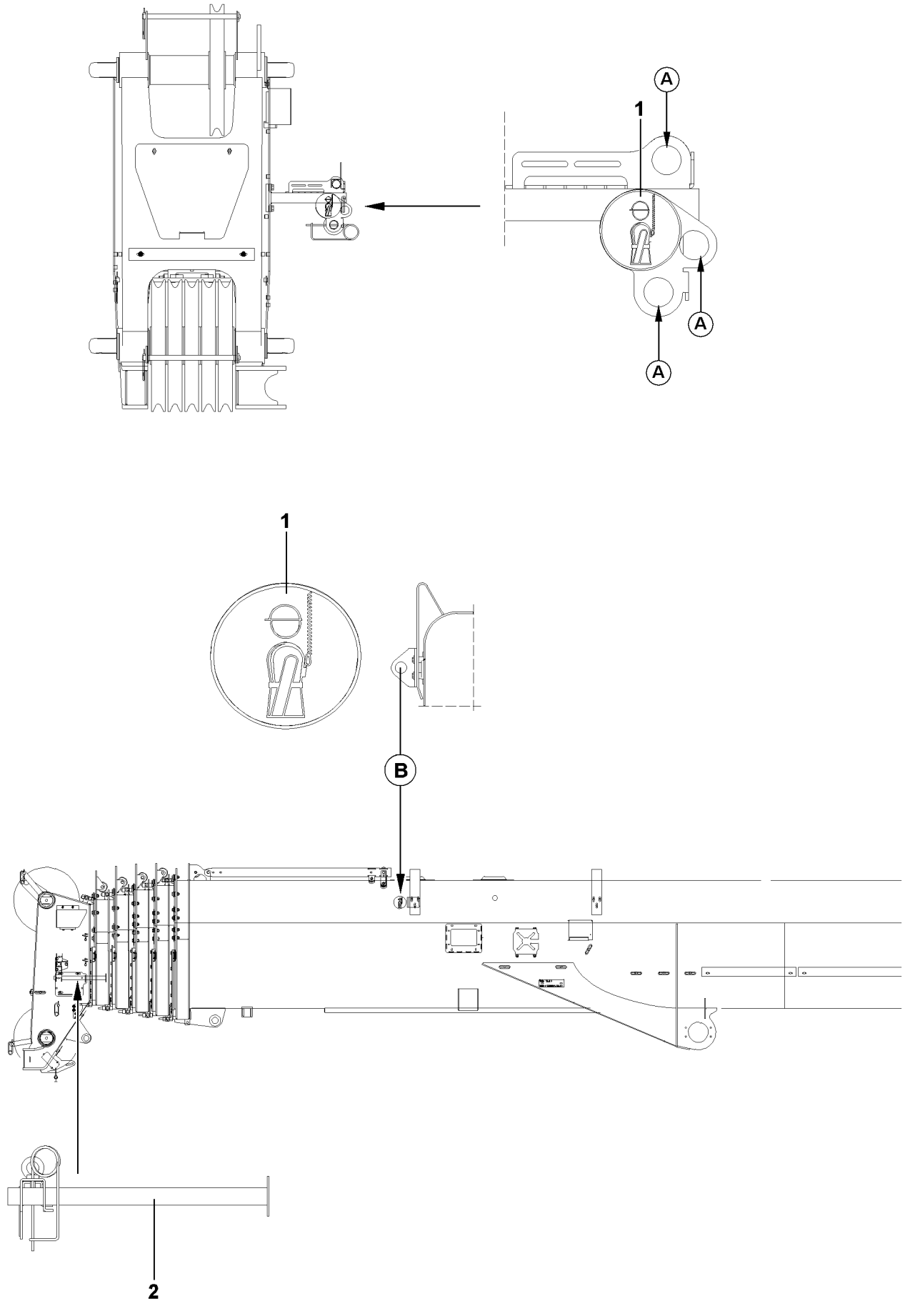
Note

- ▶ Notice signs are signs, which provide additional notes in text form.
- ▶ For that reason, all notice signs in the crane must be complete and always legible.

4.2 Notice signs on the crane

The following notice signs are installed on the crane:

- Notice sign **31**, “Operating regulations for cranes”, valid only for certain countries*
- Notice sign **32**, “Operating notes”
- Notice sign **33**, “Noise level”



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1 Antifall guards on the crane

1.1 General

DANGER
Danger of falling!
During assembly and disassembly, personnel must be secured with appropriate antifall guards to prevent them from falling. If this is not observed, personnel could fall and suffer life-threatening injuries.

- ▶ All assembly work from a height of 2 m must generally be carried out using suitable aids (lifting platforms, scaffolding, ladders, auxiliary crane, etc.)! The height above which assembly/disassembly work must be carried out with aids depends on national regulations. The national regulations must be adhered to!
- ▶ If work cannot be carried out on the ground or using such aids, then assembly personnel must be secured with suitable personal protective equipment (such as safety belts) to protect against falling!

Note

- ▶ The signs **1** mark the fastening points, where assembly personnel must engage the approved safety belts to secure itself against falling.

2 Fastening points

2.1 Fastening points on the telescopic boom

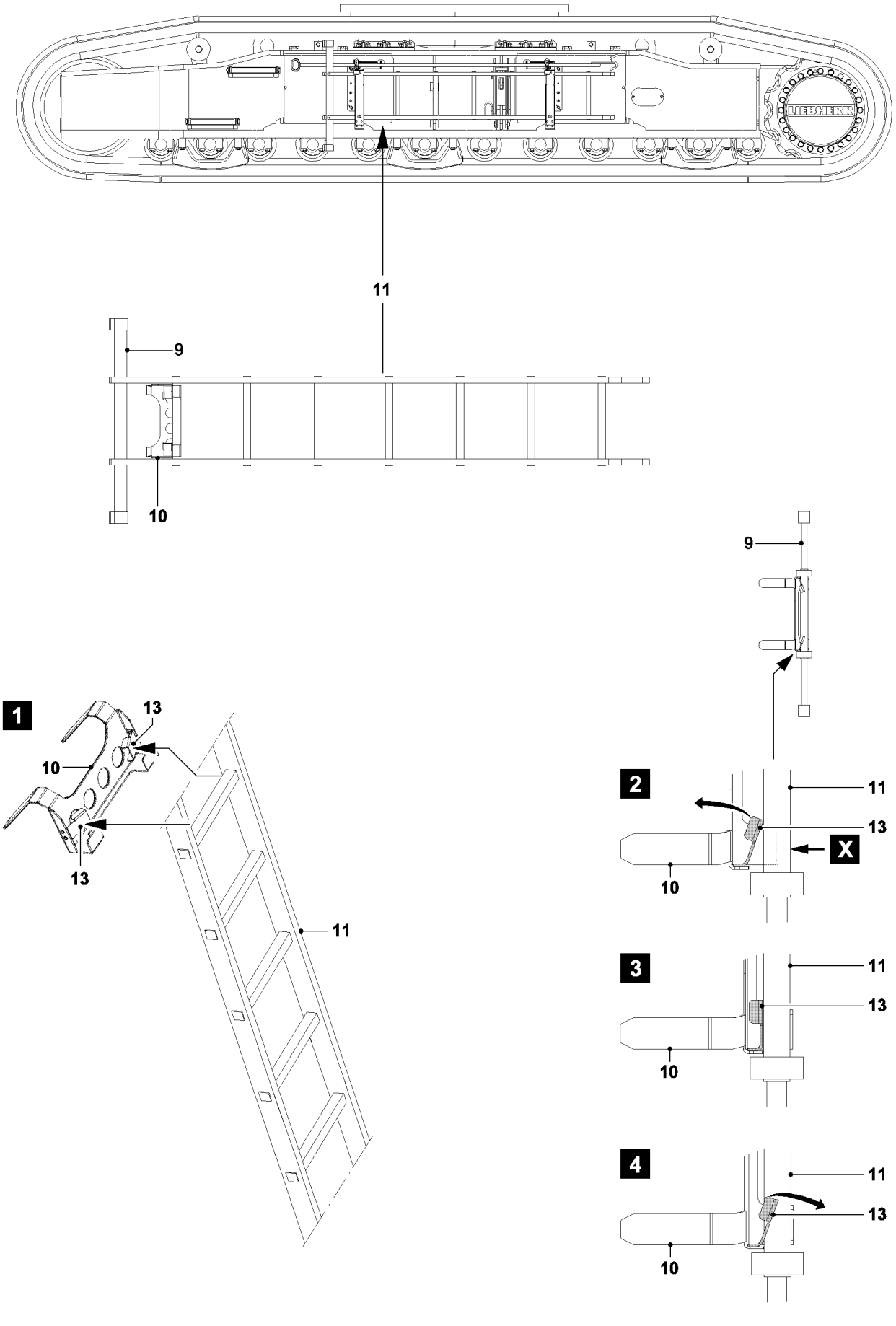
Fastening points **A** and fastening point **B** are installed on the telescopic boom.

DANGER
When working aloft, there is a danger of falling!
If the following notes are not observed, the assembly personnel could fall and suffer life-threatening injuries!

- ▶ Before any assembly / disassembly work and maintenance work on the crane superstructure and the telescopic boom, the assembly personnel must attach the approved safety belts and protective devices.
- ▶ For assembly / disassembly work, the ladder **with hook device** is engaged on pipe **2**, see also section “Installing hook device on ladder”.
- ▶ The assembly personnel must secure itself with approved safety belts on fastening point **A** or fastening point **B** to prevent falling.

DANGER
Risk of damage!

- ▶ Never hang loads or objects on fastening points **A** or fastening point **B**.



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3 Attachment points on folding jib

Note

▶ For assembly / disassembly work on the folding jib and the folding jib extension, the supplied ladder must be used.

3.1 Using the ladder

DANGER

Risk of accident!

If the following notes are not observed, the ladder can tip and the assembly personnel can fall from the ladder and sustain life-threatening injuries!

▶ Damaged ladders may **not** be used!

▶ Use only the supplied ladder with cross brace **9**!

▶ The hook device **10** on the ladder serves as protection from falling over. For all assembly / disassembly work on the folding jib, folding jib extension and telescopic boom, the ladder with hook device **10** must be used!

▶ The ladder must be set up stable and safely accessible.

▶ For safe handling of ladder, observe the safety notes on the ladder!

3.2 Installing the hook device on the ladder

Before using the ladder, the hook device **10** must be installed on a rung.

▶ Push the ladder with the required rung against the locking plates **13** on the hook device **10** (point **X**), see illustration **1**, illustration **2**.

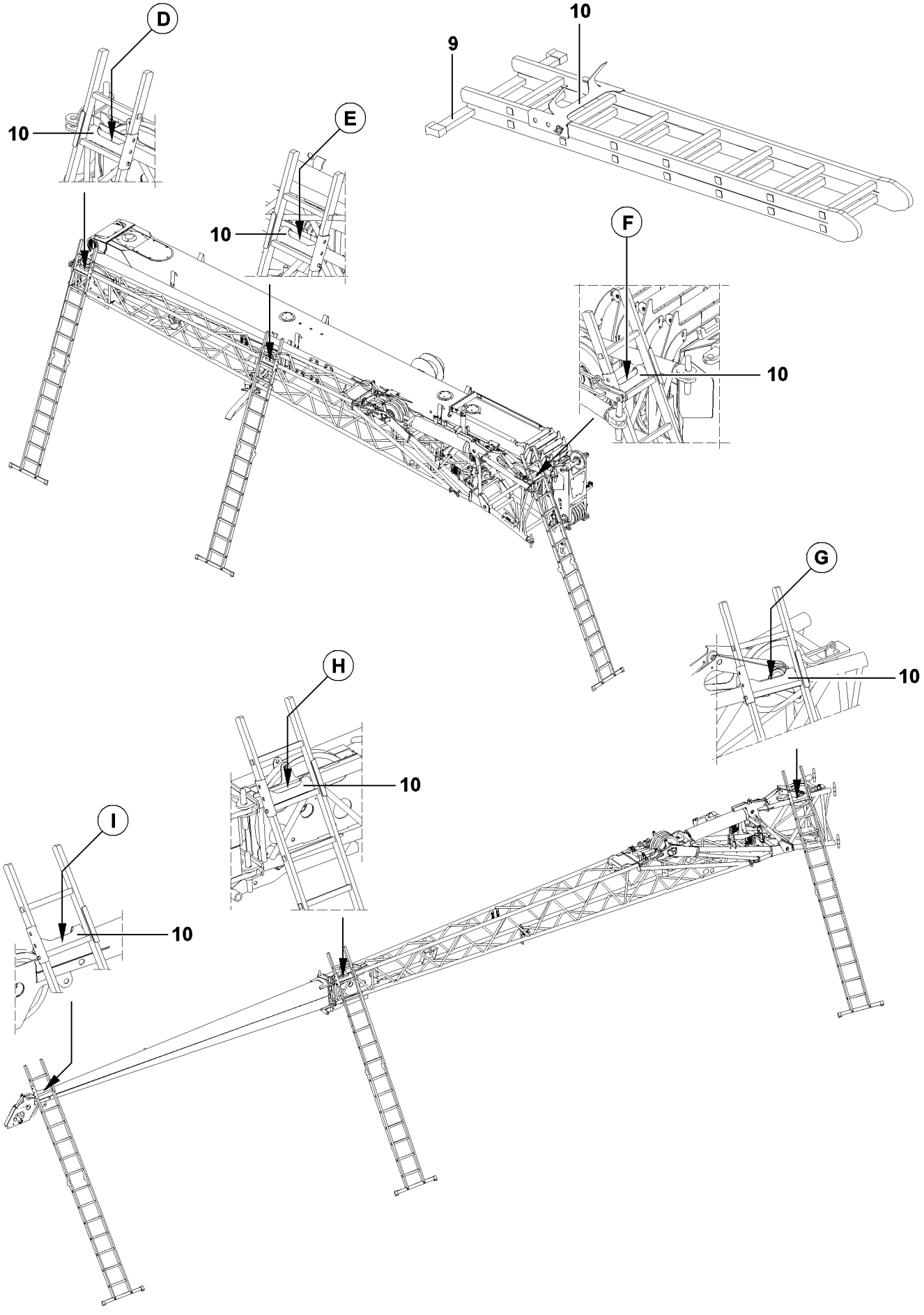
Result:

– the locking plates **13** spring in direction of the arrow and release the receptacle on the hook device **10** for the rung, see illustration **3**

▶ push the hook device **10** “upward”

Result:

– the locking plates **13** spring (arrow) “back” into their original position by themselves and secure the rung, see illustration **4**


D
10
E
10
9
10
F
10
G
10
H
10
I
10
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3.3 Fastening points on folding jib / folding jib extension

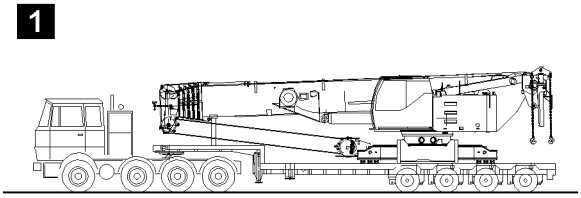
DANGER
When working aloft, there is a danger of falling!
If the following notes are not observed, the ladder can tip and the assembly personnel can fall from the ladder and sustain life-threatening injuries!

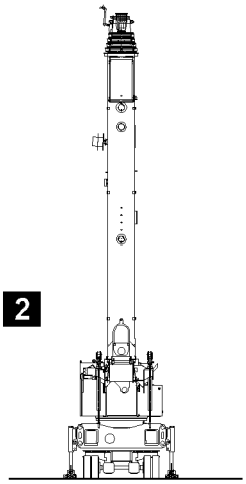
- ▶ For all assembly / disassembly work on the folding jib and the folding jib extension, use the ladder with cross brace **9** and hook device **10**, see section “Installing the hook device on the ladder”.
- ▶ Hang the ladder with hook device **10** on the corresponding attachment point and set it up stable.
- ▶ For safe handling of ladder, observe the safety notes on the ladder.
- ▶ Step on the ladder only with “clean shoes”.

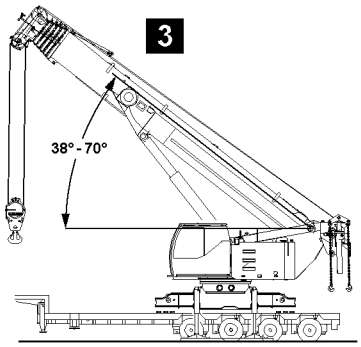
For assembly / disassembly work on the folding jib and the folding jib extension, note the following attachment points for the ladder:

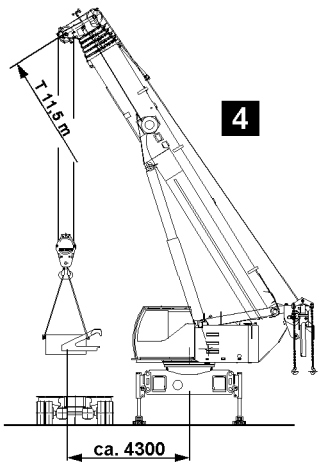
- Attachment point **D**
- Attachment point **E**
- Attachment point **F**
- Attachment point **G**
- Attachment point **H**
- Attachment point **I**

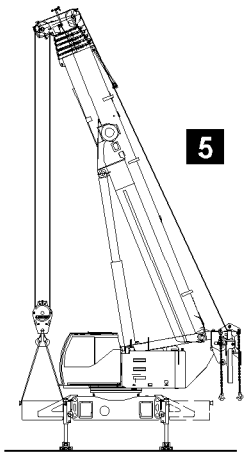
3.00 Crane assembly











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1 Assembling the crane

Ensure that the following prerequisites are met:
- The location is level, smooth and provides sufficient load-carrying capacity.
- Authorised and trained personnel are available to carry out the assembly/disassembly work.
- The telescopic boom is fully telescoped in and placed on its receptacle.
- The central ballast is disassembled.
- The counterweight on the turntable is disassembled.

DANGER
Crane can topple over!
If a counterweight is installed on the turntable when “supporting a crane with a load”, then the crane can topple over and fatally injure personnel!
- ▶ When “supporting the crane with a load”, no counterweight may be installed on the turntable!
- ▶ Do not turn the crane superstructure when the crane is resting on the transport vehicle!

Note
- ▶ For dual folding jib installed on the side of the telescopic boom, the permissible load carrying capacities in T-operation at T-11.5 (0/0/0/0/0) must be reduced by approx. 1 t. This applies especially for the central ballast and crawler carrier assembly on the support cylinders.
- ▶ The additional weight of the dual folding jib is weighed by the overload protection, so that the full utilization is reached earlier.

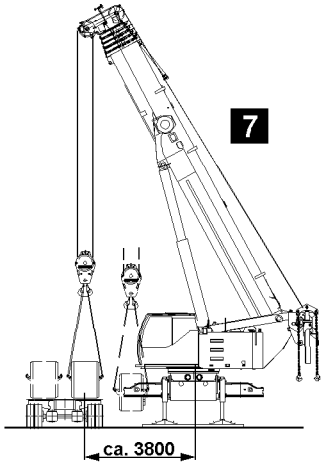
1.1 Short description of assembly procedure

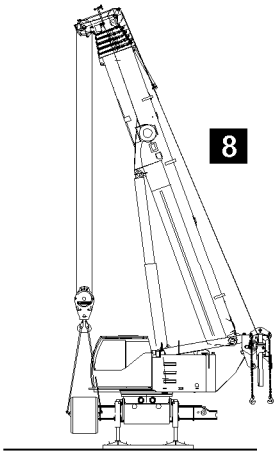
Note
- ▶ The short description of the assembly procedure is only intended as an overview. In addition, the complete assembly description must be read and understood!

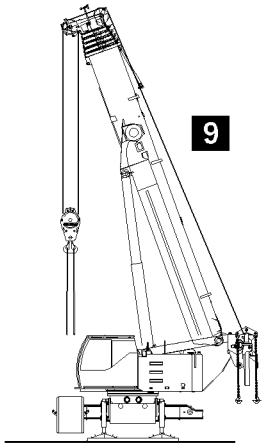
Preparatory work
- ▶ Swing the hatch consoles into their operating position and pin them in place.
- ▶ Fit and align the support pads under the support cylinders, illustration 2.

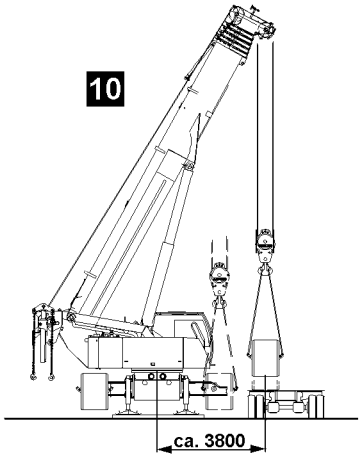
DANGER
Risk of tipping when the auxiliary boom is in its transport position at the side of the telescopic boom!
If the telescopic boom, with the auxiliary boom installed on the side of the telescopic boom is not luffed up to an angle range of 38° to 70° before supporting, then the crane can topple forward and fatally injure personnel!
- ▶ Luff the telescopic boom with the auxiliary boom installed on the side of the telescopic boom to an angle range of 38° to 70° before supporting the crane!

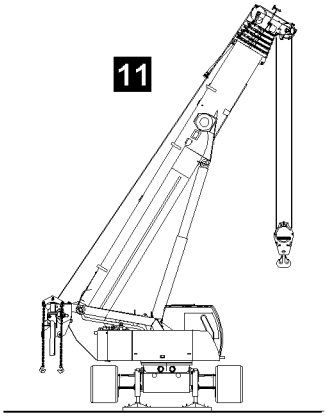
- ▶ Support the crane and remove the transport vehicle, illustration 3.
- ▶ Level out the crane and fit the central ballast, see **chapter 3.03** and illustrations 4 and 5.

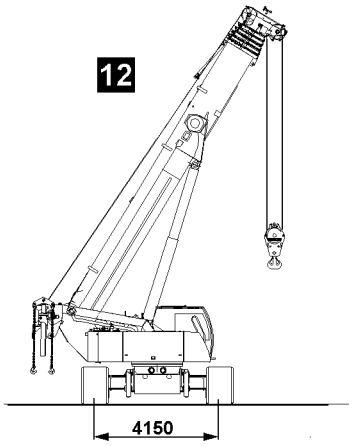


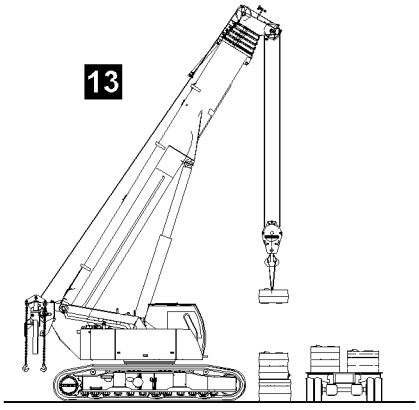


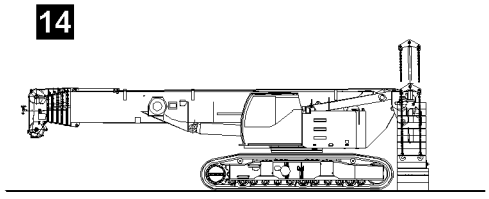












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Fit the first crawler carrier, illustrations 7 and 8

- Attach the supplied assembly suspension to the folded out transportation retainers.
- Position the crawler carrier on the beams of the crawler center section.
- Slide the crawler carrier as far along the beam as possible.
- Clamp the crawler carrier to the beams using the clamping screws.
- Secure the clamping screws with safety strips.
- Remove the assembly suspension.
- Fold in the transportation retainers and pin them in position.

Fit the second crawler carrier, illustration 10

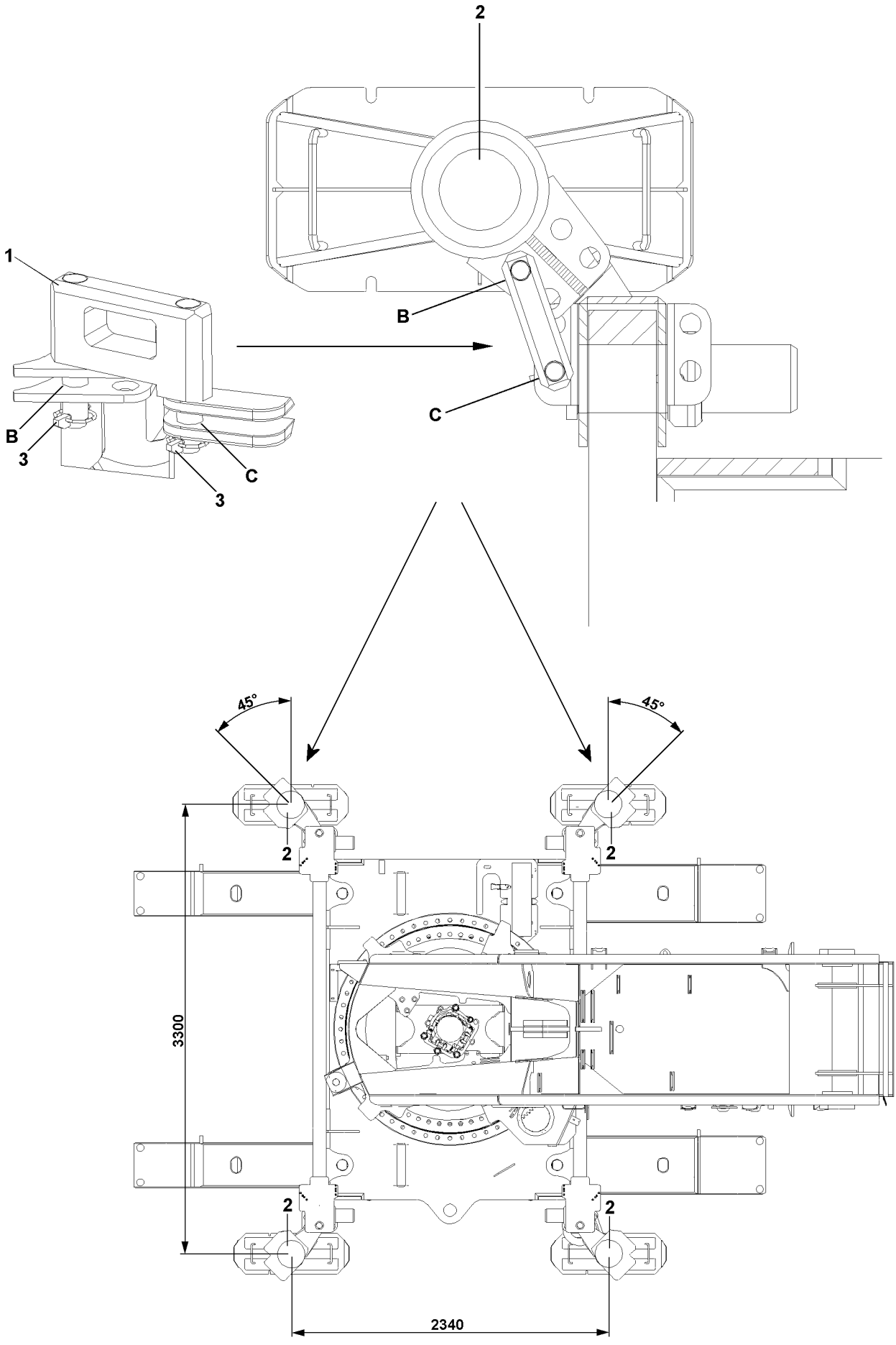
- Check and prepare the pinning points for the crawler carrier.
- Attach the supplied assembly suspension to the folded out transportation retainers.
- Position the crawler carrier on the beams of the crawler center section.
- Slide the crawler carrier as far along the beam as possible.
- Clamp the crawler carrier to the beams using the clamping screws.
- Secure the clamping screws with safety strips.
- Remove the assembly suspension.
- Fold in the transportation retainers and pin them in position.

Retract the support cylinders, illustrations 11 and 12

- Fully retract the support cylinders.
- Store the support pads in the holders on the crawler center section.

Start up the chassis and fit the counterweight, illustrations 13 and 14

- Establish the hydraulic connections.
- Retighten the clamping screws.
- Test the chassis.
- Fit the counterweight, see chapter 4.07.



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1.2 Pinning the support cylinder in assembly position

Ensure that the following prerequisites are met:
– The crane lies on the transport vehicle.
– All straight retaining brackets **1** have been unpinned and removed.

DANGER
Crane can topple over!
If the crane is supported without the support cylinders **2** being pinned in assembly position, the crane can topple over and fatally injure personnel!
▶ Support the crane only in assembly position (45° position of support cylinders **2**)!
▶ Assembly operation is only permitted at a support base of 2340 mm x 3300 mm!

▶ Swing the support cylinders **2** to 45°.
▶ Unpin the straight retaining brackets **1** at bore **B** and bore **C** and secure with linch pins **3**.

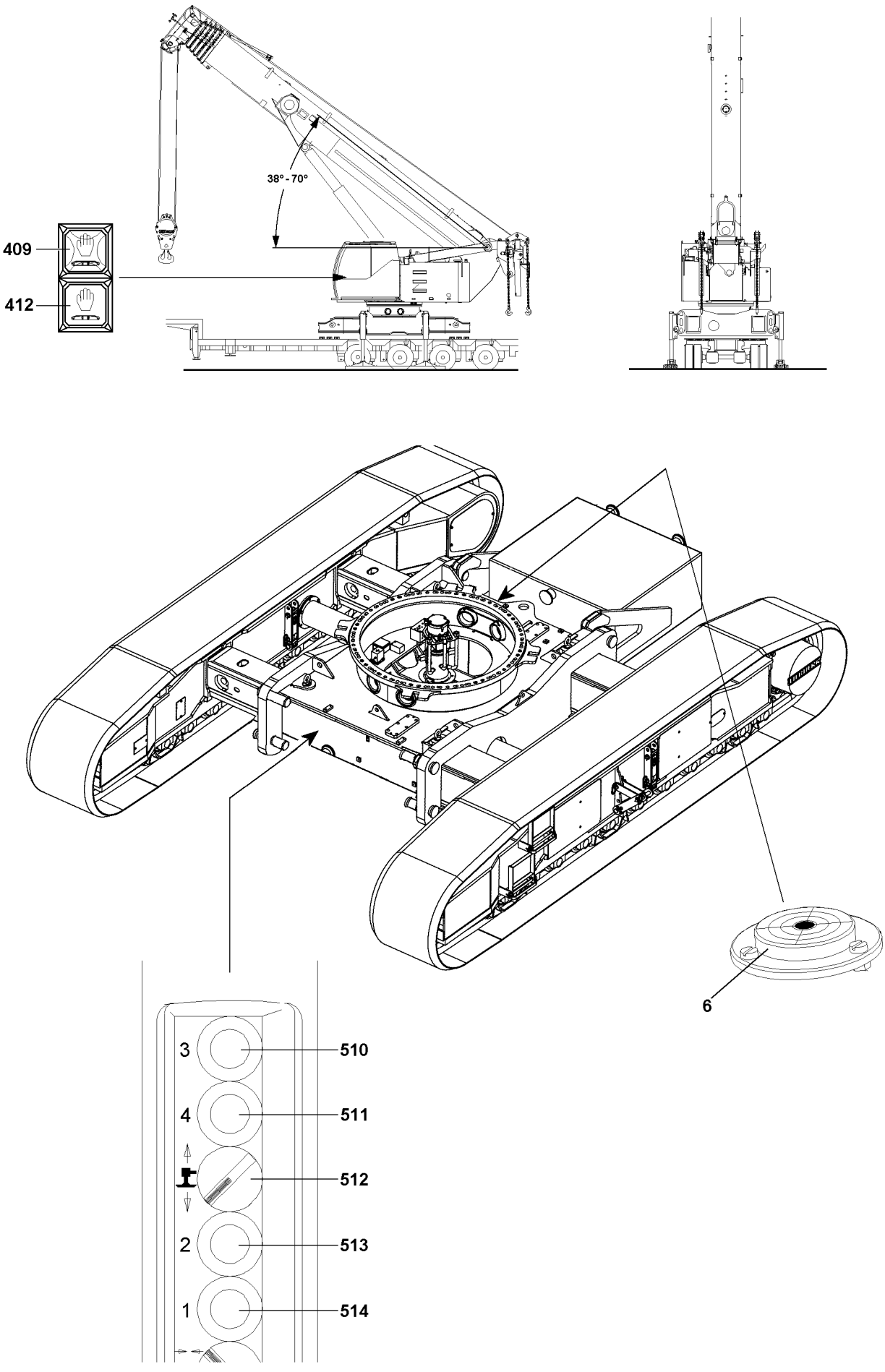
Pin the remaining support cylinders **2** correspondingly.
▶ Pin all four support cylinders **2** in assembly position support base 2340 mm x 3300 mm.

1.3 Fitting and aligning the support pads

Observe the safety instructions and permissible ground pressures (see Chapter 2.04).

DANGER
Crane can topple over!
The crane can topple and cause fatal injury if the support pads are not correctly fitted.
▶ Only use suitable support materials!
▶ Place the bases under the center of the support pads!
▶ All support pads should be underlaid with the same materials!
▶ Observe the track width of the low-loader! The underlay material should not project into the driving track.

▶ Place stable materials such as wood, steel plates or concrete slabs of a suitable size beneath the supports pads, depending on the ground conditions.
▶ Remove the support pads from the holders on the crawler center section and place them underneath the support cylinders.
▶ Align the support pads along the low-loader!
▶ Align support plates under the support cylinders as shown in the illustration on the left!



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1.4 Supporting the crane

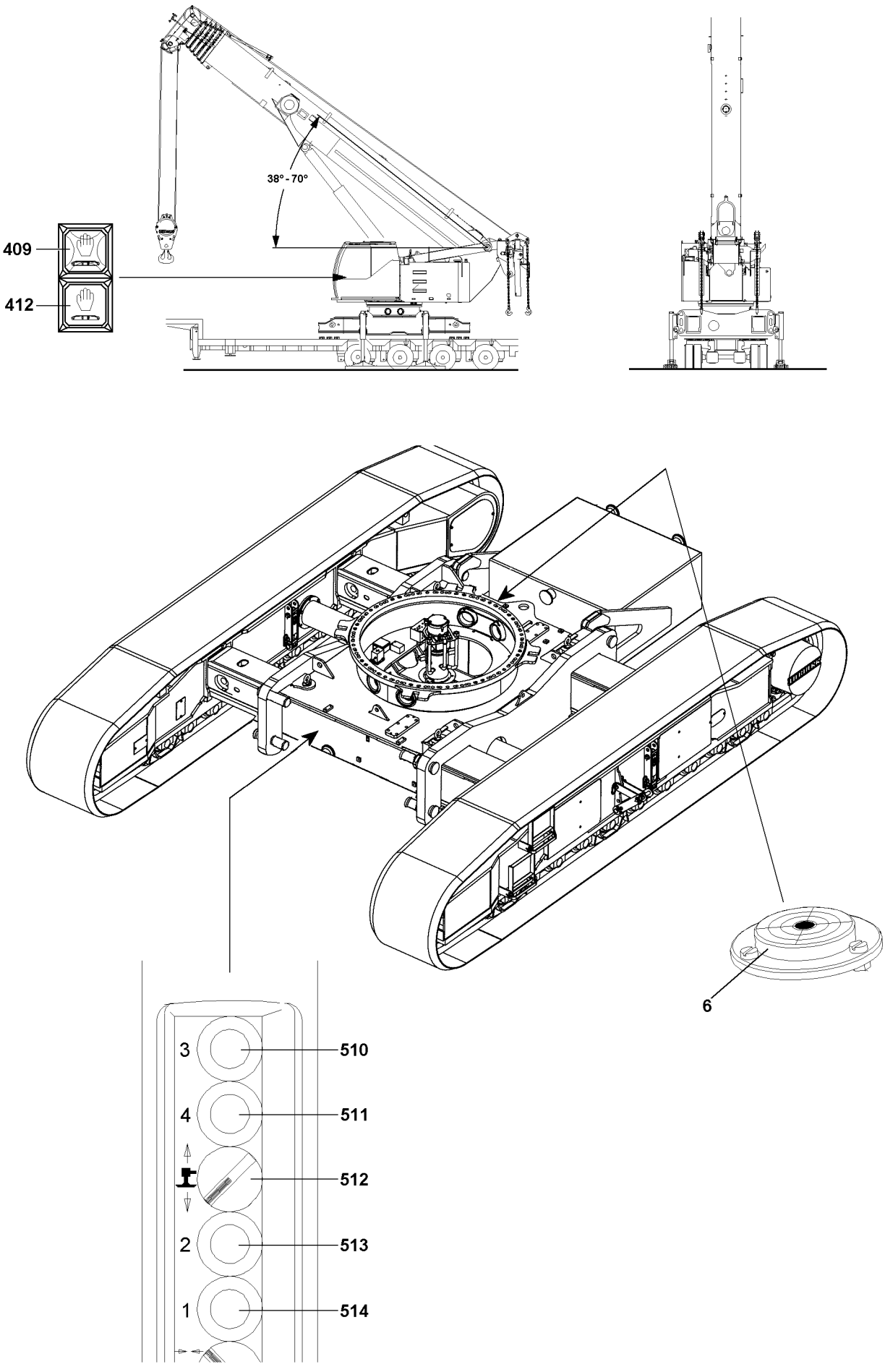
Ensure that the following prerequisites are met:
- The engine is running.
- The hatch consoles and their support cylinders are pinned in the operating position.
- The LICCON overload protection has been set according to the load chart.
- The crane has been set down on the transport vehicle.
- The beams are underlaid at both ends using timber pieces.
- The crane superstructure is mechanically locked with the crane chassis.

1.4.1 Preparatory work

DANGER
Risk of tipping when the auxiliary boom is in its transport position at the side of the telescopic boom!
If the telescopic boom, with the auxiliary boom installed on the side of the telescopic boom is not luffed up to an angle range of 38° to 70° before supporting, then the crane can topple forward and fatally injure personnel!
- ▶ Luff the telescopic boom with the auxiliary boom installed on the side of the telescopic boom to an angle range of 38° to 70° before supporting the crane!

- ▶ If an auxiliary boom is fitted to the side of the telescopic boom:
  Luff the telescopic boom up to an angle range of 38° to 70°.
- ▶ Press button **412**.

Result:
- The control light **409** lights up.
- The support pressure has been turned on.



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1.4.2 Supporting the crane with the control panel

Buttons **510**, **511**, **513** and **514** may be used to extend/retract the support cylinders. No more than a maximum of 2 support cylinders should be moved at the same time.

Button	Support cylinder
510	left front
511	left rear
513	right front
514	right rear

▶ Move the switch **512** downward.

Result:

– Extend support cylinder is preselected.

DANGER

Crane can topple over!

If the crane is not aligned horizontally, it may tip over and fatally injure personnel!

▶ Ensure that crane is horizontally aligned.

▶ The maximum permitted deviation from the horizontal position of the crane is 0.3° (0.5%).

▶ Press the corresponding button and extend all support cylinders just above the support pads.

▶ Precisely align the support pads under the support cylinders.

▶ Monitor the sight gauge **6** on the crane chassis.

▶ Lower all support cylinders into the support pads.

▶ Slowly lift and level out the crane until the desired support height is reached.

▶ Check the distance between the crawler center section and the transport vehicle (at least a hand's width).

▶ Remove the underlay timber beneath the beams.

DANGER

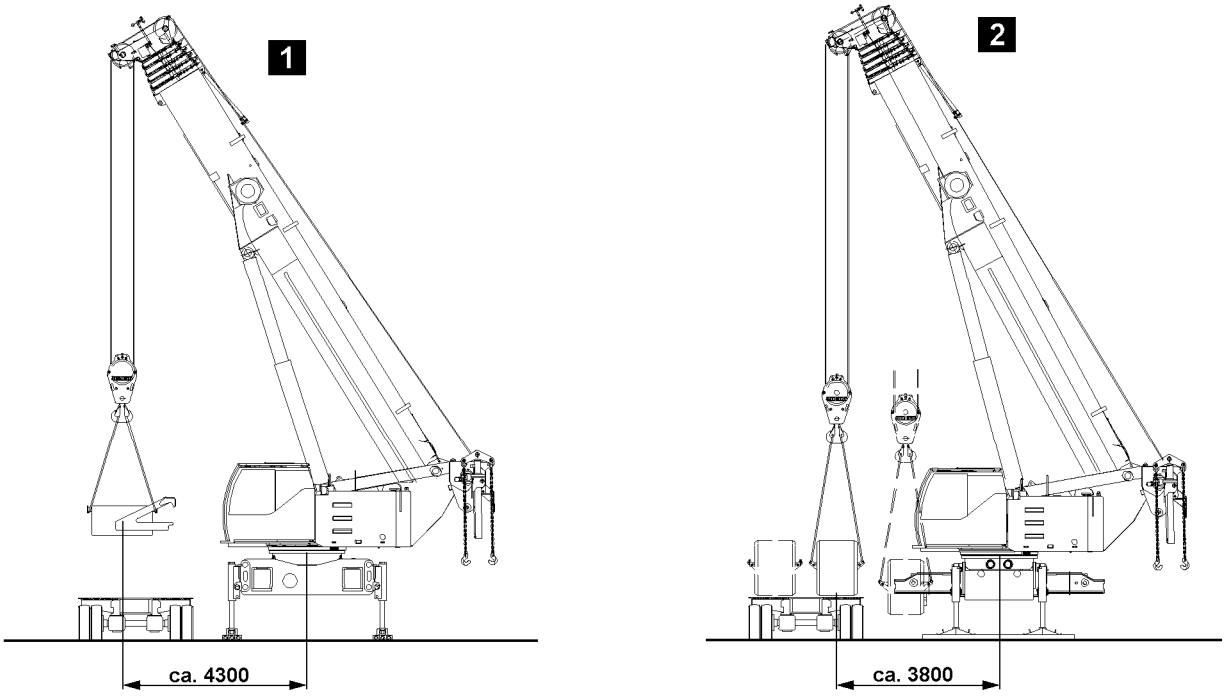
Crane can topple over!

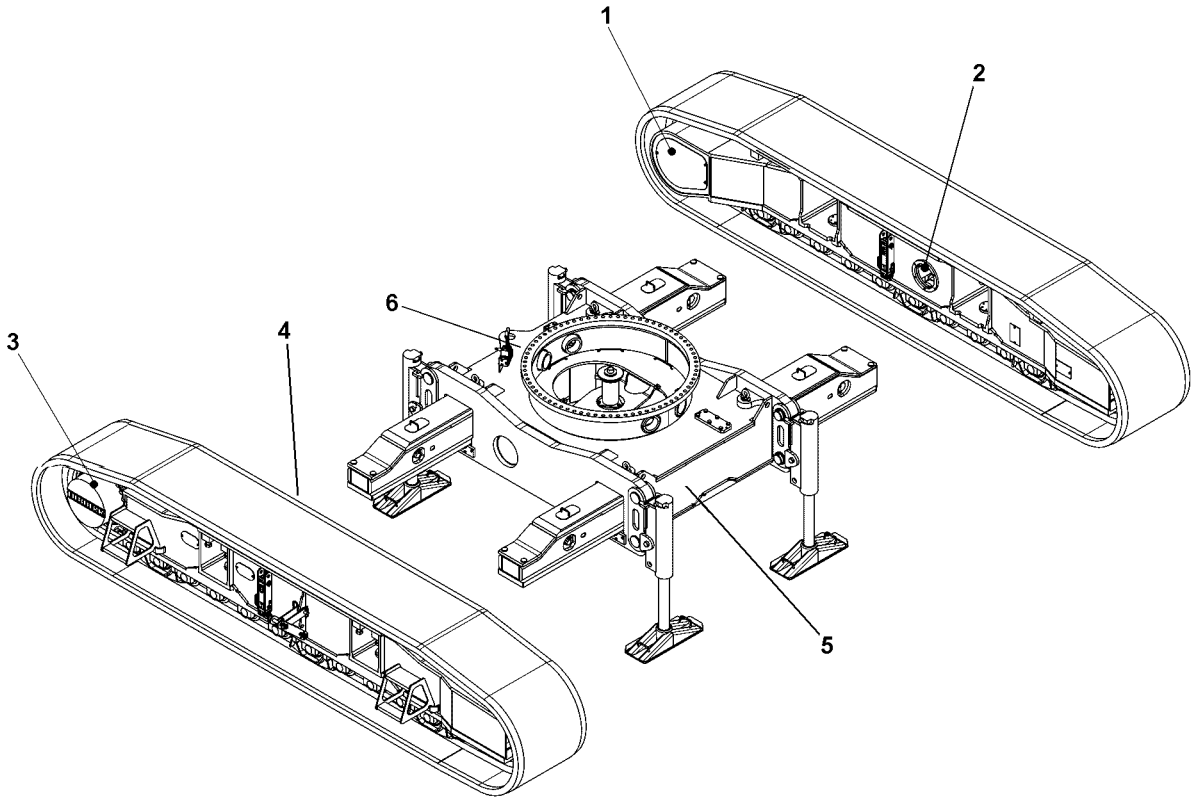
When driving out the transport vehicle, the support cylinder may be caught which could cause the crane to topple over!

▶ An assistant must guide the transport vehicle!

▶ The transport vehicle should not catch any of the support cylinders!

▶ Carefully drive the transport vehicle from under the supported crane.





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1.5 Fitting the central ballast, illustration 1

Ensure that the following prerequisites are met:
- The crane is supported and horizontally aligned.
- The LICCON overload protection has been set according to the load chart.
- The hook block weighs a maximum 0.5 t.
- The maximum permitted distance between the center of the slewing ring and the central ballast on the transport vehicle is 4300 mm.

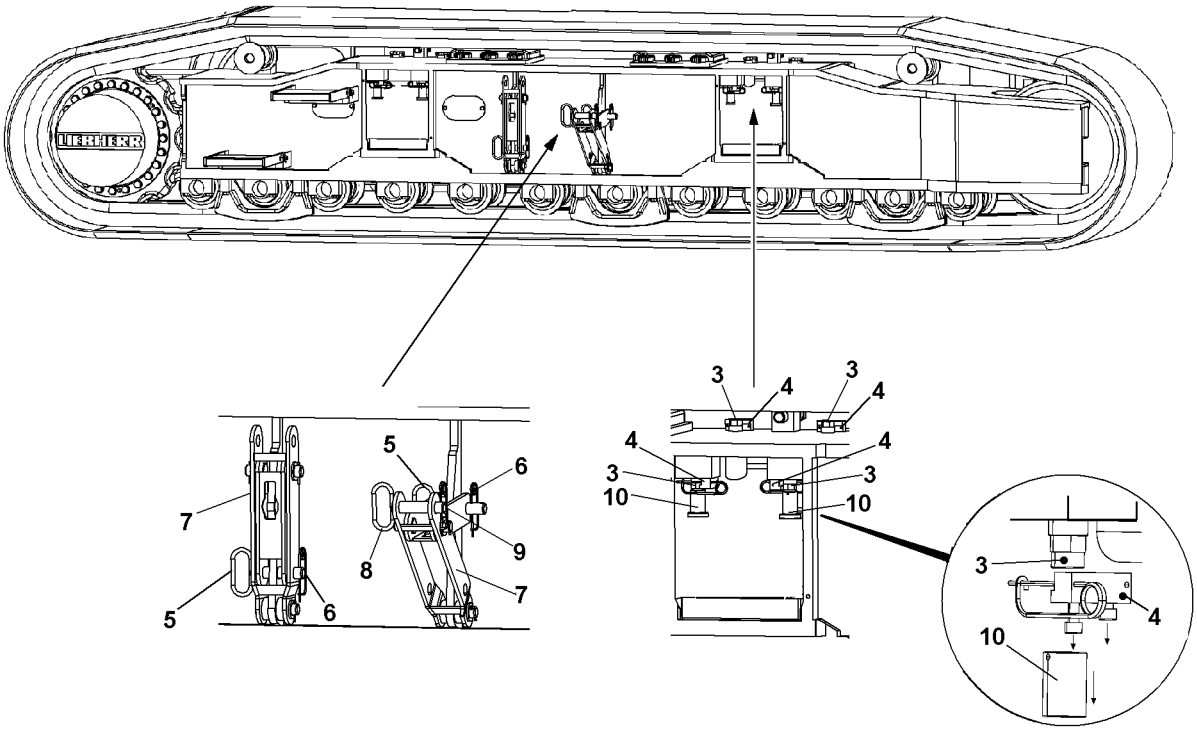
▶ Fit the central ballast to both sides, see detailed description in chapter 3.03.

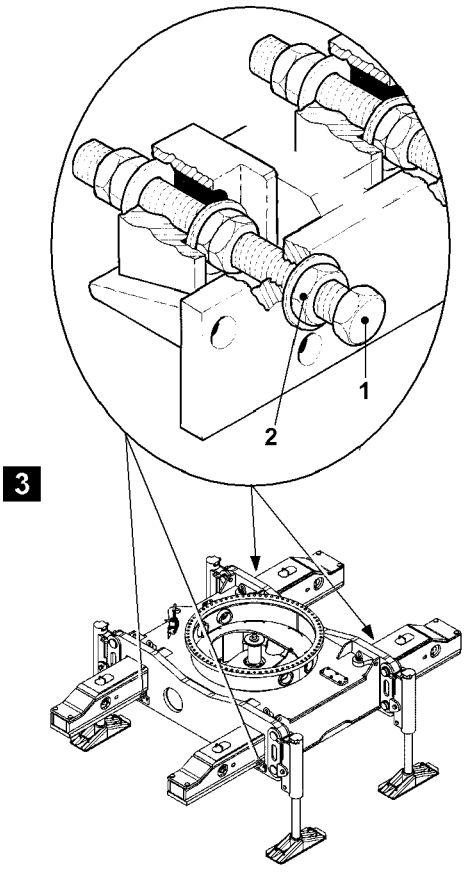
▶ Set the LICCON overload protection according to the load chart and the fitted central ballast.

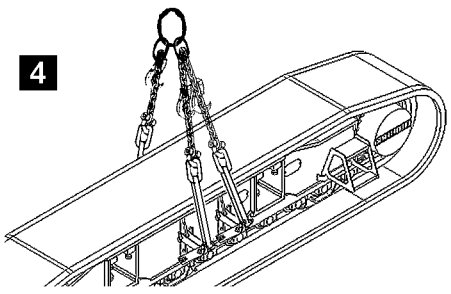
1.6 Fitting the crawler carrier, illustration 2

Observe the following when fitting the crawler carrier:
- The LICCON overload protection has been set according to the load chart.
- The travel drives must always be on the side of the sight gauge.
- The order in which the crawler carriers are fitted is arbitrary.
- Take into account the position of the crawler carriers on the transport vehicle.
- If possible, unload the crawler carriers from the transport vehicle directly in front of the beam ends, i.e. alongside the crane.
- Drive the crawler carriers as close as possible to the crane, maximum distance 3800 mm.

Position	Description
1	Travel drive left
2	Hydraulic connection left
3	Travel drive right
4	Hydraulic connection right
5	Control panel - Crane chassis
6	Sight gauge







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1.6.1 Preparing the crane, illustration 3

The lock nuts **2** and clamping screws **1** must be fully tightened.

- ▶ Check all the beam wedges on the crane.
- ▶ If a locking nut **2** or clamping screw **1** has not been fully tightened:
  Undo the locking nut **2** and fully tighten the clamping screw **1** and lock again with the locking nut **2**.
- ▶ Clean and grease all beams in contact with the sliding surfaces.

1.6.2 Preparing the first crawler carrier

Ensure that the following prerequisites are met:

- – The safety strips **4** have been removed.
- – The front clamping screws **3** have been screwed in.
- – The rear clamping screws **3** have been unscrewed.

- ▶ Clean the beam receptacles.

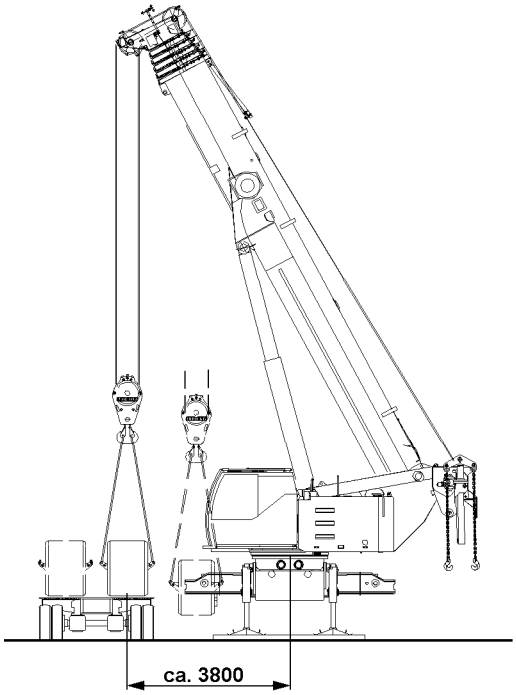
Three transportation retainers **7** are fitted to the crawler carriers. The transportation retainers **7** must be swung out and pinned.

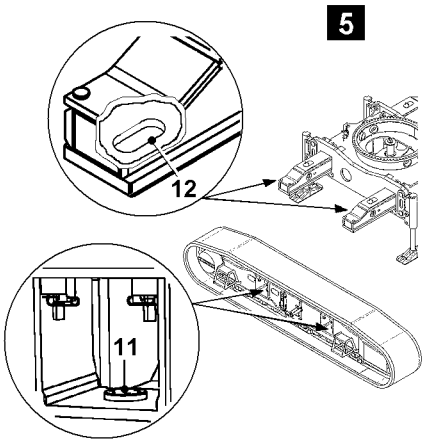
- ▶ Release and unpin the pin **5**.
- ▶ Swing out the transportation retainers **7** and pin to the upper bore on the crawler carrier using the pins **5**.
- ▶ Secure the pin **5** with spring retainer **6**.
- ▶ Release and unpin the pin **8**.

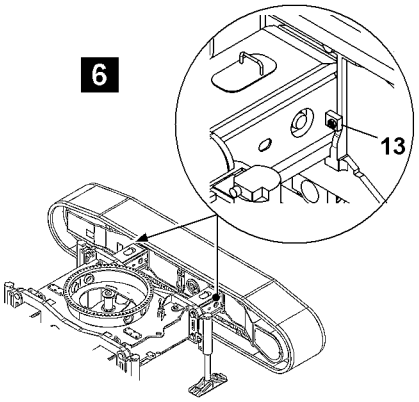
CAUTION
Damage to the crawler carrier!

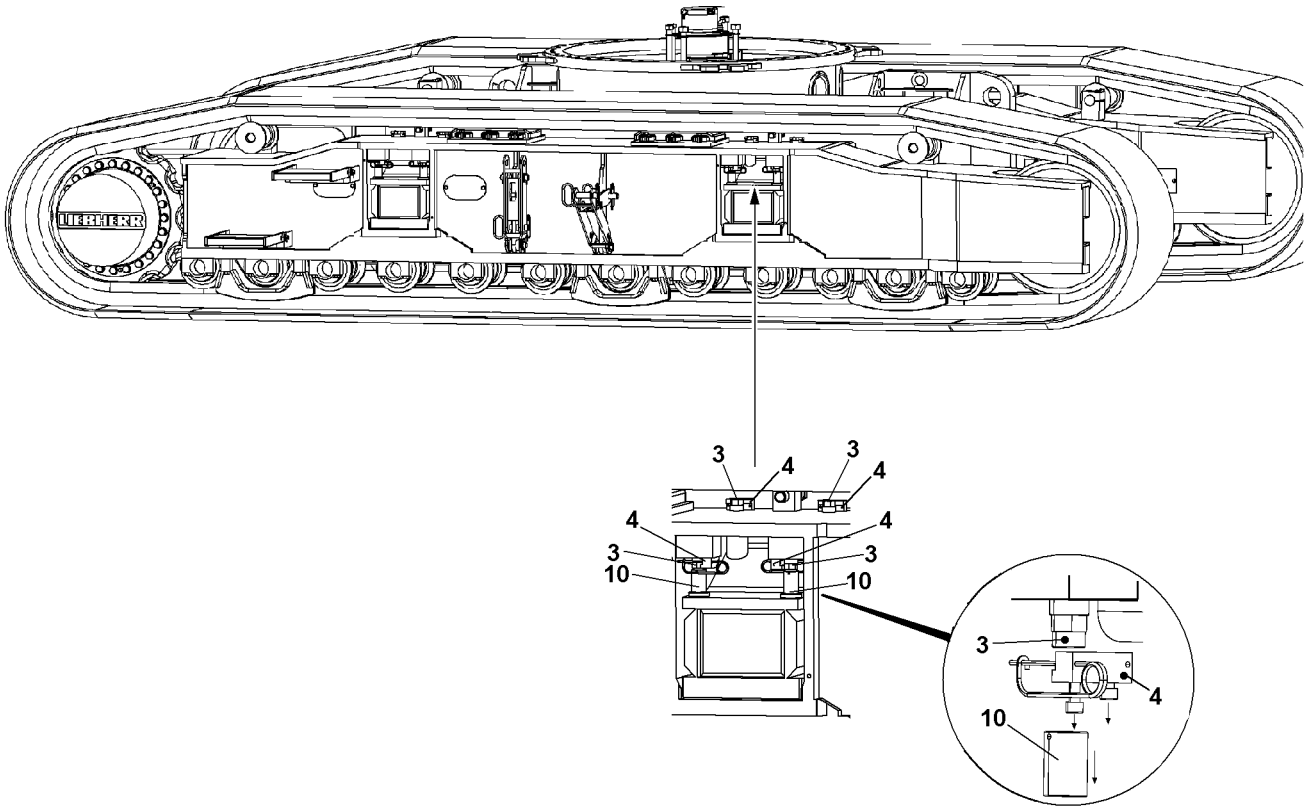
- ▶ Attach the assembly suspension in such a way that the crawler carriers are not damaged, see illustration **4**.

- ▶ Pin the assembly suspension using pins **8**.
- ▶ Secure the pin **8** with spring retainer **9**.
- ▶ Attach the crawler carrier to all 3 transportation retainers **7**, illustration 4.









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1.6.3 Fitting the first crawler carrier

Ensure that the following prerequisites are met:
- The crane is supported and horizontally aligned.
- The central ballast is installed on both sides.
- The LICCON overload protection has been set according to the load chart.
- The maximum permitted distance between the center of the slewing ring and the crawler carrier on the transport vehicle is 3800 mm.

The crawler carrier should only be fitted when using the **wide track**.

▶ Park the transport vehicle as close as possible to the crane.

DANGER

Persons may become crushed or trapped!

▶ Do not stand between the crawler carrier and the crawler center section when the crawler carrier is being fitted!

▶ Lift the crawler carrier from the transport vehicle and drive away the transport vehicle.

▶ Precisely align the beam receptacles with the beams on the crane.

CAUTION

Risk of damage to the beams and beam receptacles!

The beams and beam receptacles may become damaged if you try to physically correct a misaligned crawler carrier!

▶ Slowly slide on the crawler carrier step-by-step!

▶ If the crawler carrier begins to twist, slide it slightly backwards and re-align!

▶ Thread the wedges **11** in the beam guides into the wedge notches **12** on the underside of the beams, illustration 5.

▶ Alternately raise and lower the crawler carrier to carefully slide it onto the beam.

▶ The assistants should aid the crane operator by holding and positioning both ends of the crawler carrier.

▶ Slide the crawler carrier along the beam to the end-position **13**, illustration 6.

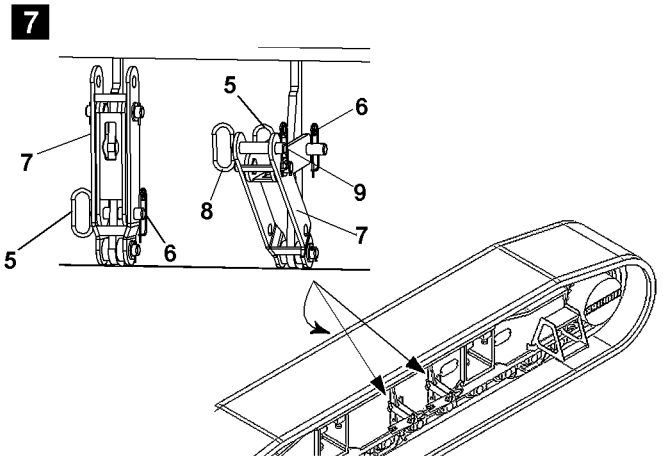
▶ Clamp the crawler carrier to both beams:

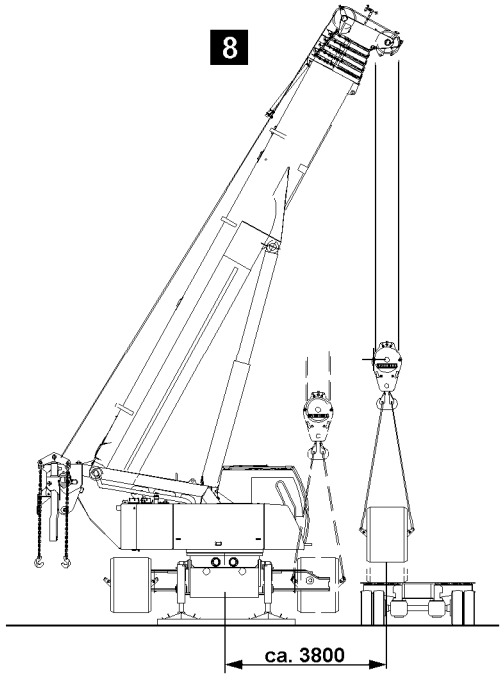
▶ Unscrew the front clamping screws **3** and clamp the sliding beams with spacers **10**.

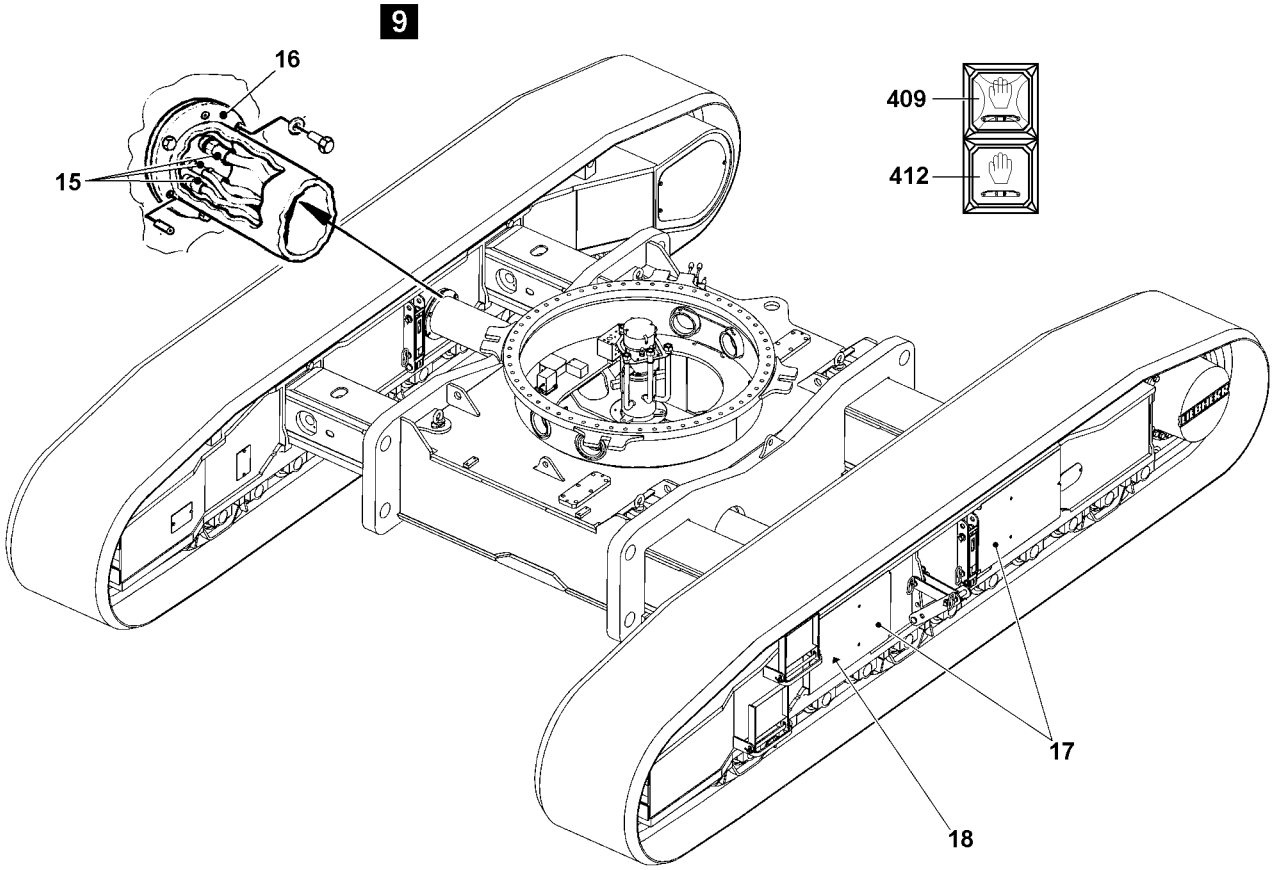
▶ Screw in the rear clamping screws **3** and clamp the beams.

▶ Secure the clamping screws **3** with safety strips **4**.

▶ Check that the beams are clamped at all four clamping points secured with safety strips **4**.







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1.6.4 Folding in the transportation retainers, illustration 7

Ensure that the following prerequisites are met:
– The first crawler carrier has been correctly assembled.

▶ Release and unpin the pins **8** and detach the assembly suspension.
▶ Pin the pins **8** again and secure with a spring retainer **9**.
▶ Release and unpin the pins **5** and swing in the transportation retainer **7**.
▶ Pin the transportation retainers **7** to the crawler carrier using pins **5** and secure with spring retainers **6**.

1.6.5 Fitting the second crawler carrier, illustration 8

The procedure for fitting the second crawler carrier is identical to that for the first.
▶ Fit the second crawler carrier.
▶ Fully retract the support cylinders.
▶ Store the support pads in the holders.

1.7 Establishing the hydraulic connections, illustration 9

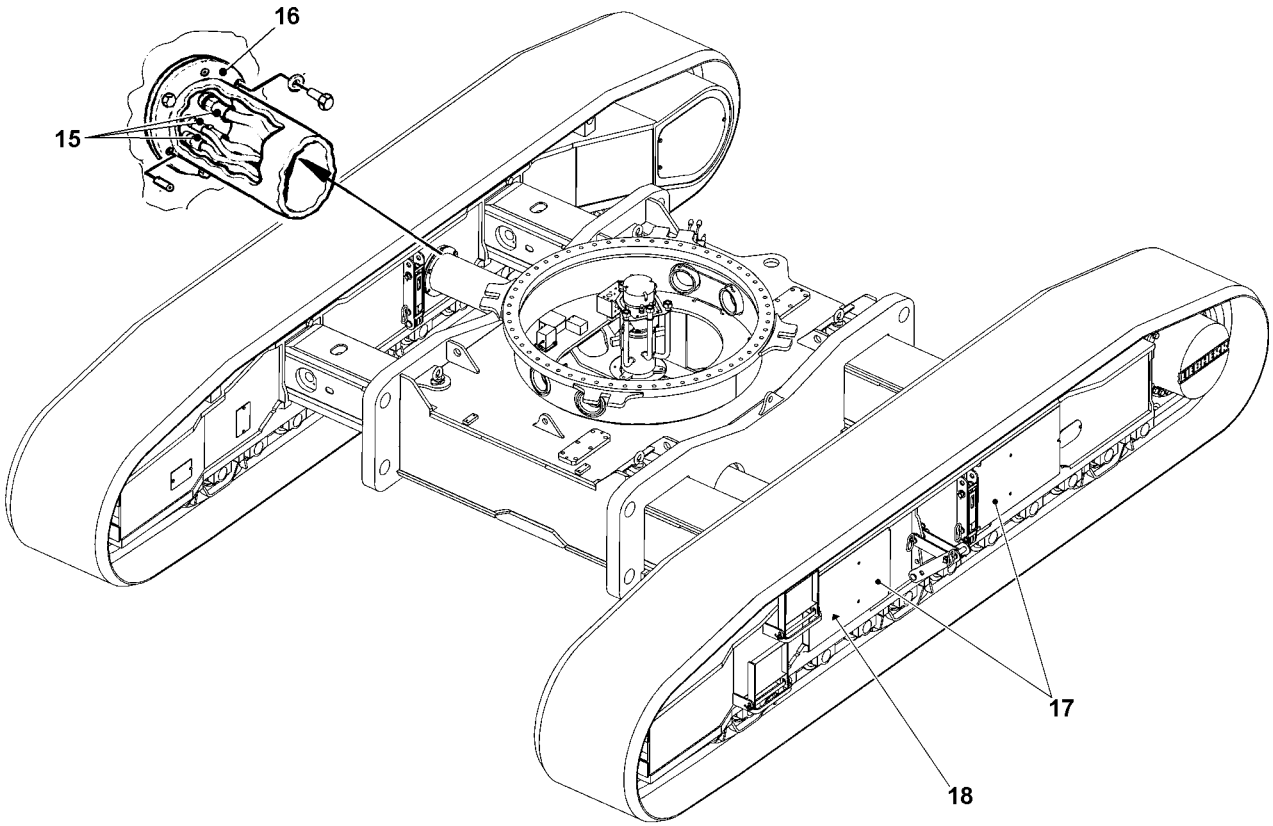
Ensure that the following prerequisites are met:
– Both crawler carriers are properly installed.

DANGER
Risk of accident when connecting the hydraulic connections!
Any movement of the crane when fitting the hydraulic connections may cause fatal injury to the installation personnel.
▶ It is prohibited to operate the pedals on the vehicle when fitting the hydraulic connections!
▶ It is prohibited to turn the crane superstructure when fitting the hydraulic connections!

The engine must be turned off before connecting and disconnecting any hydraulic lines.
All matching hydraulic connections are labelled.
▶ Establish the hydraulic connections **15** for the crawler drives.
▶ Screw the protective pipes **16** to the crawler carriers.
▶ Establish the hydraulic connections **18** to the track adjustment cylinder.
▶ Screw on the protective cover **17**.
▶ Press button **412**.

Result:
– The control light **409** goes out.
– The support pressure has been turned off.

▶ Try and test all vehicle movements.



B199139

2 Disassembling the crane

Ensure that the following prerequisites are met:
– The location is level, smooth and provides sufficient load-carrying capacity.
– Authorised and trained personnel are available to carry out the assembly/disassembly work.
– The telescopic boom is fully telescoped in.
– The crawlers are assembled on wide track.
– The counterweight on the turntable is disassembled.

DANGER
Crane can topple over!
If a counterweight is installed on the turntable when “supporting a crane with a load”, then the crane can topple over and fatally injure personnel!
▶ When “supporting the crane with a load”, no counterweight may be installed on the turntable!

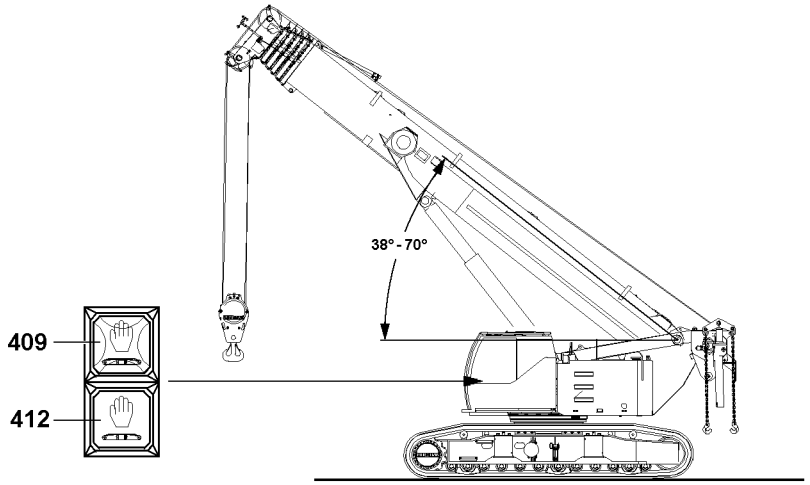
Note
▶ The crawlers can only be assembled or disassembled on wide track.

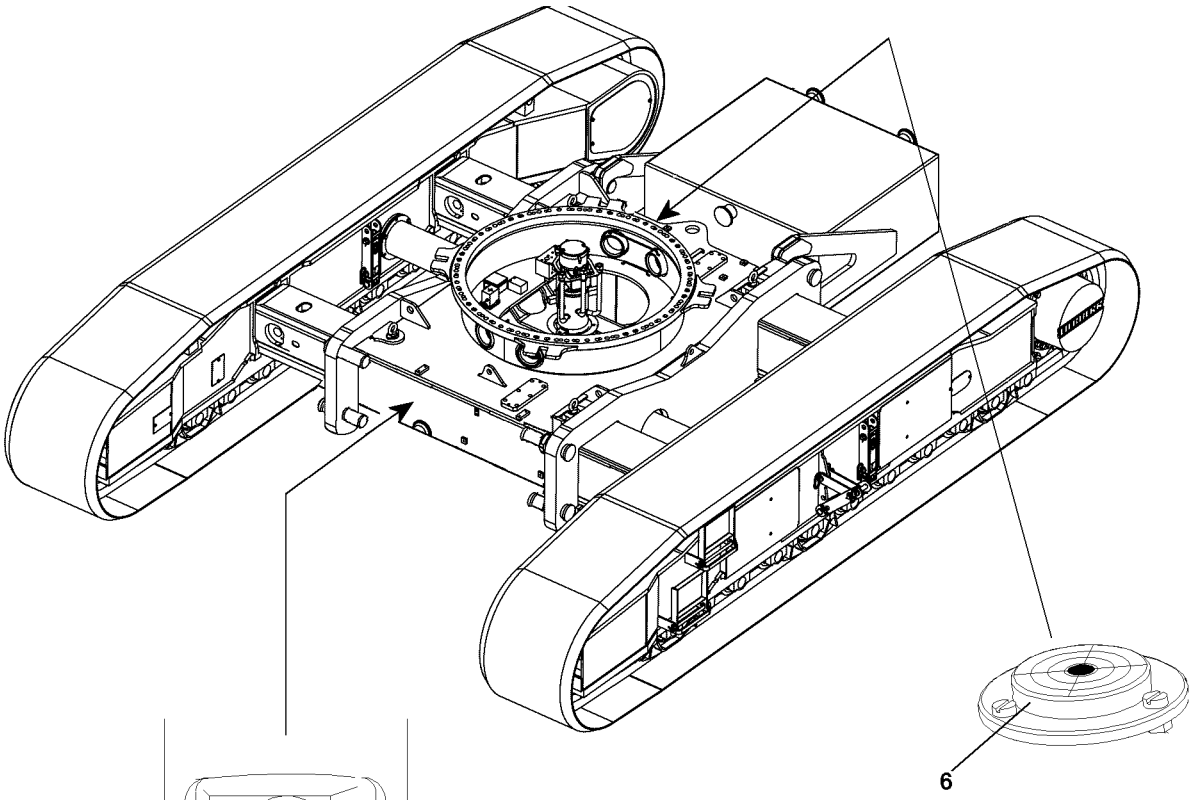
2.1 Disconnecting the hydraulic connections

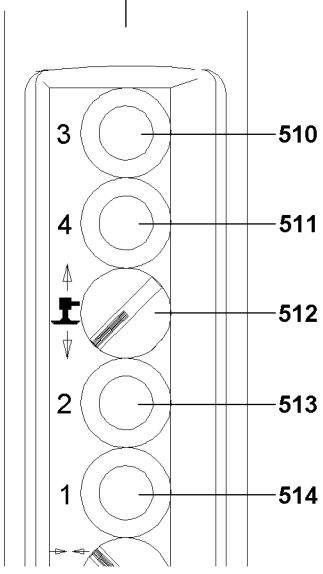
DANGER
Risk of accident when connecting the hydraulic connections!
Any movement of the crane when fitting the hydraulic connections may cause fatal injury to the installation personnel.
▶ It is prohibited to operate the pedals on the vehicle when fitting the hydraulic connections!
▶ It is prohibited to turn the crane superstructure when fitting the hydraulic connections!

▶ Remove the protective cover **17**.

The engine must be turned off before connecting and disconnecting any hydraulic lines.
▶ Remove the hydraulic connections **18** to the track adjustment cylinder.
▶ Hydraulic connections **18** must be fitted with caps to protect from contamination.
▶ Remove the protective pipe **16** from the crawler carriers.
▶ Disconnect the hydraulic connections **15** for the crawler drives.
▶ Hydraulic connections **15** must be fitted with caps to protect from contamination.







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2.2 Supporting the crane

Ensure that the following prerequisites are met:
- The engine is running.
- The support cylinders are pinned in assembly position support base 2340 mm x 3300 mm.
- The LICCON overload protection has been set according to the load chart.
- The crane superstructure is mechanically locked with the crane chassis.

DANGER
Risk of tipping when the auxiliary boom is in its transport position at the side of the telescopic boom!
If the telescopic boom, with the auxiliary boom installed on the side of the telescopic boom is not luffed up to an angle range of 38° to 70° before supporting, then the crane can topple forward and fatally injure personnel!
▶ Luff the telescopic boom with the auxiliary boom installed on the side of the telescopic boom to an angle range of 38° to 70° before supporting the crane!

▶ If an auxiliary boom is fitted to the side of the telescopic boom:
Luff the telescopic boom up to an angle range of 38° to 70°.
▶ Press button **412**.

Result:
- The control light **409** lights up.
- The support pressure has been turned on.

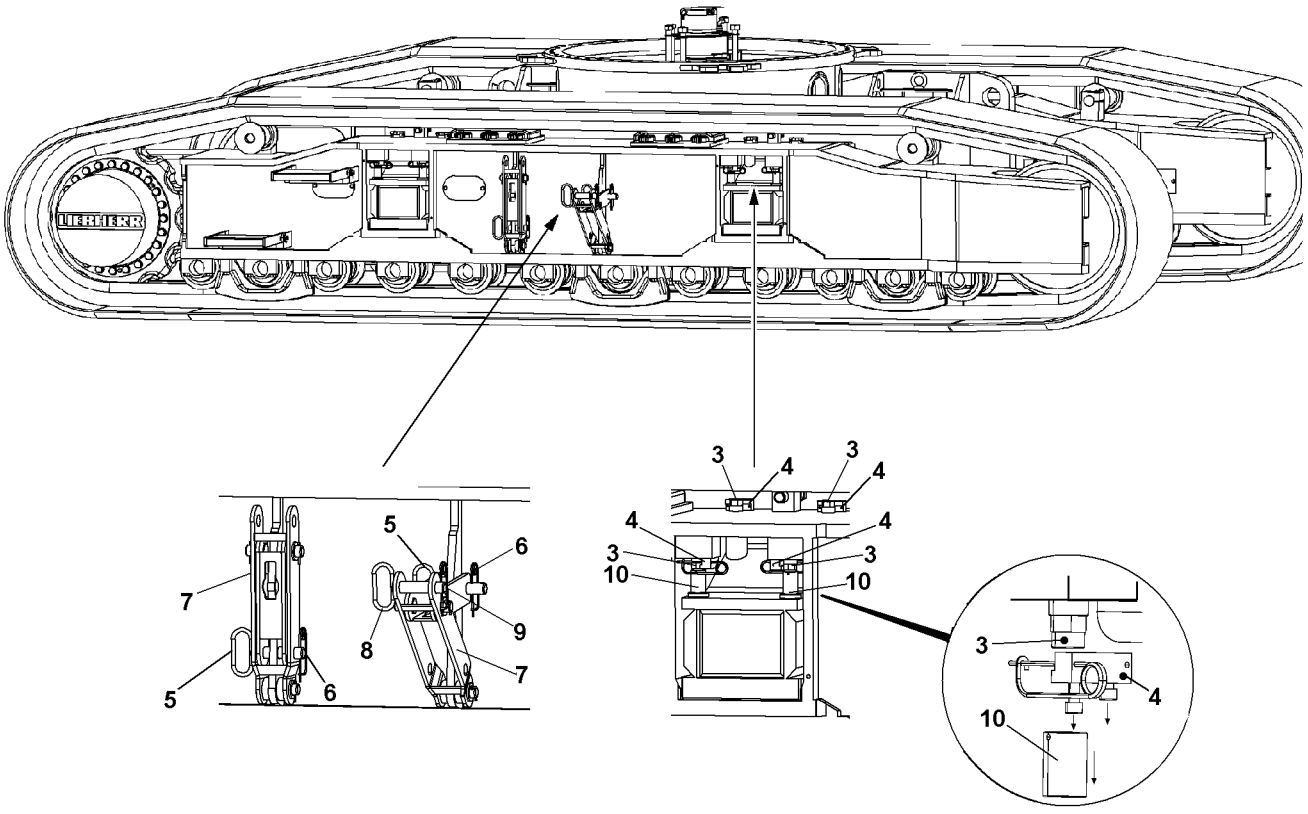
Button	Support cylinder
510	left front
511	left rear
513	right front
514	right rear

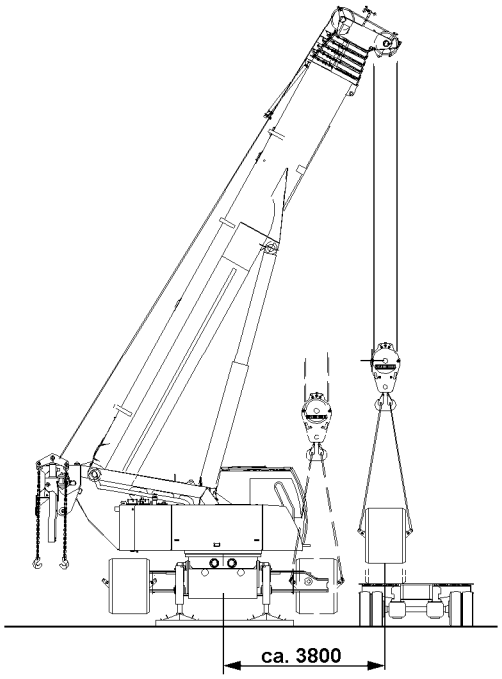
▶ Move the switch **512** downward.

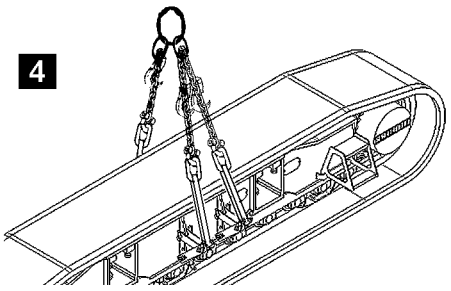
Result:
- Extend support cylinder is preselected.

DANGER
Crane can topple over!
If the crane is not aligned horizontally, it may tip over and fatally injure personnel!
▶ Ensure that crane is horizontally aligned.
▶ The maximum permitted deviation from the horizontal position of the crane is 0.3° (0.5%).

▶ Press the corresponding button and extend all support cylinders just above the support pads.
▶ Precisely align the support pads under the support cylinders.
▶ Monitor the sight gauge **6** on the crane chassis.
▶ Lower all support cylinders into the support pads.
▶ Slowly lift and level out the crane until the desired support height is reached.







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2.3 Disassembling the crawler carriers

Ensure that the following prerequisites are met:
- The crane is supported and horizontally aligned.
- The central ballast is installed on both sides.
- The LICCON overload protection has been set according to the load chart.
- The hydraulic connections is disassembled.
- The maximum permitted distance between the center of the slewing ring and the transport vehicle is 3800 mm.

2.3.1 Disassembling the first crawler carrier

Three transportation retainers **7** are fitted to the crawler carriers. The transportation retainers **7** must be swung out and pinned.

▶ Release and unpin the pin **5**.

▶ Swing out the transportation retainers **7** and pin to the upper bore on the crawler carrier using the pins **5**.

▶ Secure the pin **5** with spring retainer **6**.

▶ Release and unpin the pin **8**.

CAUTION
Damage to the crawler carrier!

▶ Attach the assembly suspension in such a way that the crawler carriers are not damaged, see illustration **4**!

▶ Pin the assembly suspension using pins **8**.

▶ Attach the crawler carrier to all 3 transportation retainers **7** and lightly tension the assembly suspension.

▶ Remove the safety strips **4**.

▶ Screw in the front clamping screws **3** and store the spacers **10** in a safe place.

▶ Unscrew the rear clamping screws **3**.

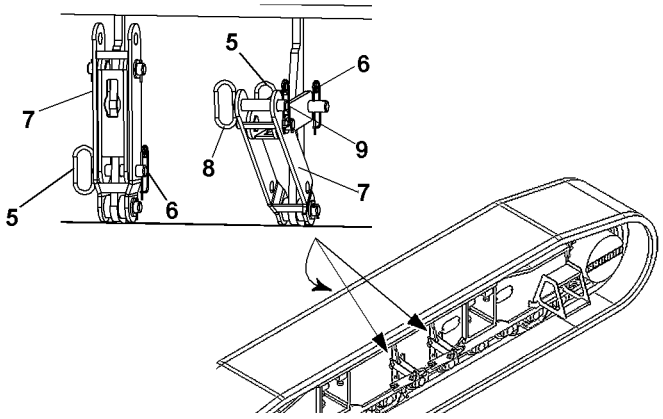
CAUTION
Risk of damage to the beams and beam receptacles!
The beams and beam receptacles may become damaged if you try to physically correct a misaligned crawler carrier!

▶ Slowly remove the crawler carrier step-by-step!

▶ Lower the crawler carried approximately 50 mm.

▶ Alternately raise and lower the crawler carrier to carefully slide it off the beam.

1



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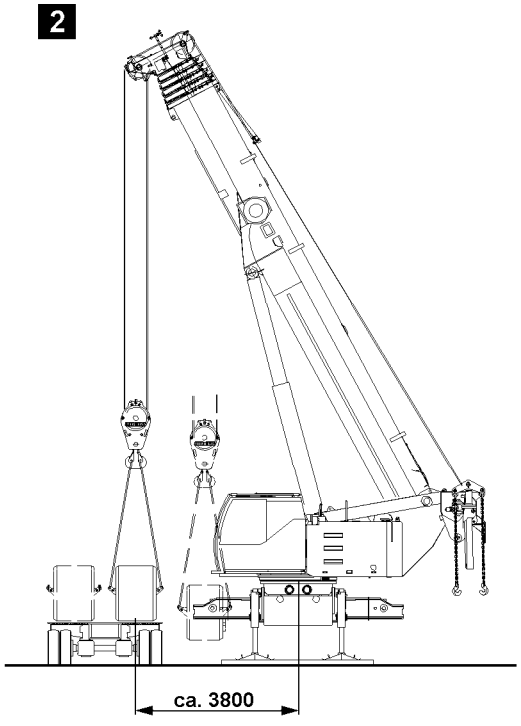

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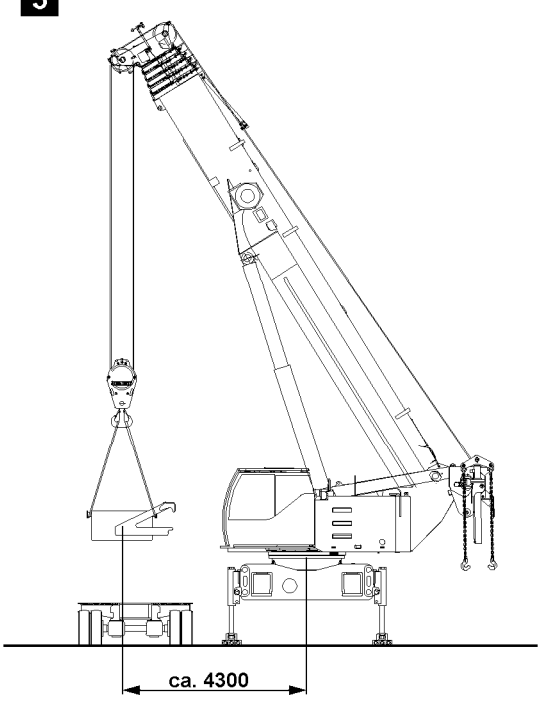

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DANGER
Persons may become crushed or trapped!
- ▶ Do not stand between the crawler carrier and the transport vehicle when the crawler carrier is being removed!

- ▶ The assistants should aid the crane operator by holding and positioning both ends of the crawler carrier.
- ▶ Load the crawler carrier onto the transport vehicle.

2.3.2 Folding in the transportation retainers, illustration 1

- ▶ Release and unpin the pins **8** and detach the assembly suspension.
- ▶ Pin the pins **8** again and secure with a spring retainer **9**.
- ▶ Release and unpin the pins **5** and swing in the transportation retainer **7**.
- ▶ Pin the transportation retainers **7** to the crawler carrier using pins **5** and secure with spring retainers **6**.

2.3.3 Disassembling the second crawler carrier, illustration 2

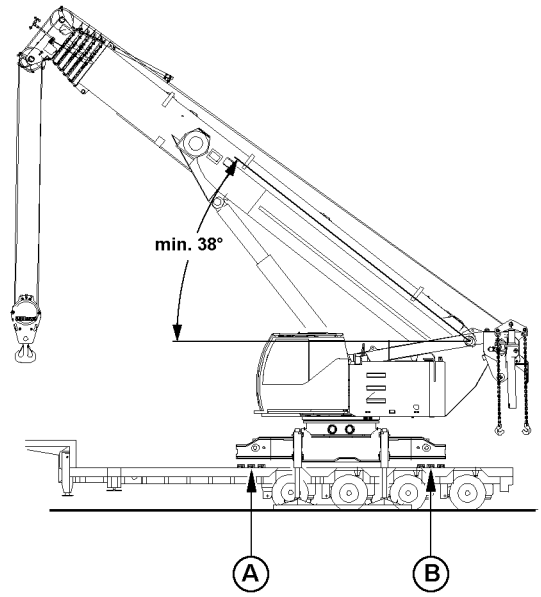
The procedure for disassembling the second crawler carrier is identical to that for the first.
- ▶ Disassemble the second crawler carrier.

2.4 Disassembling the central ballast, illustration 3

Ensure that the following prerequisites are met:
- The crawler carriers on both sides have been disassembled.
- The LICCON overload protection has been set according to the load chart.
- The hook block weighs a maximum 0.5 t.
- The maximum permitted distance between the center of the slewing ring and the central ballast on the transport vehicle is 4300 mm.

- ▶ Remove the central ballast on both sides, see detailed description in chapter 3.03.

4



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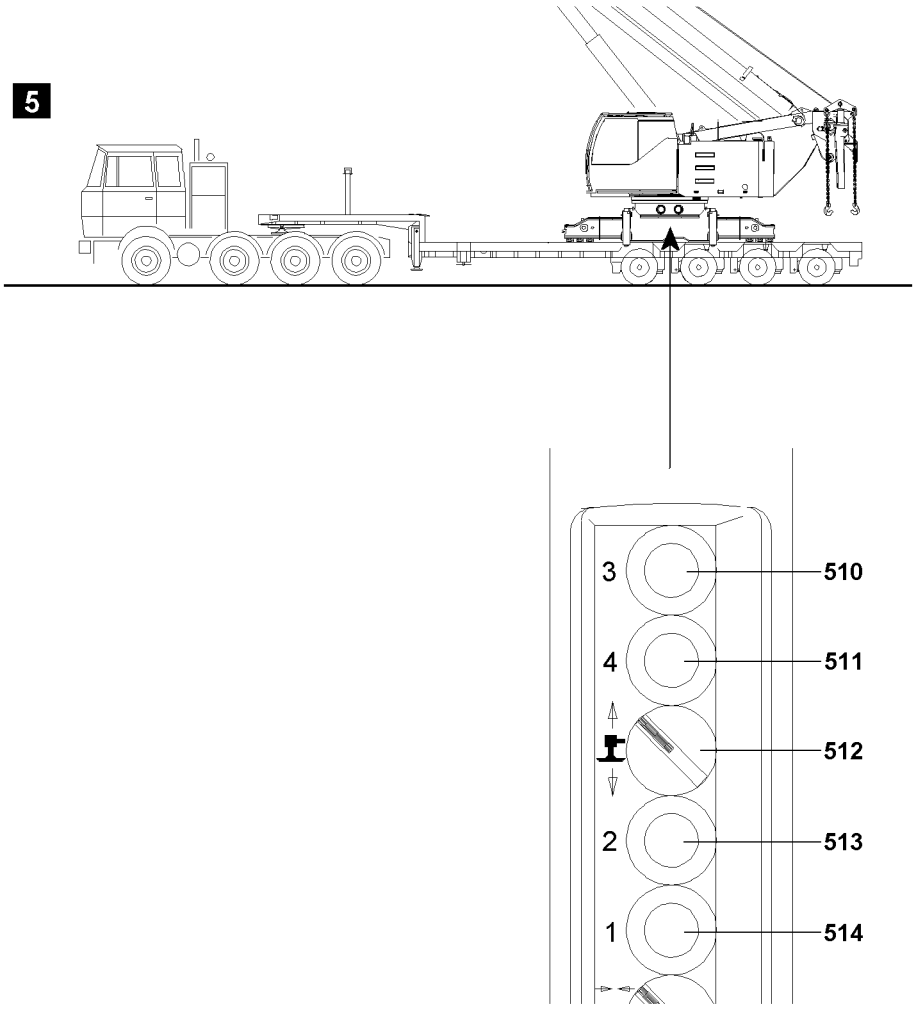

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2.5 Loading the crane onto the transport vehicle, illustrations 4 and 5

Ensure that the following prerequisites are met:
- The crawler carriers and central ballast on both sides have been disassembled.
- The crane is supported at a sufficient height to enable the transport vehicle to drive under the crane.
- The LICCON overload protection has been set according to the load chart.
- The transport vehicle is equipped with underlay timbers for supporting the beams.

Note

▶ The beams must be supported at both ends to ensure the stability of the crane. See illustration 4 position **A** and **B**.

DANGER

Crane can topple over!

When driving in the transport vehicle, the support cylinder may be caught and cause the crane to topple over!

▶ An assistant must guide the transport vehicle!

▶ The transport vehicle should not catch any of the support cylinders!

▶ Do not turn the crane superstructure when the crane is resting on the transport vehicle!

▶ Carefully drive the transport vehicle under the supported crane.

Buttons **510**, **511**, **513** and **514** may be used to extend/retract the support cylinders. No more than a maximum of 2 support cylinders should be moved at the same time.

Button	Support cylinder
510	left front
511	left rear
513	right front
514	right rear

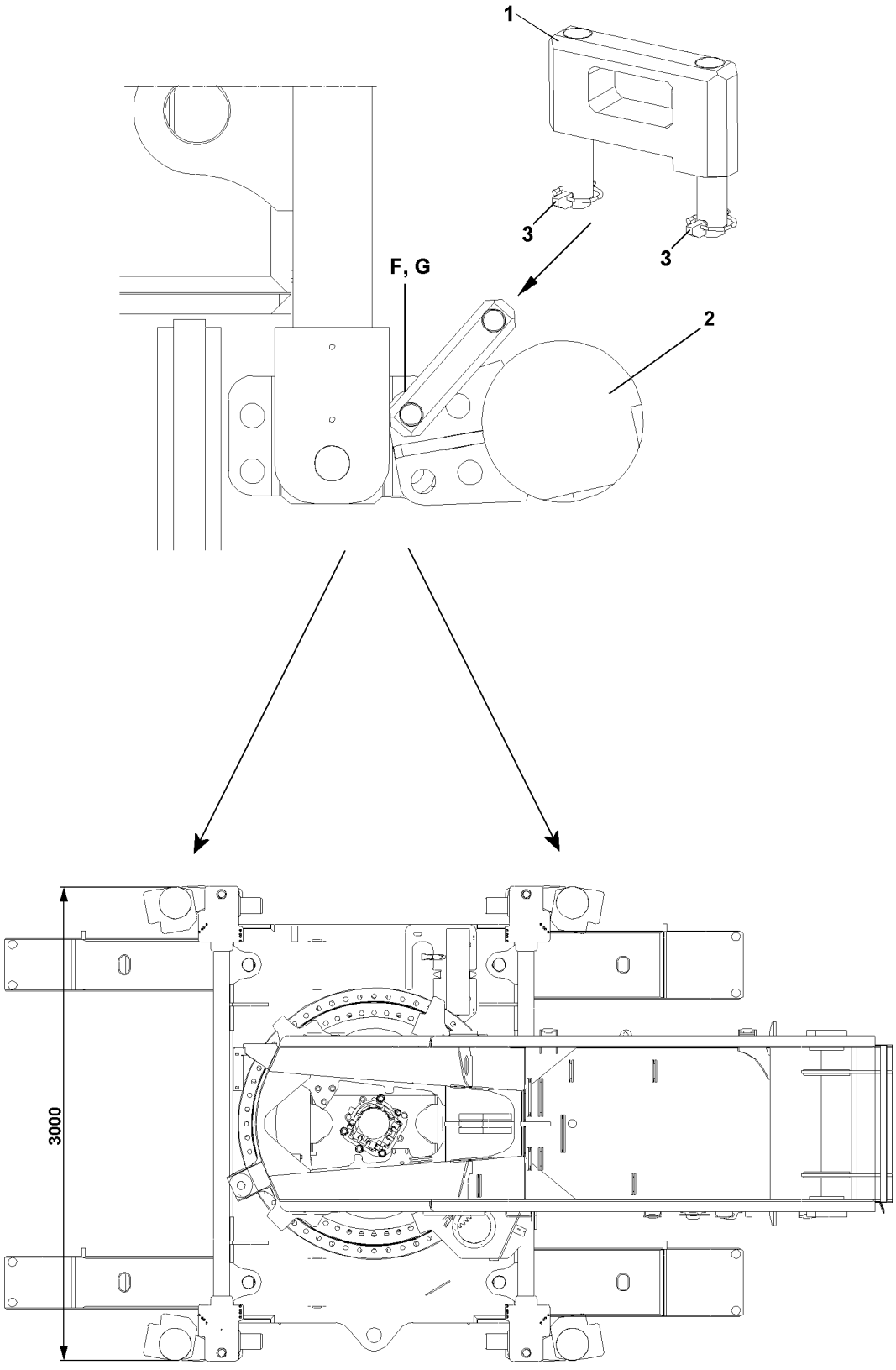
▶ Move the switch **512** upward.

Result:

- Support cylinder retraction is preselected.

▶ Press the corresponding button and retract all supports until the crane is lying on the transport vehicle.

▶ Place the support pads in the holders.



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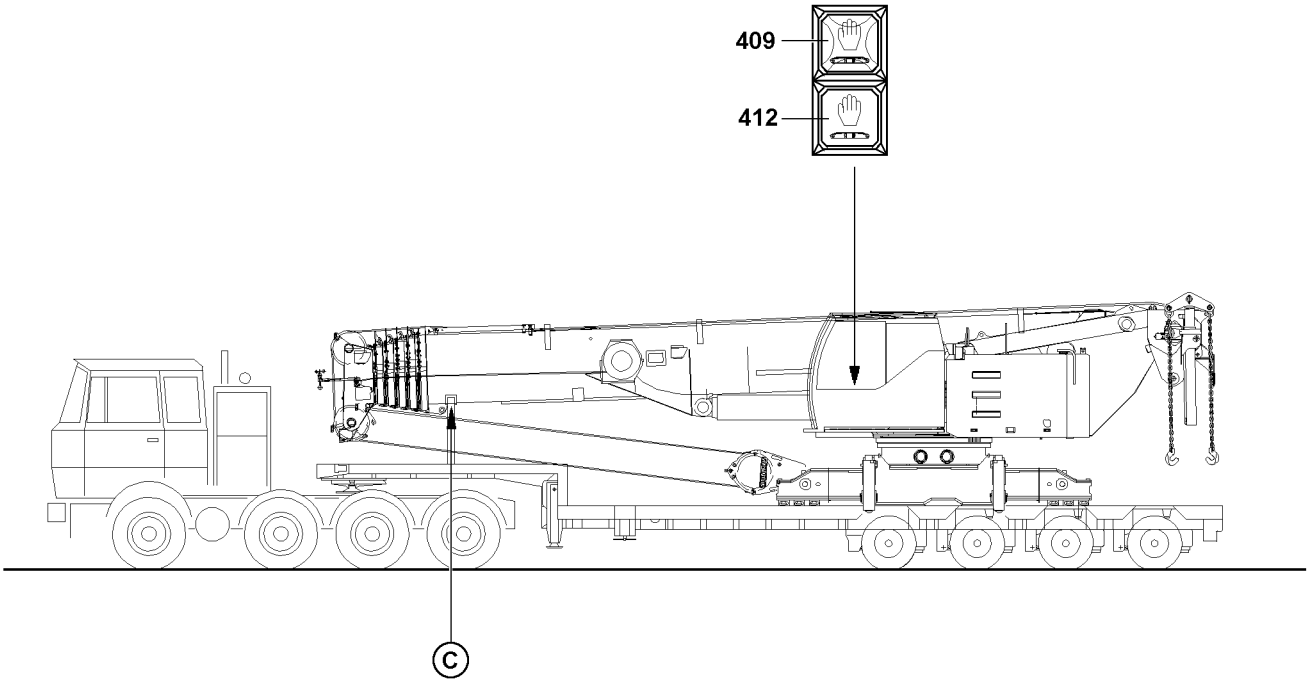
2.6 Pinning the support cylinders in transport position

Ensure that the following prerequisites are met:
- The support cylinders have been fully retracted.
- The crane has been set down on the transport vehicle.
- The beams are underlaid at both ends using timber pieces.

▶ Release and unpin the straight retaining bracket **1**.
▶ Swing the support cylinders **2** in until the bore **F** and the bore **G** align.
▶ Unpin the straight retaining bracket **3** on one side at hole **F** and hole **G** and secure with linch pins **3**.

Pin the remaining support cylinders **2** correspondingly.
▶ Pin all four support cylinders **2** in their transport position.

Note
▶ The crane has a transport width of 3000 mm when the support cylinders **2** are swung in.



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2.7 Properly secure the crane

Ensure that the following prerequisites are met:
- The hatch consoles are pinned in their transport position.
- The LICCON overload protection has been set according to the load chart.
- The crane has been set down on the transport vehicle.
- The beams are underlaid at both ends using timber pieces.

▶ Lock the crane superstructure to the crane chassis.

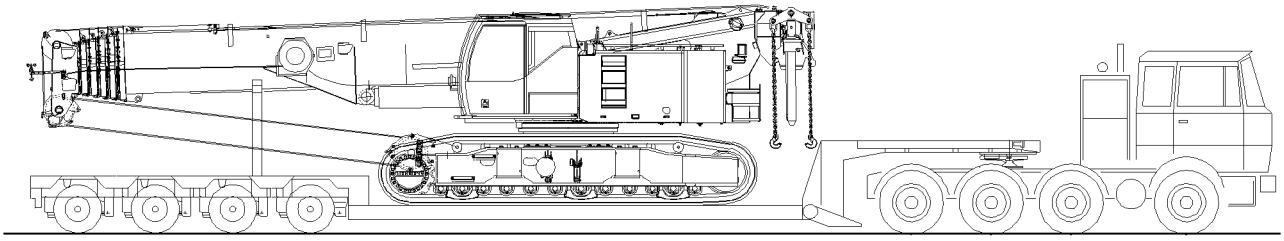
Note
▶ The crane must be secured sufficiently well to survive a heavy braking manoeuvre.

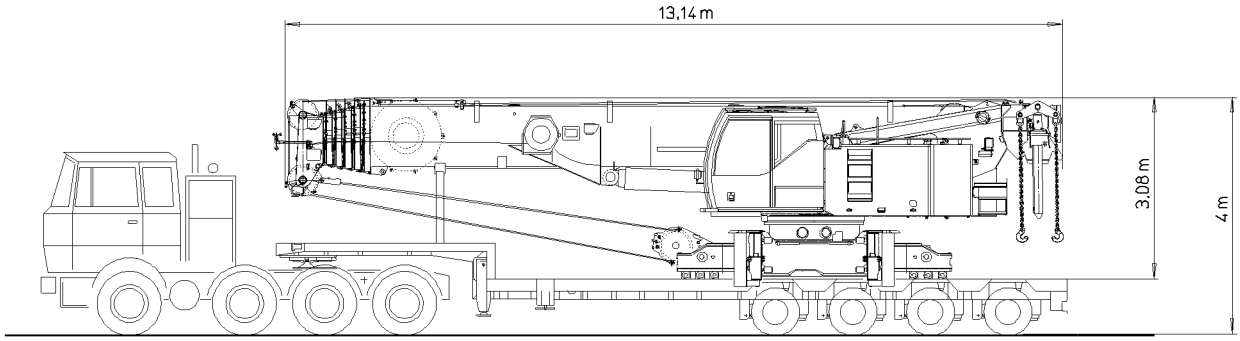
▶ Properly secure the crane on the transport vehicle.

Note
▶ The telescopic boom must be supported on the transport vehicle to ensure the stability of the crane. See position **C**.

▶ Luff down the telescopic boom and place it on the support base.
▶ Fasten the hook block to the crawler center section and lightly tension the hoist rope.
▶ Secure the ballast assembly chains to avoid uncontrolled swinging.
▶ Press button **412**.

Result:
- The control light **409** goes out.
- The support pressure has been turned off.





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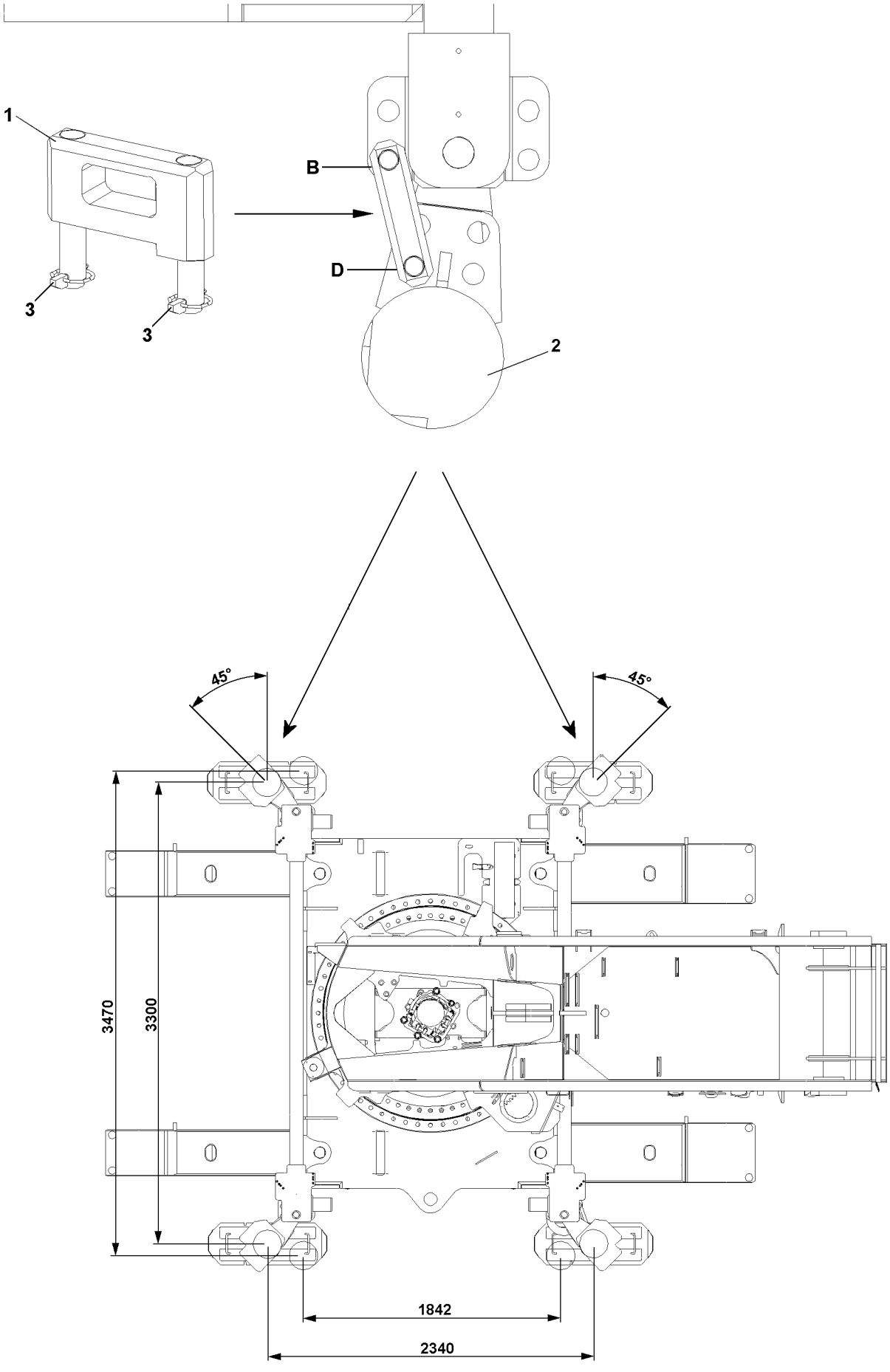
3 Transporting the crane

Ensure that the following prerequisites are met:
– The crane is properly secured.
– The telescopic boom has been set down on the support.
– The hook block is secured on the crawler center section.
– The ballast assembly chains have been secured to prevent them from swinging back and forth.

3.1 Transporting the crane with the flatbed trailer

WARNING
The counterweight can topple over!
If the counterweight remains installed to the turntable while transporting the crane, the counterweight take up can fail and the counterweight can fall down!
Personnel can be killed!
Significant property damages can result!
▶ Transporting the crane with an installed counterweight is forbidden!
▶ Only transport crane with disassembled counterweight!



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4 Unloading / loading the crane with extra wide transport vehicle

4.1 Unloading the crane with extra wide transport vehicle

Ensure that the following prerequisites are met:
- The location is level, smooth and provides sufficient load-carrying capacity.
- Authorised and trained personnel are available to carry out the assembly/disassembly work.
- The telescopic boom is fully telescoped in and placed on its receptacle.
- The crane superstructure is locked with the crane chassis.
- The crane lies on the transport vehicle.
- The straight retaining brackets **1** are released and unpinned.
- The central ballast is disassembled.
- The counterweight on the turntable is disassembled.

DANGER
Crane can topple over!
If a counterweight is installed on the turntable when “supporting a crane with a load”, then the crane can topple over and fatally injure personnel!
▶ When “supporting the crane with a load”, no counterweight may be installed on the turntable!

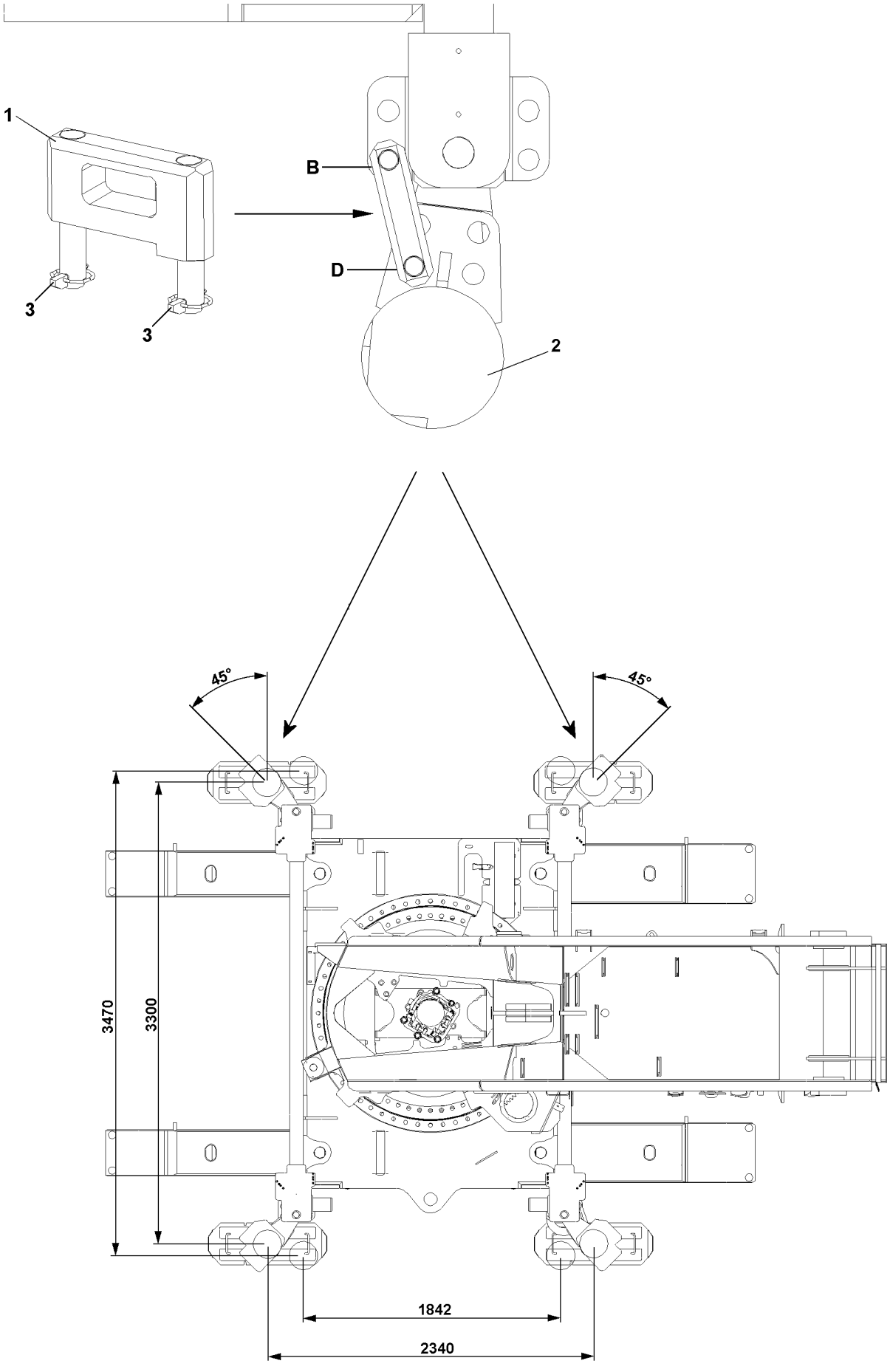
DANGER
Crane can topple over!
If the crane superstructure is turned with a support base of 1842 mm x 3470 mm, the crane can topple over and fatally injure personnel!
▶ Turning the crane superstructure at a support base of 1842 mm x 3470 mm is prohibited!
▶ The crane may only be supported at a support base of 1842 mm x 3470 mm for unloading / loading of extra wide transport vehicles!
▶ Assembly operation is only permitted at a support base of 2340 mm x 3300 mm!

▶ Swing out the support cylinder **2**.
▶ Pin the straight retaining brackets **1** at hole **B** and hole **D** and secure with linch pins **3**.

Pin the remaining support cylinders **2** correspondingly.
▶ Pin all four support cylinders **2** to support base 1842 mm x 3470 mm.

DANGER
Risk of tipping when the auxiliary boom is in its transport position at the side of the telescopic boom!
If the telescopic boom, with the auxiliary boom installed on the side of the telescopic boom is not luffed up to an angle range of 38° to 60° before supporting, then the crane can topple over and fatally injure personnel!
▶ Luff the telescopic boom with the auxiliary boom installed on the side of the telescopic boom to an angle range of 38° to 60° before supporting the crane!

▶ Support the crane until the extra wide transport vehicle can be driven off underneath the crane.
▶ Carefully drive the extra wide transport vehicle off underneath the supported crane.



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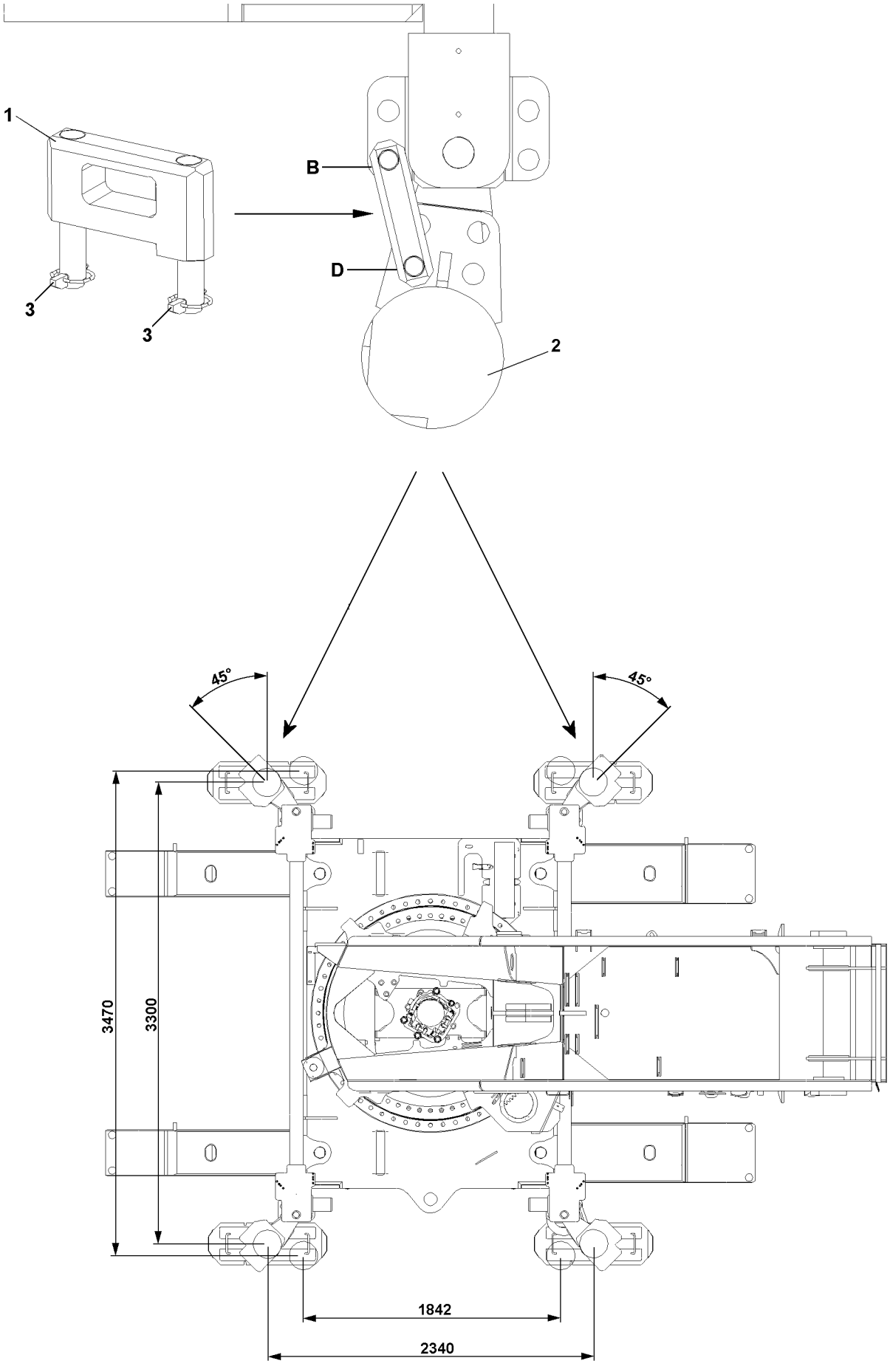
DANGER
Crane can topple over!
If the crane is not properly and safely supported, the crane can topple over and fatally injure personnel!
- ▶ Support the crane properly and safely to prevent it from tipping over.

- ▶ Support the crane properly and safely to prevent it from tipping over.
- ▶ Retract the support cylinders and carefully lower the crane onto the support.
- ▶ Swing and pin all four support cylinders in assembly position, see section “Pinning the support cylinder in assembly position”.
- ▶ Support the crane in assembly position support base 2340 mm x 3300 mm.
- ▶ Assemble the crane as described in the chapter.



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4.2 Loading the crane with extra wide transport vehicle

Ensure that the following prerequisites are met:

- The location is level, smooth and provides sufficient load-carrying capacity.
- Authorised and trained personnel are available to carry out the assembly/disassembly work.
- The crane superstructure is locked with the crane chassis.
- The central ballast is disassembled.
- The counterweight on the turntable is disassembled.
- Both crawler carriers are removed.
- Wooden beams for the support of the sliding beams are placed on the extra wide transport vehicle.
- The crane is supported at a support base of 2340 mm x 3300 mm.

DANGER

Crane can topple over!

If the crane superstructure is turned with a support base of 1842 mm x 3470 mm, the crane can topple over and fatally injure personnel!

- ▶ Turning the crane superstructure at a support base of 1842 mm x 3470 mm is prohibited!
- ▶ The crane may only be supported at a support base of 1842 mm x 3470 mm for unloading and loading of extra wide transport vehicles!
- ▶ Assembly operation is only permitted at a support base of 2340 mm x 3300 mm!

DANGER

Crane can topple over!

If the crane is not properly and safely supported, the crane can topple over and fatally injure personnel!

- ▶ Support the crane properly and safely to prevent it from tipping over.

- ▶ Support the crane properly and safely to prevent it from tipping over.
- ▶ Retract the support cylinders and carefully lower the crane onto the support.
- ▶ Release and unpin the straight retaining bracket **1**.
- ▶ Swing out the support cylinder **2**.
- ▶ Pin the straight retaining brackets **1** at hole **B** and hole **D** and secure with linch pins **3**.

Pin the remaining support cylinders **2** correspondingly.

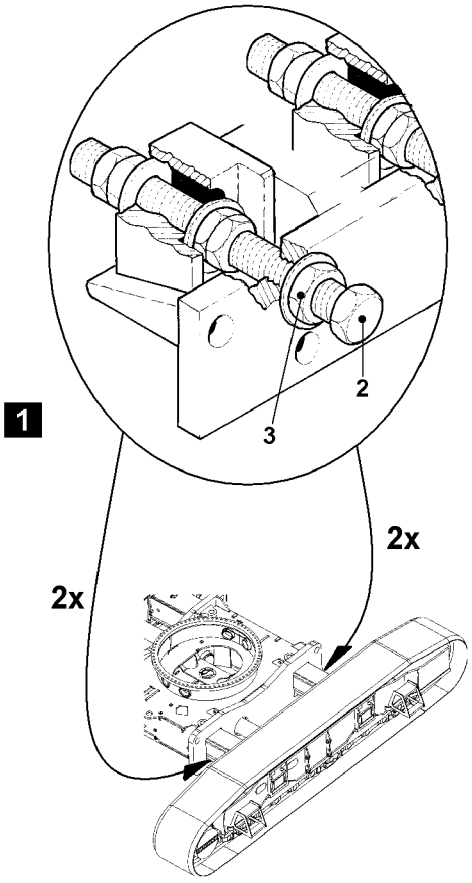
DANGER

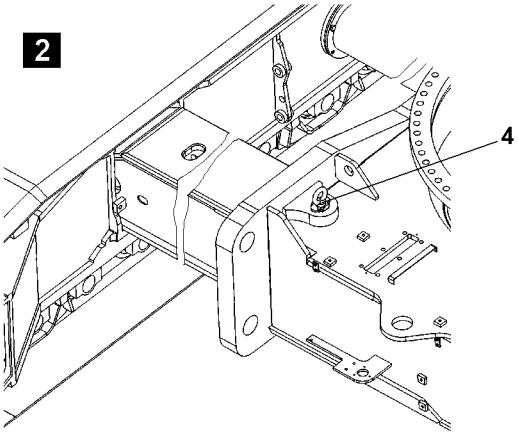
Risk of tipping when the auxiliary boom is in its transport position at the side of the telescopic boom!

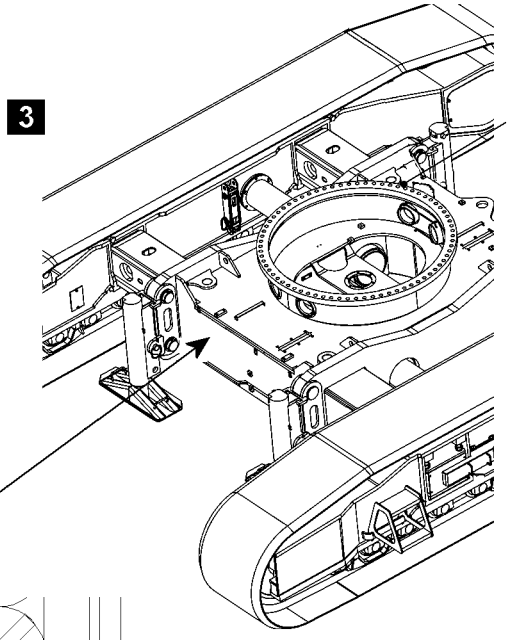
If the telescopic boom, with the auxiliary boom installed on the side of the telescopic boom is not luffed up to an angle range of 38° to 60° before supporting, then the crane can topple over and fatally injure personnel!

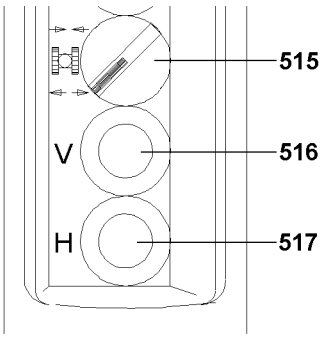
- ▶ Luff the telescopic boom with the auxiliary boom installed on the side of the telescopic boom to an angle range of 38° to 60° before supporting the crane!

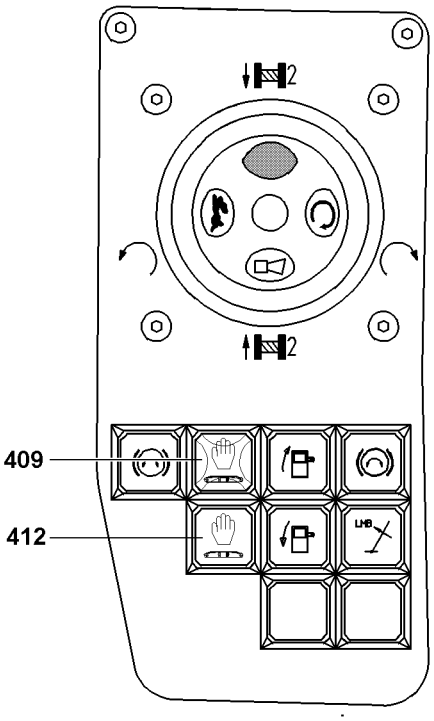
- ▶ Support all four support cylinders **2** to support base 1842 mm x 3470 mm.
- ▶ Carefully drive the extra wide transport vehicle under the supported crane.
- ▶ Retract the support cylinders and place the crane on the extra wide transport vehicle.
- ▶ Disassemble the crane as described in the chapter.

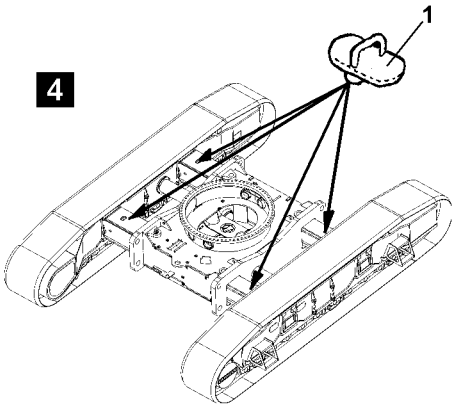












B102925

5 Adjusting the track

5.1 General

DANGER
Crane can topple over!
The reduced or retracted track reduces the stability of the crawler crane. Due to operational errors during crane operation or driving, the crawler crane can topple over and fatally injure personnel!
- ▶ Crane operation and “driving the crawler with load” is permitted for reduced or retracted track, if **extra load charts** are programmed for this case!
- ▶ Crane operation and “driving the crawler with load” is strictly prohibited for reduced or retracted track, if **no extra load charts** are programmed for this case!

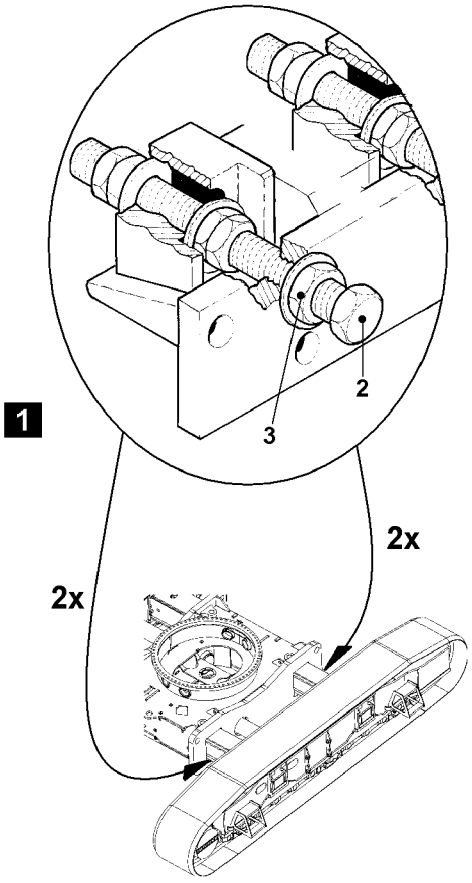
Ensure that the following prerequisites are met:
- – The crane is horizontally aligned and standing on level and smooth ground.
  The crawler carriers should not sink into the ground, or get caught by obstacles such as boulder edges when changing the track.
- – All loads and lifting equipment have been set down.
- – The engine is running.
- – The counterweight on the turntable is disassembled.
- – The crane superstructure is pointing either “backwards” or “forwards” and is mechanically locked to the chassis.
- – Two assistants are ready to help.

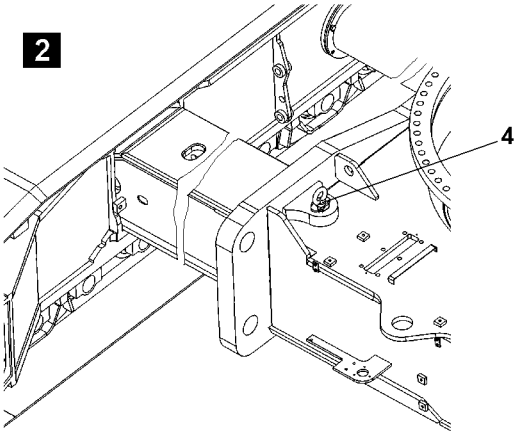
Note
- ▶ It is not possible to remove the crawler carrier, counterweight and central ballast in narrow track operation.
- ▶ The crawler carrier should always be completely converted before starting on the other crawler carrier!

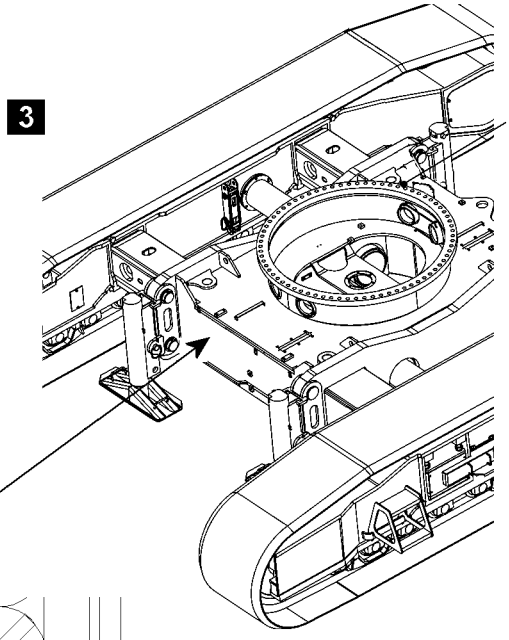
5.2 Tasks of the assistants

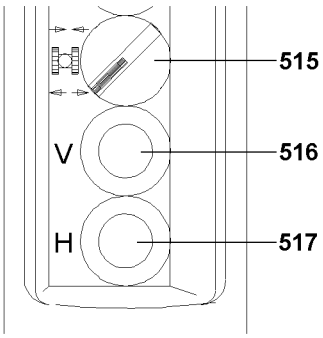
Assistant at the front of the chassis:
- ▶ Loosens the front pins **4** on the beams, illustration 2.
- ▶ Monitors the front track adjustment and maintains direct eye contact with the machine operator.
- ▶ Relays instructions from the machine operator to the assistant at the rear and vice-versa.
- ▶ Once the track has been adjusted, the front assistant must pin the front beam.

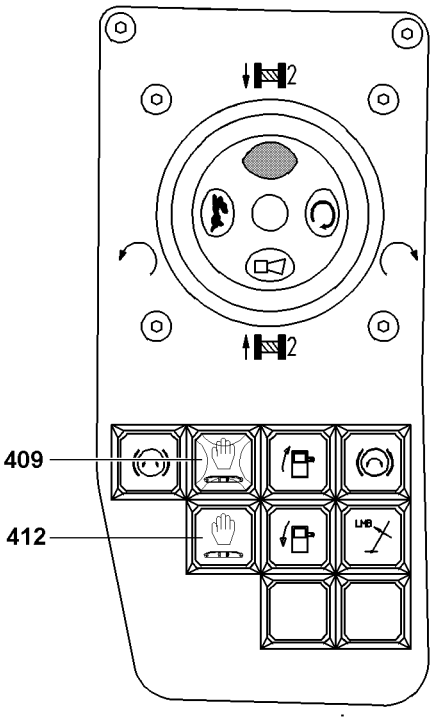
Assistant at the rear of the chassis:
- ▶ Loosens the rear pins **4** on the beams, illustration 2.
- ▶ Monitors the rear track adjustment and maintains direct eye contact with the front assistant.
- ▶ Gives/takes instructions from the front assistant.
- ▶ Once the track has been adjusted, the rear assistant must pin the rear beam.

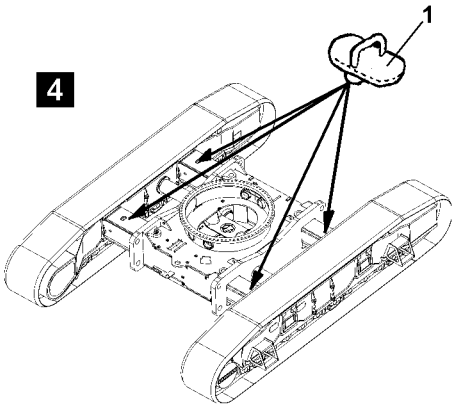












B102925

5.3 Extending the track width

DANGER
Danger of crushing!
▶ When adjusting the track, take particular care to ensure that no one is in the vicinity of the danger zone around the crawler carrier.

CAUTION
Damage to the machine!
▶ Always drive out the left crawler carrier first!

Note
▶ Left and right are defined as viewed from the rear. The crawler carrier drive is located at the rear.

▶ Remove both beam wedges at the **left front** and **left rear** of the crawler center section:

This is made easier if both wedge screws are loosened by the same amount (not too much).
▶ First loosen the nut **3** and then turn the screw **2** clockwise to remove the wedge, illustration 1.
▶ Pull the front and rear pins **4** on the left crawler center section, illustration 2.
▶ Press button **412**.
Result:
– The control light **409** lights up.
– The crawler track adjustment has been turned on.

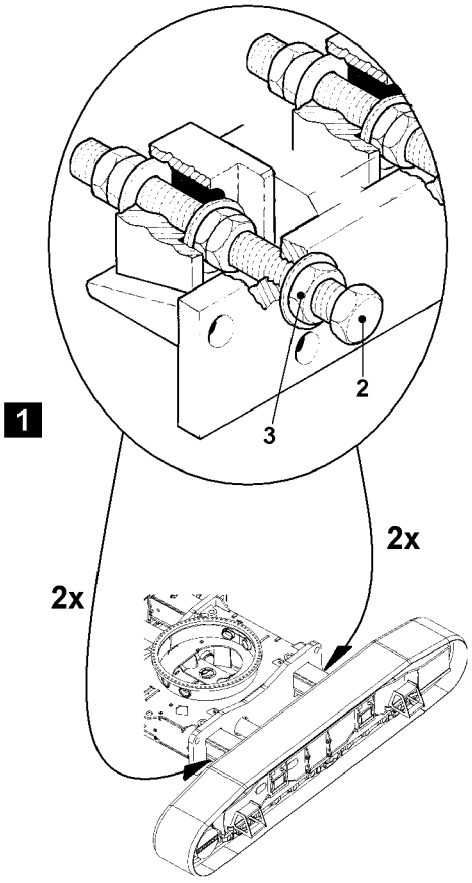
▶ Move the switch **515** downward.
Result:
– Track width enlarging is preselected.

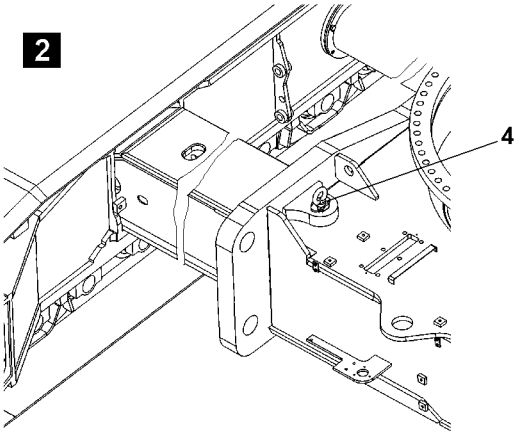
▶ Press the button **516** for “track adjustment front” and the button **517** for “track adjustment rear” and push the crawler carriers out to the outer pin points of the sliding beams, illustration 3.
▶ Insert the front and rear pins **4** into the left crawler center section, illustration 2.

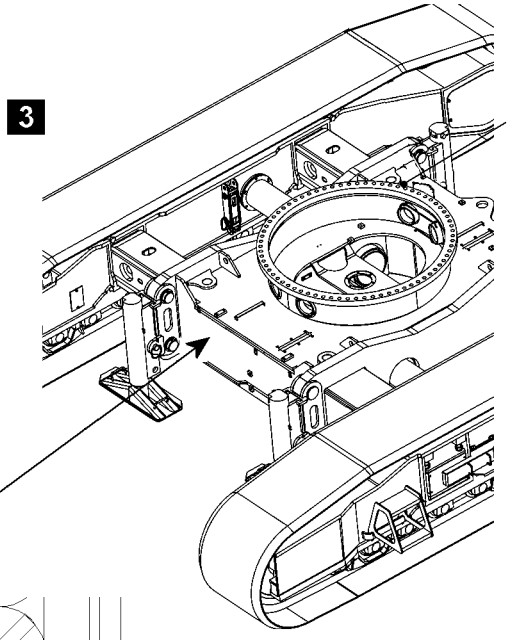
The right crawler carrier can be slid in identically as the left crawler carrier.

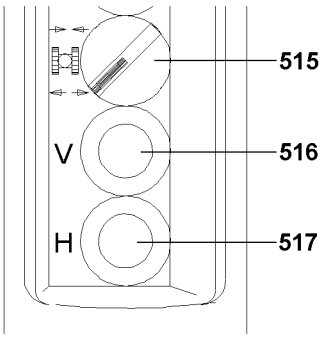
CAUTION
Hydraulic hoses may break off!
The right crawler carrier does not have a mechanical end-stop.
▶ Do not slide out the right crawler carrier beyond the specified distance (wide track)!

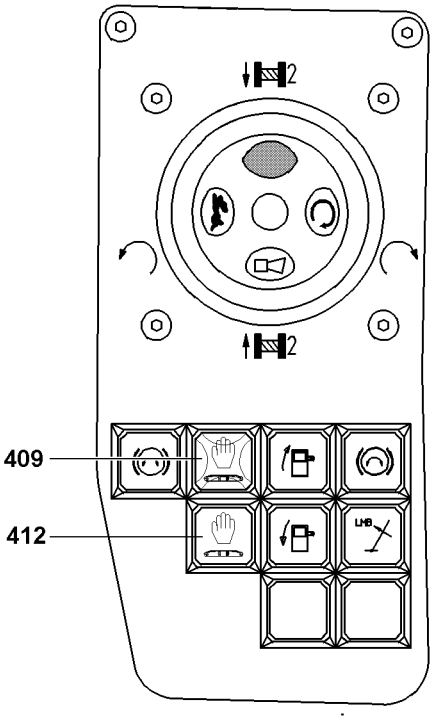
▶ Slide out the right crawler carrier and pin using pin **4**, illustration 2.

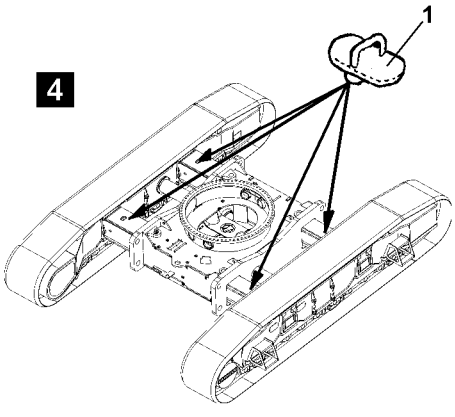












B102925

▶ Wedge the beams on the left and right crawler carriers:

The maximum tightening torque of the screw **2** is 120 Nm.

▶ When wedging each of the beams:
Unscrew the screw **2** (counter clockwise) to wedge the beams.

▶ When wedging each of the beams:
Tighten the nut **3**.

▶ Attach the cover **1** to the beams, illustration 4.

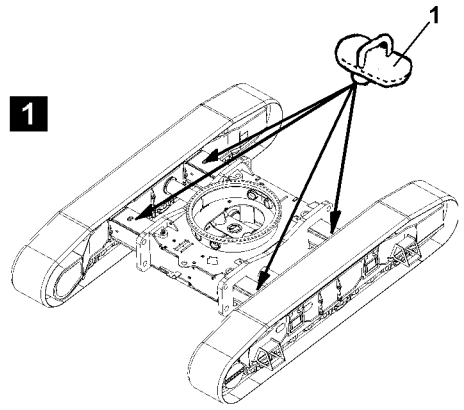
▶ Check all eight screws **2** and if necessary tighten and secure.

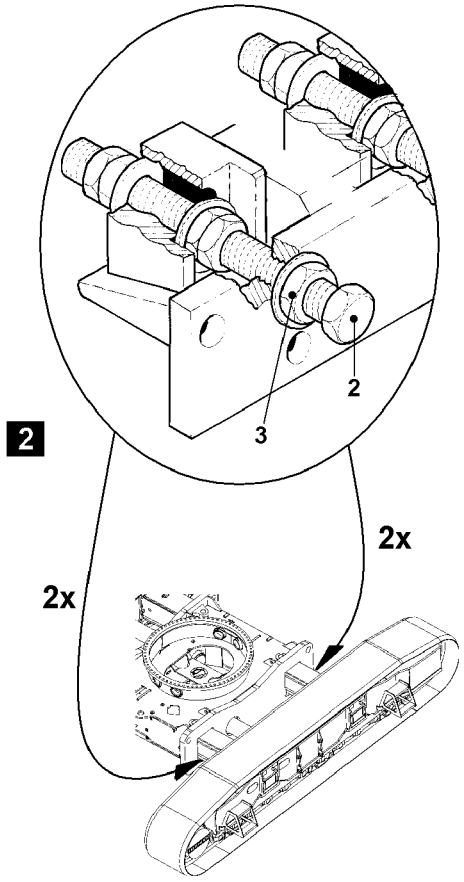
▶ After sliding out the crawler carrier:
Grease any exposed sliding surfaces on the beams.

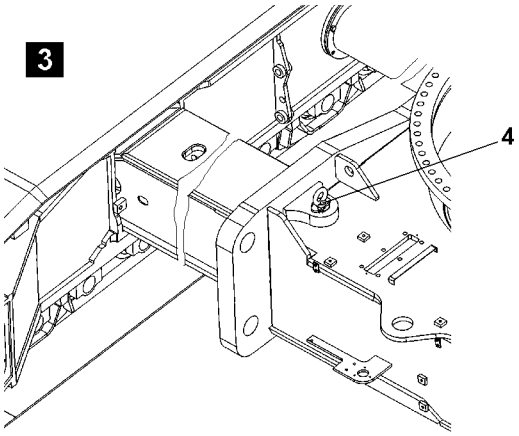
▶ Press button **412** again.

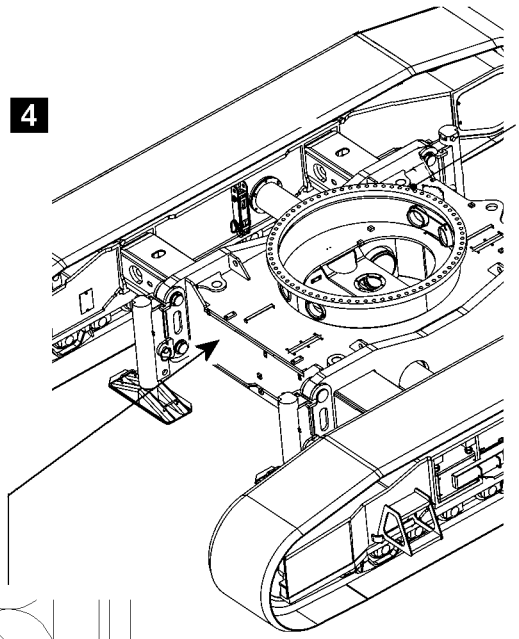
Result:

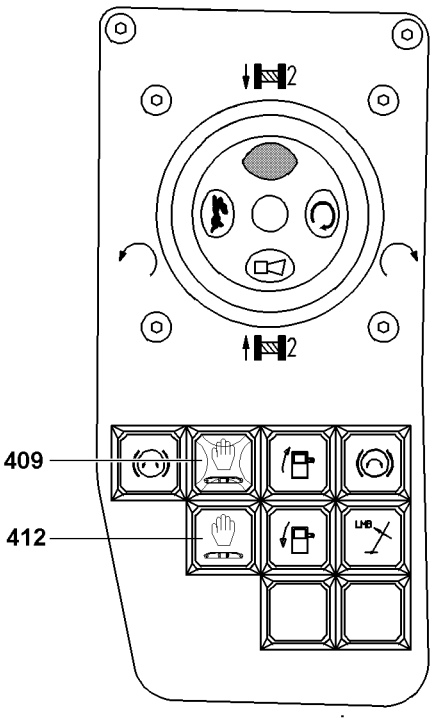
– The control light **409** turns off.
– The crawler track adjustment has been turned off.

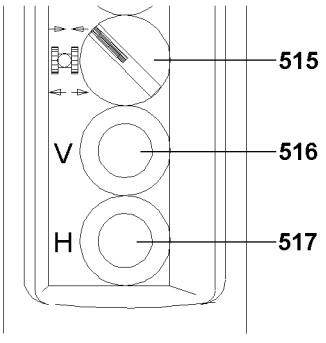












B102926

5.4 Reducing track width

DANGER
Danger of crushing!
▶ When adjusting the track, take particular care to ensure that no one is in the vicinity of the danger zone around the crawler carrier.

CAUTION
Damage to the machine!
▶ Always drive in the right crawler carrier first!

Note
▶ Left and right are defined as viewed from the rear. The crawler carrier drive is located at the rear.

▶ Remove the cover **1** from the beams, illustration 1.
▶ If necessary:
Clean any of the exposed sliding surfaces on the beams.
▶ Remove both beam wedges at the **right front** and **right rear** of the crawler center section:

This is made easier if both wedge screws are loosened by the same amount (not too much).
▶ First loosen the nut **3** and then turn the screw **2** clockwise to remove the wedge, illustration 2.
▶ Pull the front and rear pins **4** on the right crawler center section, illustration 3.
▶ Press button **412**.

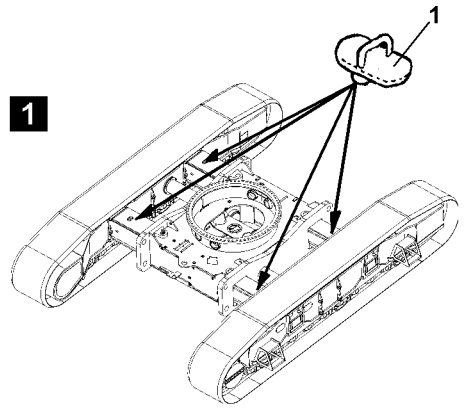
Result:
– The control light **409** lights up.
– The crawler track adjustment has been turned on.

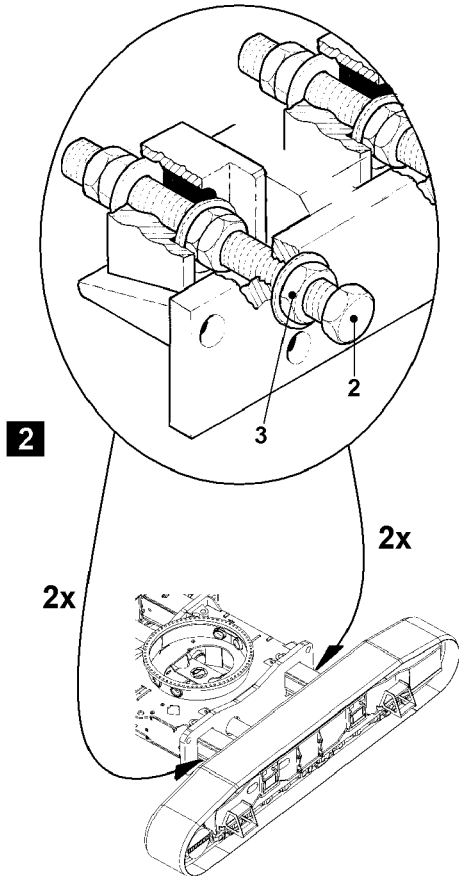
▶ Move the switch **515** upward.

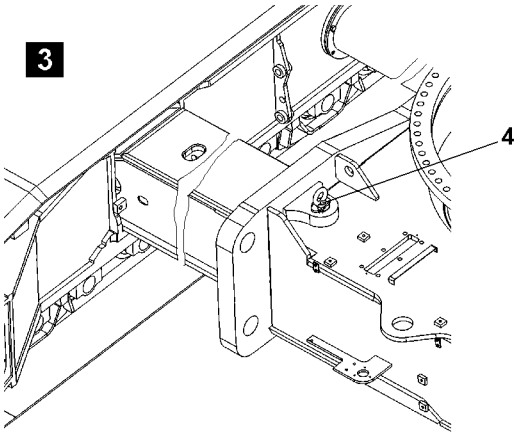
Result:
– Retract track width is preselected.

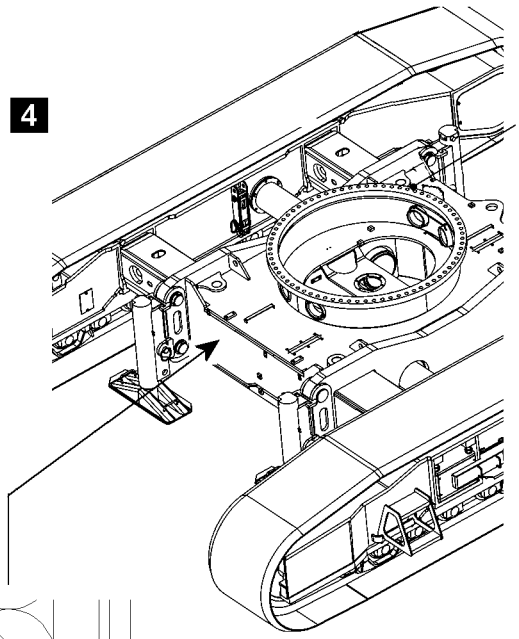
▶ Press the button **516** for “track adjustment front” and the button **517** for “track adjustment rear” and push the crawler carriers in to the inner pin points of the sliding beams, illustration 4.
▶ Insert the front and rear pins **4** into the right crawler center section, illustration 3.

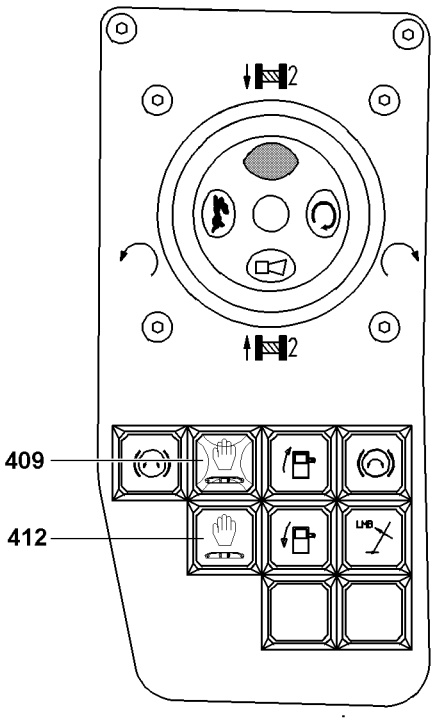
The left crawler carrier can be slid in the same way as the right crawler carrier.
▶ Slide in the left crawler carrier and pin using pins **4**, illustration 3.

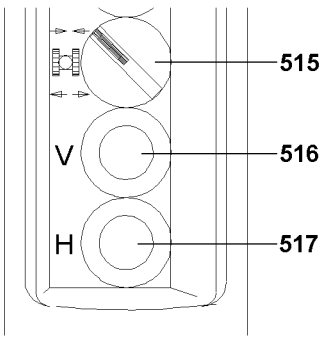












B102926

▶ Wedge the beams on the left and right crawler carriers:

The maximum tightening torque of the screw **2** is 120 Nm.

▶ When wedging each of the beams:
Unscrew the screw **2** (counter clockwise) to wedge the beams.

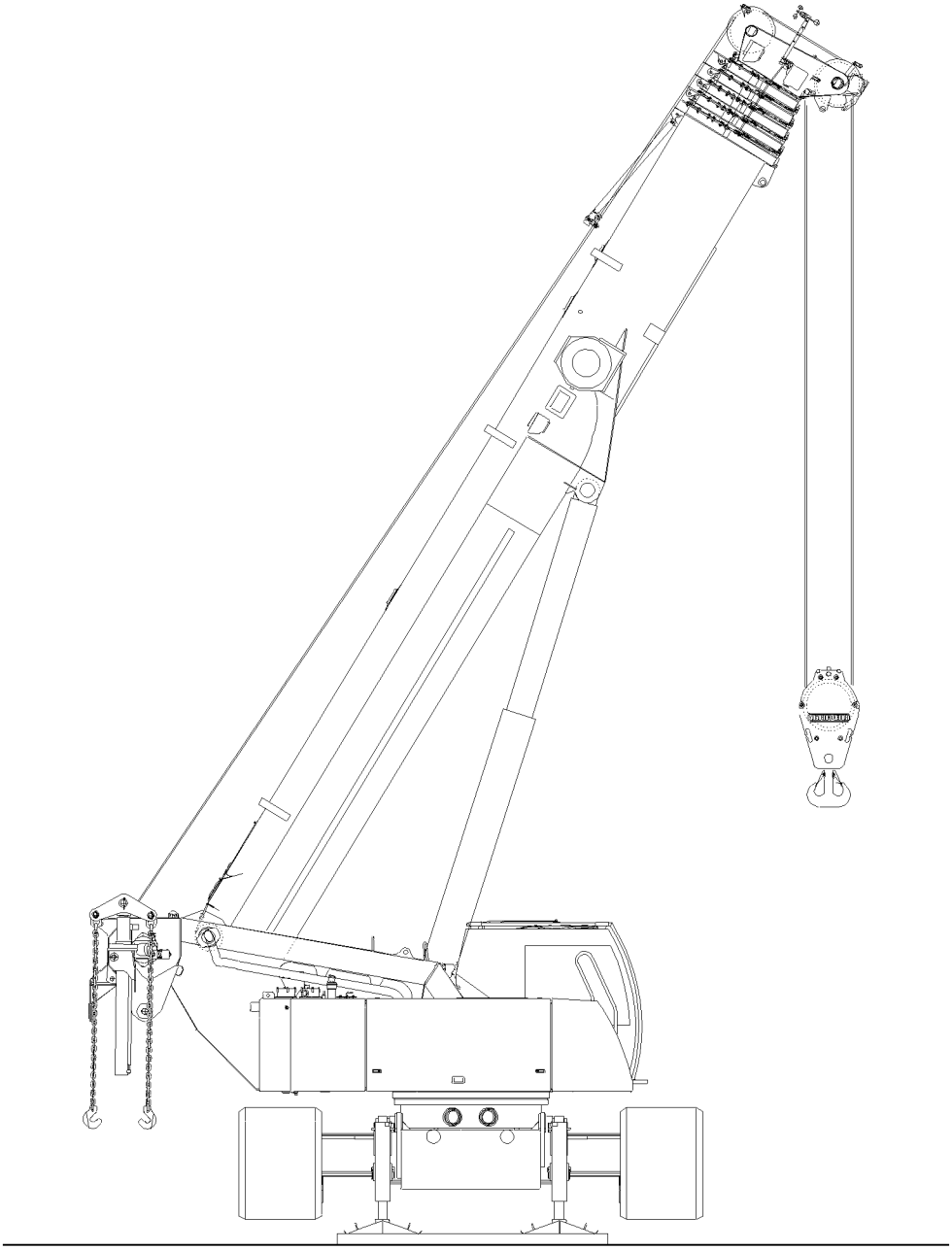
▶ When wedging each of the beams:
Tighten the nut **3**.

▶ Check all eight screws **2** and if necessary tighten and secure.

▶ Press button **412** again.

Result:

– The control light **409** turns off.
– The crawler track adjustment has been turned off.



B103678

5.5 Supporting the equipped crane without load

This crane can be supported on the support cylinders for simpler track adjustment in equipped condition (with crawler carriers and counterweight). To do so, the telescopic boom without load must be held within the angle ranges noted in the following chart.
Ensure that the following prerequisites are met:

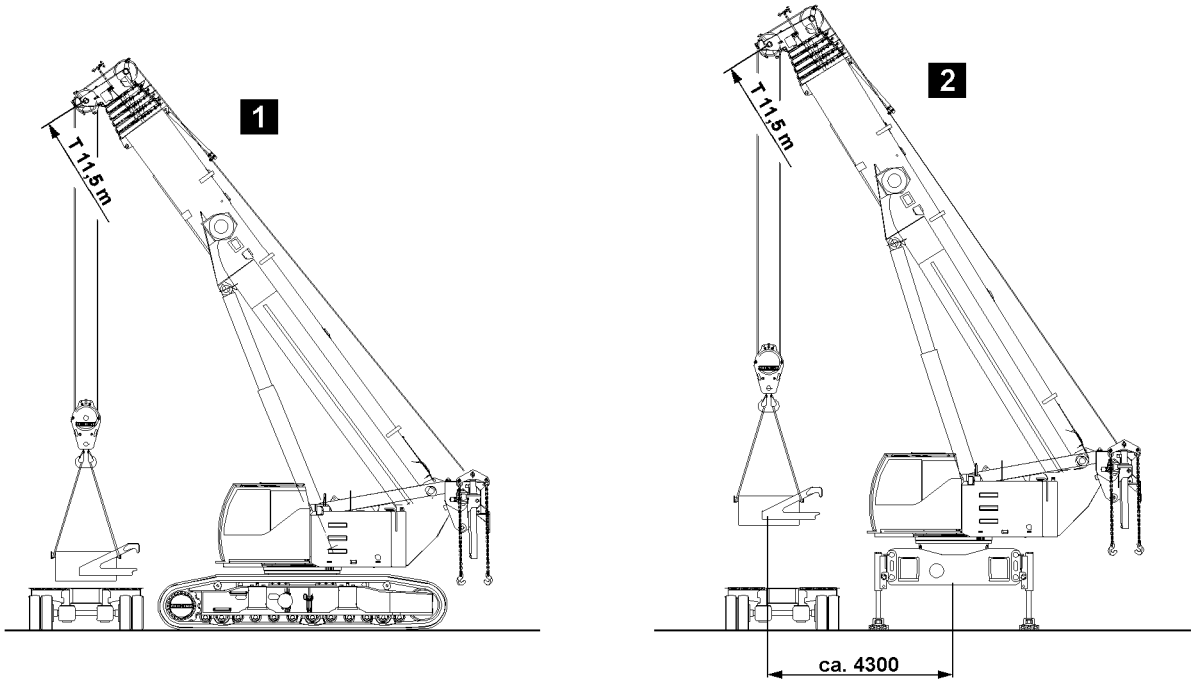
– The crane is standing on wide track 4.15 m **or** reduced track 3.40 m.
– The crane superstructure is locked to the crane chassis, in travel direction to the front or rear (0° or 180°).
– The support base 2.34 m x 3.30 m (45°) **or** 1.84 m x 3.47 m (0°) is set.
– The ground is horizontal (maximum 2.5° ground incline) and of sufficient load bearing capacity.
– The folding jib may only be installed in transport position on the side of the telescopic boom.
– The auxiliary boom K-2.9 m can be installed in transport position or in operating position.

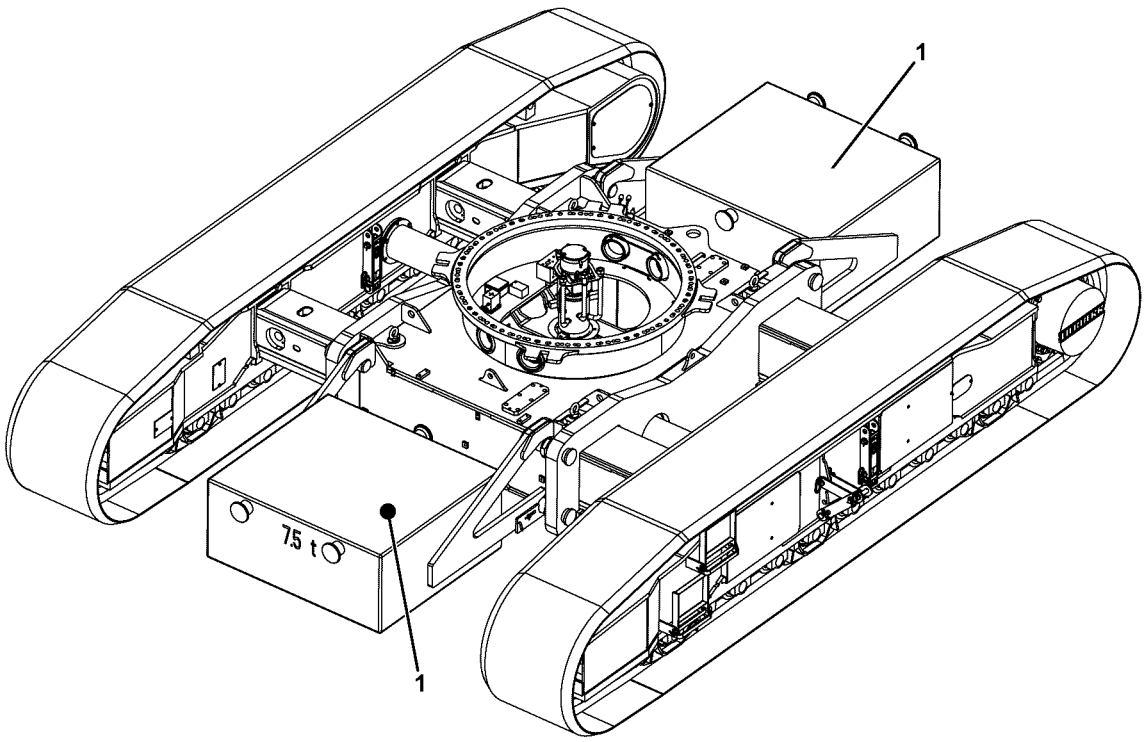
DANGER
Crane can topple over!
If the prerequisites are not strictly observed, the crane can topple over and fatally injure personnel or the support cylinders can be overloaded!
▶ Adhere to the prerequisites exactly!
▶ Support the crane only according to the data in the chart, “permissible angle window for the telescopic boom”!

Note
▶ If all conditions are observed, support forces up to maximum 350 kN can be created.
▶ The retracted track of 2.60 m cannot be set in supported condition.

Permissible angle window for the telescopic boom					
Counterweight	**Central ballast**	**T-11.5 (0/0/0/0/0)**	**T-15.2 (0/46/0/0/0)**	**T-19.0 (46/46/0/0/0)**	**T-22.7 (92/46/0/0/0)**
32.0 t	15.0 t				36° to 34°
26.0 t	15.0 t			39° to 12°	52° to 39°
22.0 t	15.0 t		36° to 8°	52° to 22°	61° to 43°
20.0 t	15.0 t		45° to 8°	57° to 26°	65° to 44°
16.0 t	15.0 t	48° to 10°	60° to 8°	68° to 31°	73° to 47°
10.0 t	15.0 t	65° to 10°	71° to 8°	75° to 38°	78° to 51°
0.0 t	15.0 t	65° to 10°	71° to 29°	75° to 48°	78° to 57°
0.0 t	0.0 t	65° to 10°	71° to 29°	75° to 48°	78° to 57°

Lift the crane only until all track rollers are cleared.
▶ Support the crane and align it horizontally.
▶ Set the desired track, see section “Assembling the crane”.





B199148

1 Fitting/removing the central ballast

Ensure that the following prerequisites are met:
- the ground is able to carry the weight of the crane, the load and the lifting equipment
- the crane is aligned in horizontal direction
- there are no persons or objects in the danger zone
- the telescopic boom is fully telescoped in
- the counterweight on the turntable has been removed
- the LICCON overload protection has been set according to the load chart
- the crawler carriers have been extended to a track width of 4.15 m (wide track), pinned and wedged, illustration 1
- **or**, the crane is supported on the support cylinders* in accordance with the load charts, illustration 2

Note

▶ The maximum permitted distance between the center of the slewing ring and the central ballast on the transportation vehicle is 4300 mm.

1.1 Possible central ballast combinations

DANGER

Crane can topple over!

If a different counterweight is used than the one specified in the load chart, the crane may topple over and cause fatal injury.

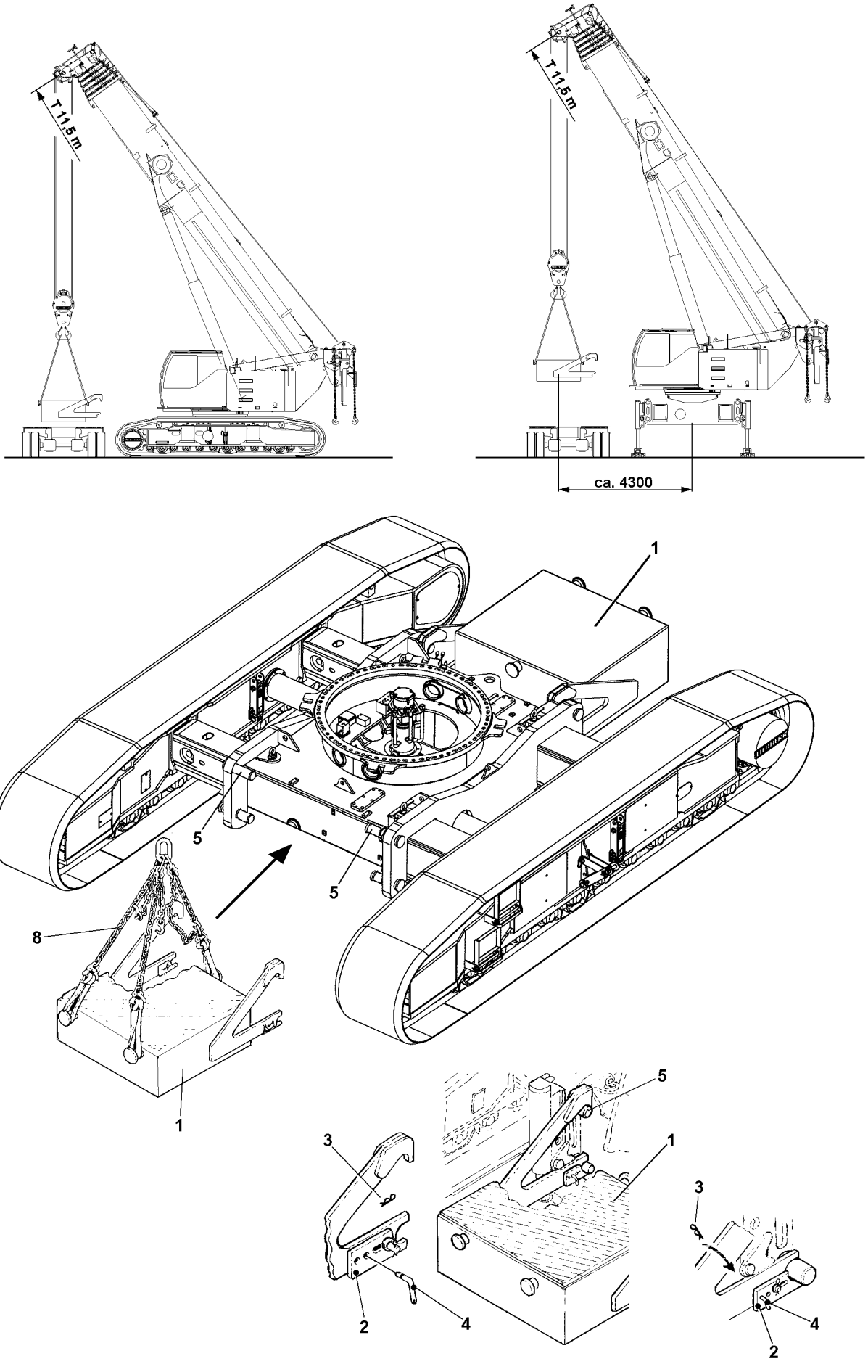
▶ Use the central ballast as specified in the load chart!

▶ The central ballast must be fitted at the front **and** rear!

The following central ballast combinations are possible:

Central ballast	Combination	Ballast block
0	no central ballast	0,0

Central ballast	Combination	Ballast block
15 t	2x ballast block **1**	7.5 t



B199149

1.2 Fitting the central ballast

- ▶ Park the transportation vehicle as close as possible to the crane.
- ▶ Attaching the ballast block **1**:
- ▶ Hang two strands of the supplied assembly equipment **8** to the front fastening points.

Note
- ▶ The front strands must be of the same length.

- ▶ Arrange the hook block at the center of gravity of the ballast block **1**.
- ▶ Attach the third strand to the rear fastening point.
- ▶ Shorten the chain so that the ballast block **1** hangs horizontally when lifted.

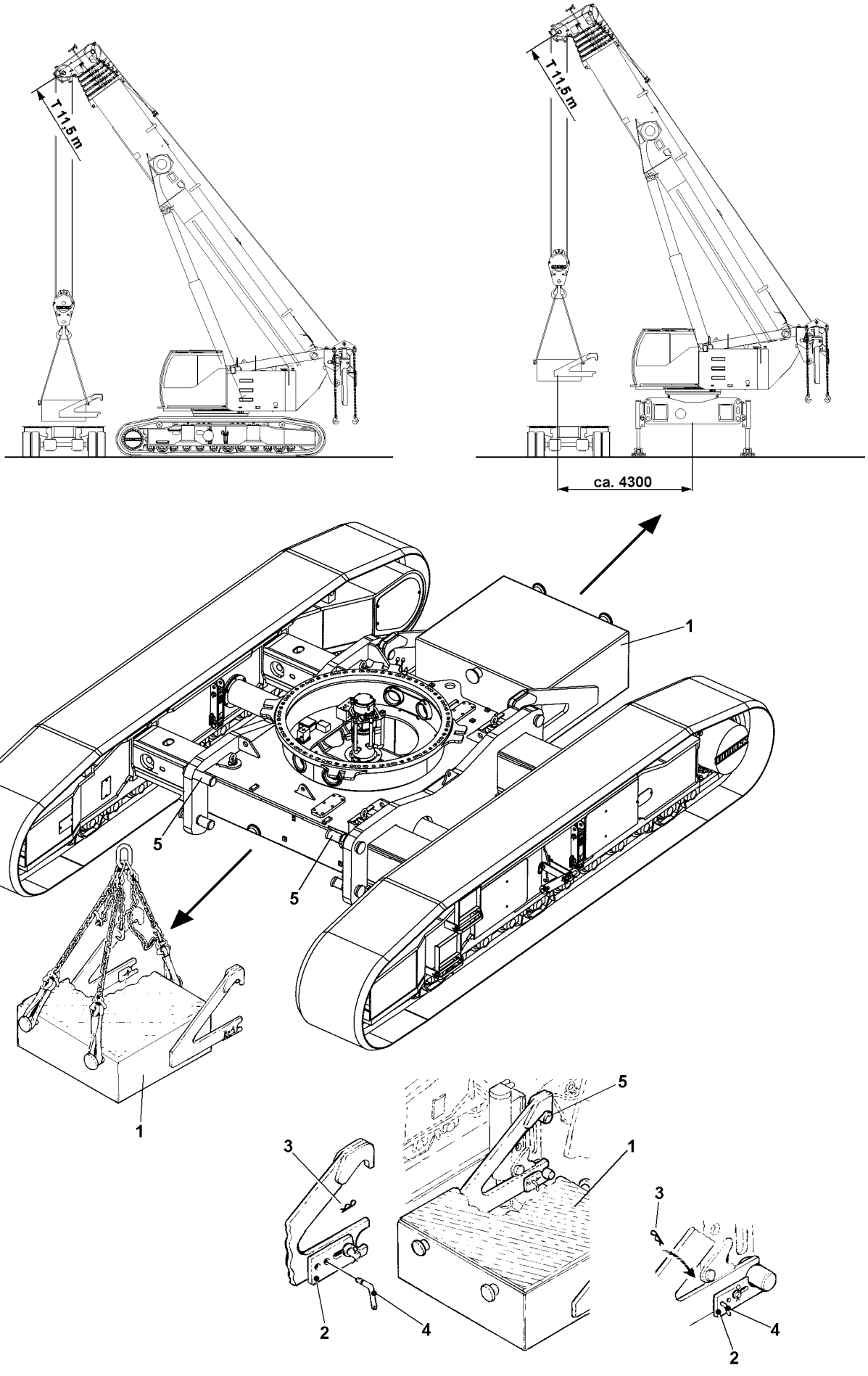
Note
- ▶ Ensure that the ballast block **1** is hanging horizontally.
- ▶ Ensure that the safety mechanism **2** has been reset.

- ▶ Lift the ballast block **1**.

CAUTION
Damage to the engine radiator!
The ballast blocks **1** could collide with the engine radiator during positioning!
- ▶ At installation of the ballast blocks **1**, watch out for the engine cooler!

- ▶ Hang the ballast block **1** in the upper pins **5**.
- ▶ Secure the ballast block **1** by sliding the lashes **2** to their end-positions on both sides.
- ▶ Pin the pins **4** at both sides and secure with spring-loaded safety pins **3**.

The second ballast block **1** is fitted in an identical manner to the first ballast block **1**.
- ▶ Fit the second ballast block **1** the same way as the first ballast block **1**.



B199150

1.3 Removing the central ballast

- ▶ Park the transportation vehicle as close as possible to the crane.
- ▶ Attaching the ballast block **1**:
- ▶ Hang two strands of the supplied assembly equipment **8** to the front fastening points.

Note

- ▶ The front strands must be of the same length.

- ▶ Arrange the hook block at the center of gravity of the ballast block **1**.
- ▶ Attach the third strand to the rear fastening point.
- ▶ Shorten the chain so that the ballast block **1** hangs horizontally when lifted.
- ▶ Release safety springs **3** and unpin pins **4** on both sides.
- ▶ Push the lashes **2** back on both sides and release the ballast block **1**.

CAUTION

Damage to the engine radiator!

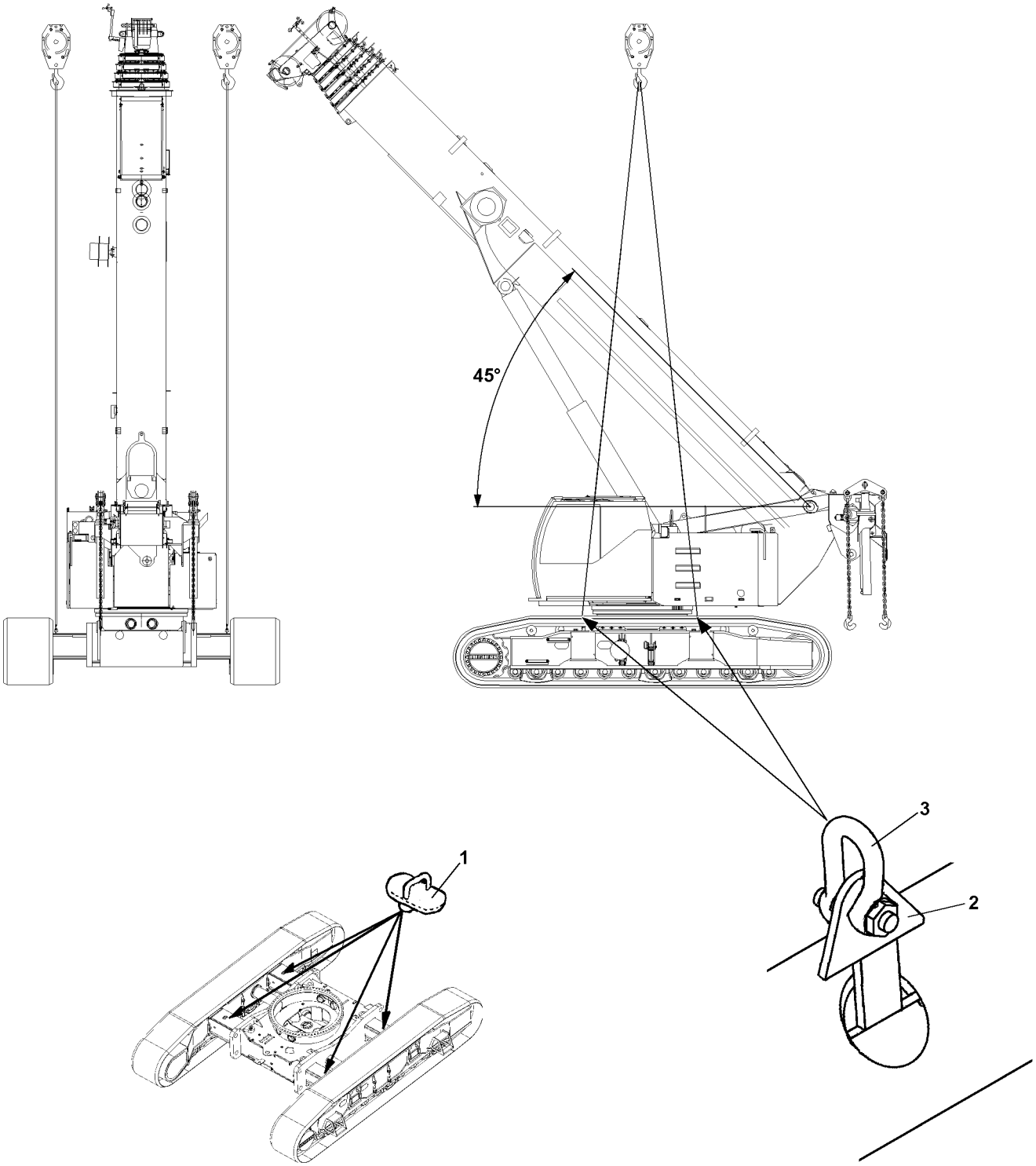
Lifting the ballast blocks **1** out of their retainers could cause them to collide with the engine radiator!

- ▶ When removing the ballast blocks **1**, watch out for the engine cooler!

- ▶ Carefully lift the ballast block **1** out of the retainer and place it on the transportation vehicle.

The second ballast block **1** is removed in an identical manner to the first ballast block **1**.

- ▶ Remove the second ballast block **1** the same way as the first ballast block **1**.



B199223

1 Loading the crane with the auxiliary cranes

Component	Weight
Crane superstructure	12 t
Telescopic boom with folding jib	14 t
Crane chassis	32 t
Overall weight	**58 t**

1.1 Attaching the crane

Ensure that the following prerequisites are met:
- the crane is horizontally aligned and is positioned on level ground
- the counterweight on the turntable has been removed
- the central ballast on the chassis has been removed
- the telescopic boom is fully telescoped in
- the crane superstructure is mechanically locked with the chassis
- the crawlers are extended to wide track, pinned and wedged
- two auxiliary cranes are provided

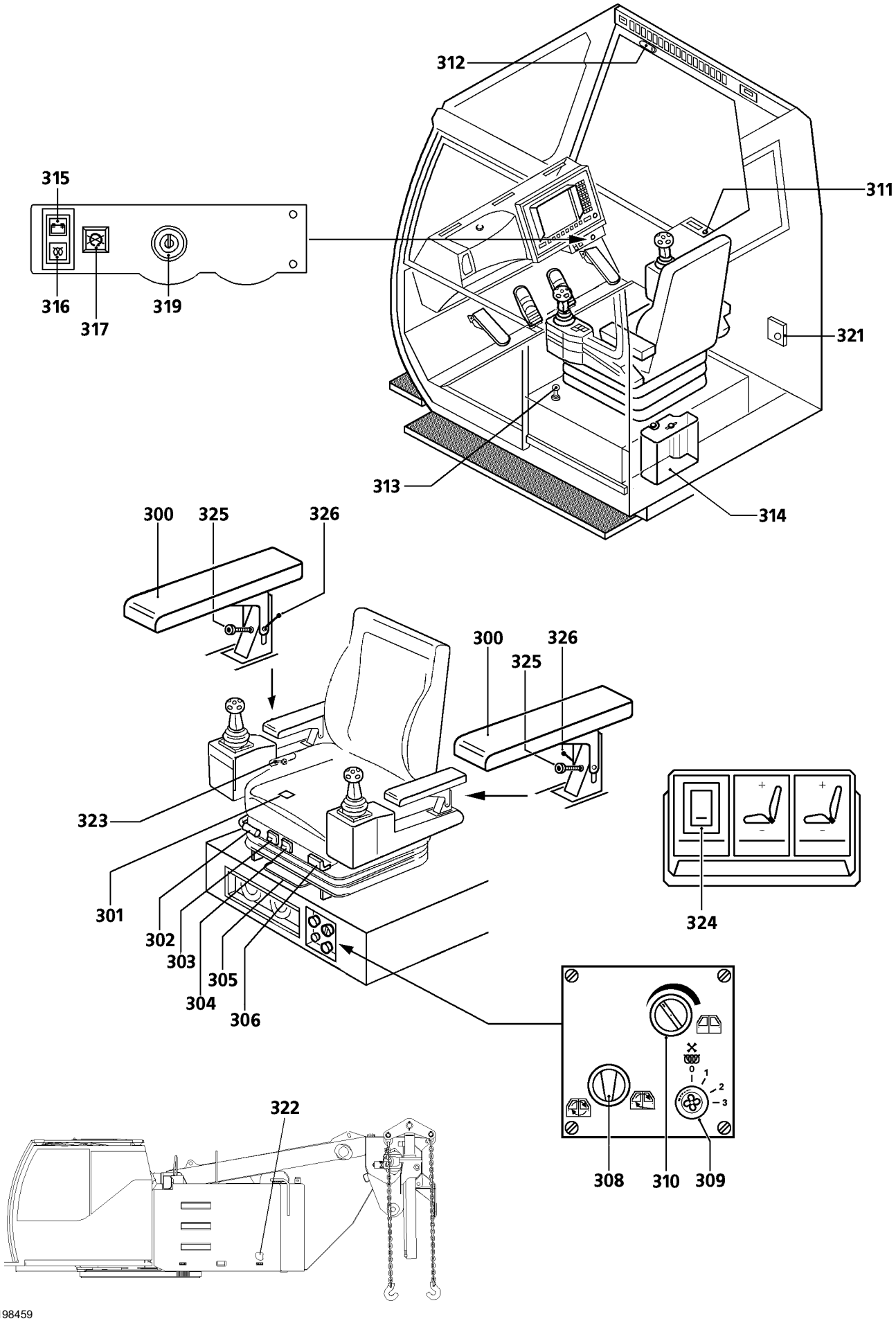
DANGER
The crane can tip over!
If the prerequisites are not observed, or the telescopic boom is not luffed up to 45° before loading, the center of gravity of the crane changes, which can cause the crane to tip over.
▶ Observe the prerequisites and luff the telescopic boom up to 45° before loading!

▶ Remove cover **1** on the 4 beams.
▶ Insert the suspension plates **2** properly into the 4 beams and turn by 90° .
▶ Attach the suspension plates **2** with shackles **3** to the left tackle ropes of the first auxiliary crane.
▶ Attach the suspension plates **2** with shackles **3** to the right tackle ropes of the second auxiliary crane.
▶ Tension the tackle ropes of the auxiliary cranes lightly.

DANGER
The crane can fall off!
When tensioning the tackle ropes of the auxiliary cranes, the suspension plates **2** may not twist.
▶ Check the correct position of the suspension plates **2** after tensioning the tackle ropes of the auxiliary cranes!

▶ Luff the telescopic boom up to 45° .
▶ Load the crane using the auxiliary cranes.

4.00 Operation of crane superstructure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B198459

1 Operating and control instruments

1.1 General operating elements

300	Armrest	
301	Seat contact switch	
302	Manual lever	• Adjustment of seat cushion angle
303	Button	• Lumbar support in lower part of backrest
304	Button	• Lumbar support in upper part of backrest
305	Manual lever	• Lock for horizontal seat adjustment
306	Manual lever	• Backrest angle adjustment
307	Rotary control*	• Air conditioning device
308	Rotary switch	• Switching between fresh air / recirculated air
309	Rotary switch	• 3-stage fan
310	Rotary control	• Cab heating temperature
311	Socket 24 V	
312	Cab lighting	
313	Lock	• The footboard securing Pull handle and hold: footboard unlocked Release and engage the handle: footboard locked
314	Tank	• Windshield washing fluid
315	Charge control light	• Motor
316	Control light	• Engine preheating, flame start system
317	Button	• Stand-by mode **Note:** Pressing the button **317** will turn off the engine, but the LICCON remains turned on.
319	Ignition starter switch	• Motor
321	Thermostat*	• Auxiliary heating
322	Battery master switch	
323	Lock screw	• Adjusting the control unit lengthwise
324	Switch *	• Seat heating
325	Set screw	• Arm rest inclination adjustment
326	Locking lever	• Am rest height adjustment


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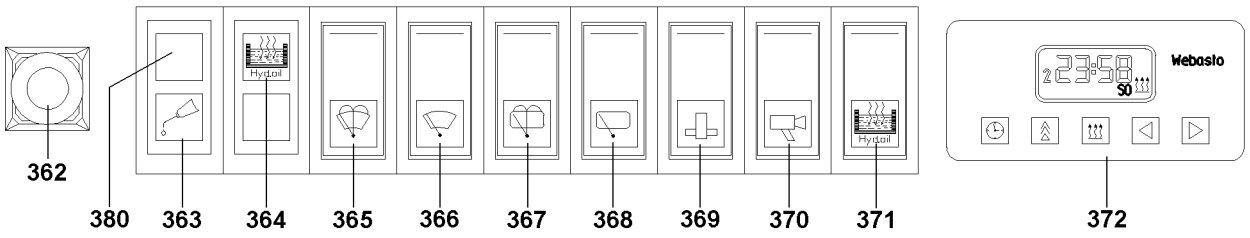
B102818

1.2 Roof console controls

341	Operating hour meter - Superstructure	
342	Control light*	• Air-conditioning system is switched on
343	Control light	• Tele pinning **Note:** The control light **343** tele pinning is only needed when the telescopic boom has to be manually pinned.
345	Switch	• Instrument panel lighting
346	Switch	• Extend / retract footboard switched upwards: footboard is extended switched downwards: footboard is retracted
347	Switch *	• Aircraft warning lights, on the boom head and/or the single and dual folding jib
348	Button*	• Height adjustment work headlight, boom articulated section
349	Switch *	• Work headlight on the boom articulated section
350	Switch *	• Work headlight on the boom articulated section or the boom head
351	Switch *	• Work headlight, cab roof rear and front
352	Switch	• Work headlight for hoist winch and mirror heater
353	Switch	• Work headlight on cab front
354	Switch *	• Air conditioning device
355	Control light*	• Auxiliary heating switched on
356	Switch *	• Auxiliary heating
357	Plate	• Function of the 2 switch positions **358** in emergency operation

358	Button	• For emergency operation, with 2 switch positions
		• Position 2 (switched up):
		  • Hoist on
		  • Turning left
		  • Telescope in the telescopic boom
		  • Luff up boom
		• Position 0 (central position):
		  • Off
		• Position 1 (switched down):
		  • Hoist off
		  • Turning right
		  • Telescope out the telescopic boom
		  • Luffing the boom down

359	Switch	• Manual pressure increase for emergency operation
360	Switch	• Telescoping • Position 2 (switched up): Unpin the telescopic boom during manual operation • Position 0 (central position): Pin the telescopic boom or lock the telescopic boom cylinder during manual operations or automatic pinning “OK” • Position 1 (switched down): Unpin the telescopic boom cylinder during manual operation
361	Plate	• Function of the 3 switch positions **360**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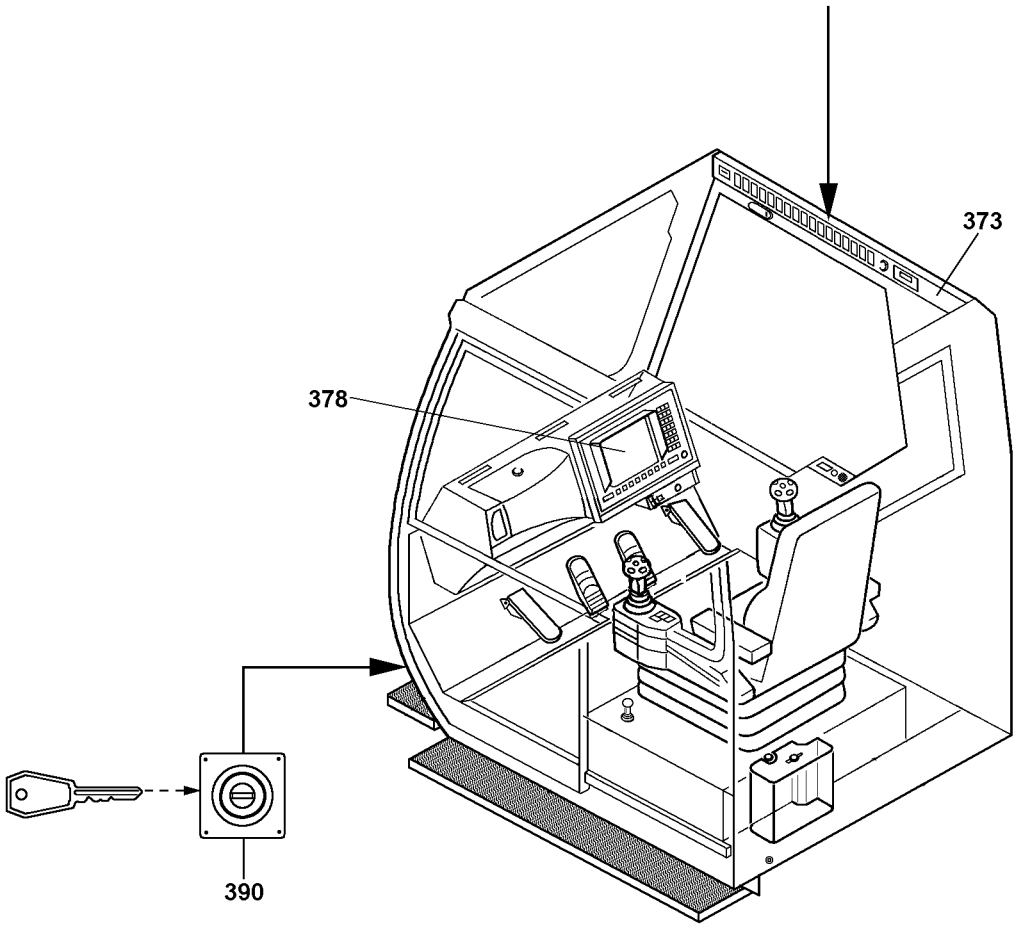
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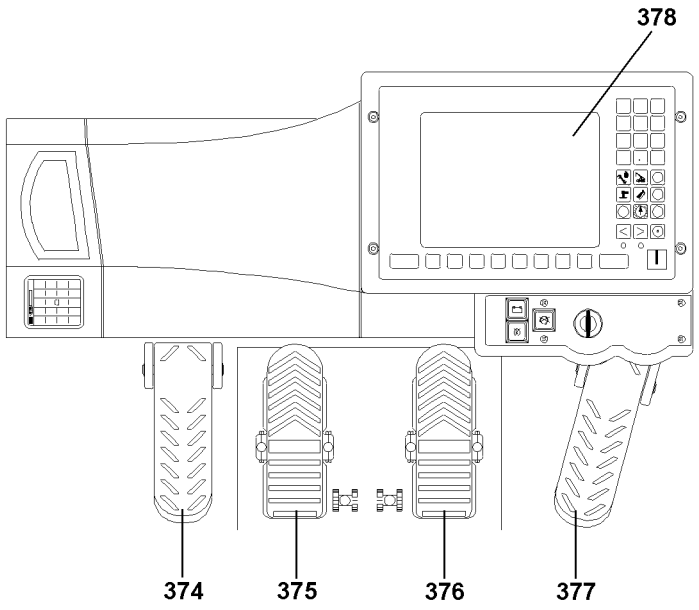
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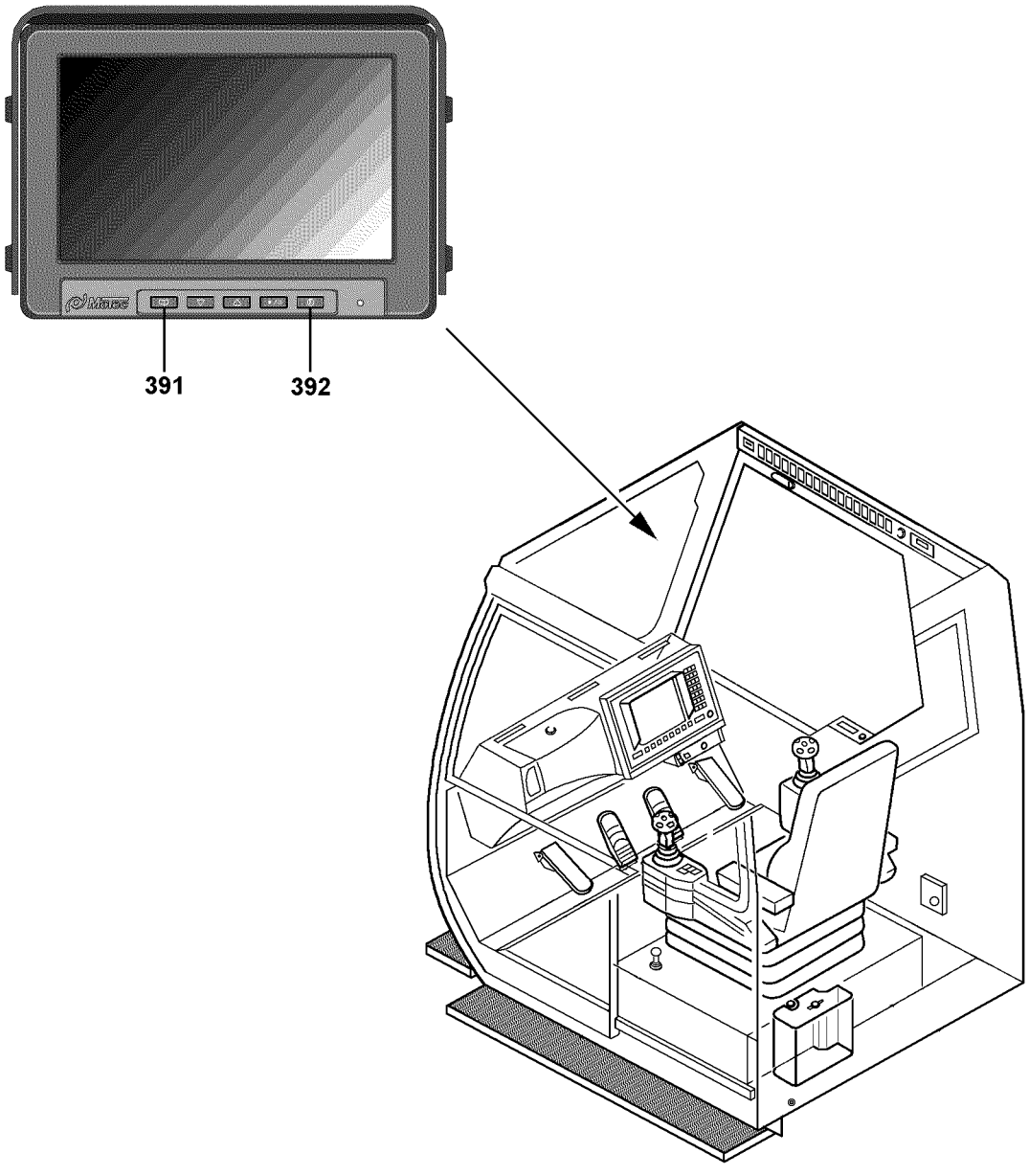
B102819

362	EMERGENCY OFF switch	
363	Control light	• Central greasing
364	Control light	• Hydraulic oil preheating is turned on
365	Button	• Windscreen washing system front window
366	Switch	• Window wiper front window, 2 stages: 1 intermittent, 2 wipe
367	Button	• Windscreen washing system roof window
368	Switch	• Roof window wiper with 2 stages: 1 intermittent, 2 wipe
369	Button	• Lock / unlock crane superstructure lock
370	Switch	• Turn on camera illumination
371	Switch	• Turn on hydraulic oil preheating
372	Timer for auxiliary heater*	with the following displays: • Time and day of the week • Fault in auxiliary heating • Air temperature • Pre-selected heating
373	Buzzer	• Ballast cylinder fully retracted/extended
374	Pedal	• Slewing gear brake
375	Master switch foot pedal left MS4	• Crawler travel gear left
376	Master switch foot pedal right MS5	• Crawler travel gear right
377	Pedal	• Engine control
378	LICCON monitor	
379	Operating hour meter - Chassis	• **Note:** The operating hour meter - chassis **379** is located in the control cabinet.
380	Warning light	• Failure central lubrication system
390	EMERGENCY OFF switch*	



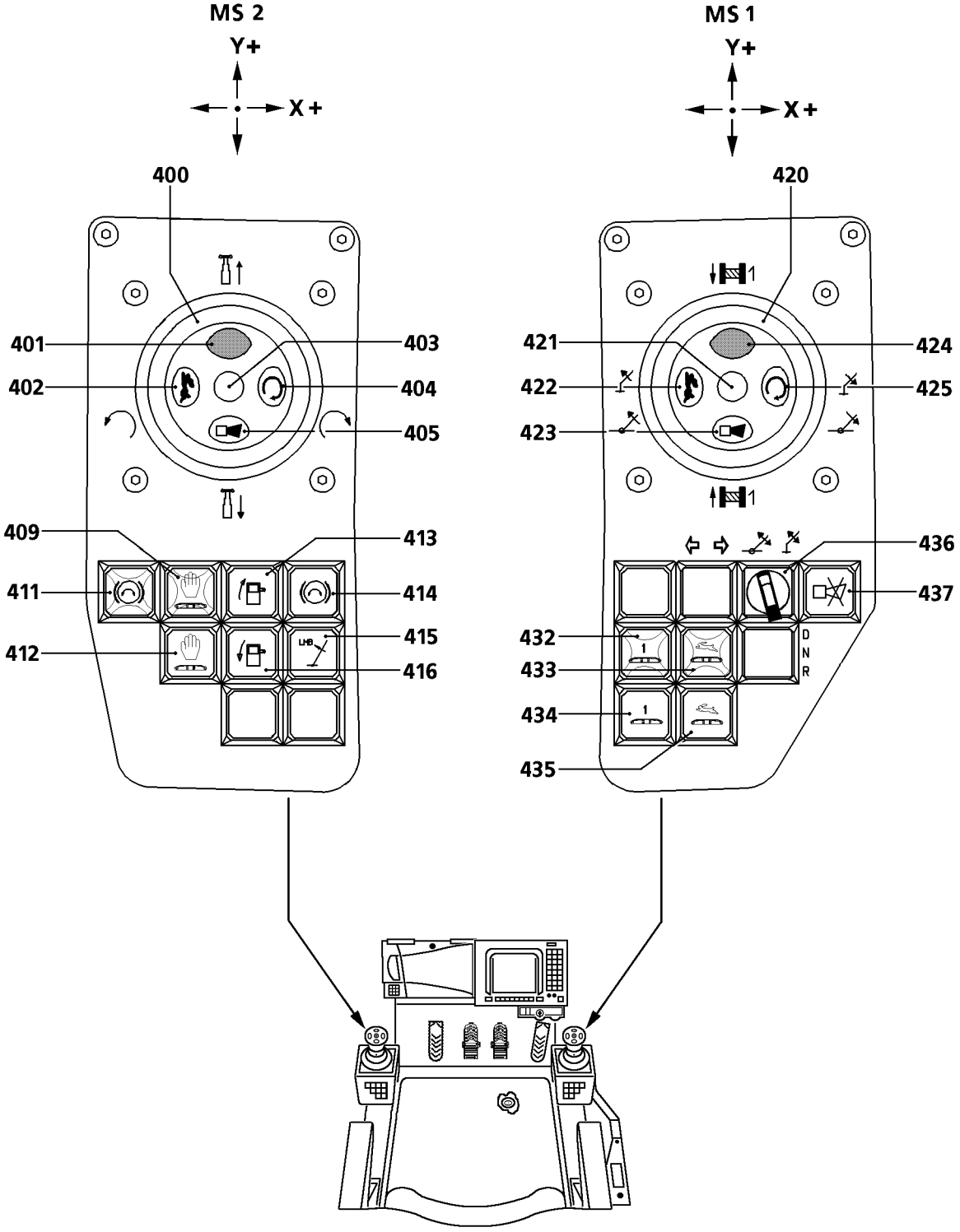
B105023

1.3 Operating elements on camera-monitor

Note

▶ The camera-monitor is used to observe the assembly or dismantling of the counterweight plates.

391 Button • Menu
392 Button • ON / OFF


MS 2
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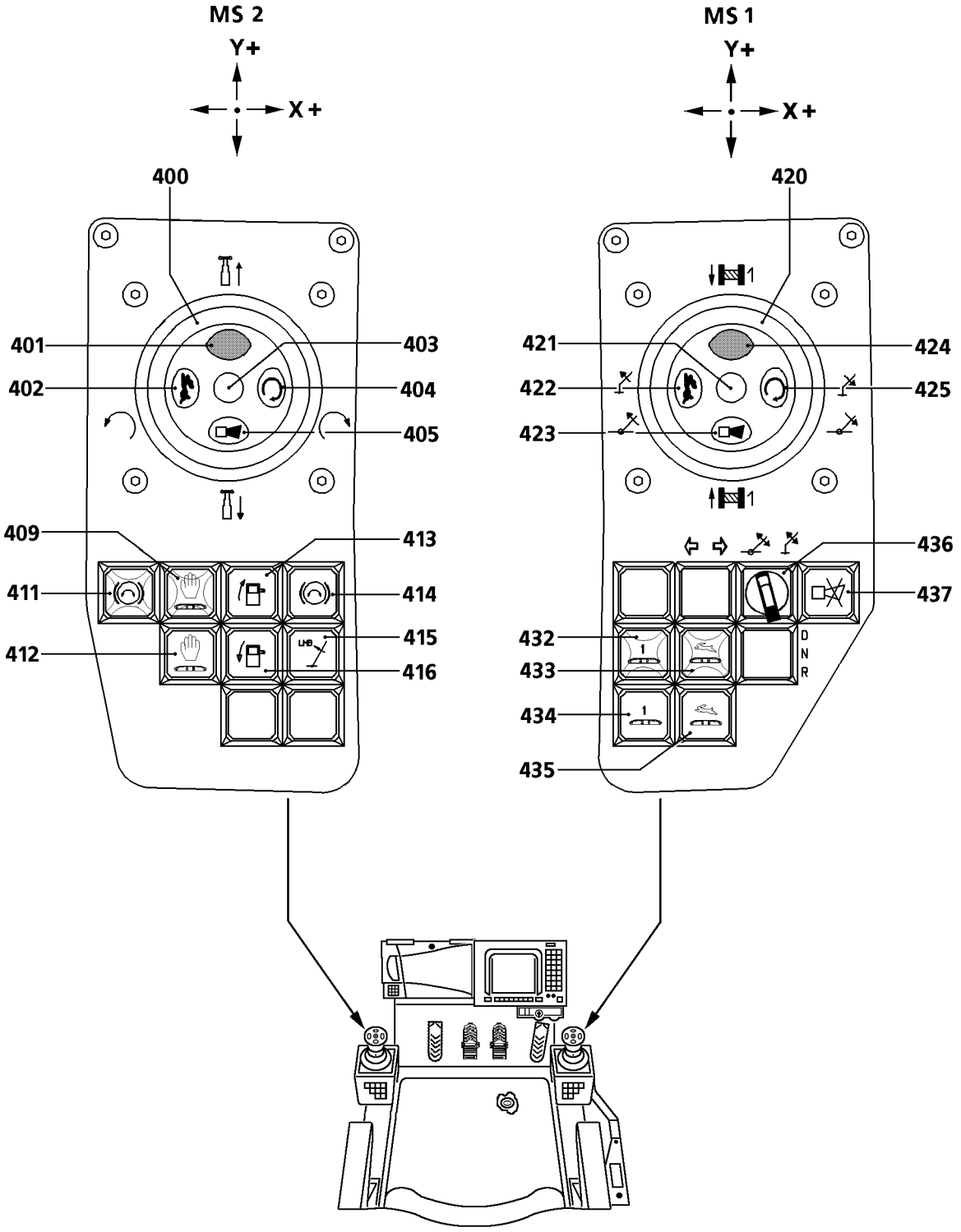
1.4 Operating instruments on control panel (cranes with one winch)

Control panel, left:

400 Master switch left (MS 2)	**Telescoping gear** • Operate master switch **400** in direction Y+ (forwards): Telescope out. • Operate master switch **400** in direction Y- (backwards): Telescope in. **Slewing gear:** • Operate master switch **400** in direction X+ (to the right): Slewing gear turns to the right. • Operate master switch **400** in direction X- (to the left): Slewing gear turns to the left.
401 Button	• Bypassing the seat contact switch. **Or** if the seat contact switch is actuated: Adding the vibration sensor **403**
402 Button	• Adding rapid gear crane operation (winch 1 and luffing up) • Adding rapid gear crawler operation
403 Vibration sensor	• Winch turn counter, (Vibrator) Winch 1.
404 Button	• Latch for superstructure engine control **Note:** Pressing button **404** will lock the engine control in its current position.
405 Button	• Signal horn (hooter)
409 Control light	• Support **and** track adjustment of crawler is added
411 Control light	• Slewing gear brake is turned off
412 Control light	• Addition of support **and** track adjustment of crawler
413 Button	• Rotate crane cab upwards
414 Button	• “Turn slewing gear brake” off / on
415 Button	• Bypassing of overload protection, used to raise an overload **Danger:** **The bypass may only be carried out if the overload has been caused by luffing down at freely suspended load and the crane operator is absolutely certain that he can leave the overload range by luffing up. For the same reason, bypassing the LICCON overload protection at a boom radius smaller or equal to 3.5 m is prohibited.**
416 Button	• Rotate crane cab downwards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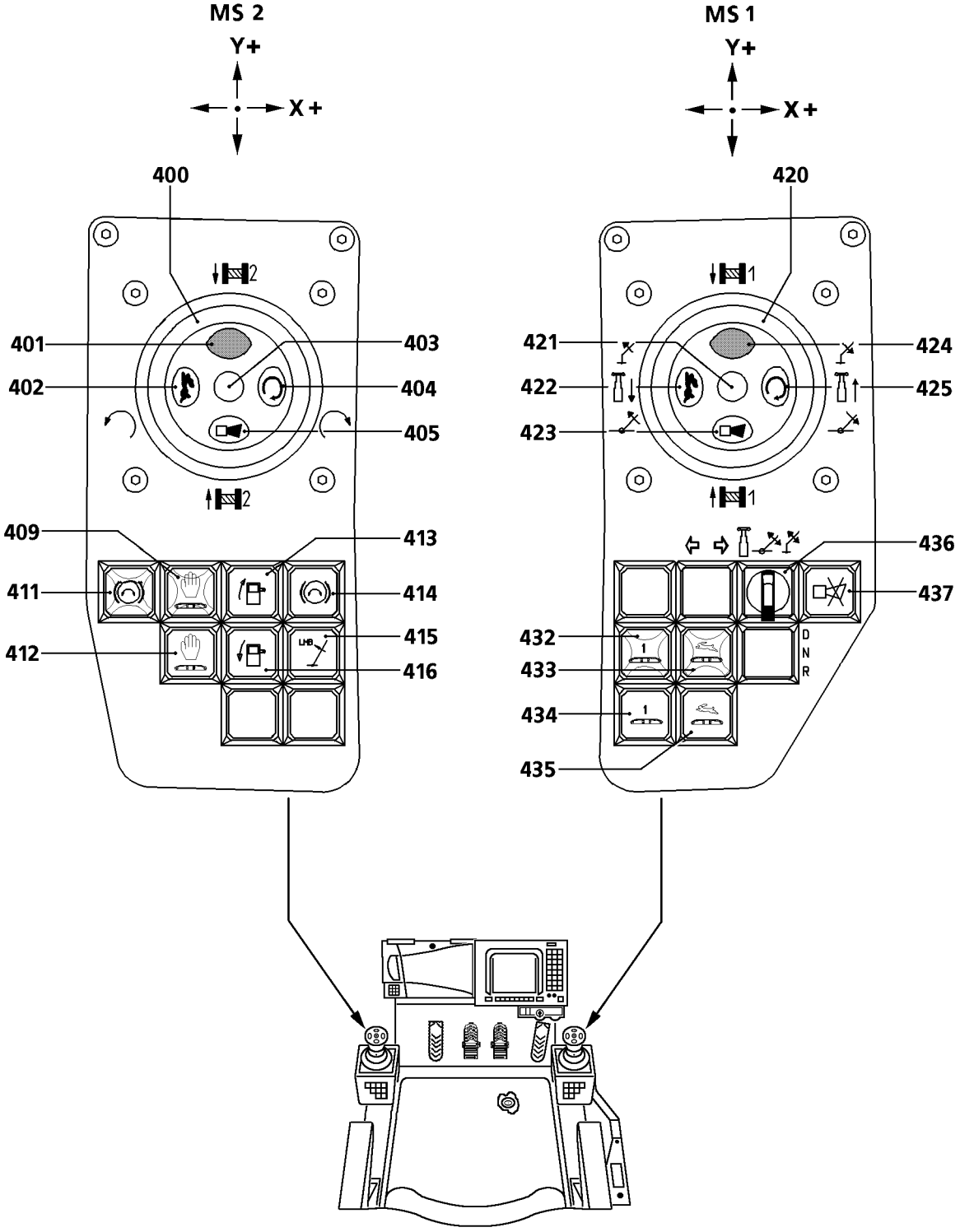
Control panel, right:

420 Master switch - right (MS 1)	**Winch 1:** • Operate master switch **420** in direction Y+ (forwards): Winch 1 reels off and the load is lowered. • Operate master switch **420** in direction Y- (backwards): Winch 1 spools up and the load is raised. **Luffing gear - telescopic boom:** Rotary switch **436** in left position: • Operate master switch **420** in direction X+ (to the right): Telescopic boom is luffed down. • Operate master switch **420** in direction X- (to the left): Telescopic boom is luffed up. **Luffing folding jib*:** Rotary switch **436** in right position: • Operate master switch **420** in direction X+ (to the right): Folding jib is luffed down. • Operate master switch **420** in direction X- (to the left): Folding jib is luffed up.
421 Vibration sensor	• Winch turn counter, (vibrator) winch 1
422 Button	• Adding rapid gear crane operation (winch 1 and luffing up) • Adding rapid gear crawler operation
423 Button	• Signal horn (hooter)
424 Button	• Bypassing the seat contact switch. **Or** if the seat contact switch is actuated: Adding the vibration sensor **421**
425 Button	• Latch for superstructure engine control **Note:** Pressing button **425** will lock the engine control in its current position.
432 Control light	• Control light is **illuminated**: Crawler operation is added Control light **does not illuminate**: Crawler operation is **not** added
433 Control light	• Control light is **illuminated**: Rapid gear crawler operation is added Control light **does not illuminate**: Creeper gear is added
434 Button	• Addition of crawler operation **Note:** Crane operation is turned on automatically.
435 Button	• Change over creeper gear / rapid gear

436 Rotary switch	• Operating mode preselection for master switch **420**
	  • Left position: Luffing telescopic boom
	  • Right position: Luffing folding jib

437 Button	• Switch off acoustic warning (bell on turntable)


MS 2
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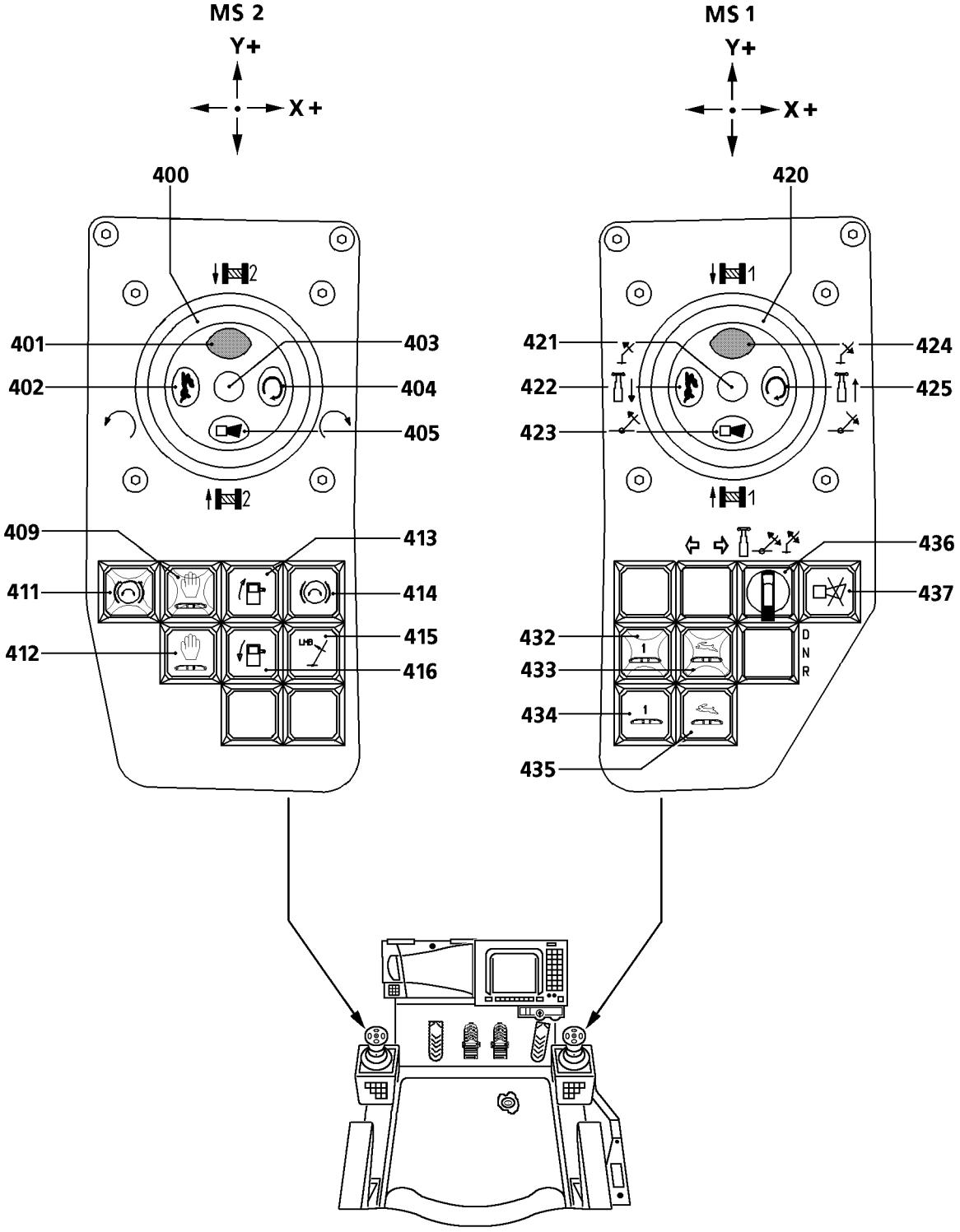
1.5 Operating instruments on control panel (cranes with two winches)*

Control panel, left:

400 Master switch left (MS 2)	**Winch 2** • Operate master switch **400** in direction Y+ (forwards): Winch 2 reels off and the load is lowered. • Operate master switch **400** in direction Y- (backwards): Winch 2 spools up and the load is raised. **Slewing gear:** • Operate master switch **400** in direction X+ (to the right): Slewing gear turns to the right. • Operate master switch **400** in direction X- (to the left): Slewing gear turns to the left.
401 Button	• Bypassing the seat contact switch. **Or** if the seat contact switch is actuated: Adding the vibration sensor **403**
402 Button	• Adding rapid gear crane operation (winch(es) and luffing up) • Adding rapid gear crawler operation
403 Vibration sensor	• Winch turn sensor, (vibrator) winch 2 **or** turn sensor, (vibrator) slewing gear
404 Button	• Latch for superstructure engine control **Note:** Pressing button **404** will lock the engine control in its current position.
405 Button	• Signal horn (hooter)
409 Control light	• Support **and** track adjustment of crawler is added
411 Control light	• Slewing gear parking brake is off
412 Control light	• Addition of support **and** track adjustment of crawler
413 Button	• Rotate crane cab upwards
414 Button	• “Turn slewing gear brake” off / on
415 Button	• Bypassing of overload protection, used to raise an overload **Danger:** **The bypass may only be carried out if the overload has been caused by luffing down at freely suspended load and the crane operator is absolutely certain that he can leave the overload range by luffing up. For the same reason, bypassing the LICCON overload protection at a boom radius smaller or equal to 3.5 m is prohibited.**
416 Button	• Rotate crane cab downwards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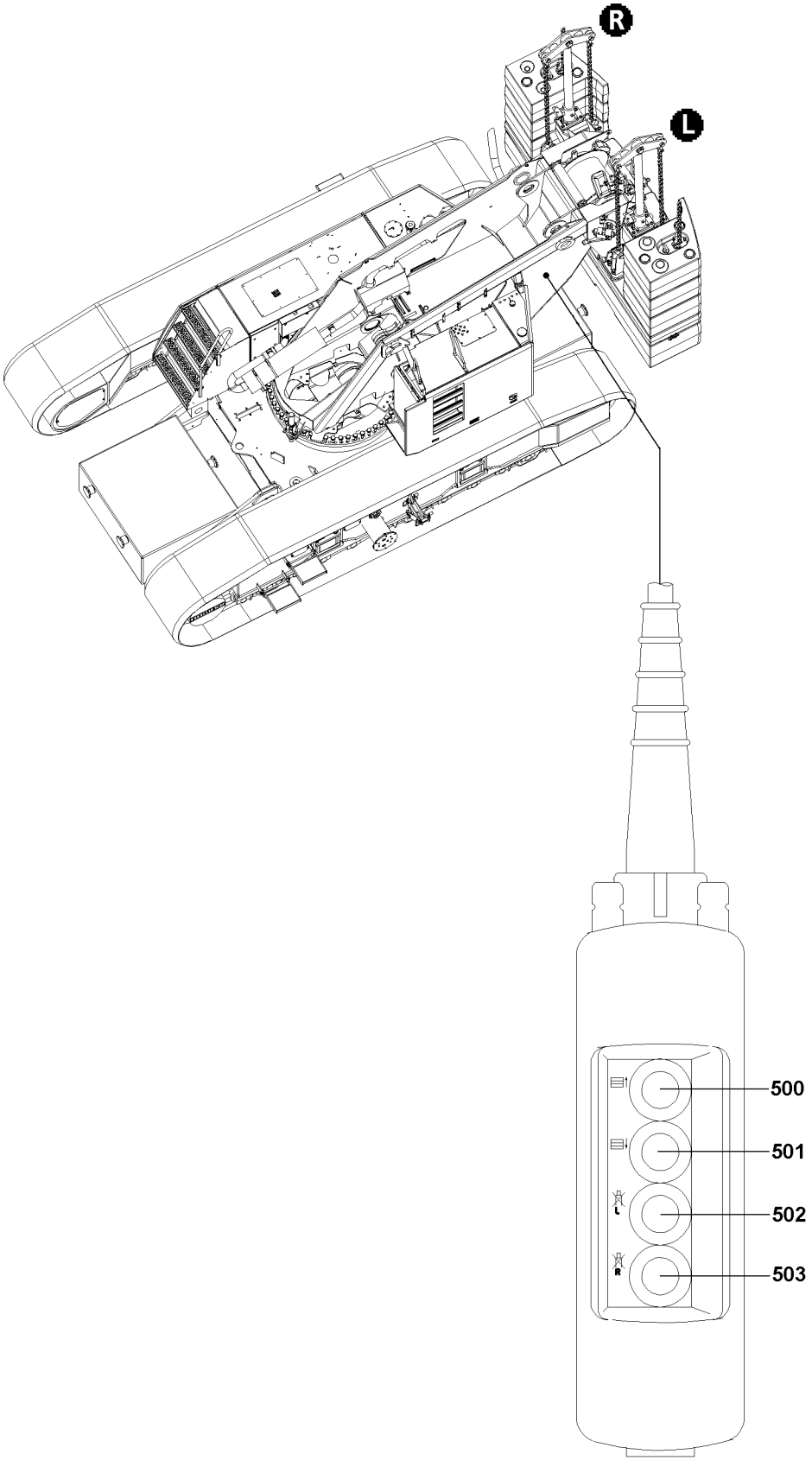
Control panel, right:

420	Master switch - right (MS 1)	**Winch 1:** • Operate master switch **420** in direction Y+ (forwards): Winch 1 reels off and the load is lowered. • Operate master switch **420** in direction Y- (backwards): Winch 1 spools up and the load is raised. **Telescoping gear:** Rotary switch **436** in left position: • Operate master switch **420** in direction X+ (to the right): telescope out • Operate master switch **420** in direction X- (to the left): telescope in **Luffing telescopic boom:** Rotary switch **436** in center position: • Operate master switch **420** in direction X+ (to the right): Telescopic boom is luffed down. • Operate master switch **420** in direction X- (to the left): Telescopic boom is luffed up. **Luffing folding jib*:** Rotary switch **436** in right position: • Operate master switch **420** in direction X+ (to the right): Folding jib is luffed down. • Operate master switch **420** in direction X- (to the left): Folding jib is luffed up.
421	Vibration sensor	• Winch turn counter, (vibrator) winch 1
422	Button	• Adding rapid gear crane operation (winch(es) and luffing up) • Adding rapid gear crawler operation
423	Button	• Signal horn (hooter)
424	Button	• Bypassing the seat contact switch. **Or** if the seat contact switch is actuated: Adding the vibration sensor **421**
425	Button	• Latch for superstructure engine control **Note:** Pressing button **425** will lock the engine control in its current position.
432	Control light	• Control light is **illuminated**: Crawler operation is added Control light **does not illuminate**: Crawler operation is **not** added
433	Control light	• Control light is **illuminated**: Rapid gear crawler operation is added Control light **does not illuminate**: Creeper gear is added
434	Button	• Addition of crawler operation **Note:** Crane operation is turned on automatically.
435	Button	• Change over creeper gear / rapid gear

436	Rotary switch	• Operating mode preselection for master switch **420**
		  • Left position: Telescoping gear
		  • Center position: Luffing telescopic boom
		  • Right position: Luffing folding jib

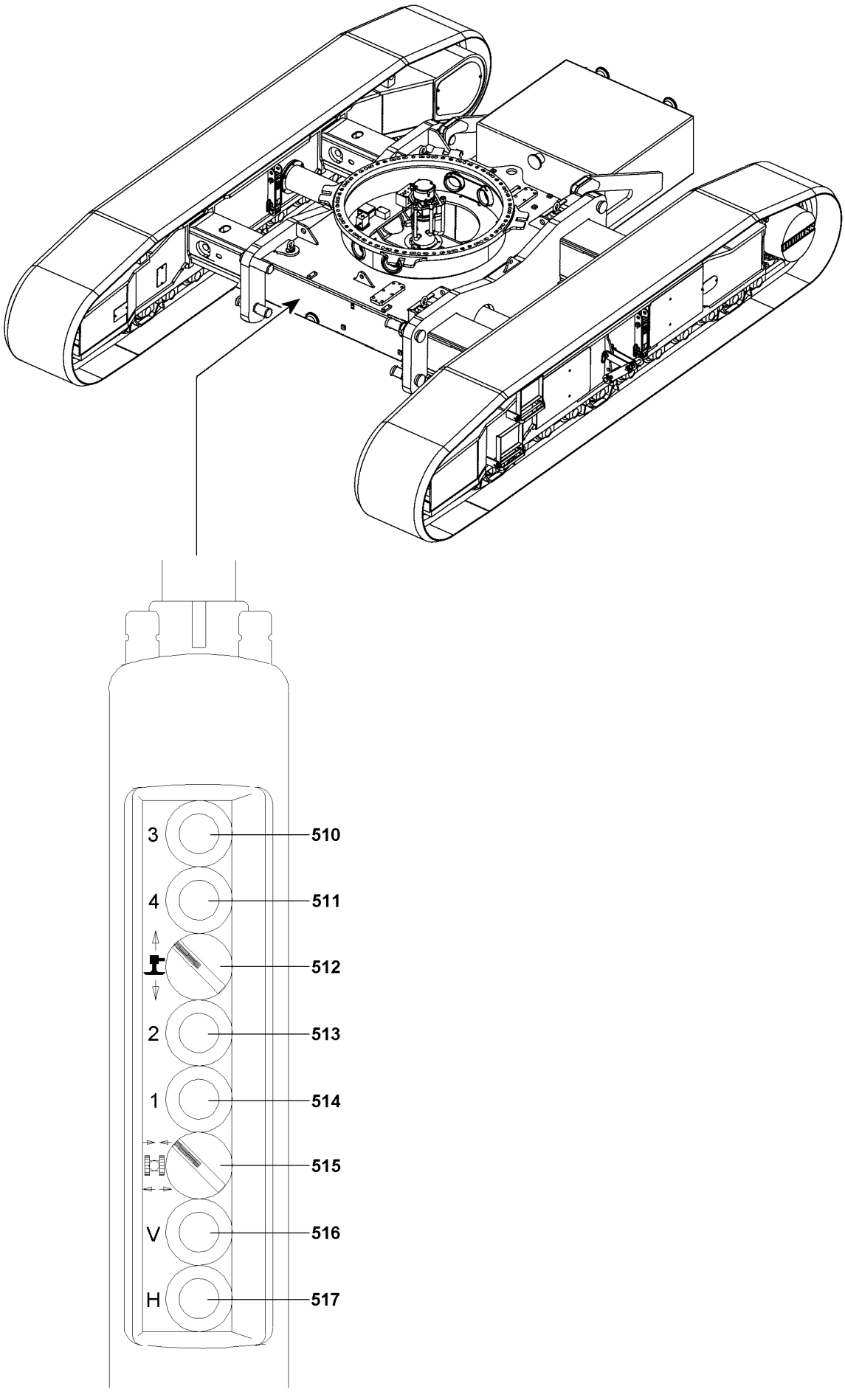
437	Button	• Switch off acoustic warning (bell on turntable)



B198611

1.6 Control panel - Ballasting

500 Button	• Retract the ballasting cylinder, lift the counterweight
501 Button	• Extend the ballasting cylinder, lower the counterweight
502 Button	• Block the ballasting cylinder on the left
503 Button	• Block the ballasting cylinder on the right



B102820

1.7 Control panel - Crane chassis

510	Button	• Retract or extend left front support cylinder
511	Button	• Retract or extend left rear support cylinder
512	Rotary switch	• Retract or extend preselected support cylinder
513	Button	• Retract or extend right front support cylinder
514	Button	• Retract or extend right rear support cylinder
515	Rotary switch	• Increase / decrease preselected track width
516	Button	• Increase / decrease front track width
517	Button	• Increase / decrease rear track width

B197731

1 General

Note
Note

▶ The monitor illustrations in this chapter are only examples. The numerical values in the individual icons and charts do not have to necessarily match the crane exactly. In addition, many of the illustrations show the maximum configuration of the LICCON monitor with icons. In normal crane operation, an identical display will **not** appear on the LICCON monitor.

The LICCON computer system is a computer system for controlling and monitoring mobile cranes. In addition to the overload protection (Load moment limitation = **LMB**) there are a number of application programs that can be used for controlling and monitoring the crane movements.
Currently the LICCON computer system includes the following application programs:
– “Configuration” program
– “Crane operation” program
– “Telescoping” program
– “Working range limiter* ” program
– “Control parameter” program
– “Engine monitoring” program

The electrical and electronic components in the superstructure and the chassis are linked via data bus transmission technology (Liebherr System Bus = LSB).

1.1 Overload protection (LMB)

Overload protection is implemented in microprocessor CPU 0 of base assembly 0. The LICCON computer system works on the principle of comparing the current / actual load with the maximum permissible load according to the load chart and reeving.

1.1.1 Actual load

The current or actual load is recorded by acquiring variable values.
The **load on the crane** results from the load momentum and the boom momentum together. It exerts a force in the boom luffing cylinder, which is measured by pressure sensors.
The **boom momentum** is calculated with data from the angle sensors (boom angle), the length sensors (boom length) and from crane data (boom weights) for the set operating mode.
The **boom radius** is calculated with data from the angle sensors (boom angle), the length sensors (boom length) and from geometry data for the set operating mode. This also takes into account the boom flexation due to its own weight and the weight of the load.
The actual load is calculated from the total load, the boom momentum and the boom radius.

1.1.2 Maximum load according to load chart and reeving

Crane data such as load charts, boom weights and geometry data are stored in the central data memory of the LICCON computer system.
The “maximum load according to the load chart and reeving” is constantly recorded for the set crane configuration state, for the set reeving, and for the calculated boom radius, based on the load charts.

1.1.3 Comparison

The actual load and the “maximum load according to the loading chart and reeving” are compared. When they approach the specified limit, an advance warning is issued. If this limit is exceeded, the overload stop is triggered and any crane movements which increase the load momentum are turned off.

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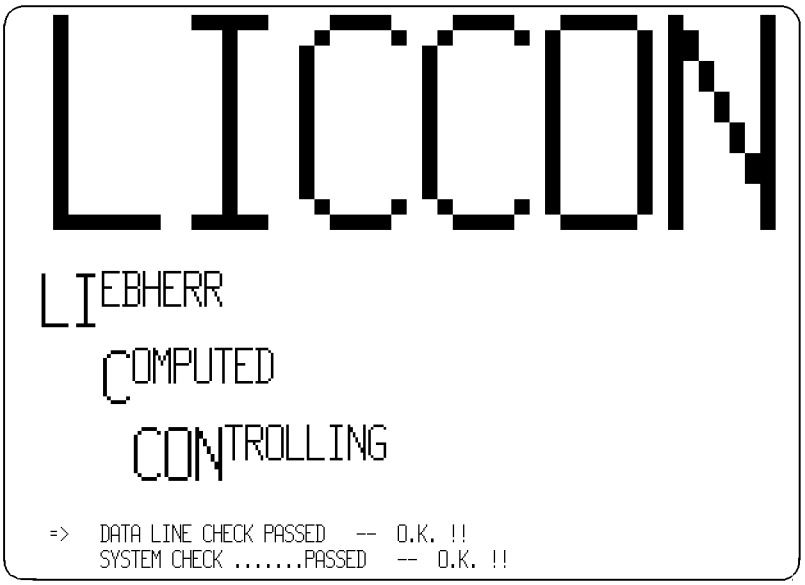
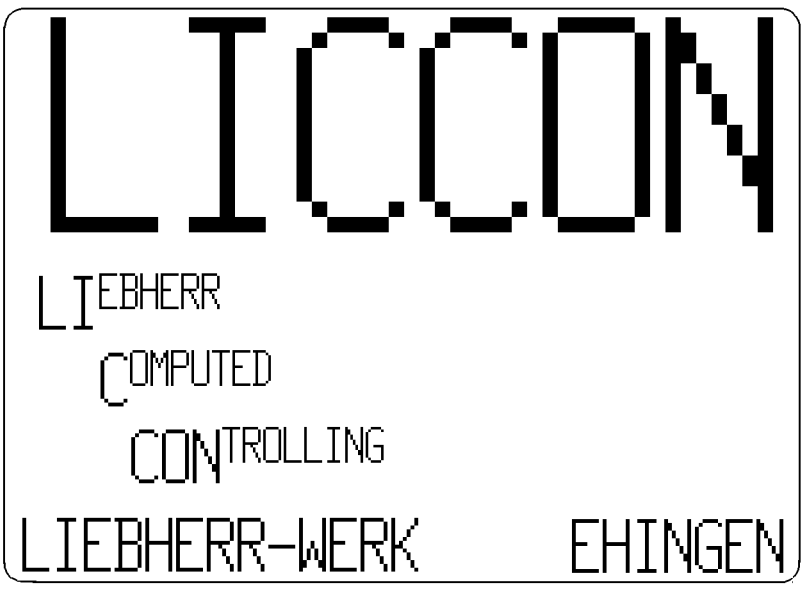
LICCON
LIEBHERR
COMPUTED
CONTROLLING
=> DATA LINE CHECK PASSED -- O.K. !!
SYSTEM CHECK .....

2


LICCON
LIEBHERR
COMPUTED
CONTROLLING
=> DATA LINE CHECK PASSED -- O.K. !!
SYSTEM CHECK .....PASSED -- O.K. !!

3


LICCON
LIEBHERR
COMPUTED
CONTROLLING
LIEBHERR-WERK EHINGEN

B197620

2 LICCON computer system boot up

After it is turned on, the LICCON computer system performs a self test.
First the connections from the microprocessor CPU (ZE 0) to the monitor are checked. If no error is found during the test, the monitor shows this image:

```
=>  DATA LINE CHECK PASSED   --  O.K. !!
    SYSTEM CHECK .......
```

If the test finds no connection problems, there is a system test of all the microprocessor CPUs (ZE). The incremental sequence of the self test can be monitored on the 7 segment displays of the CPUs. If no errors are found during the system test, the monitor shows this image:

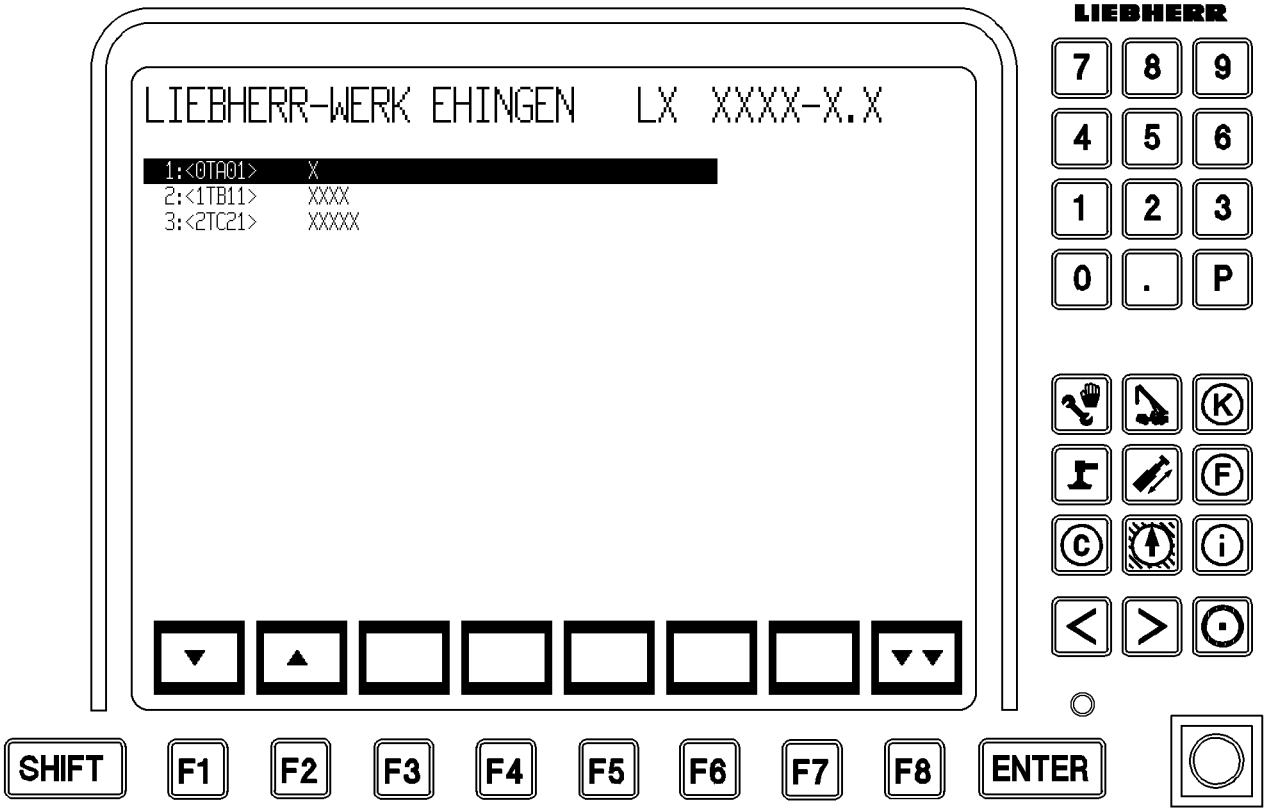
```
=>  DATA LINE CHECK PASSED   --  O.K. !!
    SYSTEM CHECK .......PASSED   --  O.K. !!
```

Shortly after that, this general initialisation screen appears on the monitor:

LIEBHERR-WERK EHINGEN

Note
Errors during the boot up procedure of the LICCON computer system.
If an advance warning, warning or STOP event occurs in the engine monitoring section while the LICCON computer system boots up, the system switches automatically to the “Engine monitoring” program.
▶ Refer to section “Engine monitoring program” for additional information.

If the start procedure has run successfully, it switches automatically to the “Configuration” program.


LIEBHERR
LIEBHERR-WERK EHINGEN LX XXXX-X.X
1:<0TA01> X
2:<1TB11> XXXX
3:<2TC21> XXXXX
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F8
ENTER

B198728

2.1 Operating mode preselection on the LICCON computer system

DANGER
Risk of accident!
▶ Only select the operating mode corresponding to the actual crane setup condition.

The operating mode preselection screen will appear on the monitor for approximately 3 s after completion of the startup procedure and successful self-test of the LICCON computer system.

Note
Note
▶ The operating mode preselection screen is skipped if the crane only has one level (for example: only teleoperation) - without optional equipment. In this case, the system changes directly into the configuration screen for the only possible level.
▶ If the memory loses its data (for example as a result of a cold start) the previous operating mode is “rejected” and the first operating mode in the operating mode selection menu is activated. In this case, the corresponding configuration screen appears.

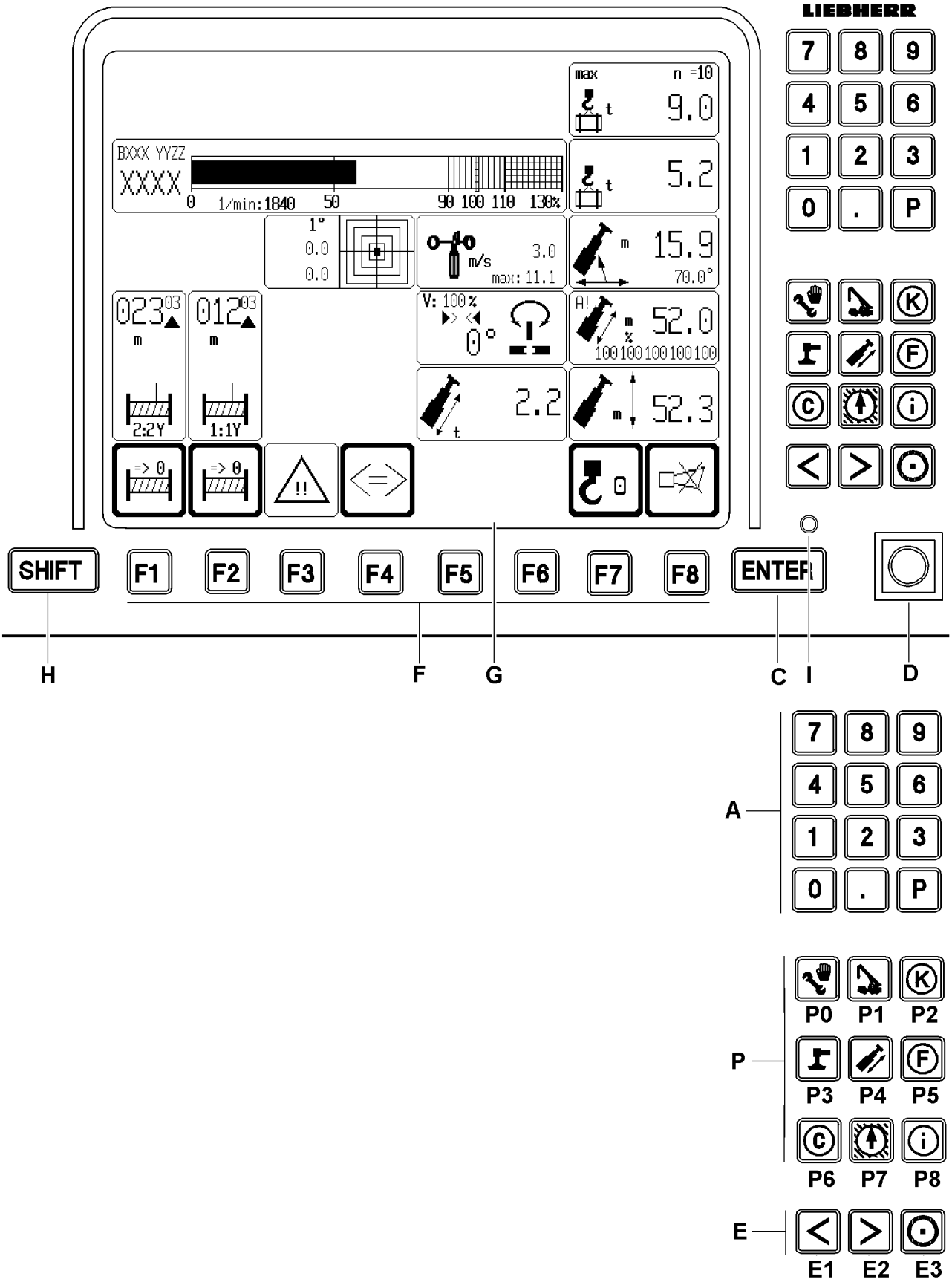
When the operating mode preselection screen appears, press function key **“F1”** or **“F2”** within 3 s.
Result:
– The operating mode selection screen is retained until the settings are confirmed by pressing either **“F8”** or **“ENTER”** .

Note
Note
▶ If the crane operator does **not** press either function key **“F1”** or **“F2”** within 3 s, the system selects the operating mode which was active before the LICCON computer system was turned off and the corresponding configuration screen appears automatically.

Press function key **“F1”** (cursor down) or **“F2”** (cursor up) to select the required crane operating mode.

Note
Note
▶ The selected operating mode is highlighted in black on the operating mode selection screen.

Press **“F8”** or **“ENTER”** .
Result:
– The selected operating mode is accepted by the LICCON computer system and the corresponding configuration screen is displayed.

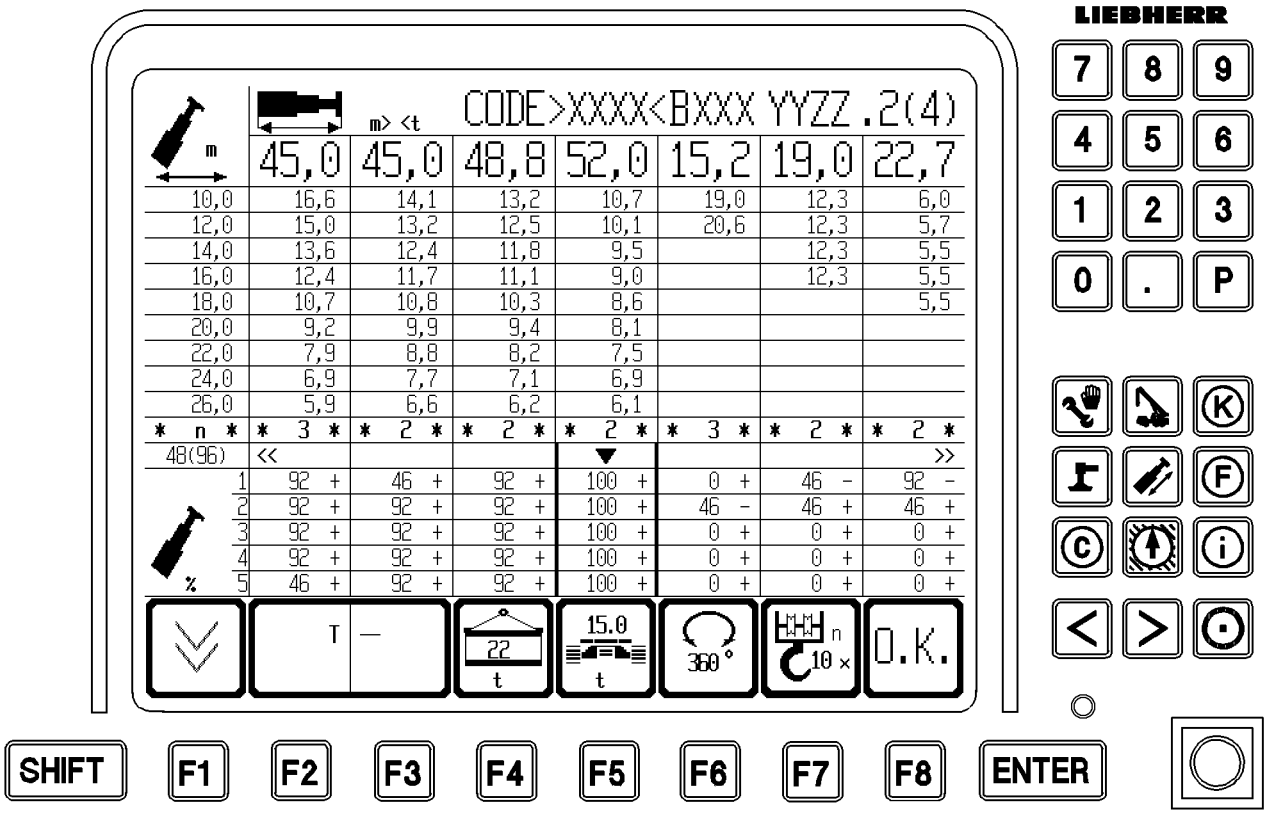

LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
max n =10
9.0
5.2
BXXX YYZZ
XXXX
0 1/min:1840 50 90 100 110 130%
1°
0.0
0.0
3.0
max: 11.1
15.9
70.0°
023 03
012 03
m
2:2Y
1:1Y
V: 100%
0°
A!
52.0
100 100 100 100 100
2.2
52.3
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
H
F
G
C
I
D
A
P
P0 P1 P2
P3 P4 P5
P6 P7 P8
E
E1 E2 E3

B198612

3 Operating elements of the LICCON computer system

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

A	Keypad	
P	Program keys	• Selection of the individual LICCON programs.
P0	Configuration	• **SHIFT** and **P0:** Engine monitoring.
P1	Crane operation	
P2	Crane acceptance	• Correction coefficients (for LIEBHERR personnel only).
P4	Telescoping	
P6	Control parameter	
P7	Working range limitation*	
P8	Test system	
C	Input key “ENTER”	• Confirmation of changes.
D	Bypass key button	• Operating position (self-retaining) = crane is in normal operation. • Position to right (touching): = the hoist limit switch and the LMB shutoff are bypassed.
E	Special function keys	• Monitor brightness adjustment. • **E3** and **E1**: Turn background illumination on / off. • **E3** and **E2**: Brightness adjustment in three stages. • Additional functions of the special function keys are program-dependent and are further explained in the descriptions of the individual LICCON programs.
F	Function keys	• The function keys should always be used in conjunction with the function key icon line displayed on the monitor.
G	Monitor	• Display of the individual programs (example: “Crane operation” program).
H	SHIFT key	• Second-level key assignments, for example “Supervisory function”.
I	LED displays	• Monitor supply voltage present.


LIEBHERR
m> <t
CODE>XXXX<BXXX YYZZ .2(4)
45,0 45,0 48,8 52,0 15,2 19,0 22,7
10,0 16,6 14,1 13,2 10,7 19,0 12,3 6,0
12,0 15,0 13,2 12,5 10,1 20,6 12,3 5,7
14,0 13,6 12,4 11,8 9,5 12,3 5,5
16,0 12,4 11,7 11,1 9,0 12,3 5,5
18,0 10,7 10,8 10,3 8,6 5,5
20,0 9,2 9,9 9,4 8,1
22,0 7,9 8,8 8,2 7,5
24,0 6,9 7,7 7,1 6,9
26,0 5,9 6,6 6,2 6,1
* n * * 3 * * 2 * * 2 * * 2 * * 3 * * 2 * * 2 *
48(96) << >>
1 92 + 46 + 92 + 100 + 0 + 46 - 92 -
2 92 + 92 + 92 + 100 + 46 - 46 + 46 +
3 92 + 92 + 92 + 100 + 0 + 0 + 0 +
4 92 + 92 + 92 + 100 + 0 + 0 + 0 +
5 46 + 92 + 92 + 100 + 0 + 0 + 0 +
%
T
22
t
15.0
t
360°
n
10 x
O.K.
7 8 9
4 5 6
1 2 3
0 . P
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER

B102822

4 “Configuration” program

After turning the LICCON computer system on and after successful boot up, the “Configuration” program appears automatically.

Note
Adjustment and display of equipment configuration and reeving.

- ▶ Normally, the most recently run equipment configuration and the reeving used at that time will be automatically set and displayed. Only when the computer system is started for the first time or after a loss of data occurred in the memory, for example due to a cold start (change of battery or CPU, etc.), will the first valid operating mode, the first valid equipment configuration and the reeving number “0” appear on configuration screen.

Using the “Configuration” program, the crane operator can set the current operating mode, the current configuration state of the crane and the reeving number of the hoist rope.
In addition, in the “Configuration” program he can also see all the load chart programmed into LICCON.

4.1 Setting the operating mode and equipment configuration

The crane operator can select the operating mode and the equipment configuration using the function keys or by entering a 4-digit short code.

Using the function keys:

The function keys are explained in the section “Function key line” in this chapter.

- ▶ Select the respective function keys.
- ▶ Press **Enter** key to confirm and accept the settings.

Result:

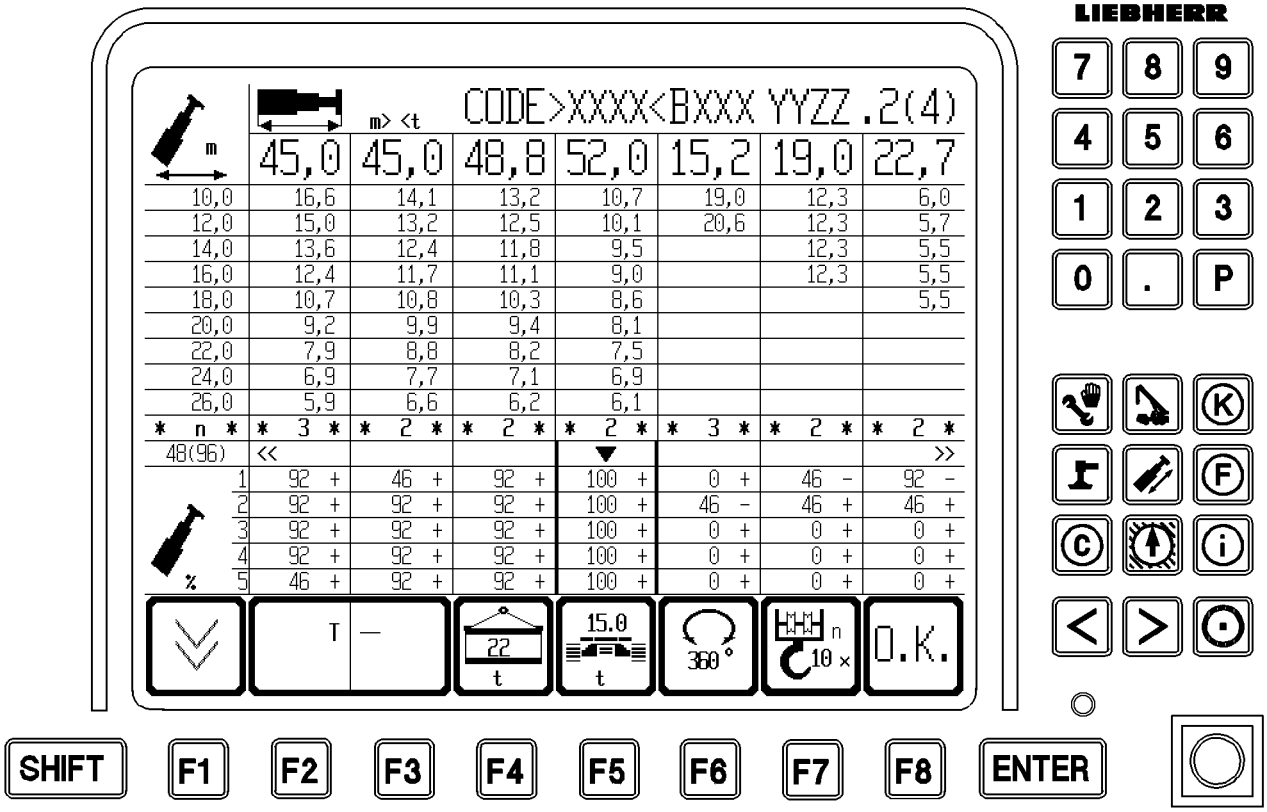
– The data from the selected load chart can be viewed.

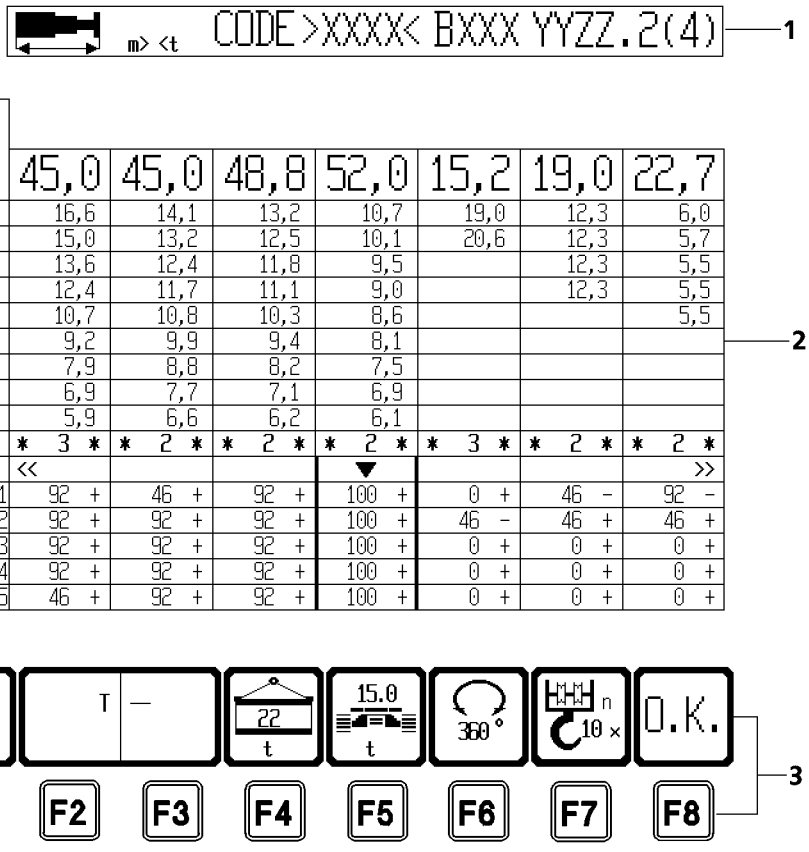
Using a 4-digit short code:

- ▶ Enter a 4-digit short code using the keypad on the LICCON monitor.
- ▶ Press **Enter** key to confirm and accept the settings.

Result:

– The data from the selected load chart can be viewed.


LIEBHERR
m> <t CODE>XXXX< BXXX YYZZ.2(4)
7 8 9
4 5 6
1 2 3
0 . P
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER
O.K.


m> <t CODE>XXXX< BXXX YYZZ.2(4)
1
2
3
O.K.
F1 F2 F3 F4 F5 F6 F7 F8

B102823

4.2 “Configuration” program areas

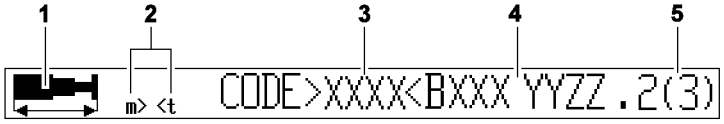
The monitor is divided into three areas in the “Configuration” program:

– General information line **1**
– Display area of load chart values **2**
– Function key line **3**

Note

Note

▶ The monitor illustrations in this chapter are only examples. The numerical values in the individual icons and charts do not have to necessarily match the crane exactly. The programmed load charts for the crane are binding.



B197624

4.2.1 General information line

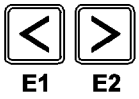
1 "Telescopic boom length" icon
- The icon is identical for all operating modes.

2 Abbreviations
- For the programmed length units (LE) and weight units (GE). Possible length units are [m] and [ft]. Possible weight units are [t] and [lbs].

3 4-digit short code
- It is located next to the text "CODE" inside angled brackets.
- Each short code uniquely identifies a crane configuration. The valid equipment configuration and their associated short code numbers for the crane can be found in the load chart manual of the crane.

4 8-digit organization number
- Relates to the selected load chart.
- Operating mode-dependent.
- Example: BXXX YYZZ
  - Letter in first position = calculation basis for the load chart (country or county specific). Example: "B" = DIN, BS 75%.
  - Number combination "XXX" = crane type.
  - 4-digit number block "YYZZ" = respective operating mode; whereby YY = main geometry status; ZZ = accessory geometry status.

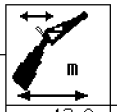
5 Page number
- Relates to the currently displayed part of the load chart.
- Separated from the organization number with "."
- The total number of pages in this load chart is in parentheses.



45,0	45,0	48,8	52,0	15,2	19,0	22,7

1

2



12,0	2,0						
14,0	1,8	2,1				2,1	
16,0	1,7	2,1	1,8	1,6		2,1	1,8
18,0	1,5	2,1	1,8	1,6	1,2	2,1	1,8
20,0	1,4	2,1	1,8	1,6	1,2	2,1	1,8
22,0	1,3	2,1	1,8	1,6	1,2	2,1	1,8
24,0	1,2	2,0	1,8	1,6	1,2	2,0	1,8
26,0	1,1	2,0	1,8	1,6	1,2	2,0	1,8

3

* n *	* 1 *	* 1 *	* 1 *	* 1 *	* 1 *	* 1 *	* 1 *

4

xx	40,0	40,0	40,0	40,0	40,0	40,0	40,0

5

1(27)	▼						>>

6

1	92 +	46 +	92 +	100 +	0 +	46 -	92 -
2	92 +	92 +	92 +	100 +	46 -	46 +	46 +
3	92 +	92 +	92 +	100 +	0 +	0 +	0 +
4	92 +	92 +	92 +	100 +	0 +	0 +	0 +
5	46 +	92 +	92 +	100 +	0 +	0 +	0 +

7

8

B198615

4.2.2 Display area of load chart values

1 Telescopic boom lengths
- In [m] or [ft].
  Maximum of 7 columns per display page.
- Displayed as the horizontal axis of the load value field.

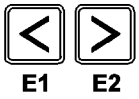
2 Icon “Boom radius”
- Operating mode-dependent.
- In [m] or [ft].
- Maximum 9 lines of boom radius values.
- Vertical axis of load value field.

3 Load value field
- Columns under the telescopic boom lengths and in the lines to the right of values for the boom radii.
- Load values depending on boom length and radii.

4 Reeving number of hoist rope
- * n *
  n = Reeving number of the hoist rope between the boom head and hook block, in order to be able to lift the maximum load in the corresponding load chart column.
  Note:
  If a load value in the column exceeds that of a load that can be lifted with the maximum possible reeving, then there is an exclamation mark beside the reeving number (“!”). This exclamation mark indicates that special equipment is needed to lift this load.

5 Main boom angle or accessory angle*
- In [°].
- In the line “xx” the main boom and accessory angles are listed. These must be set in order to be able to lift the load values in the corresponding load chart column.
  Note:
  The line “Accessory angle” is visible **only** in the TNZK / TVNZK operating modes. The number of lines for the boom projection values is thereby reduced by 1 line.

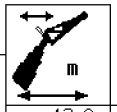
6 Line for special displays
- If a load chart consists of more than seven columns, it cannot be fully displayed because of the size of the monitor. In that case, marking arrows in the first or the seventh field indicate that there are additional columns to the left or right of the displayed chart. They can be shown by pressing the key **E1** or the key **E2**.
  As supporting information, the currently selected column number and the number of columns in the chart are shown.
  e.g. 1 (27) means the first of 27 columns.
- **Note:**
  Using the key combination **SHIFT** and **E1** or **SHIFT** and **E2**, you can, where possible, scroll left or right by seven load chart columns (corresponds to 1 page). The marking for selecting a telescope target is placed in the centre.



45,0	45,0	48,8	52,0	15,2	19,0	22,7

1

2



12,0	2,0						
14,0	1,8	2,1				2,1	
16,0	1,7	2,1	1,8	1,6		2,1	1,8
18,0	1,5	2,1	1,8	1,6	1,2	2,1	1,8
20,0	1,4	2,1	1,8	1,6	1,2	2,1	1,8
22,0	1,3	2,1	1,8	1,6	1,2	2,1	1,8
24,0	1,2	2,0	1,8	1,6	1,2	2,0	1,8
26,0	1,1	2,0	1,8	1,6	1,2	2,0	1,8

3

* n *	* 1 *	* 1 *	* 1 *	* 1 *	* 1 *	* 1 *	* 1 *

4

xx	40,0	40,0	40,0	40,0	40,0	40,0	40,0

5

1(27)	▼						>>

6

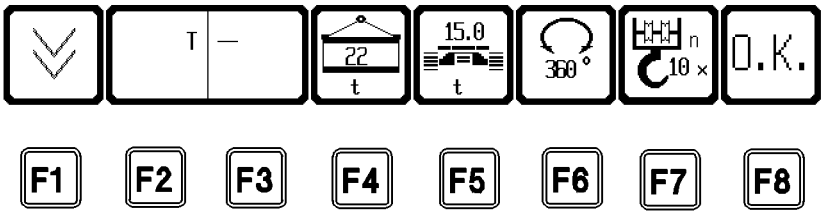
1	92 +	46 +	92 +	100 +	0 +	46 -	92 -
2	92 +	92 +	92 +	100 +	46 -	46 +	46 +
3	92 +	92 +	92 +	100 +	0 +	0 +	0 +
4	92 +	92 +	92 +	100 +	0 +	0 +	0 +
5	46 +	92 +	92 +	100 +	0 +	0 +	0 +

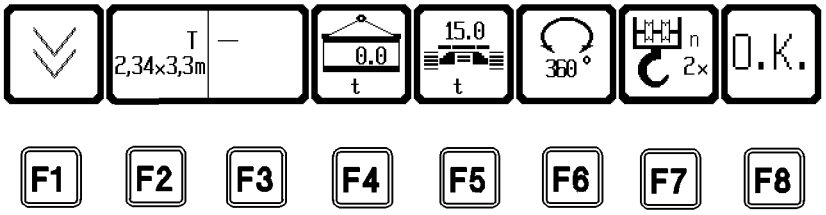
7

8

B198615

7 Extension condition of telescopic sections	• In percent [%]. • The first column contains the “boom length” icon [%]. Next to that are 5 lines for the extension condition of the telescopic sections. The number in the symbol column describes the corresponding telescopic section (highest number = outermost telescopic section). The value in the boom length column displays the extension condition of the telescope in percentages, which must be maintained for the corresponding boom length. The status indicator “+” next to the percentage boom status value means that the corresponding telescopic section must be pinned. The status indicator “-” next to the percentage boom status value means that the corresponding telescopic section can be telescoped up as far as the percentage value of the boom status under load (as in the load chart).
8 Mark for selecting telescope target	• The special function key **E1** or the special function key **E2** can be used to move the mark to the left or right. (see chapter 4.05, “Crane operation - Automatic telescoping”)


T
22
t
15.0
t
360°
n
10 x
O.K.


T
2,34x3,3m
0.0
t
15.0
t
360°
n
2x
O.K.

F1
F2
F3
F4
F5
F6
F7
F8

B102847

4.2.3 The function key line

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.
Various functions are indicated by the function key icons, or they may refer to the following changes:
– Operating mode
– Set up condition

Not all function keys have to be assigned icons on the LICCON monitor. This depends on the program selection.
Pressing a function key changes the appearance of the icon above, its meaning, or its textual content.

F1 Vertical paging
- Depending on the size of the monitor, up to 9 load chart lines can be displayed at once. If a chart consists of more than 9 lines, the display is spread over several pages. When pressing a key, the next page of the load chart will be displayed, and the number of the current page in the “general information line” will be counted up by 1. When the last page is reached, page 1 will appear again after pressing the function key **F1**.

F2 Support base
- Add or turn off the support base for the assembly / disassembly of the crane (if present).
- Example:
  2.34 x 3.3m.

F2 Main geometry status
- Options for setting the different main boom operating modes of the crane (if available). The types are described by abbreviations and length data in the icon.
- Example:
  T for **Telescopic boom**.

SHIFT and **F2**
- Previous main boom (if present).

F3 Accessories
- Options for selecting the different accessory types of the crane (if present). The types are described using abbreviations, angle and length data in the icon.
- Example:
  “K 0°” 10.8 m for the crane operation with folding jib* assembled at an angle of 0° on the telescopic boom, length 10.8 m.
- **Note:**
  Pressing the function key **F2** and/or the function key **F3** deletes all data related to the operating mode and configuration data from the monitor and sets the short code in the general information line to “CODE >????<”.
- **Operating mode dependent data:**
  - Telescopic boom length icon for the general information line.
  - Length units and weight units.
  - Load chart organization number.
  - Boom radius icon.
  - Telescopic boom lengths.
  - Telescopic boom length icon in area “Telescopic part extension status in percent [%]”.
  - Percentage telescopic section extension with status indicator.
- **Configuration dependent data:**
  - Numbering of current page number and total number of pages in load chart.
  - Radius values in length units.
  - Load values in weight units.

SHIFT and **F3**
- Previous accessory status.

F4 Counterweight (superstructure)
- Adjustment option for the current counterweight, which must be on the superstructure in order to achieve the values in the current chart.
- Example:
  “22 t ” = total counterweight of 22 t.

F5 Central ballast (chassis)
- Adjustment possibility for current central ballast, which must be on the chassis in order to obtain the values in the current chart.
- Example:
  “0 t ” = central ballast of 0 t.
  “15.0 t ” = central ballast of 15.0 t.

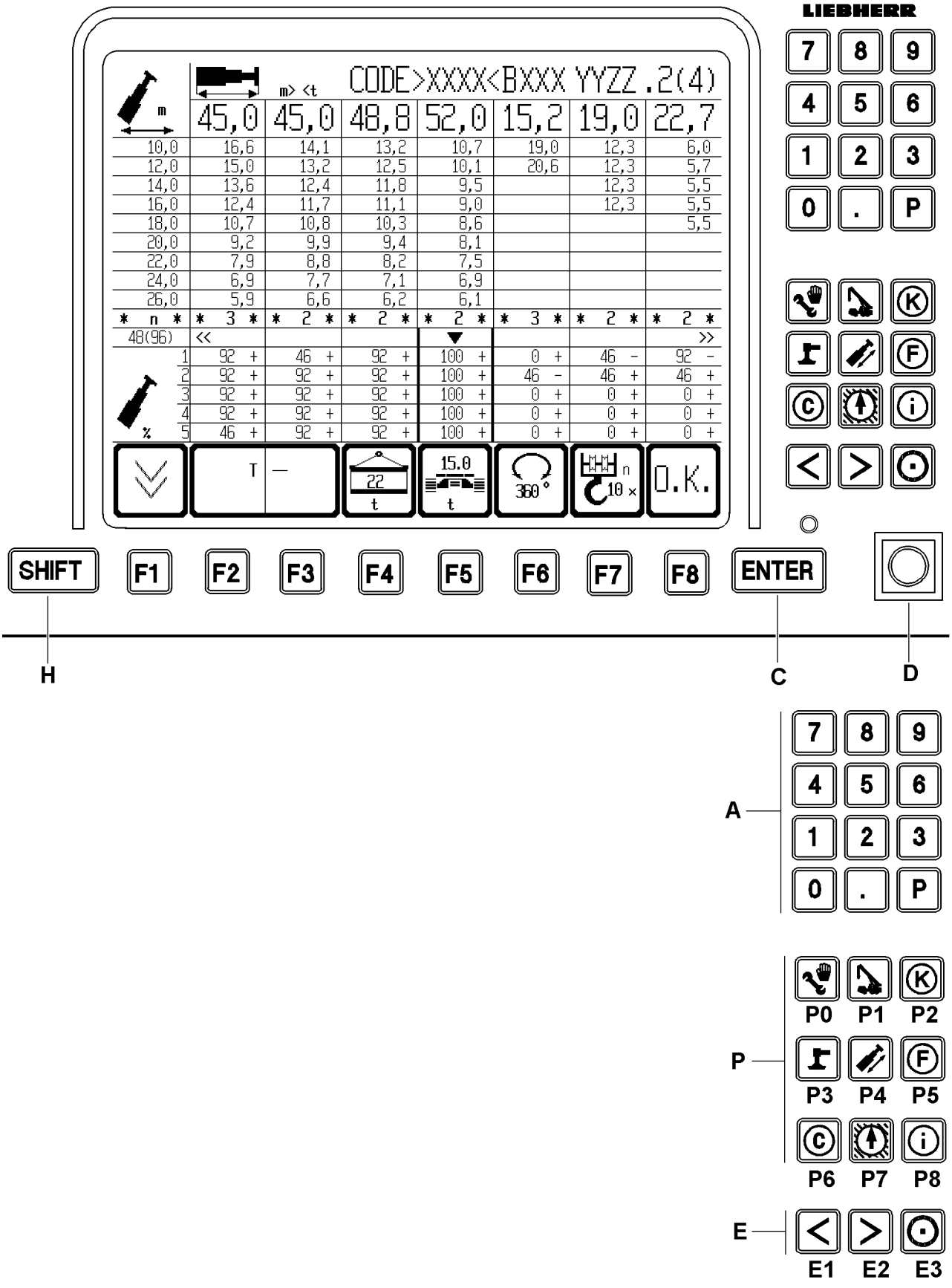
F6 Slewing range - Superstructure
- 360° working range: Unlimited rotation is possible.
- 0° working range: Toward the back (locked).

F7 Hoist rope reeving
- Option to set the number of hoist rope strands in order to reach a particular lifting capacity.
  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 for the respective operating mode. After that the count restarts from a fixed 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”.

SHIFT and **F7**
- Reduce the reeving number by 1

F8 Function key
- Confirmation of selected equipment configuration.
  Prerequisites:
  The configuration mode setting must be completed, i.e. a valid short code is displayed and load capacity values are in the chart field.
  The external conditions for this configuration state, if specified, must be fulfilled (e.g. locking the superstructure).
  In the configuration state so far, the crane must not be loaded to more than 20%, and the load on the hook must not be greater than 0.5 t. Switching to the “Crane operation” program can otherwise only be done using the program key **P1**. In that case, the newly entered equipment configuration is not accepted.
  If the crane is equipped with sliding beam monitoring*, the sliding beams must be extended to the support base specified in the selected load chart.
  If these preconditions are met, then the “O.K.” key confirms that the chosen configuration state and the selected reeving are correct and transfers the parameters to the “Crane operation” program.
  Note:
  Make sure that after switching to the crane operating screen, the chosen configuration state (short code) and the hoist rope reeving(s) have been accepted.
- Display of operating errors from the “Configuration” program.
  Operating errors caused by the “Configuration” program are displayed in the icon above the function key **F8** and in the error line for about 5 seconds. If the function key **F8** is pressed within 5 seconds, the program will switch automatically to the error determination screen in the test system and the error documentary will be displayed. The operating error will not be saved.
  Operating errors are shown at the top of the error line.

blank page!


LIEBHERR
m> <t
CODE>XXXX<BXXX YYZZ .2(4)
45,0 45,0 48,8 52,0 15,2 19,0 22,7
10,0 16,6 14,1 13,2 10,7 19,0 12,3 6,0
12,0 15,0 13,2 12,5 10,1 20,6 12,3 5,7
14,0 13,6 12,4 11,8 9,5 12,3 5,5
16,0 12,4 11,7 11,1 9,0 12,3 5,5
18,0 10,7 10,8 10,3 8,6 5,5
20,0 9,2 9,9 9,4 8,1
22,0 7,9 8,8 8,2 7,5
24,0 6,9 7,7 7,1 6,9
26,0 5,9 6,6 6,2 6,1
* n * * 3 * * 2 * * 2 * * 2 * * 3 * * 2 * * 2 *
48(96) << >>
1 92 + 46 + 92 + 100 + 0 + 46 - 92 -
2 92 + 92 + 92 + 100 + 46 - 46 + 46 +
3 92 + 92 + 92 + 100 + 0 + 0 + 0 +
4 92 + 92 + 92 + 100 + 0 + 0 + 0 +
5 46 + 92 + 92 + 100 + 0 + 0 + 0 +
%
T
22
t
15.0
t
360°
10 x
O.K.
7 8 9
4 5 6
1 2 3
0 . P
SHIFT
F1 F2 F3 F4 F5 F6 F7 F8
ENTER
H
C
D
A
P
P0 P1 P2
P3 P4 P5
P6 P7 P8
E
E1 E2 E3

B102848

4.2.4 Other operating elements

A Keypad
- Pressing the keypad deletes all operating mode and equipment configuration dependent data from the monitor.
  - The keys **0** to **9** on the keypad can be used to enter the short code directly into the LICCON monitor.
  - The key **P** and the key **.** have no function in the “Configuration” program.

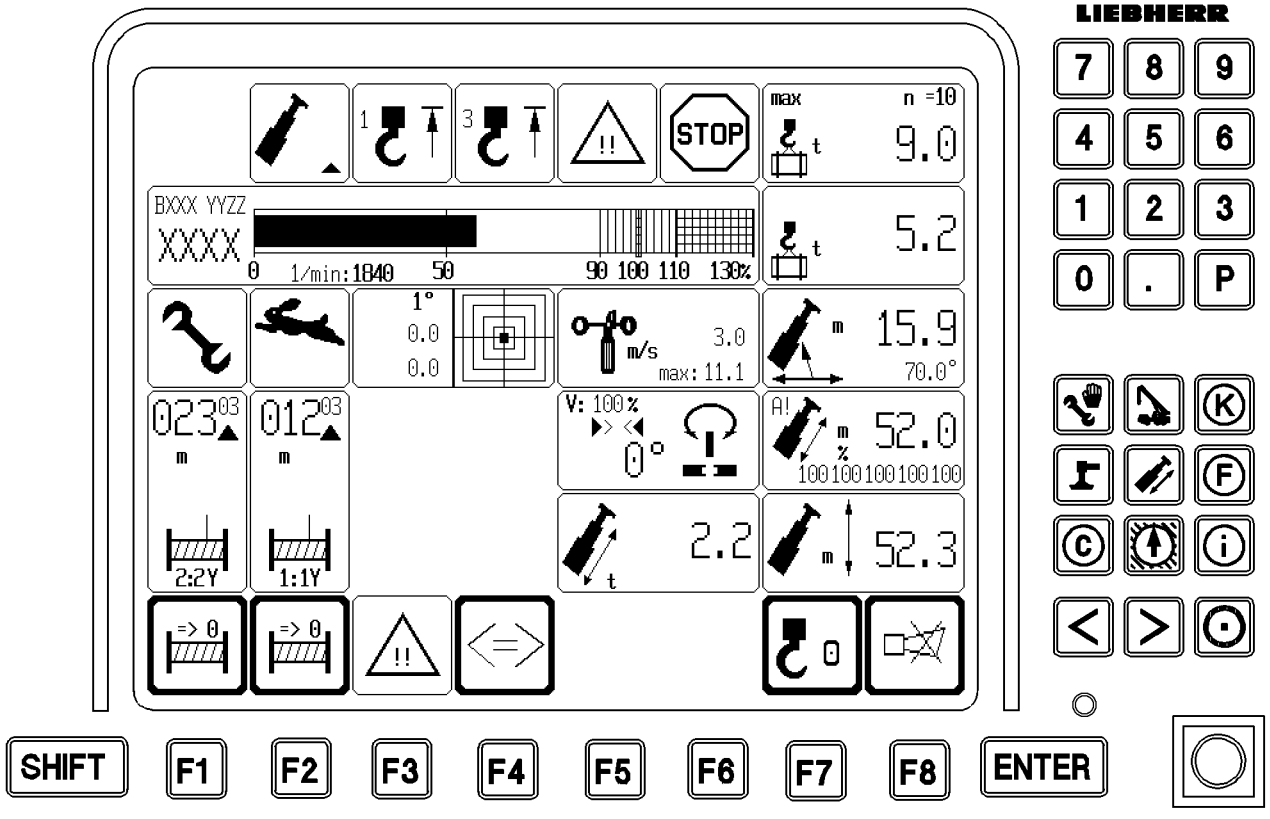
P Program keys
- Selecting from the individual programs. The settings in the Configuration program are discarded, and the equipment configuration and reeving most recently confirmed with the **O.K.** key will continue to be used.
  A program currently running **cannot** be called again using its program key.

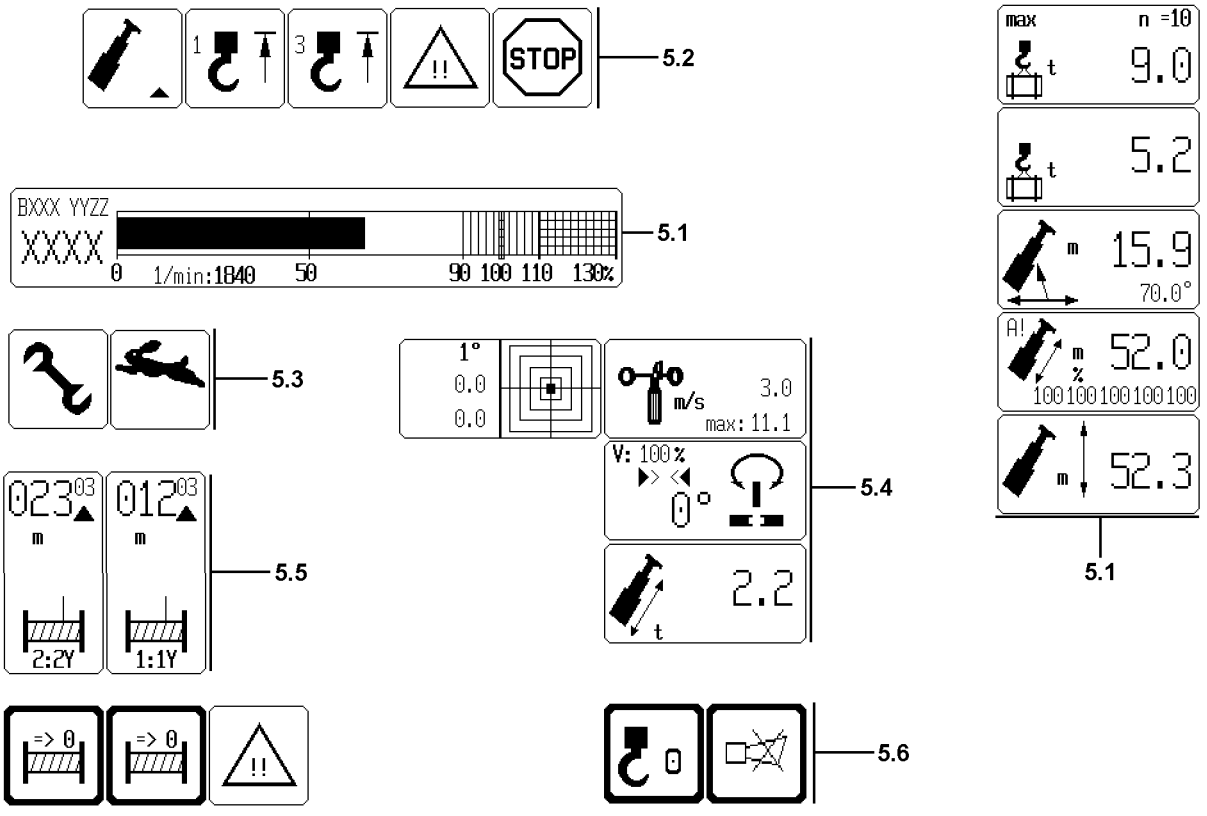
C Input key “ENTER”
- Confirmation of input both for short codes and for any change in the equipment configuration using the function keys.
- Key **Enter** after entering the short code, the code is searched for in all stored load charts. If the matching load chart has been programmed, it will be displayed in full. Otherwise there is an error message in the form of “????” in the second part of the organization number, and the acoustic signal “horn” sounds.
- Pressing **Enter** key after a changing the operating mode using the function key **F2** and the function key **F3** searches for this operating mode. If successful, sets its first equipment configuration and displays the load chart and its short code. In case of an error, the short code display remains at “CODE ????”, the organization number is displayed as “axxx???”, and the acoustic signal “horn” sounds.
- Pressing **Enter** key after a change in the configuration status using the function key **F4**, the function key **F5** and the function key **F6**, displays the load chart (if the chart exists) plus the short code on the LICCON monitor. In case of an error, the short code display remains at “CODE ????” and the acoustic signal “horn” sounds.

D Bypass key button
- Has no function in the “Configuration” program.

E Horizontal paging
- The **E1** and **E2** keys only have a function if this is indicated in the “special displays line”.
  If a load chart consists of more than seven columns, the first display of the configuration state only shows columns 1 to 7. The double arrow at the right edge of the line points to additional columns in either direction. If the cursor touches an edge with arrows, the next movement in this direction will display the next three chart columns. The cursor will then be automatically returned to the middle.

H SHIFT key
- For example Supervisory function.


LIEBHERR
STOP
max n =10
9.0
5.2
BXXX YYZZ
XXXX
0 1/min:1840 50 90 100 110 130%
15.9
70.0°
3.0
max: 11.1
52.0
52.3
2.2
2:2Y
1:1Y
7 8 9
4 5 6
1 2 3
0 . P
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER


5.2
5.1
5.3
5.4
5.5
5.6
B198618

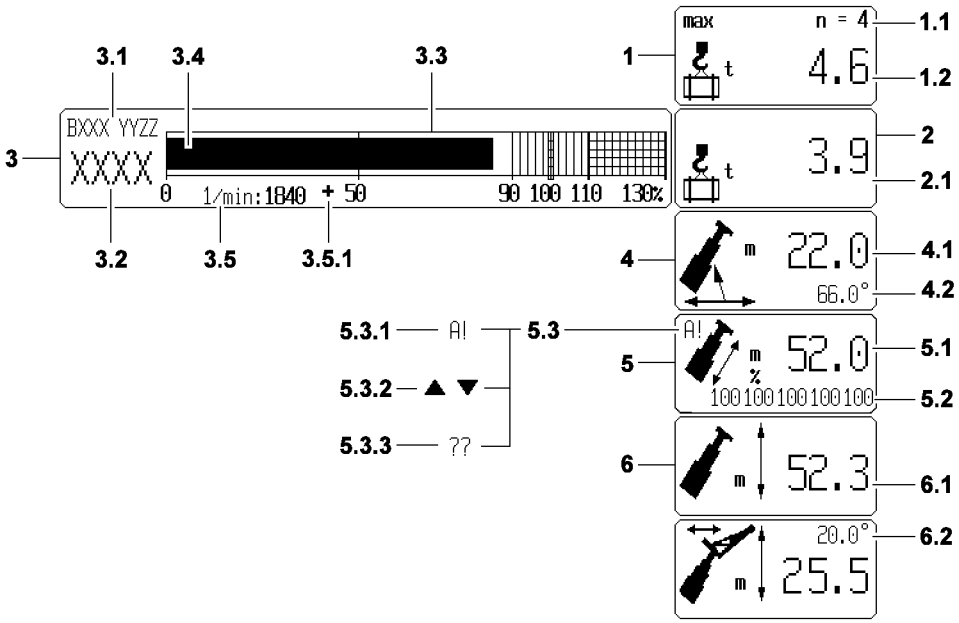
5 “Crane operation” program

The LICCON program “Crane operation” assists the crane driver by displaying clearly on the monitor the data needed for operating the crane. An acoustical signal accompanies all critical displays. Depending on the equipment, a range of other icons may also be turned on as additional displays, either as required by the crane operator, or automatically in the event of a problem.
It also alerts the crane operator to imminent overload conditions. In the event of overload and many error conditions, which could be hazardous, the system shuts off.
The monitor is divided into six areas in the “Crane operation” program:

– Crane geometry and load information **5.1**
– Alarm functions **5.2**
– Special functions **5.3**
– Monitored auxiliary functions **5.4**
– Winch display **5.5**
– Function key line **5.6**

Note
Note

▶ The monitor illustrations in this chapter are only examples. The numerical values in the individual icons and charts do not have to necessarily match the crane exactly. The configuration of the LICCON monitor with icons is only descriptive.
▶ In actual crane operations, an identical icon display will **not** appear!


max
n = 4
4.6
3.9
22.0
66.0°
52.0
100 100 100 100 100
52.3
20.0°
25.5
BXXX YYZZ
XXXX
0 1/min:1840 + 50 90 100 110 130%
A!
??
1
1.1
1.2
2
2.1
3
3.1
3.2
3.3
3.4
3.5
3.5.1
4
4.1
4.2
5
5.1
5.2
5.3
5.3.1
5.3.2
5.3.3
6
6.1
6.2

B198619

5.1 Crane geometry and load information

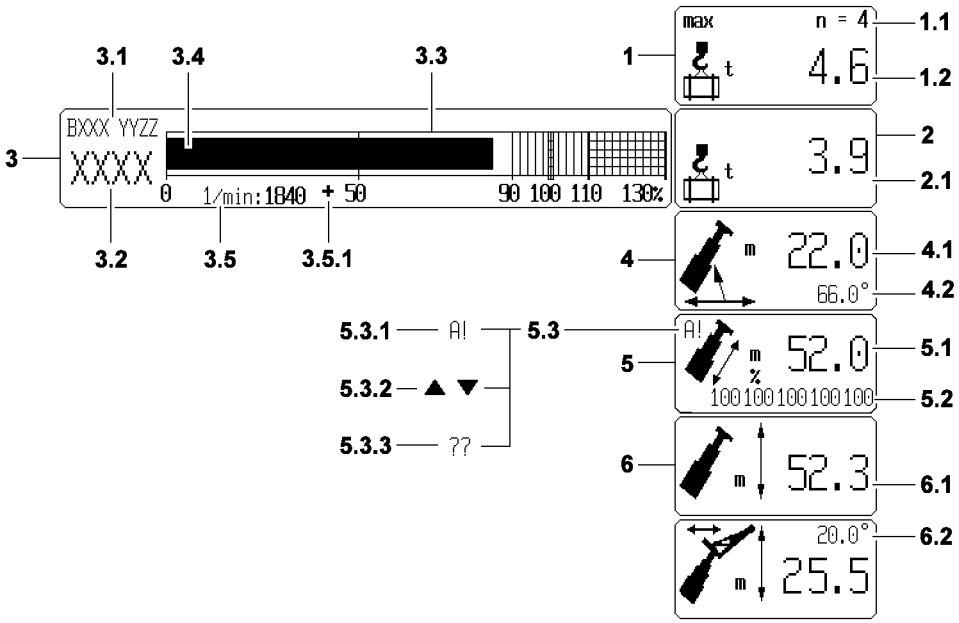
1 Icon “Maximum load”
- In [t] or [lbs].

1.1 Reeving number of hoist rope
- n = reeving number of hoist rope that is reeved at the pulley head selected via the load chart (previously selected in the “Configuration” program).

1.2 Maximum load according to load chart and reeving
- In [t] or [lbs].
- It depends on:
  - The selected operating mode.
  - The selected configuration (load chart).
  - The boom radius.
  - The hoist rope reeving.
  - **Note:**
    “? ? ? . ?” if a value in the load chart cannot be accessed, for example because the crane is not within the load chart range, or one or more sensors are missing or so defective, so that the radius cannot be calculated.

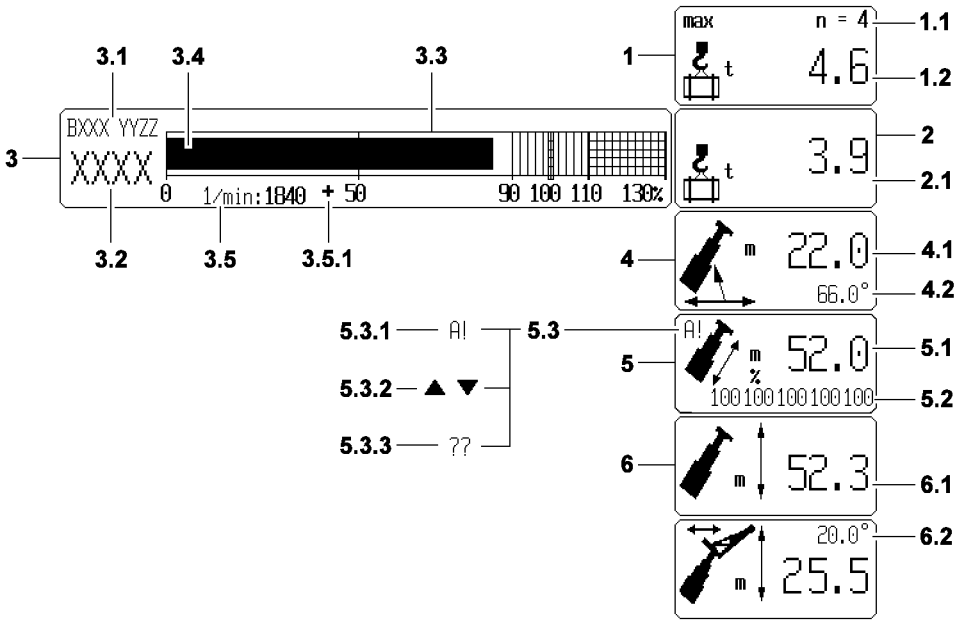
2 “Current load” icon
- In [t] or [lbs].

2.1 Current load
- Actual load display = load in [t] or [lbs] that is currently suspended from the crane hook.
- Display of the calculated total load including the weights of the support, the lifting and / or the attachment equipment.
  By using the function “tare” (see description of function key **F7** in section “Function key icon line”) the display can be changed over to display the net load. In addition, the word “net” appears in the icon, the unit of weight is then shown directly next to the load icon.
- **Note:**
  “? ? ? . ?” is displayed if one or more sensors are missing or so defective that the current load cannot be calculated.


max
n = 4
4.6
3.9
22.0
66.0°
52.0
100 100 100 100 100
52.3
20.0°
25.5
BXXX YYZZ
XXXX
0 1/min:1840 + 50 90 100 110 130%
A!
??
1
1.1
1.2
2
2.1
3
3.1
3.2
3.3
3.4
3.5
3.5.1
4
4.1
4.2
5
5.1
5.2
5.3
5.3.1
5.3.2
5.3.3
6
6.1
6.2

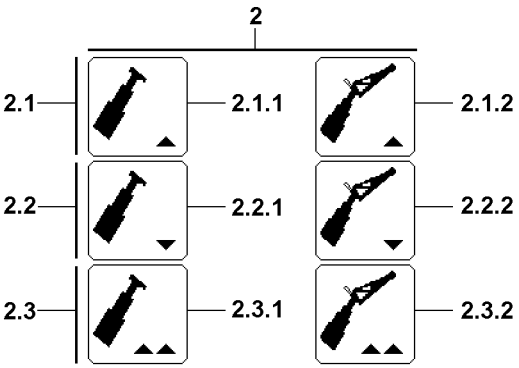
B198619

3	"Dynamic utilization bar display" icon	
3.1	8-digit organization number	• Identifies the type of load chart that has been selected and the operating mode.
3.2	Short code	• Identifies the selected equipment configuration.
3.3	Utilization scale	• Marking from load of 90%: **Advance warning.** • Marking at 100% load: **STOP shut-off.**
3.4	Utilization bar of crane	• According to load chart and reeving.
3.5	Engine RPM	• In [rpm]. • **Note:** "????" is displayed for an invalid RPM value (for approximately 10 seconds). A fixed RPM is set in the event of a problem. The digital display blinks, and an error message is displayed.
3.5.1	Engine RPM lock	• The engine RPM can be locked on the master switch. If the engine RPM has been locked, the icon "+" appears behind the RPM display.
4	Icon "Boom radius"	
4.1	Radius	• In [m] or [ft]. Identifies the horizontal center of gravity distance of the load (on the load hook selected by the operating mode) from the center of rotation of the 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 displayed, if geometrical data or sensor values are missing, so that the radius cannot be calculated.
4.2	Main boom angle to the horizontal	• In [°]. • **Note:** "? ? ? . ?" is displayed, when the geometrical data or the sensor values are missing, so that the main boom angle cannot be calculated.


max
n = 4
4.6
3.9
22.0
66.0°
52.0
100 100 100 100 100
52.3
20.0°
25.5
BXXX YYZZ
XXXX
0 1/min:1840 + 50 90 100 110 130%
A!
??
1
1.1
1.2
2
2.1
3
3.1
3.2
3.3
3.4
3.5
3.5.1
4
4.1
4.2
5
5.1
5.2
5.3
5.3.1
5.3.2
5.3.3
6
6.1
6.2

B198619

5	Icon “Main boom length”	
5.1	Length of main boom	• In [m] or [ft].
5.2	Extension condition of individual telescopic sections	• In [%]. Order: Telescope 1 to telescope 5 from left to right.
5.3	TELEMATIC	• Special functions in “Crane operation” program. **Note:** In the “Main boom length” icon all the information required is displayed to enable an experienced crane operator to telescope the telescopic boom to a desired length without switching to the “Telescoping” program.
5.3.1	Preselected telescoping target reached	
5.3.2	Nominal deflection direction of master switch	• Request: Telescope in = down arrow. • Request: Telescope out = up arrow.
5.3.3	Error in system	
6	Icon “Pulley head height”	
6.1	Pulley head height	• In [m] or [ft]. • Identifies the vertical distance from the crane base to the selected pulley head axle, to which the displayed maximum load applies. • **Note:** “? ? ? . ?” is displayed, when the geometric data or the sensor values are missing, so that the pulley head height cannot be calculated.
6.2	Angle of hydraulically adjustable folding jib (**TNZK**)*	• In [°]. • The display is in the form of the relative angle between the telescopic boom head and the folding jib. • **Note:** “? ? ? . ?” is displayed, when the geometry data or the sensor values are missing, so that the angle of the hydraulically adjustable folding jib cannot be calculated.



B104778

5.2 Alarm functions

The limit ranges of the crane movements are monitored. The crane operator is alerted that the limits are reached by fading in of the following blinking icons.

5.2.1 Boom limitation

2 Icon “Boom limitation”
- The luffing range of the boom is limited both upwards and downwards. This symbol appears if an end-position determined by the load chart is reached when luffing the boom, or when luffing up the boom is disabled by a proximity switch.

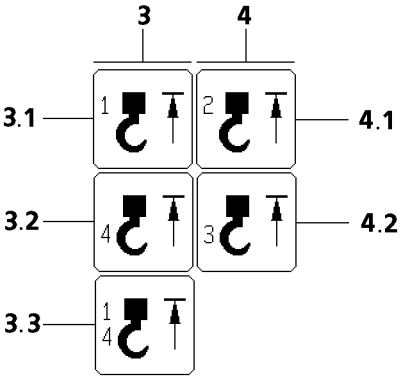
Shut off of upper / lower limit angle

2.1 Arrow pointing up
- The arrow shows that the main boom was shut off because it triggered the upper limit. During telescoping operation the icon **2.1.1** is shown on the LICCON monitor.
  If the folding jib is attached and configured, the arrow remains unchanged however the icon **2.1.2** is shown on the LICCON monitor.
  Note:
  Luffing down the main boom is still possible.

2.2 Arrow pointing down
- The arrow shows that the shut off of the main boom was due to triggering the lower limit. During telescoping operation the icon **2.2.1** is shown on the LICCON monitor.
  If the folding jib is attached and configured, the arrow remains unchanged however the icon **2.2.2** is shown on the LICCON monitor.
  Note:
  Luffing up the main boom is still possible.

Shut-off Steep boom*

2.3 Double arrow pointing up
- The double arrow indicates that the proximity switch on the turntable has shut off the main boom and folding jib. During telescoping operation the icon **2.3.1** is shown on the LICCON monitor.
  If the folding jib is attached and configured, the arrow remains unchanged however the icon **2.3.2** is shown on the LICCON monitor.
  Note:
  Luffing down the main boom is still possible.



B198397

5.2.2 Hoist top limit switch HES1 and HES4*

3 Icons “Hoist top on HES1 / HES4* ”

- In order to prevent the crane from being operated without hoist limit switches (HES), the minimum hoist limit switch configuration is continuously monitored. Four hoist limit switches are possible.
  An “operating error” is issued if a movement, which is shut off by the hoist limit switch, is actuated anyway.
  A “system error” is issued if a obligatory bus sensor is missing or an active bus sensor is defective.

3.1 HES1

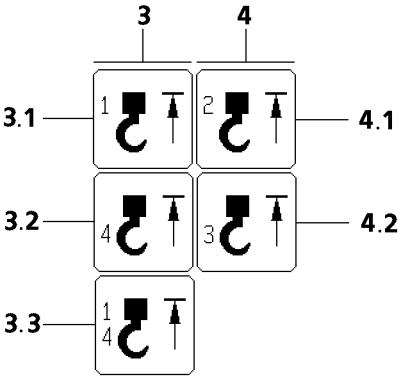
- Location: Telescopic boom head, right.
  Bus address: 28
  Switch: -S930.
- The icon appears if:
  - The hook block moves against the HES1 at the right telescopic boom head.
  - HES1 is not active, although it must be present on the bus.
  - HES1 has an internal error.
- **Note:**
  The crane movements spool up hoist winch, luff down telescopic boom and telescope out the telescopic boom are shut off.

3.2 HES4*

- Location: Telescopic boom head, left* or boom nose*.
  Bus address: 24
  Switch: -S931.
- The icon appears if:
  - The hook block runs against the HES4 at the left telescopic boom head* or on the boom nose*.
  - HES4 is not active, although it must be present on the bus.
  - HES4 has an internal error.
- **Note:**
  The crane movements spool up hoist winch, luff down telescopic boom and telescope out the telescopic boom are shut off.
  The HES4 must be plugged in in operation mode “Boom nose”.

3.3 HES1 and HES4*

- The icon appears when icon HES1 **3.1** and HES4 **3.2** appear simultaneously.



B198397

5.2.3 Hoist top limit switch HES2* and HES3*

4 “Hoist top at HES2* / HES3* ” icons .

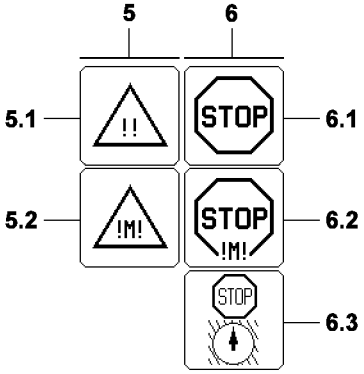
- In order to prevent the crane from being operated without hoist limit switches (HES), the minimum hoist limit switch configuration is continuously monitored.
  An “operating error” is issued if a movement, which is shut off by the hoist limit switch, is actuated anyway.
  A “system error” is issued if a obligatory bus sensor is missing or an active bus sensor is defective.

4.1 HES2*

- Location: Single folding jib* or auxiliary boom*.
  Bus address: 27
  Switch: -S940.
- The icon appears if:
  - The hook block moves against HES2 on the single folding jib* or on the auxiliary boom*.
  - HES2 is not active, although it must be present on the bus.
  - HES2 has an internal error.
- **Note:**
  The crane movements spool up hoist winch, luff down telescopic boom and telescope out the telescopic boom are shut off.
  The HES2 must be plugged in in operation mode “Single folding jib” or “Auxiliary boom”.

4.2 HES3*

- Location: Double folding jib*
  Bus address: 26
  Switch: -S945
- The icon appears if:
  - The hook block moves against the HES3 on the dual folding jib*.
  - HES3 is not active, although it must be present on the bus.
  - HES3 has an internal error.
- **Note:**
  The crane movements spool up hoist winch, luff down telescopic boom and telescope out the telescopic boom are shut off.
  The HES3 must be plugged in in operation mode “Dual folding jib”. If this is not the case, an “LMB STOP” is triggered and an operating error message is also transmitted.



B197632

5.2.4 Load chart capacity, exceeded, working range limitation*

5 “Advance warning” icon

5.1 Load chart utilization
- The current load chart utilization is calculated from the “current load” and the “maximum load according to the load chart and the reeving”. The icon “Advance warning” appears, if the current load chart capacity exceeds the (**90%**) limit programmed in for advance warning.

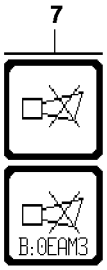
5.2 Engine monitoring
- If a warning event occurs in the engine monitoring system, the “Engine monitoring advance warning” icon is displayed on the LICCON monitor.

6 Icon “STOP”

6.1 Load carrying capacity exceeded
- The “STOP” icon is displayed if the load chart load (“current load” **>** “maximum load according to the load chart and the reeving”) exceeds the **100% mark**.
- **Note:**
  All crane movements that increase the load momentum are shut off.

6.2 Engine monitoring
- If a STOP event occurs in the engine monitoring system, an automatic switch-over (from the program “Operation”, “Support” or “Telescoping”) is activated into the program “Engine monitoring”.

6.3 Working range limitation*
- If a programmed working range limit* is reached, this condition is indicated by the STOP icon Working range limitation* **6.3** instead of the standard icon “LMB-STOP” **6.1** is displayed.
  Note:
  If an LMB-STOP occurs simultaneously, the STOP Working range limitation* **6.3** icon continues to be displayed. The LMB-STOP is identifiable if the load capacity bar exceeds 100% or if a maximum load of 0 t is permitted.



B197633

5.2.5 Horn

7 Icon “Horn”

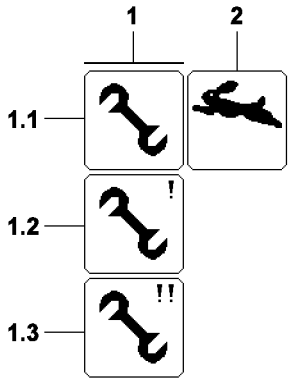
- Acoustical signal.
- Sounds in addition to the optical display (for example, E:1TMS) of detected operational errors, leading to interruption of a movement, and application errors with error number (such as sensor errors, which occurred due to insufficient sensor signals or due to defective sensors).
  “Horn” is a beeping sound of a duration of approximately 0.5 seconds, which is repeated in a second cycle.
- **Operational errors are:**
  - Overload.
  - Boom outside the angle range of the load chart.
  - Boom outside radius range of the load chart.
  - Extension condition of telescopic sections not in accordance with the load chart.
- **The following sensors are monitored:**
  - Hoist limit switch
  - Length sensors
  - Angle sensors
  - Pressure sensors
  - Wind sensor
  - Battery voltage
  - Inductive sensors

“Short horn”

- Sounds in addition to the visual display of error messages without an error number and which do not lead directly to crane movement shut off by the LICCON overload protection.
  “Short horn” is a beeping sound of a duration of approximately 0.1 seconds, which is repeated in a second cycle.
- **The following errors are monitored:**
  - Maximum permissible wind speed exceeded (only for activated wind sensor*).
  - Maximum or minimum support force exceeded (only with active support force monitoring*).
  - Crane load value for “caution” (90%) reached.

Priority and “Horn off”.

- The “horn” alarm has higher priority than the “short horn” alarm, i.e. “horn” takes preference over “short horn”.
- The “horn”, as well as the “short horn” of the monitor may be turned off by function key **F8**.
- If an operational error is present, press the function key **F8** again to automatically change into the error determination screen of the test system. The error is displayed there in documentary form.
- **Note:**
  The “horn”, as well as the “short horn” immediately become active again if an error recurs.



B197634

5.3 Special functions

For special functions, see also chapter 4.04.

DANGER
Risk of fatal injury!
- ▶ All LMB overload protection **shut downs** and “hoist up” are **ineffective** in the assembly operating modes!
- ▶ This can lead to life-threatening situations.
- ▶ The crane operator bears **full** responsibility for his actions and safe operation of the crane.

Note
- ▶ The various icons **1** are shown on the same position in the LICCON monitor, depending on the operating mode.

5.3.1 Assembly operation

1.1 Assembly

- The icon blinks:
  - When the crane control is bypassed via the bypass key button **D**.
    Note:
    The Operation program is locked, meaning, no other program can be turned on via the program keys.
    or
  - When the crane control is bypassed in active shut off (overload safety load moment limiter, “hoist top”) via the bypass key button **D**.

5.3.2 Emergency operation

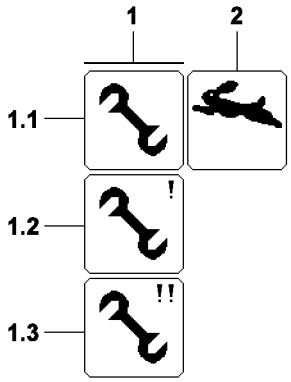
1.2 Emergency operation without assembly

- The icon blinks during emergency operation: Key switch **-S81** or plug **-XNOT.S** is activated. If the bypass key button **D** is **not** switched to “assembly”.
  Note:
  The “Operation” program is **not** locked in this case.

5.3.3 Bypass of load moment limiter emergency operation*

1.3 Emergency operation and assembly

- The icon blinks if:
  - “Assembly” is switched via the bypass key button **D** and emergency operation is switched via the key switch **-S81** or plug **-XNOT.S**.
    or
  - The key button **-S82** in the control cabinet was used to turn on the “Load moment limiter bypass, emergency operation”.

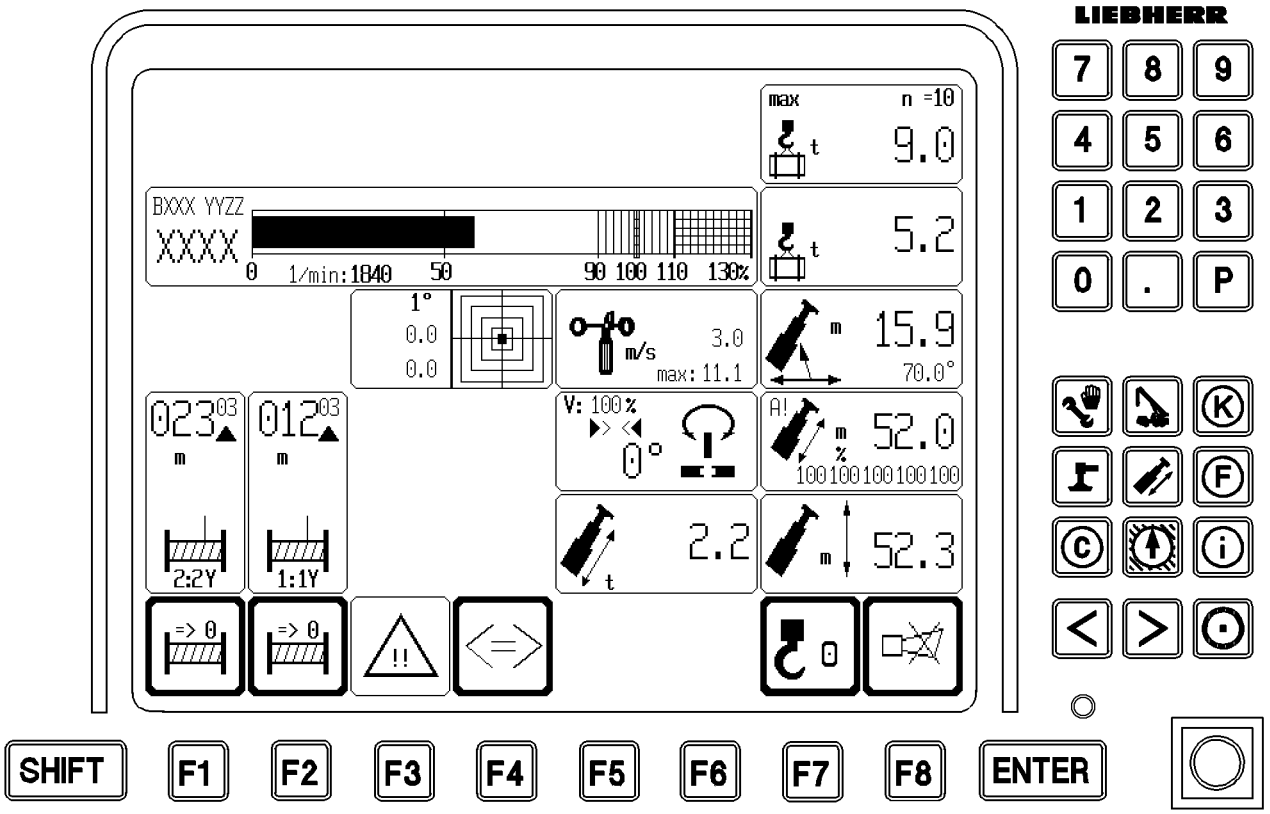


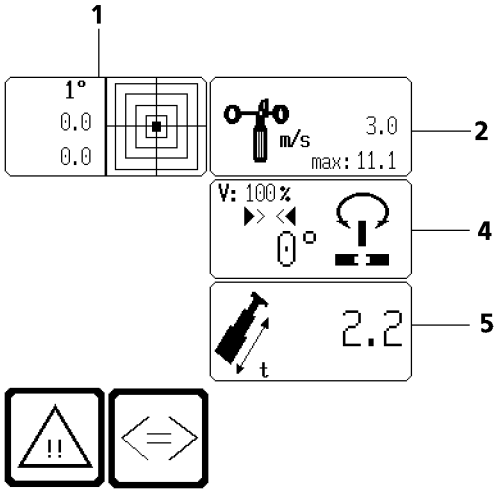
B197634

5.3.4 Fast mode (rapid gear)

2 “Fast mode” icon

- The icon appears if rapid gear is enabled during a crane movement.
- This is possible for the following crane movements:
  - Lift / lower hoist gear 1.
  - Lift / lower hoist gear 2.
  - Luff up boom.


LIEBHERR
7
8
9
4
5
6
1
2
3
0
.
P
max
n =10
9.0
5.2
BXXX YYZZ
XXXX
0
1/min:1840
50
90 100 110 130%
1°
0.0
0.0
3.0
m/s
max: 11.1
15.9
70.0°
023 03
012 03
m
2:2Y
1:1Y
V: 100%
0°
A!
52.0
100 100 100 100 100
2.2
52.3
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER


1
1°
0.0
0.0
3.0
m/s
max: 11.1
2
V: 100%
0°
4
2.2
5

B198620

5.4 Monitored auxiliary functions

There are several monitored auxiliary functions that can be displayed when required or automatically:
– Auxiliary functions for crane operation.

The monitoring of all auxiliary functions is always active, only the icons may be hidden. The icons of the monitored auxiliary functions have their fixed place on the LICCON monitor.

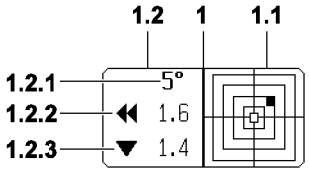
5.4.1 Auxiliary functions for crane operation

Using the function key **F3**, you can show the icons for the monitored auxiliary functions. Since not all icons of the auxiliary functions fit on one page (at maximum assignment), they are split over two pages. The icons on page 2 (if available) can be shown with the function key **F4**.
Page 1:
Crane incline **1**
Wind speed **2**
Slewing range **4**
Telescopable load **5**

Page 2:
Not assigned.

If an error occurs in one or more of these monitored functions, this is displayed in the “Crane operation” program, as follows:

- Monitored auxiliary functions **turned off F3**:
- Error in one function on page 1:
  Icon is displayed on page 1.
- Error in one function on page 2:
  Icon is displayed on page 2.
- Error in a function on page 1 and 2:
  Icon is displayed on page 1 and icon for **F4** blinks (= indicates an error in a function on page 2).
- Monitored auxiliary functions **turned on F3**:
- No error:
  Optional icons (optional) are displayed.
  If there are also optional icons on page 2, the icon “change page” of the **F4** key is activated (= indication for switching option).
- Error in one function on page 1:
  Icon has been previously displayed.
- Error in one function on page 2:
  Icon “change page” blinks (= indication regarding an error of a function on the other page).
- Error in a function on page 1 and 2:
  Icon is displayed on page 1.
  Icon “change page” blinks (= indication regarding an error of a function on the other page).



B197636

1 “Incline” icon
- Display of the incline of the superstructure to the horizontal in longitudinal and lateral direction. The display is graphic as well as numeric.

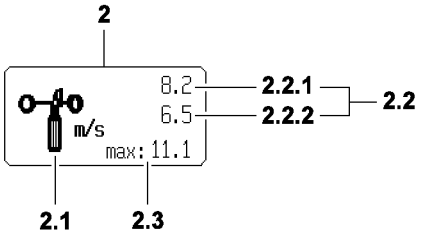
1.1 Graphic part
- The graphic display is in the form of a spirit level, with a moving dot (small square) representing the air bubble. The center of the dot shows the precise incline value.

1.2 Numeric part

1.2.1 Incline range
- Value either 1° or 5°.
  This value describes the distribution of the graphic illustration and can only assume the two values “1°” or “5°”.
- If the incline is less than 1° in lateral direction **and** in longitudinal direction, the level moves within the 1° range.
  Note:
  With the maximum deflection this corresponds to 1°.
- If at least one value exceeds the 1° limit, it switches to the 5° range.
  Note:
  With the maximum deflection this corresponds to 5°.
- The range change is automatic.

1.2.2 Crane incline
- In [°] in lateral direction.
- The double arrow shows the direction of incline:
  - Double arrow to left = crane is inclined to the left.
  - Double arrow to right = crane is inclined to the right.

1.2.3 Crane incline
- In [°] in longitudinal direction.
- The arrow shows the direction of incline:
  - Up arrow = crane is inclined to the rear.
  - Down arrow = crane is inclined to the front.

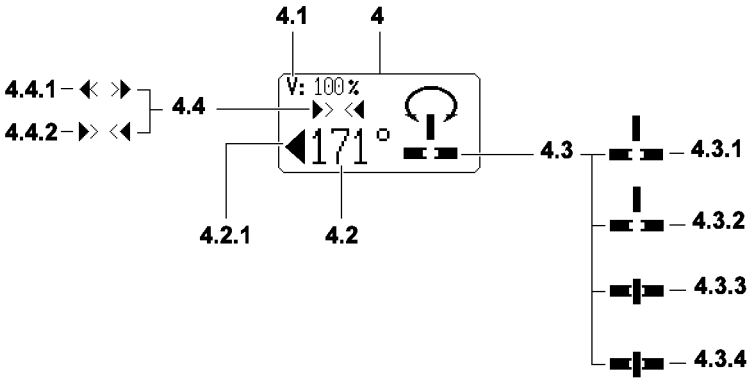


B197637

2	Icon “Wind speed”	• The wind speeds are displayed in [m/sec.] or [ft/sec.] depending on the units of measurement shown in the load chart.
2.1	Icon “Wind speed”	• In [m/sec.] or [ft/sec.].
2.2	Current wind speeds	
2.2.1	Current wind speed WG	• In crane operation with equipment / accessories: **TK**, **TNZK**. • **Note:** If several wind sensors are attached to the LSB bus, the location of the wind sensor determines the corresponding display in the icon “wind speed”. The priority depends on the location of the wind sensor, from “outside” (accessory) to “inside” (telescopic boom). 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**. **Note:** If only one wind sensor is installed and connected to the LSB bus, the wind speed is displayed in **2.2.1**.
2.2.2	Current wind speed WG	• If two wind sensors are installed and connected to the LSB bus, the wind speed of the “inner” wind sensor is displayed in **2.2.2**.

Note
Note
▶ If no wind sensor is connected to the LSB bus, **“????”** appears in the display.

2.3	Maximum permissible wind speed	• With icon text “max:” • The value depends on the operating mode and the equipment configuration. **Note:** If access to a load chart is not possible, then the maximum value starts to blink and the acoustic alarm “short horn” sounds. If the current wind speed value exceeds the displayed maximum value, the maximum value starts to blink and the acoustic alarm “short horn” sounds. **The crane movements will not be shut off!**



B197639

4	Icon “Slewing range”	
4.1	Maximum slewing speed	• V: [%] • Identifies the current (selected) “maximum slewing speed” of the slewing gear with a fully deflected master switch, relating to the maximum attainable slewing speed of the slewing gear at a preselected speed of 100%. This value may be selected in fixed percentage stages in the LICCON program “Control Parameter”.

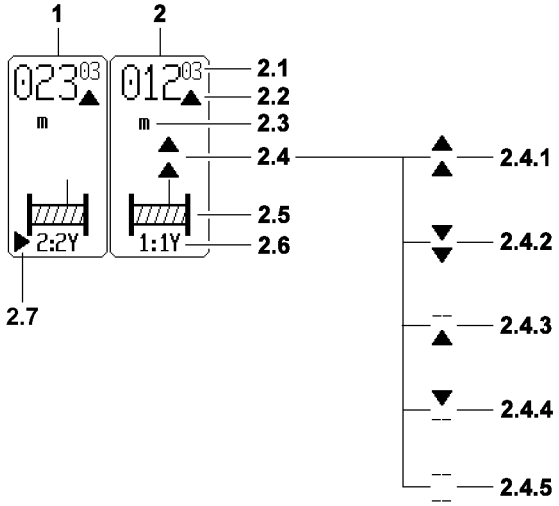
DANGER
Danger of accidents in case of excessive slewing speed!
▶ Make the preselection according to the specifications in the load chart.

4.2	Current superstructure position*	• In relation to the main working direction “to the rear” (0 [°]). Increases clockwise to a maximum value of 180°.
4.2.1	Deviation direction	The arrow in front of the value indicates the deviation direction. • Arrow to the right: Turn to the right. • Arrow to the left: Turn to the left.
4.3	Status of lock between superstructure and chassis	
4.3.1	Lock is static	• Locking pin on top: Superstructure unpinned.
4.3.2	Lock is blinking	• Locking pin in intermediate position: Error.
4.3.3	Lock is static	• Locking pin bottom, ±5° in length axle: Superstructure pinned in length axle.
4.3.4	Lock is blinking	• Locking pin bottom, ±5° **not** in length axle: Superstructure pinned.
4.4	Slewing gear operating mode	
4.4.1	Flexible slewing gear* “freely rotating”	
4.4.2	Flexible slewing gear* “fixed”	

B197640

5 Icon “Telescopable load”

- This icon is automatically shown if “telescoping” crane movement has been selected and the telescopic boom is still pinned.
  The weight unit [t] or [lbs] defined in the load chart is displayed in the icon, under which the selected telescopic section can still be unpinned and then telescoped.
- The displayed value begins to flash and the acoustic alarm “short horn” sounds, if the load on the hook is greater or if the displayed value is “0”.
- If the telescopic boom is not pinned, the icon “Maximum load” **1** shows the same value as the icon “Telescopable load” **5** and the icon “Telescopable load” **5** no longer appears automatically, but only after pressing the function key **F3**.



B197641

5.5 “Winch display” icon

1 Icon “Winch2”

- The meanings for the icons for winch1 and winch2* are the same, and are explained at the icon “winch1” **2**.

2 Icon “Winch 1”

2.1 Travelled distance

- In [m] or [ft].
  From a zero point which must be determined.
- For a single operation with the reeving setting made in the “Configuration” program: Completed hook path.
  For parallel operation: Distance completed by hook block.
- The positions before the decimal point are displayed with up to 3 large digits. The digits after the decimal point are displayed with small digits. (Also refer to the description of the function key **F1** and function key **F2**).
- A precondition for a correct display is that the value entered equals the actual number of rope strands between the boom head and the hook block.
  If the set reeving does not correspond with the reeving of the appropriate winch (for example, winch on the boom nose at a set load capacity table for the main boom), the correct block travel can be calculated from the displayed hook travel as follows:

$$s_{Hk} = \frac{s_{Ha} \times n_e}{n_t}$$

Legend:

- s_{Hk} = correct hook path
- s_{Ha} = displayed hook path
- n_e = selected reeving
- n_t = actual reeving
- 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.
- **Note:**
  The length display (hook travel display) is only accurate and the layer sheer is only taken into account correctly if the winch has been calibrated and no interruptions of the CPU power supply have occurred (cold start). The hook travel display is calibrated by spooling the rope up or out until the calibration switch reacts.

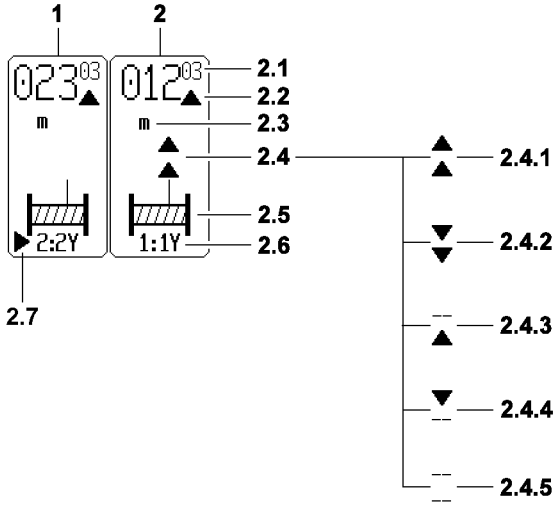
2.2 Direction of hook movement

The arrows on the length value show the direction of the hook movement in relation to the zero point:

- Arrow pointing up: Hook has moved upward from the zero point.
- Arrow pointing down: Hook has moved down from the zero point.

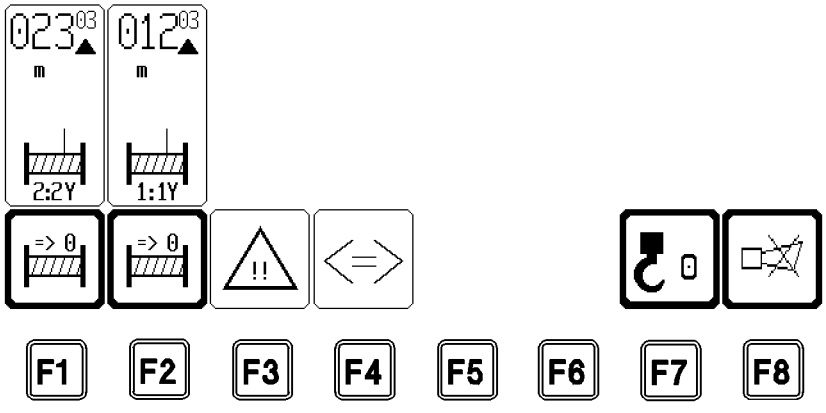
2.3 Length unit for hook path display

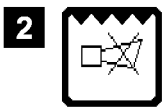
- In [m] or [ft].



B197641

2.4	Winch status display	• There are five winch status icons (all flashing):
2.4.1	Spool out	
2.4.2	Spool up	
2.4.3	Spooled out.	• Spooling out is blocked.
2.4.4	Spooled up	• Spooling up is blocked.
2.4.5	Winch is deactivated or unplugged	• Spooling up and spooling out are blocked (via “Control parameter” program). • **Note:** If no winch status icon appears, the activated winch is inactive and is neither spooled up nor spooled out.
2.5	Winch icon	• (With rope end for winch status icon).
2.6	Winch number with master switch number and master switch operating direction	• Example: 1 : 1 Y First digit: Winch number. Second digit: Master switch number. Letter: Master switch operating direction.





B197642

5.6 The function key line

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 may change their appearance when a key is pushed (function keys) and thereby their definition.
Not all function keys must have assigned icons. This depends on the “active” program selection.
Pressing a function key changes the appearance of the icon above, its meaning, or its textual content.

Note

▶ The function key icons **F3** to **F6** have different assignment in the programs “Crane operation” and “Driving mode superstructure”.

5.6.1 Crane operation

F1 Function key
- Zero point for hook travel display winch2.
- Pressing the function key **F1** causes the “set winch display to zero” icon to appear, i.e. the winch2 hook path display in the winch icon above is set to “000.00” when the key is pressed. The path measurement begins here.

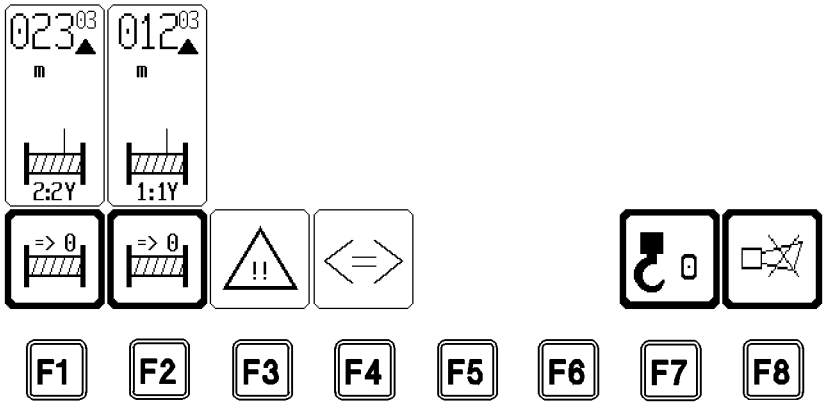
F2 Function key
- Zero point for hook travel display winch 1.
- Pressing the function key **F2** causes the “Set winch display to zero” icon to appear, i.e. the winch1 hook path display in the winch icon above is set to “000.00” when the key is pressed. The path measurement begins here.

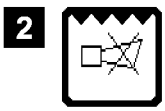
F3 Function key
- Turn monitoring icons on / off.
- The function key **F3** can be used to turn all the monitored auxiliary functions in the crane on or off.
- The appearance of the icon changes according to the condition:
  - “Thick border” = auxiliary function icons turned off.
  - “Thin border” =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

F4 Function key
- Change monitoring page (if present).
  See also section “Monitored auxiliary functions”.

F5 Function key
- Not assigned.

F6 Function key
- Not assigned.





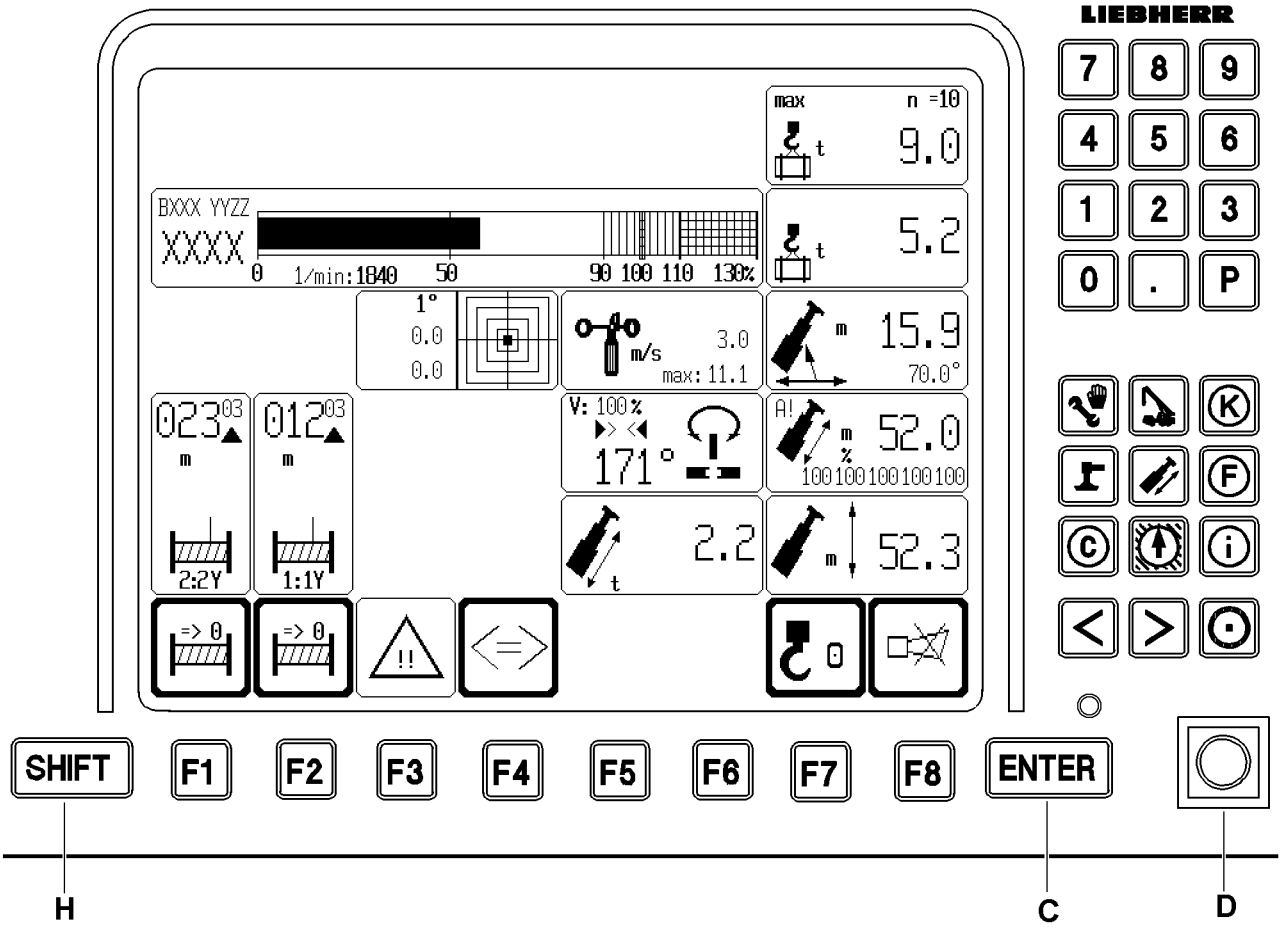
B197642

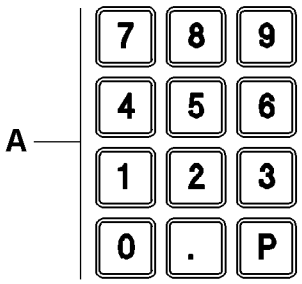
F7 Function key

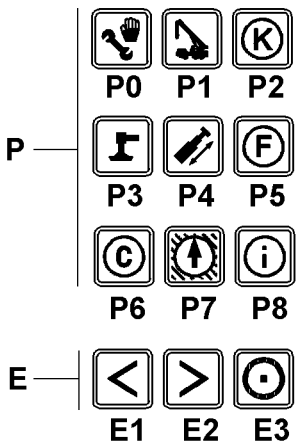
- Taring.
- When the function key **F7** is pressed, the actual load display is set to “zero”. At the same time, the word “net” appears in the icon of the actual load display. This function, for example, makes it possible to eliminate the weights of the hoist rope, load carriers, lifting and attachment equipment and only display the weight of the load that must be lifted (net load).
  If the taring is cancelled, the word “net” disappears from the icon “Actual load display” and the gross load value is displayed.
- Taring is cancelled by one of the following three actions:
  - Pressing the function key **F7** again.
  - Telescoping the boom by more than 3 LE (dm or 1/10 ft.).
  - Luffing by more than ±4°.

F8 Function key

- Turn off horn / error diagnostics.
- Turn off the acoustic warning.
  The “horn” and “short horn” acoustic warnings can be turned off by pressing the function key **F8**.
  A new error turns the acoustic warning on again.
- Error message in “Horn” icon.
  If a system, application or operating error occurs, an error message appears in the “Horn” icon (refer to illustration **1**).
  Example: E:0EAM1
  By pressing the function key **F8** twice, the acoustic warning is turned off and the “Test system” program switches to the error determination screen where the error is documented.
- Special function “Horn” icon.
  A special program is available for crane acceptance in the LICCON computer system. This program is blocked after completion of crane acceptance. If an additional marking is displayed in the “Horn” icon (talons along the upper margin, see illustration **2**), this means that the acceptance program is not yet blocked. Contact LIEBHERR Service immediately.
  In order to prevent error functions, access to the special program is only permitted for trained LIEBHERR personnel.


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
max n =10
9.0
5.2
BXXX YYZZ
XXXX
0 1/min:1840 50 90 100 110 130%
1°
0.0
0.0
3.0
max: 11.1
15.9
70.0°
023 03
012 03
m
2:2Y
1:1Y
V: 100%
171°
52.0
100 100 100 100 100
2.2
52.3
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
H
C
D


A
7 8 9
4 5 6
1 2 3
0 . P


P
P0 P1 P2
P3 P4 P5
P6 P7 P8
E
E1 E2 E3

B198621

5.7 Other operating elements

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

A Keypad

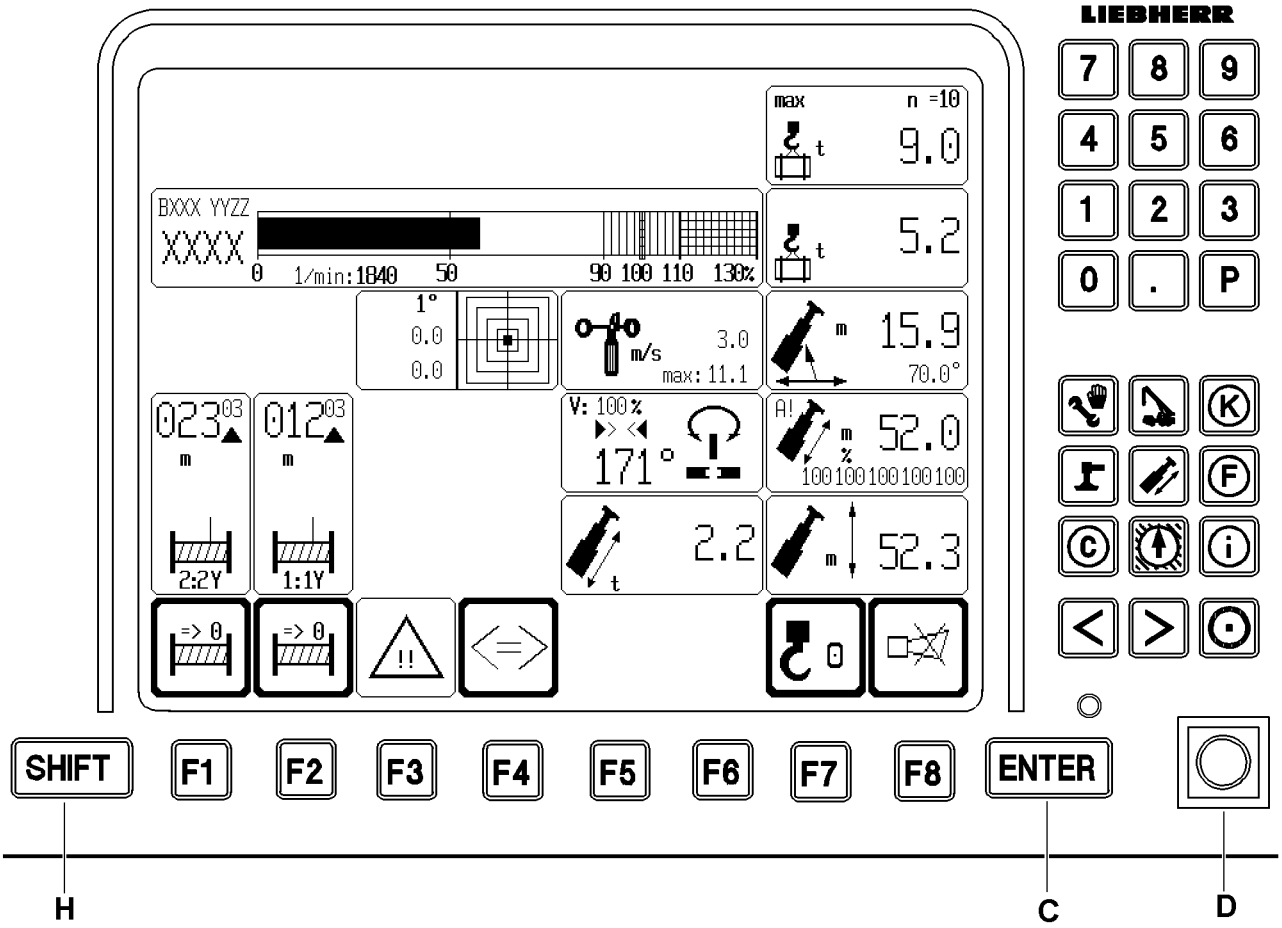
- Keys “0” to “9” and “P” have no function in the “Crane operation” program.
- “**SHIFT** ” and **“.”** keys
  Using key “.”, the so-called test pattern function is turned on and off, meaning that all available symbols appear on the monitor with an incorrect display value.
  Note:
  The monitored auxiliary functions, however, must be opened on the desired page if they are to appear in the test pattern.
  The test pattern display may be held by pressing the “**SHIFT** ” key and **“.”** , otherwise the normal crane operating pattern will appear after 10 seconds or after again pressing the key “.”.

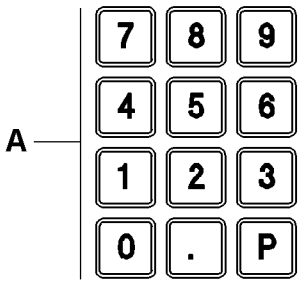
P Program keys

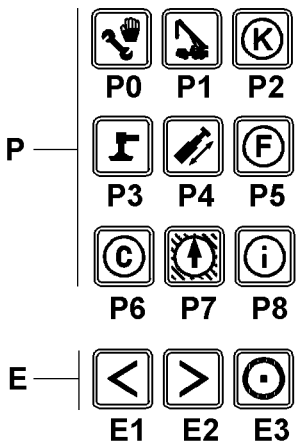
- The program keys are used to select individual programs. However, the appropriate program-specific features (for example, switching from “configuration” to “crane operation” using the “O.K.”) must always be observed.
  Note:
  A program currently running **cannot** be called again using its program key.
  The programs may only be called up with their program key, if the bypass key switch “assembly” is not in the “assembly” position.

C Input key “**ENTER** ”

- No function in “Crane operation” program.


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
max n =10
9.0
5.2
BXXX YYZZ
XXXX
0 1/min:1840 50 90 100 110 130%
1°
0.0
0.0
3.0
max: 11.1
15.9
70.0°
023 03
012 03
m
2:2Y
1:1Y
V: 100%
171°
52.0
100 100 100 100 100
2.2
52.3
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
H
C
D


A
7 8 9
4 5 6
1 2 3
0 . P


P
P0 P1 P2
P3 P4 P5
P6 P7 P8
E
E1 E2 E3

B198621

D Bypass key button

The bypass key button has two positions:
- Operating position (self-retaining).
  Crane is in normal operation.
- Position to right (touching):
  The hoist limit switch and the LMB shutoff are bypassed.

- **Bypassing the overload protection:**
  If the maximum permissible load moment is exceeded, the LICCON overload protection turns off all crane movements that increase the load moment. This shut-off can be bypassed by the bypass key button **D** in the “right touching position”.

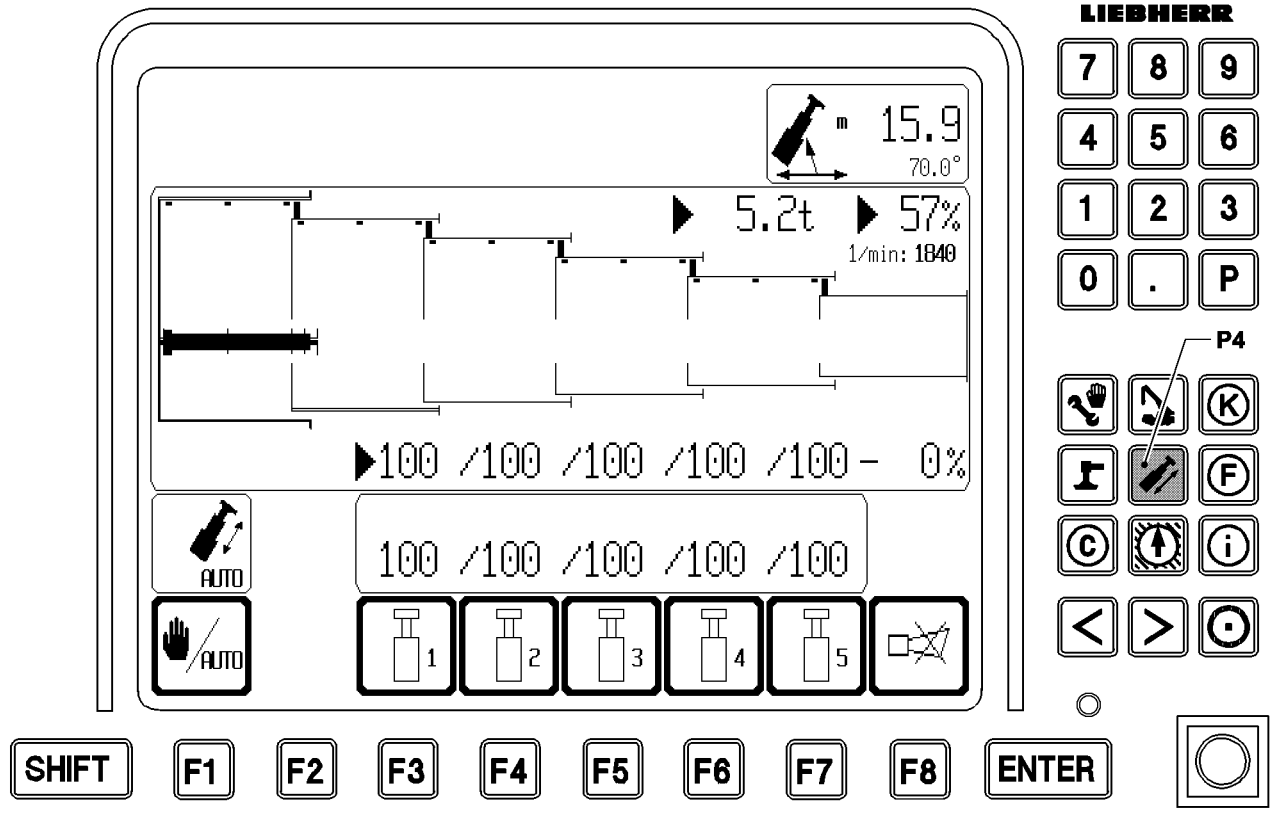
DANGER
Increased accident risk when bypassing the overload protection!
If the overload protection is bypassed, there is no further protection against crane overload!
All LICCON overload protection displays remain functional.
- ▶ It is only permitted to bypass the overload protection during assembly or in emergencies!
- ▶ The bypass key button **D** should only be operated by persons aware of the consequences of bypassing!
- ▶ Bypassing overload protection may only be done if the crane supervisor is present and with utmost caution.
- ▶ Crane operation with overload protection bypassed is prohibited!

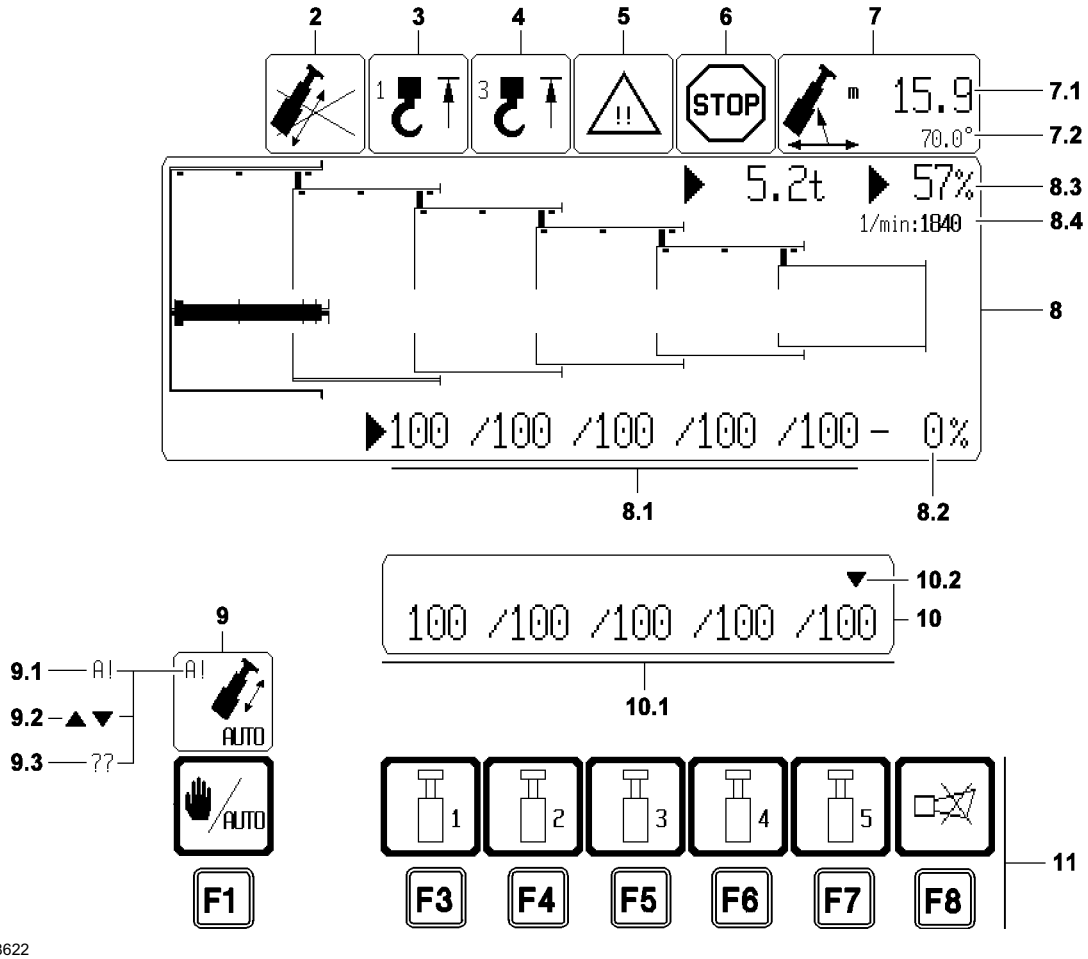
- **Bypassing the hoist top shut off.**
  If the hook block touches the hoist limit switch weight during the upward movement, the hoist limit switch reacts. The crane movements “Spool up winches”, “Luff telescopic boom down” and “Telescope out” are shut off. The shut off can be bypassed by the bypass key button **D** in the “right touching” position.

DANGER
Increased accident risk when bypassing the overload protection!
When bypassing the hoist top shut-off, there is a risk that the hook block may be pulled against the pulley head when continuing to lift or luffing down the boom. This may damage the pulleys and cause the loads to fall!
- ▶ The hoist up shut-off must only be bypassed if the crane supervisor is present, and with the help of a “guide”. The guide must be in direct contact with the crane operator and must continually monitor the distance between the hook block and the boom head.
- ▶ Carry out all crane movements with maximum care and minimum speed.

E Special function keys
- Monitor brightness adjustment (see section “Control elements of the LICCON computer system”).

H “SHIFT” key
- Second level key assignments.
  “SHIFT” and “P0”: Program call up for engine monitoring.


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
P4
m 15.9
70.0°
5.2t 57%
1/min: 1840
100 /100 /100 /100 /100 - 0%
100 /100 /100 /100 /100
AUTO
1 2 3 4 5
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER


2 3 4 5 6 7
STOP
m 15.9
70.0°
7.1
7.2
5.2t 57%
1/min:1840
8.3
8.4
8
100 /100 /100 /100 /100 - 0%
8.1
8.2
10.2
100 /100 /100 /100 /100
10
10.1
9
9.1 A!
9.2 ▲▼
9.3 ??
AUTO
1 2 3 4 5
11
F1 F3 F4 F5 F6 F7 F8

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6 “Telescoping” program

The telescoping screen shows the crane operator the pinned state of the telescopic boom, the position of the individual telescopes and the extension state of the telescoping cylinder, in full dynamic graphics (refer to chapter 4.05 “Crane operation”).

6.1 Starting the program

▶ Press program key **P4**.

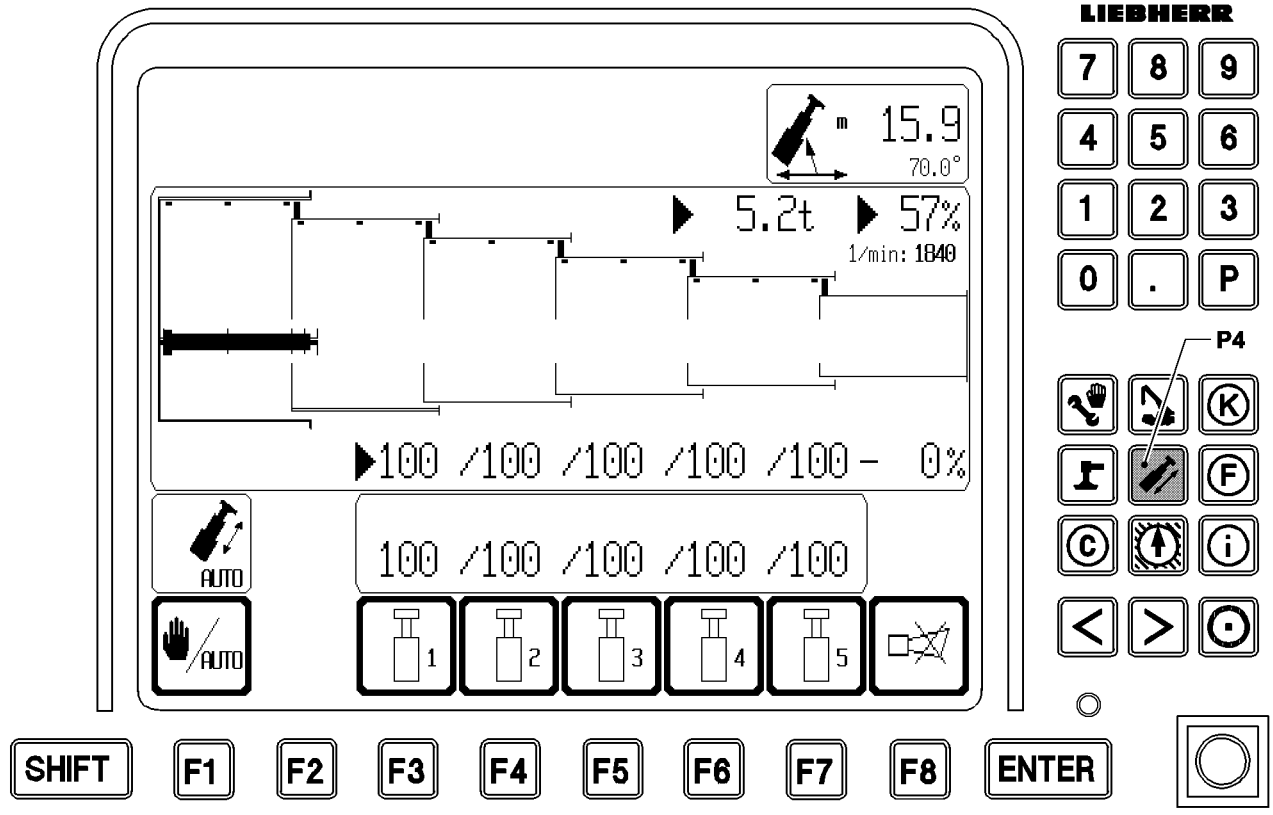
or

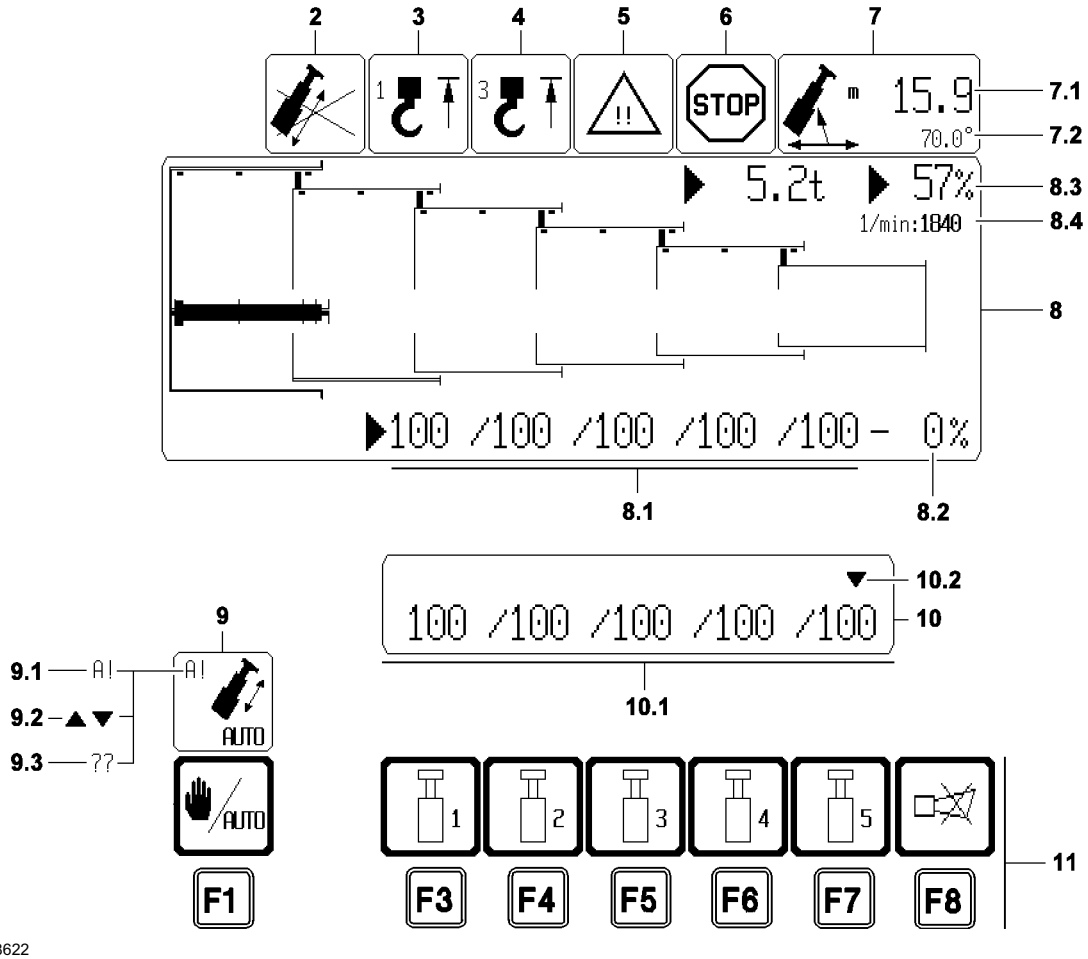
- Automatic start from “Crane operation” program when telescoping target (A!) **9.1** is reached and telescoping at master switch.

6.2 User interface

For a description of icons 2 to 7, see section “Alarm functions” in the “Crane operation” program.

2	Preventing further telescoping processes in relation to the telescoping cylinder	• Based on exceeding the expected load in the unpinned state. • **Note:** This is the same program-specific illustration of the same topic as in section “Telescopable load”.
3	Icon “Hoist top” on HES1 and / or HES4	
4	“Hoist top” icon at HES2 or HES4	
5	Icon “Advance warning”	
6	Icon “STOP”	
7	Icon “Boom radius”	
7.1	Radius	• In [m] or [ft].
7.2	Main boom angle to the horizontal	• In [°].
8	Icon “Stylized illustration of the telescopic boom”	
8.1	Current extension condition of telescopes 1 - 5	• In [%].
8.2	Current extension condition of telescoping cylinder	• In [%].
8.3	Display of actual load and utilization of crane in percentages	• In [t] or [kips] and in [%].
8.4	Engine RPM	• In [rpm].


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
P4
m 15.9
70.0°
5.2t 57%
1/min: 1840
100 /100 /100 /100 /100 - 0%
AUTO
100 /100 /100 /100 /100
1 2 3 4 5
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER


2 3 4 5 6 7
STOP
m 15.9
70.0°
7.1
7.2
5.2t 57%
1/min:1840
8.3
8.4
8
100 /100 /100 /100 /100 - 0%
8.1
8.2
10.2
100 /100 /100 /100 /100
10
10.1
9
9.1 A!
9.2 ▲▼
9.3 ??
AUTO
11
F1 F3 F4 F5 F6 F7 F8

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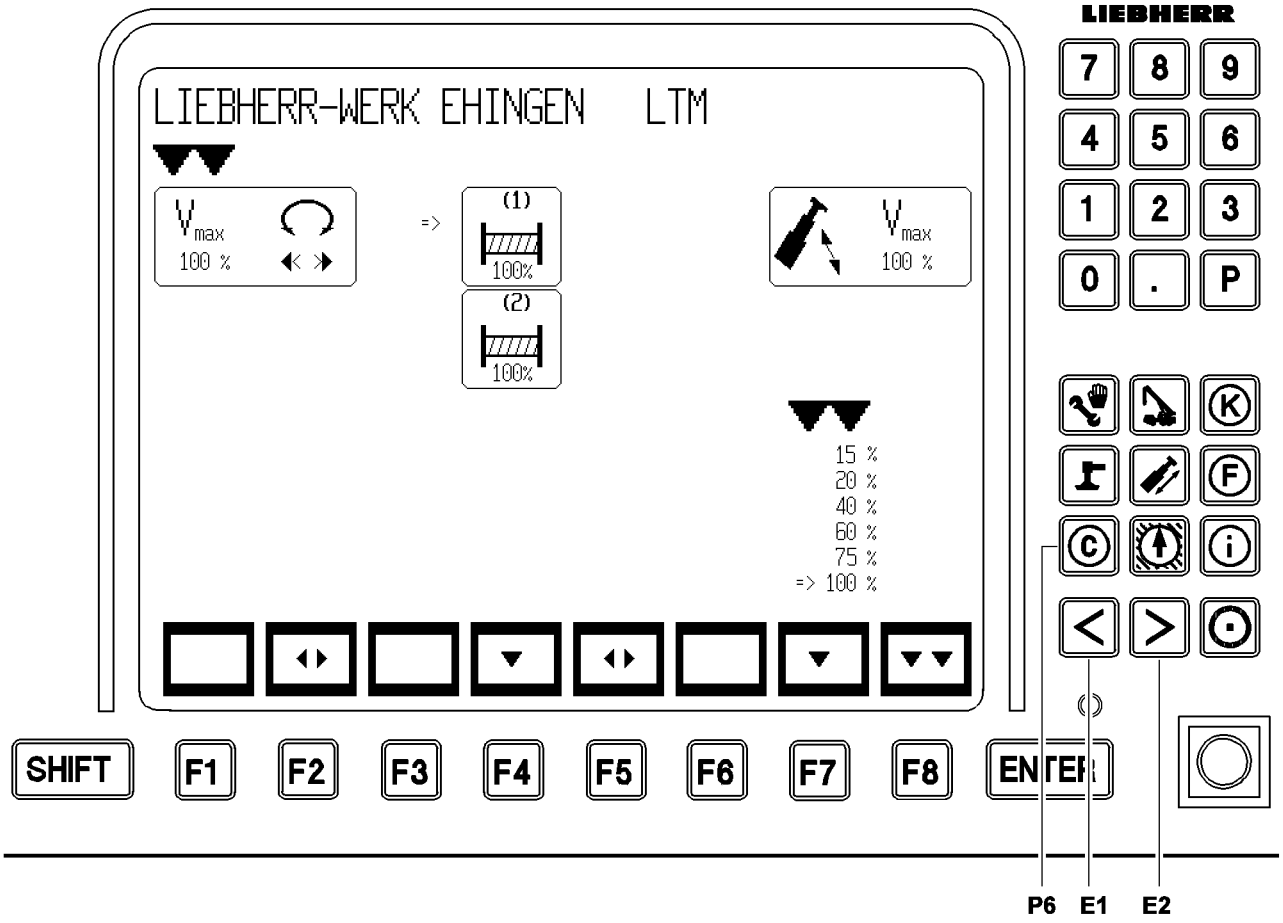
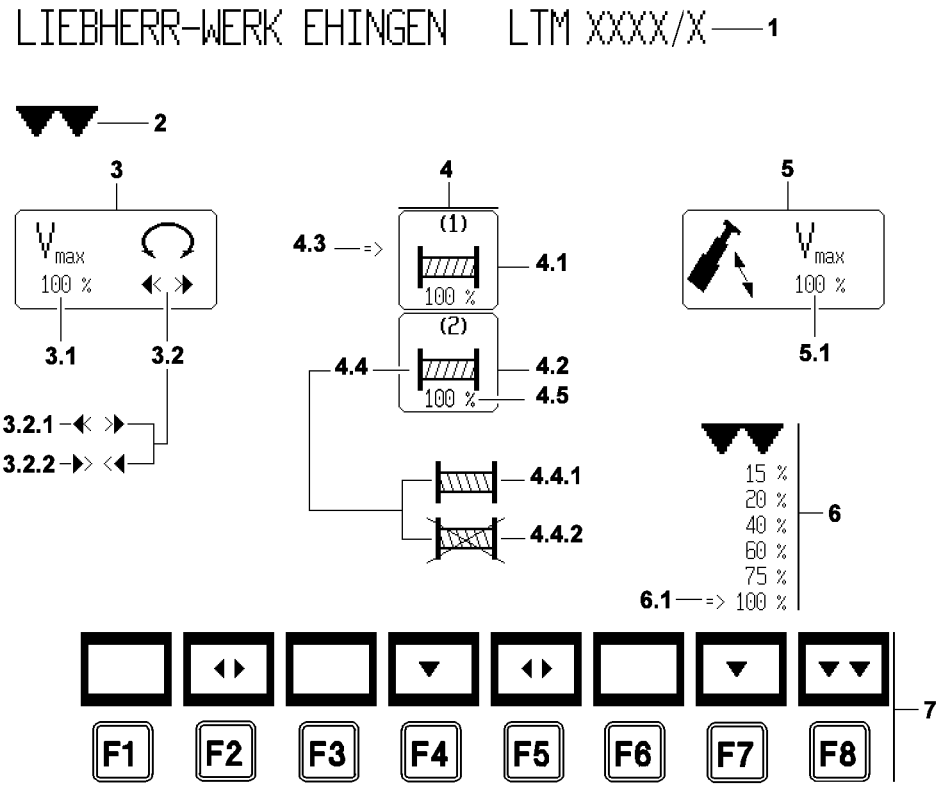
9	“Automatic telescoping mode” icon	
9.1	Preselected telescoping target reached	
9.2	Nominal deflection direction of master switch	Request: • Telescope in = down arrow. • Telescope out = up arrow.
9.3	Error in system	
10	Icon “Selected telescoping targets of telescopes 1 -5”	
10.1	Telescope 1 - 5 target selection	
10.2	Blinking marker (arrow)	• To the selected telescoping target. • As a warning in the event of incorrect operation, target already reached, or enter new target.
11	Function key line	
F1	Function key	• Switch between automatic operation and manual telescoping.
F3	Function key	• Telescope 1 target selection.
F4	Function key	• Telescope 2 target selection.
F5	Function key	• Telescope 3 target selection.
F6	Function key	• Telescope 4 target selection.
F7	Function key	• Telescope 5 target selection.
F8	Function key	• Press once: Turn the acoustic signal off. • Press twice: Fields that are displayed visually in the “Horn” icon are automatically displayed in the error determination display.


LIEBHERR
LIEBHERR-WERK EHINGEN LTM
Vmax
100 %
(1)
100%
(2)
100%
15 %
20 %
40 %
60 %
75 %
=> 100 %
7 8 9
4 5 6
1 2 3
0 . P
SHIFT
F1 F2 F3 F4 F5 F6 F7 F8
P6 E1 E2


LIEBHERR-WERK EHINGEN LTM XXXX/X
1
2
3
4
5
Vmax
100 %
3.1
3.2
3.2.1
3.2.2
4.3
(1)
100 %
4.1
(2)
4.4
4.2
100 %
4.5
4.4.1
4.4.2
5.1
15 %
20 %
40 %
60 %
75 %
6
6.1
=> 100 %
7
F1 F2 F3 F4 F5 F6 F7 F8

B197645

7 “Control parameter” program

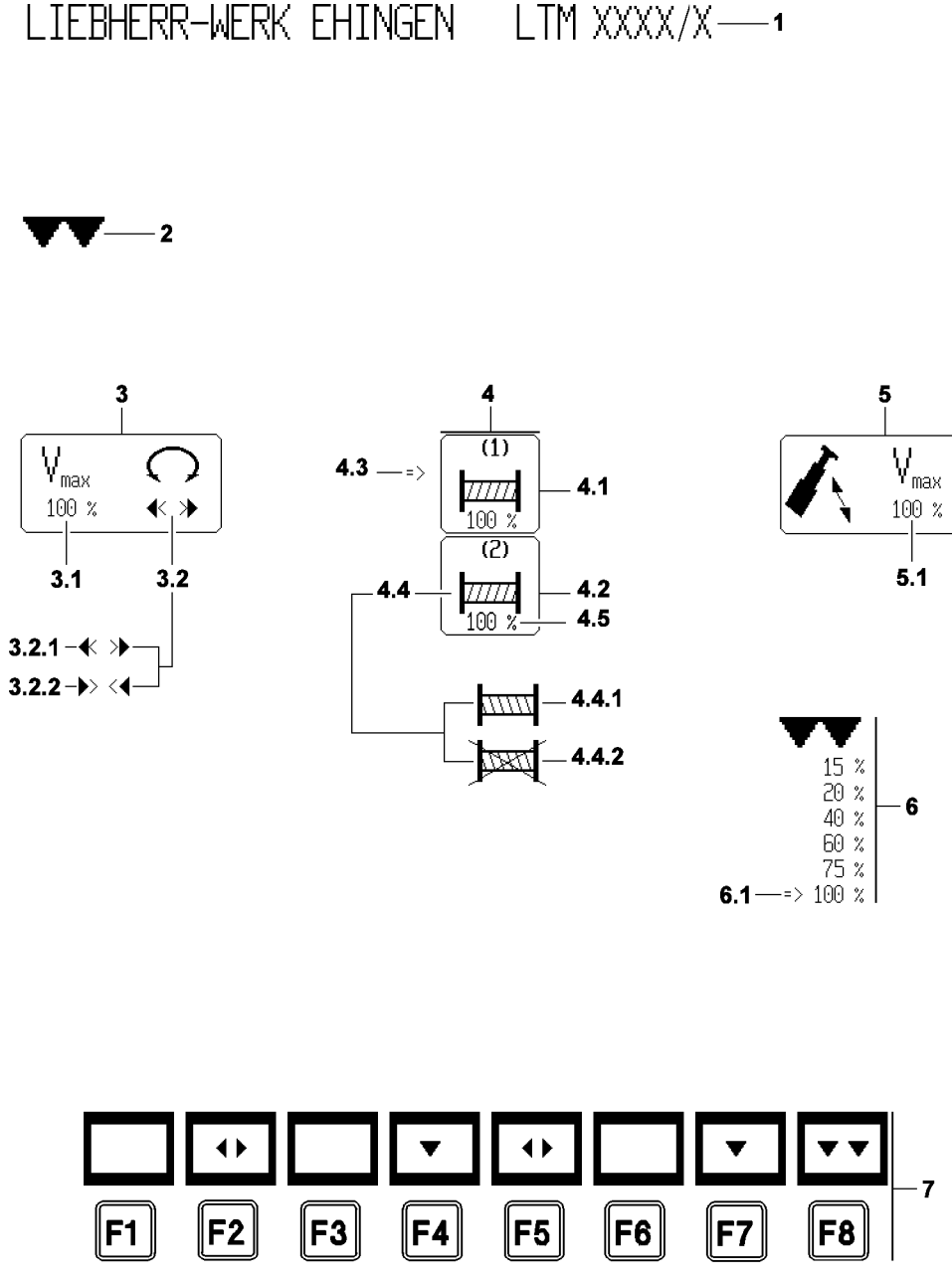
The “Control parameter” program offers the following possibilities:
– Preselection of maximum slewing gear rotation speed.
– Selection between “freely rotating slewing gear” and “fixed slewing gear”.
– Preselection of the maximum winch rotation speed and activation / deactivation of winch 1 and winch 2*.
– Preselection of the telescopic boom maximum luffing speed.

The assembly and bypass switches are monitored during the “Control Parameter” program. If one of these switches is activated during the program, the system immediately switches back to the “Crane operation” program.

DANGER
Risk of accident!
▶ **Never** change the maximum speeds or the activation / de-activation of the winches during a crane movement.

7.1 Starting the program

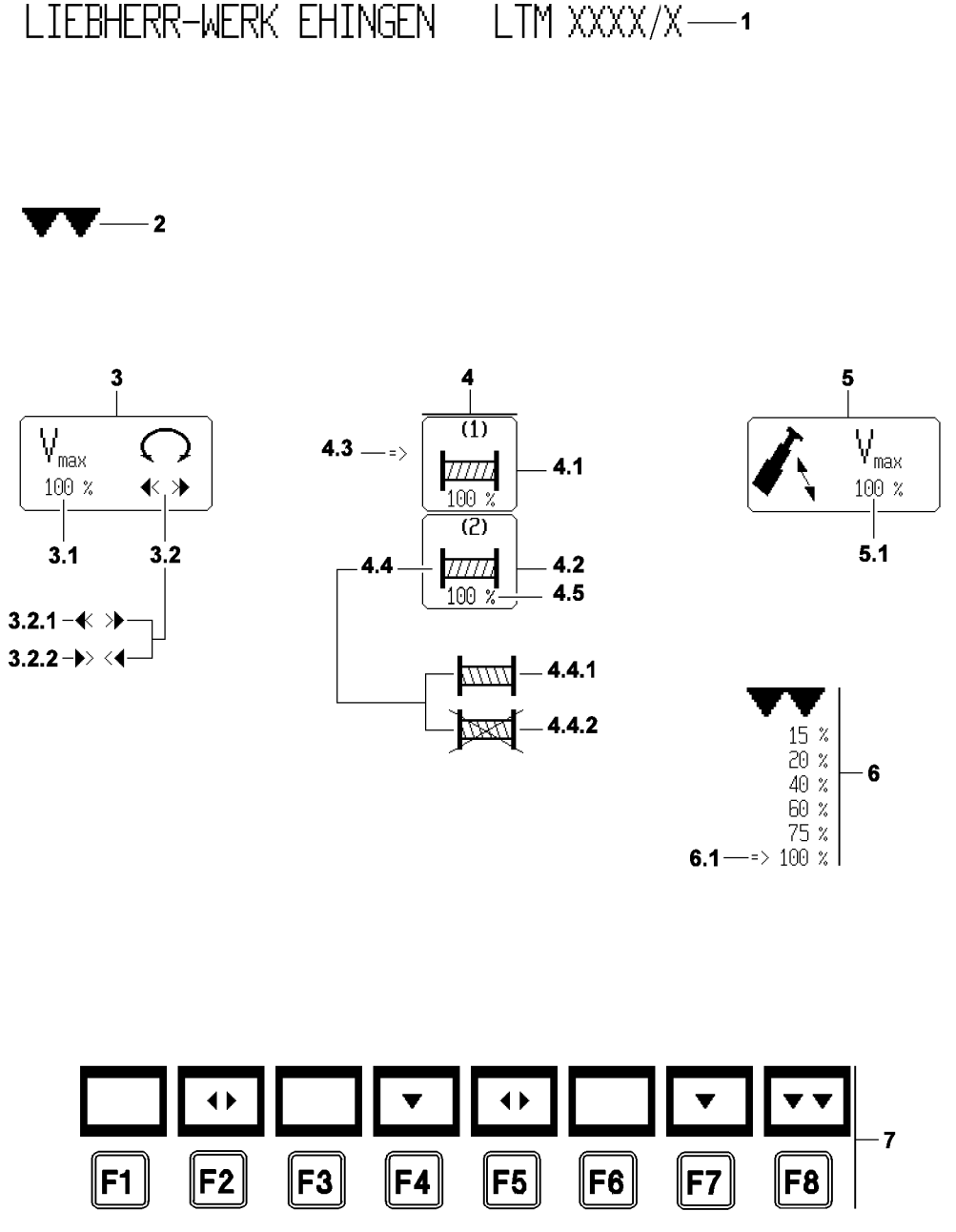
▶ Press program key **P6**.


LIEBHERR-WERK EHINGEN LTM XXXX/X
1
2
3
Vmax
100 %
3.1
3.2
3.2.1
3.2.2
4
(1)
4.3
4.1
100 %
(2)
4.4
4.2
100 %
4.5
4.4.1
4.4.2
5
Vmax
100 %
5.1
15 %
20 %
40 %
60 %
75 %
6
6.1
100 %
F1
F2
F3
F4
F5
F6
F7
F8
7

B197732

7.2 User interface

1	Crane type	
2	Selector	• Double arrow pointing down. • For selecting icons.
3	Icon “Slewing gear”	
3.1	Icon “Maximum slewing speed”	• V_{max} in [%].
3.2	Slewing gear operating mode	• Changing operating mode using the function key **F2** (see chap. 4.05, “Crane operation”).
3.2.1	Flexible slewing gear “freely rotating / coasting”	
3.2.2	Flexible slewing gear “fixed”	
4	Icon group “Winches”	
4.1	Winch 1	
4.2	Winch 2	
4.3	Selector	• Right arrow. • For selecting winches.
4.4	Winch icon	
4.4.1	Winch activated	
4.4.2	Winch deactivated	
4.5	Speed	• In [%]. • See value field with selector.
5	Icon “Maximum luffing speed”	• V_{max} in [%].
6	Value field with selector	• The percentage values relate to the speed with maximum deflection of the manual control lever, always in relation to the maximum achievable speed of the drive, with 100% preselected speed. Five stages may be preselected.
7	Function key line	
F2	Function key	• Operating mode selection for slewing gear*.
F4	Function key	• Winch selection.
F5	Function key	• Activation and deactivation of selected winches.
F7	Function key	• Selection of percentage value for respective speed in value field.
F8	Function key	• Switch back to “Crane operation” program and transfer parameters.
8	Input key “**ENTER** ”	• Transfer selected speed setting to the preselected functions.
9	Special function keys	
E1	Special function key	• Moves the selector **2** for selecting icons to the left.
E2	Special function key	• Moves the selector **2** for selecting icons to the right.


LIEBHERR-WERK EHINGEN LTM XXXX/X
1
2
3
Vmax
100 %
3.1
3.2
3.2.1
3.2.2
4
(1)
4.3
4.1
100 %
(2)
4.4
4.2
100 %
4.5
4.4.1
4.4.2
5
Vmax
100 %
5.1
15 %
20 %
40 %
60 %
75 %
6
6.1
100 %
F1
F2
F3
F4
F5
F6
F7
F8
7

B197732

7.3 Changing the maximum rotation speed of slewing gear

DANGER
Risk of accident!
- ▶ Always adhere to the maximum speeds relative to the boom length and the operating modes during crane operations with loads (according to load charts)!
- ▶ The greater the boom length, the heavier the equipment and the greater the load, the smaller the set “maximum rotation speed”.
- ▶ **Never** deflect the master switch for the slewing gear to the stop at maximum load.

▶ Using the special function key **E1** or special function key **E2**, select the icon “Maximum slewing speed” **3.1**.

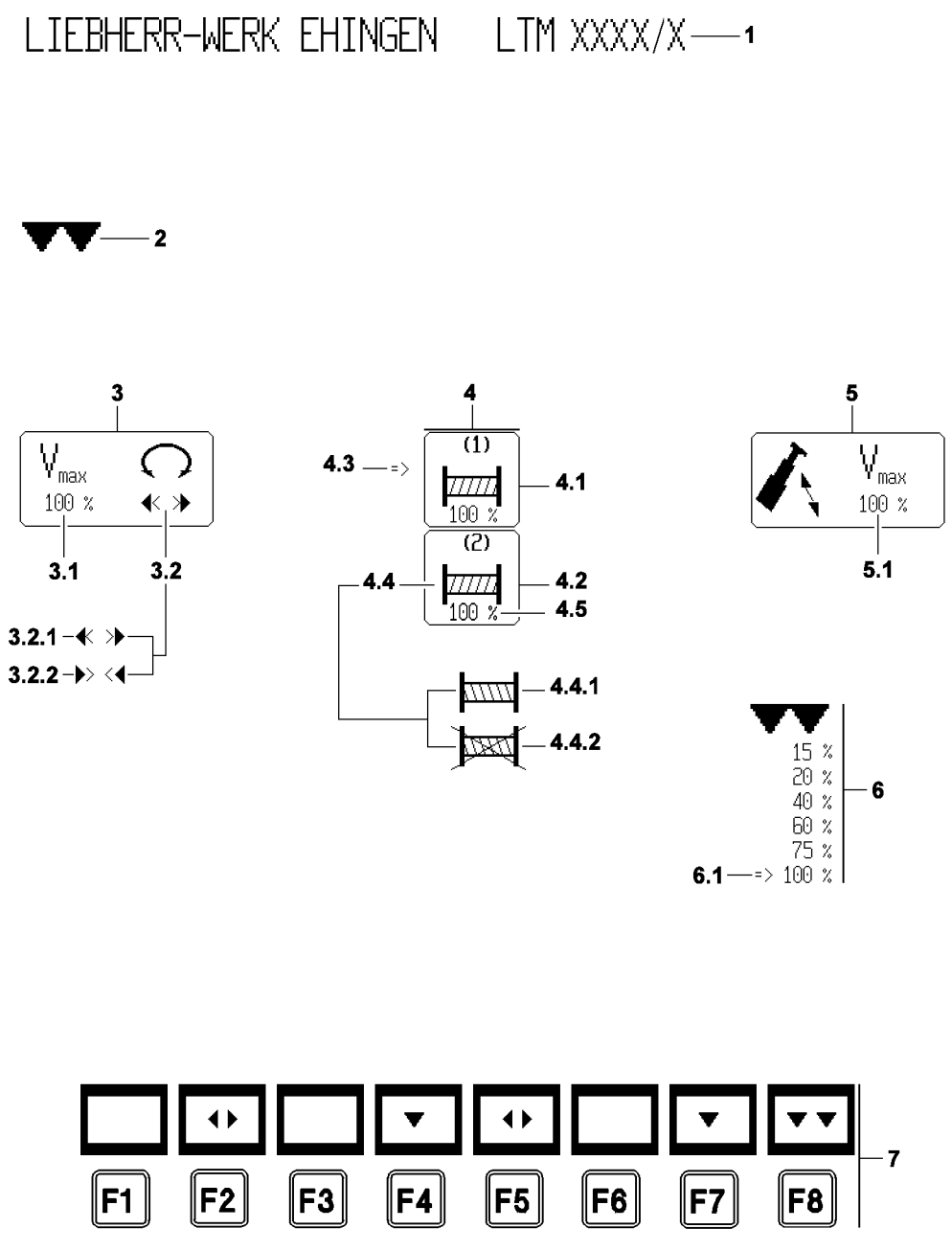
Result:
– Selector (double arrow down) **2** appears above the icon.

▶ Select the maximum rotation speed in [%] with function key **F7**.

Result:
– Selector (arrow to right) **6.1** shows the selected percentage value.

▶ Use the “Enter” key **8** to confirm the selected maximum rotation speed.

Result:
– The value of the maximum rotation speed will be accepted.


LIEBHERR-WERK EHINGEN LTM XXXX/X
1
2
3
Vmax
100 %
3.1
3.2
3.2.1
3.2.2
4
(1)
4.3
4.1
100 %
(2)
4.4
4.2
100 %
4.5
4.4.1
4.4.2
5
Vmax
100 %
5.1
15 %
20 %
40 %
60 %
75 %
6
6.1
100 %
F1
F2
F3
F4
F5
F6
F7
F8
7

B197732

7.4 Winches

7.4.1 Changing maximum rotation speed

▶ Using the special function key **E1** or special function key **E2**, select the icon group winches **4**.

Result:

– Selector (double arrow down) **2** appears above the icon group.

▶ Using the function key **F4**, select the icon for winch 1 or winch 2.

Result:

– Selector (arrow to right) **4.3** shows the selected winch.

▶ Select the maximum rotation speed in [%] with function key **F7**.

Result:

– Selector (arrow to right) **6.1** shows the selected percentage value.

▶ Use the “ENTER” key **8** to confirm the selected maximum rotation speed.

Result:

– The value of the maximum rotation speed will be accepted.

7.4.2 Activating / deactivating individual winches

In order to prevent unintentional activation of a winch that is currently not required, de-activate individual winches.

▶ Using the special function key **E1** or special function key **E2**, select the icon group winches **4**.

Result:

– Selector (double arrow down) **2** appears above the icon group.

▶ Using the function key **F4**, select the icon for winch 1 or winch 2*.

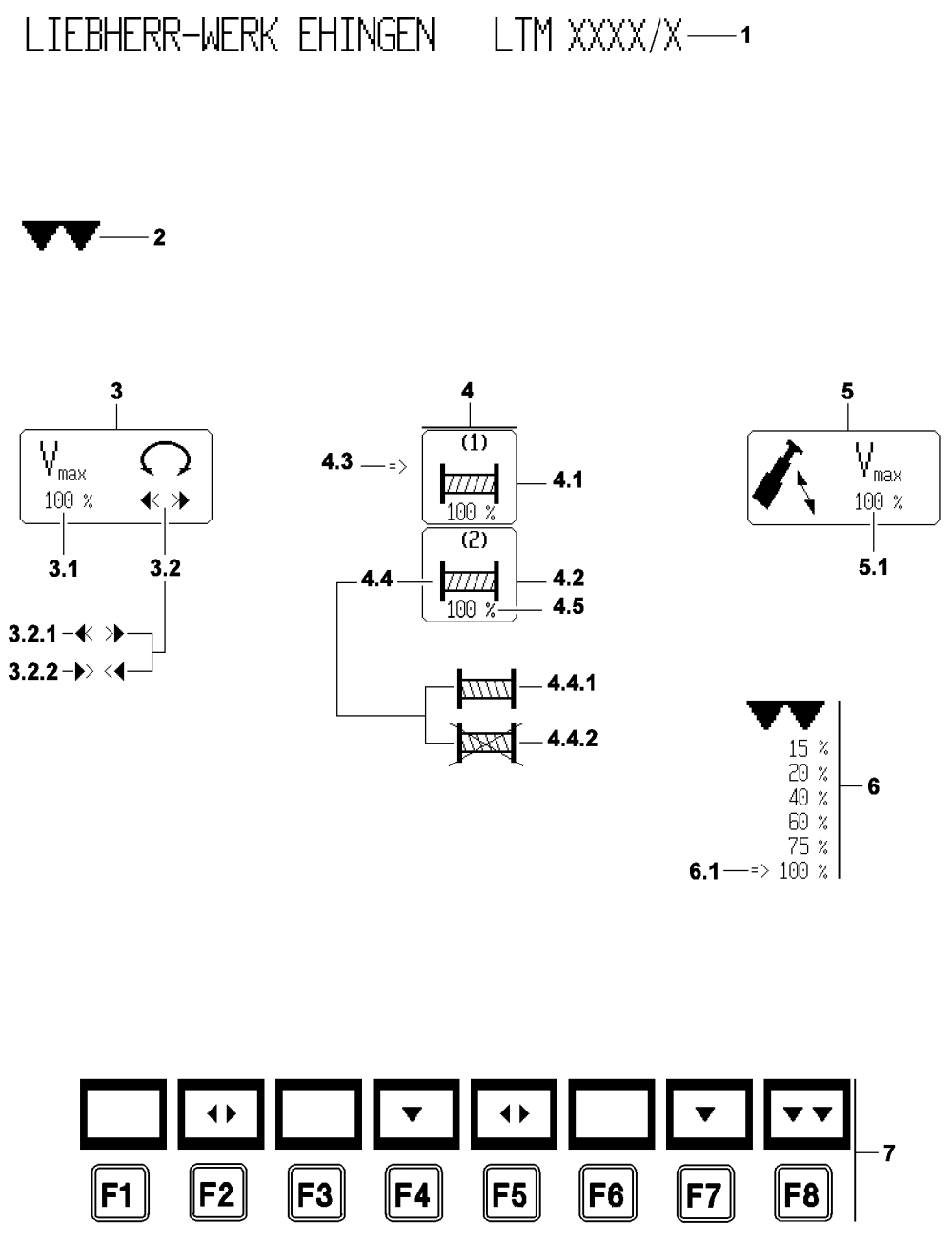
Result:

– Selector (arrow to right) **4.3** shows the selected winch.

▶ Using the function key **F5**, activate or deactivate the selected winch.

Result: The winch icon in the icon changes the appearance:

– Winch icon crossed out = winch deactivated **4.4.2**.
– Winch icon not crossed out = winch activated **4.4.1**.


LIEBHERR-WERK EHINGEN LTM XXXX/X
1
2
3
Vmax
100 %
3.1
3.2
3.2.1
3.2.2
4
(1)
4.3
4.1
100 %
(2)
4.4
4.2
100 %
4.5
4.4.1
4.4.2
5
Vmax
100 %
5.1
15 %
20 %
40 %
60 %
75 %
6
6.1
100 %
F1
F2
F3
F4
F5
F6
F7
F8
7

B197732

7.5 Changing maximum luffing speed

▶ Using the special function key **E1** or special function key **E2**, select the “Maximum luffing speed” icon **5**.

Result:

– Selector (double arrow down) **2** appears above the icon.

▶ Select the maximum luffing speed in [%] with function key **F7**.

Result:

– Selector (arrow to right) **6.1** shows the selected percentage value.

▶ Use the “Enter” key **8** to confirm the selected maximum luffing speed.

Result:

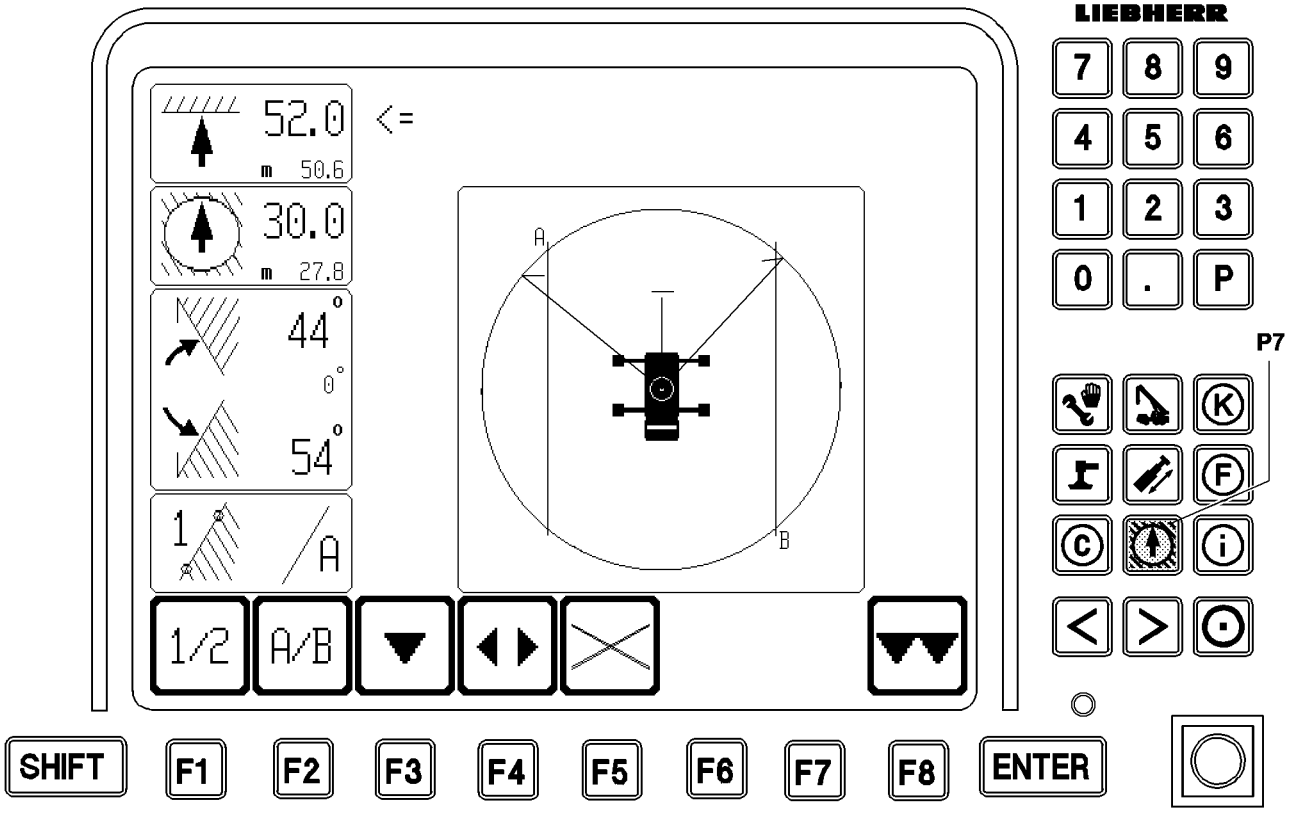
– The value of the maximum luffing speed will be accepted.

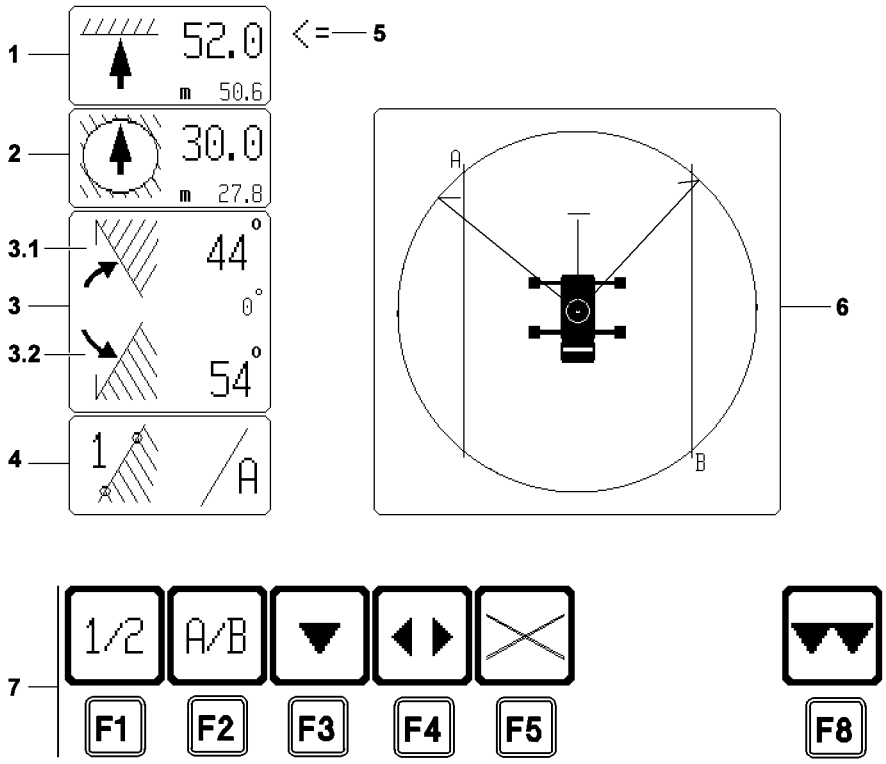
7.6 Switching back to the “Crane operation” program

▶ Press function key **F8**.

Result:

– The parameters previously confirmed using the “Enter” key **8** will be accepted.


LIEBHERR
52.0
m 50.6
30.0
m 27.8
44°
0°
54°
1
A
1/2
A/B
7
8
9
4
5
6
1
2
3
0
.
P
P7
K
F
C
i
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER


1
52.0
m 50.6
5
2
30.0
m 27.8
3.1
44°
3
0°
3.2
54°
4
1
A
6
7
1/2
A/B
F1
F2
F3
F4
F5
F8

B197646

8 The “Working range limitation” * program

A detailed description of operating range limitation can be found in the separate operating instructions for “Working range limitation”.

8.1 Starting the program

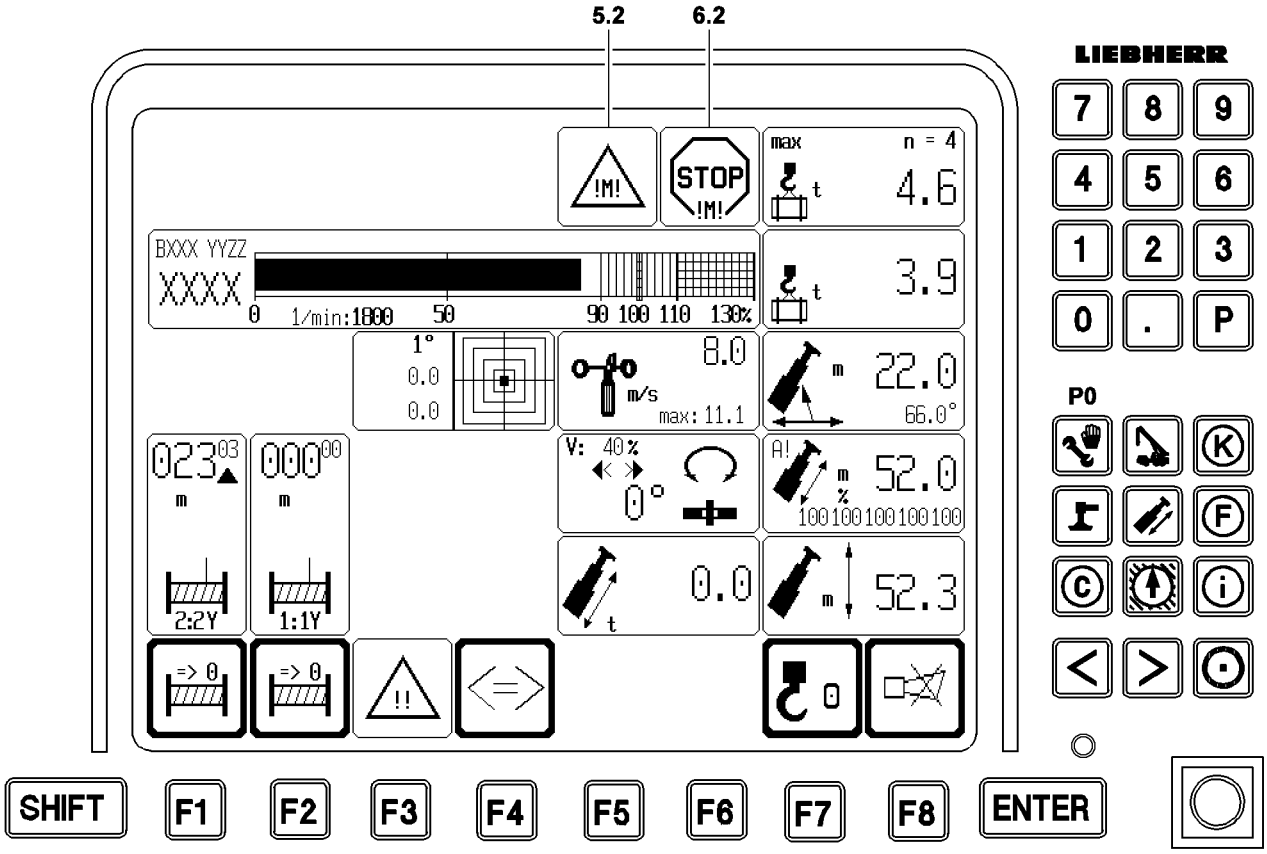
▶ Press program key **P7**.

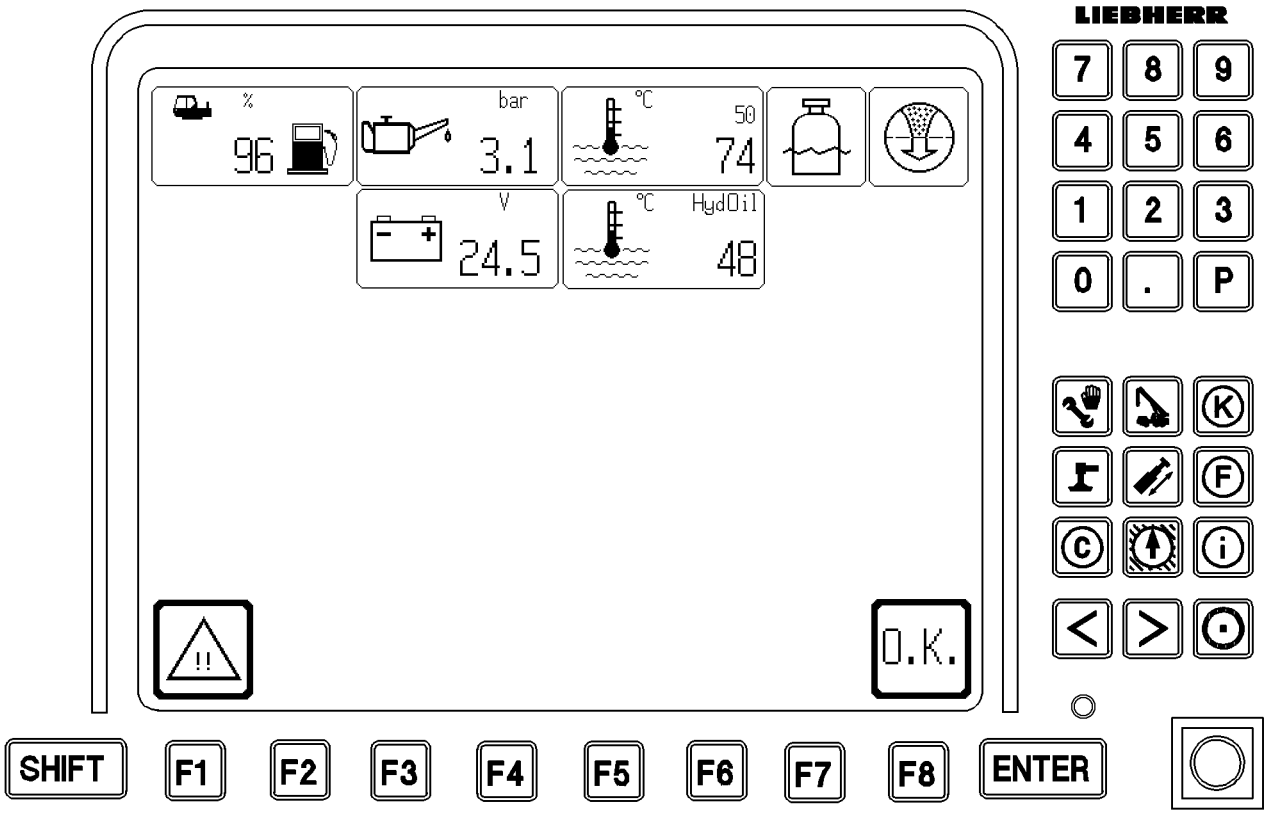
8.2 User interface

1	Icon “Limitation of pulley head height”	
2	Icon “Radius limitation”	
3	Icon “Slewing limit stop”	
3.1	Right slewing limit stop	
3.2	Left slewing limit stop	
4	Icon “Edge limit with edge and point selection”	• The limit function icons are shown crossed out if they are inactive.
5	Function selector	• For selecting limiting functions.
6	Icon “Graphic display of programmed limits”	
7	Function key line	
F1	Function key	• Select point 1 or 2 of selected edge A or B.
F2	Function key	• Selected edge A or B that is being programmed.
F3	Function key	• The function selector is moved down by one limit function.
F4	Function key	• The limit function selected with the function selector changes its status. If previously active, it will now be inactive when the function key **F4** is pressed, and vice versa. An inactive limit function is identified by a crossed out icon. If the function selector shows a slewing limit to the left or the right, then both limits will always be switched. **Note:** For the edge limit, only the preselected edge will be switched. The edge that is not displayed can be active or inactive at the same time.
F5	Function key	• All limit functions become inactive.
F8	Function key	• Exit the program and return to the “Crane operation” program.

8.3 Displays in “Crane operation” program

If a programmed working range limiter is activated, this condition is indicated in the “Crane operation” program by an alternative STOP icon in the position of the normal LMB STOP icon (see section “Alarm functions” in “Crane operation” program).


5.2
6.2
LIEBHERR
!M!
STOP
!M!
max
n = 4
4.6
3.9
XXXX
1/min:1800
8.0
max: 11.1
22.0
66.0°
52.0
52.3
0.0
7 8 9
4 5 6
1 2 3
0 . P
P0
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER


LIEBHERR
96
3.1
74
24.5
48
O.K.
7 8 9
4 5 6
1 2 3
0 . P
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER

B198623

9 The “Engine monitoring” program

In the “Engine monitoring” program, all relevant data for the engine are shown, such as engine oil pressure, coolant temperature etc. In case of a problem, the system switches back automatically from “Crane operation” or “Telescoping” programs.

9.1 Starting the program

The program starts automatically:

▶ Once if a STOP event takes place during crane operations (at least one master switch is deflected or activated). The engine monitoring screen is displayed for 3 seconds and then automatically reverts to the crane operating screen.

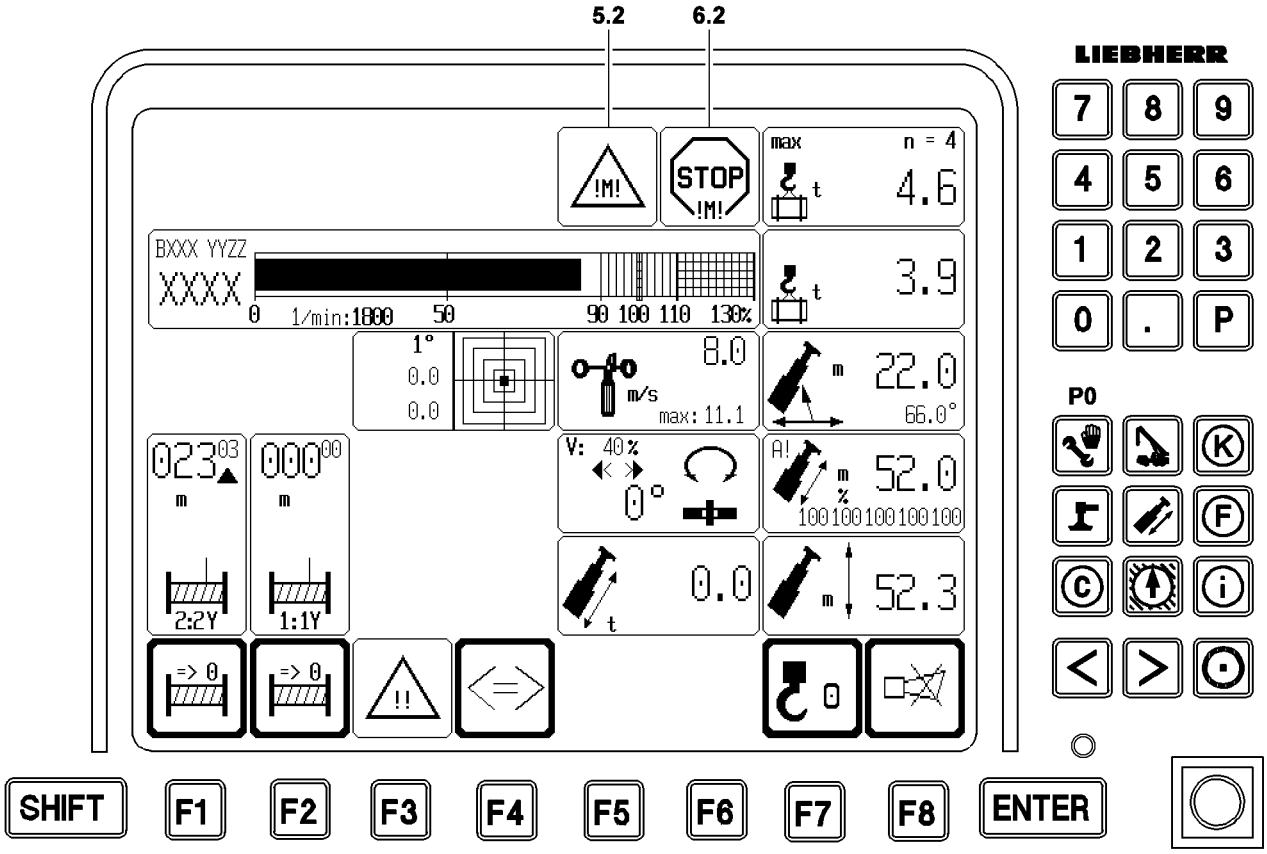
or

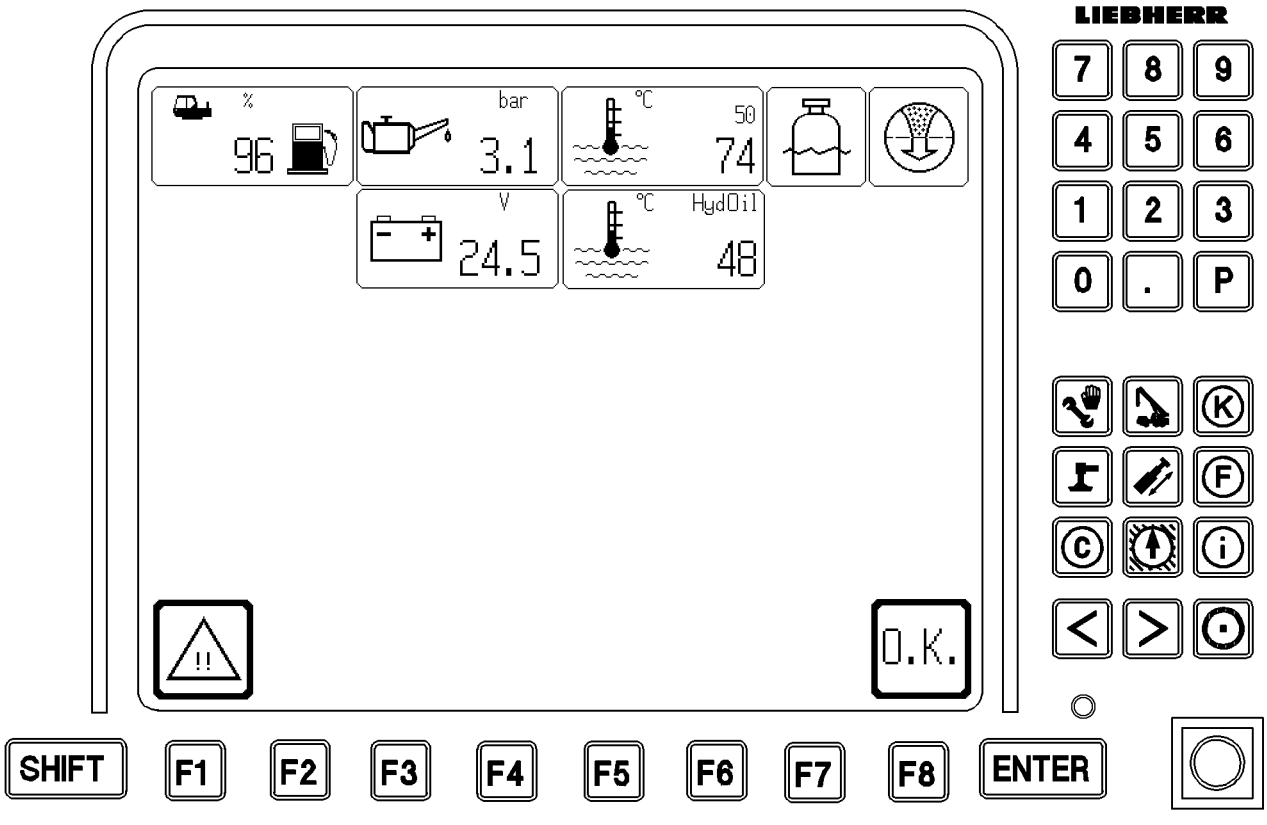
- At an advance warning, warning or STOP event during the start-up of the LICCON computer system.

This is how you start the program on request:

In that case the engine monitoring screen is retained, and all **load torque increasing** crane movements are locked or turned off.

▶ Press of the key combination **SHIFT** and **P0** (Configuration).


5.2
6.2
LIEBHERR
STOP
!M!
max
n = 4
4.6
3.9
XXXX
8.0
m/s
max: 11.1
22.0
66.0°
52.0
52.3
0.0
P0
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER

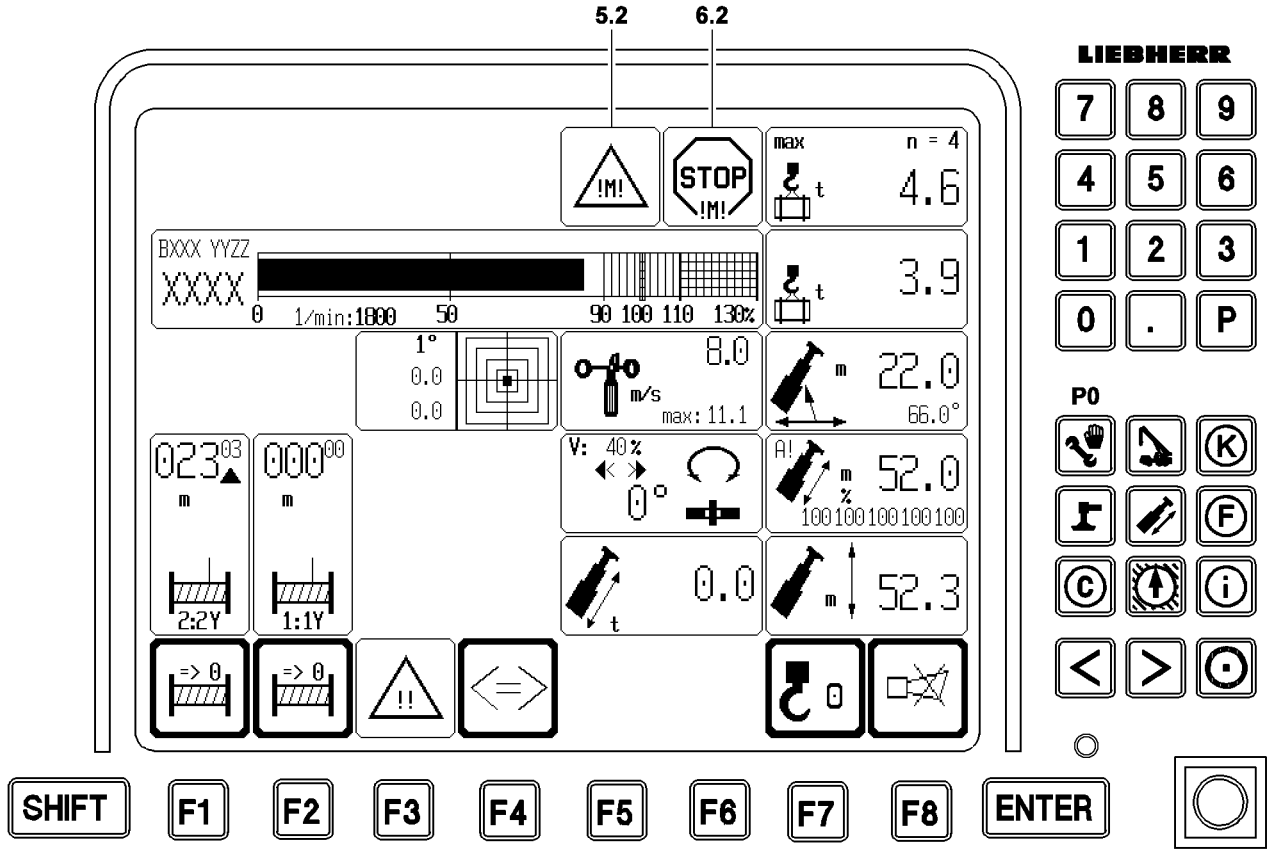

LIEBHERR
96
3.1
74
24.5
48
O.K.
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER

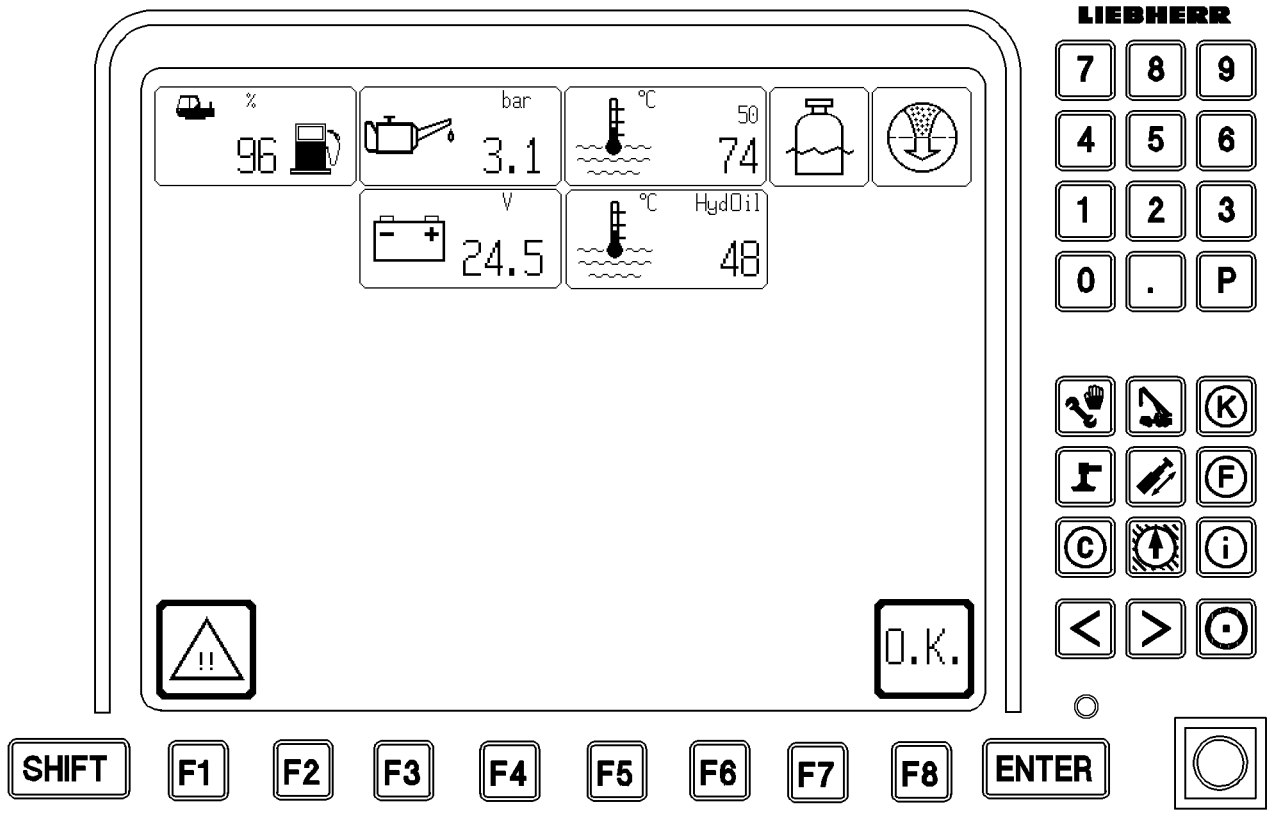
B198623

9.2 Possible engine monitoring advance warning, warning and STOP events

Events	Advance warning	Warning 5.2	STOP 6.2
Engine oil pressure (display value) missing		x	
Erroneous engine oil pressure (display value)		x	
Engine oil pressure warning active			x
Coolant / charge air temperature (display value) missing		x	
Erroneous coolant / charge air temperature (display value)		x	
Coolant / charge air temperature warning active			x
Coolant level warning active			x
Hydraulic oil temperature (display value) too high		x	
Air filter monitoring		x	
Battery voltage (display value) missing	x		
Erroneous battery voltage (display value)	x		
Battery voltage not between 16 V and 36 V	x		
Fuel reserve (display value) missing	x		
Erroneous fuel reserve (display value)	x		
Fuel reserve (display value) 5% or less	x		
Fuel reserve (display value) 1% or less		x	
Fuel reserve (display value) 0%			x

If the system automatically switches to the “Engine monitoring” program when an engine STOP event occurs, there is an option for retaining the engine monitoring screen within 3 seconds (retaining the engine monitoring screen is achieved by pressing the function key **F1**). Switch back to the crane operating screen using the function key **F8** (OK) or the program key **P1** (Crane operation). If the engine monitoring screen is **not** retained, then after 3 seconds the system switches back automatically to the “Crane operation” program.


5.2
6.2
LIEBHERR
STOP
!M!
max
n = 4
4.6
3.9
XXXX
8.0
m/s
max: 11.1
22.0
66.0°
52.0
52.3
0.0
P0
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER


LIEBHERR
96
3.1
74
24.5
48
O.K.
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER

B198623

9.3 Retaining the engine monitoring screen

The automatic change over to the engine monitoring screen can only take place from the “Crane operation” or “Telescoping” programs.

If you confirm a monitoring event in the engine monitoring screen with the function key **F8**, then there will be **no** automatic change over to the engine monitoring screen for the same event.

On switching back to the “Crane operation” program, the STOP icon **6.2** or the Advance warning icon **5.2** appears. There is no indication about advance warnings in the “Crane operation” or “Telescoping” programs.

WARNING

There is a danger of severe damage to the engine if STOP events are ignored!

If other programs are used for extended periods of time, for example the “configuration” or “test system”, it is essential to switch occasionally to the engine monitoring screen in order to ensure that no engine monitoring events have occurred, which could lead to damage or destruction of the engine.

▶ Switch over occasionally to the engine monitoring screen!

▶ Press function key **F1**.

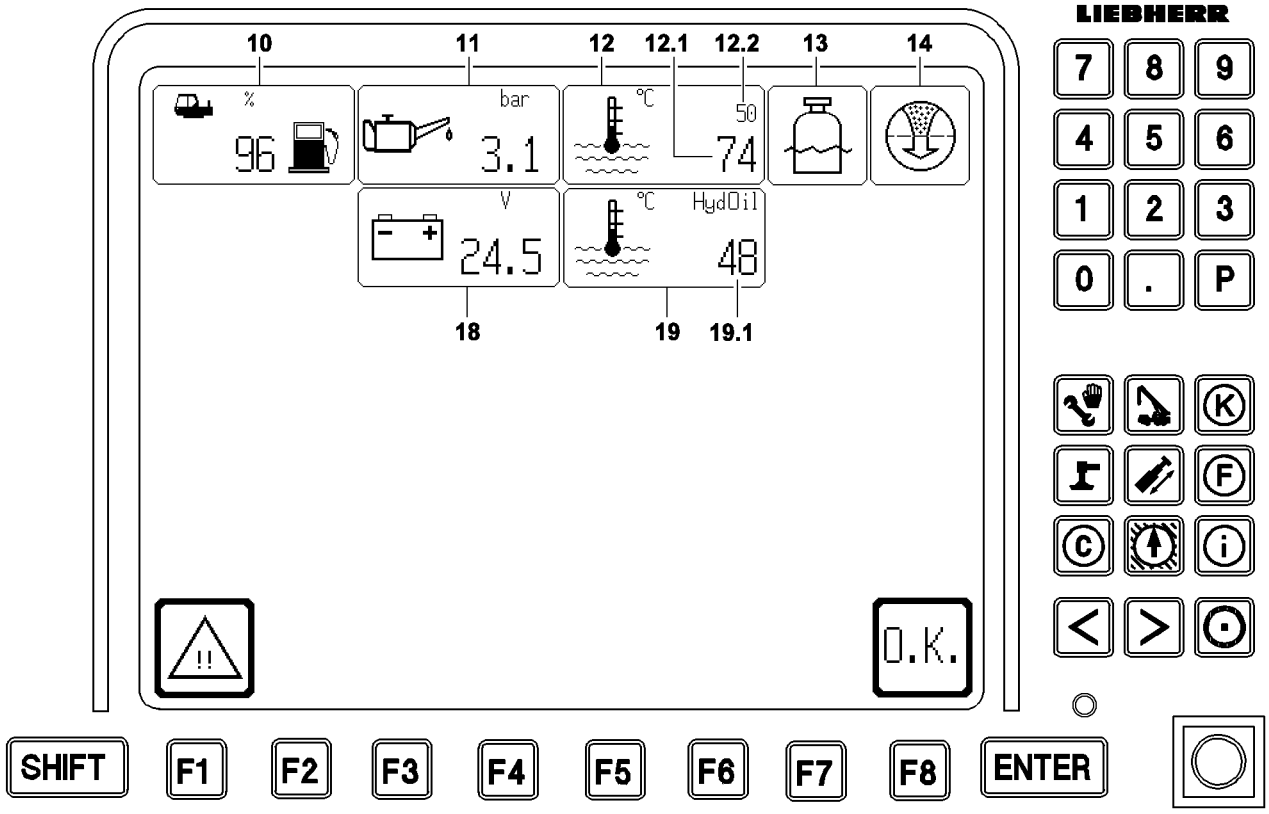
Result:

– Icon frames are displayed with a thin border.
– All load moment increasing crane movements will be turned off or blocked.

▶ Press function key **F8**.

Result:

– System switches back to the “Crane operation” program.
– The block of the load moment increasing crane movements will be lifted.
– The warning or STOP icon is faded into the “Crane operation” program.


LIEBHERR
10
11
12
12.1
12.2
13
14
%
96
bar
3.1
°C
50
74
V
24.5
°C
HydOil
48
18
19
19.1
0.K.
7
8
9
4
5
6
1
2
3
0
.
P
K
F
C
i
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER

B198624

9.4 Engine monitoring icons

9.4.1 Engine

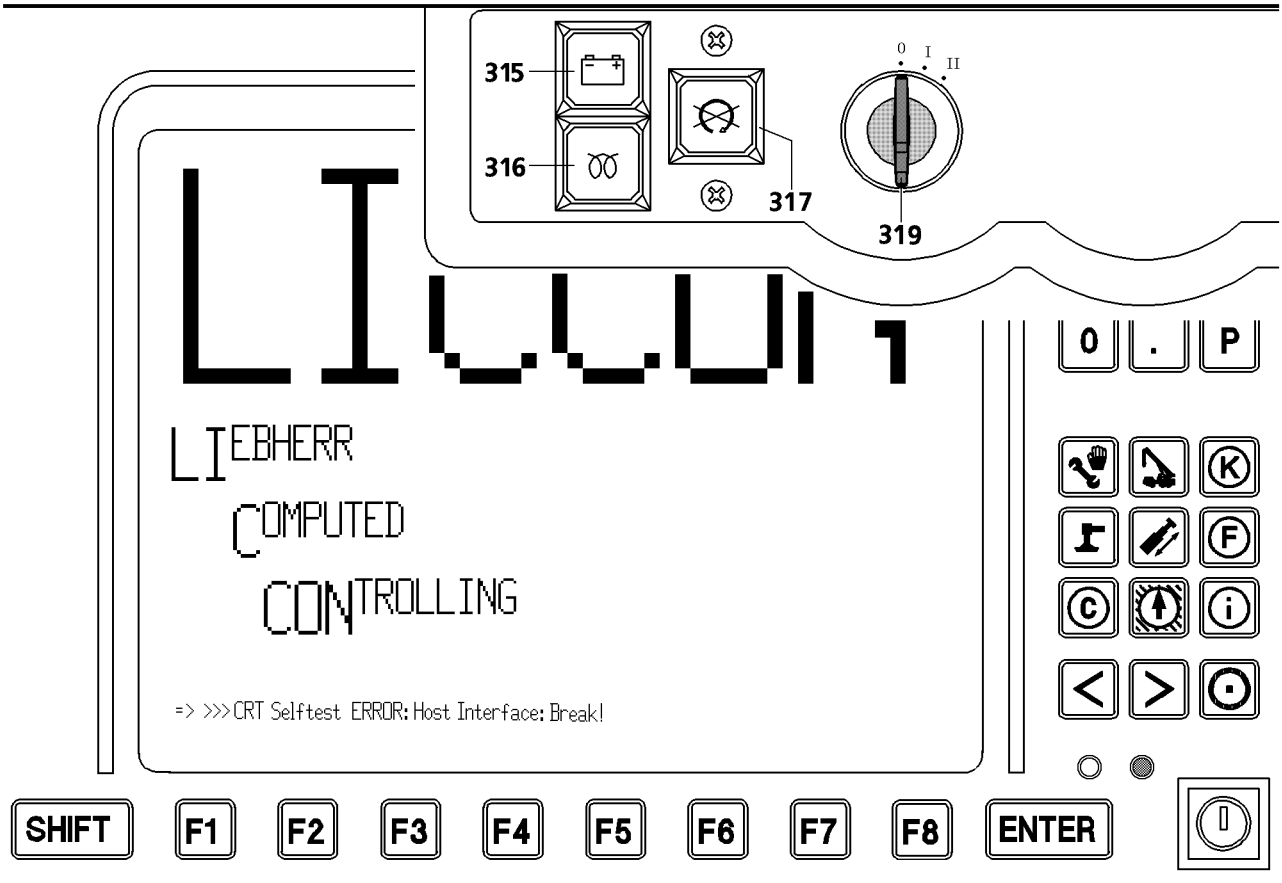
10	Tank capacity	• In [%]. Icon blinks the fuel reserve is less than 10%.
11	Oil pressure	• In [bar]. Numeric display in icon blinks if the engine oil pressure is too low.
12	Coolant / charge air temperature	• In [°C].
12.1	Coolant temperature	• Numeric display blinks if the coolant temperature is too high.
12.2	Charge air temperature	• Numeric display blinks if the charge air temperature is too high.
13	Coolant level too low	• Icon appears if the coolant level is too low.
14	Air filter is dirty	• Icon appears if air filter is dirty.
18	Auxiliary function - Battery voltage	• In [V]. Numeric display in icon blinks if the operating voltage is less than 16 volts or above 36 volts.
19	Hydraulic oil temperature	• In [°C].
19.1	Hydraulic oil temperature	• Numeric display blinks if the hydraulic oil temperature is too high.

9.5 Function key line

F1	Function key	• Retaining the engine monitoring screen.
F8	Function key	• Switching back to the “Crane operation” program.

Function keys **F2** - **F7** are **not** used


LIEBHERR
LICCON
LIEBHERR
COMPUTED
CONTROLLING
STANDBY
..... OFF !
7 8 9
4 5 6
1 2 3
0 . P
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER


315
316
317
319
0 I II
LIEBHERR
COMPUTED
CONTROLLING
=> >>>CRT Selftest ERROR: Host Interface: Break!
0 . P
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER

B194896

10 LICCON computer system in stand-by mode

10.1 Starting LICCON computer system in stand-by mode

There are two ways of achieving stand-by mode with the LICCON computer system.

Starting the LICCON computer system without engine:

▶ Turn the ignition key **319** to position “I” and leave it there.

Result:

– The LICCON computer system runs and the monitor shows the configuration screen, or alternatively for a stop / warning / advance warning, the engine monitoring screen.

▶ Press function key **F8** (O.K.).

Result:

– System switches to the “Crane operation” program.

Turning off the engine with the engine stop key:

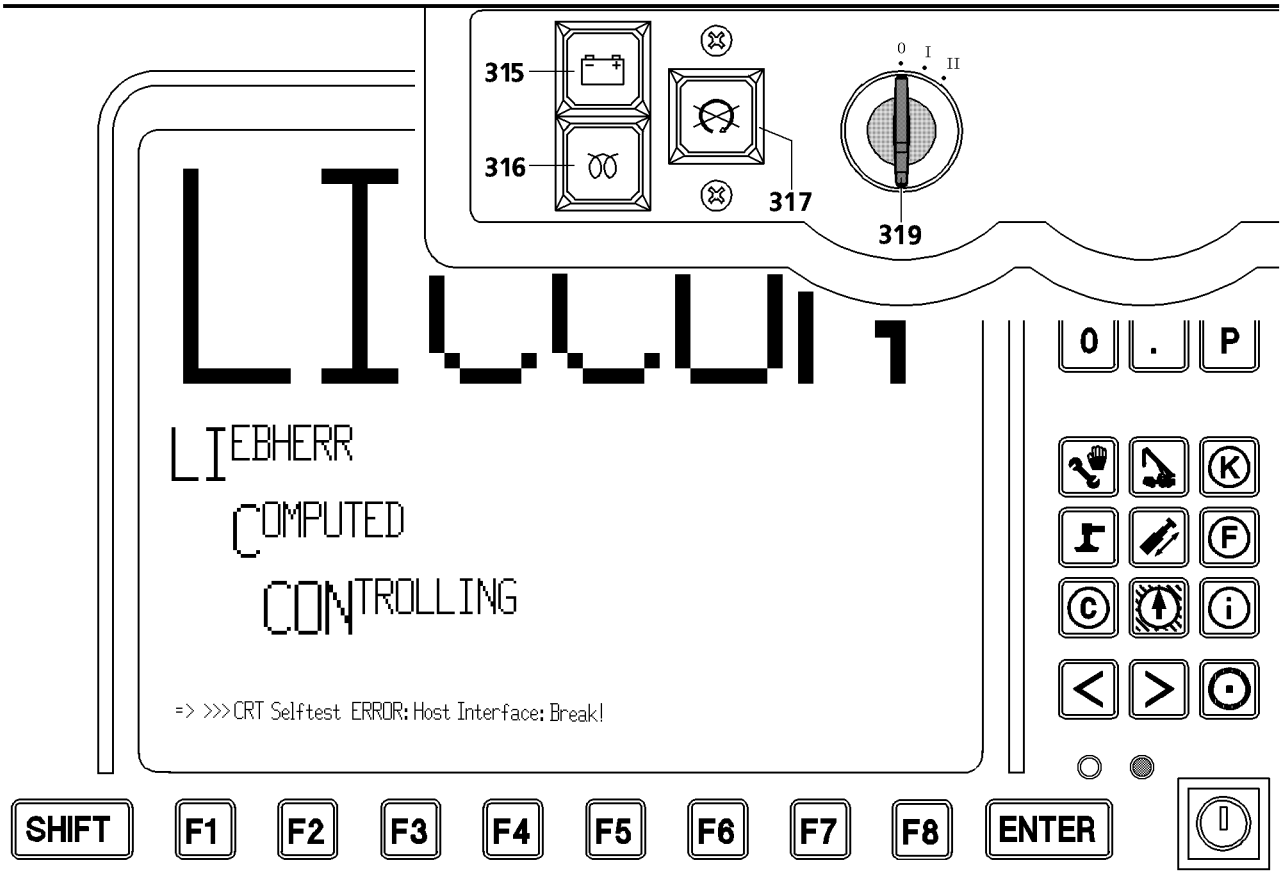
▶ Press the button **317**.

▶ Leave the ignition key **319** in position “I”.

Result:

– The engine is turned off.


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
LICCON
LIEBHERR
COMPUTED
CONTROLLING
STANDBY
OFF !
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER


315
316
317
319
0 I II
0 . P
LIEBHERR
COMPUTED
CONTROLLING
=> >>>CRT Selftest ERROR: Host Interface: Break!
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER

B194896

10.2 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 a further 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 self test: ERROR: Host Interface: Break!** (see illustration) and the control lights **315**, **316** and **317** blink. In this case, 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.

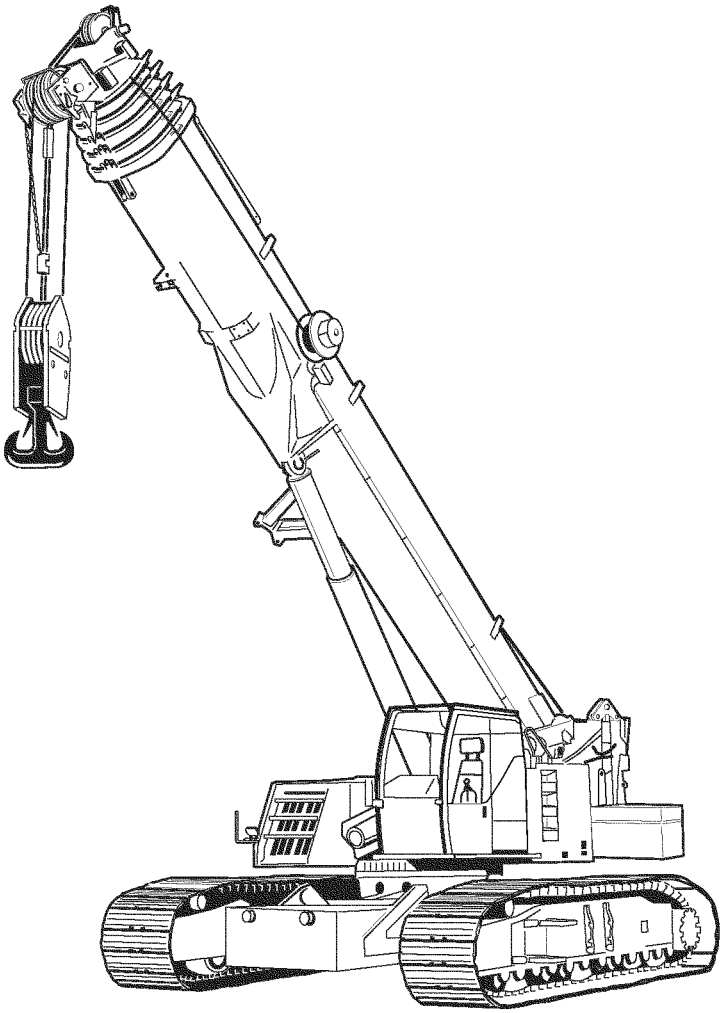
10.3 Start prevention

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

▶ Return the ignition switch **319** first to position “0”.
▶ Turn the ignition switch **319** to position “I” (note the preheating time).
▶ Turn the ignition switch **319** briefly to position “II”.

Result:

– The engine starts.



B198625

1 Checks before starting up

Various checks must be performed before starting up.

1.1 Checking oil level and filters

- ▶ Check engine oil level.
- ▶ Check oil level in hydraulic fluid reservoir.
- ▶ Check filter on hydraulic tank.

1.2 Checking the fuel level

Note
Deaerate fuel system.
If the fuel tank has been run dry, always deaerate the whole fuel system.
- ▶ Do not run the fuel tank dry.

On the LICCON monitor, the amount in the tank is given in the form of a numerical display in percent [%].
- ▶ Check tank contents on LICCON monitor.

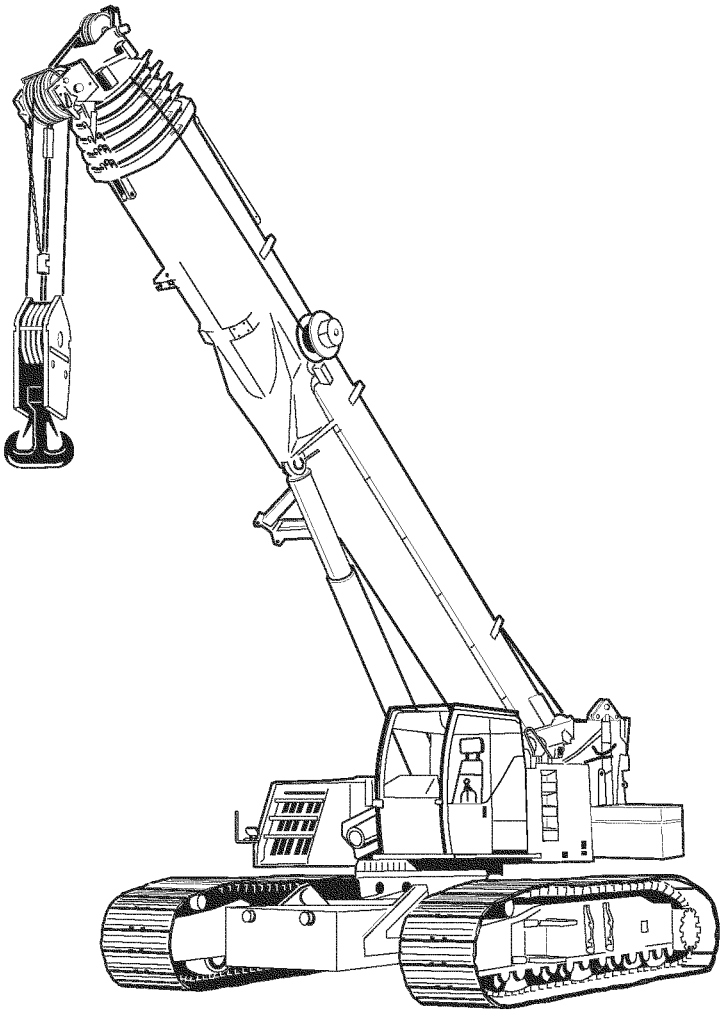
1.3 Checking the coolant level

WARNING
Danger of injury due to scalding of the skin.
- ▶ Engine must be cold when performing coolant level check.

Fill coolant expansion tank up to overflow on filler neck.
- ▶ Check the coolant level.

1.4 Checking central lubrication system

The grease container must be kept filled with grease as specified in the lubrication chart, see chapter 7.05.
- ▶ Check the grease container.

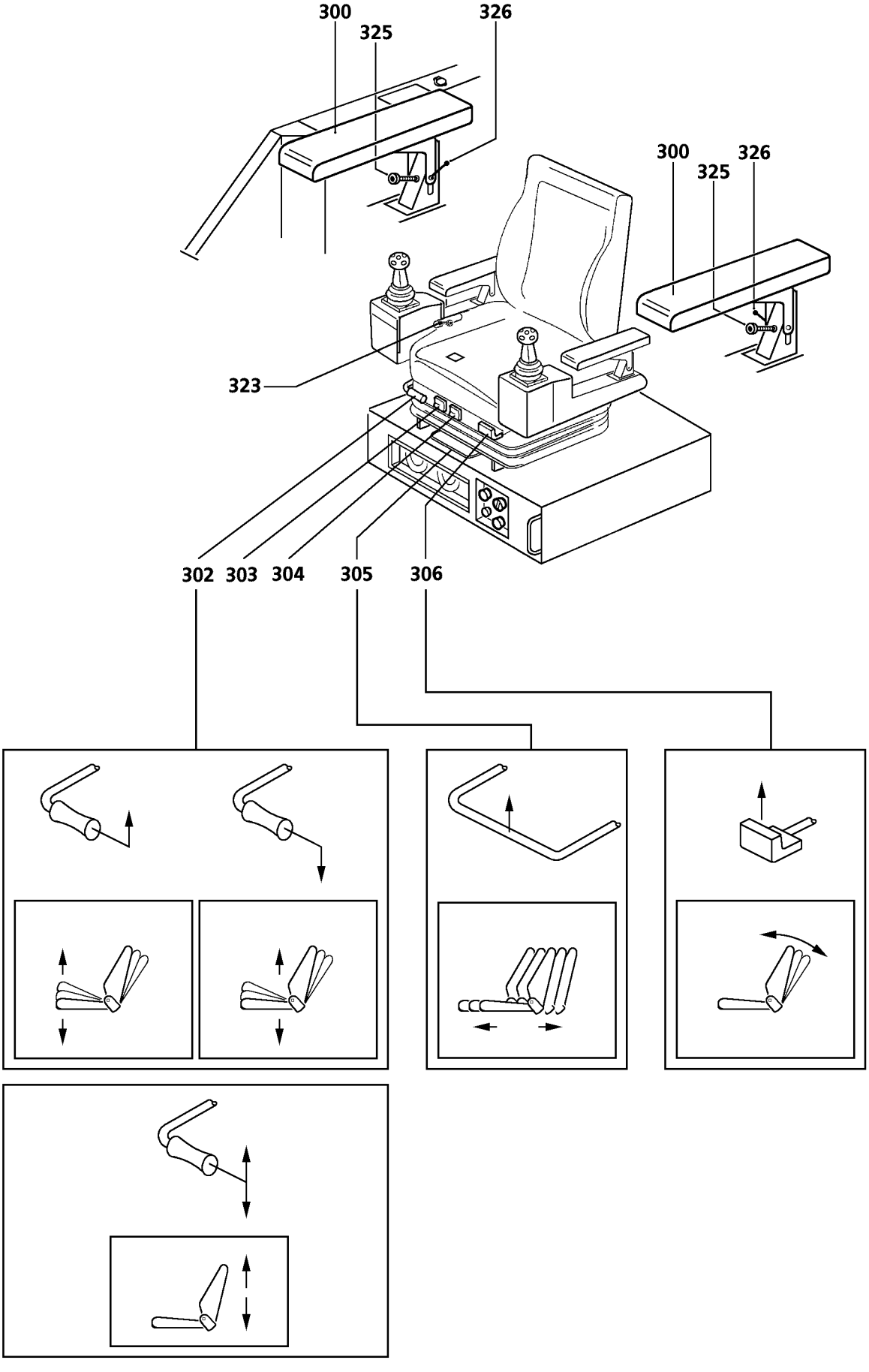


B198625

1.5 Checking general condition of crane

DANGER
Risk of accident from falling parts!
- ▶ Before raising the boom, check that there are no loose parts on the main boom and/or the auxiliary boom, such as pins, safety springs or ice.

- ▶ Check whether the crane is level.
- ▶ Check that the toothed ring of the slewing ring connection is clean and greased.
- ▶ Check the air supply to the oil cooler and water cooler.
- ▶ Check that the side covers are closed and locked.
- ▶ Ensure that there are no people or objects in the crane danger zone.
- ▶ Make sure that the cable / rope drums and the limit switches are free of snow and ice.
- ▶ Make sure that there are no loose parts on the superstructure or the telescopic boom.



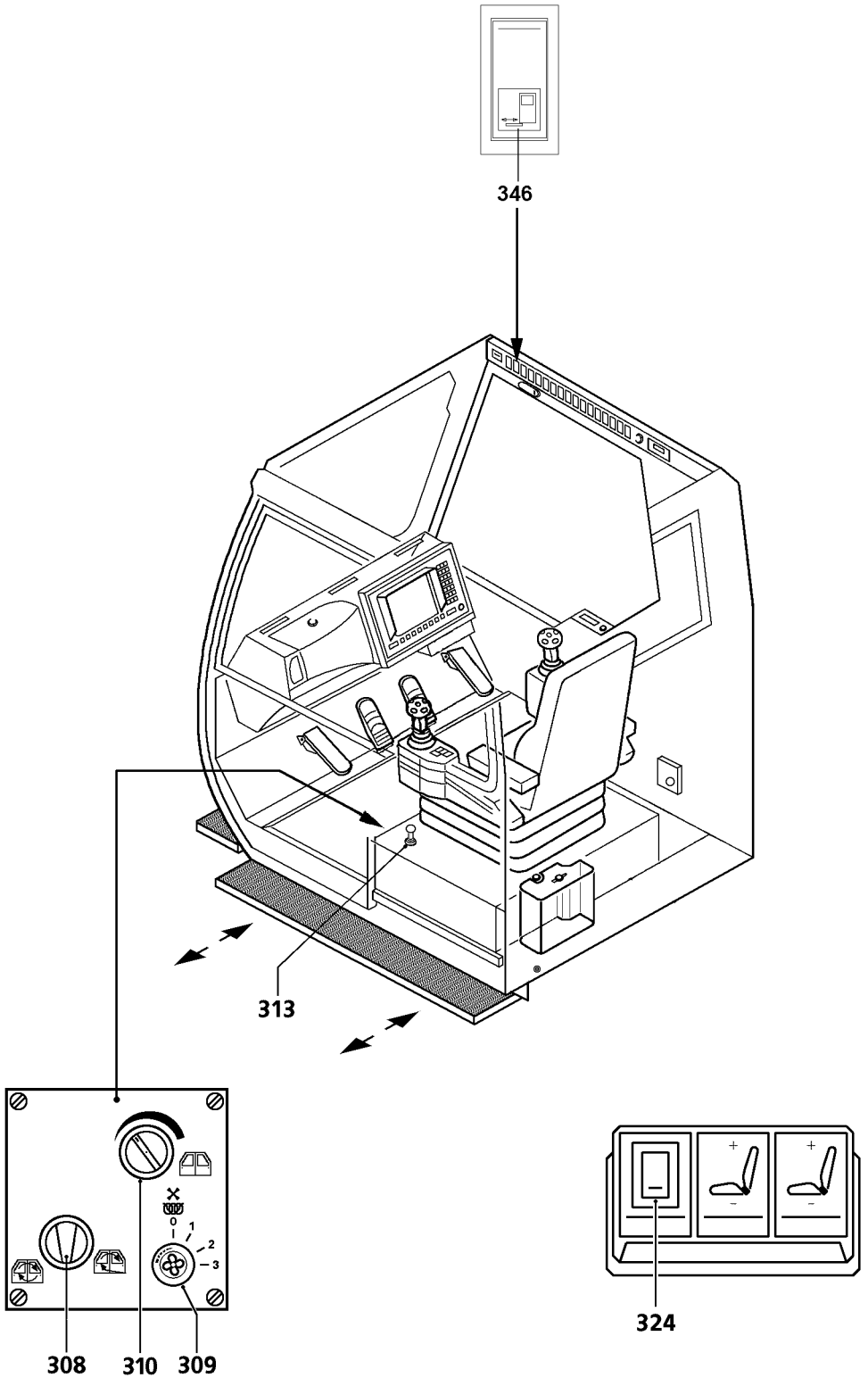
B197017

2 Crane operator's cab workplace

2.1 Adjusting crane operator's seat

The crane operator's seat can be adjusted to suit different body sizes.

- ▶ Using the lever **302**, adjust angle of seat.
- ▶ Using the lever **302**, adjust height of seat.
- ▶ Using the button **303**, adjust pneumatic lumbar support in lower part of backrest.
- ▶ Using the button **304**, adjust pneumatic lumbar support in upper part of backrest.
- ▶ Using the manually operated lever **305** unlock the horizontal seat adjustment.
- ▶ Using the lever **306**, adjust the inclination of backrest.
- ▶ Use the lock screw **323** to adjust the control station in longitudinal direction.
- ▶ Using set screw **325**, adjust angle of arm rests.
- ▶ Using the lever **326**, adjust height of the arm rests.



B102849

2.2 Footboard

In order to make it easier for the crane operator to enter and leave the crane, the crane cab footboard can be extended or retracted.
When you have finished working with the crane, retract the footboard again and secure it in the end position.

2.2.1 Extending footboard

- ▶ Swivel left armrest upwards.
- ▶ Pull locking **313** and operate button **346** on top.

Result:

– Footboard is extended.

- ▶ Release locking **313** as soon as the footboard extends.
- ▶ Extend the footboard until it again locks into place.

2.2.2 Retracting footboard

- ▶ Swivel left armrest upwards.
- ▶ Pull locking **313** and press button **346**.

Result:

– Footboard is retracted.

- ▶ Release locking **313** as soon as the footboard retracts.
- ▶ Retract the footboard until it again locks into place.

2.3 Turning the seat heating* on

- ▶ Press switch **324**.

2.4 Turning heater / ventilation on

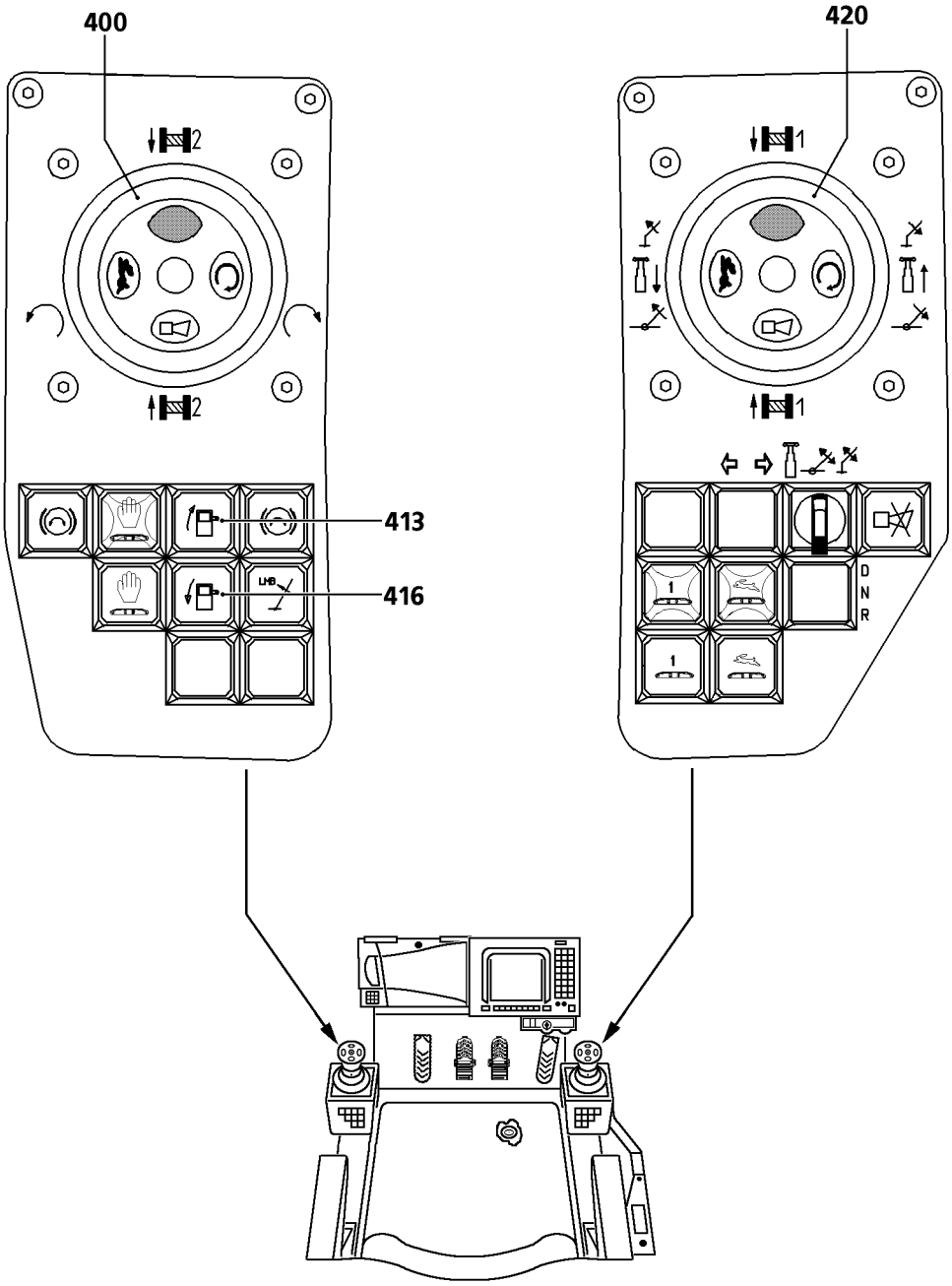
The cab can be heated or ventilated to the desired temperature. The operating controls for heater / ventilation are below the crane operator's seat. For a detailed description see Chapter 6.01.

2.4.1 Heating

- ▶ Move variable switch **308** to recirculated air.
- ▶ Turn the fan on using the rotary switch **309**.
- ▶ Control temperature with the variable switch **310**.

2.4.2 Ventilation

- ▶ Move variable switch **308** to fresh air.
- ▶ Turn the fan on using the rotary switch **309**.



B198627

2.5 Tilting crane cab

To give the crane operator a better field of view, the cab can be tilted upwards.
When the cab is tilted, the cab doors will open more quickly and hit the backstop. Therefore hold the door by the handle and open slowly.
When you have finished working with the crane, set it to horizontal.

CAUTION
Risk of accident!
▶ If the cab is tilted, it is forbidden to stand on the footboard.

2.5.1 Tilting cab upwards

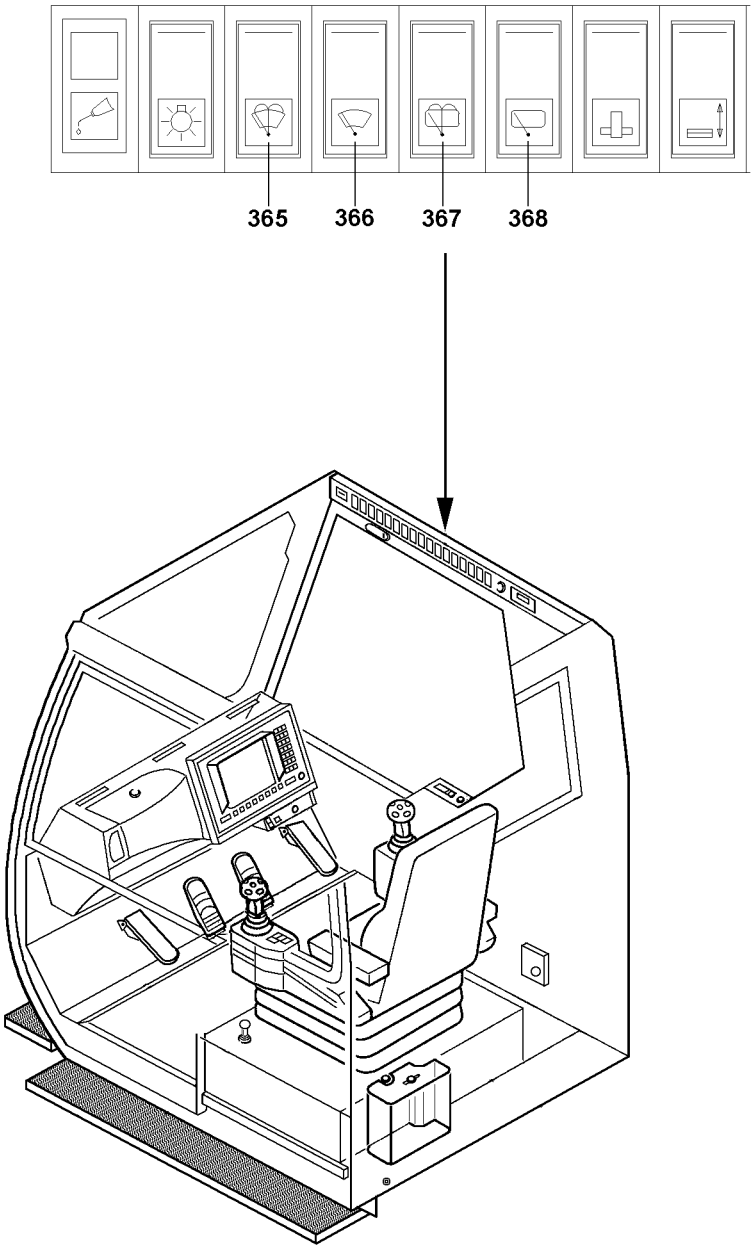
▶ Press button **413**.

Result:
– The cab swivels upwards.

2.5.2 Moving the cab to a horizontal position

▶ Press button **416**.

Result:
– Cab swivels downwards.



B102850

2.6 Operating the windshield wiper / windshield washing system

2.6.1 Operating the windshield wiper

The windshield wipers for the windshield and the roof window are operated using a 2-stage switch (first stage - intermittent, second stage - continuous wipe).

▶ To activate the windshield wiper on the front window:
Press switch **366**.

or

To activate the windshield wiper on the roof window:

- Press switch **368**.

2.6.2 Operating the windshield washing system

The windshield wipers on the front and roof windows can be assisted by a windshield washing system.

Before the start of the cold season, fill the container for the windshield washing fluid with standard antifreeze mix.

▶ To activate the windshield washing system on the front window:
Press button **365**.

or

To activate the windshield washing system on the roof window:

- Press button **367**.

2.7 Opening front window

WARNING
Danger of hand injury from trapping!
▶ Be careful with your hands when closing the front window.

A pair of nitrogen gas cylinders provide help to lift the front window.

▶ To open from inside, just press on the front window.

or

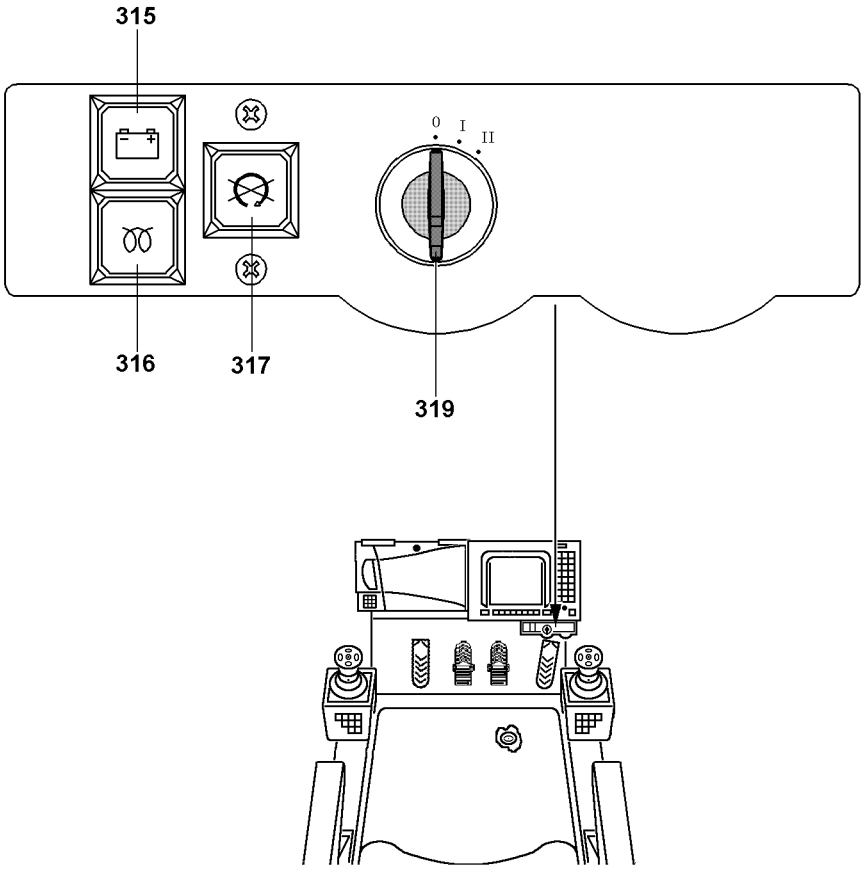
If you only want to partly open the window:

- Use the attached strap to set the desired opening angle.

2.8 Checking the signal horn

Note
Use of signal horn!
▶ Only use the signal horn in dangerous situations, to maintain its warning effect.

▶ Before starting work, check that the signal horn is functioning.



B198629

3 Starting and stopping the engine

The engine is only at full capacity when the operating temperature has been reached.
Ensure that the following prerequisites are met:
– the battery master switch is turned on

3.1 Starting the engine

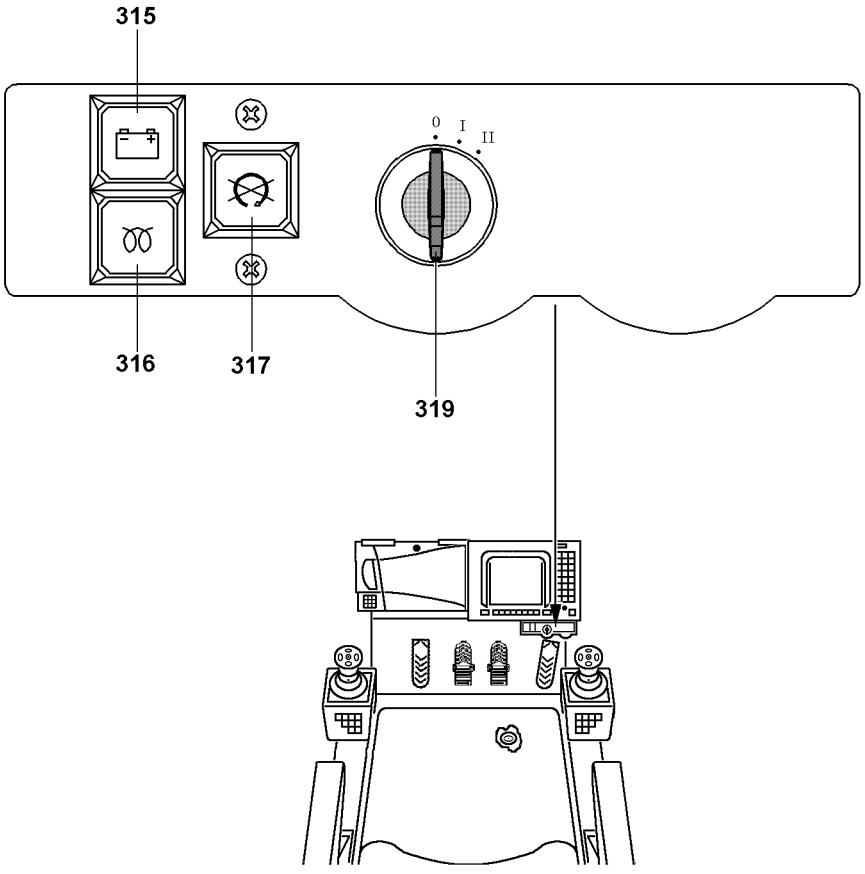
▶ Turn ignition switch **319** to position “I”.

Result:
– The control light **316** flashes.
– The control light **315** is lit.
The engine is ready to start.

CAUTION
Danger of equipment damage!
▶ Only start the engine if the control light **315** is on, and the control light **316** is flashing.

▶ Turn ignition switch **319** to position “II”.
▶ Start the engine.

Troubleshooting
The engine does not start after a maximum of 10 seconds:
▶ Wait for 1 minute. The starter can be operated three times for 10 seconds per attempt with a pause in between of one minute each time.



B198629

3.2 Starting the engine with flame starting device

To improve the cold start process and the warm-up phase, the engine is equipped with a flame starting device.
The flame starting device switches off automatically if:

– The engine is not start when it is ready.
– The engine is started while the control light **316** is illuminated.
– The coolant temperature reaches 20 °C while the engine is running.

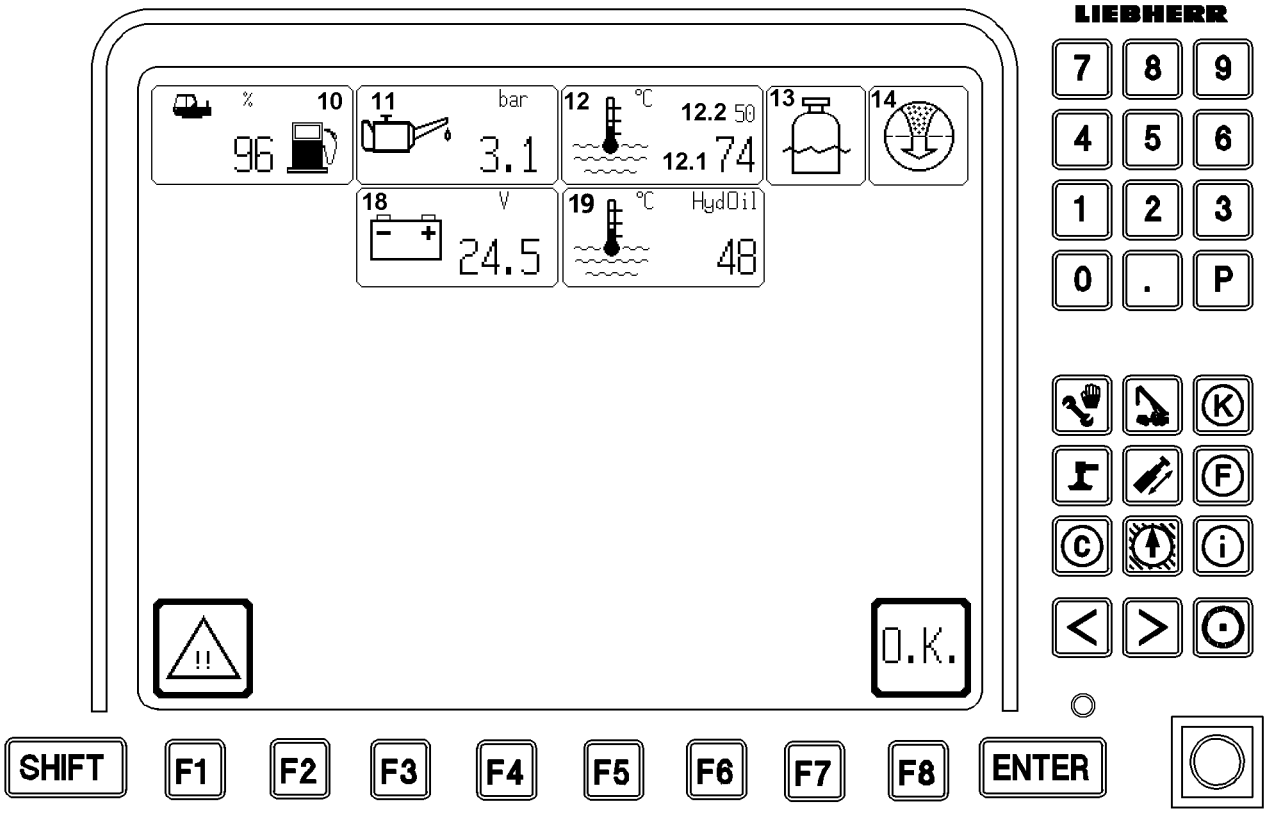
WARNING
Battery functioning capacity in the cold season.
The starting capacity of the battery is considerably reduced in cold weather: for example, at a temperature of -10 °C, the battery is at only 66% of its normal capacity
▶ Once the engine has been turned off, store batteries in a heated room, if possible.

▶ Turn ignition switch **319** to position “I”.

Result:
– The control light **316** lights up and then after a short time starts to flash.
The engine is ready to start.

▶ Turn ignition switch **319** to position “II”.
▶ Start the engine.

Troubleshooting
Is the control light **316** flashing?
The control unit has identified a defect with the flame starting device.
▶ Rectify the defect.


LIEBHERR
10
96
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bar
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7 8 9
4 5 6
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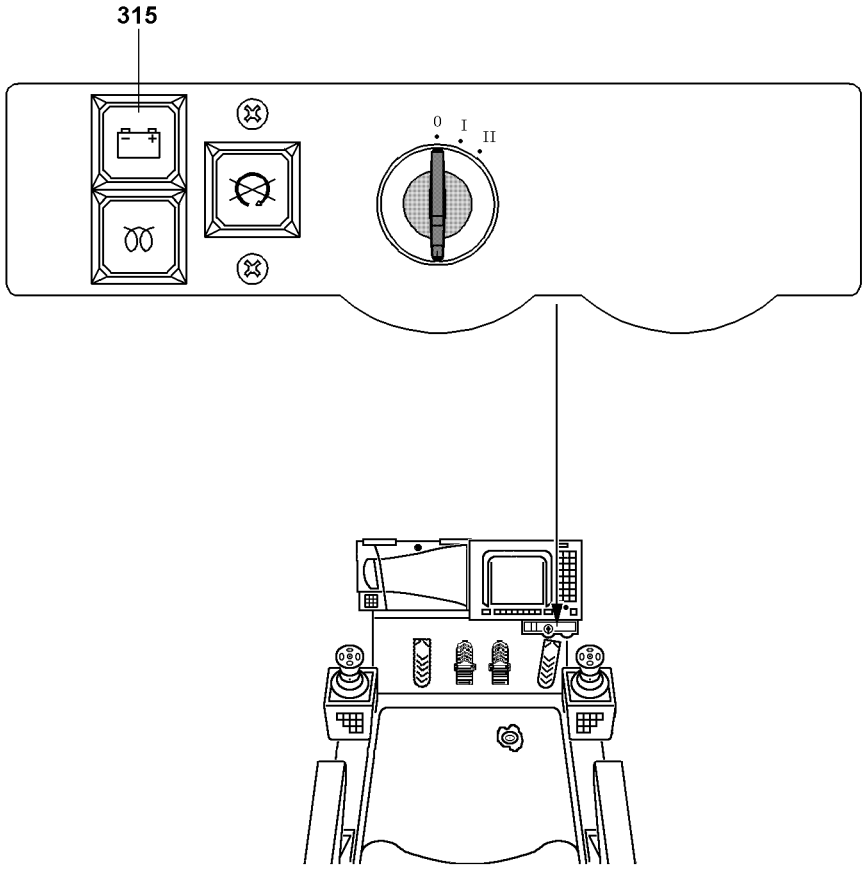
C
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER


315
0 I II

B198630

3.3 Checking the instruments after starting the engine

As soon as a stable voltage is present with the engine running, the crane controls and the LICCON computer system are automatically switched on. A self-test of the microprocessor system follows, and after a few seconds the configuration state screen appears on the monitor.

3.3.1 Checking the instruments on LICCON monitor

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

- ▶ Check the control light **315**.
- ▶ Check icon **11** “engine oil pressure” on LICCON monitor.

Troubleshooting

Does the numerical display for the engine oil pressure in the icon **11** blink after approximately 10 seconds or does it start to blink during crane operation?

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

- ▶ Turn off engine and determine the cause.

- ▶ Check the numerical display of the coolant temperature in icon **12.1**.

Troubleshooting

Does the numerical display for the “coolant temperature” in icon **12.1** flash during operation?

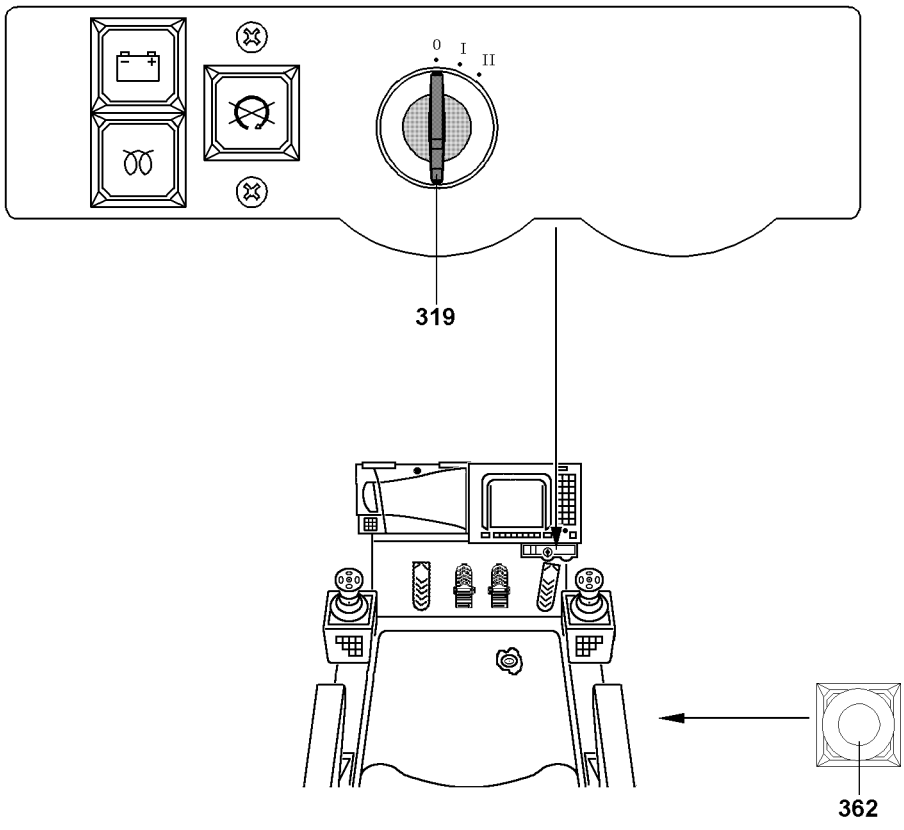
Coolant temperature is too high. Excessive coolant temperatures can lead to engine damage.

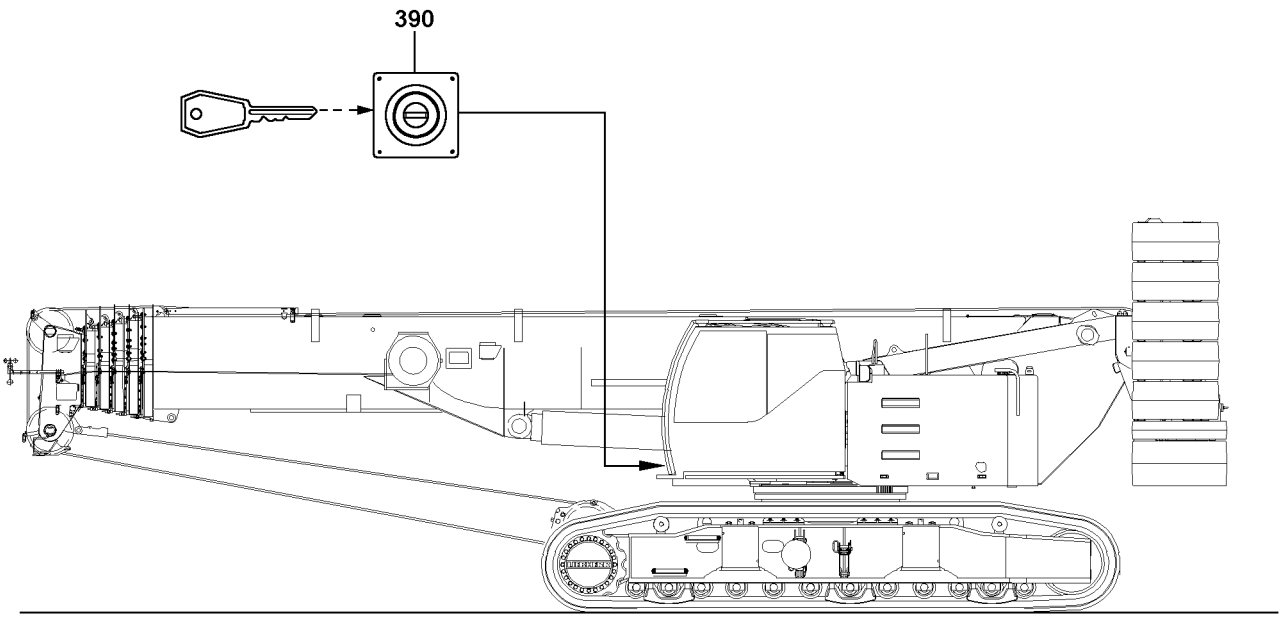
- ▶ Turn off the engine immediately.

- ▶ Check icon **10** for “fuel tank level”.
- ▶ Check icon **19** for “hydraulic fluid temperature”.
- ▶ Check icon **12.2** for “charge air temperature”.
- ▶ Check icon **13** for “coolant level”.
- ▶ Check icon **14** for “air filter”.
- ▶ Check icon **18** for “battery voltage”.

3.4 Engine monitoring

Refer to chapter 4.02, section Engine monitoring.





B102851

3.5 Turning off the engine

3.5.1 Turning off the engine

If the crane has been operated at full engine output, or with very high coolant temperatures (above 95 °C), let the engine run without load for 1-2 minutes at idling speed.

▶ Turn ignition starter switch **319** back to the stop.

▶ Pull out ignition starter switch **319** and store in a safe place.

3.5.2 Turning off the engine in the event of danger

CAUTION

Operating the emergency-off switch

▶ Only use the emergency off switch **390** or the emergency off switch **362** in case of serious emergency. Use of the emergency off-switch **390** or the emergency off-switch **362** in normal situations is forbidden!

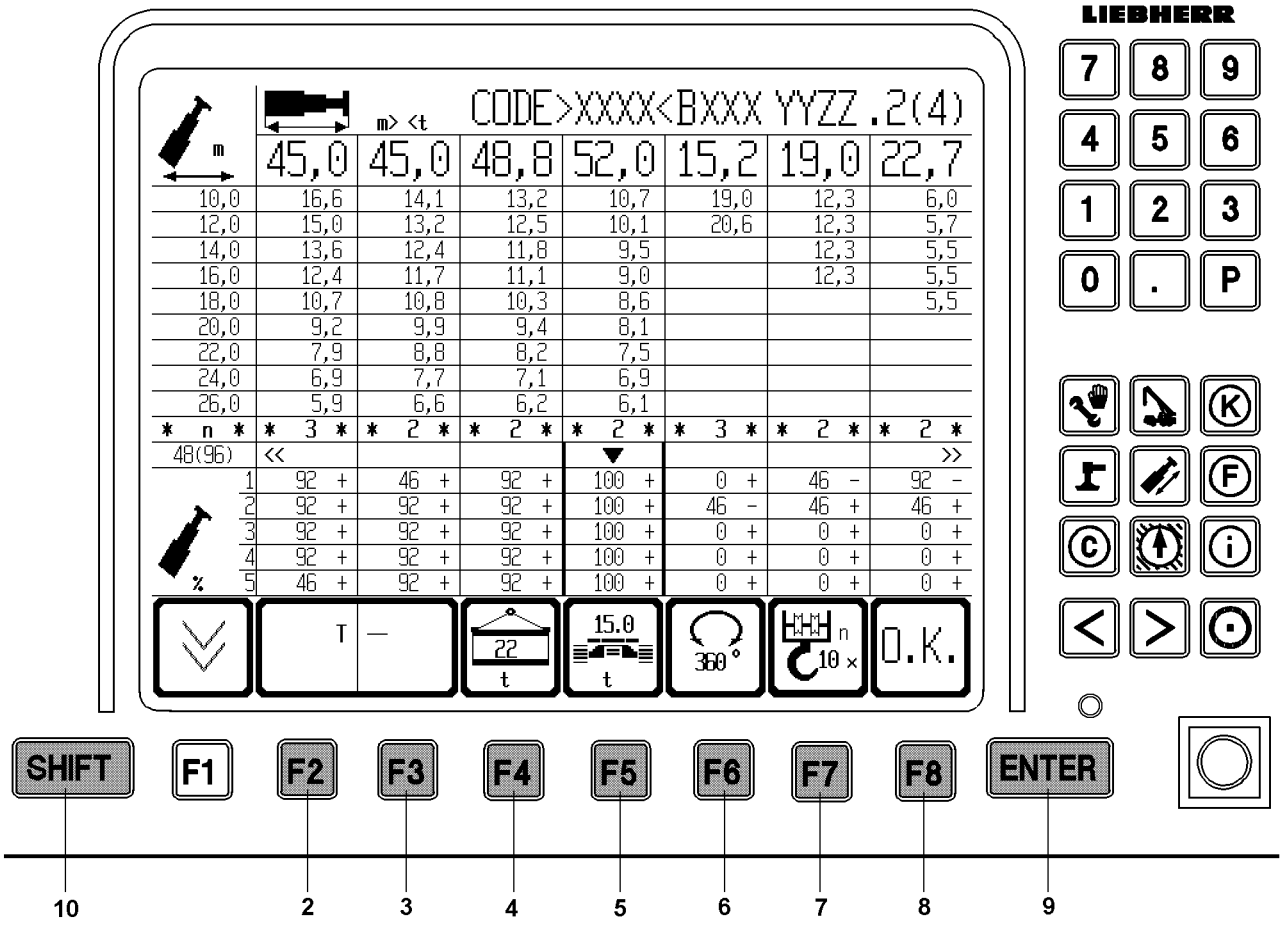
▶ Press the emergency-off switch **390**.

or

■ Press the emergency-off switch **362**.

Result:

– The crane will be turned off immediately.


LIEBHERR
m> <t
CODE>XXXX<BXXX YYZZ .2(4)
45,0 45,0 48,8 52,0 15,2 19,0 22,7
10,0 16,6 14,1 13,2 10,7 19,0 12,3 6,0
12,0 15,0 13,2 12,5 10,1 20,6 12,3 5,7
14,0 13,6 12,4 11,8 9,5 12,3 5,5
16,0 12,4 11,7 11,1 9,0 12,3 5,5
18,0 10,7 10,8 10,3 8,6 5,5
20,0 9,2 9,9 9,4 8,1
22,0 7,9 8,8 8,2 7,5
24,0 6,9 7,7 7,1 6,9
26,0 5,9 6,6 6,2 6,1
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48(96) << >>
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3 92 + 92 + 92 + 100 + 0 + 0 + 0 +
4 92 + 92 + 92 + 100 + 0 + 0 + 0 +
5 46 + 92 + 92 + 100 + 0 + 0 + 0 +
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B102853

4 LICCON computer system after engine start

The LICCON computer system is only operational with the engine running.

4.1 Waiting for the run-up phase

After being switched on, the LICCON computer system runs up and carries out a self-test, see chapter 4.02.

▶ Wait for the run-up phase.

Result:

– The configuration screen appears on the LICCON monitor.

Normally, the most recently set configuration state and reeving number will be displayed.

If a master switch is moved away from the zero position during the run-up phase, the function circuit of the electrical safety chain is interrupted.

▶ In this case:
Turn off the engine and ignition and start again.

Troubleshooting

If an error message appears on the LICCON monitor?

▶ Turn off the engine and ignition and start again.

▶ The LICCON computer system automatically displays the troubleshooting display.

Troubleshooting

The LICCON monitor does not show the most recently set configuration state and reeving number?

If there has been a loss of data in the storage device (cold start), the first valid configuration state appears in the configuration screen. The reeving number is set to “0”.

▶ Set the configuration state and reeving number again.

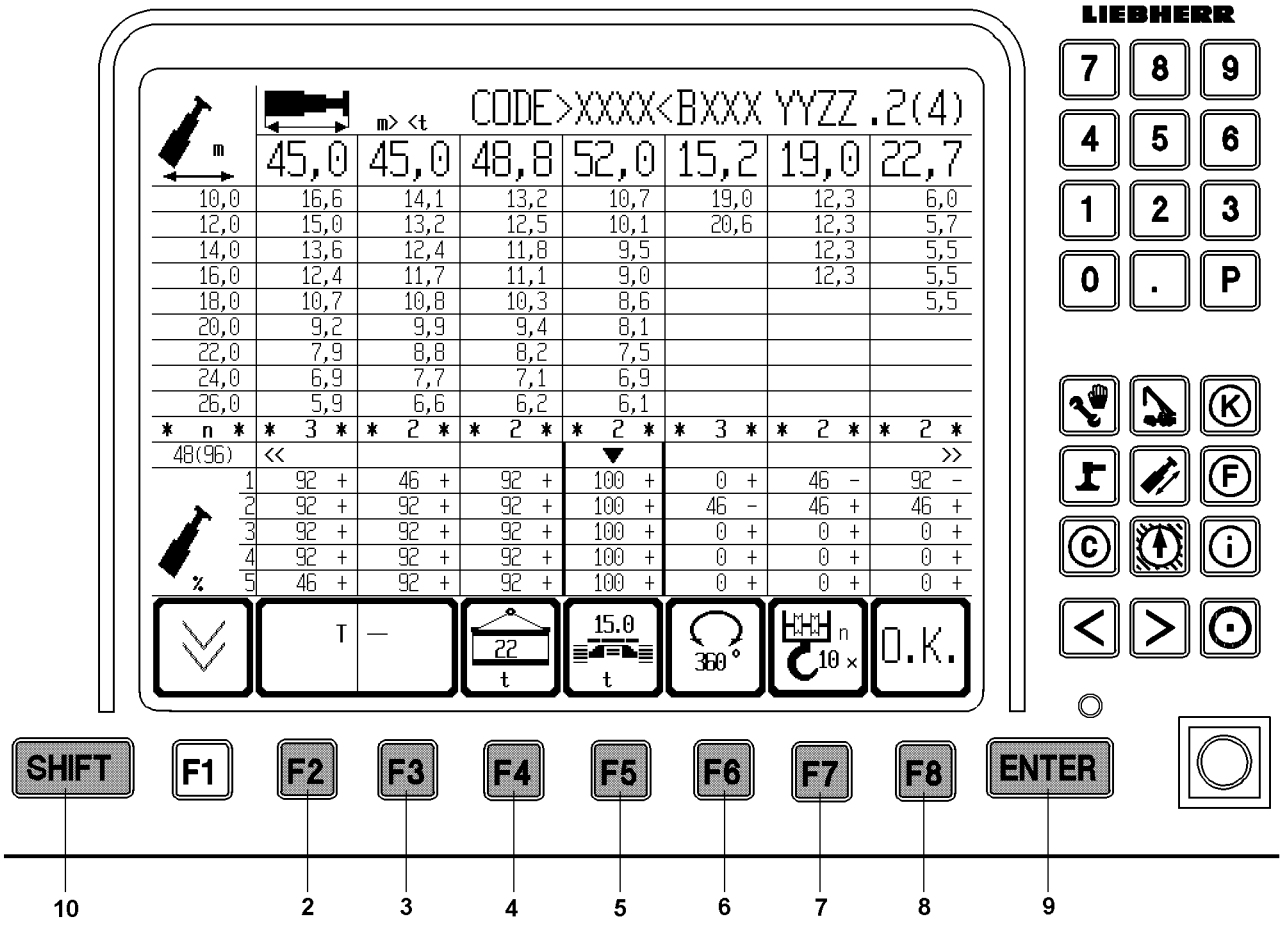
4.2 Taking over the previously selected configuration and hoist rope reeving

Check whether the correct short code and the correct reeving number have been selected on the operating screen.

▶ If the settings on the operating screen are correct:
Press function key “F8” **8**.

Result:

– The “Configuration” program will terminate, and the parameters set will be accepted by the newly started “Operation” program.


LIEBHERR
m> <t
CODE>XXXX<BXXX YYZZ .2(4)
45,0 45,0 48,8 52,0 15,2 19,0 22,7
10,0 16,6 14,1 13,2 10,7 19,0 12,3 6,0
12,0 15,0 13,2 12,5 10,1 20,6 12,3 5,7
14,0 13,6 12,4 11,8 9,5 12,3 5,5
16,0 12,4 11,7 11,1 9,0 12,3 5,5
18,0 10,7 10,8 10,3 8,6 5,5
20,0 9,2 9,9 9,4 8,1
22,0 7,9 8,8 8,2 7,5
24,0 6,9 7,7 7,1 6,9
26,0 5,9 6,6 6,2 6,1
* n * * 3 * * 2 * * 2 * * 2 * * 3 * * 2 * * 2 *
48(96) << >>
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2 92 + 92 + 92 + 100 + 46 - 46 + 46 +
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B102853

4.3 Selecting the new configuration and hoist rope reeving

The selected and displayed configuration can be modified either by using the function keys or entering the short code.

4.3.1 Selecting the new configuration using function keys

- ▶ Press function key “F2” **2** until the desired main geometry status is selected.
- ▶ Press function key “F3” **3** until the desired accessory status is selected.
- ▶ Press function key “F4” **4** until the desired superstructure counterweight is selected.
- ▶ Press function key “F5” **5** until the desired chassis central ballast status is selected.
- ▶ Press function key “F6” **6** until the desired slewing area of the superstructure is selected.
- ▶ Press “Enter” **9** key.
- ▶ Check the set load chart.

4.3.2 Selecting new configuration with short code

The short code can be found in the load chart.

- ▶ Entering the 4-digit short code with keypad **A**.
- ▶ Press “ENTER” **9** key.

Result:

– The data of the selected load chart can be viewed.

For a more detailed description of the “Configuration” program, see chapter 4.02.

- ▶ Check the set load chart.

4.3.3 Selecting the new hoist rope reeving

- ▶ Press function key “F7” **7** until the desired reeving number is selected.

or

- ■ Press function keys “SHIFT” **10** and “F7” **7** until the desired reeving number is selected.

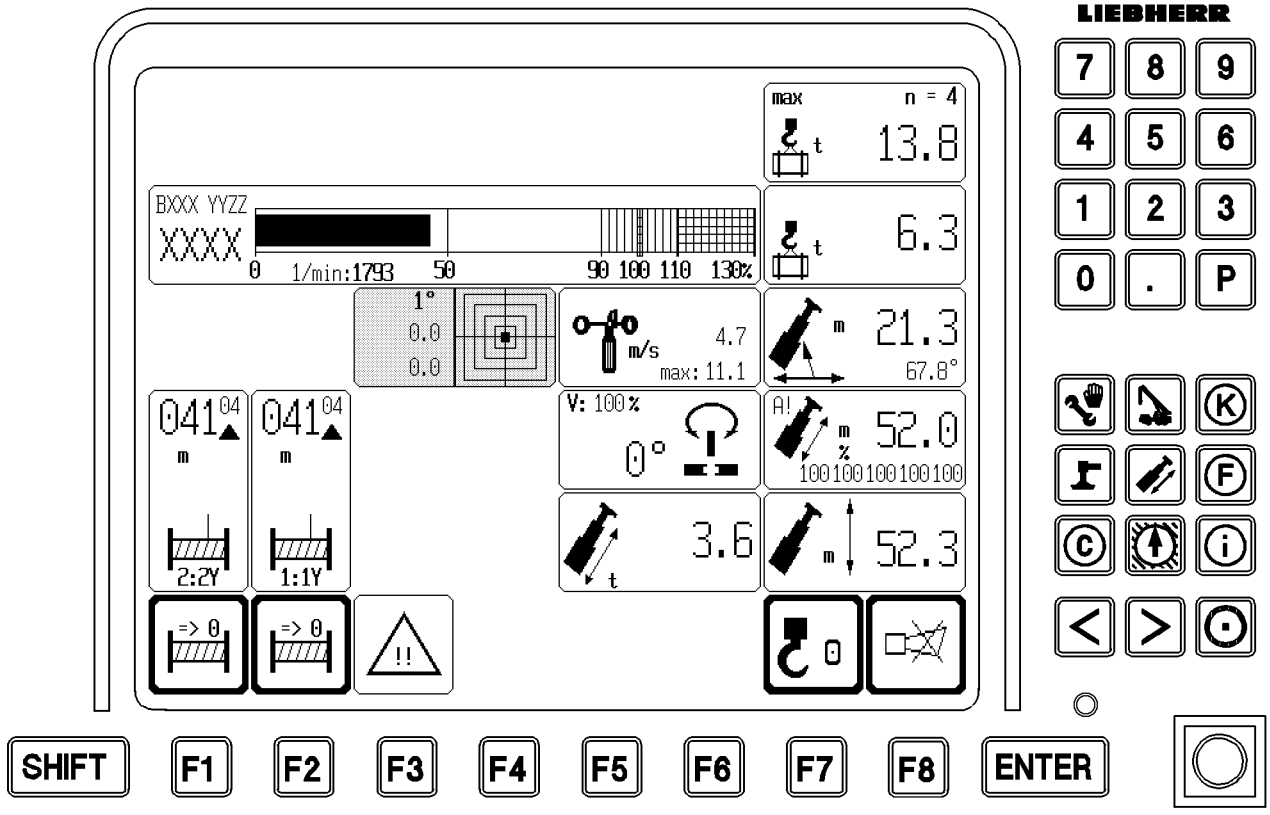
4.3.4 Checking the new configuration and hoist rope reeving and accept

- ▶ If the settings on the configuration screen are correct:
  Press function key “F8” **8**.

Result:

– The “Configuration” program will terminate, and the parameters set will be accepted by the newly started “Operation” program.

- ▶ Check whether the correct short code and the correct reeving number have been selected on the operating screen.


LIEBHERR
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F3
F4
F5
F6
F7
F8
ENTER

B198633

1 General

1.1 Safety systems

Every time the crane is operated, the crane operator is required to satisfy himself about the functionality of the safety systems.

DANGER
Danger of accident from defective warning and safety systems!
Operating the crane with defective warning and safety systems can lead to life-threatening accidents!
▶ Make sure that all warning and safety systems are functioning.
▶ Make sure that the overload protection is functioning.

1.1.1 Checking overload protection

If the telescopic boom without a load and lifting equipment is fully telescoped in and horizontally aligned, then the LICCON must show approximately the following:
– Load 0 t.
– Telescopic boom length 11.5 m.
– Telescopic boom angle 0°.

1.2 Levelling instruments

To ensure the working safety of the crane, the crane must be aligned horizontally on level ground with sufficient load bearing capacity.

DANGER
Danger of accidents due to toppling of the crane!
If the crane is not aligned horizontally, it may tip over. The maximum permitted deviation from the horizontal position of the crane is ± 0.5% (± 0.3°).
▶ Ensure that crane is level.

2 LICCON computer system

The LICCON computer system is a system for controlling and monitoring mobile cranes. In addition to the overload protection (Load moment limiter **LMB**) there are a number of application programs that can be used for controlling and monitoring the crane movements, see chapter 4.02.

2.1 Overload protection

The relevant sensors for the overload protection are:
– Length sensors
– Angle sensors
– Pressure sensors
– Inductive sensor - Telescopic boom pinning

The electronic overload protection **turns** all **load moment increasing** crane movements **off** if the permissible load moment is being exceeded. Only load moment decreasing movements can then be carried out.

DANGER
Risk of accident!
The presence of the overload protection does not relieve the crane operator of his obligation for care and attention.
▶ Before lifting a load, determine its approximate weight and center of gravity, and with the help of the load chart, decide whether the crane is in a position to carry out this job.

The overload protection cannot cover all possible operational conditions.

DANGER
Danger of accident due to incorrect operation of the crane!
Due to incorrect operation of the crane, the overload protection does not become effective or the shut off does not occur quickly enough. In these cases, accidents are possible despite an installed overload protection!
▶ Be especially vigilant!

The overload protection registers, but:
– does not turn off, for example the wind speed,
– does not monitor, for example the crane incline,
– does not monitor, for example the turn angle of the turntable.

The overload protection does **not** register:
– the hooking of the load or the load tackle,
– excessive delay forces,
– loads falling onto the rope,
– angular pull,
– driving the crane on ground with large slope,
– collapsing ground.

DANGER
Danger of toppling or destroying the crane!
▶ The overload protection is a device according to EN 13000. It may not be used as an operational shut off device for crane movements of any kind.
▶ The overload protection must be adjusted to the current equipment configuration of the crane before crane operation to match the load chart. Only that way can it fulfill its protective task.
▶ After every equipment configuration change and / or boom configuration, the overload protection device must be reset to the corresponding equipment configuration and / or boom configuration.
▶ The crane operator must meet his duty of caution and attention, despite the overload protection.

2.1.1 Failure of the overload protection

It is technically possible to operate the crane without the LICCON.

DANGER
Serious risk of accidents!
If the LICCON system is no longer functioning properly because of a error in the LICCON monitor, the CPU or the power supply, then the crane can be operated in emergency mode with utmost caution, if absolutely necessary.
▶ In this case, the crane operator bears full responsibility.
▶ The crane operator may **not** use emergency mode if he is **not** fully aware of the extent of the monitoring tasks and dangers associated with that mode.

2.1.2 Procedure to follow in case of a problem

Basically, all conditions in the load charts must be strictly adhered to, even those not monitored by the LMB:

– The exact weight of the load, including load tackle, must be known.
– The condition of the boom and the boom geometry must be known and must agree with the stated values in the corresponding load chart.
  The boom length and boom projection radius must be measured manually.
– It must be ensured that the telescopic boom has been pinned.

In the event of a LICCON monitor failure:
Replace LICCON monitor with a functioning substitute monitor.

In the event of a CPU failure:
Replace CPU with a functioning substitute CPU.

In the event of power supply failure:
Replace the power supply unit with a functioning substitute power supply unit.

If one or more sensors fail, it is possible to continue work manually, if the “missing values” are monitored manually and agree with the values in the load chart that is used.

2.1.3 Ending a load lift

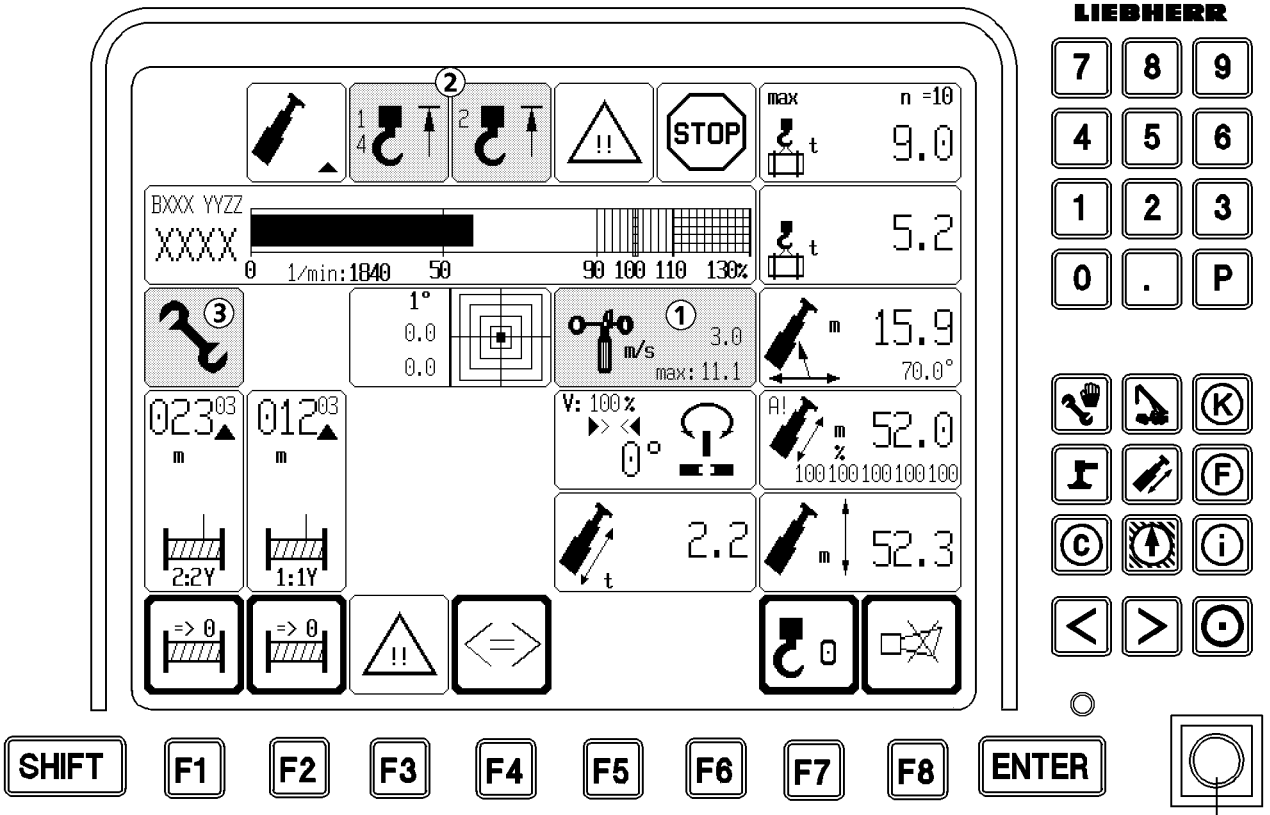
If the problem cannot be remedied using these measures, we recommend:

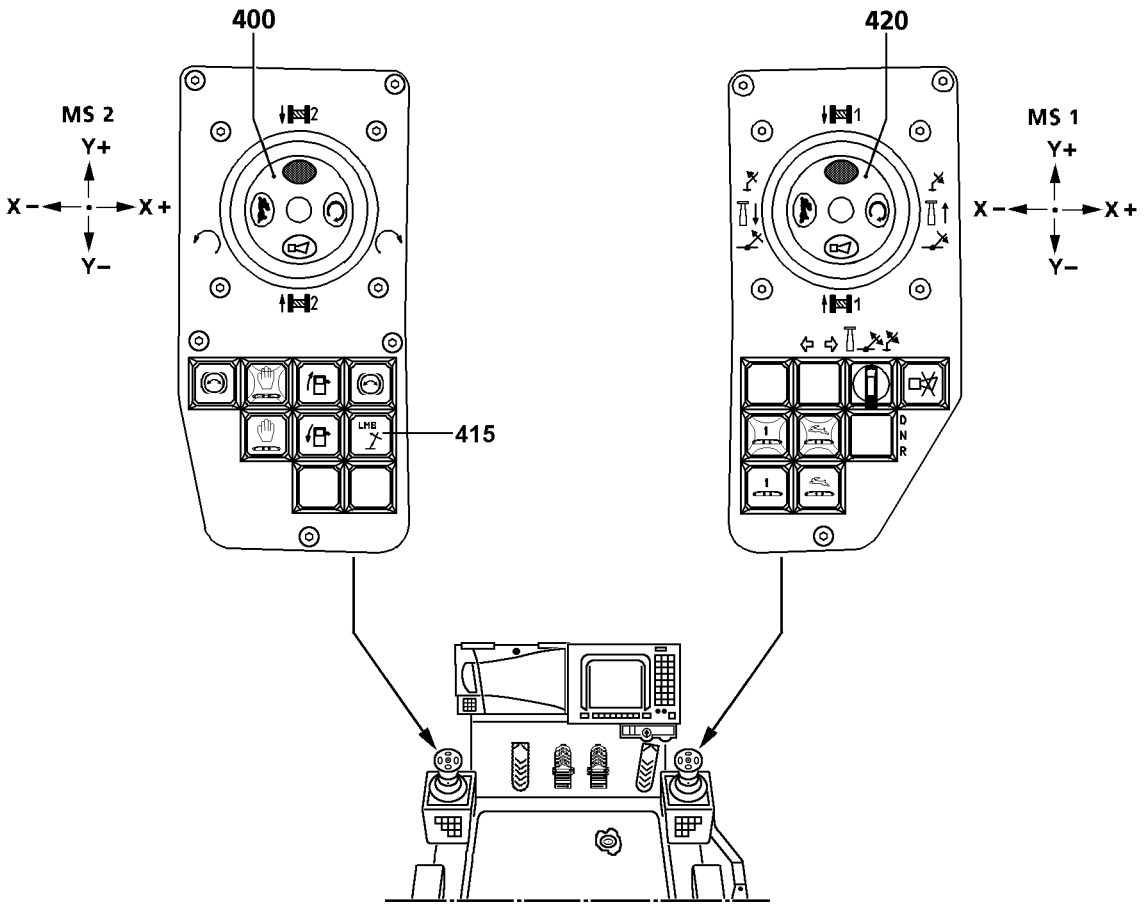
– Before continuing the load lift, contact the nearest Liebherr Service center or the Liebherr-Werk in Ehingen.

If this is not possible, then the load lift can be completed with utmost caution, as follows:

– All values that are needed for determining the equipment configuration and the associated load chart must be measured and / or manually determined.

DANGER
Risk of accident due to overloading the crane!
▶ The exact weight of the load, including hook and attachment equipment, must be known!


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
STOP
max
n =10
9.0
5.2
15.9
70.0°
52.0
2.2
52.3
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
D


400
420
MS 2
Y+
X−
X+
Y−
MS 1
Y+
X−
X+
Y−
415

B198634

3 General safety equipment

3.1 Wind warning device

The wind warning appears in the operating view of the LICCON computer system.
If the current wind speed exceeds the displayed maximum value, the “Wind warning” icon **1** starts to blink and the acoustic alarm “short horn” sounds. But there is **no shut off** of crane movements.

DANGER
Danger of accidents from exceeding the permitted wind speed!
There is **no** automatic shut off of crane movements.
- ▶ Stop crane operation and place down the boom.

3.2 Hoist limit switch “Hoist top”

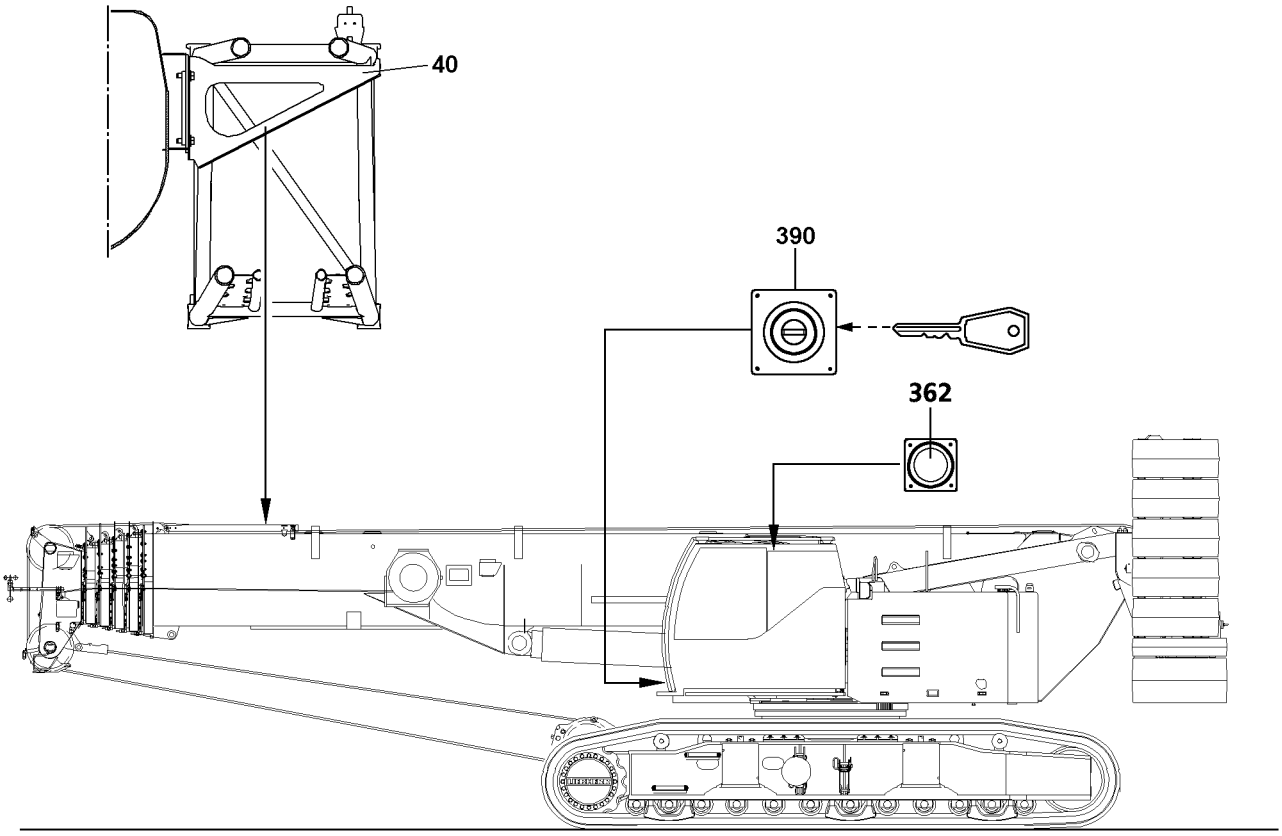
The hoist limit switch is intended to prevent the hook block from colliding with the boom head.
Before every crane application, the function of the hoist limit switch must be checked by running against the switch weight with the hook block.
When the hoist limit switch is actuated, the icon **2** appears in the operations screen. The crane movements “lift”, “luff down” and “telescope out” are turned off.

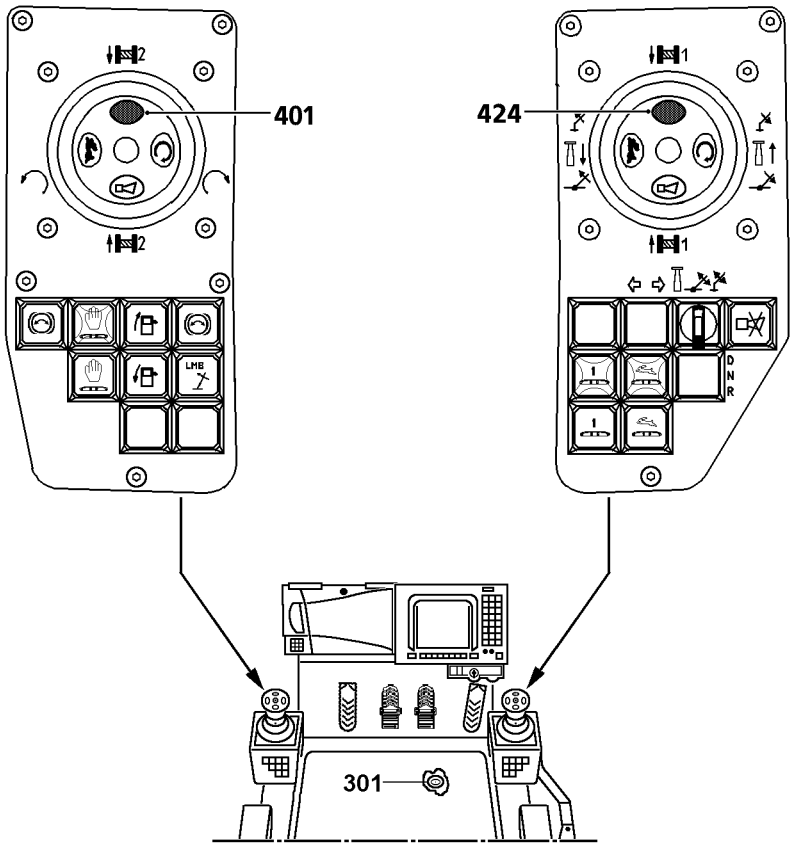
DANGER
Risk of accident due to crane toppling over or destruction of the crane!
- ▶ During crane operations, only bypass the hoist limit switch with the key switch if an observer can monitor the distance between the hook block and the boom head exactly. The guide must be in direct contact with the crane operator.
- ▶ Carry out hoist movements with maximum caution and minimum speed.
- ▶ In emergency situations, only an authorized person may bypass the hoist limit switch.
- ▶ Do **not** use the hoist limit switch as an operational shut off function.

3.3 Limit switch winch spooled out

The cam limit switch installed in the winch turns “winch spool out” off if there are only 3 rope coils remaining on the winch.

DANGER
Risk of accident due to falling load!
If the following notes are not observed, the rope attachment may be torn out and the load may topple.
- ▶ The cam limit switch must turn off when there are 3 cable coils remaining on the winch!
- ▶ If the hoist rope is spooled up during assembly, please ensure that the rope end remains in front of the winch and is not pulled over the winch. If the rope end is pulled over the winch by another rotation, the cam-type limit switch must be reset!
- ▶ If a new rope is used, the cam limit switch must be reset!





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3.4 EMERGENCY OFF switch*

If the EMERGENCY OFF switch **60**, the EMERGENCY OFF switch **362** or the EMERGENCY OFF switch **390** is operated, the engine and the electrical crane control are switched off. Every carried out movement can be stopped immediately.
After the EMERGENCY OFF switch **60** or the EMERGENCY OFF switch **390** has been operated, the system can only be released by an authorized person with a key.

Note
It is imperative to comply with the following instructions!
- ▶ Only use the EMERGENCY OFF switch in the event of a clear emergency!
- ▶ Use of the EMERGENCY OFF switch for normal operation is not permitted!

3.5 Control release

The seat contact switch **301** shuts the crane control down as soon as the crane operator gets up from the seat.
This prevents unintended crane movements by accidentally touching the master switch when getting in or out of the cab.
The button **401** and the button **424** bypass the seat contact switch **301** if necessary if the operator has to work standing up.

3.6 Hydraulic safety valves

A distinction is made between two types:
- – Pressure limitation valves against pipe and hose breaks.
- – Shut off valves in the luffing cylinder, telescoping cylinder and in the support cylinders.

3.7 Catch bar

The catch bar **40** on the telescopic boom articulated piece is a mechanical safety device!

DANGER
Danger of fatal injuries due to toppling folding jib!
As a result of improperly mounted, damaged or non-existing catch bar **40** on the telescopic boom pivot section, the folding jib – due to an assembly error – can fall down and cause fatal injuries.
- ▶ Before folding jib assembly, make sure that the catch bar **40** is properly mounted on the telescopic boom pivot section and that it is not damaged.
- ▶ The catch bar **40** is a mechanical safety device. For that reason, it is prohibited to change the catch bar **40** in any way.

4 Acoustic / visual warning overview

4.1 Crane operator

Function	Signal	Crane operator						
		Acoustic warning		Visual warning - LICCON monitor icons				
		Slow	Fast	Advance warning	Shut off			
								
Crane operation, assembly, disassembly	Utilization greater than 90%	X[2]		X				
Crane operation, assembly, disassembly	Utilization greater than 100%		X[2]		X			
Bypass key button **D**	Assembly					X		X
Key switch **-S81 or** plug **XNOT**	Emergency operation						X	X
Bypass key button **D**	Bypass of load torque limiter - hoist top					X		X
	Bypass “without motor”						X	
Key switch **-S82**	Bypass of load moment limiter - emergency operation							X

X = cannot be turned off
X[1] = can be turned off after 5 seconds on control platform

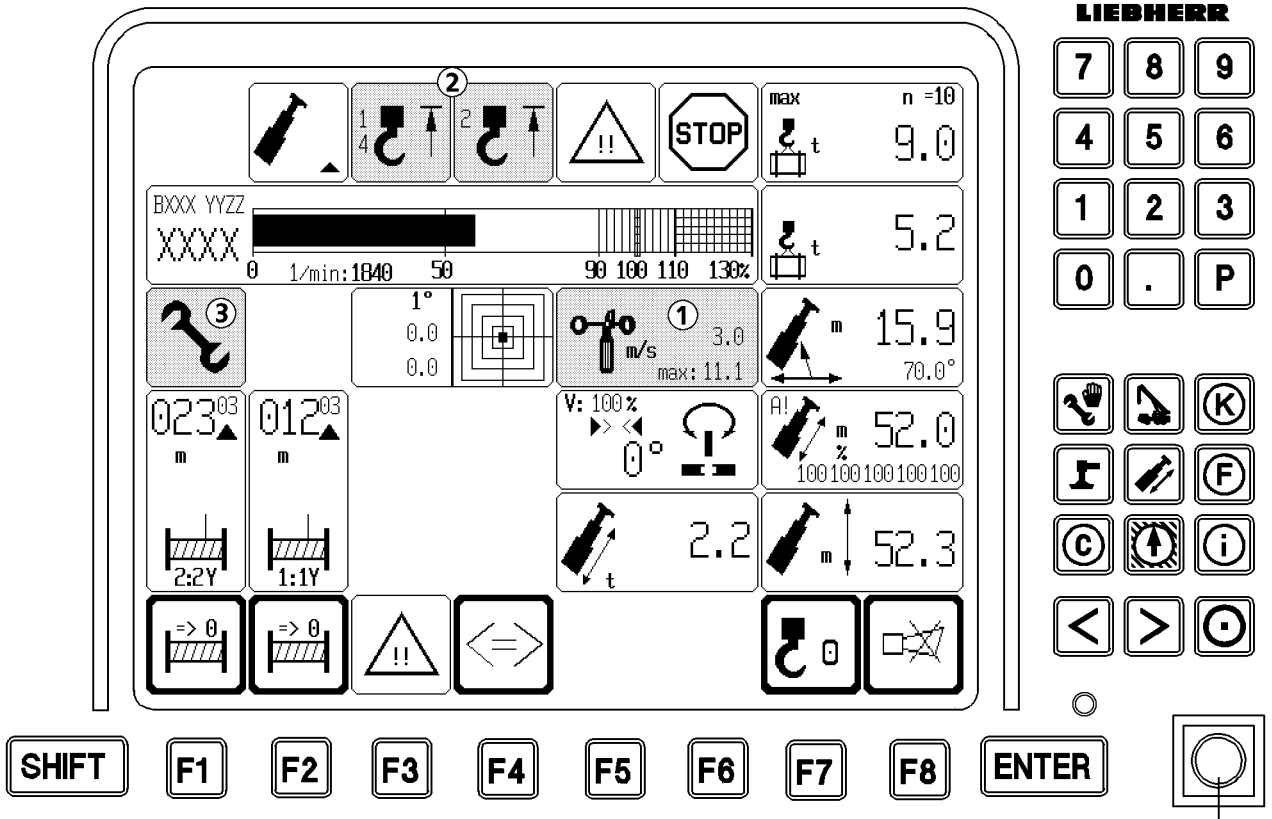
X[2] = can be turned off immediately at LICCON monitor

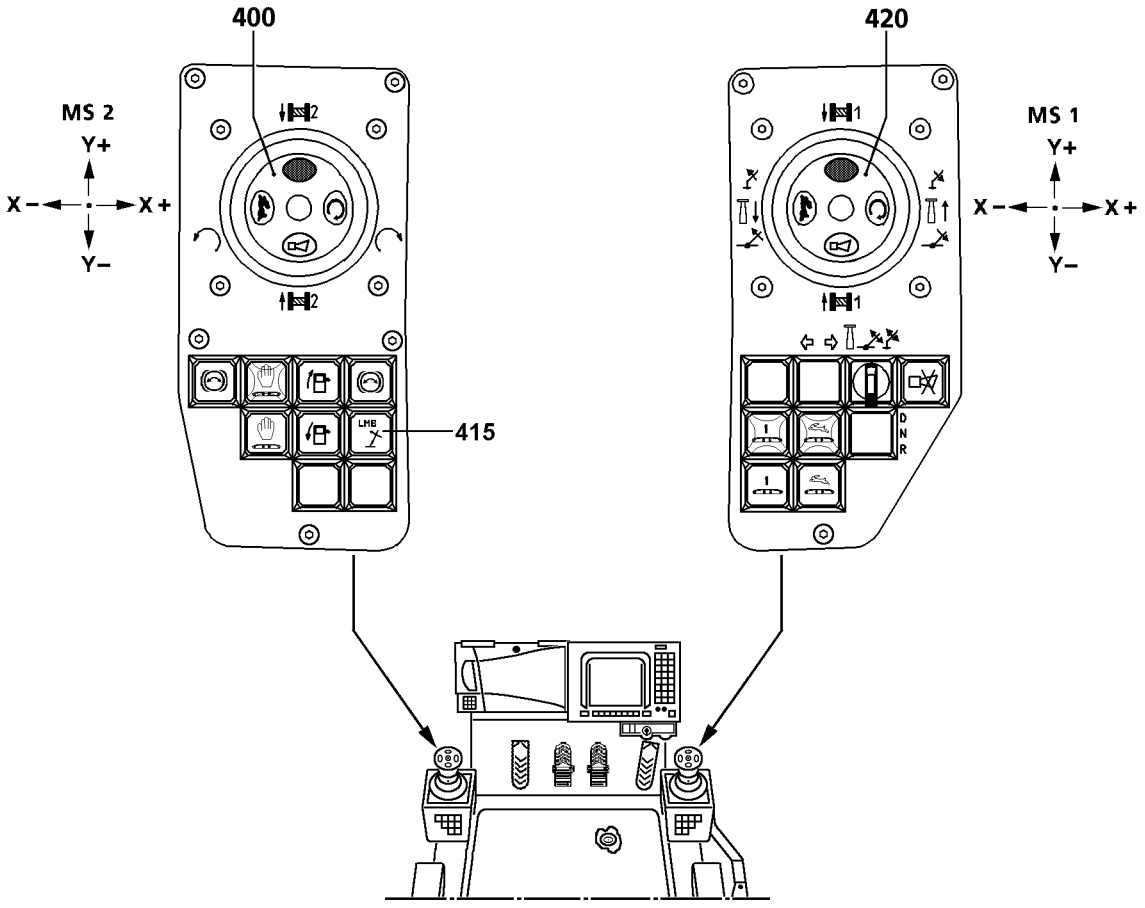
4.2 Personnel present in danger zone

Function	Signal	Personnel present in danger zone	
		Acoustic warning	Visual warning
		Turntable signal bell	Cabin / roof flashing beacon
Crane operation, assembly, disassembly	Utilization greater than 90%		
Crane operation, assembly, disassembly	Utilization greater than 100%	X[1]	
Bypass key button **D**	Assembly	X	X
Key switch **-S81 or** plug **XNOT**	Emergency operation		X
Bypass key button **D**	Bypass of load torque limiter - hoist top	X	X
	Bypass “without motor”		
Key switch **-S82**	Bypass of load moment limiter - emergency operation	X	X

X = cannot be turned off
X[1] = can be turned off after 5 seconds on control platform

X[2] = can be turned off immediately at LICCON monitor


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
STOP
max
n =10
9.0
5.2
15.9
70.0°
52.0
2.2
52.3
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
D


400
420
MS 2
Y+
X−
X+
Y−
MS 1
Y+
X−
X+
Y−
415

B198634

5 LICCON overload safety device

There are three ways of bypassing the LICCON overload protection:
– Bypassing the load moment limiter by pressing bypass key button **D** on the LICCON monitor.
– Bypassing the load moment limiter by pressing button **415** on the control panel.
– Bypass of the boom limitation with key button* **-S82** in control cabinet.

5.1 Bypass with the bypass key button D on the LICCON monitor

The bypass key button **D** on the LICCON monitor is used to bypass the following shut off mechanisms:
– Hoist-top shut off.
– Load moment limiter.
– Shut off upper / lower limit angle.
– Proximity switch “Steep boom”.

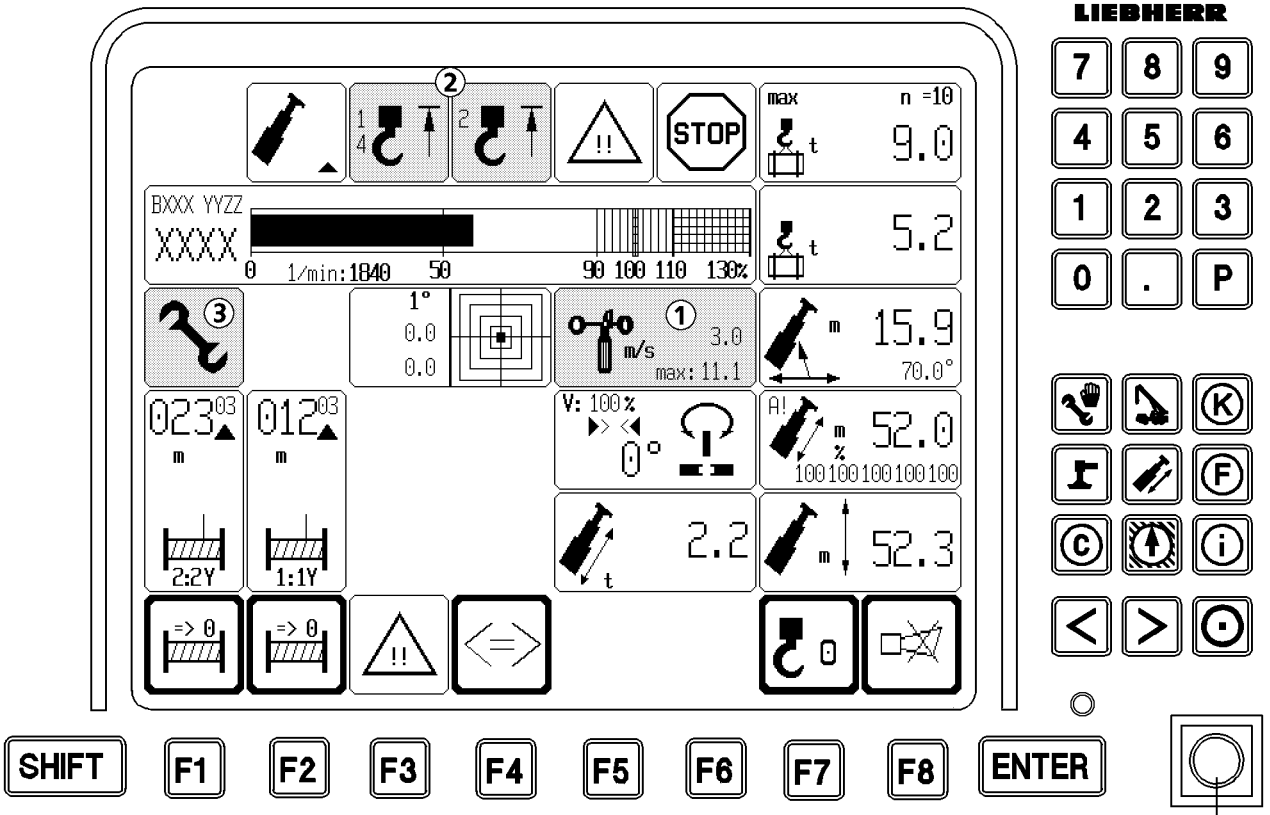
Note
▶ If it is not possible to bypass the shut offs “upper / lower limit angle”, “steep boom” via the bypass key button **D**, then they must be bypassed with the key button* **-S82** in the control cabinet, see section “Bypass with key button -S82* in control cabinet”.

The bypass key button **D** on the LICCON monitor has two positions:
– Operating position (not pressed): Crane is in normal operation.
– Position to right (touching): The hoist limit switch and load moment limiter are bypassed.

5.1.1 Bypassing the hoist top shut off

If the hook block touches the hoist limit switch weight during the upward movement, the hoist limit switch reacts. The hoist-top icon **2** on the LICCON monitor flashes. The crane movements “spool up winches”, “luff telescopic boom down”, “luff hydraulic folding jib down” and “telescope out” are turned off. The shut off can be bypassed with the bypass key button **D** in position “right touching”, see section “Actuate bypass key button D on the LICCON monitor”.

DANGER
Increased accident risk when bypassing the overload protection!
When bypassing the hoist top shut-off, there is a risk that the hook block may be pulled against the pulley head when continuing to lift or luffing down the boom. This may damage the pulleys and cause the loads to fall!
▶ The hoist up shut-off must only be bypassed if the crane supervisor is present, and with the help of a “guide”. The guide must be in direct contact with the crane operator and must continually monitor the distance between the hook block and the boom head.
▶ Carry out all crane movements with utmost caution!


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
STOP
max
n =10
9.0
5.2
15.9
70.0°
52.0
2.2
52.3
SHIFT
F1
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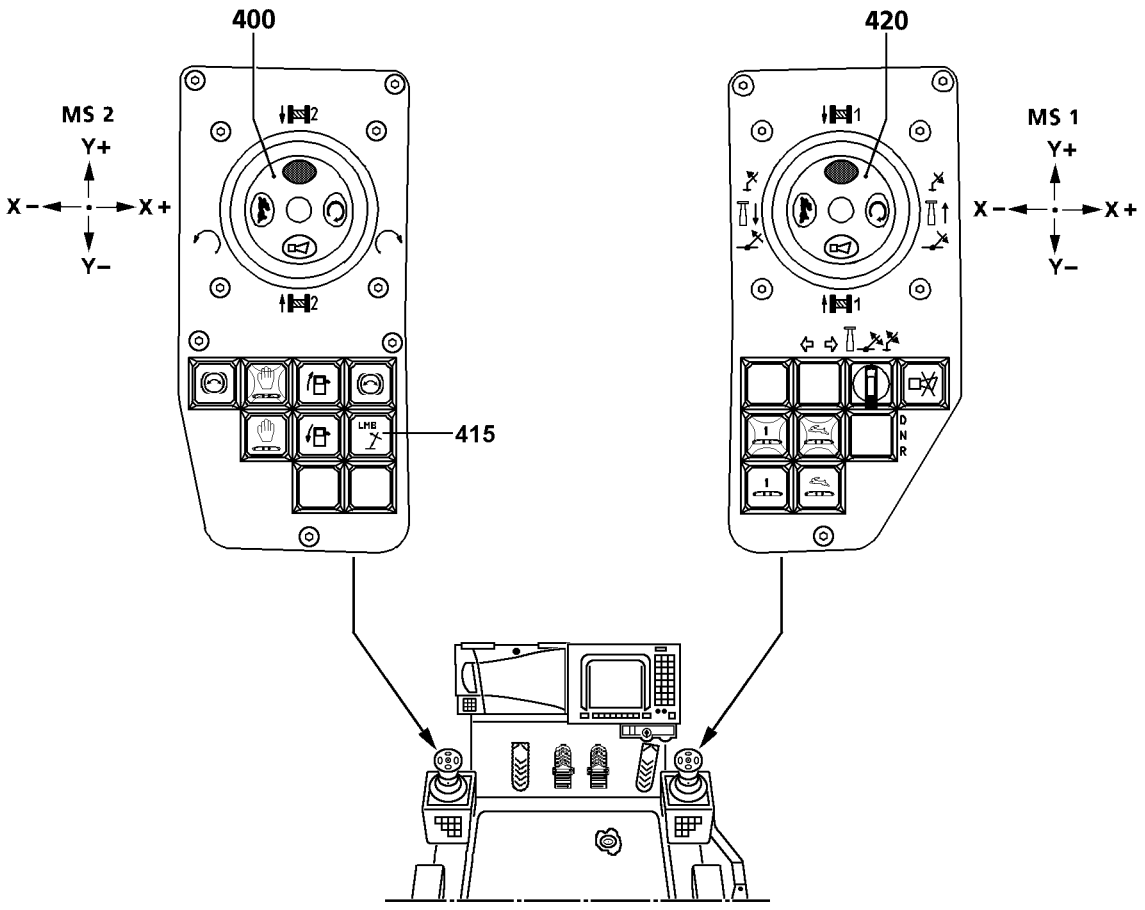
F7
F8
ENTER
D


400
420
MS 2
Y+
X−
X+
Y−
MS 1
Y+
X−
X+
Y−
415

B198634

5.1.2 Bypassing the load moment limiter

If the maximum permissible load moment is exceeded, the LICCON overload protection turns off all crane movements that increase the load moment. This shut off can be bypassed with the bypass key button **D** in position “right touching”, see section “Actuate bypass key button D on the LICCON monitor”.

DANGER

Increased accident risk when bypassing the overload protection!

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

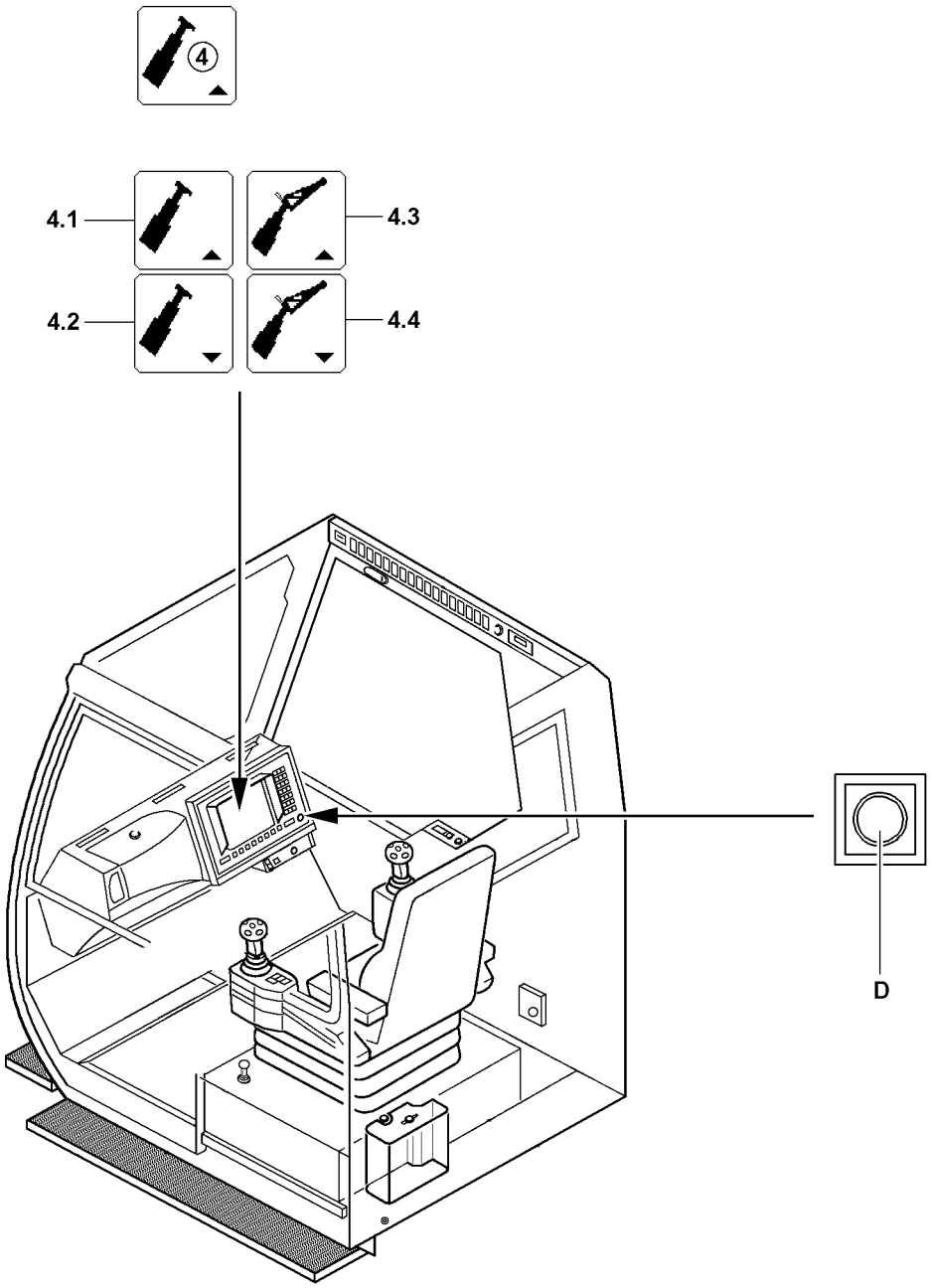
In the event of deliberate improper use, the crane could collapse, the boom can break off or the crane can topple over!

Personnel can be killed!

This could result in high property damage!

All LICCON overload protection displays remain functional!

- ▶ It is only permitted to bypass the overload protection during assembly or in emergencies!
- ▶ The bypass key button **D** may only be actuated 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!



B107323

5.1.3 Bypassing shut-off upper / lower limit angle

If the angle exceeds or falls below the programmed limit angle for a given load chart when luffing the boom up or down, the crane movements “luffing up” or “luffing down” are shut off by the load torque limiter. The limit angle symbol **4** appears on the LICCON monitor and the arrow for the upper **4.1** or lower limit angle **4.2** flashes.

If the folding jib is attached and configured, the shut-off function remains the same, however icon **4.3** and icon **4.4** appear for the upper and lower limit angle respectively.

The shut off can be bypassed with the bypass key button **D** on the monitor, see section “Actuate bypass key button D on the LICCON monitor ”.

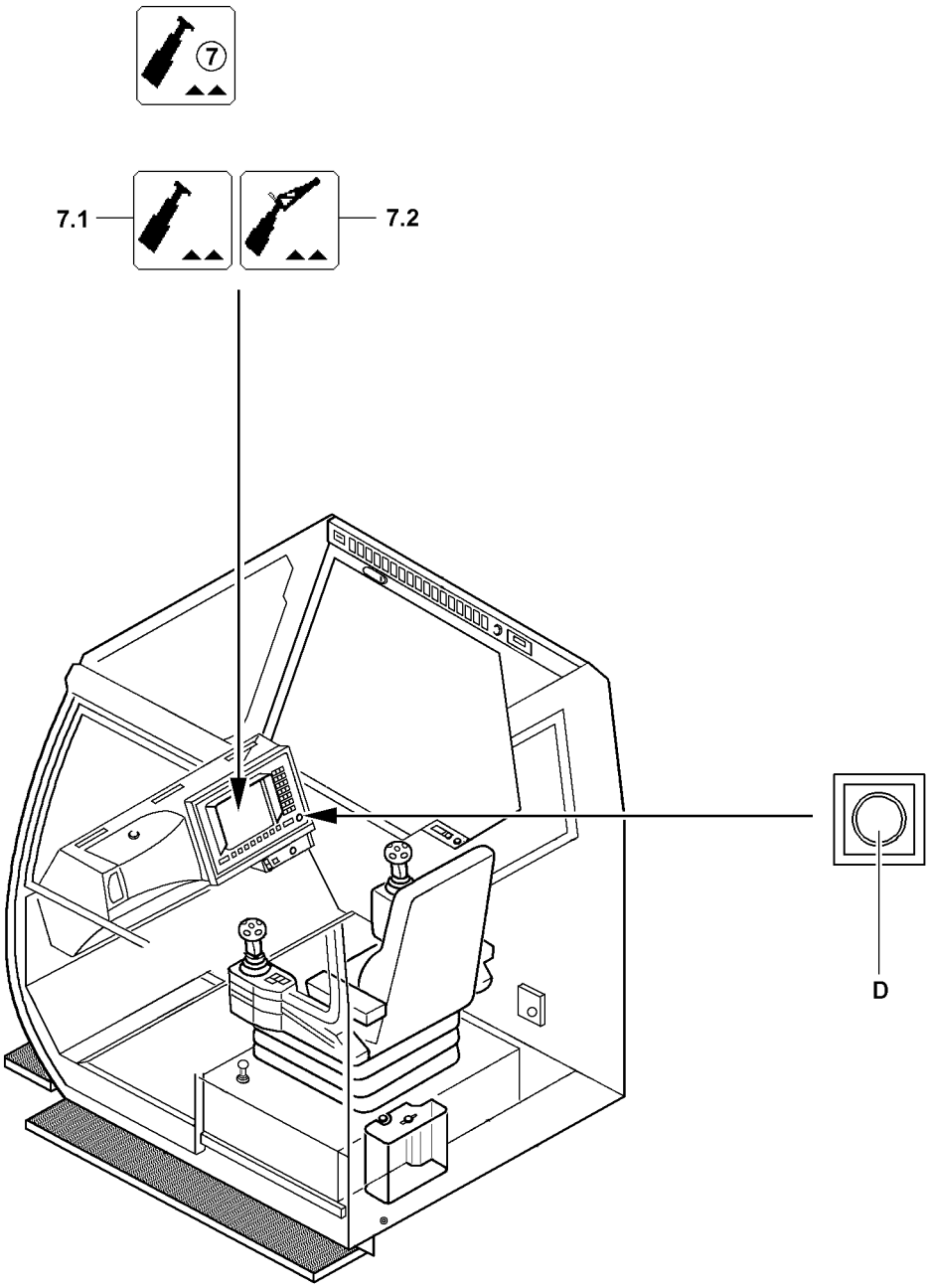
DANGER

Increased accident risk when bypassing the load moment limiter!

If the shut-off for the upper / lower limit angle is bypassed, there is a risk that the boom will lie outside the range of the load chart if it continues to be luffed up or down. This may lead to dangerous situations and could even cause the crane to topple over.

Personnel could be killed or seriously injured.

- ▶ The shut-off for the upper / lower limit angle should only be bypassed if the crane supervisor is present, and with the help of a “guide”. The guide must be in direct contact with the crane operator and must continually monitor the crane.
- ▶ Carry out all crane movements with utmost caution!



B107324

5.1.4 Bypassing proximity switch “Steep boom”.

If the boom is luffed up to just before the block position of the luffing cylinder, a proximity switch on the turntable will shut off the “luffing up” movement of the crane. The “Boom steep” icon **7** appears on the LICCON monitor and the double arrow flashes.

The icon **7.1** appears on the LICCON monitor if a shut-off occurs during telescoping operation. If the folding jib is attached and configured, the icon **7.2** is displayed.

The shut off can be bypassed with the bypass key button **D** on the monitor, see section “Actuate bypass key button D on the LICCON monitor ”.

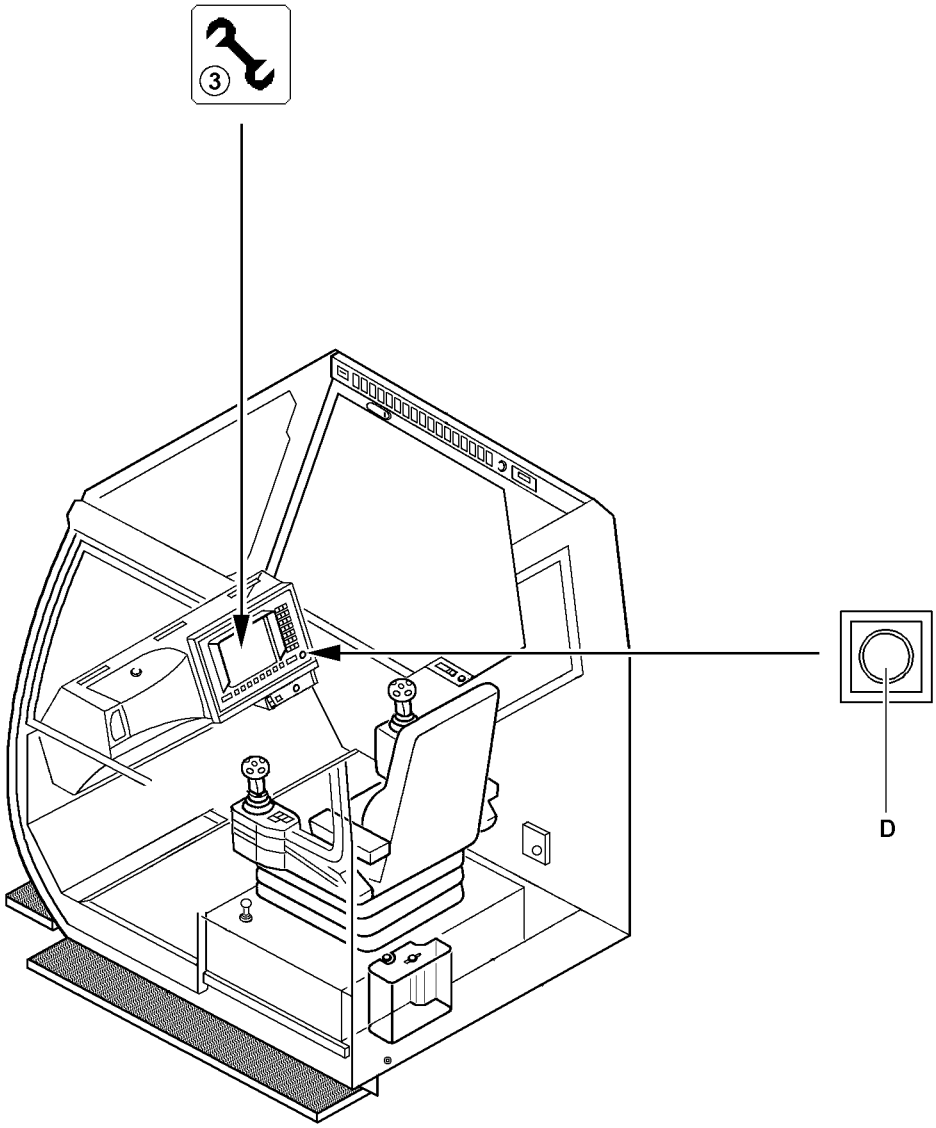
DANGER

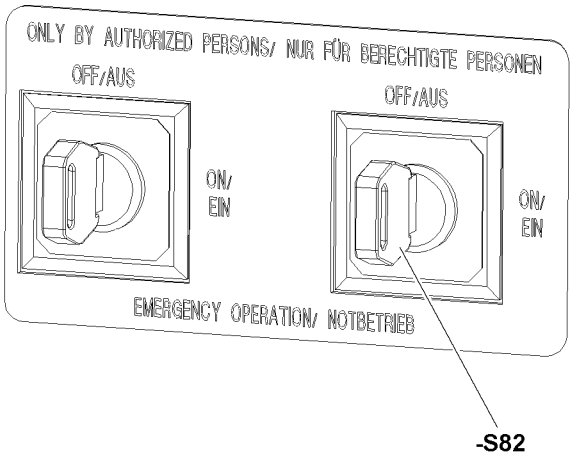
Increased accident risk when bypassing the load moment limiter!

If the boom steep shut-off is bypassed, there is a risk that further luffing will cause the block position of the luffing cylinder to be reached. This can damage the luffing cylinder and could even cause the crane to topple over.

Personnel could be killed or seriously injured.

- ▶ The boom steep shut-off should only be bypassed if a crane supervisor is present, and with the help of a “guide”. The guide must be in direct contact with the crane operator and must continually monitor the crane.
- ▶ Carry out all crane movements with utmost caution!


3
D


ONLY BY AUTHORIZED PERSONS/ NUR FÜR BERECHTIGTE PERSONEN
OFF/AUS
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EIN
OFF/AUS
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EIN
EMERGENCY OPERATION/ NOTBETRIEB
-S82

B107326

5.1.5 Operating the bypass key button D on the LICCON monitor

Make sure that the following prerequisites are met:
- the master switches have **not** been operated,
- one of the following shut offs is active:
  - hoist-top shut off,
  - load moment limiter,
  - shut off upper / lower limit angle,
  - proximity switch “Steep boom”.

Note

▶ It is **not** possible to bypass the hoist limit switch without performing an active shut-off.

▶ Turn the bypass key button **D** to the right and hold.

Result:
- The assembly icon **3** on the LICCON monitor blinks.
- An acoustic signal sounds.
- The red flashing beacon on the crane cab blinks.
- The working speed is reduced for all functions, except for the slewing gear and the hydraulic folding jib*.

Troubleshooting

When the shut offs “upper / lower limit angle”, “steep boom” cannot be bypassed with the bypass key button **D**?

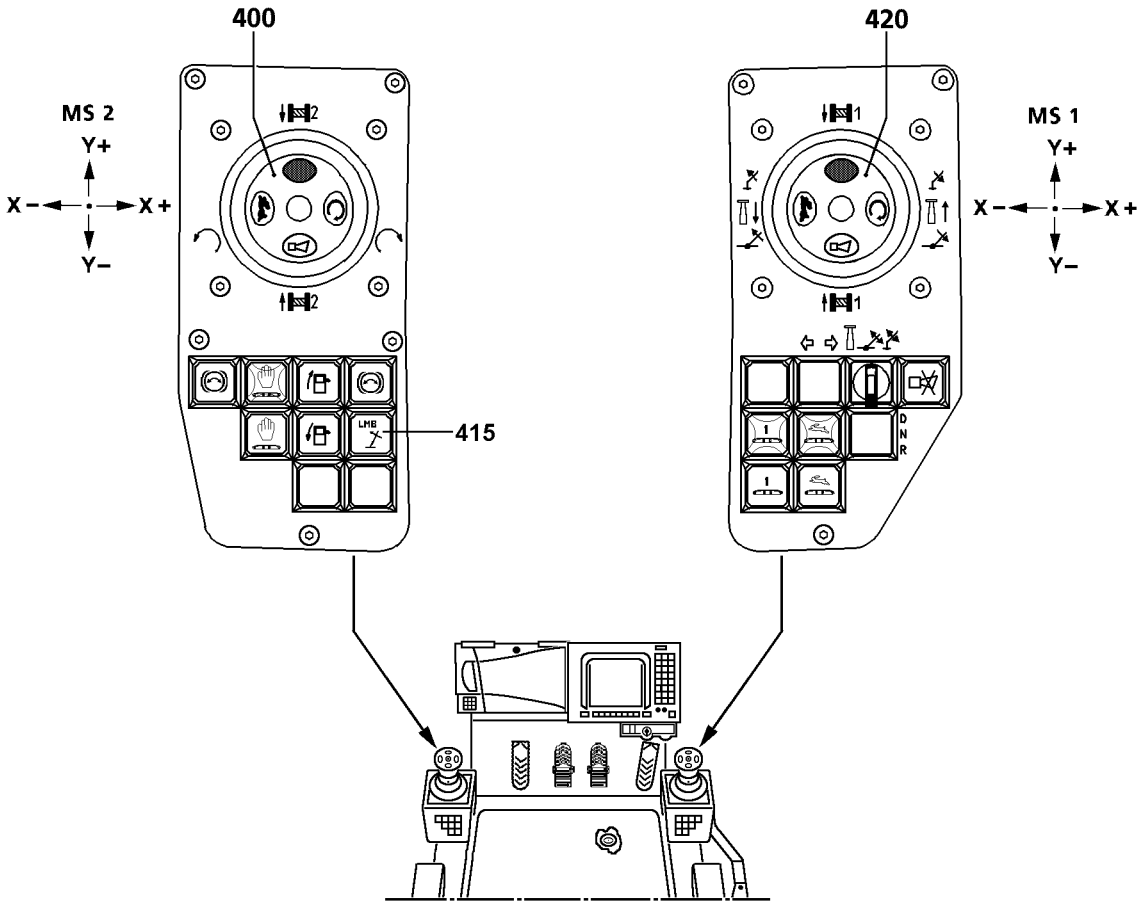
▶ Bypass them with key button **-S82** in the control cabinet.

▶ See section “Bypass with key button -S82* in the control cabinet”.

The bypass function turns off:
- If the bypass key button **D** is no longer pressed.
- If the bypass key button **D** is actuated but all master switches are in neutral position for 10 seconds.

▶ The bypass function turns off.

Result:
- The assembly symbol **3** on the LICCON monitor extinguishes.
- The acoustic signal is turned off.
- The red flashing beacon on the crane cab extinguishes.
- The working speed is reduced* until the master switches are in neutral position, after releasing the bypass key button **D**.



B107362

5.2 Bypassing the load torque limiter by pressing button 415 on the control panel

5.2.1 Bypassing “Luff up at overload”

In case of an overload, the “luffing up” crane movement is disabled, even though this is a load torque-reducing crane movement with a freely suspended load.

DANGER
Risk of accident from overloading and toppling the crane!
Never hoist a load by raising the boom if, when trying to lift the load, the hoist gear would be turned off by the load torque limiter.

▶ Bypass the limit range only if the LICCON overload protection with a freely suspended load does not report an overload and if the boom radius is not less than 3.5 m.

Ensure that the following prerequisite is met:
– the master switches have **not** been operated,
– a shut off mechanism is active.

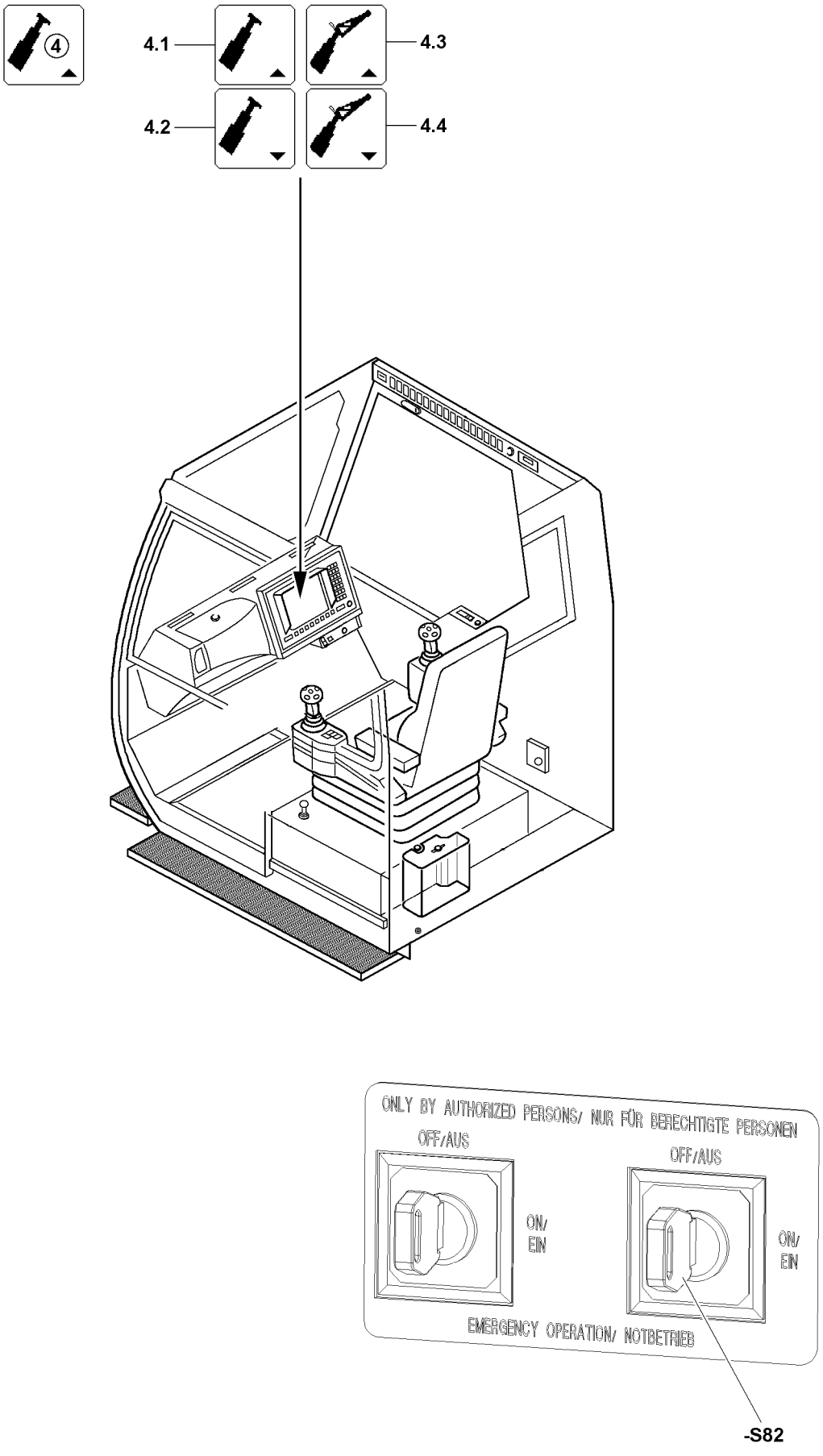
▶ In order to still perform this crane movement:
Operate button **415** and deflect the master switch “MS1 **420** ” in X-direction.

Result:
– The LICCON overload protection is inactive.
– The boom is luffed up at a reduced* working speed.

The bypass function turns off:
– If the button **415** is no longer pressed.
– If all master switches are in neutral position for 10 seconds.

▶ The bypass function turns off.

Result:
– The LICCON overload protection is active.
– The working speed is reduced* until the master switches are in neutral position, after releasing the button **415**.


4
4.1
4.2
4.3
4.4
ONLY BY AUTHORIZED PERSONS/ NUR FÜR BERECHTIGTE PERSONEN
OFF/AUS
ON/
EIN
OFF/AUS
ON/
EIN
EMERGENCY OPERATION/ NOTBETRIEB
-S82

B107328

5.3 Bypass with key button -S82* in control cabinet

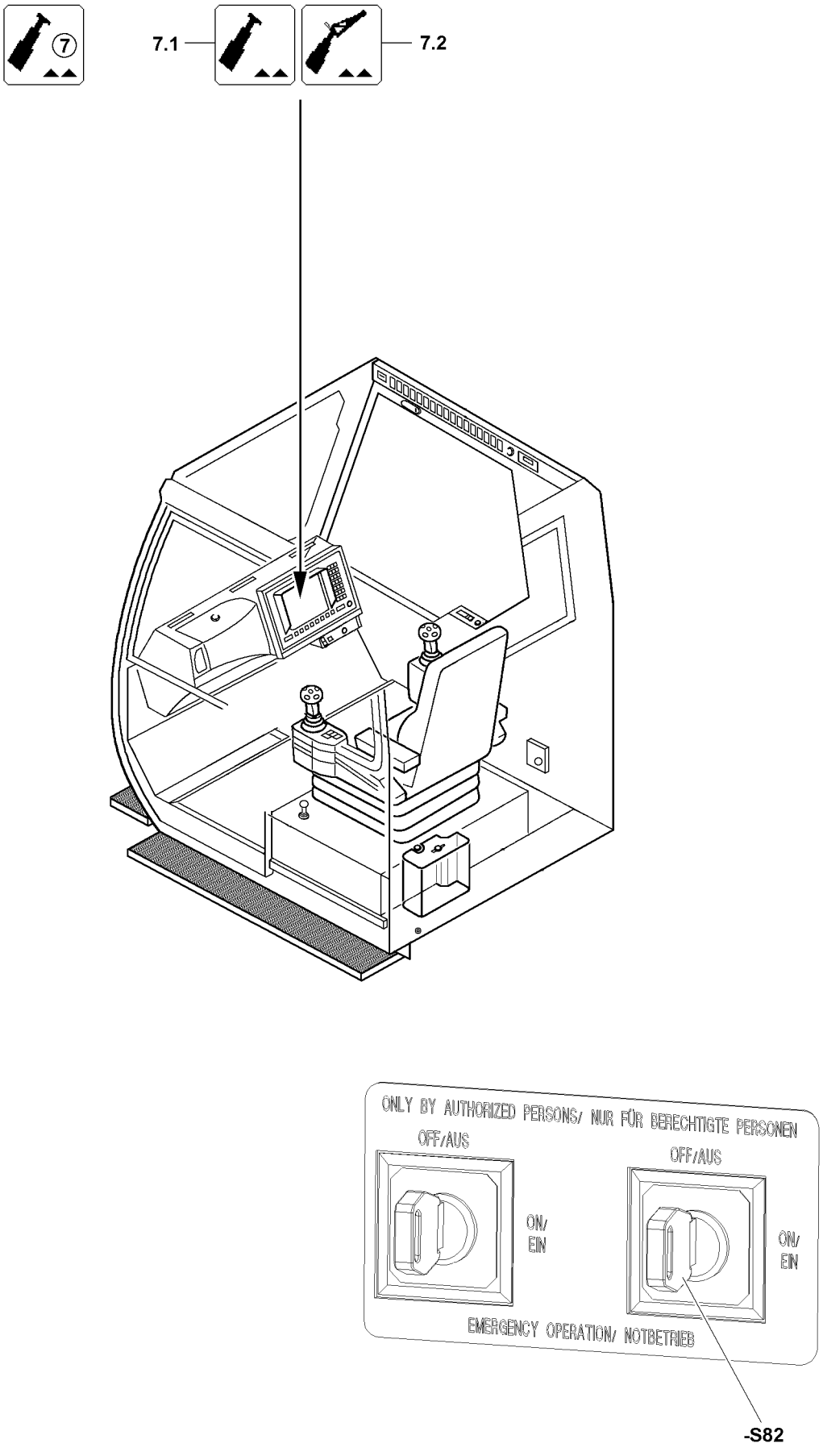
With the key button **-S82** in the control cabinet, the following shut offs can be bypassed:
– Bypassing shut-off upper / lower limit angle.
– Bypassing proximity switch “Steep boom”.

The key button **-S82** in the control cabinet has two positions:
– Operating position (not pressed): Crane is in normal operation.
– Position to right (touching): Load moment limitation bypass is activated (self-retaining).

5.3.1 Bypassing shut-off upper / lower limit angle

If the angle exceeds or falls below the programmed limit angle for a given load chart when luffing the boom up or down, the crane movements “luffing up” or “luffing down” are shut off by the load torque limiter. The limit angle symbol **4** appears on the LICCON monitor and the arrow for the upper **4.1** or lower limit angle **4.2** flashes.
If the folding jib is attached and configured, the shut-off function remains the same, however icon **4.3** and icon **4.4** appear for the upper and lower limit angle respectively.
The shut off can be bypassed via the key button **-S82** in the control cabinet with reduced* working speed, see section “Bypass of load moment limiter emergency operation with key button -S82* ”.

DANGER
Increased accident risk when bypassing the load moment limiter!
If the shut-off for the upper / lower limit angle is bypassed, there is a risk that the boom will lie outside the range of the load chart if it continues to be luffed up or down. This may lead to dangerous situations and could even cause the crane to topple over.
Personnel could be killed or seriously injured.
▶ The shut-off for the upper / lower limit angle should only be bypassed if the crane supervisor is present, and with the help of a “guide”. The guide must be in direct contact with the crane operator and must continually monitor the crane.
▶ Carry out all crane movements with utmost caution!


7
7.1
7.2
ONLY BY AUTHORIZED PERSONS/ NUR FÜR BERECHTIGTE PERSONEN
OFF/AUS
ON/
EIN
OFF/AUS
ON/
EIN
EMERGENCY OPERATION/ NOTBETRIEB
-S82

B107329

5.3.2 Bypassing proximity switch “Steep boom”

If the boom is luffed up to just before the block position of the luffing cylinder, a proximity switch on the turntable will shut off the “luffing up” movement of the crane. The “Boom steep” icon **7** appears on the LICCON monitor and the double arrow flashes. In addition, the shut off is shown by an acoustical signal.

The icon **7.1** appears on the LICCON monitor if a shut-off occurs during telescoping operation. If the folding jib is attached and configured, the icon **7.2** is displayed.

The shut off can be bypassed via the key button **-S82** in the control cabinet with reduced* working speed, see section “Bypass of load moment limiter emergency operation with key button -S82* ”.

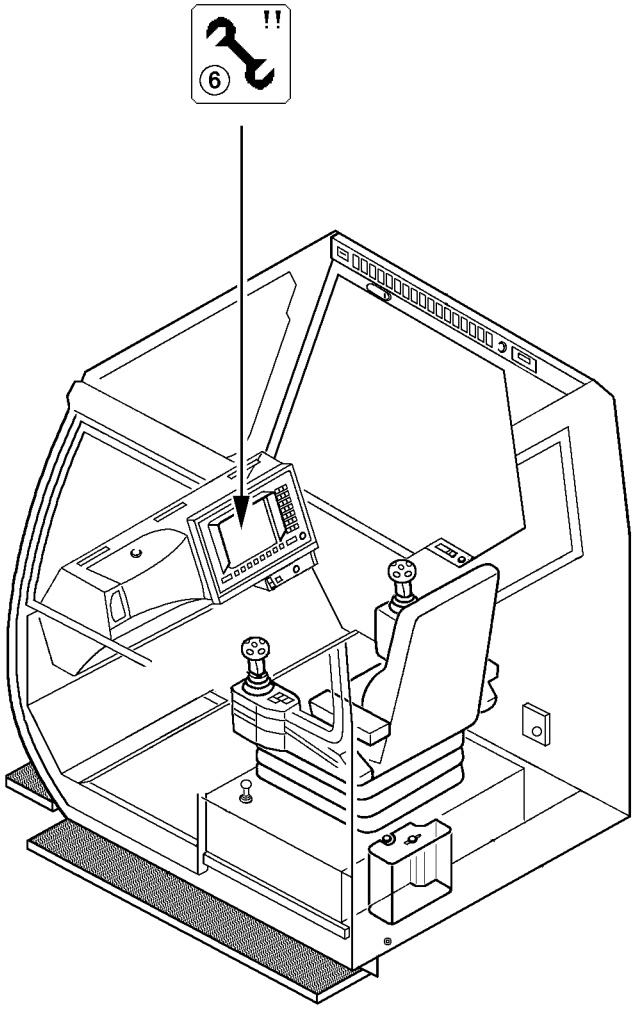
DANGER

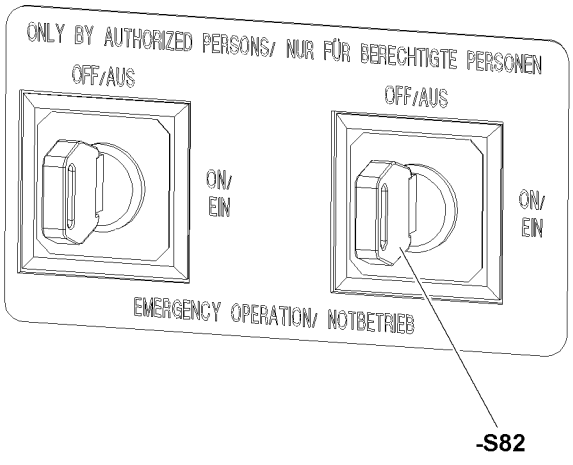
Increased accident risk when bypassing the load moment limiter!

If the boom steep shut-off is bypassed, there is a risk that further luffing will cause the block position of the luffing cylinder to be reached. This can damage the luffing cylinder and could even cause the crane to topple over.

Personnel could be killed or seriously injured.

- ▶ The boom steep shut-off should only be bypassed if a crane supervisor is present, and with the help of a “guide”. The guide must be in direct contact with the crane operator and must continually monitor the crane.
- ▶ Carry out all crane movements with utmost caution!


!!
6


ONLY BY AUTHORIZED PERSONS/ NUR FÜR BERECHTIGTE PERSONEN
OFF/AUS
ON/
EIN
OFF/AUS
ON/
EIN
EMERGENCY OPERATION/ NOTBETRIEB
-S82

B107334

5.3.3 Bypass of “Load moment limiter emergency operation” with key button -S82*

Ensure that the following prerequisite is met:
- the master switches have **not** been operated,
- one of the following shut offs is active:
  - shut off upper / lower limit angle,
  - proximity switch “steep boom”.

▶ Turn the key button **-S82** to the right to the stop and release.

Result:
- The LICCON overload protection is inactive.
- The Assembly / bypass load torque limitation symbol **6** in the LICCON monitor blinks.
- An acoustic signal sounds.
- The red flashing beacon on the crane cab blinks.
- The working speed is reduced* for all functions, except for the slewing gear and the hydraulic folding jib.

The bypass is active for maximum 30 minutes. Then it turns off automatically after the last deflection of a master switch.

Note

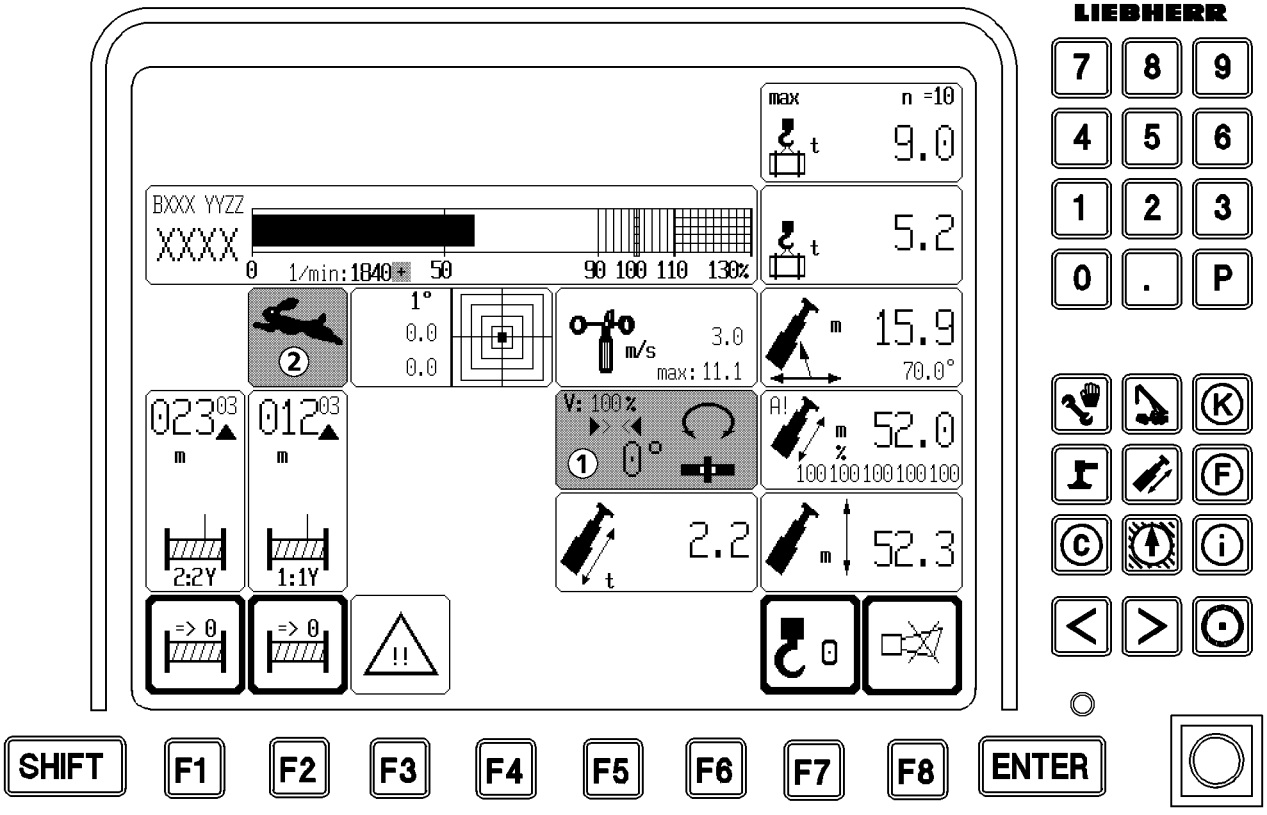
▶ If a movement is initiated via the master switch shortly before the maximum bypass time of 30 minutes is over, then the bypass time is extended until the master switch is again in zero position.

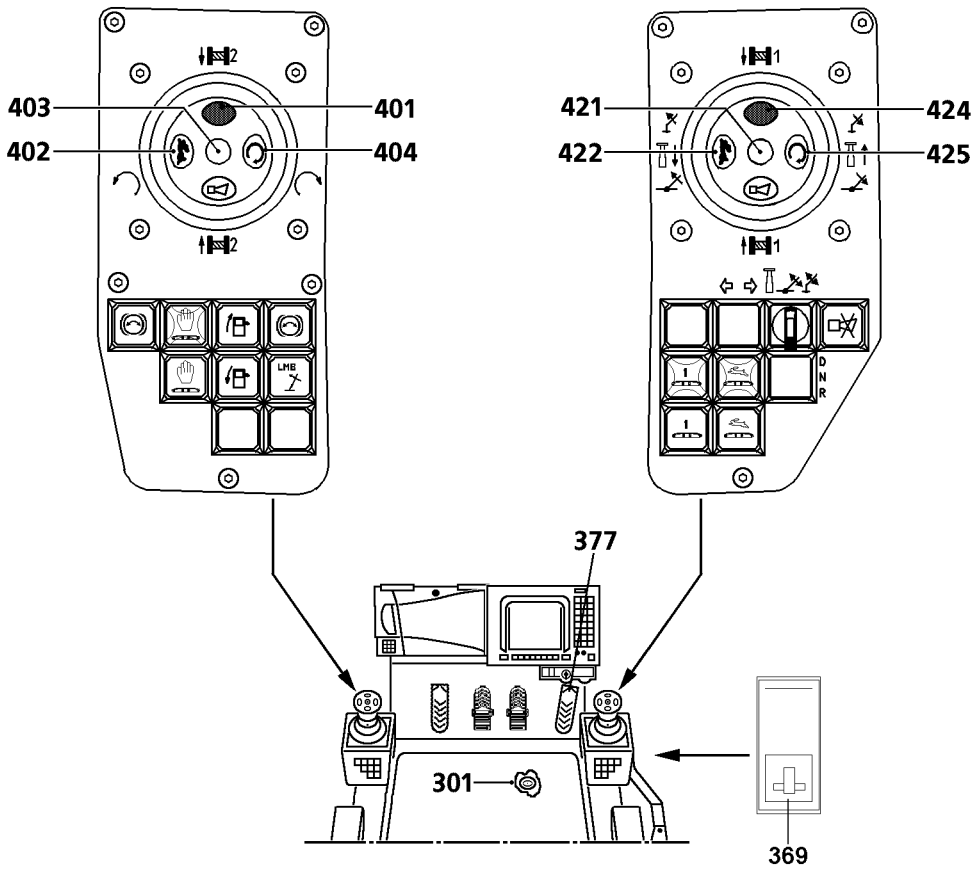
The bypass function turns off:
- When all master switches are for 10 seconds in neutral position after the last deflection.

▶ The bypass function turns off.

Result:
- The LICCON overload protection is active.
- The Assembly / bypass load moment limitation icon **6** in the LICCON monitor turns off.
- The acoustic signal is turned off.
- The working speed is reduced* until the master switches are in neutral position, after turning the bypass off.
- The red beacon on the crane cab turns off after ignition off.

▶ If the bypass is to be reactivated:
Turn the key button **-S82** to the right to the stop and release.


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
max n =10
9.0
5.2
BXXX YYZZ
XXXX
0 1/min:1840 50 90 100 110 130%
1°
0.0
0.0
3.0
m/s
max: 11.1
15.9
70.0°
023 03
012 03
m
2:2Y
1:1Y
V: 100 %
A!
52.0
100 100 100 100 100
2.2
52.3
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER


403
401
402
404
421
424
422
425
377
301
369

B198636

1 General

Ensure that the following prerequisites are met:
– the crane is aligned in horizontal direction
– the counterweight is attached and secured in accordance with the information in the load chart
– the ground is able to carry the weight of the crane, the load and the lifting equipment
– the central ballast is attached and secured in accordance with the information in the load chart
– the hook block is correctly reeved as shown in reeving plan
– the crane engine is running
– all safety devices have been adjusted as per the information in the load chart
– there are no persons or objects in the danger zone
– the crawlers are pushed out, pinned and wedged to a travel track width as specified in the load chart

DANGER
Crane can topple over!
The reduced or retracted track reduces the stability of the crawler crane. Due to operational errors during crane operation or driving, the crawler crane can topple over and fatally injure personnel!
▶ Crane operation and “driving the crawler with load” is permitted for reduced or retracted track, if **extra load charts** are programmed for this case!
▶ Crane operation and “driving the crawler with load” is strictly prohibited for reduced or retracted track, if **no extra load charts** are programmed for this case!

DANGER
Risk of accident!
▶ In order to protect the crane and reduce the danger of accidents always use the master switch slowly and sensitively.
▶ Ensure that there are no obstacles in the crane working area and no persons in the danger zone.

1.1 Superstructure

1.1.1 Locking the superstructure

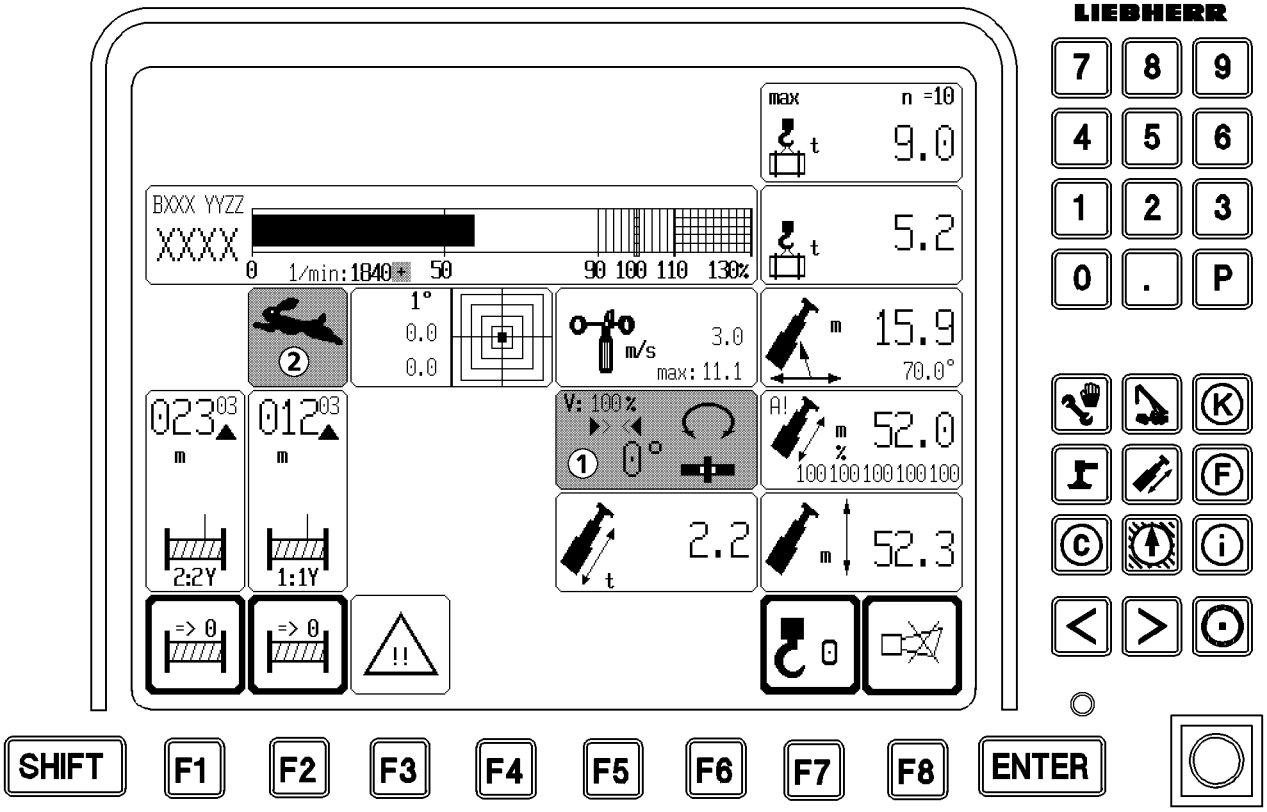
▶ Press button **369**.

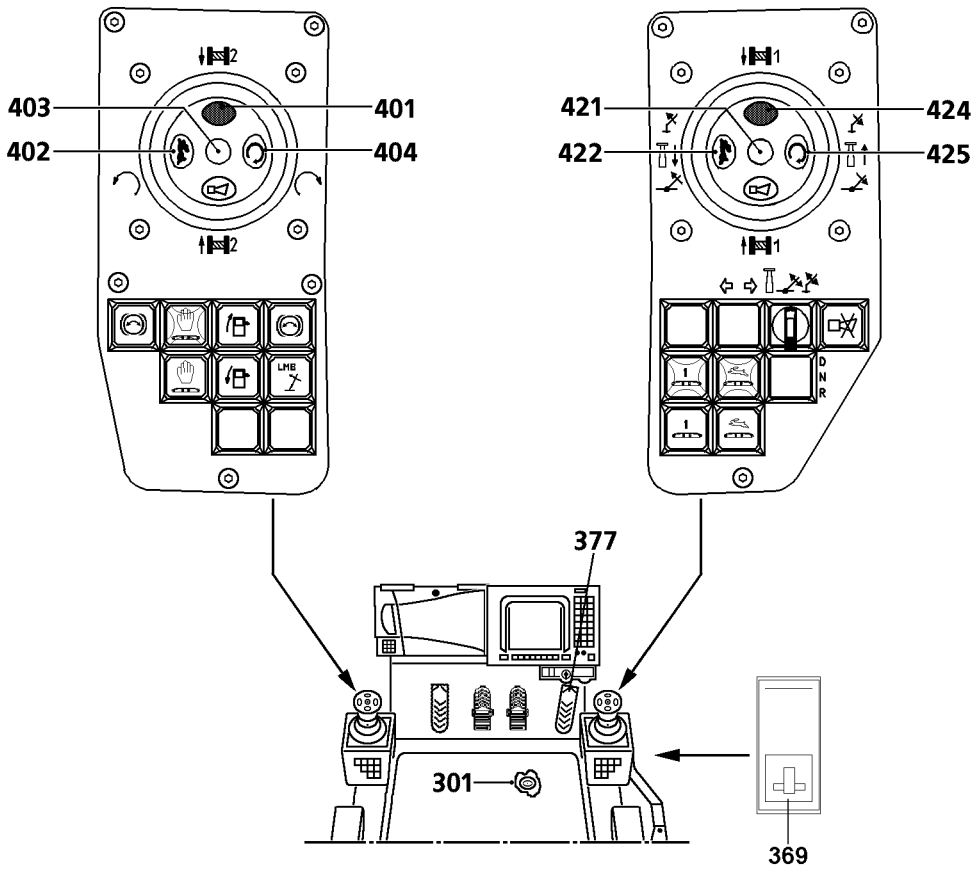
Result:
– The locking mechanism of the superstructure is locked.
The icon **1** appears on the LICCON monitor.

1.1.2 Releasing superstructure locking

▶ Once the superstructure is locked:
Press button **369** again.

Result:
– The locking mechanism of the superstructure is unlocked.


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
max n =10
9.0
5.2
15.9
70.0°
52.0
2.2
52.3
3.0
max: 11.1
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER


403
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B198636

1.2 Engine RPM

1.2.1 Locking the engine RPM

Locking engine RPM frees the crane operator if he needs to work for a length of time with constant RPM. The engine control can be locked in any position.

▶ Activate pedal **377** for engine control until desired RPM is reached.

▶ Press button **404**.

or

■ Press button **425**.

Result:

– Pedal **377** is locked.

– The “+” symbol appears on the monitor.

1.2.2 Releasing the RPM

▶ If RPM is locked:
Press button **404** again.

or

■ Press button **425** again.

Result:

– Locking is removed.

– The “+” symbol extinguishes on the monitor.

1.3 Rapid gear “crawler operation and crane operation”

1.3.1 Adding rapid gear “crawler operation and crane operation”

Using the button **402** or the button **422**, the speed of the crane movement is increased for “Luffing up” and “Lift/lower”.

DANGER

Accident hazard in the event of one to three strand reeving!

▶ Do **not** add rapid gear if the crane is loaded to more than 50% of its maximum permitted load carrying capacity for the respective boom radius.

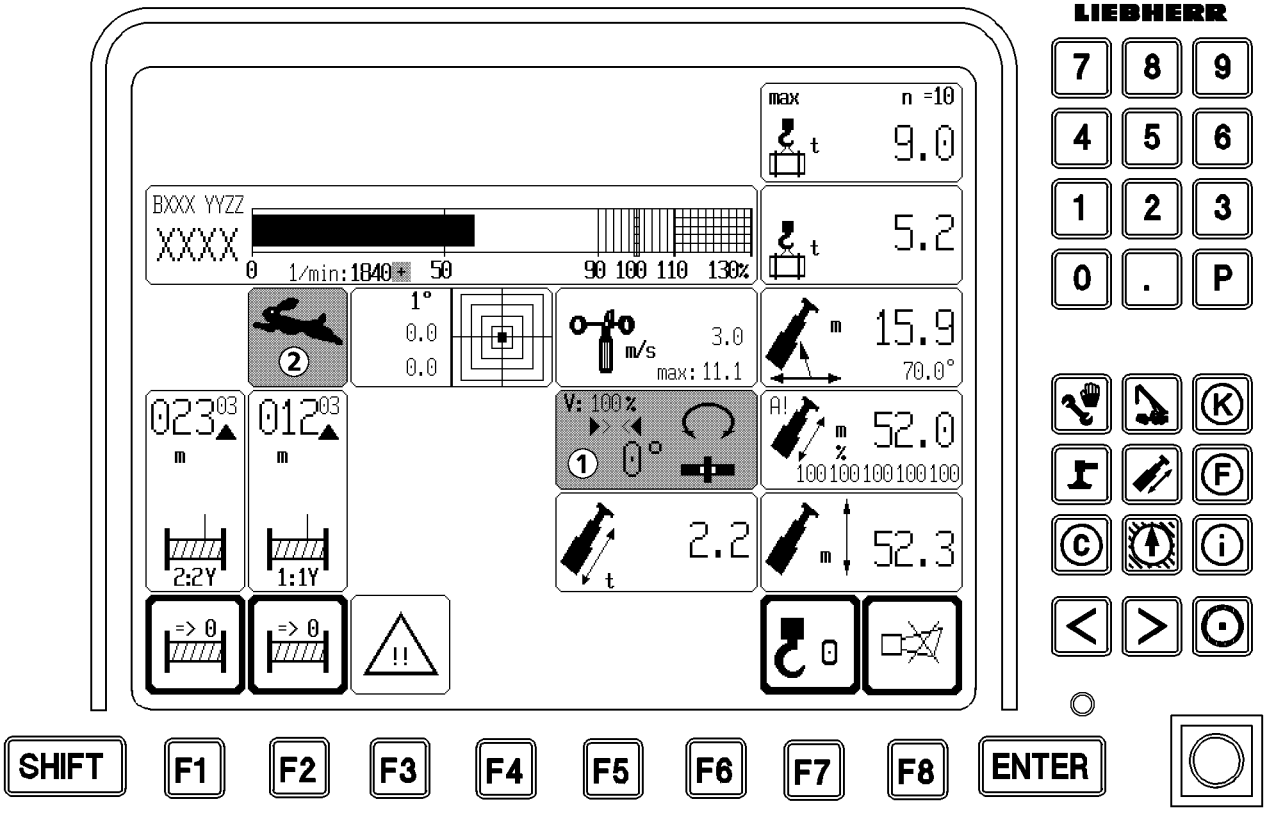
▶ Press button **402**.

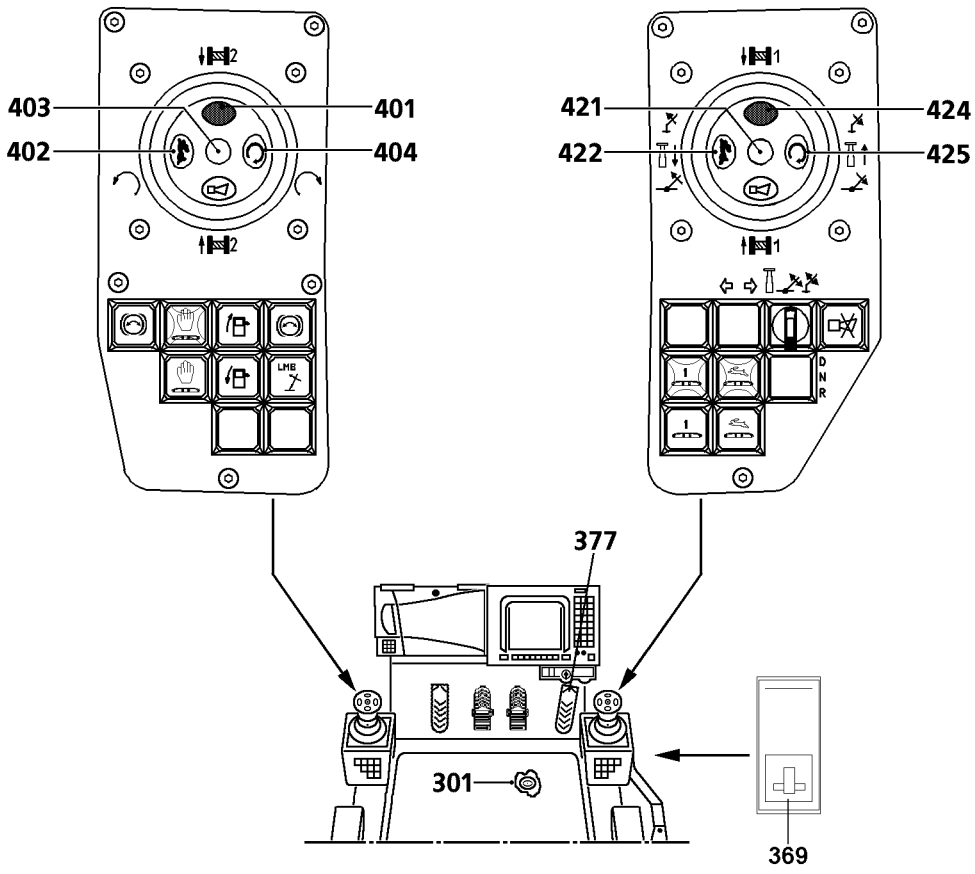
or

■ Press button **422**.

Result:

– The rapid gear “crawler operation and crane operation” is added.
The icon **2** appears on the LICCON monitor.


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
max n =10
9.0
5.2
15.9
70.0°
52.0
2.2
52.3
3.0
max: 11.1
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER


403
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402
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422
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B198636

1.3.2 Turning off rapid gear “crawler operation and crane operation”

▶ If the rapid gear “crawler operation and crane operation” is added:
Press button **402** again.

or

■ Press button **422** again.

Result:

– The rapid gear “crawler operation and crane operation” is turned off.
The icon **2** extinguishes on the LICCON monitor.

1.4 Vibration sensor

By switching along the vibration sensor, crane movements can be detected over the vibration of the master switch.
Ensure that the following prerequisites are met:

– the seat contact switch **301** is activated

1.4.1 Winch 1

▶ Press button **424**.

Result:

– The vibration sensor **421** is turned on.

▶ When the vibration sensor **421** is turned on:
Press button **424** again.

Result:

– The vibration sensor **421** is turned off.

1.4.2 Winch 2 or slewing gear

If winch 2 and the slewing gear are operated, the vibration sensor **403** will react to the first deflecting movement.

▶ Press button **401**.

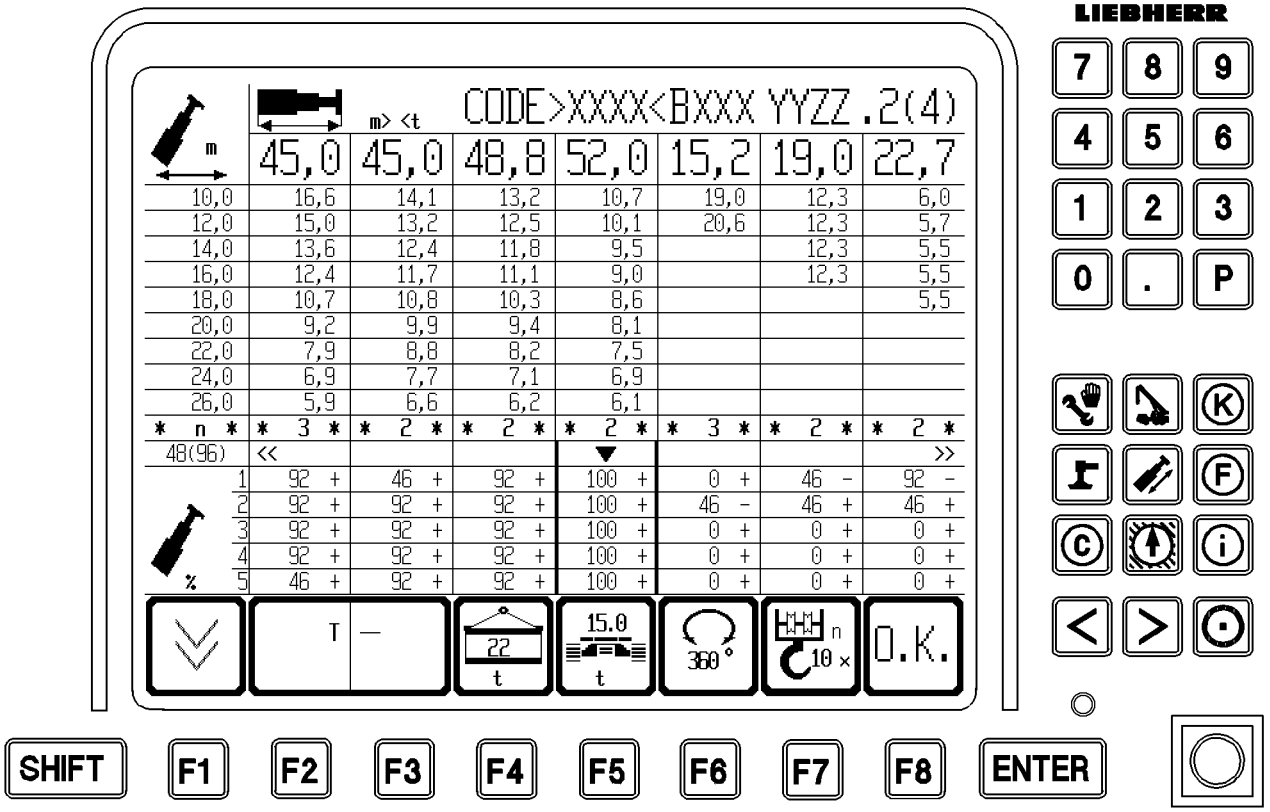
Result:

– The vibration sensor **403** is turned on.

▶ When the vibration sensor **401** is turned on:
Press button **401** again.

Result:

– The vibration sensor **403** is turned off.


LIEBHERR
m> <t CODE>XXXX<BXXX YYZZ .2(4)
45,0 45,0 48,8 52,0 15,2 19,0 22,7
10,0 16,6 14,1 13,2 10,7 19,0 12,3 6,0
12,0 15,0 13,2 12,5 10,1 20,6 12,3 5,7
14,0 13,6 12,4 11,8 9,5 12,3 5,5
16,0 12,4 11,7 11,1 9,0 12,3 5,5
18,0 10,7 10,8 10,3 8,6 5,5
20,0 9,2 9,9 9,4 8,1
22,0 7,9 8,8 8,2 7,5
24,0 6,9 7,7 7,1 6,9
26,0 5,9 6,6 6,2 6,1
* n * * 3 * * 2 * * 2 * * 2 * * 3 * * 2 * * 2 *
48(96) << >>
1 92 + 46 + 92 + 100 + 0 + 46 - 92 -
2 92 + 92 + 92 + 100 + 46 - 46 + 46 +
3 92 + 92 + 92 + 100 + 0 + 0 + 0 +
4 92 + 92 + 92 + 100 + 0 + 0 + 0 +
5 46 + 92 + 92 + 100 + 0 + 0 + 0 +
%
T
22
t
15.0
t
360°
n
10 x
O.K.
7 8 9
4 5 6
1 2 3
0 . P
K
F
C
i
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER

B102854

2 LICCON computer system

See chapter 4.02.

2.1 Crane engine is running

Ensure that the following prerequisites are met:
– batteries are charged by the generator
– a stable voltage is present

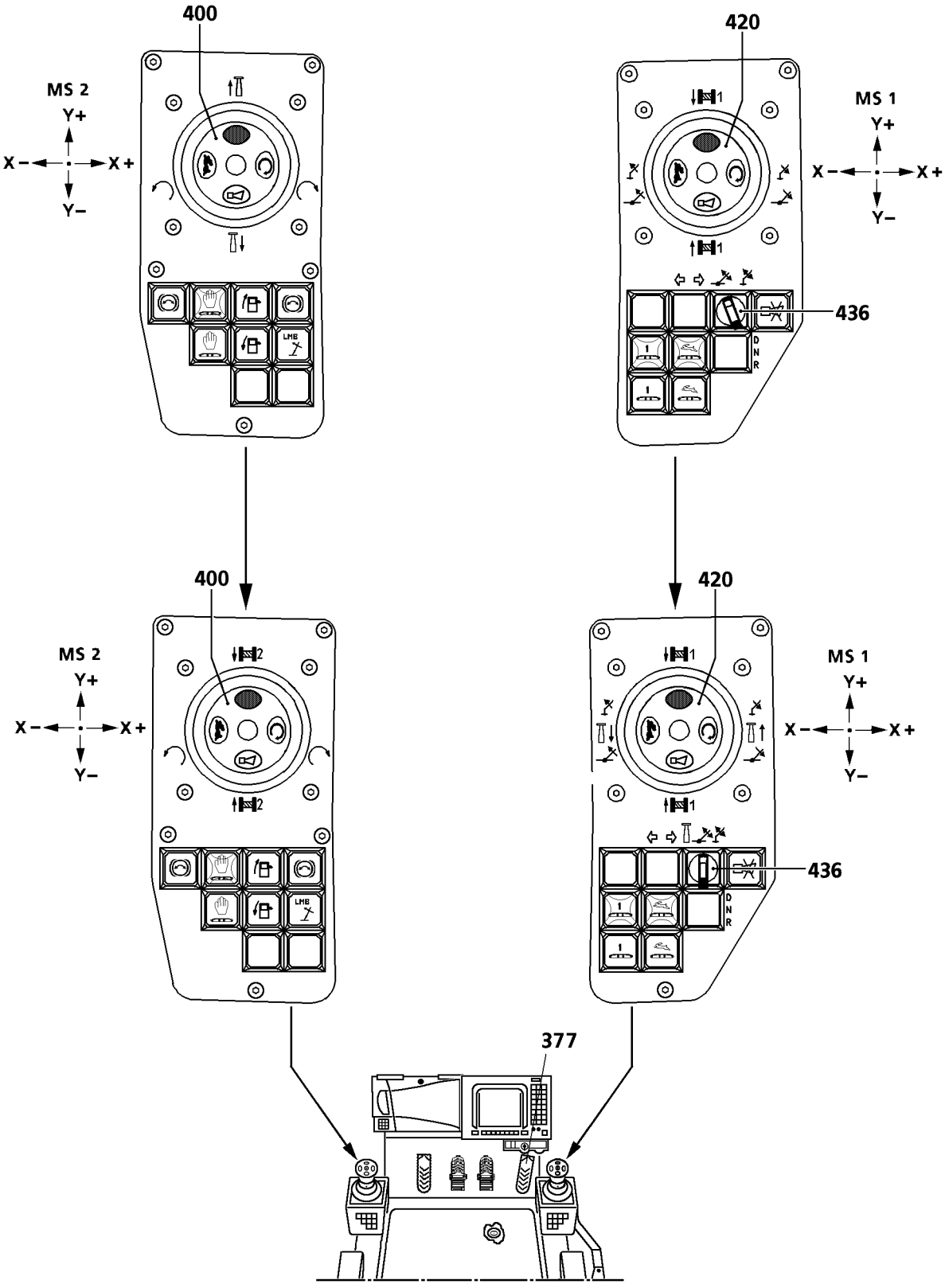
The electric crane control system and the LICCON computer system are turned on automatically. There is then a self test of the LICCON computer system.
▶ Await self test.

Result:
– After a few seconds the configuration screen appears on the monitor.

Troubleshooting
The configuration screen does not appear on the monitor?
A fault was detected during the self test of the LICCON computer system.
▶ See chapter 4.02.

2.2 Stand-by mode

No crane movements are possible. Please refer to Chapter 4.02.



B198637

3 Luffing

The speed of the crane movement “Luffing” is controlled by the deflection of master switch 1 **420** and by the pedal **377** of the engine control.

DANGER
Crane can be damaged or topple over!
▶ If an attempt to lift a load with the hoist gear causes the LICCON overload protection to switch off, then the load must not be lifted by luffing up the boom head.

3.1 Luffing the telescopic boom

In the “Control Parameter program”, it is possible to preselect the maximum luffing speed of the telescopic boom.
See chapter 4.02, section “Control parameter”.

3.1.1 Luffing the telescopic boom on cranes with one winch

Ensure that the following prerequisites are met:
– the rotary switch **436** is at position left “luffing telescopic boom”

▶ Move master switch 1 **420** in direction X-.
Result:
– The telescopic boom is luffed up.

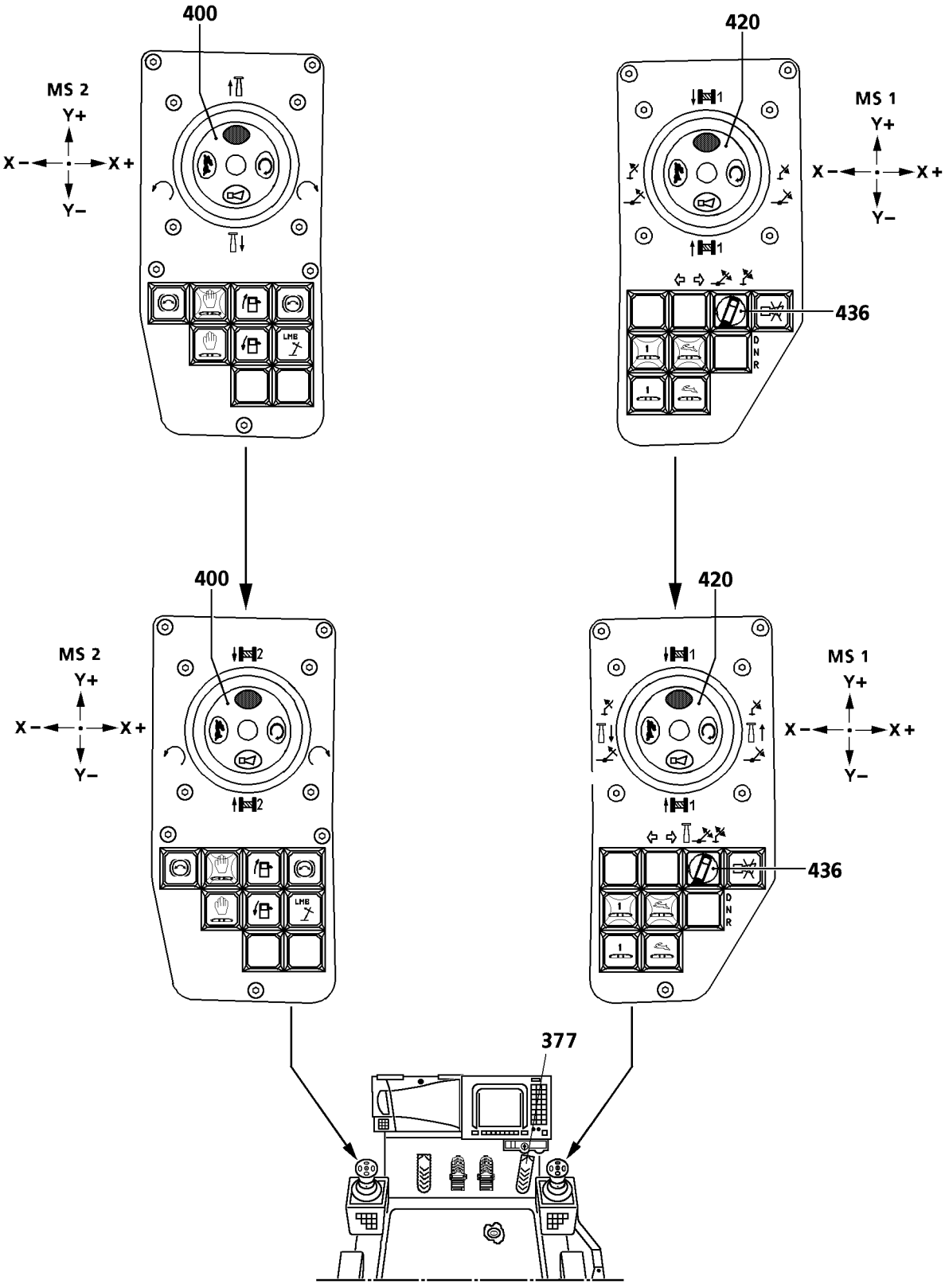
▶ Move master switch 1 **420** in direction X+.
Result:
– The telescopic boom is luffed down.

3.1.2 Luffing the telescopic boom on cranes with two winches

Ensure that the following prerequisites are met:
– the rotary switch **436** is at position central “luffing telescopic boom”

▶ Move master switch 1 **420** in direction X-.
Result:
– The telescopic boom is luffed up.

▶ Move master switch 1 **420** in direction X+.
Result:
– The telescopic boom is luffed down.



B198638

3.2 Luffing the folding jib*

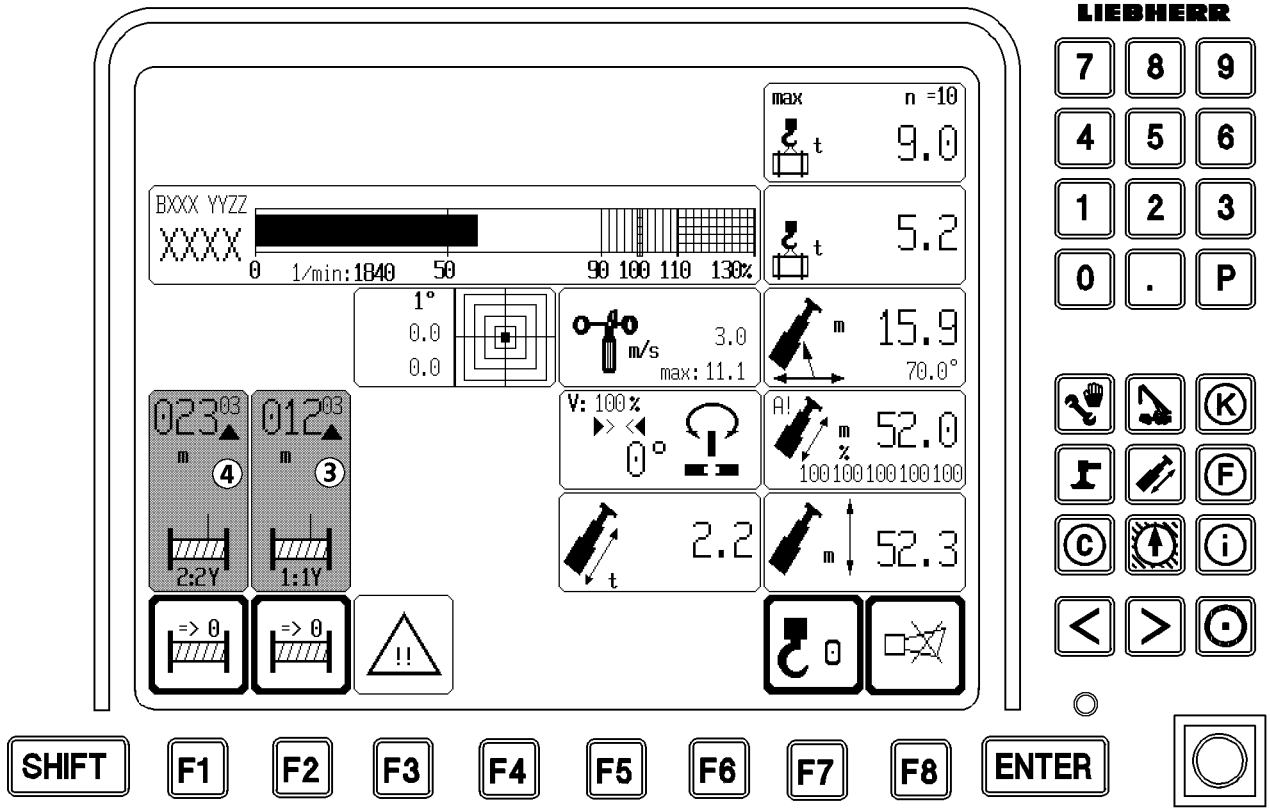
Ensure that the following prerequisites are met:
– the rotary switch **436** is set to position right “luff folding jib”
– Operating mode hydraulically adjustable folding jib has been selected on the LICCON.

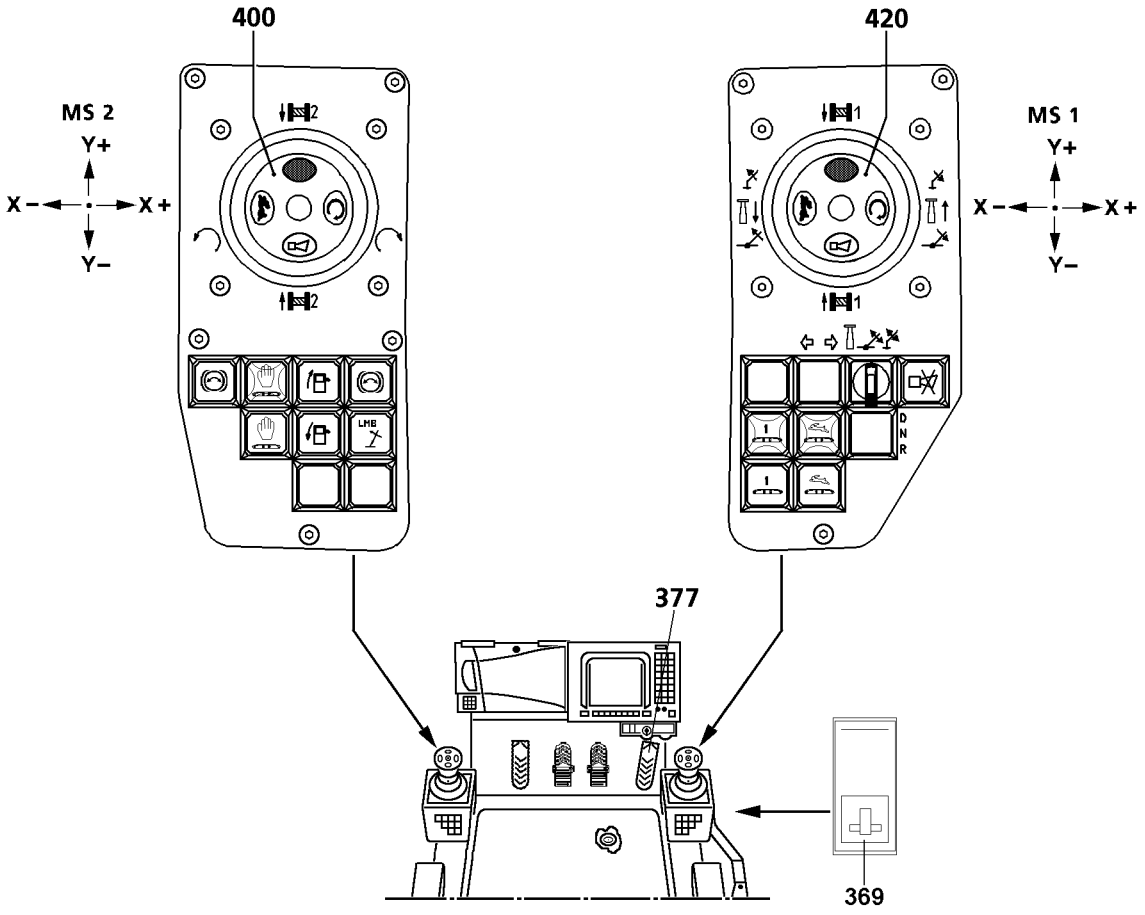
▶ Move master switch 1 **420** in direction X-.

Result:
– Folding jib is luffed up.

▶ Move master switch 1 **420** in direction X+.

Result:
– Folding jib is luffed down.


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
max n =10
9.0 t
5.2 t
BXXX YYZZ
XXXX
0 1/min:1840 50 90 100 110 130%
1°
0.0
0.0
m/s 3.0
max: 11.1
15.9 m
70.0°
V: 100%
0°
A!
52.0 m %
100 100 100 100 100
2.2 t
52.3 m
023 03 m 4
012 03 m 3
2:2Y
1:1Y
=> 0
=> 0
!!
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER


400
420
MS 2
Y+
X− X+
Y−
MS 1
Y+
X− X+
Y−
377
369

B198639

4 Lifting / lowering

CAUTION
Danger of damaging the hoist rope when spooling up and/or reeling off!
▶ Do not allow slack cable to build up.

Speed of crane movement “Lifting” is controlled by the deflection of the respective master switch and by the pedal **377** of the engine control.
In the “Control Parameter program”, it is possible to preselect the maximum winching speed. Equally it is possible to deactivate or activate the individual winches.
See chapter 4.02, section “Control parameter”.

4.1 Lifting / lowering the winch 1

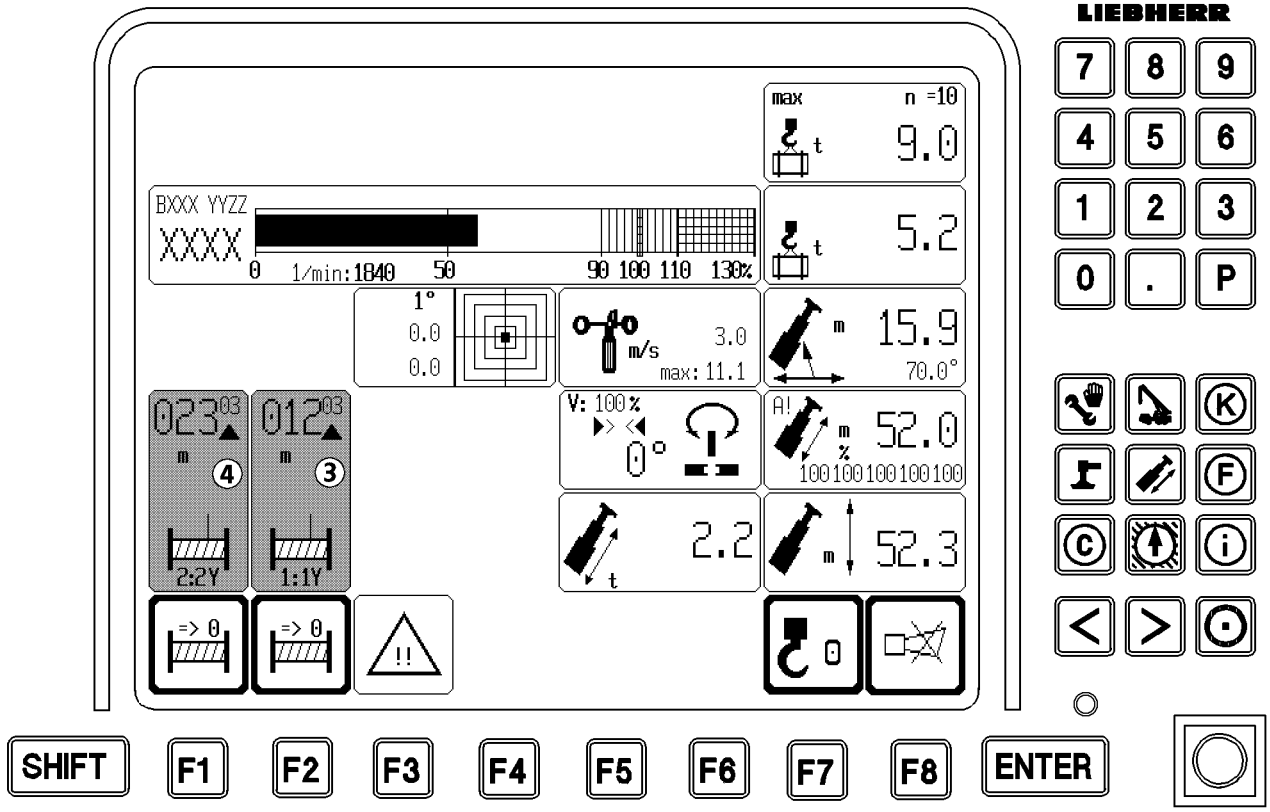
Winch icon **3** displays whether winch 1 is turning, even when because of multiple reeving and low speed, no movement of the hook is visible.
▶ Move master switch 1 **420** in direction Y+.
Result:
– Winch 1 reels off and the load is lowered.

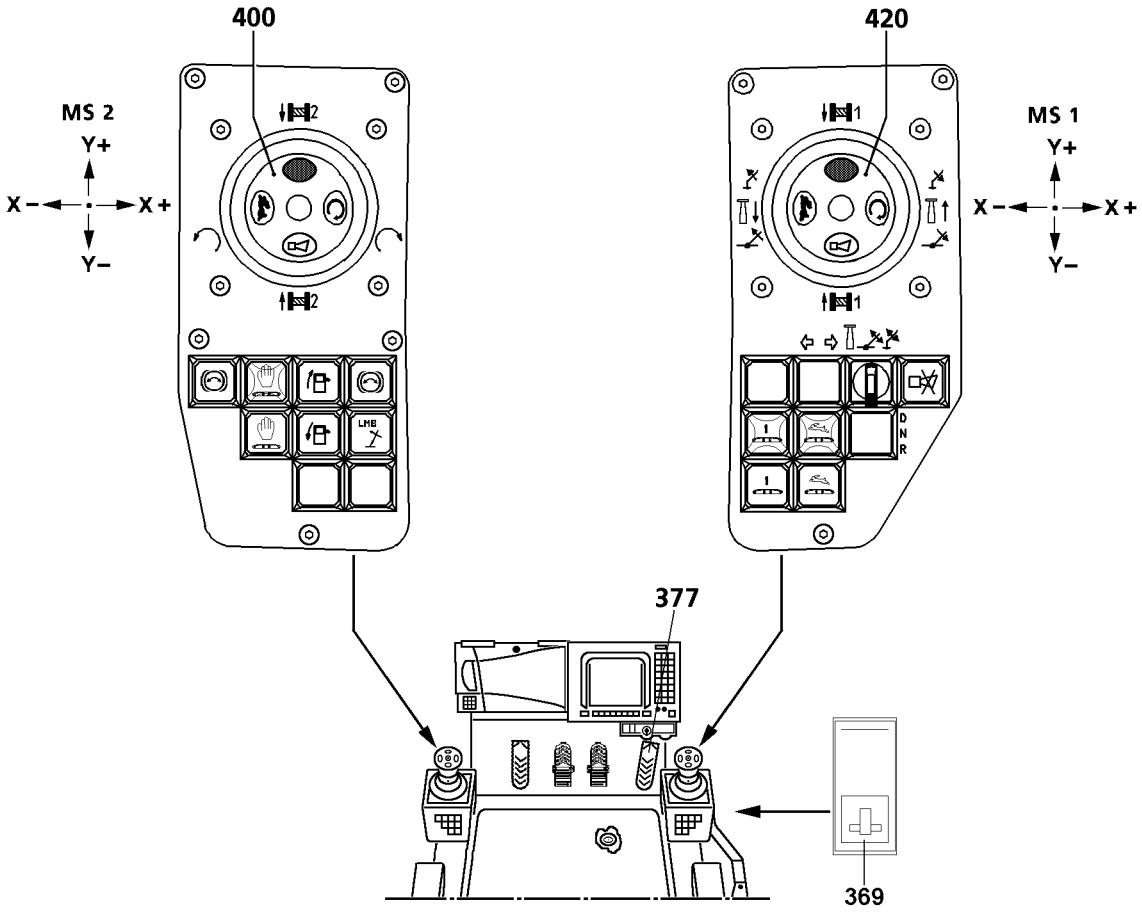
▶ Move master switch 1 **420** in direction Y-.
Result:
– Winch 1 spools up and the load is lifted.

4.2 Lifting / lowering the winch 2

Winch icon **4** displays whether winch 2 is turning, even when because of multiple reeving and low speed, no movement of the hook is visible.
▶ Move master switch 2 **400** in direction Y+.
Result:
– Winch 2 reels off and the load is lowered.

▶ Move master switch 2 **400** in direction Y-.
Result:
– Winch 2 spools up and the load is lifted.


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
max n =10
9.0
5.2
15.9
70.0°
52.0
2.2
52.3
3.0
max: 11.1
1/min: 1840
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER


400
420
MS 2
MS 1
Y+
X−
X+
Y−
377
369
B198639

5 Turning

The speed of the crane movement “Turning” is controlled by the deflection of master switch 2 **400** and by the pedal **377** of the engine control.

CAUTION
Damage to the crane!
If the crawler travel gear is added while turning the crane, the crane can be damaged!
▶ Adding the crane travel gear while turning the crane is prohibited!

5.1 Turning the crane superstructure

Ensure that the following prerequisites are met:
– the crane superstructure must be unpinned before starting the turning movement

DANGER
Danger of fatal injury!
▶ Make sure, that there are no obstacles within the slewing range of the crane and that there are no persons in the danger zone.
▶ Give a short warning signal (horn) before starting a crane movement.
▶ When slewing with a load, initiate the turning movement very carefully, and apply the brakes.

▶ Move master switch 2 **400** in direction X+.

Result:
– The crane superstructure turns to the right.

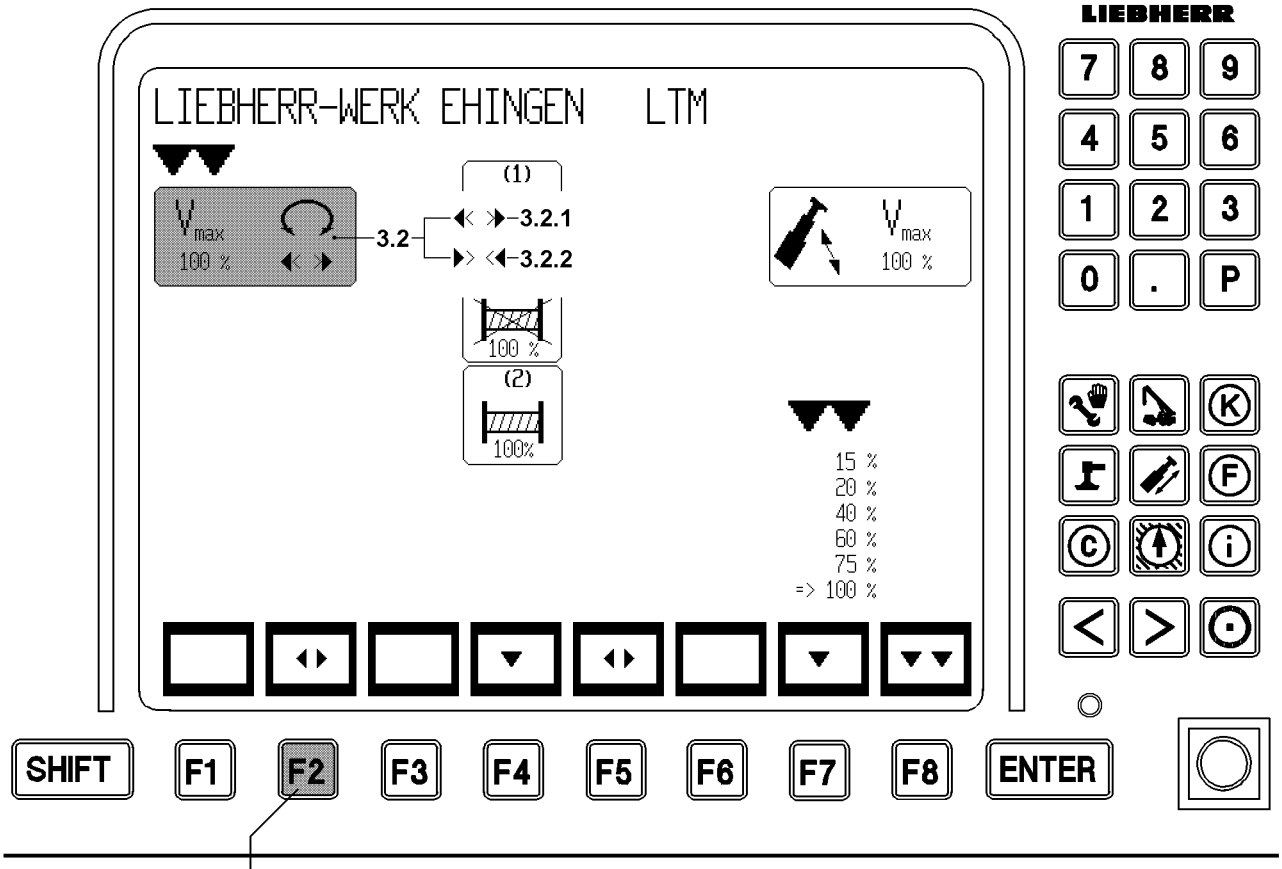
▶ Move master switch 2 **400** in direction X-.

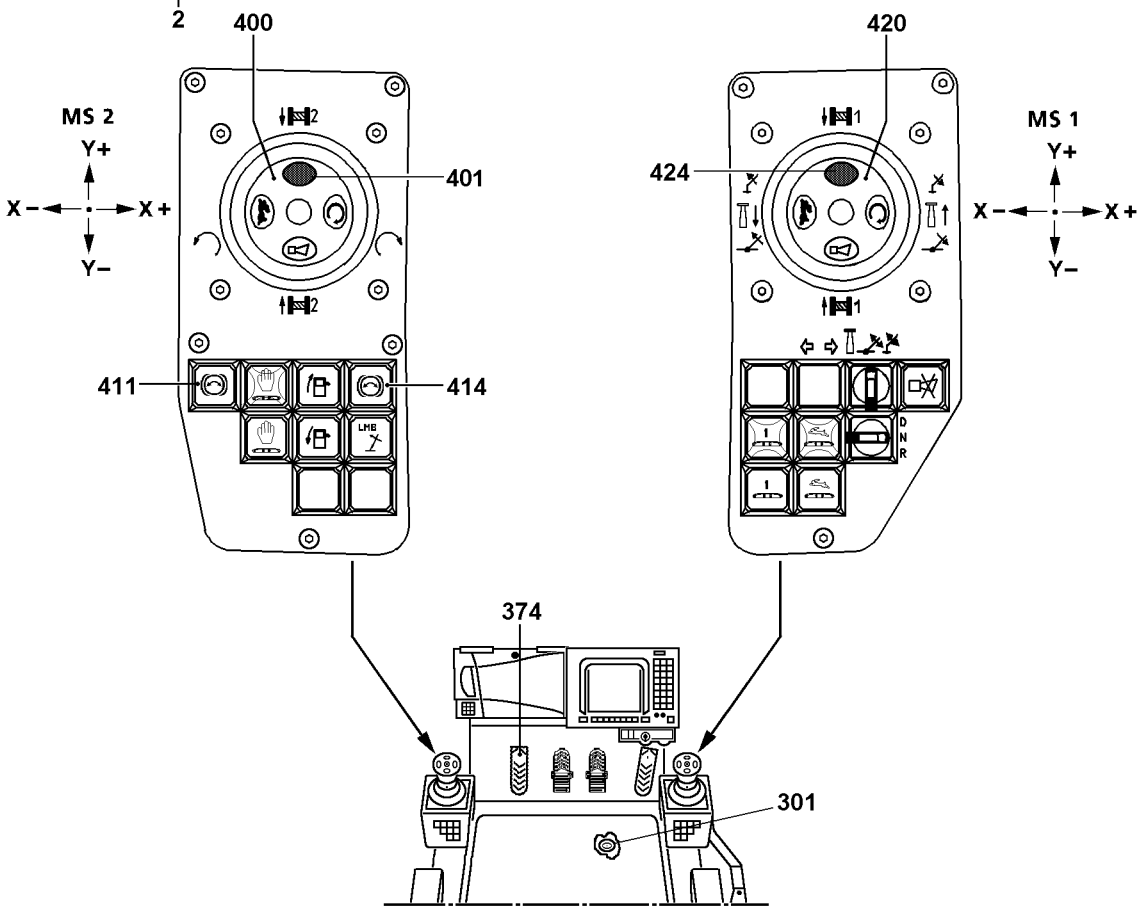
Result:
– The crane superstructure turns to the left.

5.2 Rotation speed preselection

The load chart manual gives the maximum rotation speeds in percentages. The maximum rotation speeds can be set using the “Control Parameter” program, see Chapter 4.02, section “Control Parameter” program. Always move at slow speed with a long boom and a heavy load.

DANGER
Risk of accident due to toppling crane!
▶ The boom length values and the operating mode that are specified in the load chart must **not** be exceeded during crane operation! See chapter 4.02 LICCON computer system, Control Parameter program. The maximum rotation speed must not be modified during crane movements.


LIEBHERR
LIEBHERR-WERK EHINGEN LTM
(1)
3.2
3.2.1
3.2.2
100 %
(2)
100%
15 %
20 %
40 %
60 %
75 %
=> 100 %
7 8 9
4 5 6
1 2 3
0 . P
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER


2
400
401
411
414
MS 2
Y+
X-
X+
Y-
420
424
MS 1
374
301

B104736

5.3 Slewing gear generally

With this slewing gear it is possible to select between “free rotating” and “fixed” slewing gear. Switching over takes place in the “Control Parameter program” using function key “F2” **2** and can only be carried out while the crane is stationary. If the “slewing gear is freely rotating” symbol **3.2.1** is displayed, and if the “slewing gear is fixed” symbol **3.2.2** is displayed. See chapter 4.02, section “Control Parameter program”.
The slewing gear cannot be switched to “freely rotating” if:

– the crawler travel gear is added
– remote radio control is being used
– the working range limiter is active
– charts that have not been approved are selected

In these cases a preselection can be made using function key “F2” **2**, but the function is not taken over into the “Operation” program.

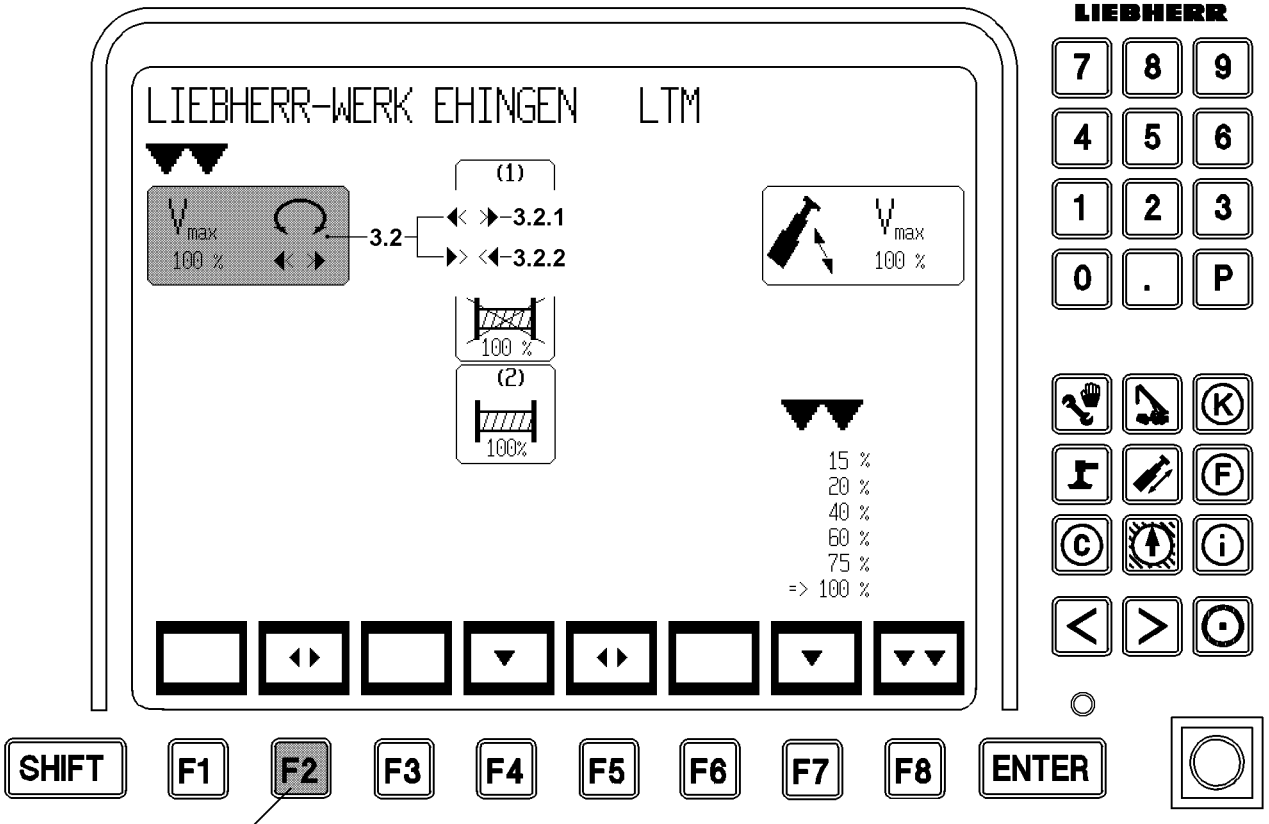
5.3.1 Freely rotating slewing gear (open)

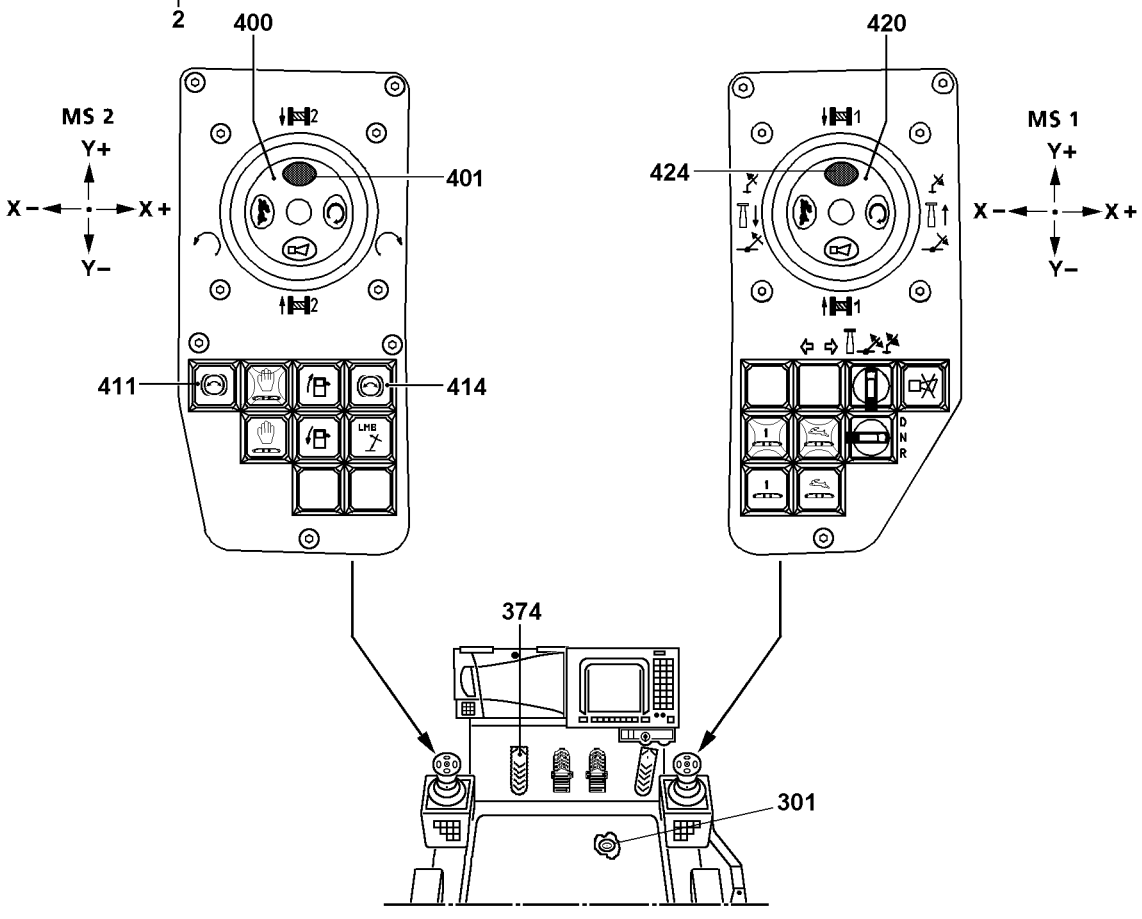
To be able to operate the “freely rotating slewing gear” must:

– the parking brake of the slewing gear be **off**
– the control light **411** be illuminated

DANGER
The slewing gear can move!

▶ While the parking brake of the slewing gear is **off**, the slewing gear can move due to wind, leaning or angular pulling.
▶ The parking brake of the slewing gear must then be **turned on** using the button **414**.
▶ For more information see section “Turning parking brake on/off”.


LIEBHERR
LIEBHERR-WERK EHINGEN LTM
(1)
3.2
3.2.1
3.2.2
100 %
(2)
100%
15 %
20 %
40 %
60 %
75 %
=> 100 %
7 8 9
4 5 6
1 2 3
0 . P
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER


2
400
401
411
414
MS 2
Y+
X-
X+
Y-
420
424
MS 1
374
301

B104736

5.3.2 Fixed slewing gear

The “fixed slewing gear” can be operated with the parking brake **turned on and off**.
For more information see section “Turning parking brake on/off”.

Note

- If the parking brake is **turned off**, then it is **always released**, regardless if the slewing gear is actuated with the master switch **400** or if it is not actuated.
- If the parking brake is **turned on**, the parking brake is **released** as soon as the master switch **400** is deflected. The parking brake is **applied** as soon as the master switch **400** is moved in zero position and the **slewing gear** is no longer actuated.

DANGER
The slewing gear can move!

- While the parking brake of the slewing gear is **off**, the slewing gear can move due to wind, leaning or angular pulling.
- The parking brake of the slewing gear must then be **turned on** using the button **414**.
- For more information see section “Turning parking brake on/off”.

5.3.3 Foot brake slewing gear

The “freely rotating” and the “fixed slewing gear” can also be slowed down with the pedal **374**.

DANGER
Risk of accident!

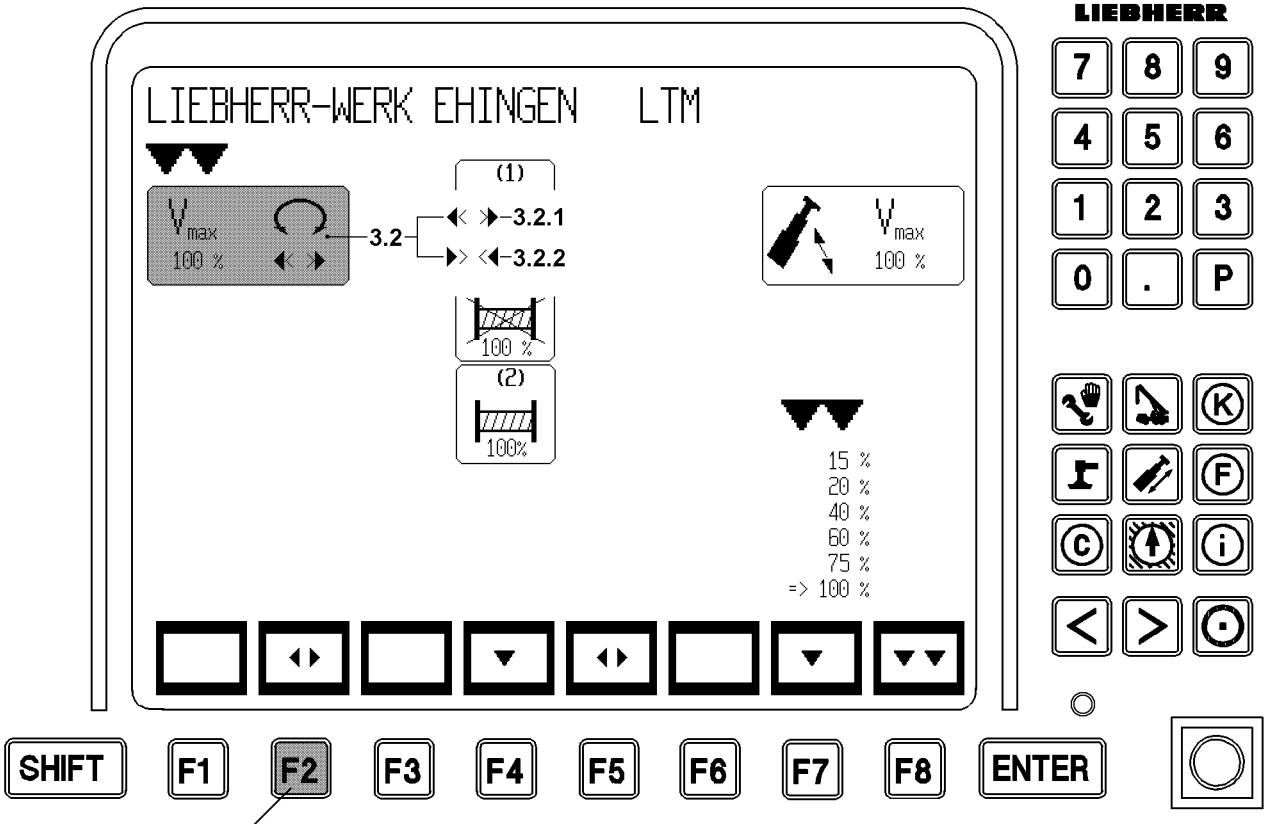
- The foot brake must be carefully actuated with the pedal **374**!
- The harder the pedal **374** is operated, the greater the braking force!
- If this is not observed, a danger of accident exists!

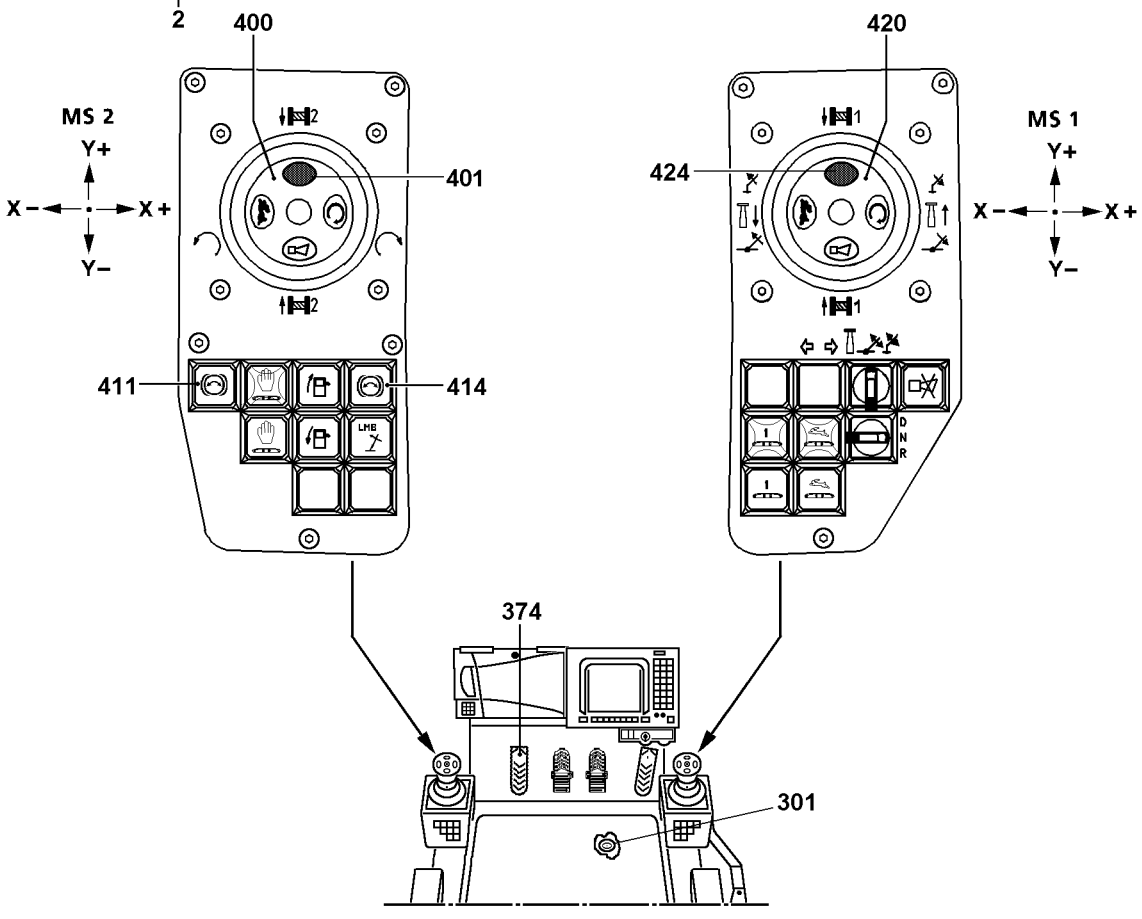
- Carefully actuate the foot brake with the pedal **374**.

CAUTION
Increased brake lining wear!

- The pedal **374** must not be operated for long periods with simultaneous actuation of a turning movement.

- Do not actuate the pedal **374** for an extended period of time.


LIEBHERR
LIEBHERR-WERK EHINGEN LTM
(1)
3.2
3.2.1
3.2.2
100 %
(2)
100%
15 %
20 %
40 %
60 %
75 %
=> 100 %
7 8 9
4 5 6
1 2 3
0 . P
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER


2
400
401
411
414
MS 2
Y+
X-
X+
Y-
420
424
MS 1
374
301

B104736

5.4 Parking brake - Slewing gear

The parking brake of the slewing gear can be **turned on or off** with “freely rotating” and “fixed” slewing gear using the button **414**.

The control light **411** shows if the parking brake is turned off or on.

5.4.1 Turning the parking brake off (release)

Ensure that the following prerequisites are met:

– Parking brake is **turned on**
– Control light **411 does not** illuminate
– Seat contact button **301** or bypass seat contact switch **401** or seat contact switch **424** actuated
– The engine is running
– The crawler travel gear is not added

▶ Press button **414**.

Result:

– Parking brake is **turned off**.
– The control light **411** lights up.

5.4.2 Turning the parking brake on (close)

Ensure that the following prerequisites are met:

– Parking brake is **turned off**.
– Control light **411** illuminates.

▶ Press button **414**.

or

■ Turn engine off.

or

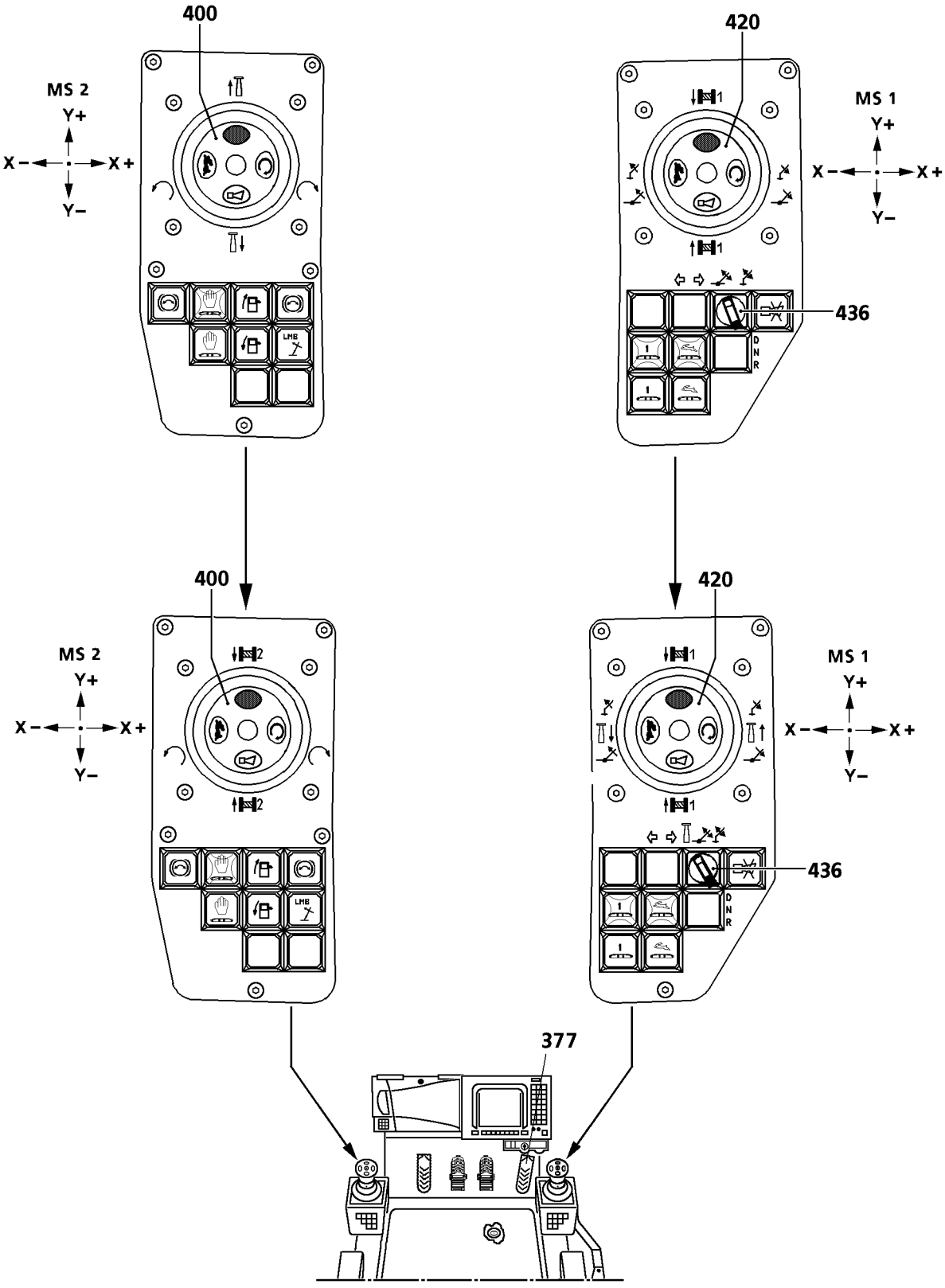
■ Do no longer actuate seat contact button **301** or bypass seat contact switch **401** or seat contact switch **424**.

or

■ Adding crawler travel gear

Result:

– The parking brake is **turned on**.
– The control light **411** turns off.



B198641

6 Telescoping

6.1 Control of crane movement “Telescoping”

6.1.1 Cranes with one winch

Speed of crane movement is controlled by the deflection of master switch **400** and by the pedal of the engine control **377**.

▶ Move master switch **400** in direction Y+ (forward).

Result:

– Telescopic boom is telescoped out.

▶ Move master switch **400** in direction Y- (backward).

Result:

– Telescopic boom is telescoped in.

6.1.2 Cranes with two winches*

Speed of crane movement is controlled by the deflection of master switch **420** and by the pedal **377** of the engine control.

Ensure that the following prerequisites are met:

– the rotary switch **436** is at position left “telescoping”

▶ Move master switch **420** in direction X+ (toward the right).

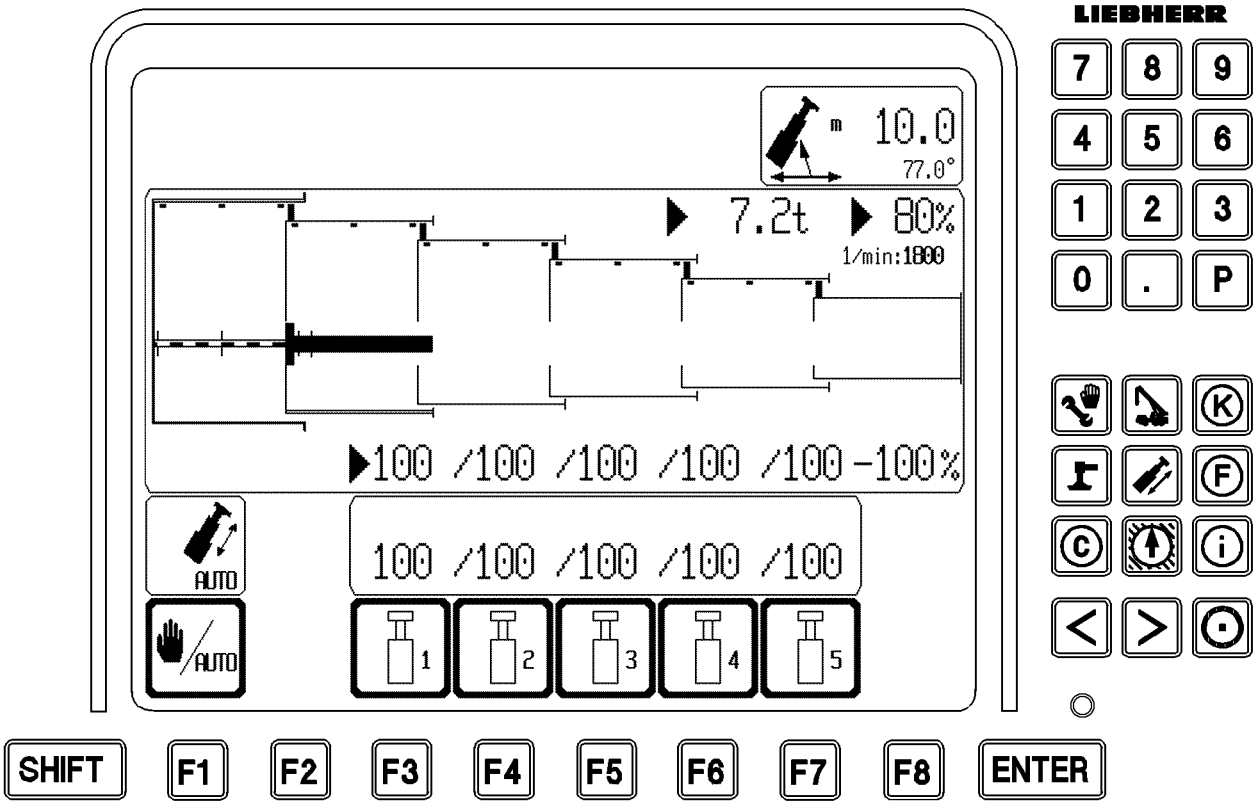
Result:

– Telescopic boom is telescoped out.

▶ Move master switch **420** in direction X- (toward the left).

Result:

– Telescopic boom is telescoped in.


LIEBHERR
m 10.0
77.0°
7.2t
80%
1/min:1800
100 /100 /100 /100 /100 -100%
AUTO
100 /100 /100 /100 /100
AUTO
1
2
3
4
5
7
8
9
4
5
6
1
2
3
0
.
P
K
F
C
i
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER

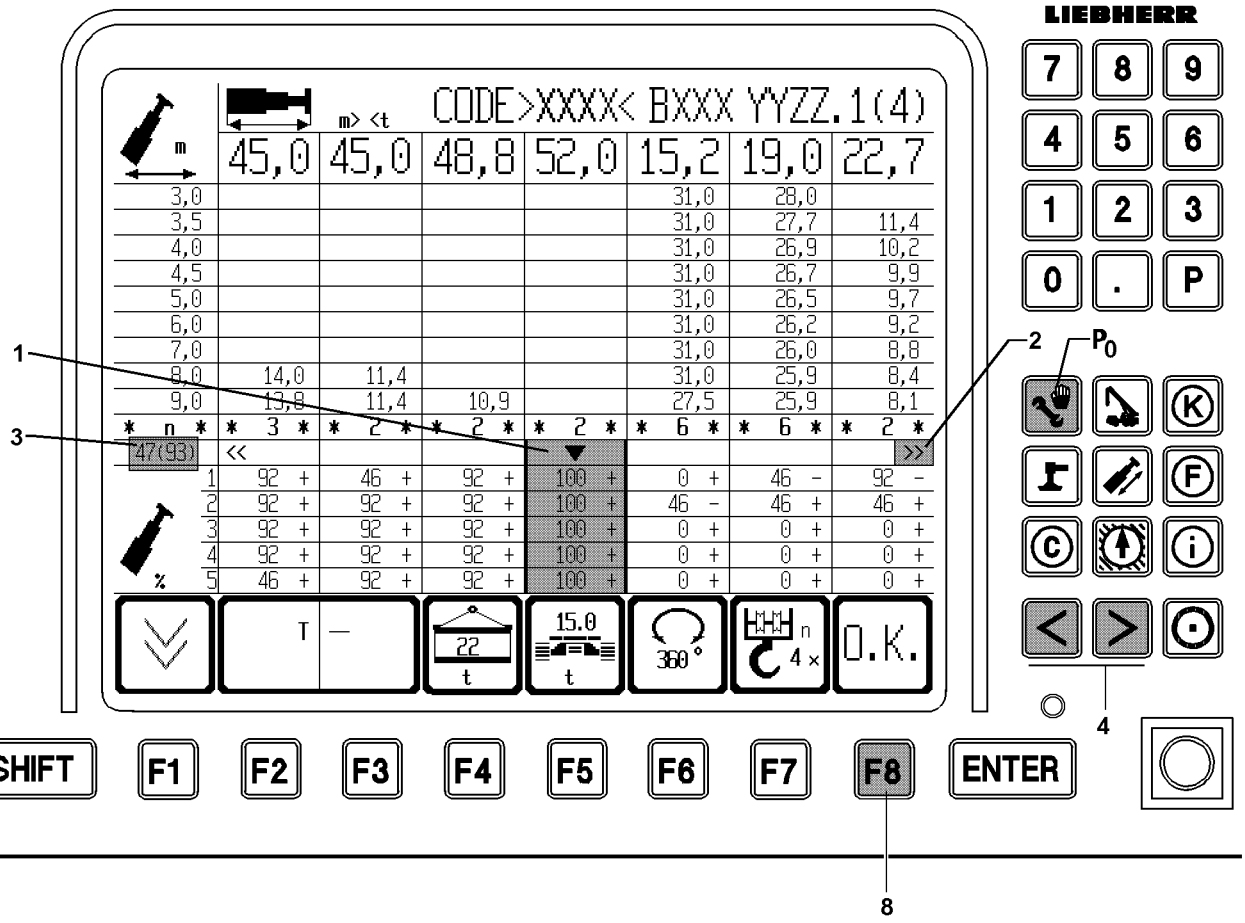
B196273

6.2 General

The “Telematik” automatic telescopic boom control system consists of:
– the dual action telescoping cylinder
– the hydraulically operated gripper pinning
– the hydraulically operated boom pins

The gripper and boom assembly pins are mechanically interlinked, in other words the telescopic section can only be unpinned when at the same time the gripper is locked with this telescopic section.
In the LICCON telescoping screen the crane operator can see, in dynamic graphics, the pinning state of the telescopic boom, the position of the individual telescopes in relation to each other, and the boom status of the telescoping cylinder.
Thanks to the automatic telescoping procedure, the crane operator can easily telescope the telescopic boom, as he does not have to concern himself with the pinning or unpinning of the telescoping cylinder or the telescope. The LICCON telescoping control system therefore makes possible very straightforward telescoping, only the desired telescoping targets need to be entered into the system.
The LICCON telescoping control system decides the sequence in which the individual telescopes will be moved in order to achieve the desired end state. After setting the desired telescoping targets, all telescoping movements, as well as locking and unlocking, are carried out fully automatically.
The following procedures are carried out by the system:
– locking and unlocking of the telescoping cylinder
– pinning and unpinning of the telescopes
– sequence of events for the telescopes to be telescoped, in order to achieve the desired end state

This automatic process will however only be carried out as long as the master switch is operated.
The master switch determines the direction and the speed of the telescoping movement. In this way the crane operator has continuous control over the crane.
The direction of the cylinder movement is set by the LICCON computer system.
If the telescopic boom is lengthened, with the result that telescopes that are currently unreachable have to be moved, then they must first be telescoped in until the last telescope to be moved is reached. In this case, in order to lengthen the telescopic boom (telescope out), telescoping in must first take place.
The LICCON computer system displays the direction in which the next telescoping must be done. The master switch must also be pressed to correspond to this direction setting. In this way the connection between the direction of movement of the appropriate master switch and the telescope continues.
In this way it is possible to move to a telescope target automatically without an operating screen. It is therefore also not essential to keep watching the LICCON monitor all the time.
If the direction needs to be changed by the master switch, the telescopic boom remains stationary if the current direction is to be maintained. This also means that the master switch must be moved in the other direction. If there is no further movement in the other direction, this means that the telescope target has been reached. This state is displayed visually on the operating screen. If the master switch is still being pressed, then after 3 to 5 seconds, the system switches to the telescoping screen.


LIEBHERR
CODE>XXXX< BXXX YYZZ.1(4)
m> <t
m
45,0 45,0 48,8 52,0 15,2 19,0 22,7
3,0 31,0 28,0
3,5 31,0 27,7 11,4
4,0 31,0 26,9 10,2
4,5 31,0 26,7 9,9
5,0 31,0 26,5 9,7
6,0 31,0 26,2 9,2
7,0 31,0 26,0 8,8
8,0 14,0 11,4 31,0 25,9 8,4
9,0 13,8 11,4 10,9 27,5 25,9 8,1
* n * * 3 * * 2 * * 2 * * 2 * * 6 * * 6 * * 2 *
47(93)
<<
>>
1 92 + 46 + 92 + 100 + 0 + 46 - 92 -
2 92 + 92 + 92 + 100 + 46 - 46 + 46 +
3 92 + 92 + 92 + 100 + 0 + 0 + 0 +
4 92 + 92 + 92 + 100 + 0 + 0 + 0 +
5 46 + 92 + 92 + 100 + 0 + 0 + 0 +
%
T
22
t
15.0
t
360°
4 x
O.K.
7 8 9
4 5 6
1 2 3
0 . P
K
F
C
i
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER
1
2
3
4
8
P0

B102855

6.3 Selecting the telescoping target

There are two options for selecting the telescoping target:

1.) Target selection via the configuration screen

2.) Target selection via the telescoping screen

6.3.1 Target selection via the configuration screen

▶ Press program key **P0**.

Result:

– The configuration screen appears on the LICCON monitor.

▶ Using the arrow keys **4**, move the cursor **1** to the left or the right into the column corresponding to the desired telescopic boom length.

As supporting information, the currently selected column number **3** and the number of columns in the table are shown. For example, 47(93) means 47 of 93 columns.
The status indicator (±) next to the percentage boom status value means:

– "**+**" the corresponding telescopic section must be pinned.

– "**-**" the corresponding telescopic section can be telescoped up to the percentage value of the boom status value under load (as in the load chart).

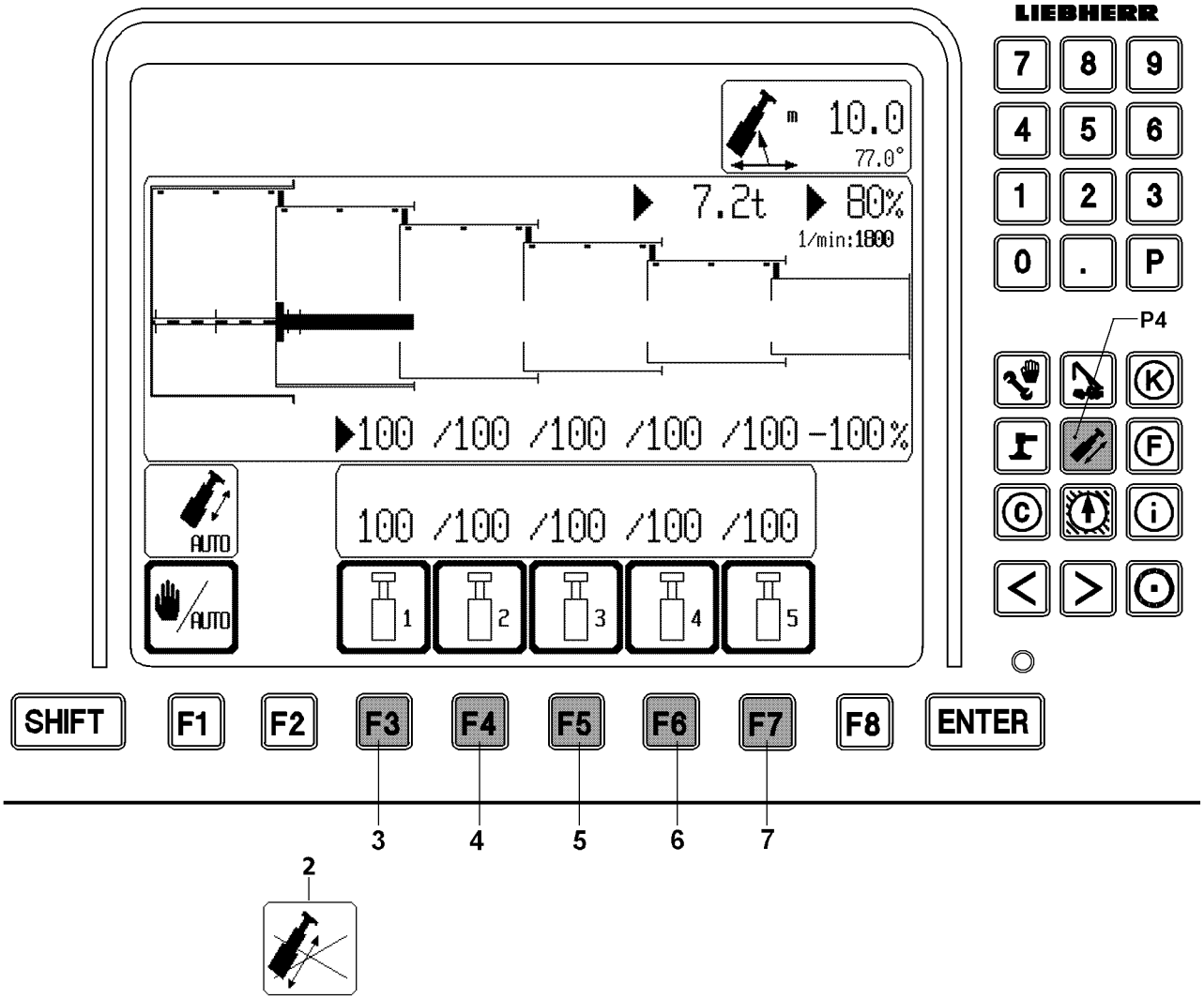
The double arrow **2** at the left and/or right-hand edge of this line points to additional columns in either direction.
If the cursor **1** touches an edge marked with arrows, the next movement in this direction will display the next load chart column(s).
The cursor **1** itself will be put on the next column, if possible in the middle.
A change in the telescoping target is only possible if the master switch is at neutral.
If no cursor appears in the configuration screen, this means that on the telescoping screen a boom configuration that is not supported in the tables was selected and perhaps even started!

▶ Press function key "F8" **8**.

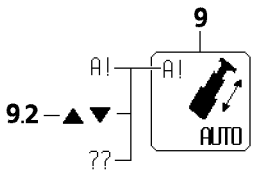
Result:

– The selected telescoping target will be activated.

– The selected column for the telescoping target concerned will be marked in bold along the side.


LIEBHERR
m 10.0
77.0°
7.2t
80%
1/min:1800
100 /100 /100 /100 /100 -100%
100 /100 /100 /100 /100
AUTO
AUTO
1
2
3
4
5
7 8 9
4 5 6
1 2 3
0 . P
P4
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
3
4
5
6
7

2


9
A!
A!
9.2
AUTO
??

B196275

6.3.2 Target selection via the telescoping screen

▶ Press program key **P4**.

Result:

– The telescoping screen appears on the LICCON monitor.

The selection of the telescoping target is achieved by pressing the function key assigned to the telescope concerned several times. After every key press, the intended extension status of the associated telescope changes to the next percentage value where there is a hole for pins.
In contrast to the configuration screen, the telescoping length is displayed immediately as a target, without further confirmation, as soon as the function key is pressed. No confirmation is required, as the assigned function keys do not have any other functions.
The appearance of a direction arrow in the automatic icon **9.2** immediately after a change in the telescoping target can be interpreted as feedback.
If the flashing icon **2** appears on the LICCON monitor, then:

– the telescopic sections cannot be unpinned
– unpinned load exceeded
– no load chart present

▶ Press function key “F3” **3**.

Result:

– The following appears on telescopic section 1: 0%, 46%, 92%, or 100%.

▶ Press function key “F4” **4**.

Result:

– The following appears on telescopic section 2: 0%, 46%, 92%, or 100%.

▶ Press function key “F5” **5**.

Result:

– The following appears on telescopic section 3: 0%, 46%, 92%, or 100%.

▶ Press function key “F6” **6**.

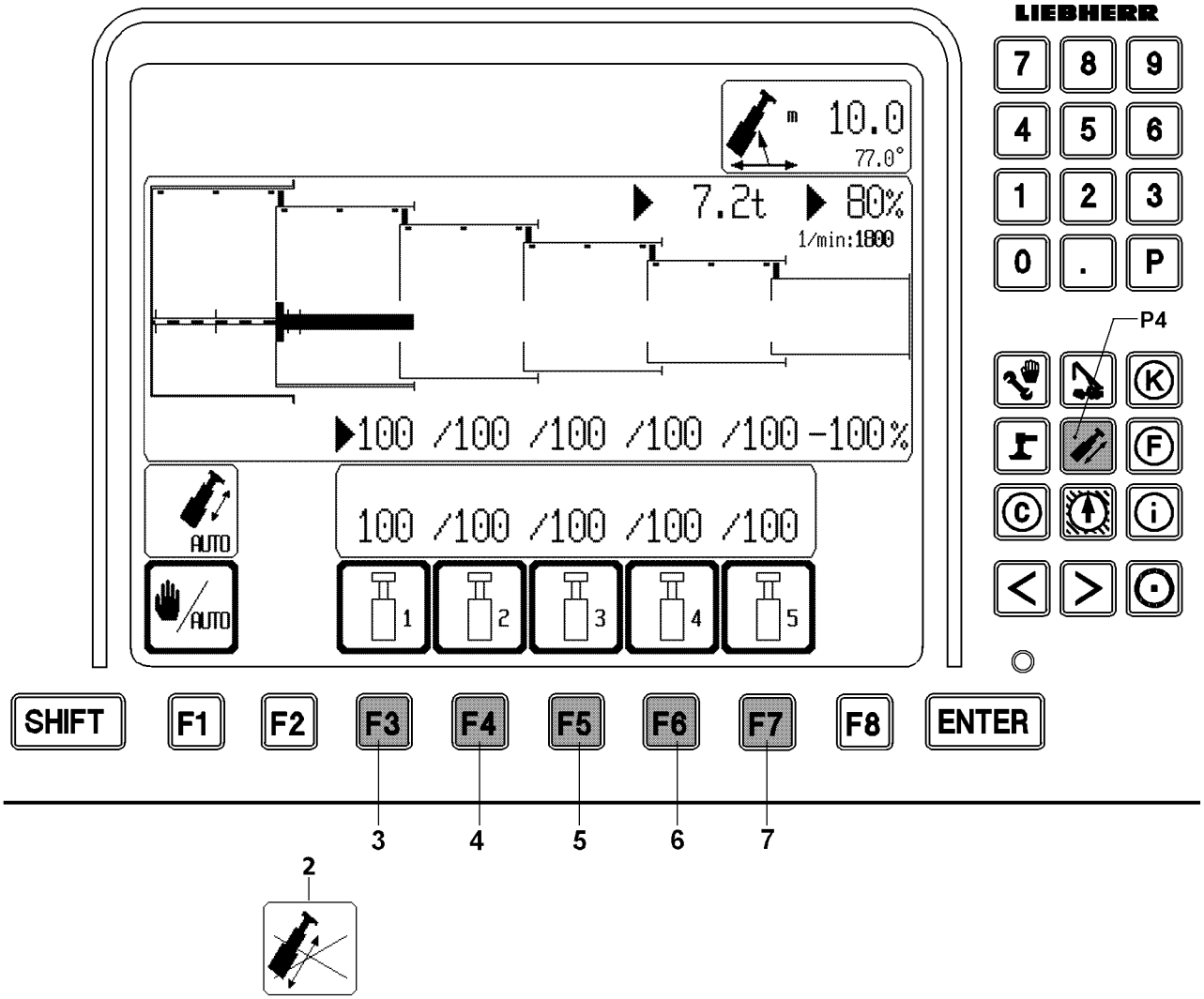
Result:

– The following appears on telescopic section 4: 0%, 46%, 92%, or 100%.

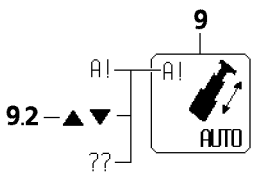
▶ Press function key “F7” **7**.

Result:

– The following appears on telescopic section 5: 0%, 46%, 92%, or 100%.


LIEBHERR
m 10.0
77.0°
7.2t
80%
1/min:1800
100 /100 /100 /100 /100 -100%
100 /100 /100 /100 /100
AUTO
AUTO
1
2
3
4
5
7 8 9
4 5 6
1 2 3
0 . P
P4
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
3
4
5
6
7

2

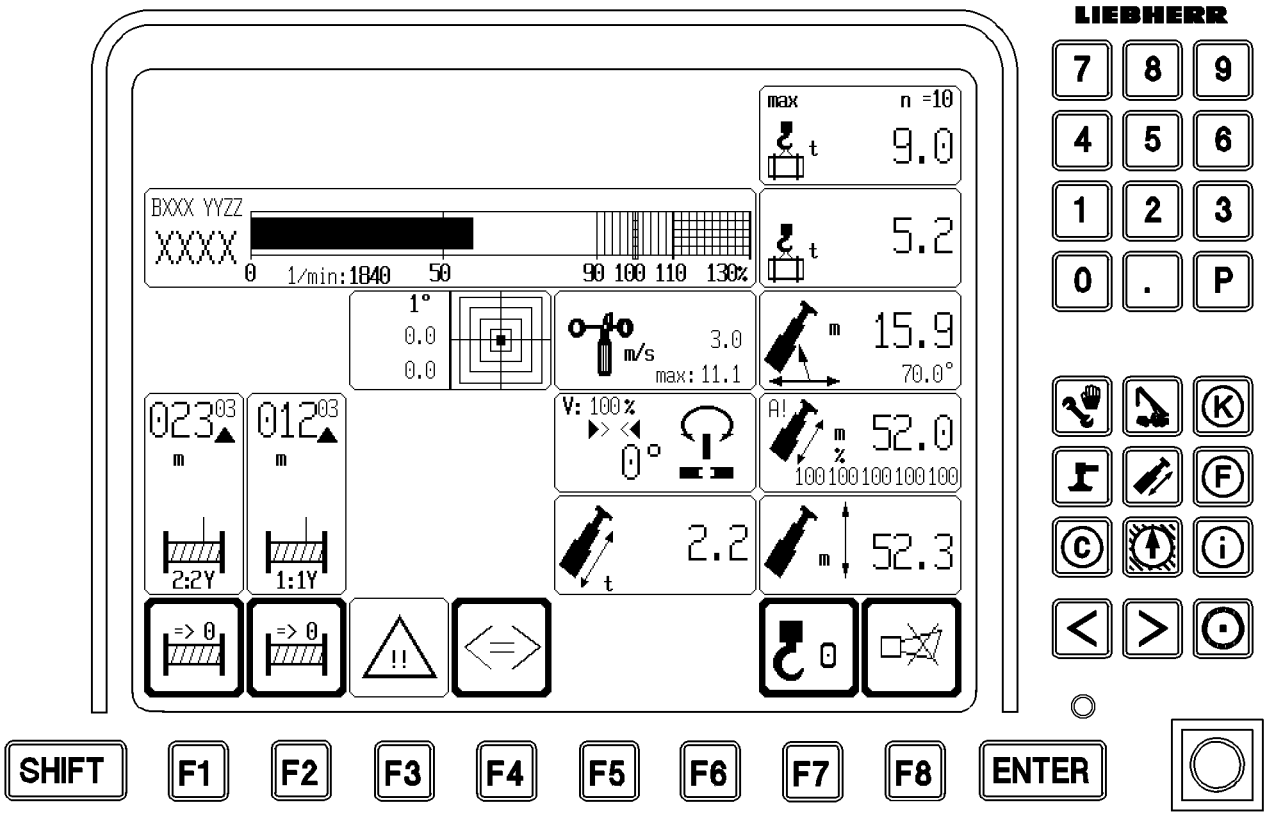

9
A!
A!
9.2
AUTO
??

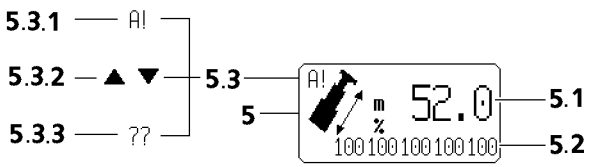
B196275

6.4 Telescoping to the selected target

If the desired telescoping target is set, then the direction in which the master switch must be deflected is displayed on the operating screen and on the telescoping screen.
If the master switch is moved against the specified direction, the telescopic section remains stationary. The default direction remains visible as a possible error criterion.
If the set telescoping target has been reached, then the telescopic boom remains stationary, regardless of any movements of the master switch, and the markings on the set telescoping target begin to flash. The target has thus been reached.

- ▶ If the Up Arrow **9.2** appears in the automatic icon **9**:
  Telescope the telescopic boom out.
- ▶ If the Down Arrow **9.2** appears in the automatic icon **9**:
  Telescope the telescopic boom in.


LIEBHERR
max n =10
9.0
5.2
BXXX YYZZ
XXXX
0 1/min:1840 50 90 100 110 130%
1°
0.0
0.0
3.0
max: 11.1
15.9
70.0°
023 03
012 03
m
2:2Y
1:1Y
V: 100%
0°
A!
52.0
100 100 100 100 100
2.2
52.3
7 8 9
4 5 6
1 2 3
0 . P
SHIFT F1 F2 F3 F4 F5 F6 F7 F8 ENTER


5.3.1 A!
5.3.2 ▲ ▼
5.3.3 ??
5.3
5
A!
52.0
100 100 100 100 100
5.1
5.2

B198643

6.5 Telescoping using the operating screen

The telescoping system is designed so that an experienced crane operator can telescope without the telescoping screen, in other words using just the operating screen.
The crane operator receives information about the direction in which the master switch must be moved from the arrow **5.3.2** in the icon **5**.
If the crane operator attempts further telescoping once the telescoping target has been reached, then there is an automatic switch-over from the operating screen to the telescoping screen. If the master switch is still being pressed, then the markings on the set telescoping target flash. This means that the telescoping target has been reached.

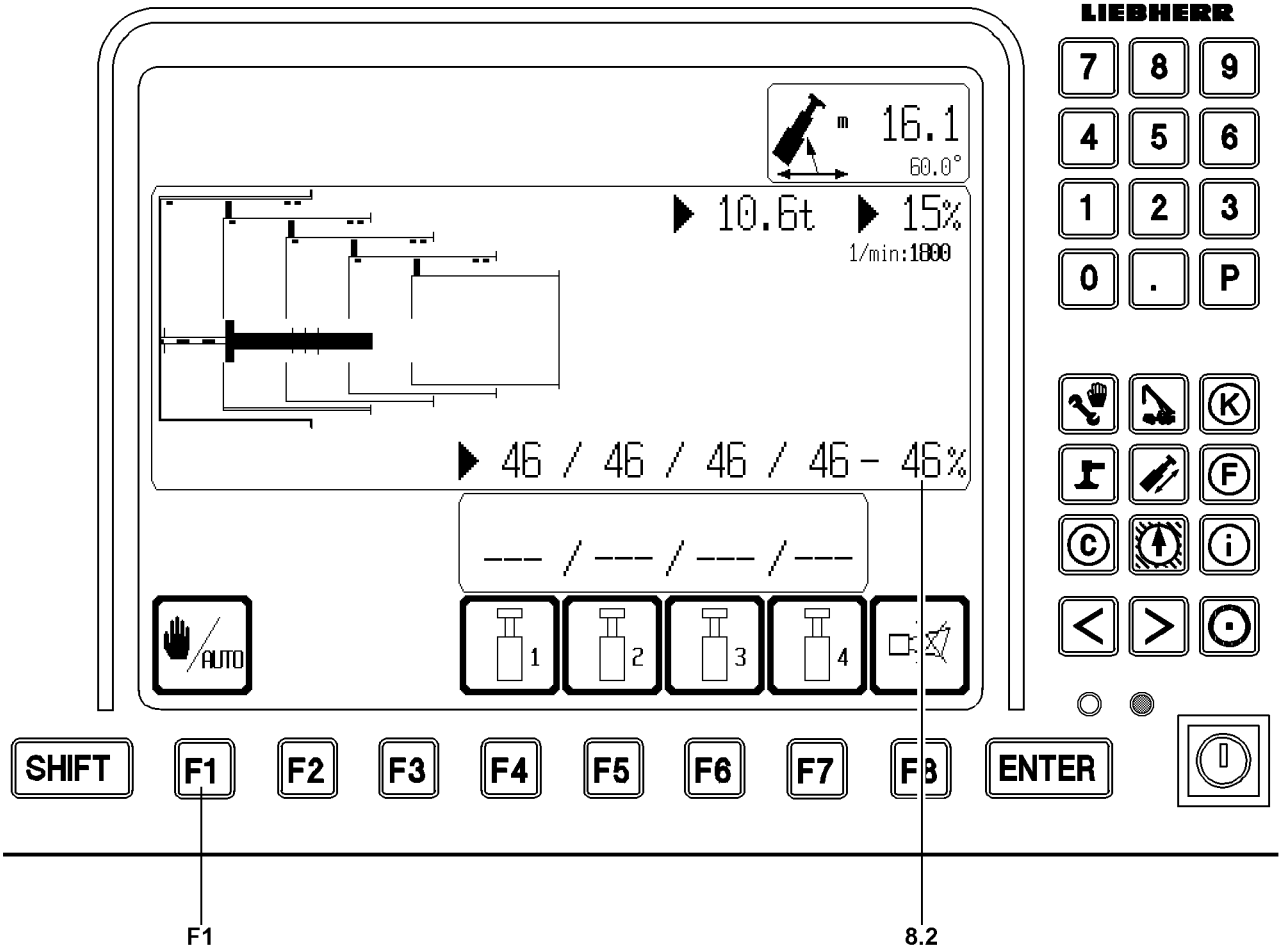
- ▶ If the Up Arrow **5.3.2** appears in the icon **5**:
  Telescope the telescopic boom out.
- ▶ If the Down Arrow **5.3.2** appears in the automatic icon **5**:
  Telescope the telescopic boom in.

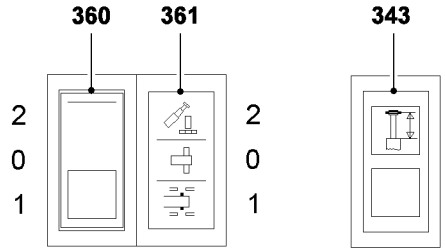
Once the telescoping target is reached, symbol A! **5.3.1** appears.

- ▶ Press the master switch for another 3 seconds or so, until the telescopic section is resting on the pin.

6.6 Aborting the telescoping

Telescoping can be aborted at any time.
The pins, the telescoping cylinders and the telescopic sections remain where they were, in the last state they were in when the master switch was still being pressed.
If desired, a new telescoping target can be set and telescoped to automatically.
It is also possible to proceed manually by switching over to manual operation.


LIEBHERR
16.1
60.0°
10.6t
15%
1/min:1800
46 / 46 / 46 / 46 - 46%
--- / --- / --- / ---
AUTO
1
2
3
4
7
8
9
4
5
6
1
2
3
0
.
P
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
F1
8.2


360
361
343
2
0
1
2
0
1

B104761

6.7 Manually telescoping the telescopic boom

Manual telescoping is regarded as an exception mode, as automatic mode makes it possible to reach any chosen extension state.
In manual telescoping, pinning and unpinning of the telescoping cylinder and telescoping must be carried out manually.
The marking on the telescoping screen will indicate in which telescope the pinning equipment of the telescoping cylinder is currently located.
The proximity to a telescope pinning hole can only be inferred on the telescoping screen to an accuracy of 1%.

6.7.1 Activating manual telescoping operation

▶ Press function key **F1**.

Result:

– Manual telescoping operation is now activated.

6.7.2 Unpinning the telescopic section

▶ Change over switch **360** from position **0** to position **2**.

Result:

– Unpin the telescopic section will be preselected.

▶ Move the master switch for the telescopic boom forwards until the telescopic section is unpinned.

Result:

– The unpinned telescopic section is displayed on the telescoping screen.

6.7.3 Telescoping and pinning the telescopic section

▶ Operate the master switch. Telescope the telescopic section.

▶ Change over switch **360** from position **2** to position **0**.

Result:

– Pin the telescopic section will be preselected.

▶ Continue to move the master switch in the same direction until the locking pin latches in audibly.

Result:

– Telescopic section is pinned.

6.7.4 Unpinning the telescoping cylinder

Before carrying out any other steps, please ensure that the locking pin has latched in audibly.

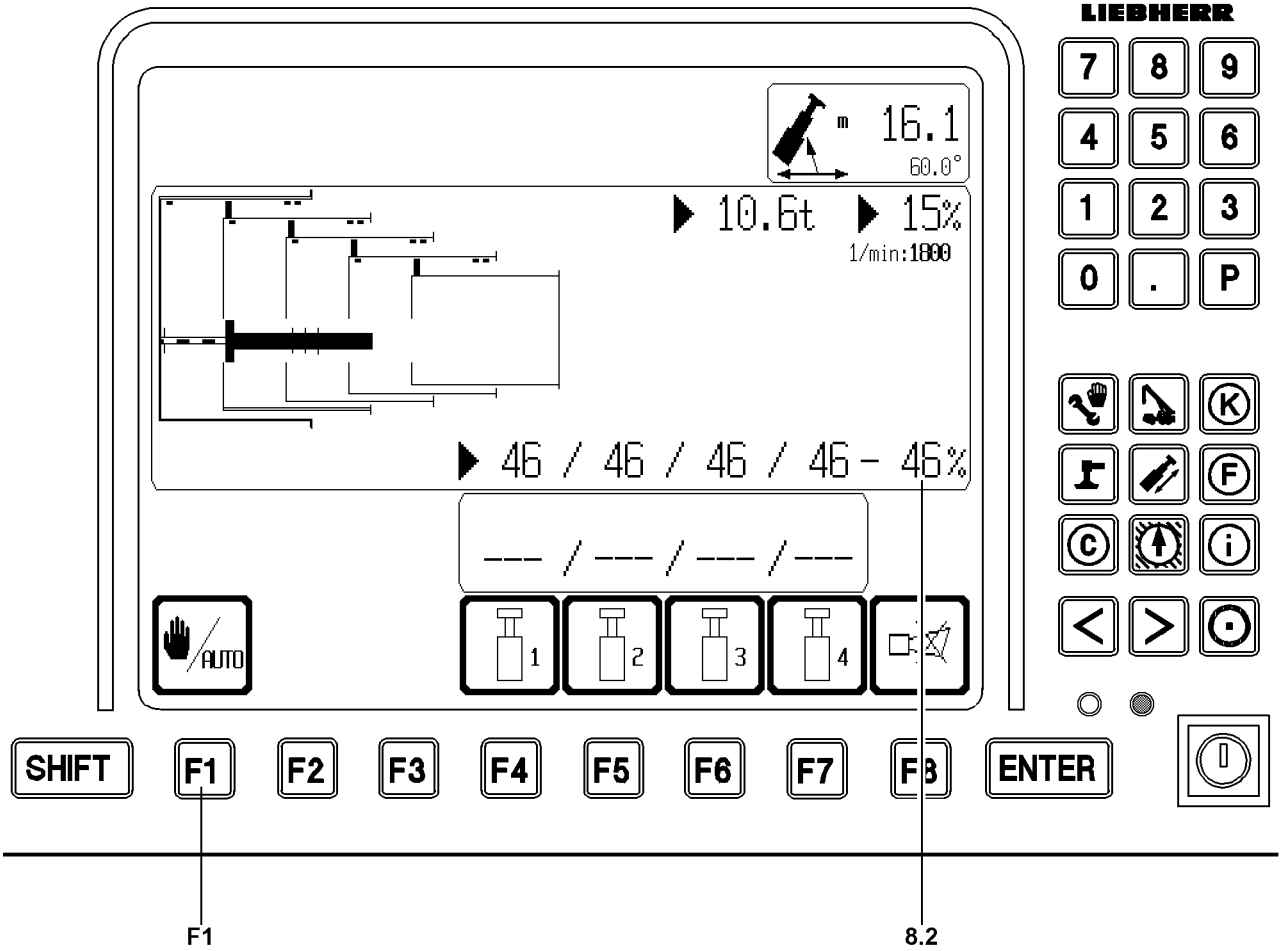
▶ Move the master switch for the telescopic boom forwards until the locking pins of the telescoping cylinder are released.

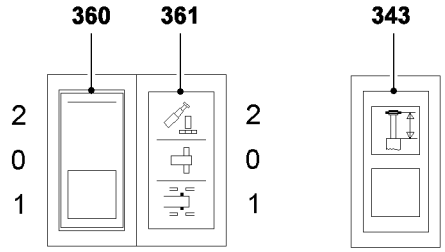
▶ Do not operate the master switch again.

▶ Change over switch **360** from position **0** to position **1**.

Result:

– Telescoping cylinder will be unpinned.
– The telescoping screen displays the unpinned telescoping cylinder.


LIEBHERR
16.1
60.0°
10.6t
15%
1/min:1800
46 / 46 / 46 / 46 - 46%
--- / --- / --- / ---
AUTO
1
2
3
4
7
8
9
4
5
6
1
2
3
0
.
P
K
F
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
F1
8.2


360
361
343
2
0
1
2
0
1

B104761

6.7.5 Telescoping and pinning the telescoping cylinder

The position of the telescoping cylinder is indicated by the image shown on the monitor and in symbol **8.2**.

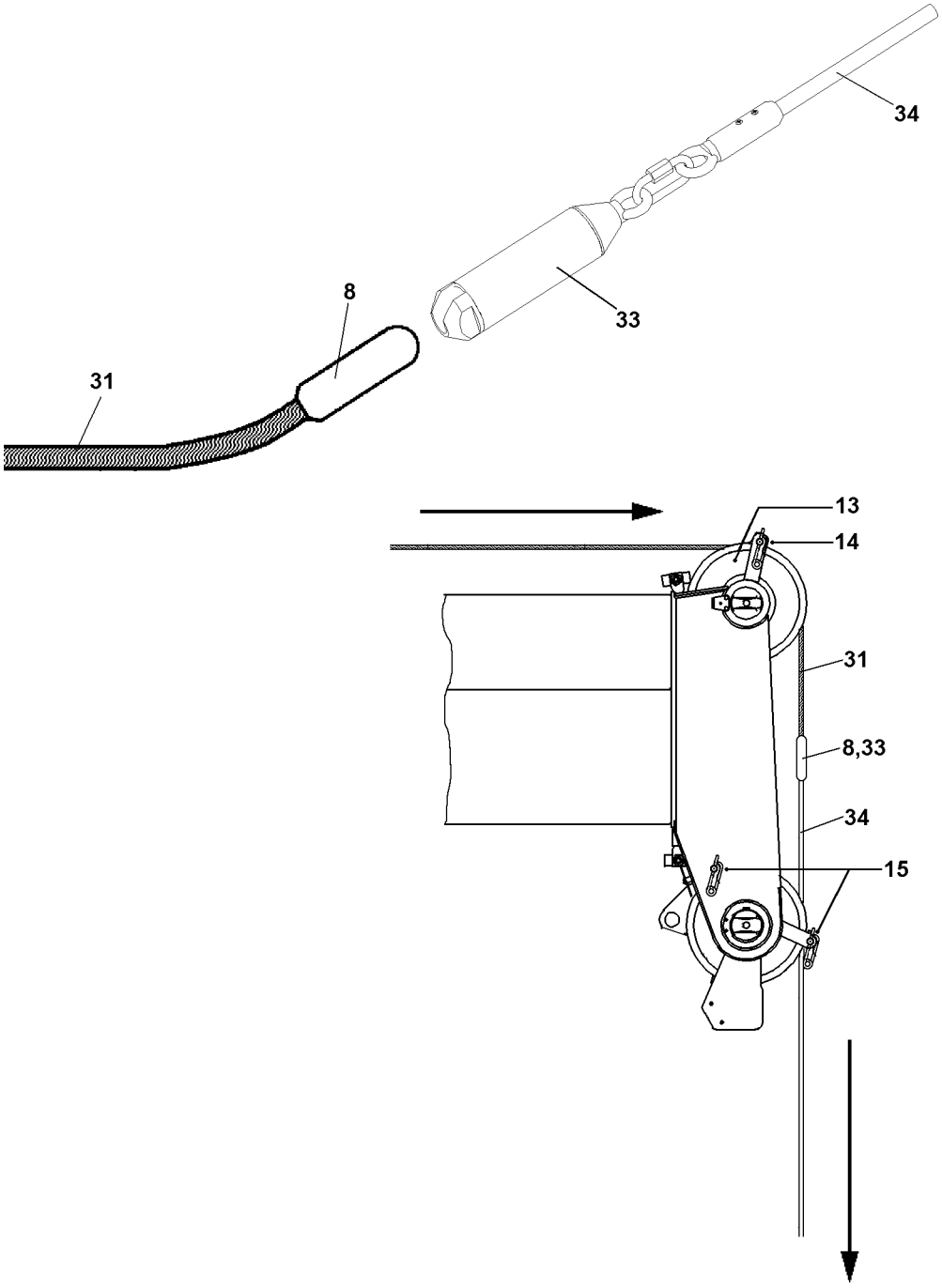
▶ Telescope the telescoping cylinder until it reaches the pinning position.

CAUTION
Risk of damage to the telelocking!
▶ Only pin the telescoping cylinder when it is in the pinning position!
▶ Only pin the telescoping cylinder when the control light **343** is lit!
▶ The locking pins must latch in audibly!

▶ Change over switch **360** from position **1** to position **0**.

Result:
– Pin the telescoping cylinder will be preselected.

▶ Continue telescoping the telescoping cylinder in the same direction and pin the telescoping cylinder.



B199147

1 General

1.1 Wire ropes and rope end connections

Please check whether a **twisting** or a **non-twisting** rope is required for the application. The type of rope that is selected then determines the required type of rope end connections, see chapter 8.04.

Note

- The correct choice and use of rope and rope end connections are decisive preconditions for proper and accident-free crane operation.

DANGER

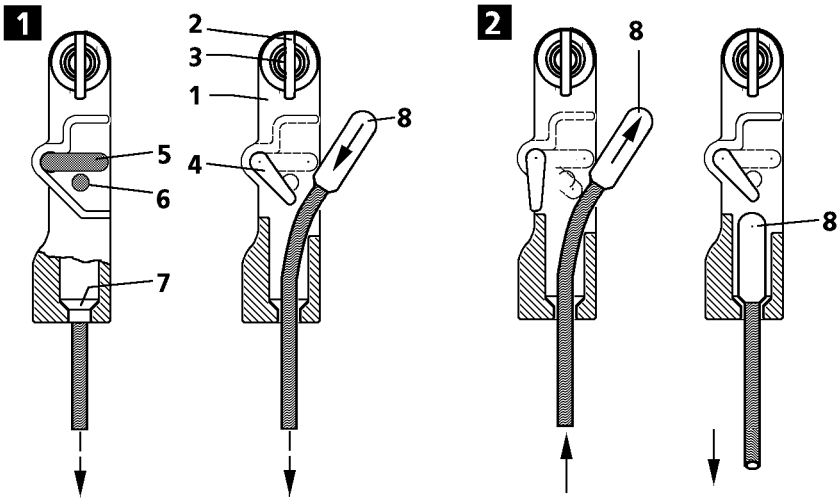
Danger of serious personnel injury and equipment damage!

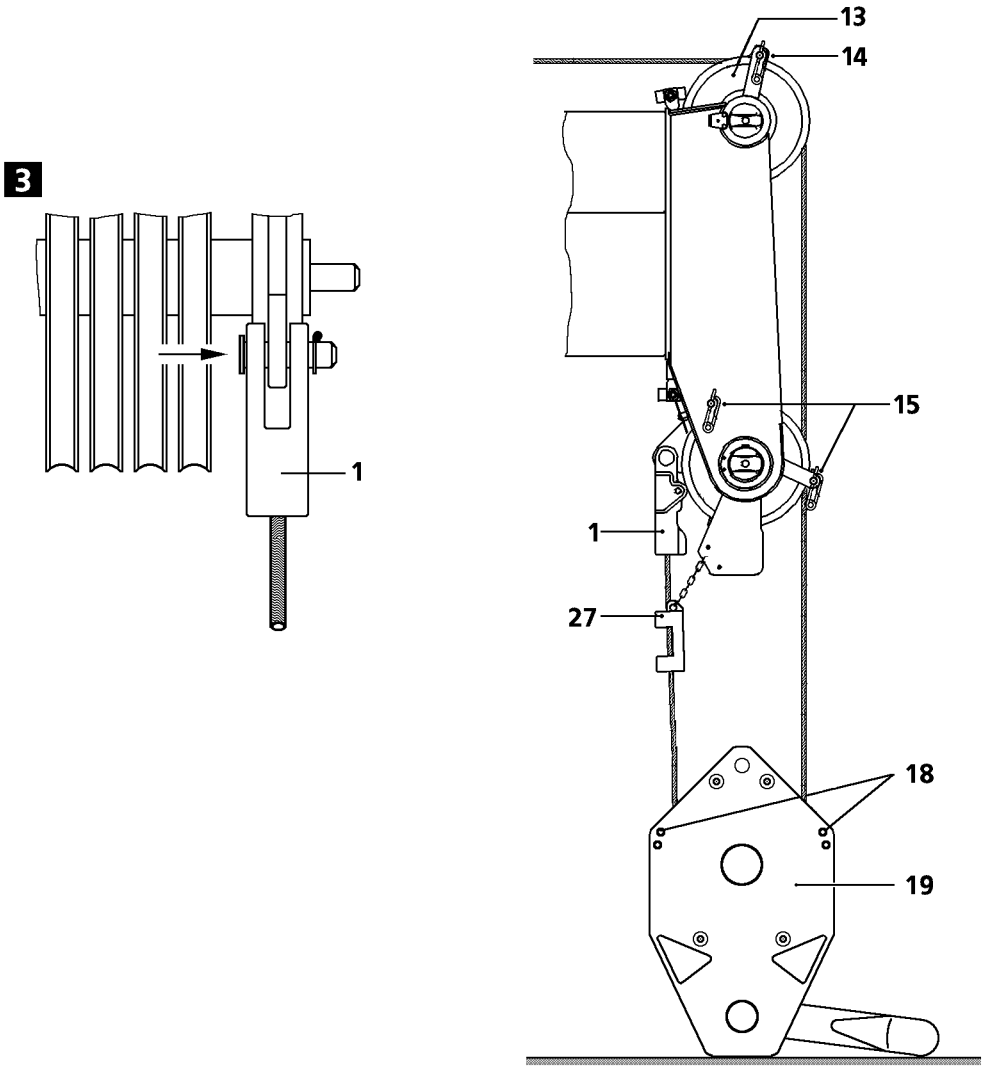
- **Never** use twisting ropes with a rotating rope end connection!
- **Never** install a twist compensator / swivel!

1.2 Reeving the hoist rope with the auxiliary rope*

If winch 2 is attached on the crane, an auxiliary rope **34** is supplied to reeve the hoist rope **31**.

- Remove rope retaining tubes **14** and **15** on the pulley head.
- Take the auxiliary rope **34** out of the toolbox.
- Connect the auxiliary rope **34** with the hoist rope **31**: Slide the press fitting **8** onto the retraction sleeve **33**.
- Throw the auxiliary rope **34** forward over the pulley head, if possible.
- Use the assembly rod to place the auxiliary rope **34** over the upper rope pulley **13**.
- Spool winch 2 out and pull the auxiliary rope **34** with the hoist rope **31** over the upper rope pulley **13**.
- Detach the auxiliary rope **34** from the hoist rope **31** and reeve the hoist rope **31** into the hook block.





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2 Reeving the hook block in and out

2.1 Reeving in

Ensure that the following prerequisites are met:
– the crane is properly supported and horizontally aligned,
– an assistant is present to guide the hoist rope.

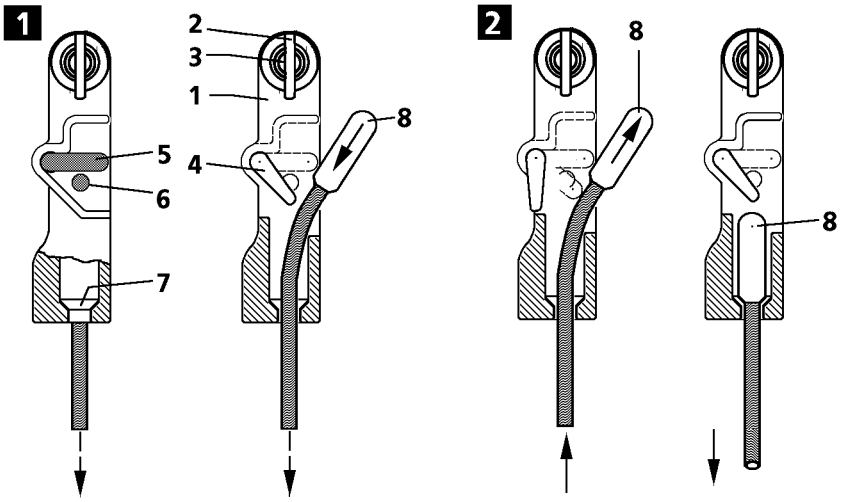
2.1.1 Assembling

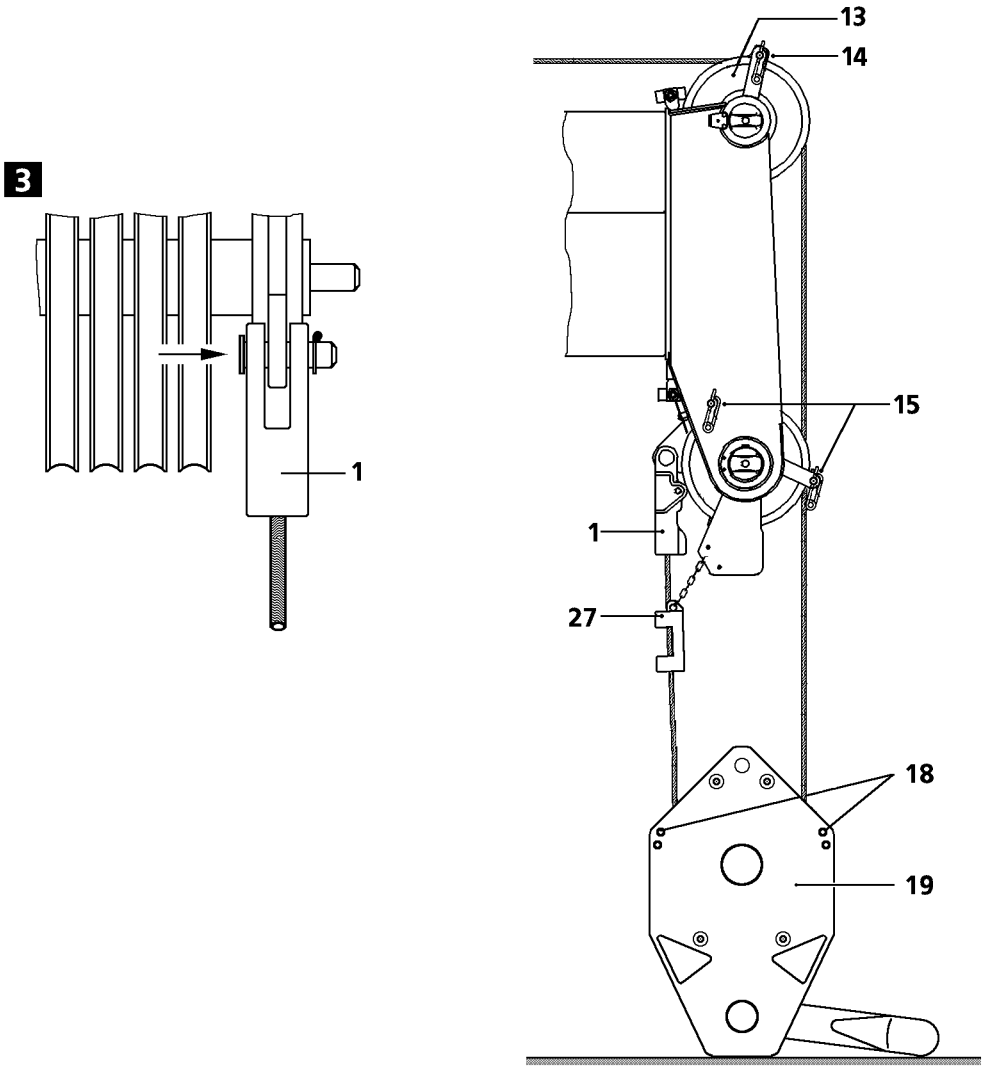
NOTICE
Damage to hoist rope!
An incorrectly reeved hoist rope or the incorrect selection of the rope fixed point can cause the hook block not to hang vertically and thus cause damage to the hoist rope!
- ▶ Always carry out the reeving of the hoist rope according to the reeving plan!
- ▶ The rope fixed point on the hook block is to be selected in such a way that the last strand runs parallel to the remaining rope strands, as much as possible!

- ▶ Place the required hook block under the pulley head of the telescopic boom.
- ▶ On the hook block **19**, remove the spring retainers **18** on both rope retaining pins and pull out both rope retaining pins.
- ▶ On the pulley head, remove the spring retainers on the rope retaining tube **14** and on the rope retaining tube **15** and pull out both rope retaining tubes.

WARNING
Risk of accidents due to improper operation of the crane function and danger of slipping on the telescopic boom!
- ▶ Do not step on the telescopic boom!
- ▶ Complete the assembly work from a stable location!
- ▶ Use the auxiliary rope to reeve the hoist rope!

- ▶ The assistant guides the hoist rope over the telescopic boom to the pulley head and at the same time the crane operator uses the winch.
- ▶ Lay the hoist rope over the upper rope pulley **13** and as specified in the reeving plan for the corresponding load chart, reeve between the pulley head and the hook block.
- ▶ Insert the rope retaining pipe again and secure with spring retainers.





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2.1.2 Attaching the hoist rope, fig. 1, 2, 3

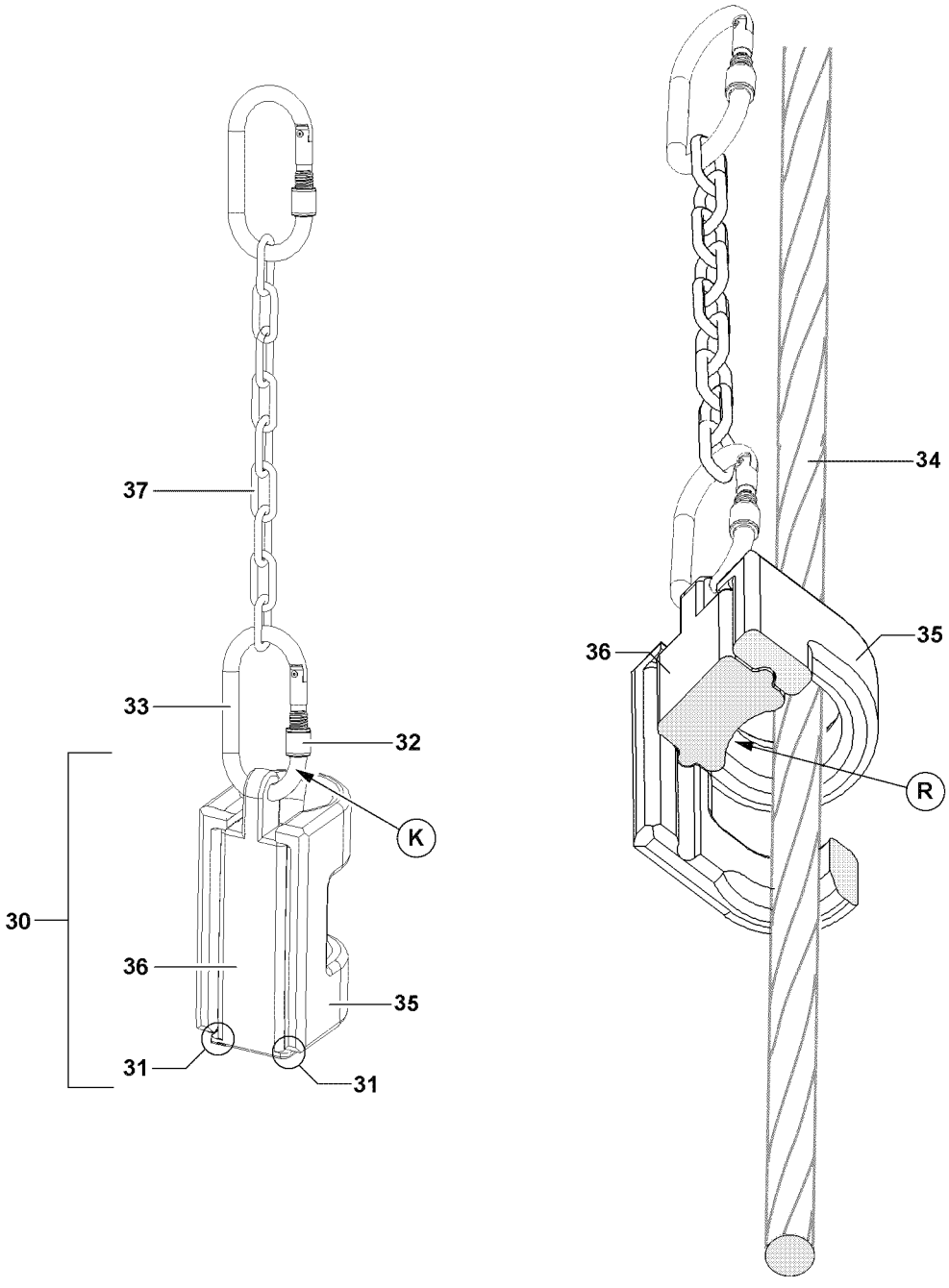
NOTICE
Damage to hoist rope!
If the pin **3** has been assembled incorrectly, the hoist rope may rub against the pin **3** or on the linch pin **2**, refer to fig. **3**.
▶ Always insert pins **3** from “inside to outside” and secure on the outside.

▶ Pin the rope lock **1** depending on the reeving either on the pulley head or on the hook block and secure with spring retainer.
▶ Push the retaining pin **6** into the rope lock **1**, move the lever **5** “downward” and hold it in this position.

Result:
– The catch lever **4** will be swivelled downward.

▶ Attach the rope end with press fitting **8** in the rope lock and pull the rope firmly “downward” (in direction of arrow), until the press fitting **8** touches on the cone **7**.
▶ Release the lever **5**.

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



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2.1.3 Attaching the hoist limit switch weight

The hoist limit switch weight **30** consists of 2 parts, which are pushed into each other:
– The weight **35**
– The carrier section **36**

▶ Loosen and open the screw retainer **32**.

WARNING
The hoist limit switch weight can fall down!
If the hoist limit switch weight is incorrectly assembled, components can fall down!
Personnel can be severely injured or killed!
▶ Do not replace the snap hook **33** with other parts, such as a shackle or similar!
▶ When attaching or detaching the hoist limit switch weight **30** make sure that the weight **35** and the carrier section **36** do not fall down!
▶ Make sure that the curvature **R** of the carrier section **36** points to the hoist rope **34**!
▶ Make sure that the stubs **31** of the carrier section **36** touch on the weight **35**!
▶ Make sure that the screw retainer **32** may be turned downward, point **K**!

The attachment of the hoist limit switch weight **30** depends on the position of the rope fixed point.

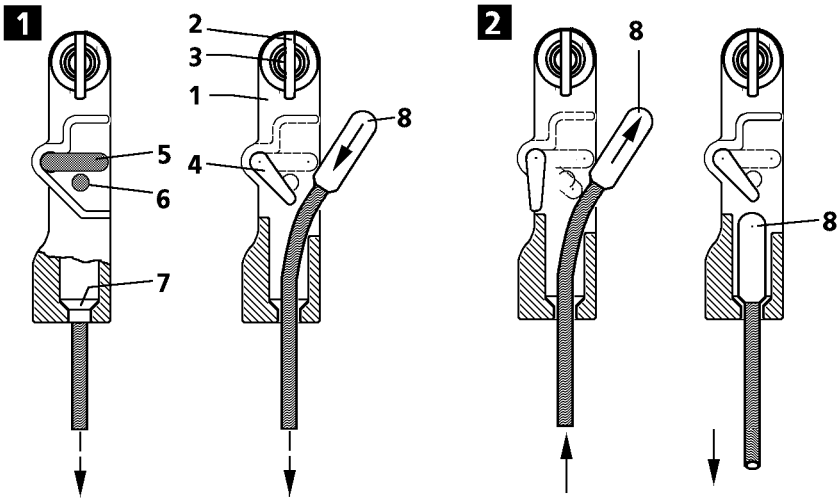
Rope fixed point on the pulley head:
– In the event of multiple hoist rope reeving, the hoist limit switch weight **30** must always be laid around the “stationary rope strand”, in other words around the rope strand that leads directly to the rope lock.

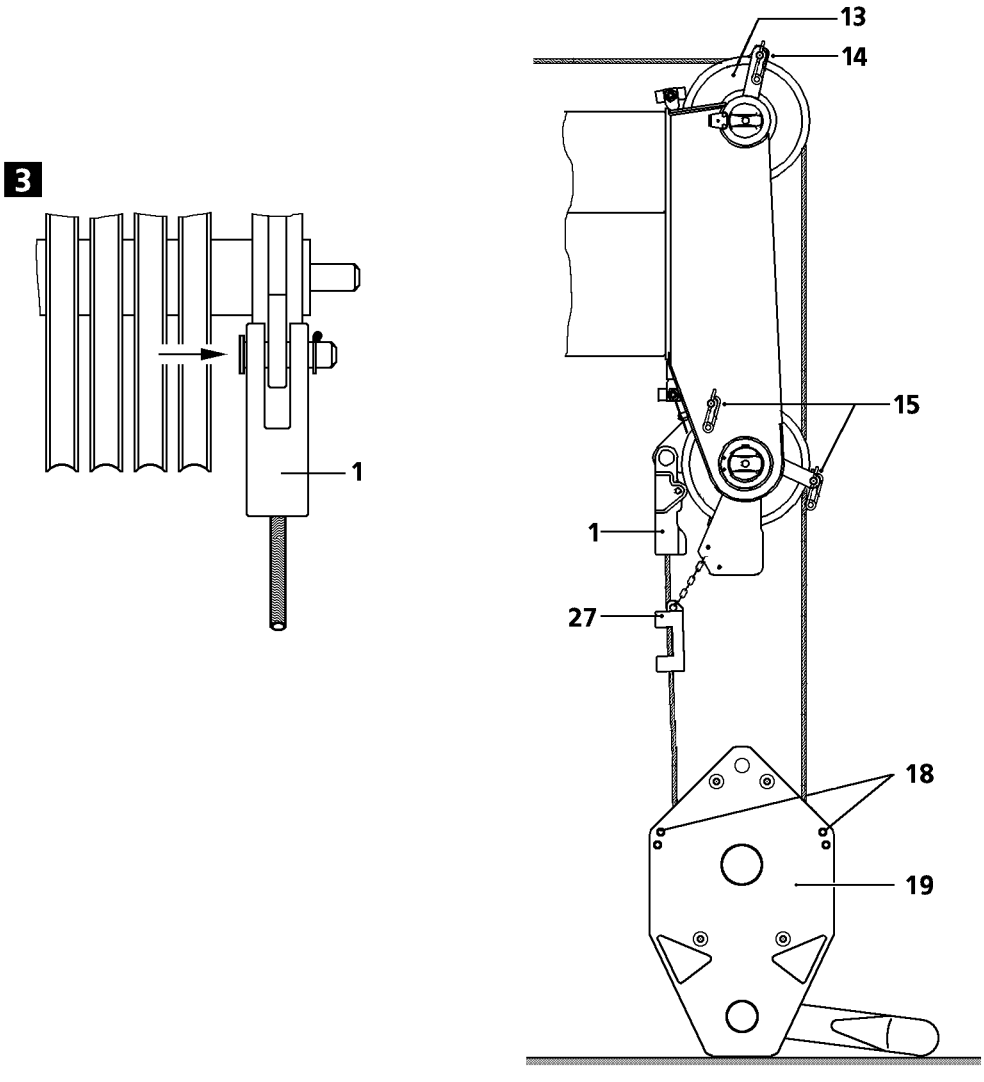
Rope fixed point on hook block:
– The hoist limit switch weight **30** is laid around the outer strand which shows the least diagonal pull, i.e. the one with the smallest angle between the hanging hoist limit switch weight and the hoist rope.

Note
▶ The chain **37** must be attached in full length during crane operation and may not be shortened.

▶ Push the weight **35** with one hand on the hoist rope **34** and hold it.
▶ With the other hand, guide the carrier section **36** behind the hoist rope **34** and under the weight **35**. The curvature **R** of the carrier section **36** must point to the hoist rope **34**.
▶ Push the weight **35** on the carrier section **36**.
▶ Hang the hoist limit switch weight **30** with the carrier section **36** in the snap hook **33**.

The snap hook **33** must be secured with the screw retainer **32**.
▶ Close the screw retainer **32** on the snap hook **33**.





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2.1.4 Visual checks to be performed

Ensure that the following prerequisite is met:

– the screw retainer on the snap hook **33** is completely closed,
– the hoist limit switch weight has been installed.

WARNING
Crane can topple over!
If reeving is incorrect or the reeving number is incorrectly entered into the LICCON computer system, the crane can topple over!
Personnel can be severely injured or killed!

▶ Make sure once more that the reeving has been done properly and that the overload protection has been correctly set.

▶ Check and / or enter the reeving into the configuration program of the LICCON computer system.

2.2 Reeving out

2.2.1 Lowering the hook block

WARNING
Danger of injury from hook block tipping over when reeving out!

▶ Make sure the hook block is safely positioned.

▶ Lower the hook block and set it on the ground.

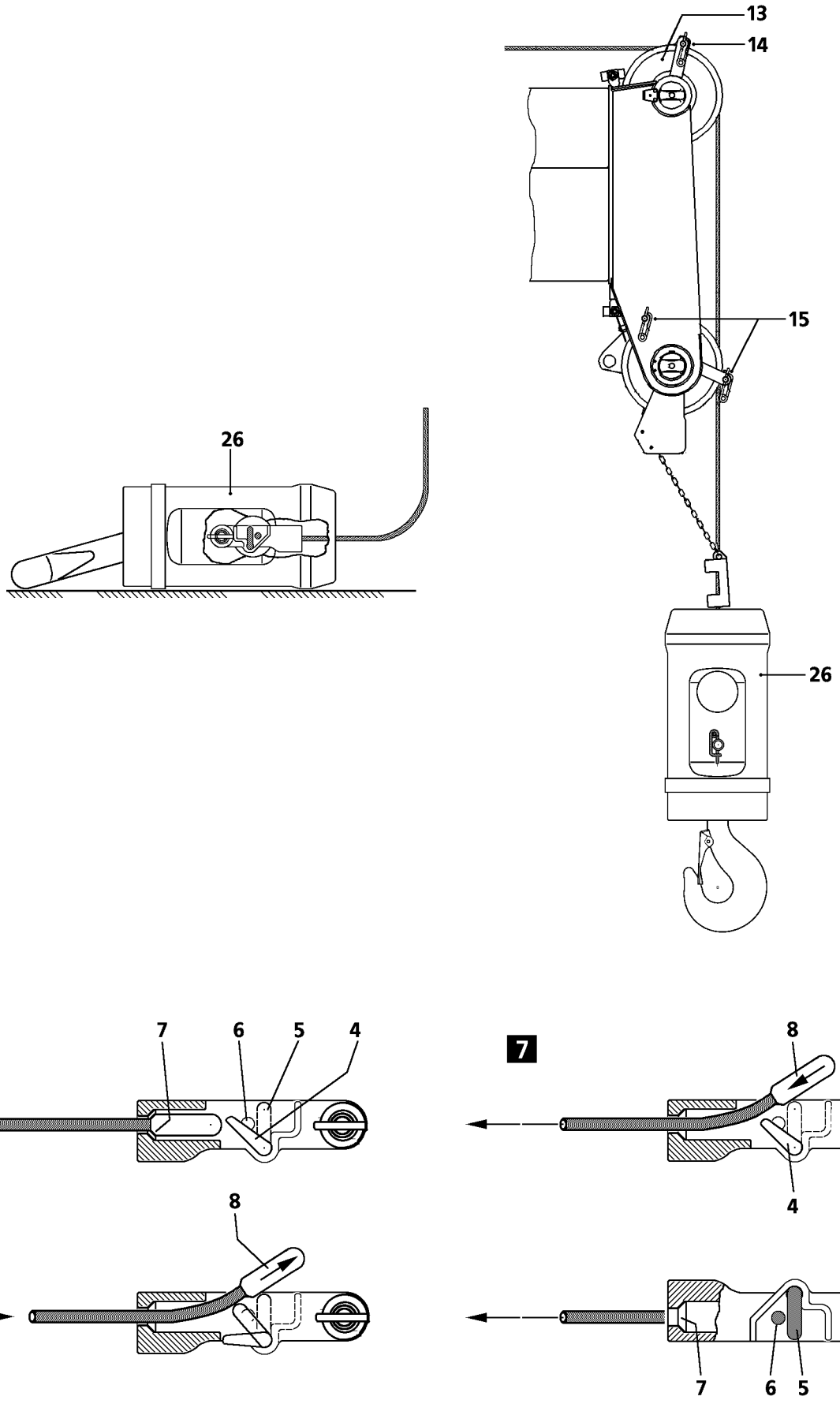
2.2.2 Detaching the hoist rope

▶ Push the retaining pin **6** into the rope lock **1**, move the lever **5** downward and hold it in this position.

Result:

– The catch lever **4** is moved to the side and the rope fitting **8** is released.

▶ Push the hoist rope upwards and detach the rope fitting **8**.



B105780

3 Attaching and removing the load hook*

3.1 Attaching

Ensure that the following tools are available:

– An open-end wrench (size 13 mm)

3.1.1 Assembling

▶ Place the load hook under the pulley head of the telescopic boom.

▶ On the pulley head, remove the spring retainers on the rope retaining tube **14** and on the rope retaining tube **15** and pull out both rope retaining tubes.

WARNING

Risk of accidents due to improper operation of the crane function and danger of slipping on the telescopic boom!

▶ Do not step on the telescopic boom!

▶ Complete the assembly work from a stable location!

▶ Use the auxiliary rope to reeve the hoist rope!

▶ The assistant guides the hoist rope over the telescopic boom to the pulley head and at the same time the crane operator operates the winch.

▶ Place hoist rope over the upper rope pulley **13**.

▶ Plug in the rope securing pipe **14** and the rope securing pipe **15** and secure with spring retainers.

▶ Pin rope rope lock **1** into load hook **26** and secure with spring retainers.

3.1.2 Attaching the hoist rope, fig. 7

▶ Push the retaining pin **6** into the rope lock **1**, move the lever **5** sideways and hold it in this position.

Result:

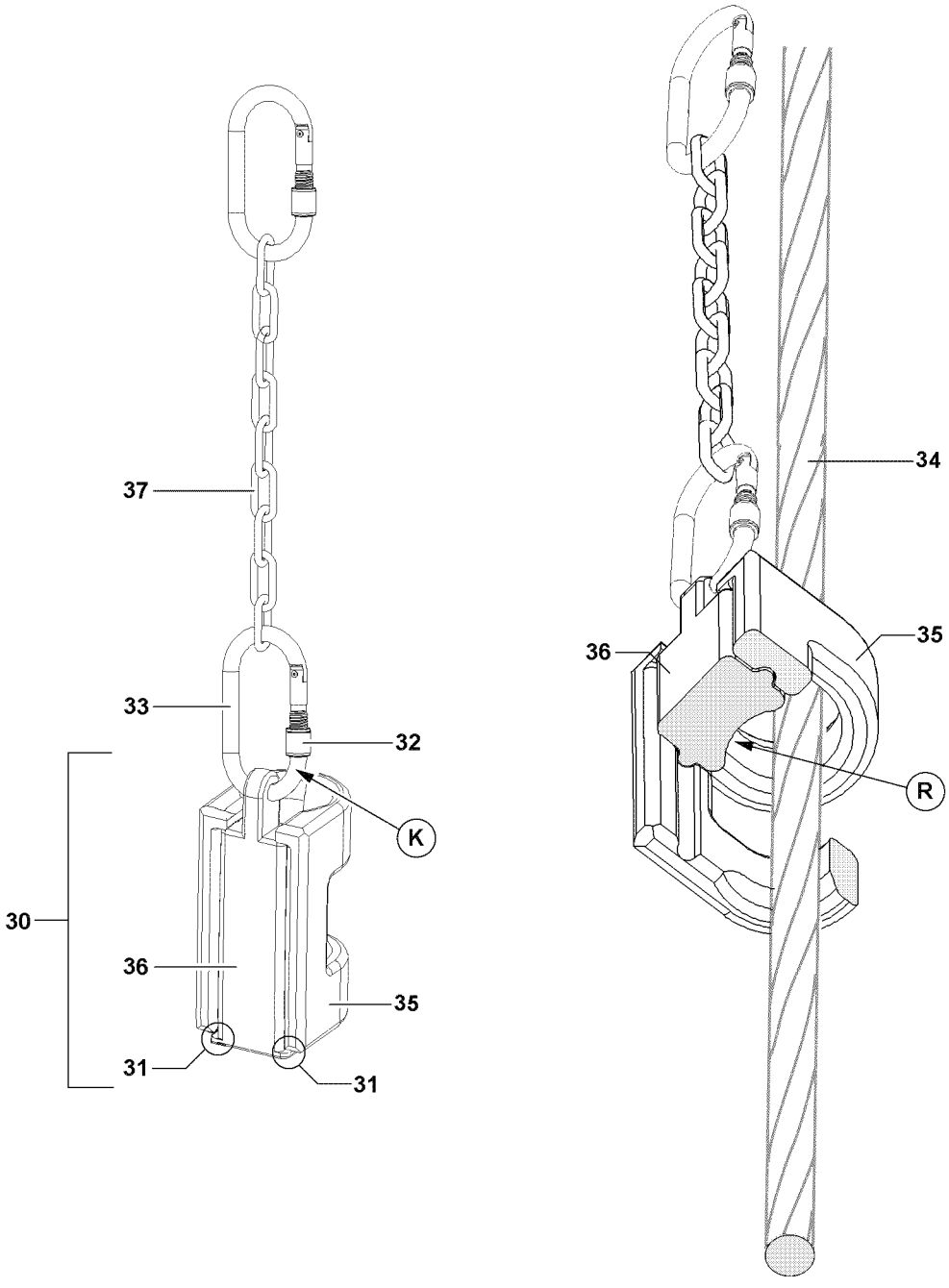
– The catch lever **4** is moved to the side.

▶ Attach the rope end with press fitting **8** in the rope lock and pull the rope firmly in the direction of the arrow, until the press fitting **8** contacts the cone **7**.

▶ Release the lever **5**.

Result:

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



B106127

3.1.3 Attaching the hoist limit switch weight

The hoist limit switch weight **30** consists of 2 parts, which are pushed into each other:
– The weight **35**
– The carrier section **36**

▶ Loosen and open the screw retainer **32**.

WARNING
The hoist limit switch weight can fall down!
If the hoist limit switch weight is incorrectly assembled, components can fall down!
Personnel can be severely injured or killed!
▶ Do not replace the snap hook **33** with other parts, such as a shackle or similar!
▶ When attaching or detaching the hoist limit switch weight **30** make sure that the weight **35** and the carrier section **36** do not fall down!
▶ Make sure that the curvature **R** of the carrier section **36** points to the hoist rope **34**!
▶ Make sure that the stubs **31** of the carrier section **36** touch on the weight **35**!
▶ Make sure that the screw retainer **32** may be turned downward, point **K**!

The attachment of the hoist limit switch weight **30** depends on the position of the rope fixed point.

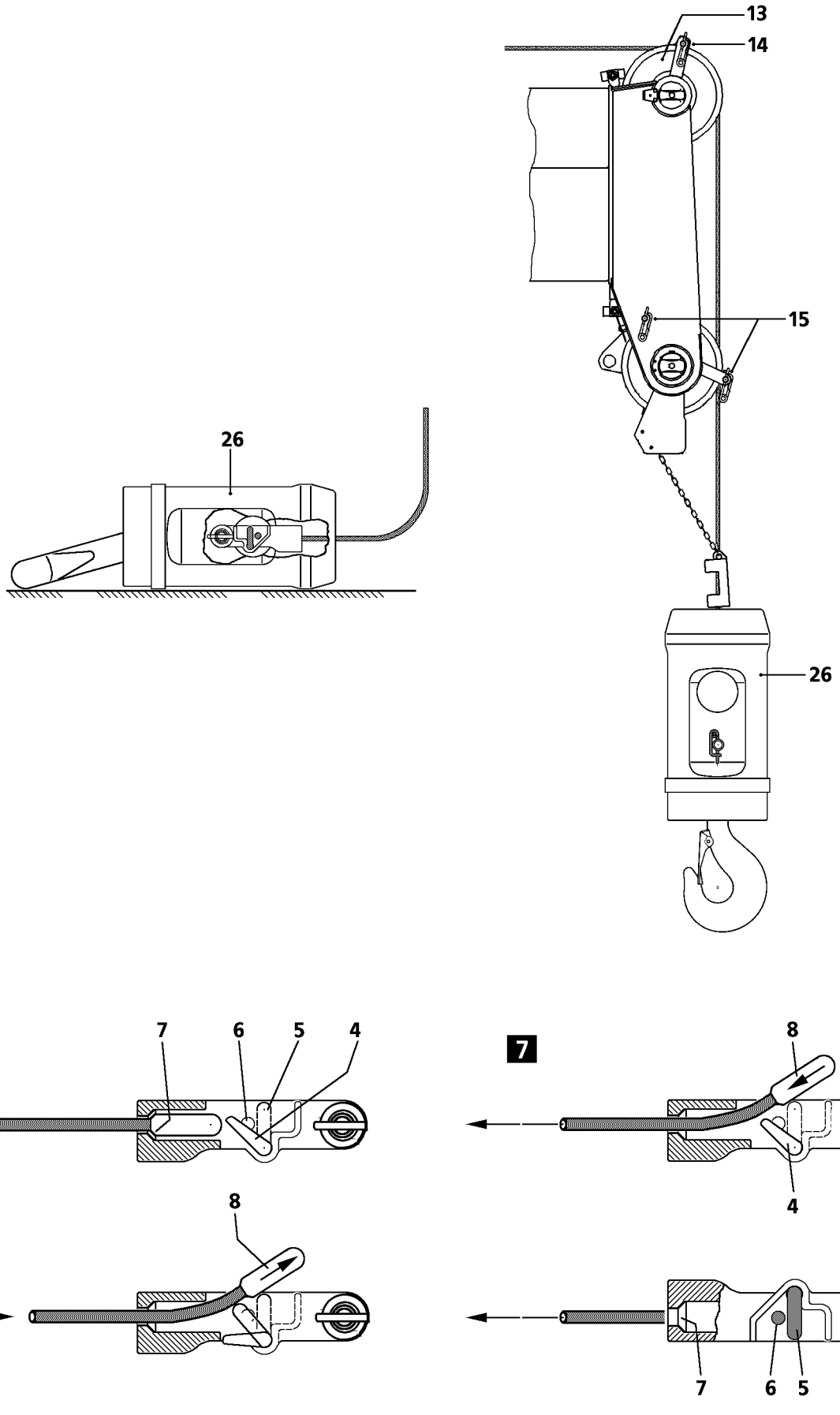
Rope fixed point on the pulley head:
– In the event of multiple hoist rope reeving, the hoist limit switch weight **30** must always be laid around the “stationary rope strand”, in other words around the rope strand that leads directly to the rope lock.

Rope fixed point on hook block:
– The hoist limit switch weight **30** is laid around the outer strand which shows the least diagonal pull, i.e. the one with the smallest angle between the hanging hoist limit switch weight and the hoist rope.

Note
▶ The chain **37** must be attached in full length during crane operation and may not be shortened.

▶ Push the weight **35** with one hand on the hoist rope **34** and hold it.
▶ With the other hand, guide the carrier section **36** behind the hoist rope **34** and under the weight **35**. The curvature **R** of the carrier section **36** must point to the hoist rope **34**.
▶ Push the weight **35** on the carrier section **36**.
▶ Hang the hoist limit switch weight **30** with the carrier section **36** in the snap hook **33**.

The snap hook **33** must be secured with the screw retainer **32**.
▶ Close the screw retainer **32** on the snap hook **33**.



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3.1.4 Visual checks to be performed

Ensure that the following prerequisite is met:

– the screw retainer on the snap hook **33** is completely closed,
– the hoist limit switch weight has been installed.

WARNING
Crane can topple over!
If reeving is incorrect or the reeving number is incorrectly entered into the LICCON computer system, the crane can topple over!
Personnel can be severely injured or killed!

▶ Make sure once more that the reeving has been done properly and that the overload protection has been correctly set.

▶ Check and / or enter the reeving into the configuration program of the LICCON computer system.

3.2 Removing

3.2.1 Lowering the load hook

▶ Place the load hook **26** on the ground.
▶ Remove the hoist limit switch weight **27**, as described at the beginning of this chapter.

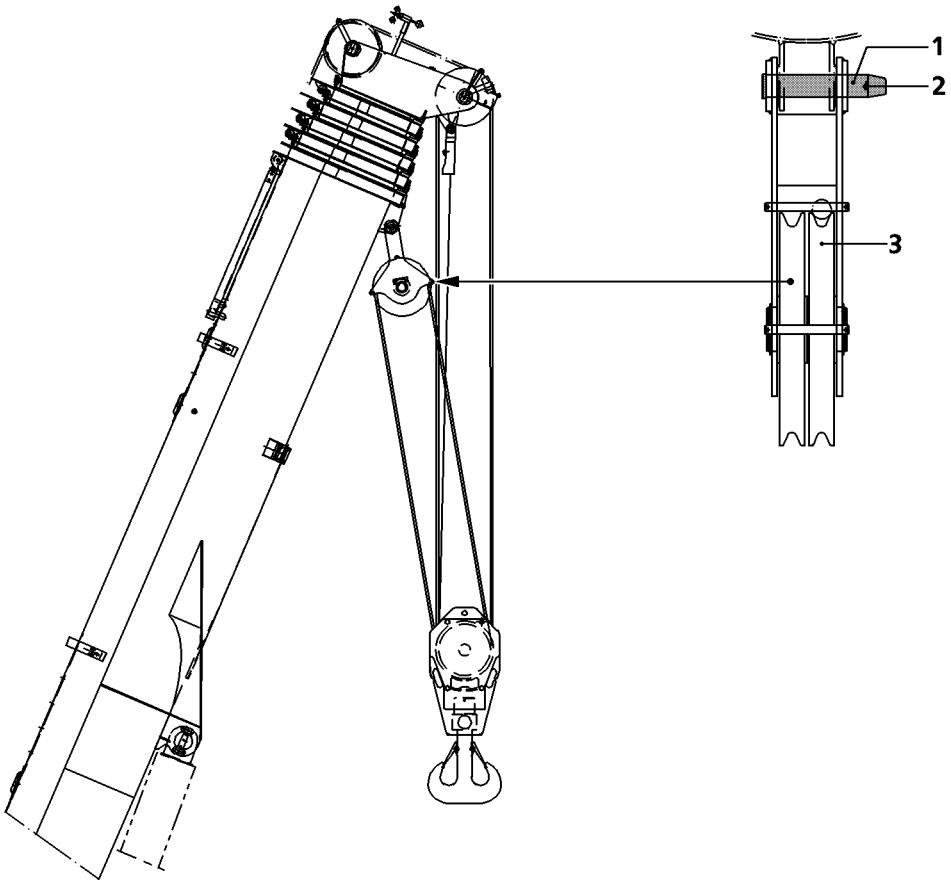
3.2.2 Detaching the hoist rope, fig. 6

▶ Push the retaining pin **6** into the rope lock **1**, move the lever **5** sideways and hold it in this position.

Result:

– The catch lever **4** is moved to the side and the rope fitting **8** is released.

▶ Slide hoist rope in direction of load hook and unhook the rope fitting **8**.

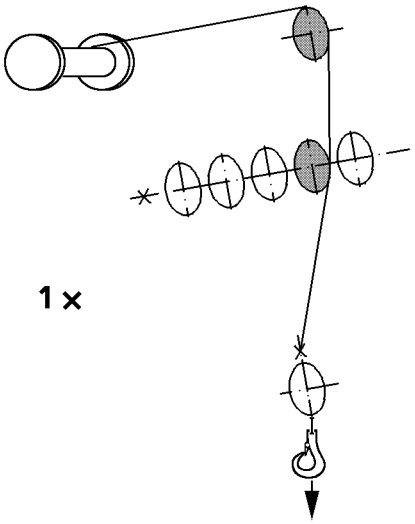


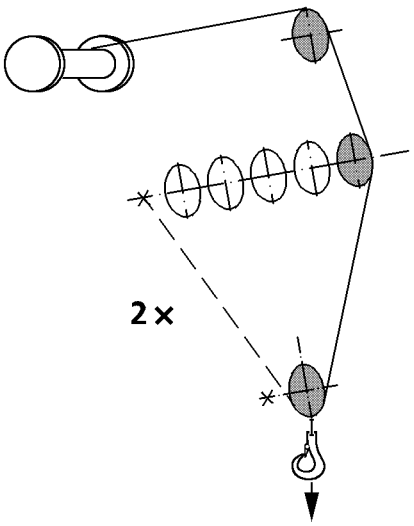
B193996

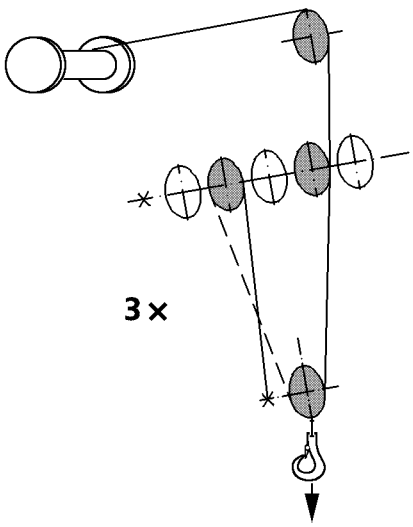
4 Reeving plans

4.1 Assembling the auxiliary equipment*

- ▶ Affix the auxiliary pulleys **3** on the intended bores.
- ▶ Insert the pins **1**.
- ▶ Secure pins **1** with spring retainers **2**.







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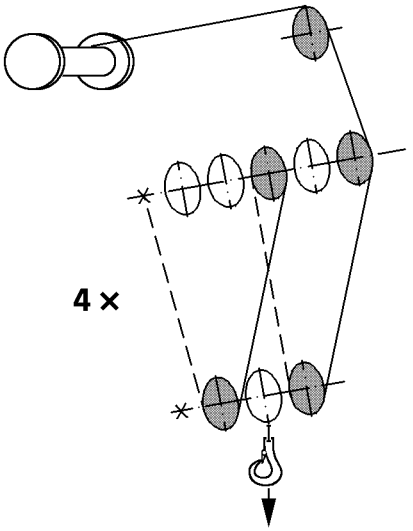
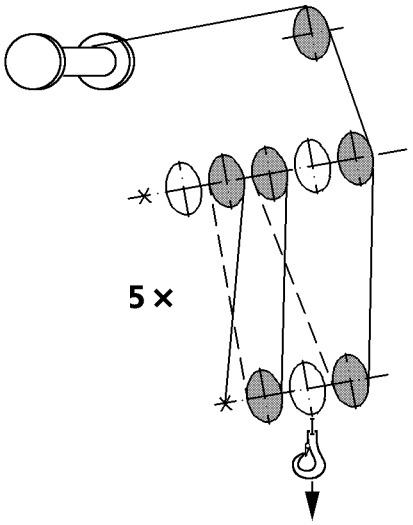
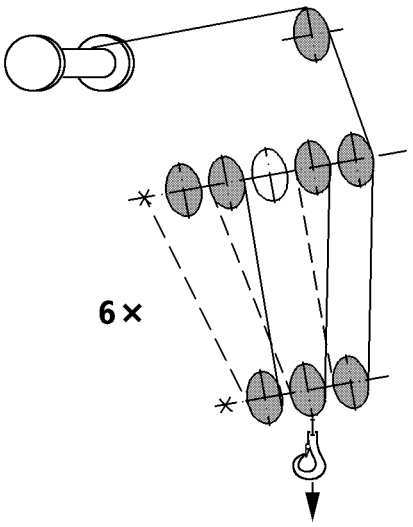
4.2 Reeving in, T operation

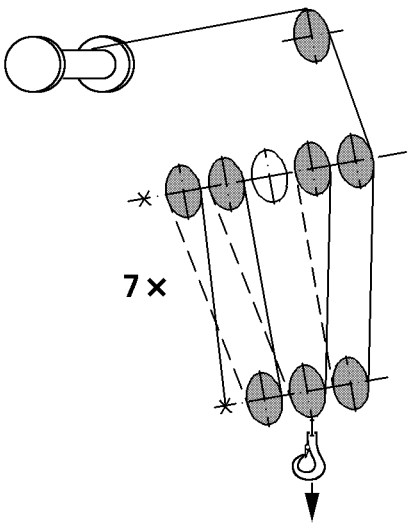
4.2.1 1-pulley hook block / load hook

Reeving	Rope fixed point
1-way	On the hook block or on the load hook fixed point
2-way	On pulley head
3-way	On hook block









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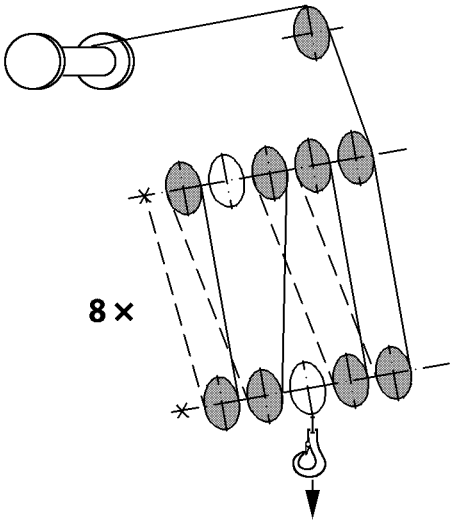
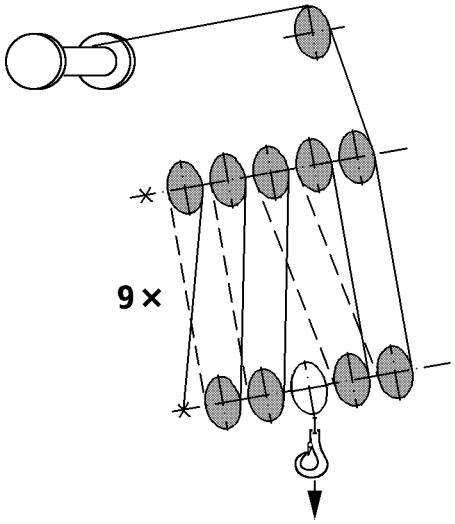
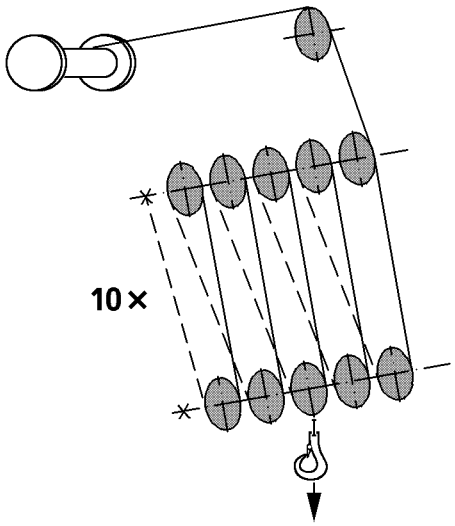
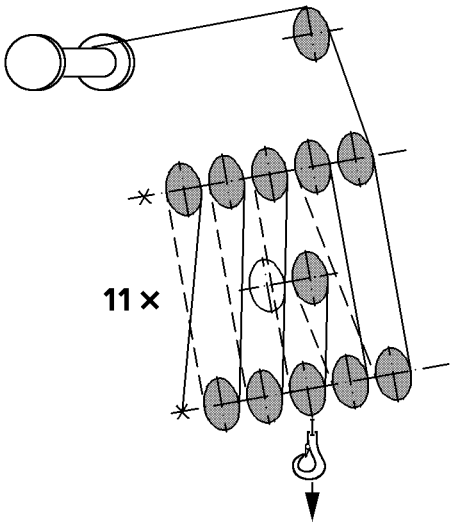
4.2.2 3-pulley hook block

Reeving	Rope fixed point
4-way	On pulley head
5-way	On hook block
6-way	On pulley head
7-way	On hook block









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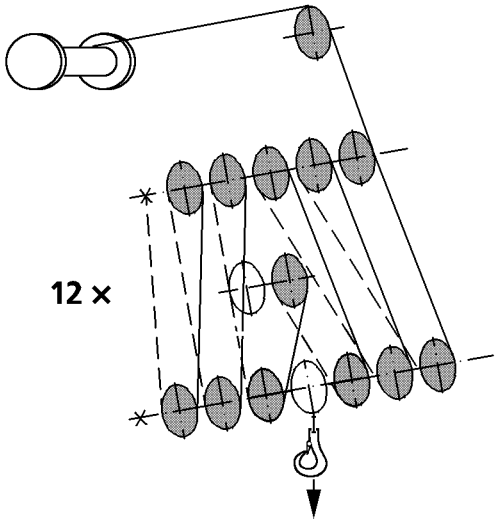
4.2.3 5-pulley hook block

Reeving	Rope fixed point
8-way	On pulley head
9-way	On hook block
10-way	On side of pulley head
11-way	On hook block



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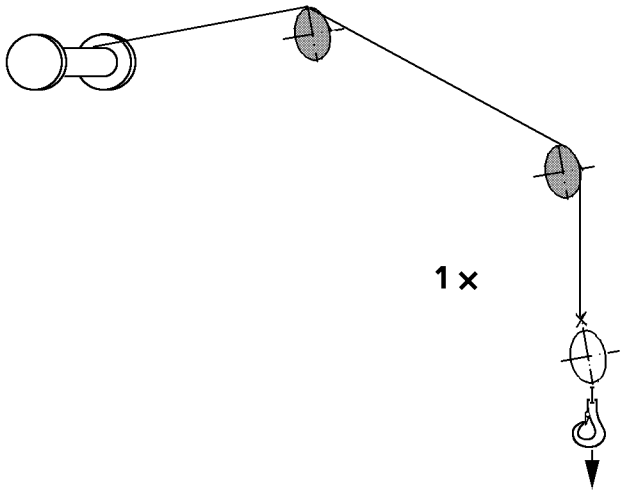
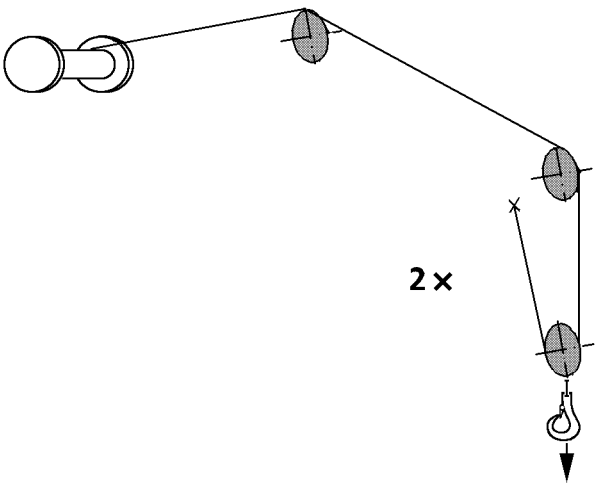
4.2.4 7-pulley hook block

Reeving	Rope fixed point
12-way	On pulley head





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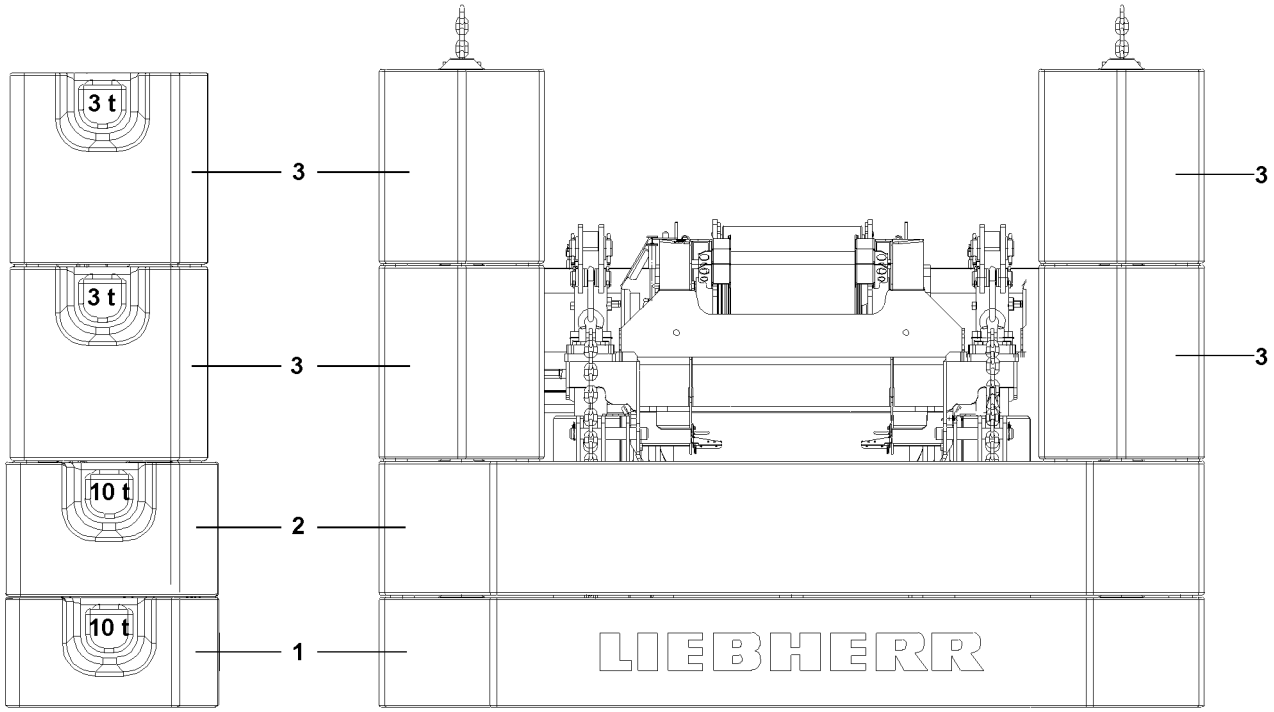
4.3 Reeving in, TK/TNZK operation

Reeving	Rope fixed point
1-way	On the hook block or on the load hook fixed point
2-way	On pulley head



B102814

1 General

1.1 Counterweight combinations

The counterweight plates are marked with their own weights.

DANGER
Crane can topple over!
If a different counterweight than the one listed in the load chart is used, the crane may be damaged or topple over.
▶ Counterweight must be attached according to the data in the load chart!

The following counterweight combinations are possible:

Counterweight	Combination	Individual weight
0	no counterweight	0

Counterweight	Combination	Individual weight
10	Base plate **1**	10

Counterweight	Combination	Individual weight
16 t	Base plate **1**	10 t
	2x counterweight plate **3**	3 t

Counterweight	Combination	Individual weight
20 t	Base plate **1**	10 t
	Counterweight plate **2**	10 t

Counterweight	Combination	Individual weight
22 t	Base plate **1**	10 t
	4x counterweight plate **3**	3 t

Counterweight	Combination	Individual weight
26 t	Base plate **1**	10 t
	Counterweight plate **2**	10 t
	2x counterweight plate **3**	3 t

Counterweight	Combination	Individual weight
32 t	Base plate **1**	10 t
	Counterweight plate **2**	10 t
	4x counterweight plate **3**	3 t

1.2 Checking the counterweight plates

DANGER
Risk of accident from damaged counterweights!
If damaged counterweights are ballasted, the stable seating of the counterweights can no longer be ensured.
▶ Replace damaged counterweights immediately!

Before assembly or disassembly of the counterweight plates, perform a visual check for damage and foreign matter.

1.3 Taking on permissible telescopic boom angle at counterweight

Make sure that the following prerequisites for the stability to the ballast side on the crawlers are met:
– the telescopic boom is fully telescoped in, T-11.5
– there is no load on the hook

DANGER
Crane can topple over!
If the permissible telescopic boom angles are not abided by, the crane can tip to the rear and cause fatal injury to personnel!
▶ Observe the permissible telescopic boom angle when taking on counterweight!

1.3.1 Permissible telescopic boom angle at wide track 4.15 m

At 0°, 90°, 180° and 270°.

Counterweight on super-structure	Central ballast	Permissible telescopic boom angles
32 t	15 t	-2° to 70.4°
26 t	15 t	-2° to 81°
22 t	15 t	-2° to 82°
20 t	15 t	-2° to 82°
16 t	15 t	-2° to 82°
10 t	15 t	-2° to 82°
0 t	15 t	-2° to 82°
0 t	0 t	-2° to 82°

1.3.2 Permissible telescopic boom angle at reduced track 3.40 m

At 90° and 270°.

Counterweight on super-structure	Central ballast	Permissible telescopic boom angles
32 t	15 t	-2° to 45.2°
26 t	15 t	-2° to 61.9°
22 t	15 t	-2° to 70.4°
20 t	15 t	-2° to 73.1°
16 t	15 t	-2° to 81°
10 t	15 t	-2° to 82°
0 t	15 t	-2° to 82°
0 t	0 t	-2° to 82°

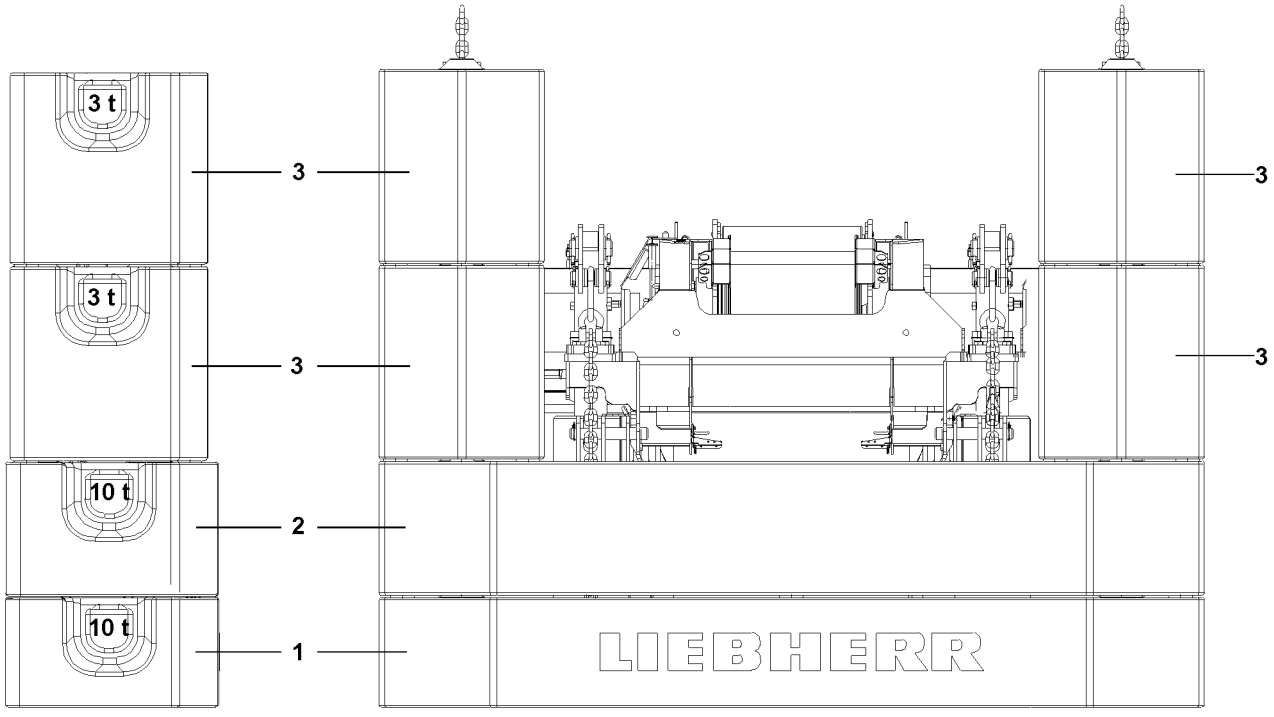
1.3.3 Permissible telescopic boom angle at retracted track 2.60 m

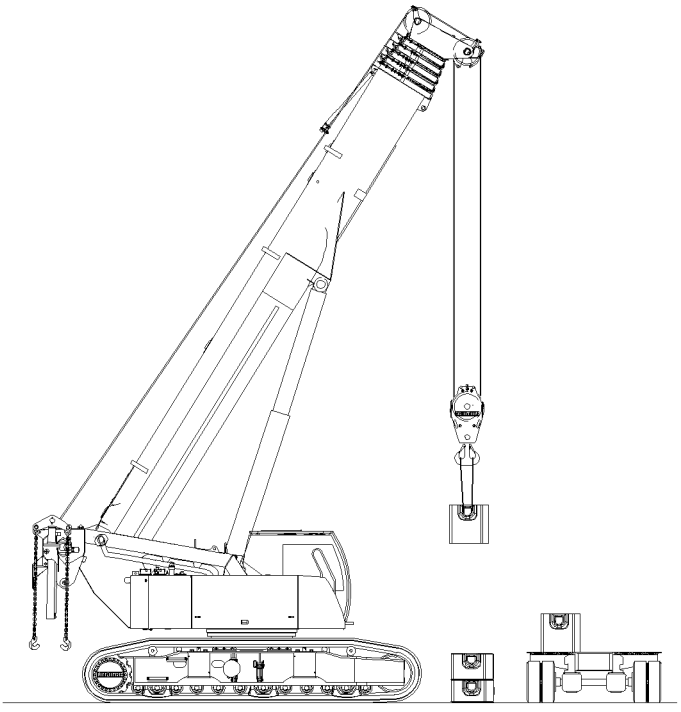
At 90° and 270°.

Counterweight on super-structure	Central ballast	Permissible telescopic boom angles
–	–	–
–	–	–
22 t	15 t	-2° to 45.2°
20 t	15 t	-2° to 52.4°
16 t	15 t	-2° to 61.9°
10 t	15 t	-2° to 75.8°
0 t	15 t	-2° to 82°
0 t	0 t	-2° to 82°

1.4 Permissible incline for ballasting

DANGER
Crane can topple over!
If the incline for ballasting is larger than +/- 1°, the crane can topple over and fatally injure personnel!
▶ Do not exceed nor fall below an incline of +/- 1° for ballasting!





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2 Assembly

2.1 General

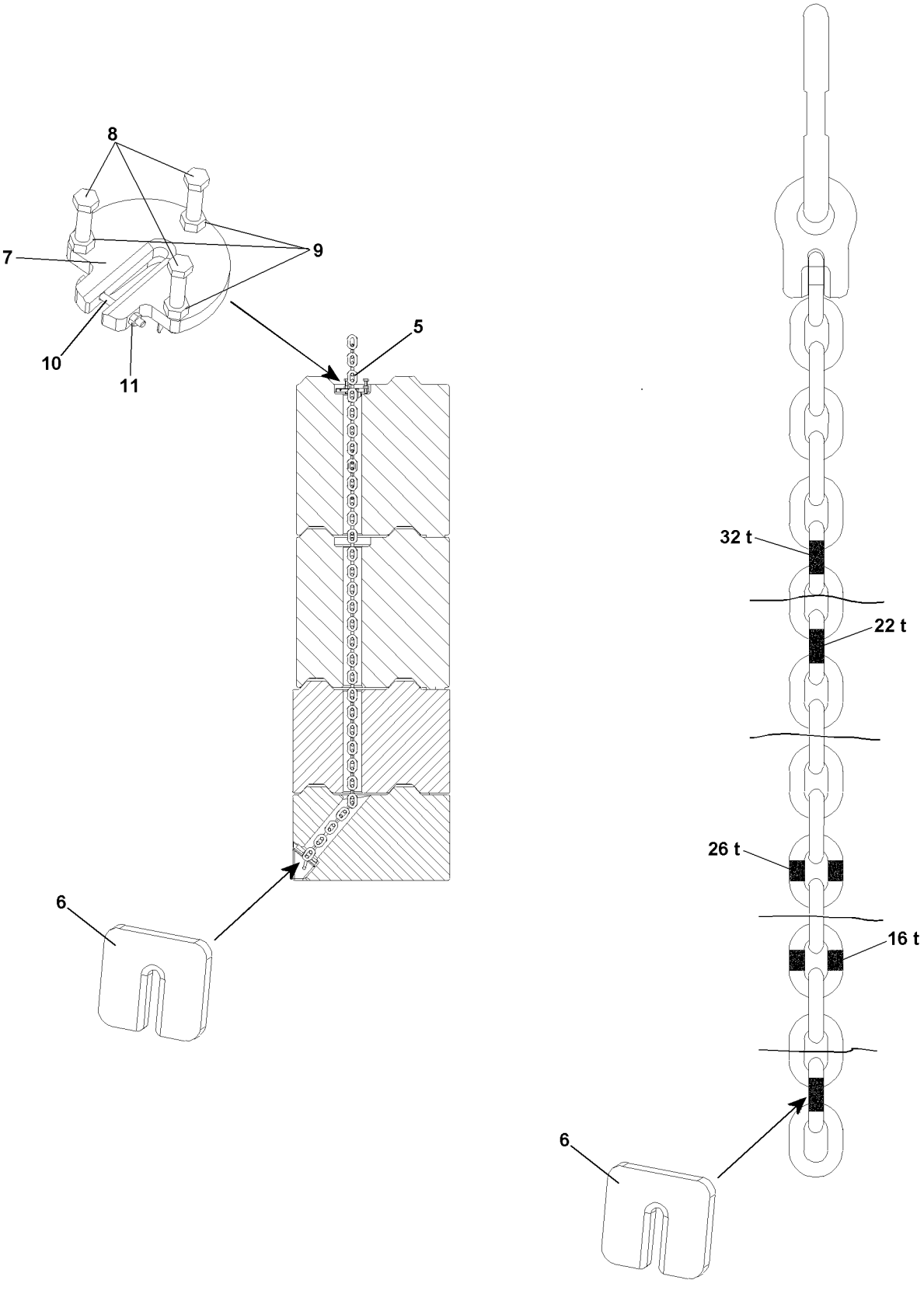
Ensure that the following preconditions are met:
- the crane is aligned in horizontal direction
- the central ballast is installed
- the crane with installed crawler carriers is operational as assembly crane
- the transport vehicle with the counterweight plates is in the immediate vicinity of the crane
- the ground is level and of sufficient load carrying capacity

DANGER
Collapsing substrate!
For assembly or disassembly of the counterweight, make sure that the ground is of sufficient load carrying capacity, otherwise the counterweight can sink in and topple over.
▶ If ground gives way, select assembly location with sufficient load bearing capacity!

2.2 Unloading the base plate and the counterweight

DANGER
Crane can topple over!
Before the boom is raised, the LICCON overload protection must be set according to the valid load chart! The boom lengths and boom radii specified in the load chart may not be exceeded during ballasting!
▶ The data in the load charts must be strictly observed!

▶ Set the LICCON overload protection according to the load chart.
▶ Hang the base plate **1** on the suspension bitts.
▶ Lift the base plate **1** with the own crane and set in down on the assembly location.
▶ Unload the remaining counterweight plates, align and stack them on top of each other.



B103203

2.3 Securing the counterweight

DANGER
Danger of accident when tensioning the counterweight plates!
An increased accident hazard exists, if the following notes are not observed!
- ▶ To pretension, use only supplies safety chains **5**, chain receptacles **6** and retaining plates **7**!
- ▶ For larger ballasting, use a non-skid ladder to thread the safety chains **5**!
- ▶ Secure the counterweights before starting to use the crane!

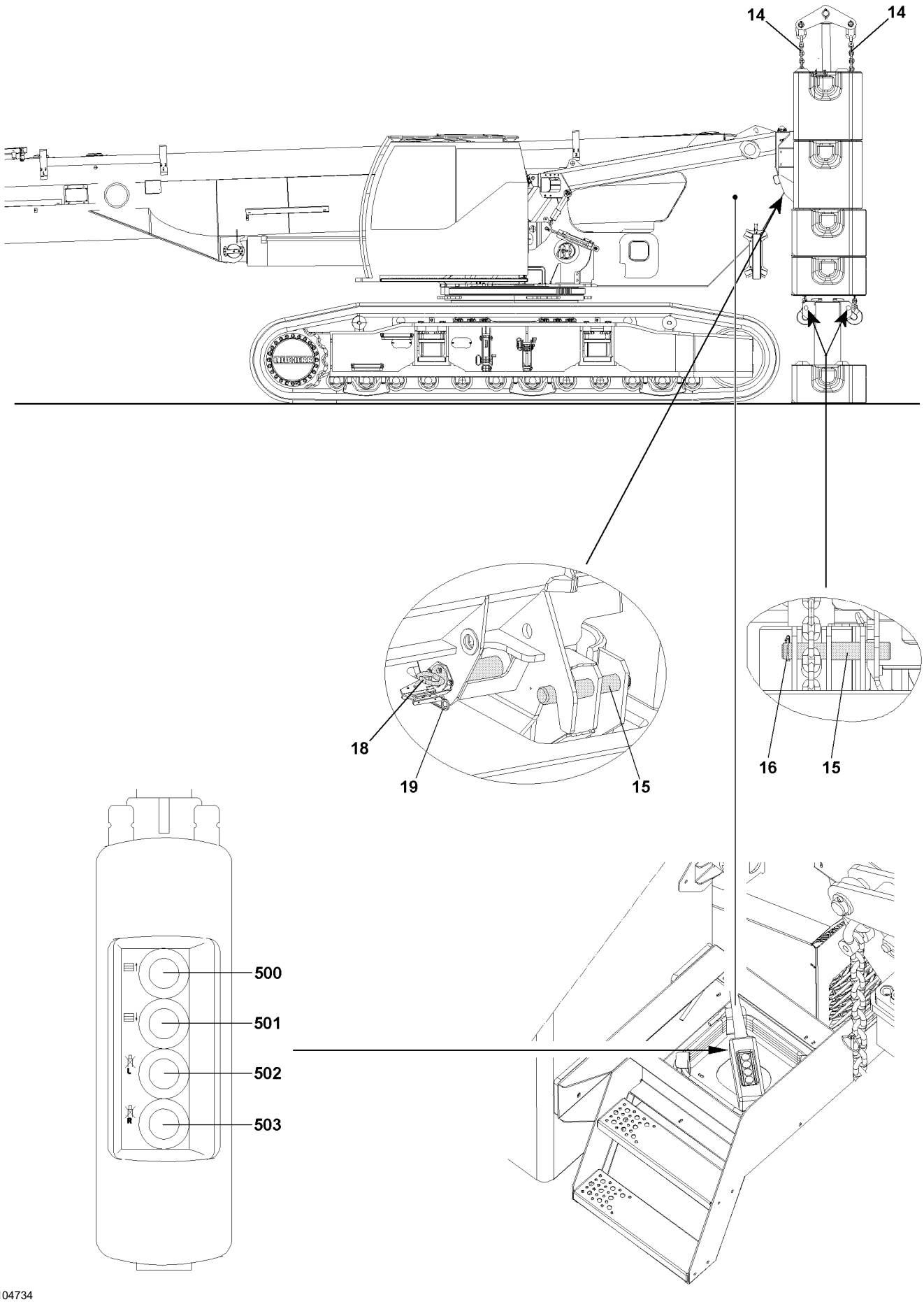
Red and blue marks are applied to the safety chains **5**. The chain receptacles **6** and retaining plates **7** must be attached on these marks. For various counterweight combinations, chain links with different marks must be used to attach the retaining plates **7**.
Chain links with the following marks must be used:
- – To attach the chain receptacles **6**, the lowest chain links with a red mark.
- – To attach the retaining plates **7** for the 16 t counterweight, the lower chain links with a blue mark.
- – To attach the retaining plates **7** for the 26 t counterweight, the lower chain links with a red mark.
- – To attach the retaining plates **7** for the 22 t counterweight, the upper chain links with a blue mark.
- – To attach the retaining plates **7** for the 32 t counterweight, the upper chain links with a red mark.

- ▶ Push the retaining plates **7** on both sides on the marked chain links onto the safety chains **5**.
- ▶ Secure the retaining plates **7** on both sides with screws **10**.
- ▶ Secure the screws **10** with nuts **11**.

The crane can be used to lift and link the safety chains **5**.
- ▶ Link the safety chains **5** on both sides from the top to the bottom through the counterweight assembly.
- ▶ Push the chain receptacles **6** on both sides on the lowest red mark onto the safety chains **5**.

Note
- ▶ The tensioning screws **8** of the retaining plates **7** must be tightened with a tightening torque of 63 Nm.

- ▶ Tension the safety chains **5** with tensioning screws **8** and then counter with nuts **9**.



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2.4 Taking up the counterweight

Ensure that the following preconditions are met:
- the crane is aligned in horizontal direction
- the central ballast is installed
- the respective counterweight has been placed and secured on the base plate
- the pins **15** to engage the ballast assembly chains **14** are pinned and secured with linch pins **16**
- the crane superstructure is mechanically locked with the crane chassis
- the telescopic boom is fully telescoped in
- the telescopic boom is luffed to a permissible telescopic boom angle, see paragraph “Taking on permissible telescopic boom angle at counterweight”
- a guide for reverse travel is available

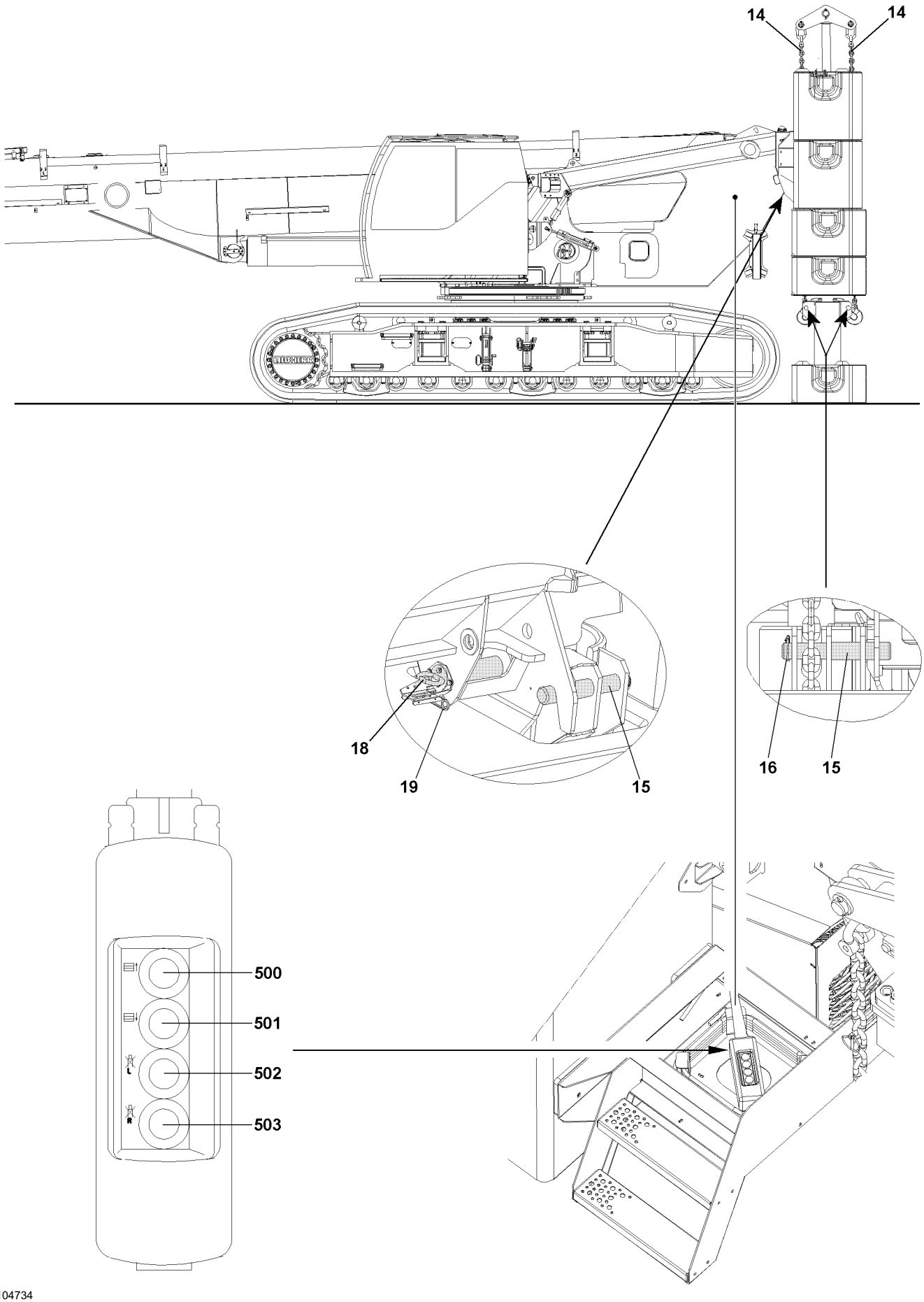
CAUTION
The counterweight may oscillate when pulled up!
If the crane is not aligned in lengthwise or crosswise direction exactly over the counterweight, then oscillating movements can occur when the counterweight is lifted, which in turn can cause damage to the ballasting cylinders or the crane.
▶ Align the crane exactly over the counterweight!

The crane is aligned exactly if the ballast assembly chains **14** are above the corresponding pins **15** on the base plate.
▶ Move the crane backwards with the turntable between the ballasting stacks until the ballast assembly chains **14** are above the corresponding pins **15**.
▶ Press button **501** and fully retract the ballasting cylinders.
▶ Engage the ballast assembly chains **14** on the pins **15**.
▶ Release safety springs **19** and unpin pins **18** on both sides.

DANGER
Counterweight can fall down!
Due to an assembly error, the counterweight could fall down and fatally injure personnel!
▶ As long as the counterweight is not properly pinned and secured on the turntable, it is prohibited for anyone to remain under the counterweight as well as within the complete danger zone!

▶ Press the button **500** and evenly tension the ballast assembly chains **14**.
▶ Press the button **500** and lift the counterweight a little off the ground and let it stop swinging.
▶ Press the button **500** and slowly extend the ballasting cylinders all the way.

Troubleshooting
The counterweight is hanging unevenly on the turntable!
If the counterweight is hanging unevenly on the turntable, then the uneven position can be equalized by blocking the corresponding ballasting cylinder.
▶ Press the button **502** and block the ballasting cylinder on the left.
▶ **or**, press the button **503** and block the ballasting cylinder on the right.
▶ Equalize the uneven position by extending or retracting the corresponding ballasting cylinder.


14
14
18
19
15
16
15
500
501
502
503
B104734

2.5 Pinning the counterweight to the turntable

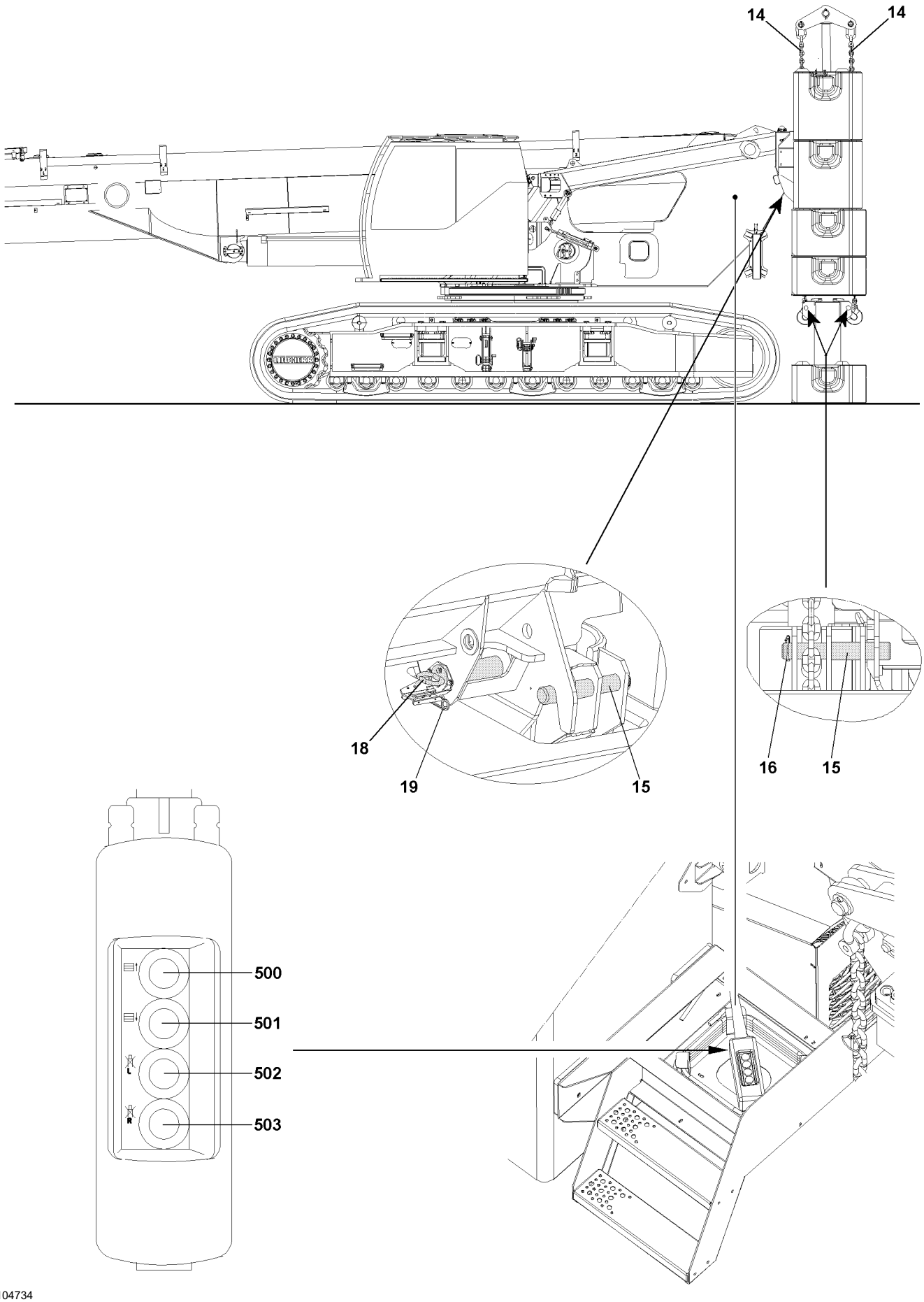
Ensure that the following preconditions are met:
– the counterweight is horizontally aligned
– the pin points on the turntable and the counterweight align

DANGER
Counterweight can fall down!
Due to an assembly error, the counterweight could fall down and fatally injure personnel!
▶ As long as the counterweight is not properly pinned and secured on the turntable, it is prohibited for anyone to remain under the counterweight as well as within the complete danger zone!

▶ Pin the pins **18** on both sides and secure with safety springs **19**.
▶ Check if the pins **18** are fully inserted and secured with safety springs **19**.
▶ Press the button **501** and fully retract the ballasting cylinders.

Troubleshooting
The pin **18** cannot be inserted.
The pin points on the turntable and the counterweight are not aligned.
▶ Unpin the other pin **18**.
▶ Lower the counterweight a little and raise it again.
▶ Align the pin points on the turntable and the counterweight exactly until they align.

Note
▶ After assembly, the ballast assembly chains **14** remain engaged on the pins **15** and rest on the base plate.



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3 Disassembly

3.1 General

Ensure that the following preconditions are met:

– the crane is aligned in horizontal direction
– the crane superstructure is aligned in lengthwise direction to the crawler carriers
– the central ballast is installed
– the ballast assembly chains **14** are engaged on all four pins **15**
– the telescopic boom is fully telescoped in
– the telescopic boom is luffed to a permissible telescopic boom angle, see paragraph “Permissible telescopic boom angles”
– the ground is level and of sufficient load carrying capacity

DANGER
Collapsing substrate!
For assembly or disassembly of the counterweight, make sure that the ground is of sufficient load carrying capacity, otherwise the counterweight can sink in and topple over.
▶ If ground gives way, select assembly location with sufficient load bearing capacity!

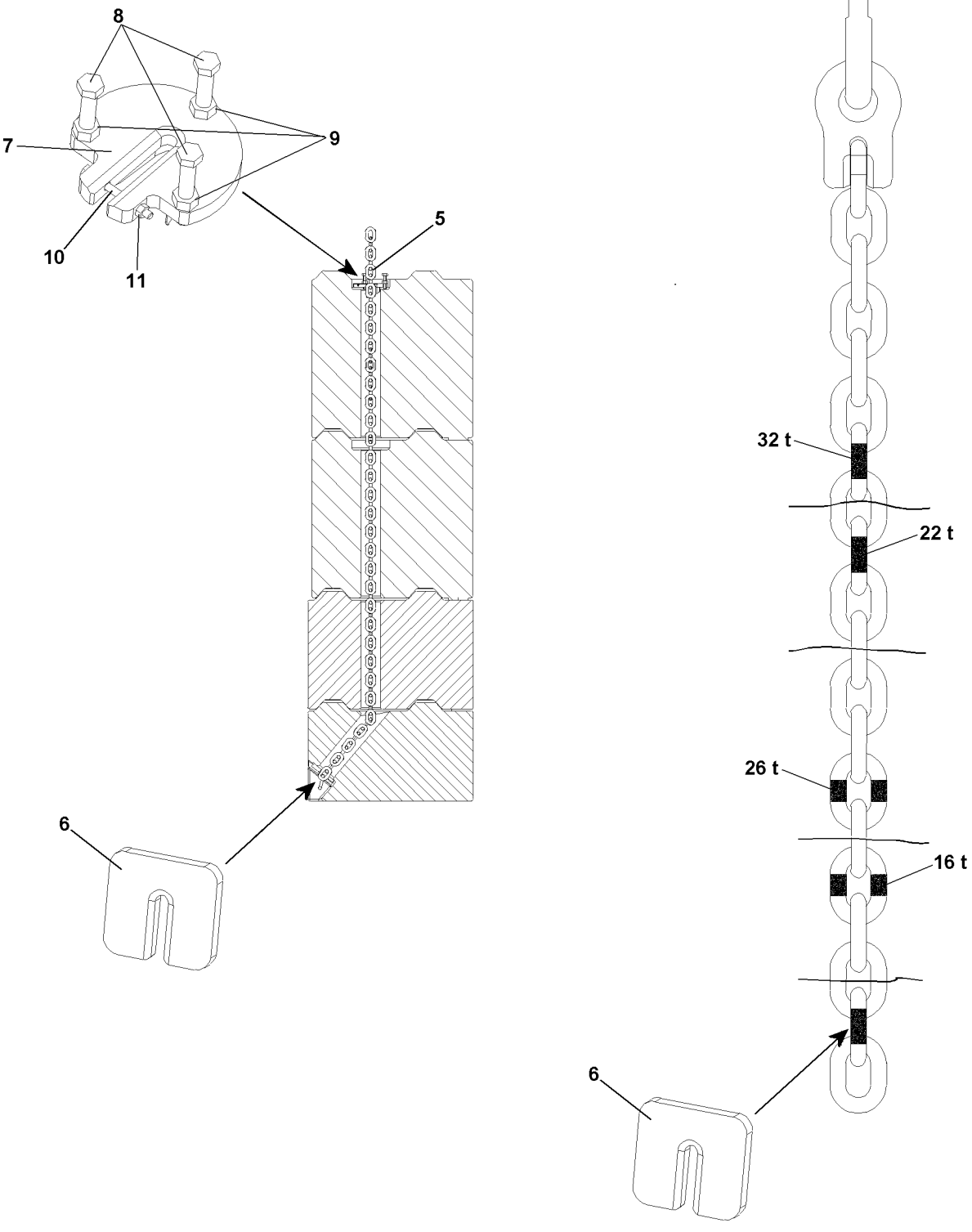
3.2 Placing the counterweight down

For the lift of the ballasting cylinder to be sufficient, the counterweight must be properly supported from below by 100 mm to 200 mm.

▶ Establish proper support for the counterweight.
▶ Press the button **500** and slowly extend the ballasting cylinder.
▶ Tension the ballast assembly chains **14** evenly until the pin points of the counterweight and the turntable align.

DANGER
Counterweight can fall down!
Due to a disassembly error, the counterweight could fall down and fatally injure personnel!
▶ The ballast assembly chains **14** must be engaged on all four pins **15** and must be tensioned!
▶ During and after loosening the counterweight, it is prohibited for anyone to remain under the counterweight as well as within the complete danger zone!

▶ Release safety springs **19** and remove pins **18** all the way on both sides.
▶ Press the button **501** and slowly and evenly retract the ballasting cylinders and carefully lower the counterweight.
▶ When the counterweight has been lowered to the ground:
Press button **501** and fully retract the ballasting cylinders.
▶ Disengage the ballast assembly chains **14** from the pins **15**.
▶ Drive the crawler crane away from the counterweight.



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3.3 Releasing and loading the counterweight

DANGER
Danger of accidents when releasing the safety chains!
▶ For larger ballasting, use a non-skid ladder to disengage the safety chains **5**!

▶ Loosen the nuts **9** and unscrew the tensioning screws **8** a little.
▶ Release the chain receptacles **6** on both sides.
▶ Pull out the retaining chains **5** through the top.
▶ Loosen the nuts **11** and unscrew the screws **10** on the retaining plates **7**.
▶ Remove the retaining plates **7** on the safety chains **5**.
▶ Store the safety chains **5**, chain receptacles **6** and retaining plates **7**.
▶ Adjust LICCON overload retainer as per load chart.

DANGER
Crane can topple over!
The boom lengths and radii specified in the load chart may not be exceeded. If this is not observed, the crane can topple over fatally injure personnel!
▶ The boom lengths and radii noted in the load chart must be strictly observed!

▶ Place counterweight plates onto the transport vehicle.

B195219

1 Technical safety instructions for working with loads

For more information, see chapter 2.04.

WARNING
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 “backwards”, 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
Risk of accident from cracks in the rope!
If the reeving number on the pulley head is less than the reeving number set on the LICCON computer system, 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 required number of minimum coils (three) 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!
▶ Call in an additional observer if the lowest windings position of a winch drum has been reached!
▶ The job of the additional observer is to ensure that there are always at least three coils on the winch drum!

Always comply with the maximum load specified in the load chart.
Initiate all crane movements carefully and also use the brakes carefully during crane movements. That way you can avoid a swinging or pendulum motion in the suspended load.
Reeve the hook block to the maximum extent required to lift the load. Bigger hook blocks must not be reeved.

2 Checking before starting to work with the crane

Before starting work with the crane, the crane operator must carry out a further inspection to satisfy himself about the crane's operational safety:
– check that the crane is properly supported and level
– check that all values in the load chart that apply to the current equipment configuration have been entered and met
– ensure that there are no people or objects in the crane danger zone

WARNING
Danger of accidents when turning the crane superstructure!
By turning the crane superstructure in restricted space conditions on the jobsite, especially in the rear area of the counterweight and towards the chassis, personnel can be crushed and severely injured or killed!
- ▶ Give a short warning signal (hooter) before starting a crane movement!
- ▶ Ensure before starting any slewing movement that there are no people or objects in the danger zone!

2.1 Visual check for damage

WARNING
Risk of accident!
If the crane is operated despite existing defects, personnel can be severely injured or killed!
- ▶ In the event of deficiencies that threaten operational safety, stop crane operations immediately!

The following deficiencies threaten the crane's operational safety:
- – Damage to load-bearing parts of the crane design, such as booms, supports etc.
- – Failure of the hoist gear brake and consequent slipping of the load
- – Functional failures in the crane control system
- – Functional failures in the control and warning lights
- – Damage to the hoist ropes
- – Functional failures in the safety devices
- – Leakage in the crane hydraulics

Inform the appropriate supervisor about the deficiencies on the crane and also inform your relief when crane operators are changed.

2.2 Telescopic boom distortion because of sunshine on one side

A temperature difference occurs between the side facing the sun and the side facing away from the sun in cranes with telescopic booms. This causes telescopic boom side distortion, which can reduce the load-bearing capacity of the telescopic boom. For example, a temperature difference between the two boom sides of 30 °C and a boom length of 60 m results in a length difference caused by the temperature difference between the two sides of the telescopic boom of approximately 22 mm. Particularly with narrow boom parts, this causes the profiles to bend sideways!
If the maximum load is being fully utilized, particularly when a telescopic boom extension such as a lattice jib, luffing lattice jib or folding jib is being used, the equipment must be visually inspected before picking up the load in order to ensure that the boom is not showing signs of side deformation because the sun shining on one side.

WARNING
Risk of accident because of component overloading!
If the telescopic boom has become distorted because of one-sided sunlight, this can cause component overloading and therefore accidents!
- ▶ Turn crane so that both sides of the boom are brought to about the same temperature, therefore preventing side deformation!

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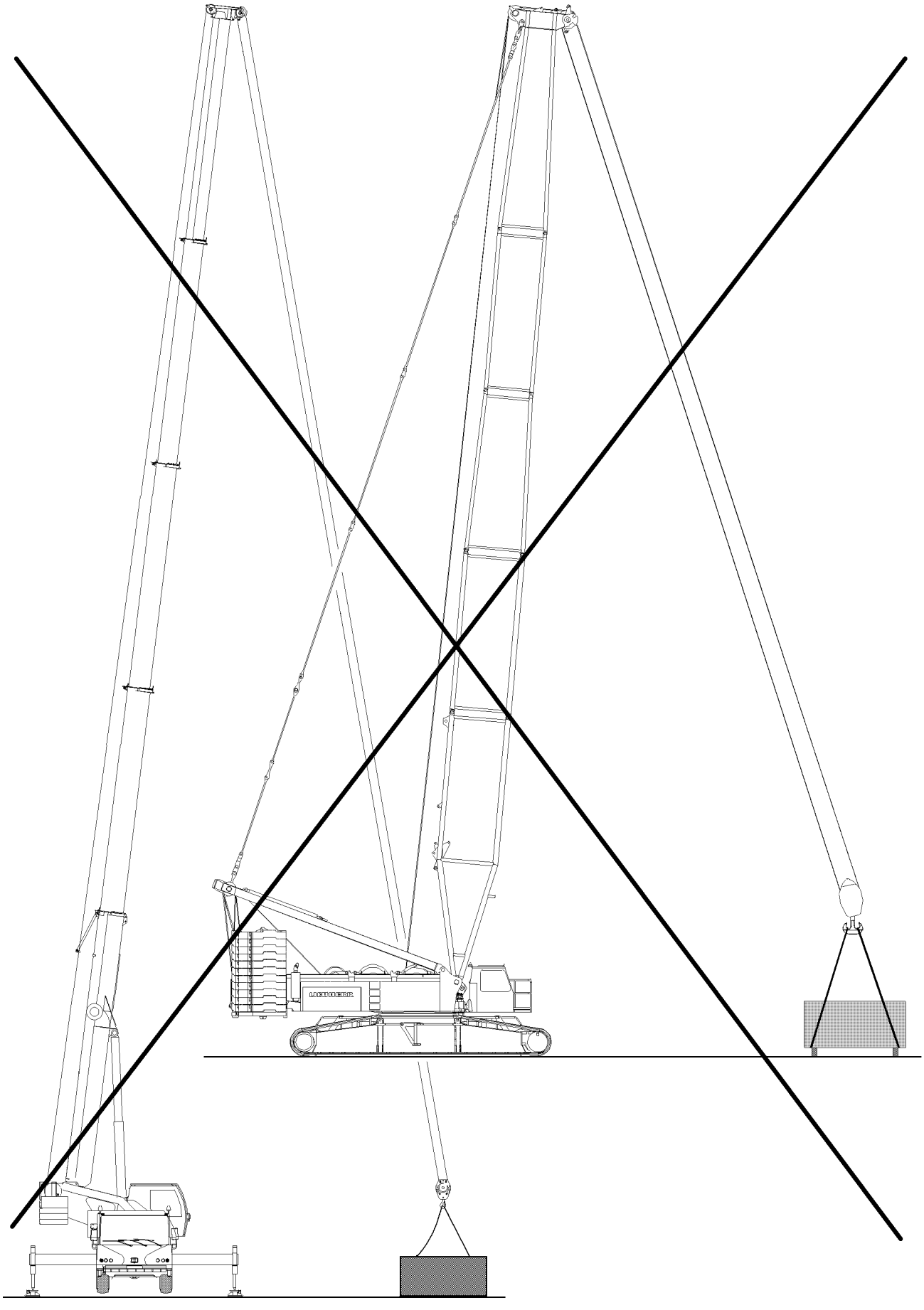

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3 Taking on a load

The crane must always be operated in such a way that its load-bearing parts are not destroyed or damaged and its stability is ensured.

3.1 Lifting the load

WARNING
Danger of crushing for people in the load zone!
If personnel is located between the load to be lifted and a possible interfering edge (such as a wall of a building or similar) when the load is lifted, personnel can be severely injured or killed!
- ▶ The crane operator must ensure, before lifting the load, that there are no persons within the danger zone!
- ▶ It is forbidden to stand in the danger zone!
- ▶ Exercise extreme caution when lifting a load!

WARNING
Crane can topple over!
If an attempt to lift a load above the hoist gear causes the LICCON overload protection to turn off, then the load must not be lifted by raising the boom. This leads to overloading and toppling of the crane!
Personnel can be severely injured or killed!
- ▶ Do not lift the load by raising the boom from the ground!

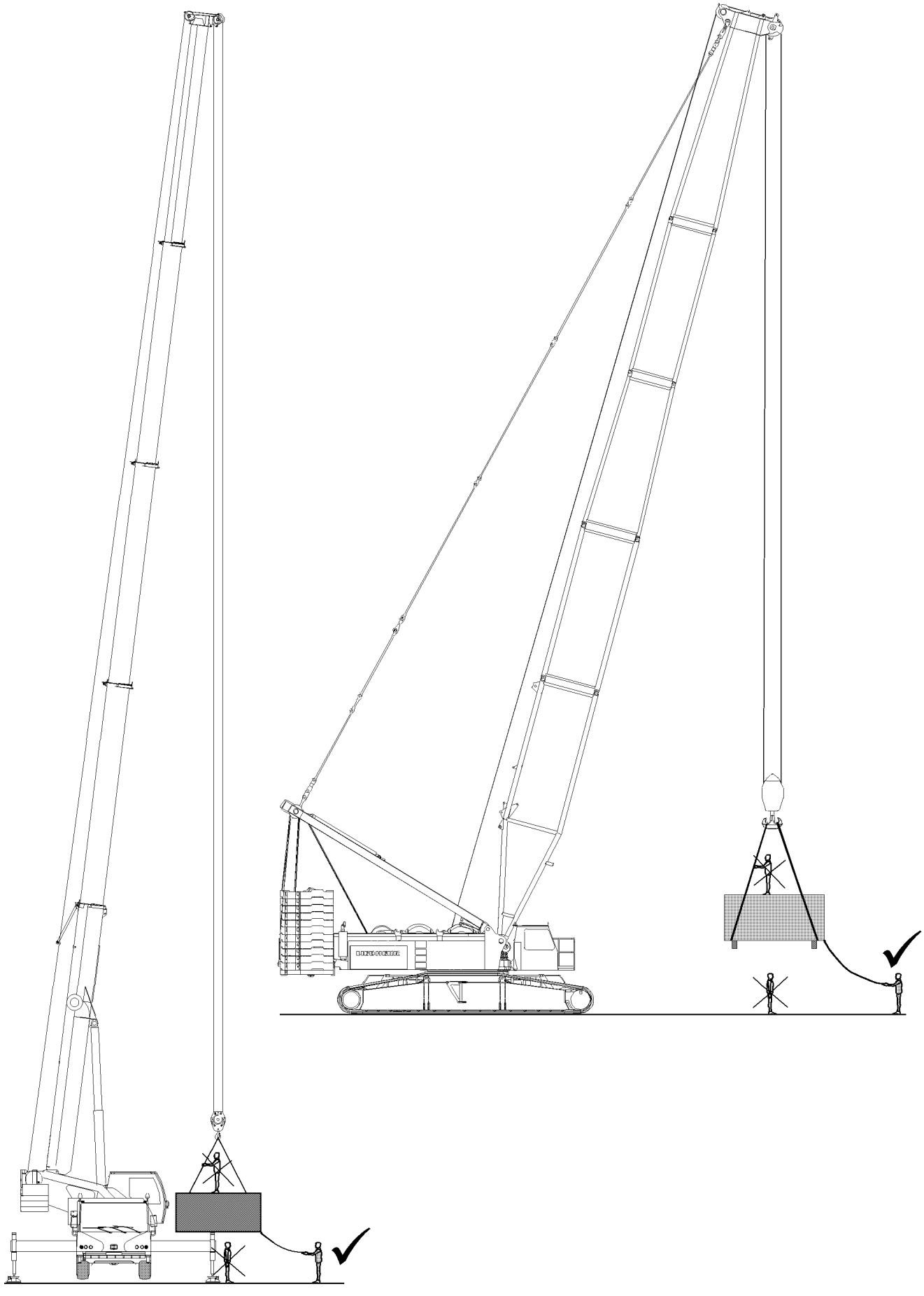
Note
When using an auxiliary winch* (installation or reeving winch), observe the following:
- ▶ Only use the auxiliary winch (installation or reeving winch) for installation and not to lift loads!
- ▶ Lifting of loads with the auxiliary winch is prohibited!

If the rope is manually attached to the load to be raised by an assistant:
- – Make sure that the assistant's hands are not crushed between the load and the rope by the tautly pulled ropes.
- – Make sure that the assistant's body parts (hands, legs etc.) are not crushed by a pendulum movement of the load during lifting.

3.2 Diagonal pulling

WARNING
Crane can topple over!
Diagonal pulling can destroy the crane or cause it to topple over!
Personnel can be severely injured or killed!
- ▶ The hook block must always be attached vertically over the center of gravity of the load to be lifted!
- ▶ Diagonal pulling is not permitted!

The crane is designed only to lift loads vertically. During diagonal pulling, regardless of whether this is done in the same direction as the boom or diagonally, horizontal forces are generated in addition to the vertical ones, for which the boom is not designed.



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3.3 Breaking away fixed loads

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

4 Crane operation

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

4.1 General

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

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

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

4.2 Guiding the load

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

4.3 Carrying people

The crane is not designed to carry people.

WARNING
Mortal danger due to impermissible personnel transport!
▶ Transporting personnel with the load tackle and on the load is prohibited!

4.4 Danger of crushing

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

4.5 Working in the vicinity of electricity transmission lines

DANGER
Risk of accident!
Failure to observe the following notes can lead to damage!
▶ Note the following points carefully!

If there are electricity transmission lines in the immediate vicinity of the building site, these must be turned off by qualified electricians. If this is not possible, the danger area must be covered over or cordoned off. If even these measures cannot be carried out, the following safety distances must be maintained:

Rated voltage	Minimum distance
up to 1 kV	1 m
1 kV to 110 kV	3 m
110 kV to 220 kV	4 m
220 kV to 380 kV	5 m
rated voltage not known	5 m

If the crane becomes electrified despite having taken all necessary precautions, proceed as follows:
– Remain calm!
– Stay inside the crane operator's cab!
– Warn anyone who is outside and advise them to remain stationary and not to touch the crane!
– Move the crane away from the danger zone!

4.6 Ram work or pulling sheet piles

Vibration can be transmitted to the supporting steel structure of the crane during ram work or when pulling sheet piles with the crane. This vibration can cause premature fatigue of the material and therefore cracks in the supporting steel structure.

DANGER
Important instructions for “ram work” or “pulling of sheet piles”!
If the crane is used for ram work or pulling sheet piles, then the following instructions must be followed. Failure to follow the instructions can result in damage to the crane.
▶ The ramming equipment must not introduce vibration into the boom!
▶ When pulling sheet piles the maximum lifting power of the crane is limited as per the load chart! Restricting the maximum lifting power via the crane overload protection **only** is prohibited! The lifting force restriction can be achieved by suspending a crane scale between the load hook and the pulling equipment.

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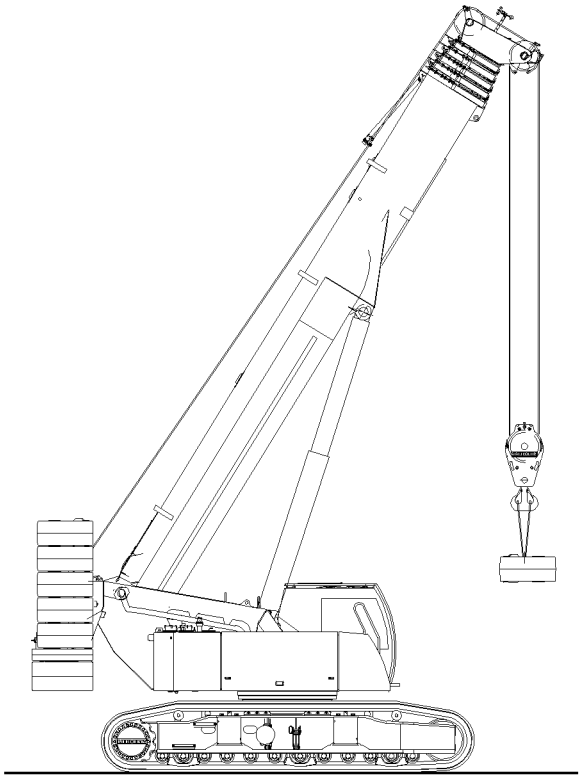

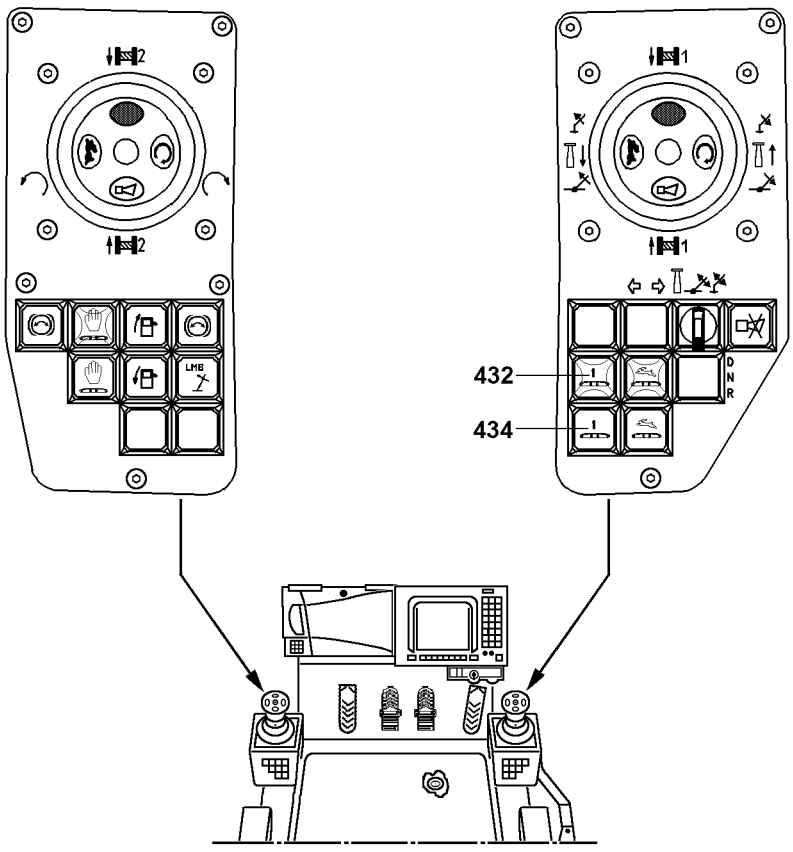

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1 Operating the crawler

Ensure that the following prerequisites are met:
– the ground is able to carry the weight of the crane, the load and the lifting equipment
– the engine is running
– there are no persons or objects in the danger zone
– the crawlers are pushed out, pinned and wedged to a travel track width as specified in the load chart

DANGER
Crane can topple over!
The reduced or retracted track reduces the stability of the crawler crane. Due to operational errors during crane operation or driving, the crawler crane can topple over and fatally injure personnel!
▶ Crane operation and “driving the crawler with load” is permitted for reduced or retracted track, if **extra load charts** are programmed for this case!
▶ Crane operation and “driving the crawler with load” is strictly prohibited for reduced or retracted track, if **no extra load charts** are programmed for this case!

Note
▶ The danger zone should be monitored by cameras or a supervisor when driving or turning the crane!

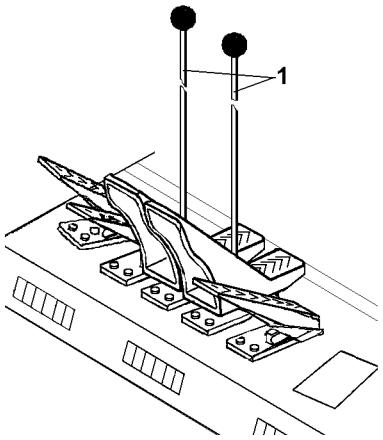
1.1 Activating crawler operation

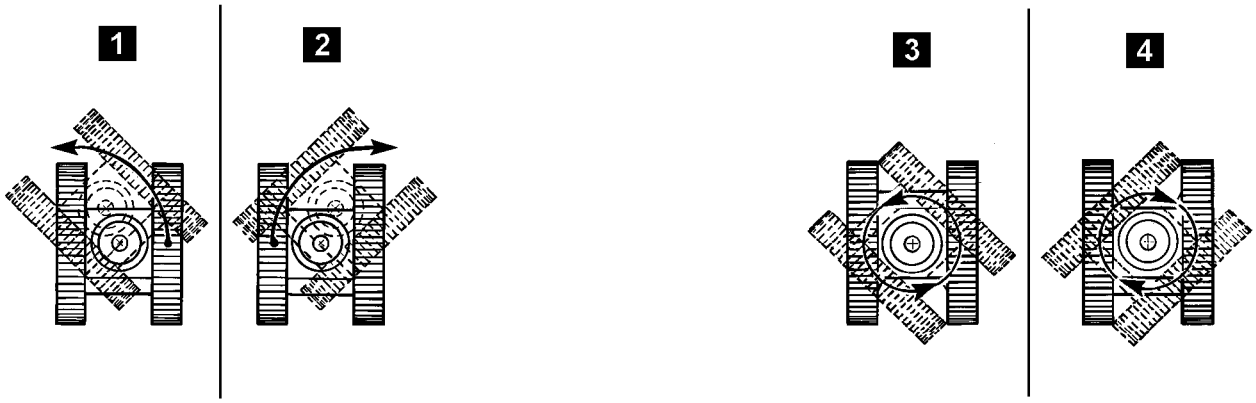
Crane operation is turned on automatically. Use the button **434** to switch on/off crawler operation.
▶ Press button **434**.

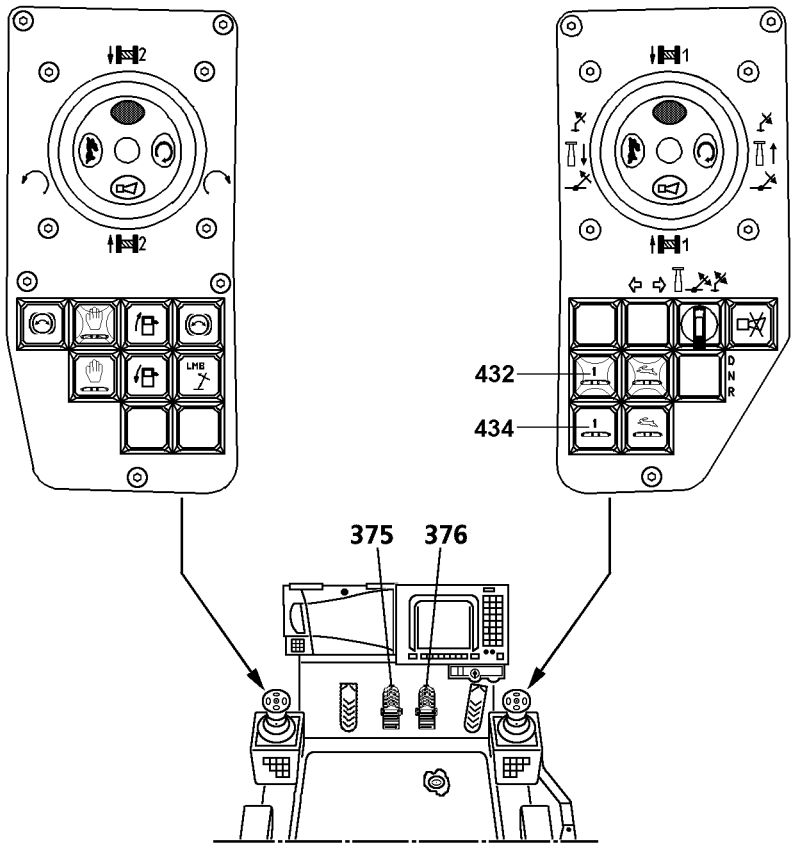
Result:
– The control light **432 is lit**.
Crawler operation **and** crane operation are turned on.

▶ To turn off crawler operation:
Press button **434** again.

Result:
– The control light **432** is **not illuminated**.
Crawler operation is turned off, crane operation remains on.







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1.2 Driving the crawler

Ensure that the following prerequisites are met:
– the crane is switched to crawler operation
– the control light **432** lights up

Special hand levers **1** can be screwed to the foot rockers. These hand levers **1** are used for delicate driving manoeuvres. Operation is identical to that for the foot rockers.
The driving direction is relative to the position of the crane superstructure. If the crane superstructure is slewed by 90°, the forward/reverse driving direction changes. When pedal **375** or **376** is operated, and the crane slews beyond 90°, the driving direction will be maintained until the relevant pedal is set to zero. This means that the new driving direction will only become active once the pedal is no longer pressed.

▶ Move left foot rocker MS4 **375** forwards

Result:
– The left crawler moves forwards.

▶ Move left foot rocker MS4 **375** backwards

Result:
– The left crawler moves backwards.

▶ Move right foot rocker MS5 **376** forwards

Result:
– The right crawler moves forwards.

▶ Move right foot rocker MS5 **376** backwards

Result:
– The right crawler moves backwards.

▶ To drive the crawler crane forwards:
Move left foot rocker MS4 **375** and right foot rocker MS5 **376** forwards.

▶ To drive the crawler crane backwards:
Move left foot rocker MS4 **375** and right foot rocker MS5 **376** backwards.

Note

▶ Protect the chassis by always using the maximum possible turning radius, and avoid turning backwards!

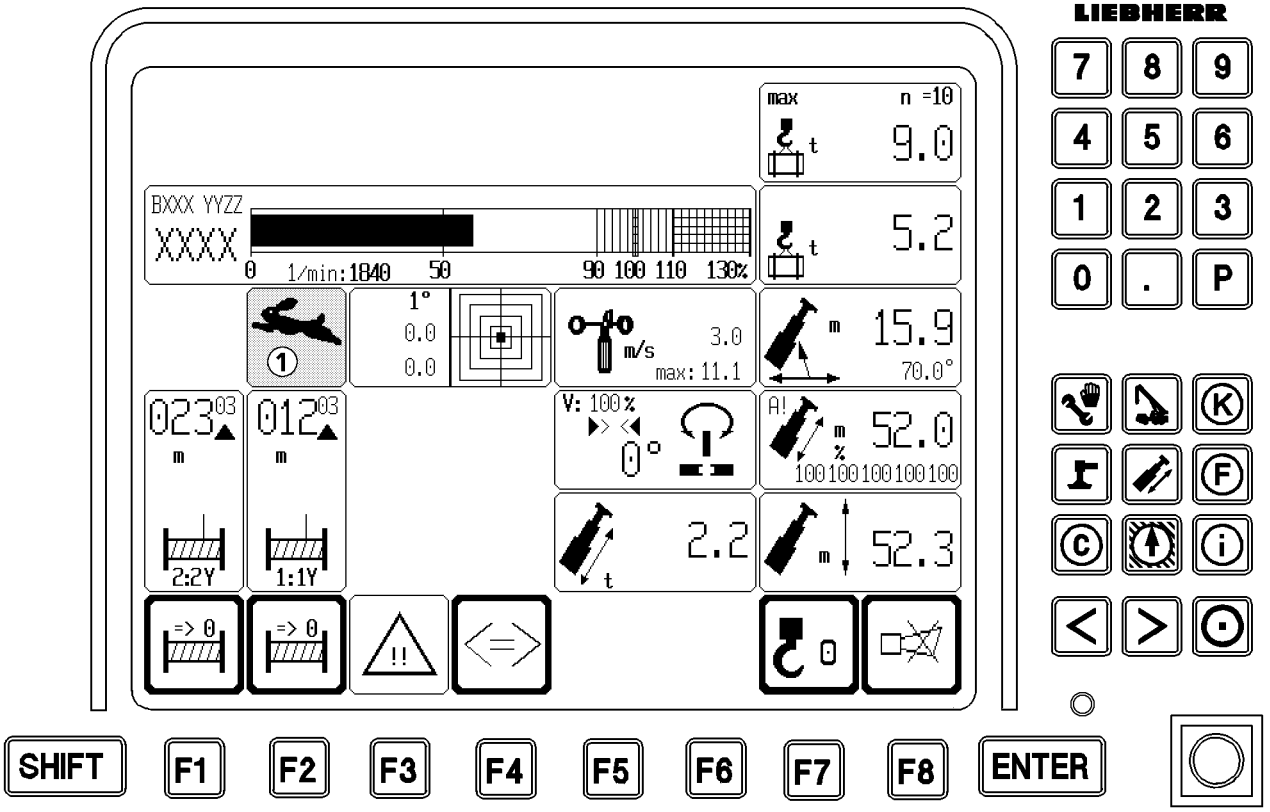
▶ Protect the chassis by not turning on the spot!

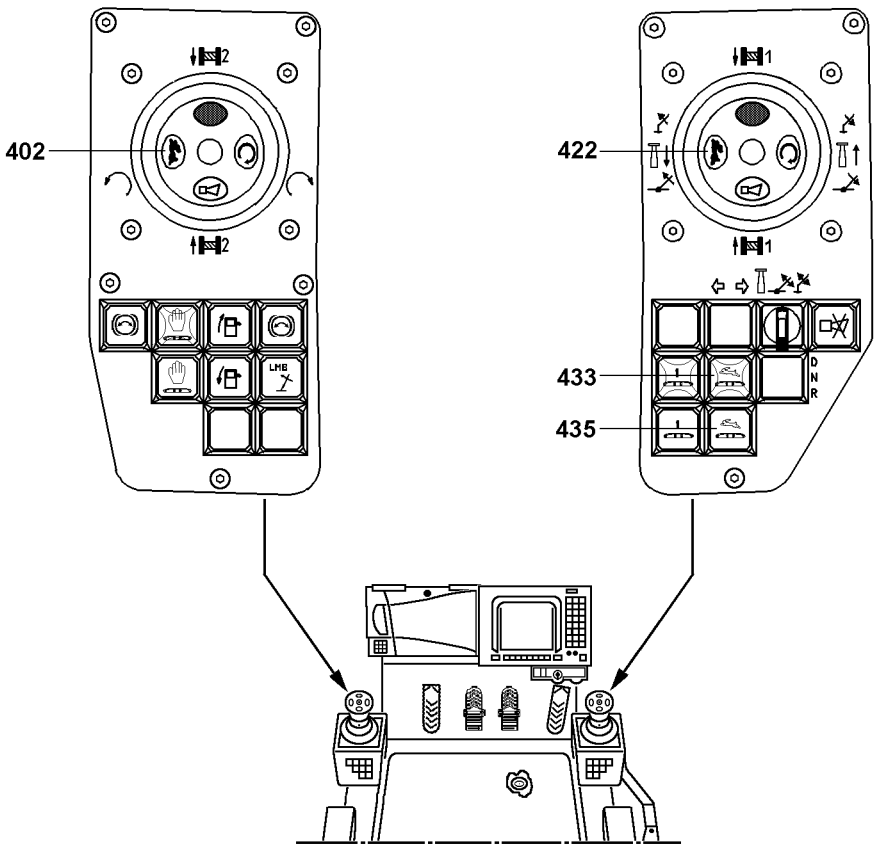
▶ To drive the crawler crane towards the left:
Move right foot rocker MS5 **376** forwards, illustration 1.

▶ To drive the crawler crane towards the right:
Move left foot rocker MS4 **375** forwards, illustration 2.

▶ To turn the crawler crane left on its spot:
Move right foot rocker MS5 **376** forwards and left foot rocker MS4 **375** backwards, illustration 3.

▶ To turn the crawler crane right on its spot:
Move left foot rocker MS4 **375** forwards and right foot rocker MS5 **376** backwards, illustration 4.


LIEBHERR
7 8 9
4 5 6
1 2 3
0 . P
max n =10
9.0
5.2
15.9
70.0°
52.0
2.2
52.3
3.0
max: 11.1
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER


402
422
433
435

B198656

1.3 Selecting the driving speed

This crawler crane has 4 possible speeds:

1.) Speed level 1
creeper gear is activated

2.) Speed level 2
rapid gear “for crane and crawler operation” is activated

3.) Speed level 3
rapid gear “for crawler operation” is activated

4.) Speed level 4
rapid gear “for crane and crawler operation” **and** “crawler operation” is activated

▶ To select speed level 1:
Do **not** press button **435** and button **402** and button **422**.

Result:

– Creeper gear has been turned on.
– The icon **1** does **not** appear on the monitor.
– The control light **433** is **not** illuminated.

▶ To select speed level 2:
Press button **402** or button **422**.

Result:

– Rapid gear “for crane and crawler operation” is activated.
– The icon **1** appears on the monitor.

▶ To select speed level 3:
Press button **435**.

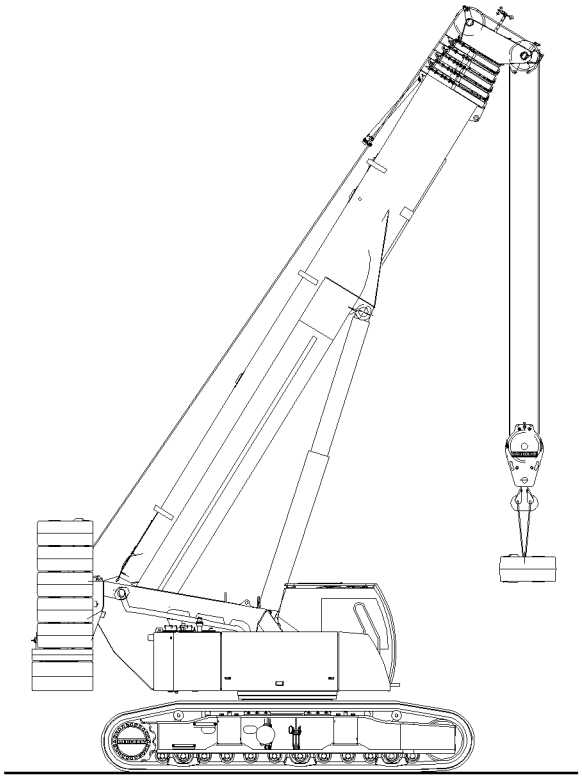
Result:

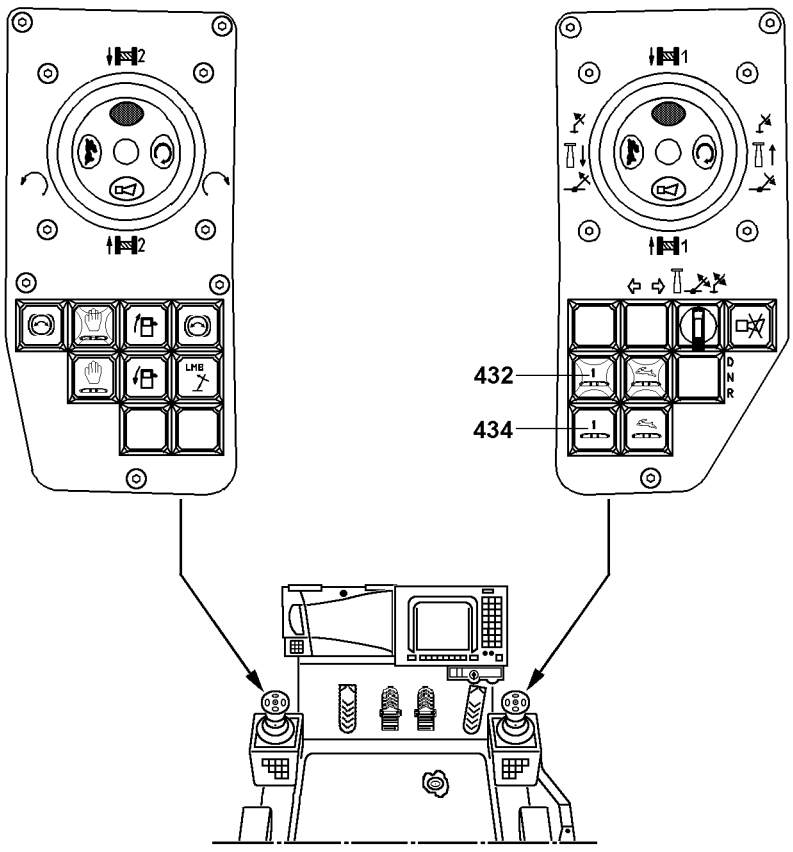
– Rapid gear “crawler operation” is activated.
– The control light **433** is lit.

▶ To select speed level 4:
Press button **435** and button **402** or button **422**.

Result:

– Rapid gear “for crane and crawler operation” **and** “crawler operation” is activated.
– The icon **1** appears on the monitor.
– The control light **433** is lit.





B198657

1.4 Steerability of the crawler

The steerability of the crawler is dependent on the following conditions:

– The friction conditions under the chains.
  Underlaid panels, sand or gravel improve crane steerability.
– Flatness of the ground.
  Steering is not possible if the crawler chassis is only making contact with the ground at the front and rear!
– Load-bearing capability of the ground.
  Steerability is significantly restricted if the crawler chassis sinks into the ground!
– Position of the combined center of gravity.
  Steering will be difficult or may not even possible if the combined center of gravity of the crane and load is at the center of the crane!

1.5 Driving with an attached load

DANGER
Crane can topple over!
The crane can be driven with the loads given in the load charts providing the following conditions are fulfilled.

▶ The ground may not exceed the maximum incline according to the load chart!
▶ The ground must be able to take the calculated ground pressure (using operation planning)!
▶ Only drive at the lowest possible speed!
▶ Avoid jerky driving movements!
▶ The attached load must be secured to prevent it from swinging!
▶ Perform any steering manoeuvres with utmost care!

Note
For all driving states, the ratio between the front and rear ground pressures (or vice-versa) must be greater than 0.3.

▶ A: B must be greater than 0.3

A = maximum ground pressure of the crawler which has the lower load of the two crawlers
B = maximum ground pressure of the crawler which has the higher load of the two crawlers

1.6 Driving the crawler crane without a load with equipment in place on an uphill / downhill slope

The maximum climbing ability of the crawler crane is limited by the following criteria:

– the location of the center of gravity for the complete crawler crane
– the friction coefficient between roadway and track pads
– the transit between the horizontal and the incline
– the maximum incline / slope of 10°
– the maximum side incline 1°

Ensure that the following prerequisites are met:

– the ground has sufficient load carrying capacity and has sufficient traction to prevent the crane from slipping
– the counterweight is secured on the turntable with a round steel chain
  see chapter 4.07.
– the telescopic boom is set with the aid of the job planner in such a way that the center of gravity is in the center of the crawler track
– the medium oil level in the engine is available

DANGER
Crane can topple over!
If the following prerequisites for driving the crawler crane on an incline are not met, the crane can topple over and fatally injure personnel!

- The ground must be able to take the exerted pressure.
- The friction coefficient between the roadway and the ground must be large enough to take on the occurring drive forces. Slippy ground conditions may result in the crane slipping sideways and could cause it to lean in an inadmissible position.
- The turntable must be parallel to the crawler carriers and secured against rotation.
- The side incline may be no more than max. 1° !
- Use slow driving speeds; carefully perform any acceleration and delayed manoeuvres.
- The transfer from the horizontal into an uphill slope and from the uphill slope into the horizontal must be made evenly, i.e. there may be no edges which can cause the crane to topple over. Any changes in gradient should be steady.
- The ground pressures which will occur should be calculated prior to driving (using operation planning).

Note

- The telescopic boom must be telescoped in before driving and luffed down until the load is even on the crawlers.
- If there is a large counterweight on the superstructure, it might be necessary to first telescope the telescopic boom out below a flat angle to obtain a suitable distribution of ground pressure for driving the crane.

Note
For all driving states, the ratio between the front and rear ground pressures (or vice-versa) must be greater than 0.3.

- A: B must be greater than 0.3

A = maximum ground pressure of the crawler which has the lower load of the two crawlers
B = maximum ground pressure of the crawler which has the higher load of the two crawlers

1.6.1 Calculation of required length for transfers

The required length **L** for transfers results from the existing uphill angle **α** and the length of the crawlers **LC**.

– L = Required length of transfers
– α= Angle of uphill slope in degrees
– LC = Length of crawlers between drive wheels and change over wheels

Calculation example

Given:
α= 10°
LC = 5.36 m
Wanted:
L = ?
Formula:
L = 0.5 * α* LC
Result:
L = 0.5 * 10* 5.36 m = 26.8 m

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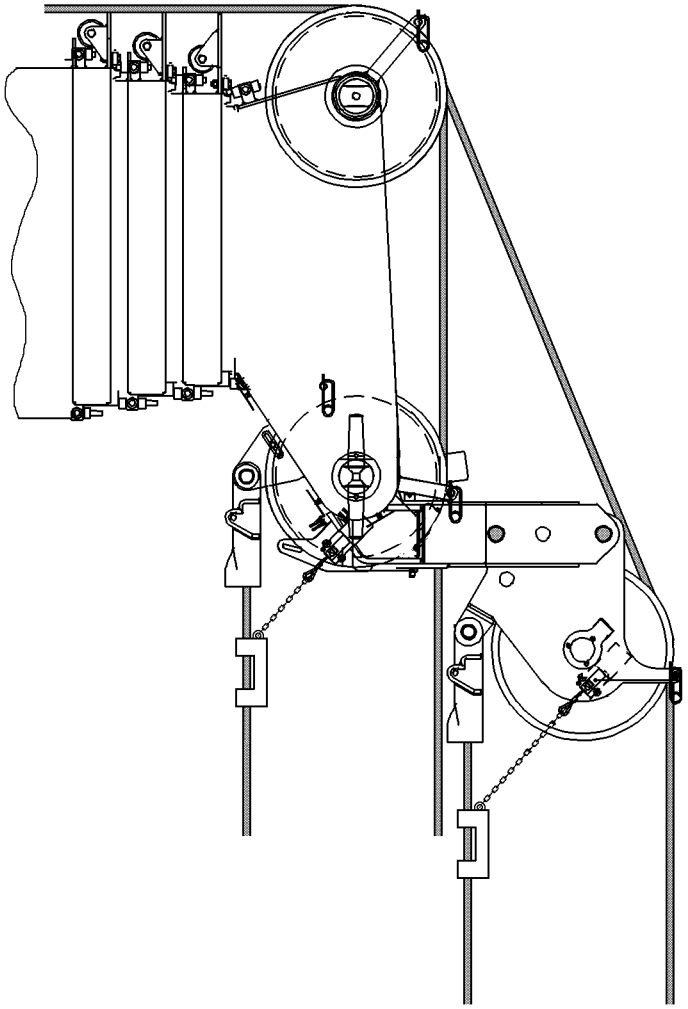


B195478

1 General

In 2-hook operations there is a difference between:

1.) Operations with a boom nose* on the telescopic boom
2.) Operations with a boom nose* on the lattice jib
3.) Operations with a boom extension (folding jib, auxiliary boom, luffing jib)

1.1 Operations with a boom nose* on the telescopic boom

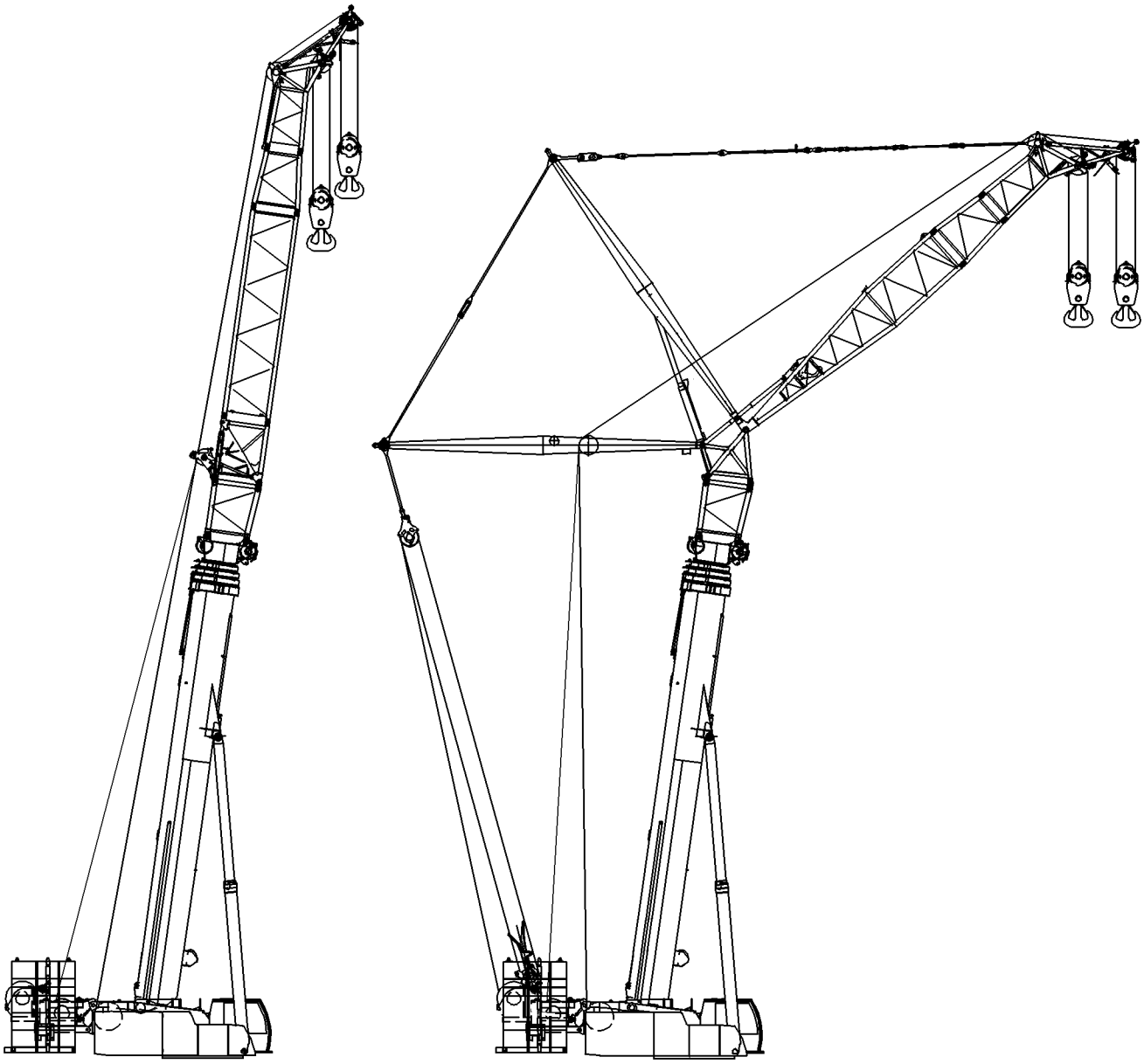
This option is set up for rapid hoists over the boom nose, whereby the hook block reeved on the telescopic boom can remain reeved.
No special loading tables are available for boom nose operations. The boom nose is generally run in the telescopic boom operating mode.

DANGER
Danger of accidents because of imprecise radius and load displays.
▶ When operating with the boom nose, the overload protection radius and load display is not precise, because the boom nose is not taken into account in the boom geometry.

▶ Set the operating mode of the telescopic boom to overload protection.

DANGER
Danger of accidents because of overloading the hoisting gear or the hoisting cable!
Overload protection is only achieved when the reeving on the telescopic boom is equal to, or greater than, the reeving on the mast boom.
▶ Set the overload protection to the smaller reeving of the two hooks.

The weight of the hook blocks (load hook), the boom nose and the lifting accessories must be added to the load to be lifted.
Setting this to the smaller reeving of the two hooks ensures that the crane cannot be overloaded.
▶ Enter the cable reeving that corresponds to the actual reeving on the mast nose.



B195475

1.2 Operations with a boom nose* on the lattice jib

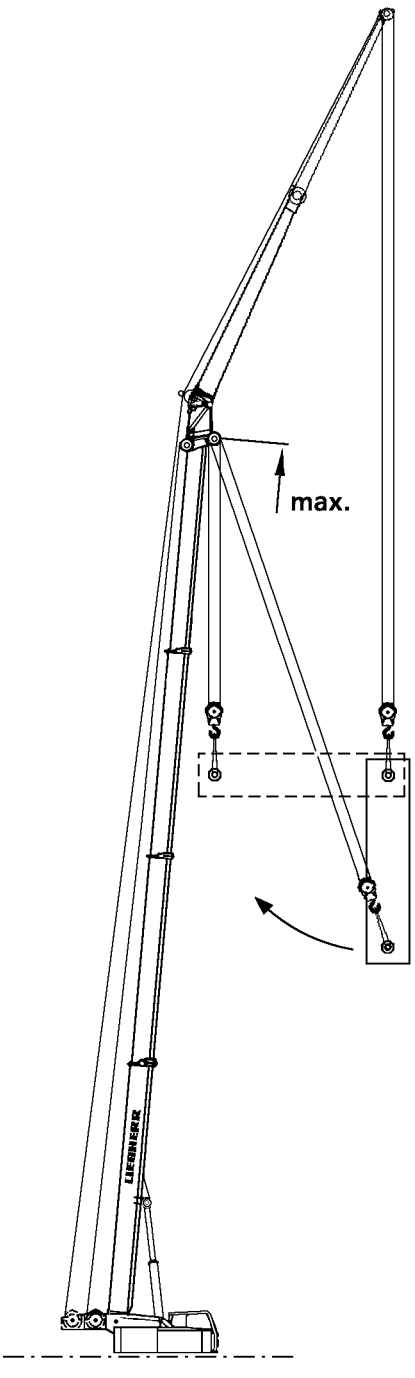
This option is set up for rapid hoists over the boom nose, whereby the hook block reeved on the lattice jib can remain reeved.
No special loading tables are available for boom nose operations. The boom nose is generally extended in the lattice jib operating mode.

DANGER
Danger of accidents because of imprecise radius and load displays.
▶ When operating with the boom nose, the overload protection radius and load display is not precise, because the boom nose is not taken into account in the boom geometry.

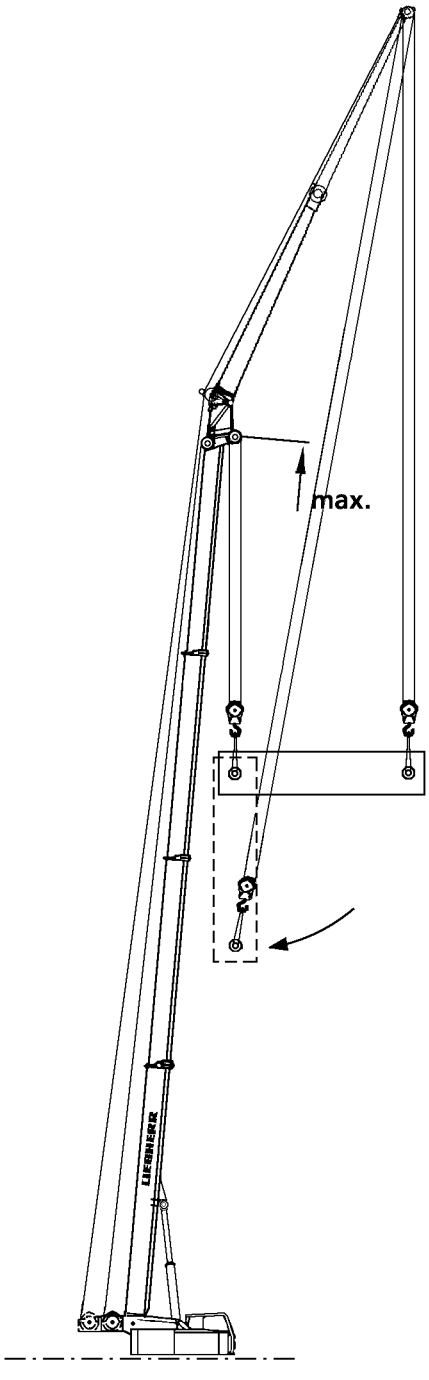
▶ Set the operating mode of the lattice jib to overload protection.

DANGER
Danger of accidents because of overloading the hoisting gear or the hoisting cable!
Overload protection is only achieved when the reeving on the lattice jib is equal to, or greater than, the reeving on the mast boom.
▶ Set the overload protection to the smaller reeving of the two hooks.

The weight of the hook blocks (load hook) and the lifting accessories must be added to the load to be lifted.
Setting this to the smaller reeving of the two hooks ensures that the crane cannot be overloaded.
▶ Enter the cable reeving that corresponds to the actual reeving on the mast nose.



Va. 1



Va. 2

B180647

1.3 Operations with a boom extension (folding jib, auxiliary boom, luffing jib)

This option is set up for turning loads during the simultaneous operation of both sets of hoisting gear.

Note
Raising the load
- ▶ The load must always be raised or lowered using the weakest component (folding jib, auxiliary boom, luffing jib) initially at 100%

- ▶ In “2-hook operations” with a boom extension (folding jib, auxiliary boom, luffing jib), the overload protection must be set to the operating mode boom extension (folding jib, auxiliary boom, luffing jib).

DANGER
Risk of accident by overloading the hoisting gear or hoisting cable!
- ▶ The reeving on the boom must be equal to or greater than the reeving on the boom extension (folding jib, auxiliary boom, luffing jib).

- ▶ Enter the reeving that corresponds to the existing reeving on the boom extension (folding jib, auxiliary boom, luffing jib) into the overload protection.

In this case, the maximum permissible total load corresponds to the maximum permissible load in the corresponding loading table for operating with the boom extension (folding jib, auxiliary boom, luffing jib).
The weight of the hook blocks (load hook) and the lifting accessories must be added to the load to be lifted.

Note
Radius display
- ▶ The radius is displayed, depending on the boom extension (folding jib, auxiliary boom, luffing jib) entered.
- ▶ The load-bearing capacity for each hook in “2-hook operations” is the permissible load in the corresponding loading table for operating with a boom extension (folding jib, auxiliary boom, luffing jib).
- ▶ In 2-hook operations, the total load is the permissible load in the corresponding loading table for operating with a boom extension (folding jib, auxiliary boom, luffing jib).

DANGER
Risk of accident from overloading individual components on the crane!
- ▶ Lifting a load with two hooks is only permissible if done as shown in the illustrations Va. 1 and Va 2.

DANGER
Danger of accidents
- ▶ If both hooks are loaded, it is forbidden to lower the boom!
- ▶ In those circumstances, safety cover from the overload protection is not available.
- ▶ This is why the load must always be picked up at the maximum radius.

As soon as the inner hook is pulled, the overload protection load display is wrong!
- ▶ If a load is raised as shown in Va. 1, the load must first be fully lifted to 100% with the hook furthest away.

5.00 Equipment

B195219

1 Checking the retaining elements

Retaining elements are used to secure the pins in the folding jibs and lattice sections. The spring force of the retaining elements may significantly reduce if they are mechanically damaged or distorted. Do not re-use retaining elements if there is insufficient spring force. The pins must be secured with correctly **functioning** retaining elements.

DANGER
Risk of accident if retaining element does not provide enough spring force!
It cannot be guaranteed that the pin is correctly secured if the retaining element does not provide sufficient spring force.
▶ Use retaining elements with sufficient spring force!

2 Checking the ropes

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 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 more than 10 % of the nominal size
– Rope deformation

2.1 Attaching a new hoist rope

In order to guarantee safety and operating characteristics only use original Liebherr replacement parts.
Worn rope pulleys must be removed and replaced **before** fitting a new hoist rope. If this is not done the new hoist rope will be damaged.

2.1.1 Cranes with cam limit switch

The cam limit switch is calibrated in the factory to switch off when only 3 hoist rope coils are left on the winch.

WARNING
Risk of accident due to falling load!
If the following instructions are not observed, the hoist rope end attachment may be torn out causing the load to topple.
▶ If a new hoist rope is used, the cam limit switch must be reset!
▶ The cam limit switch must be adjusted so that it turns off when only 3 hoist rope coils remain on the winch!
▶ If the hoist rope is wound up during the assembly, the hoist rope end must remain in front of the winch and may not be pulled over the winch, otherwise the cam limit switch must be reset!

2.1.2 Cranes with winch turn sensor

The winch turn sensor is adjusted in the factory. If used properly, the winch turn sensor will not need to be readjusted.

DANGER

Avoid the following situations otherwise the winch speed sensor will need readjusting.

- Pulling the hoist rope ends under the winch by spooling up the winch!
- Pulling the hoist rope from the “stationary” winch.
- The winch turn sensor must also be readjusted if it is established that the “winch does not stop spooling out” when 4 rope coils are left on the winch. This applies during operation or when changing the hoist rope.

3 Inspection procedures

Note

▶ If the crane operator leaves the cab, even for a short time, the operating mode setting must be checked and reset if necessary before resuming crane operation.

Perform the following checks before operating the crane:

– On mobile cranes:
  Check if the axle suspension is blocked.
– On mobile cranes:
  Check if the support pads are secured in the operating position.
– Check if the ground has adequate load-bearing capacity.
– Check if there is adequate safety distance to excavations and embankments.
– Check if there are any live cables within the operating range of the crane.
– Ensure that the work can be carried out with minimum boom radius.
– Check that there are no obstacles that might hinder required crane movements.
– On mobile cranes:
  Check if the sliding beams are prevented from sliding by pins.
– On mobile cranes:
  Check if the crane is supported.
– Check if the crane is level.
– On mobile cranes:
  Check that the tires are not in contact with the ground.
– Check that the overload protection has been adjusted as per the information in the load chart.
– Check if the bypass keyed button and the assembly keyed button are turned off.
– On certain crawler cranes:
  Check that the crawler assembly keyed button is turned off.
– Check the shut-off of the overload protection by running against the operating position on “top” and “bottom”.
– Check the shut-off of the overload protection by running against the hoist limit switch.
– Check the easy movement and function of the wind speed sensor.
– Check the shut-off of the limit switches - boom “steepest position”. See chapter 8.12.
– On cranes with derrick:
  Check the shut-off of the limit switches - derrick. See chapter 8.12.
– On cranes with lattice jib:
  Check the shut-off of the limit switches - lattice jib “steepest position”. See chapter 8.12.
– On cranes with lattice jib:
  Check the shut-off of the limit switches - lattice jib “lowest position”. See chapter 8.12.
– On cranes with lattice jib:
  Check the shut-off of the limit switches – flap in position lattice jib “steepest position”. See chapter 8.12.
– Check the easy movement of the pendulum for the mechanical relapse retainer over the total swing range of the pendulum.

WARNING

Crane can topple over!

If the control measures are not carried out before crane operation, then the crane can topple over or be damaged!

Personnel can be killed or injured!

▶ Crane operation with safety devices which are **not** functioning correctly is strictly prohibited!
▶ Start crane operation only after all safety devices have been checked and are functioning correctly!
▶ Start crane operation only if the overload protection has been set according to the data in the load chart!
▶ Start crane operation only if the crane is properly supported and horizontally aligned!

4 Dangerous conditions without shut-off

4.1 Block position of relapse cylinders when setting down a load

NOTICE
Damage to boom or relapse cylinder!
If the block position of the relapse cylinders is triggered by the boom or the derrick with attached, freely suspended load, then there is a danger of damaging the boom or the relapse cylinders when setting down the load onto the ground! By setting down the load, the crane is relieved, which causes the boom system to move to the rear.
There is no shut-off of the hoist gear down function!
- ▶ Actuate the opposite direction of movement which caused the block position and eliminate the block position!

5 Transporting components

If any components are transported on an auxiliary vehicle, then they must be properly secured. If necessary, transport these components on supports or using a special transport device.

5.1 Transporting lattice sections

If the lattice sections are pushed inside each other for transportation purposes, they must each be secured with 2 chains.

6 Pneumatic springs for assembly support of components

Pneumatic springs are installed on various components to simplify the installation of these components.

WARNING
Danger of crushing!
Defective pneumatic springs no longer provide the supporting properties on the movable components!
Due to falling components, personnel can be killed or severely injured!
High risk of accident!
- ▶ Do not use components with defective pneumatic springs! Replace defective pneumatic springs!
- ▶ Always check pneumatic springs for external damage before actuating the corresponding components!
- ▶ It is strictly prohibited for personnel or objects to remain within the movement range of the components, which are supported by the pneumatic spring!
- ▶ It is prohibited for personnel or objects to remain within the danger zone of the moveable components!

7 Weights

Note

Please note:

- The weight of each component is specified in the corresponding chapter or stated on the tag attached to the corresponding component!
- Contact the customer service department at the Liebherr works in Ehingen if the component weight is not stated on the tag or in the operating instructions.
- If components are pushed into one another (for example intermediate pieces) or folded together (for example the folding jib), then the total weight is given by the sum of the individual components.
- Use auxiliary crane with sufficient load carrying capacity.

8 Reduction of load carrying capacity with placed guy rods

Note

- The load carrying capacities noted in the load charts are valid without placed guy rods!
- If the guy rods are placed, then the possible load carrying capacity values are reduced!
- The reduction of the load carrying capacity depends on the boom angle and the boom length. The longer the main boom and the wider the boom is inclined to the horizontal, the larger is the reduction of load carrying capacity.

B197716 *Example for cranes with LICCON overload protection*

9 Bypassing the overload protection

DANGER

Increased accident risk when bypassing the overload protection!

As section 4.2.6.3.2 of EN 13000 does not put the requirements of appendix 1 of the EC machinery directive 89/37/EC into concrete terms, the overload protection has not been designed according to this definition.

Proper and destined use of the crane is ensured due to the construction of the overload protection system and observance of the information in the crane's operating instructions. All **sensibly foreseeable erroneous operations** of the crane have been taken into consideration.

Impermissible crane operation with bypassed overload protection – with the aim of increasing the maximum load-bearing capacity of the crane above the rated value in the load chart, or to extend the designated working range of the crane – does not constitute a **sensibly foreseeable erroneous operation**, rather **a deliberate improper use with high risk of accident**!

The possible risks and consequences of such deliberate improper use are detailed in the operating instructions.

Such deliberate improper use can neither be prevented by means of the constructive design, nor by means of information in the operating instructions!

- ▶ Only operate the bypass keyed button in accordance with the operating instructions!
- ▶ All other usage of the bypass keyed button other than as described in the operating instructions is prohibited!

9.1 Bypassing the overload protection

If the maximum permissible load moment is exceeded, the overload protection turns all load moment increasing crane movements off. This shut off can be bypassed with the bypass keyed button. The LICCON overload protection displays remain functional.

WARNING

Increased accident risk when 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 killed!

This could result in high property damage!

- ▶ It is only permitted to bypass the overload protection during assembly or in emergencies!
- ▶ The bypass keyed button may only be actuated by persons who are aware of the effects of their acts regarding the bypass of the overload safety!
- ▶ 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 strictly prohibited!

B197716 *Example for cranes with LICCON overload protection*

9.2 Bypassing the hoist-top shut off

If the hook block touches the hoist limit switch weight during the upward movement, the hoist limit switch reacts. The crane movements “Spool up winches”, “Luff boom down” and “Telescope telescopic boom out” are turned off. The shut off can be bypassed by the bypass keyed button.

WARNING
Increased accident risk when bypassing the overload protection!
When bypassing the hoist top shut off, there is a risk that the hook block may be pulled against the pulley head when continuing to lift or luffing down the boom. This may damage the pulleys and cause the loads to fall!

- ▶ The hoist up shut off may only be bypassed if the crane supervisor is present and with the help of a “guide”. The guide must be in direct contact with the crane operator and must continually monitor the distance between the hook block and the boom head.
- ▶ Carry out all crane movements with maximum care and minimum speed.

9.3 Actuating the overload protection

9.3.1 Actuating the LICCON overload protection

▶ Turn the bypass keyed button to the right and hold.

Result:

– The LICCON overload protection is inactive.
– The assembly symbol on the LICCON monitor blinks.
– An acoustic signal sounds.
– The red beacon on the crane cab blinks.

▶ If the bypass keyed button is to be turned off:
Do not actuate the bypass key button any more.

Result:

– The LICCON overload protection is active.
– The assembly icon on the LICCON monitor turns off.
– The acoustic signal is turned off.
– The red flashing beacon on the crane cab turns off.

9.3.2 Actuating the PAT overload protection

▶ Actuate the bypass keyed button and turn the PAT overload protection off.

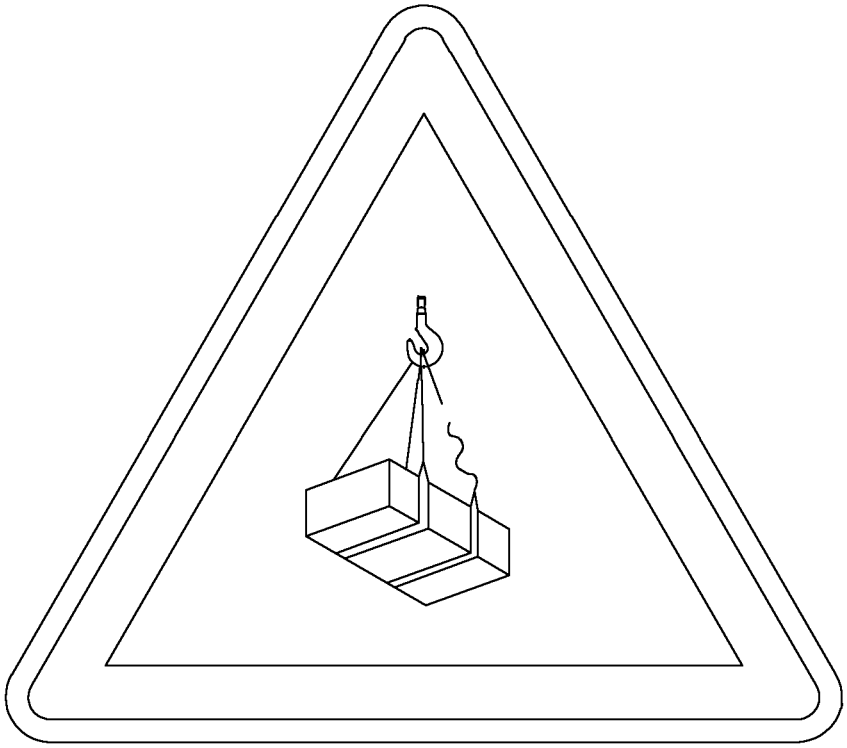
Result:

– The PAT overload protection is inactive.

▶ Actuate the bypass keyed button and turn the PAT overload protection on.

Result:

– The PAT overload protection is active.



B197714

10 Assembly / disassembly

WARNING
Risk of fatal injury due to incorrect assembly or disassembly!
The assembly / disassembly of components may never be performed by untrained personnel.
Incorrect assembly / disassembly can result in death or severe injury!
- ▶ Assembly and disasssembly may only be carried out by authorized trained experts!

Note
- ▶ For assembly / disassembly of individual components, also refer to the chapters relating to those components!
- ▶ Only use the auxiliary winch (installation or reeving winch) for installation and not to lift loads!
- ▶ Lifting of loads with the auxiliary winch is prohibited!

Normal assembly / disassembly procedures require all separately transported components to be transported close to the ground using appropriate auxiliary cranes and tackle. They must be safely (correctly) connected to the crane.
Suspended loads such as counterweights, lattice sections or auxiliary booms etc. must be placed on the ground or on a frame or other suitable load bearing device before being approached by assembly personnel.

WARNING
Danger of impact and crushing!
There is a risk of impact and crushing when standing in the vicinity of suspended loads moving sideways.
- ▶ During assembly / disassembly no one may be in the dangerous area around or even underneath the suspended load before the load has been secured!

WARNING
Risk of falling!
During assembly and disassembly, inspection and maintenance work, personnel must be secured with appropriate antifall guards 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 (ladders, lifting platforms, scaffolding, auxiliary crane, etc.)!
- ▶ If work cannot be carried out on the ground or using such aids, then assembly personnel must be secured with suitable personal protective equipment (see chapter 2.04) to protect against falling! The personal protective equipment must be attached in the corrsponding fastening points on the crane (see chapter 2.06).
- ▶ If railings are present for the crane, then they must be brought into the corresponding position and secured for assembly / disassembly, inspection and maintenance work.
- ▶ Only step on aids and antifall guards with clean shoes!
- ▶ Keep aids and antifall guards clean and free from snow and ice!
- ▶ It is prohibited to walk on the telescopic or auxiliary booms!

B197715

10.1 Assembly / disassembly of the booms

If lattice sections are not in contact with the ground during assembly / disassembly they must be supported with suitable, stable materials. Adjust the height of the support so that the lattice sections are not in contact with the ground. Pay particular attention if the lattice sections are equipped with rope pulleys. Otherwise the rope pulleys could be damaged.

During disassembly it must be ensured that the auxiliary crane lifts the load vertically. The crane operator must ensure that the load bearing capacity of the auxiliary crane is sufficient to safely raise the dismantled component at the given radius. When attaching the auxiliary crane it must be ensured that the hook of the auxiliary crane is above the center of gravity of the disassembled component and the fastening ropes are attached to the load.

WARNING

Crane can topple over!

Angular pulling can destroy the crane or cause it to topple over.

- ▶ The hook block must always be attached vertically over the center of gravity of the load to be lifted!
- ▶ Diagonal pull is not permitted!

WARNING

Danger of accident at assembly / disassembly of booms!

The dismantling of unsecured or unsupported booms may result in fatal injury or mutilation.

- ▶ Never unpin the pins under unsecured or unsupported booms!
- ▶ Never unpin the connecting pins under unsecured or unsupported booms!
- ▶ Do not stand under the booms or within the complete danger zone during the pinning and unpinning procedure of the booms!
- ▶ Safely secure the pins in the bearing points as well as receptacles!
- ▶ Do not lean the ladder against the component being disassembled!

WARNING

Risk of accident from distorted pins!

Angular pulling or excessive / low hoisting force of the auxiliary crane may result in distortion of the pins.

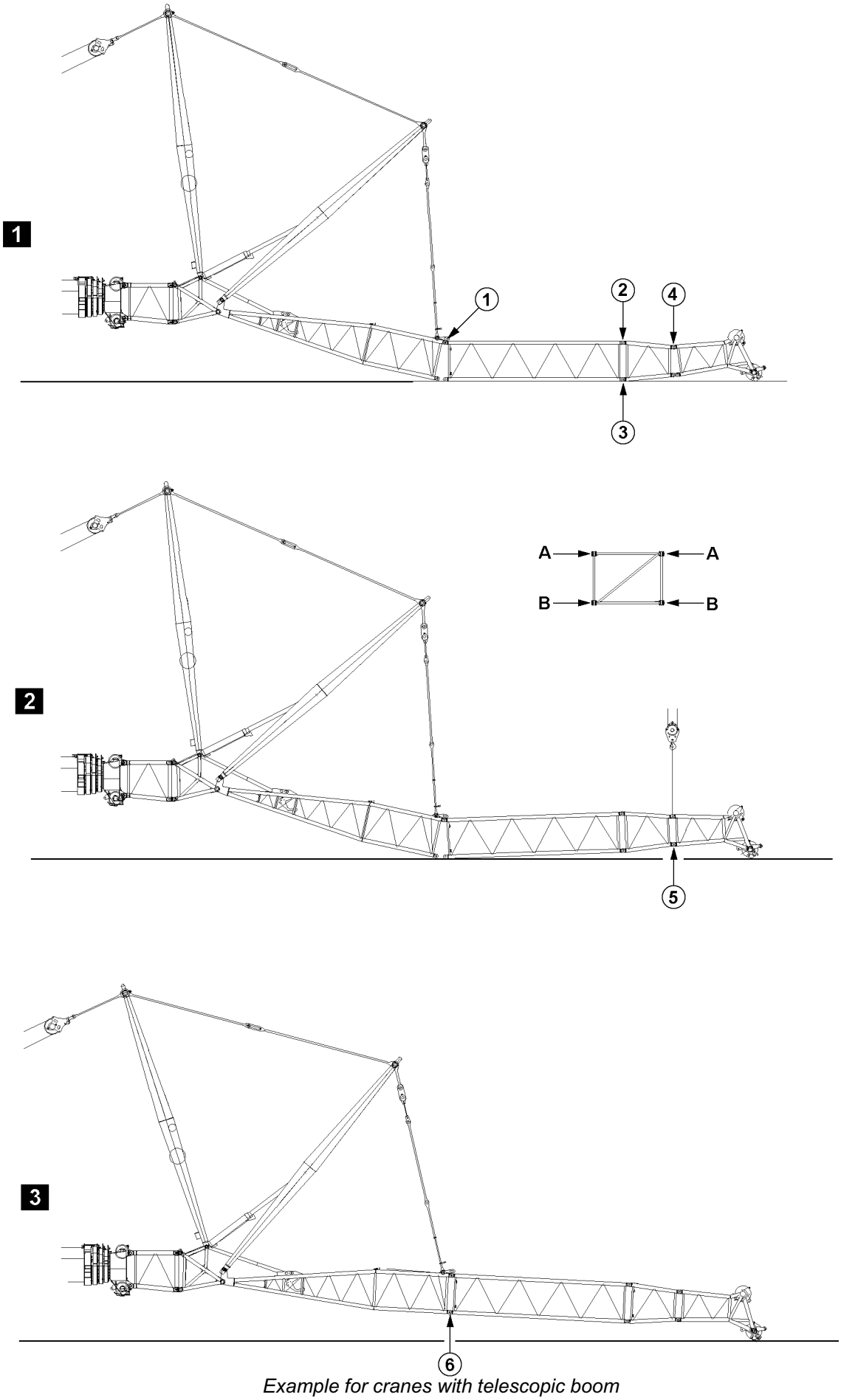
Distorted parts can suddenly detach themselves when the pins are unpinned. This represents a fatal injury risk to assembly personnel.

- ▶ When the pins are unpinned, the “lifting force” of the crane must be adapted to the “weight” of the parts being lifted!
- ▶ Do **not** remove difficult to remove pins by force!
- ▶ Remove the reason for the distortion!

Note

Instructions for pinning and unpinning:

- ▶ Unpin or pin both pins at the same horizontal level, i.e. **left and right**!
- ▶ Pin the lower pins **from inside to outside** and unpin from **outside to inside**!
- ▶ Pin and unpin horizontally-mounted double cone pins from **outside to inside**!
- ▶ Pin and unpin vertically mounted double cone pins from **top to bottom**!



B197718

Example for cranes with telescopic boom

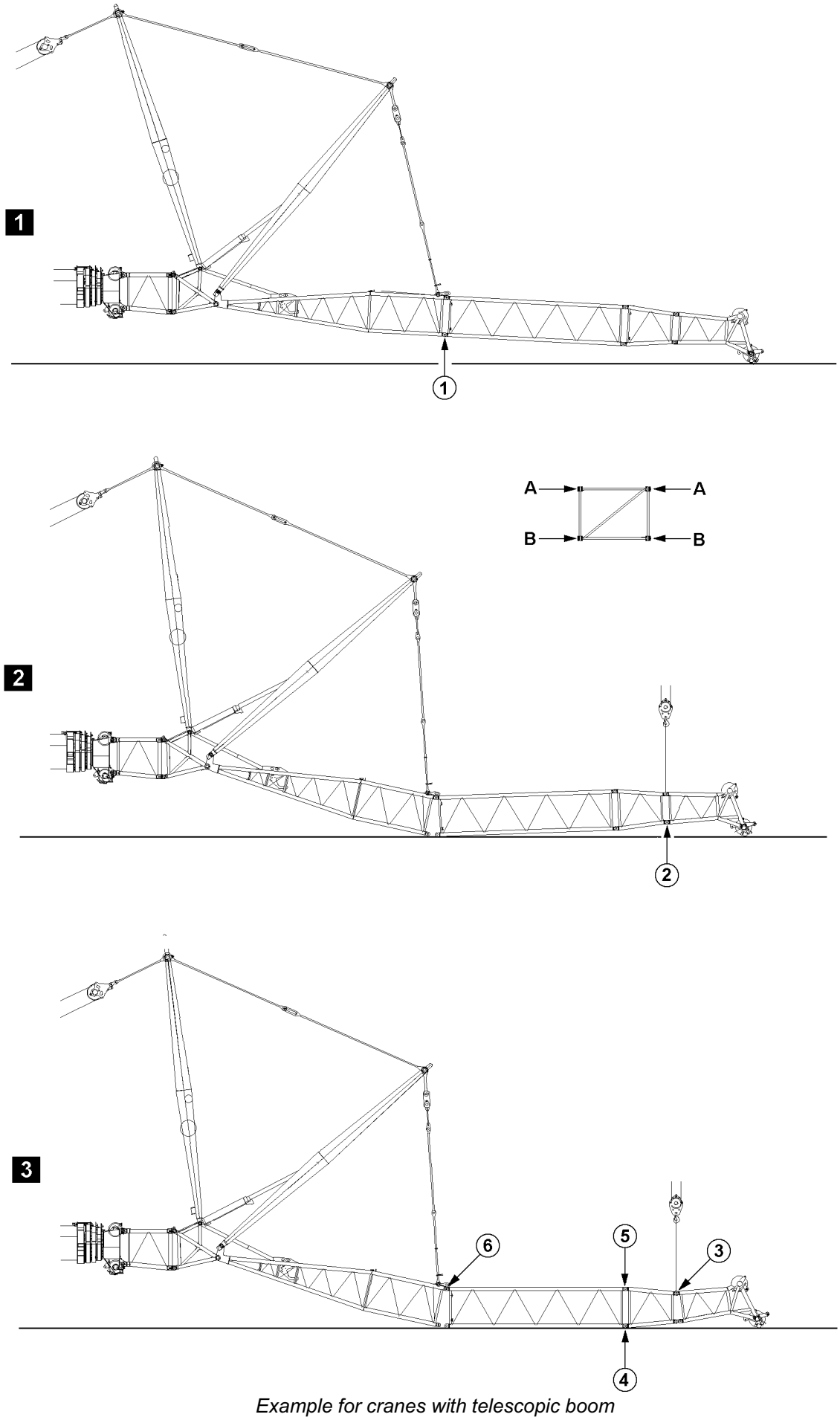
10.2 Assembly of lattice sections for telescopic cranes

10.2.1 Assembly 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 assembling auxiliary booms!
If the pins are not pinned in the given sequence, then lattice sections may suddenly fold down or even fall down. This can result in life-threatening injuries to personnel.
- ▶ Pins must be pinned in the order specified!

- ▶ Pin and secure pins at both sides (level **A**) at point **1**, fig. 1.
- ▶ Pin and secure pins at both sides (level **A**) at point **2**, fig. 1.
- ▶ Pin and secure pins at both sides (level **B**) at point **3**, fig. 1.
- ▶ Pin and secure pins at both sides (level **A**) at point **4**, fig. 1.
- ▶ Lift the end section with the auxiliary crane, fig. 2.
- ▶ Pin and secure pins at both sides (level **B**) at point **5**, fig. 2.
- ▶ Lift the lattice sections, fig. 3.
- ▶ Pin and secure pins at both sides (level **B**) at point **6**, fig. 3.



B197719

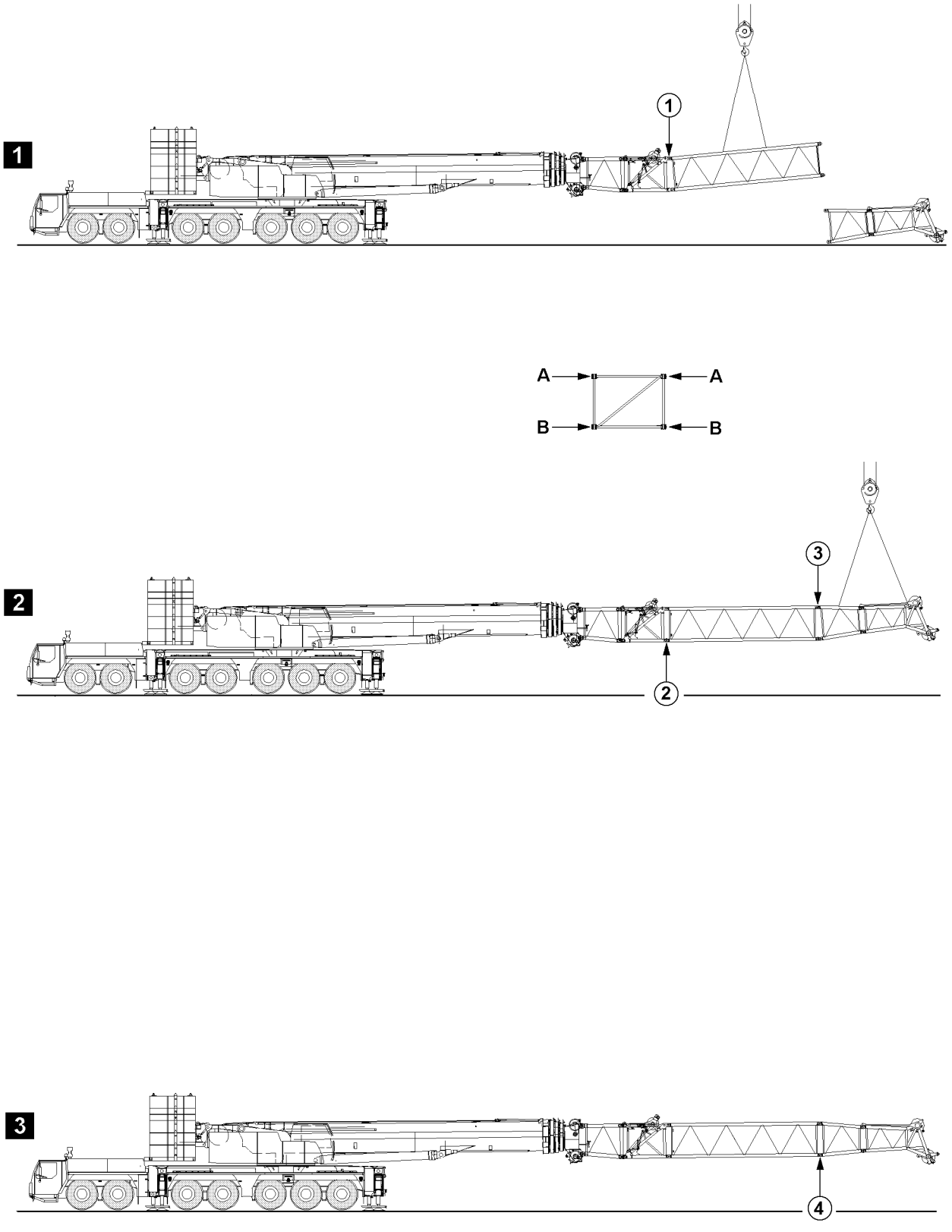
Example for cranes with telescopic boom

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

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

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

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



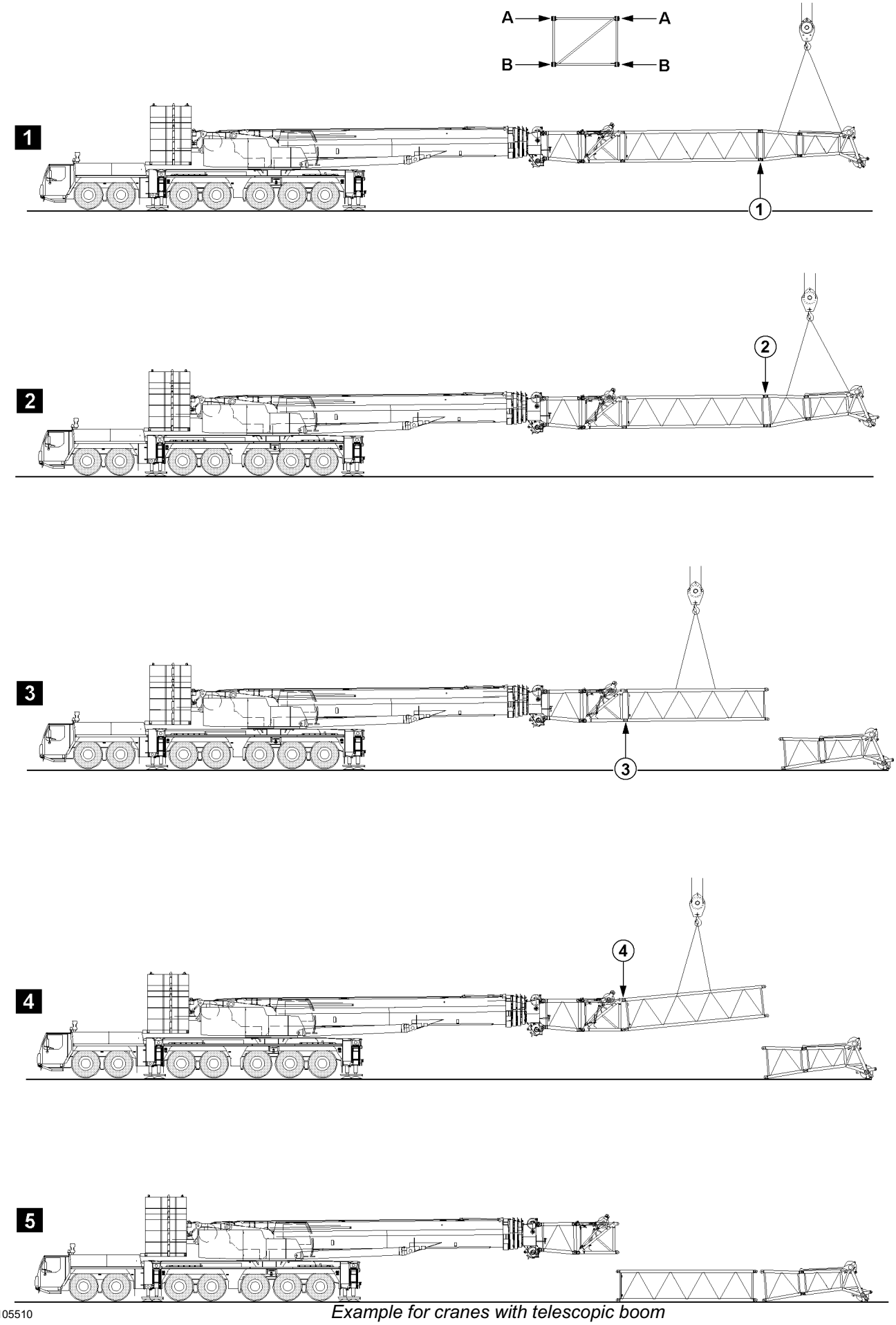
B197705 *Example for cranes with telescopic boom*

10.2.3 Assembly of lattice sections on self-supporting auxiliary booms using an auxiliary crane

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

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

- ▶ Pin and secure pins at both sides (level **A**) at point **1**, fig. 1.
- ▶ Pin and secure pins at both sides (level **B**) at point **2**, fig. 2.
- ▶ Pin and secure pins at both sides (level **A**) at point **3**, fig. 2.
- ▶ Pin and secure pins at both sides (level **B**) at point **4**, fig. 3.



B105510

Example for cranes with telescopic boom

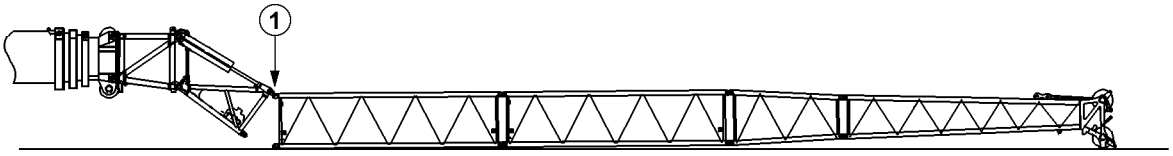
10.2.4 Disassembly of lattice sections on self-supporting auxiliary booms using an auxiliary crane

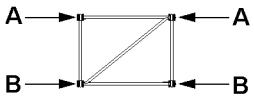
The illustrations serve as examples. The illustrations may differ depending on the crane.

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

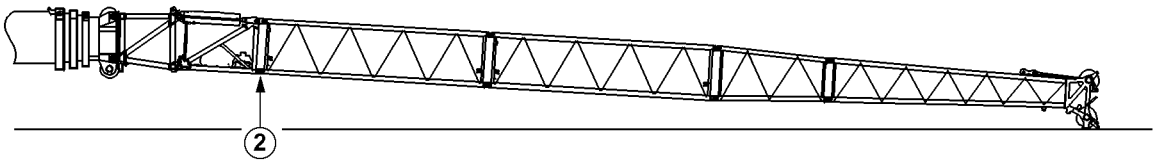
- ▶ Release and unpin pins at both sides (level **B**) at point **1**, fig. 1.
- ▶ Release and unpin pins at both sides (level **A**) at point **2**, fig. 2.
- ▶ Release and unpin pins at both sides (level **B**) at point **3**, fig. 3.
- ▶ Release and unpin pins at both sides (level **A**) at point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

1

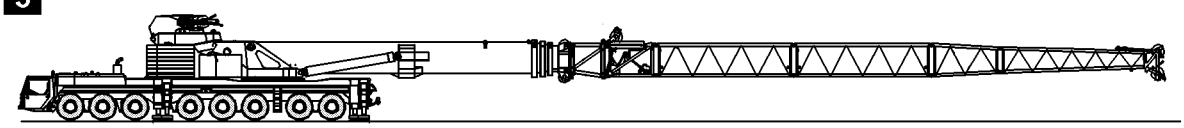




2



3



B197712 *Example for cranes with telescopic boom*

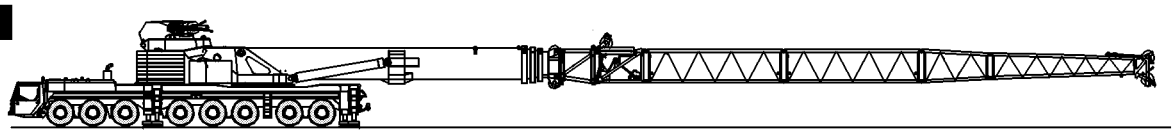
10.2.5 Assembly of lattice sections on self-supporting auxiliary booms without using an auxiliary crane

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

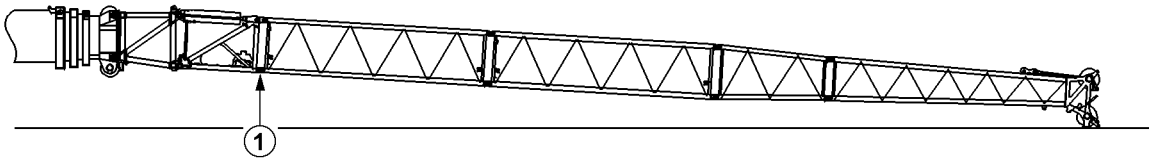
WARNING
Risk of fatal injury when assembling auxiliary booms!
If the pins are not pinned in the given sequence, then lattice sections may suddenly fold down or even fall down. This can result in life-threatening injuries to personnel.
▶ Pins must be pinned in the order specified!

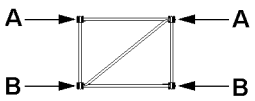
For cranes with hydraulic angle adjustment and self-supporting auxiliary boom, the assembly / disassembly of additional lattice sections may be performed using the crane itself.
In order to do so, proceed as follows.
▶ Assemble the lattice sections to the required length.
▶ Pin and secure pins at both sides (level **A**) at point **1**, fig. 1.
▶ Luff the auxiliary boom up until the pins can be pinned at point **2**, fig. 2.
▶ Pin and secure pins at both sides (level **B**) at point **2**, fig. 2.

1

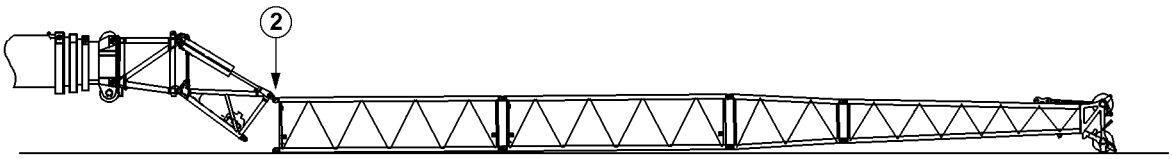


2





3



B197713

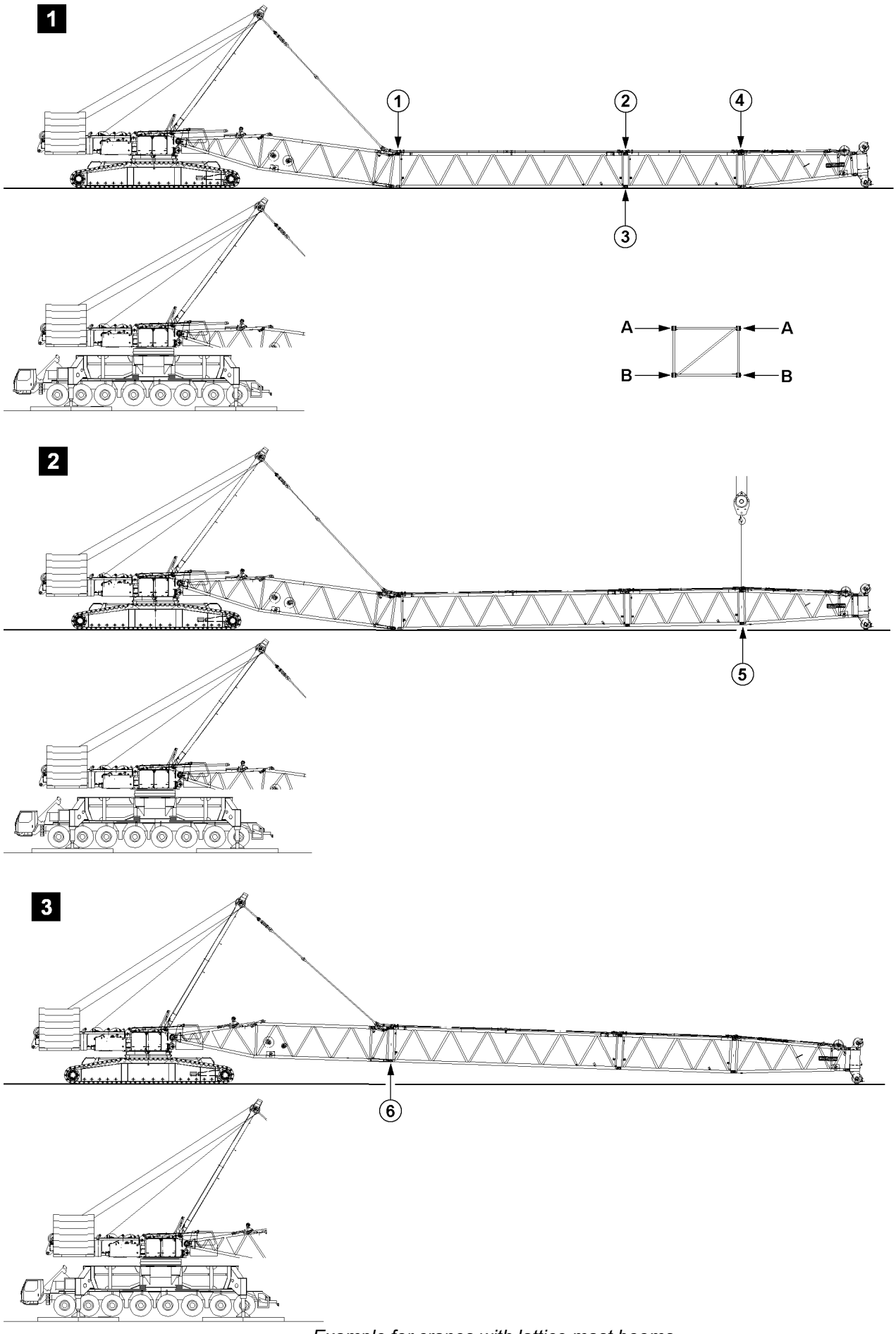
Example for cranes with telescopic boom

10.2.6 Disassembly of lattice sections on self-supporting auxiliary booms without using an auxiliary crane

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

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

For cranes with hydraulic angle adjustment and self-supporting auxiliary boom, the assembly / disassembly of additional lattice sections may be performed using the crane itself.
In order to do so, proceed as follows.
- ▶ Luff the auxiliary boom down until the end section is lightly touching the ground, fig. 2.
- ▶ Release and unpin pins at both sides (level **B**) at point **1**, fig. 2.
- ▶ Luff the auxiliary boom down until the lattice section to be disassembled are completely laying on the ground, fig. 3.
- ▶ Release and unpin pins at both sides (level **A**) at point **2**, fig. 3.
- ▶ Completely remove the auxiliary boom.



B197710 *Example for cranes with lattice mast booms*

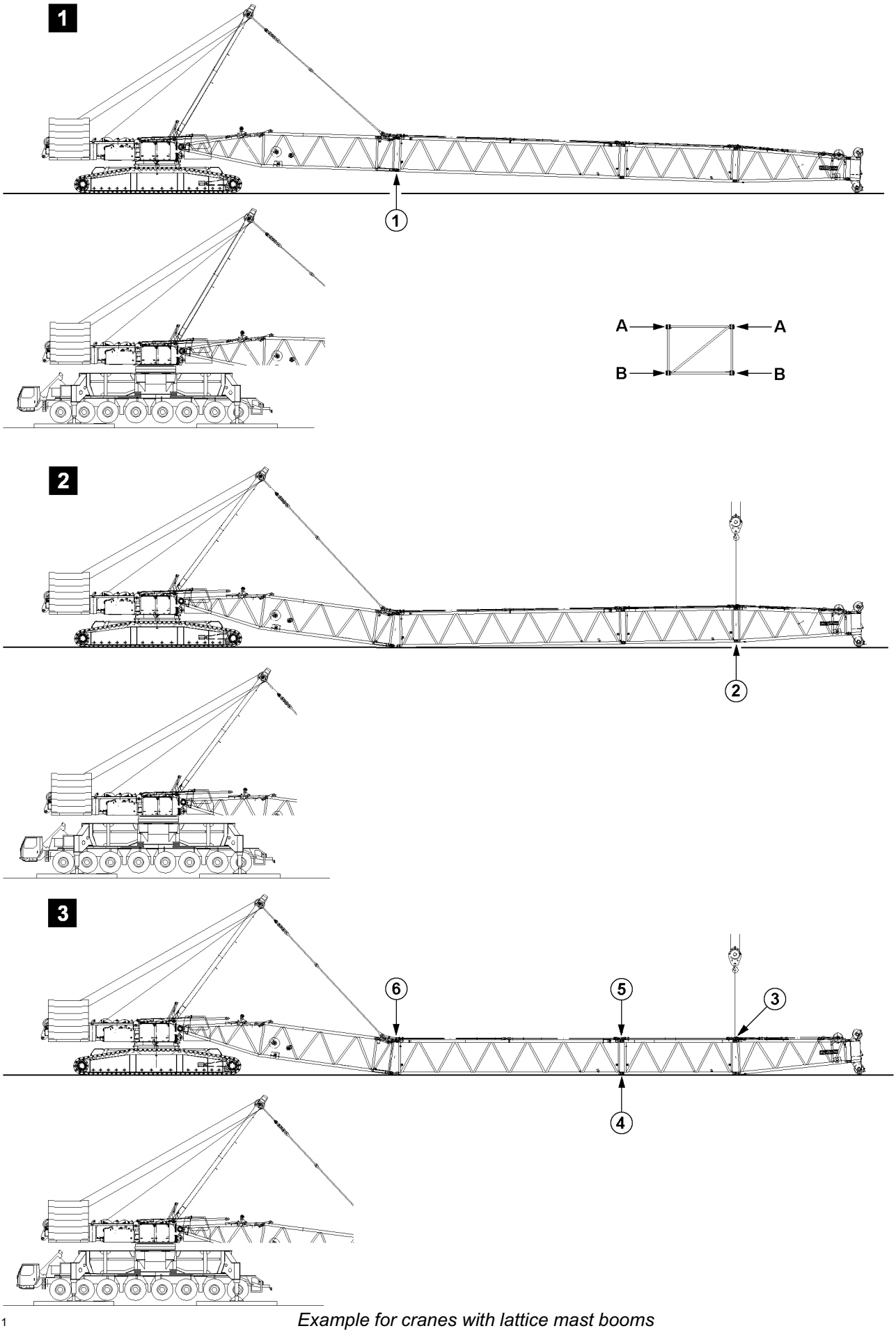
10.3 Assembly of lattice sections for lattice mast cranes

10.3.1 Assembly of lattice sections

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

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

- ▶ Pin and secure pins at both sides (level **A**) at point **1**, fig. 1.
- ▶ Pin and secure pins at both sides (level **A**) at point **2**, fig. 1.
- ▶ Pin and secure pins at both sides (level **B**) at point **3**, fig. 1.
- ▶ Pin and secure pins at both sides (level **A**) at point **4**, fig. 1.
- ▶ Lift the end section with the auxiliary crane, fig. 2.
- ▶ Pin and secure pins at both sides (level **B**) at point **5**, fig. 2.
- ▶ Lift the lattice sections, fig. 3.
- ▶ Pin and secure pins at both sides (level **B**) at point **6**, fig. 3.



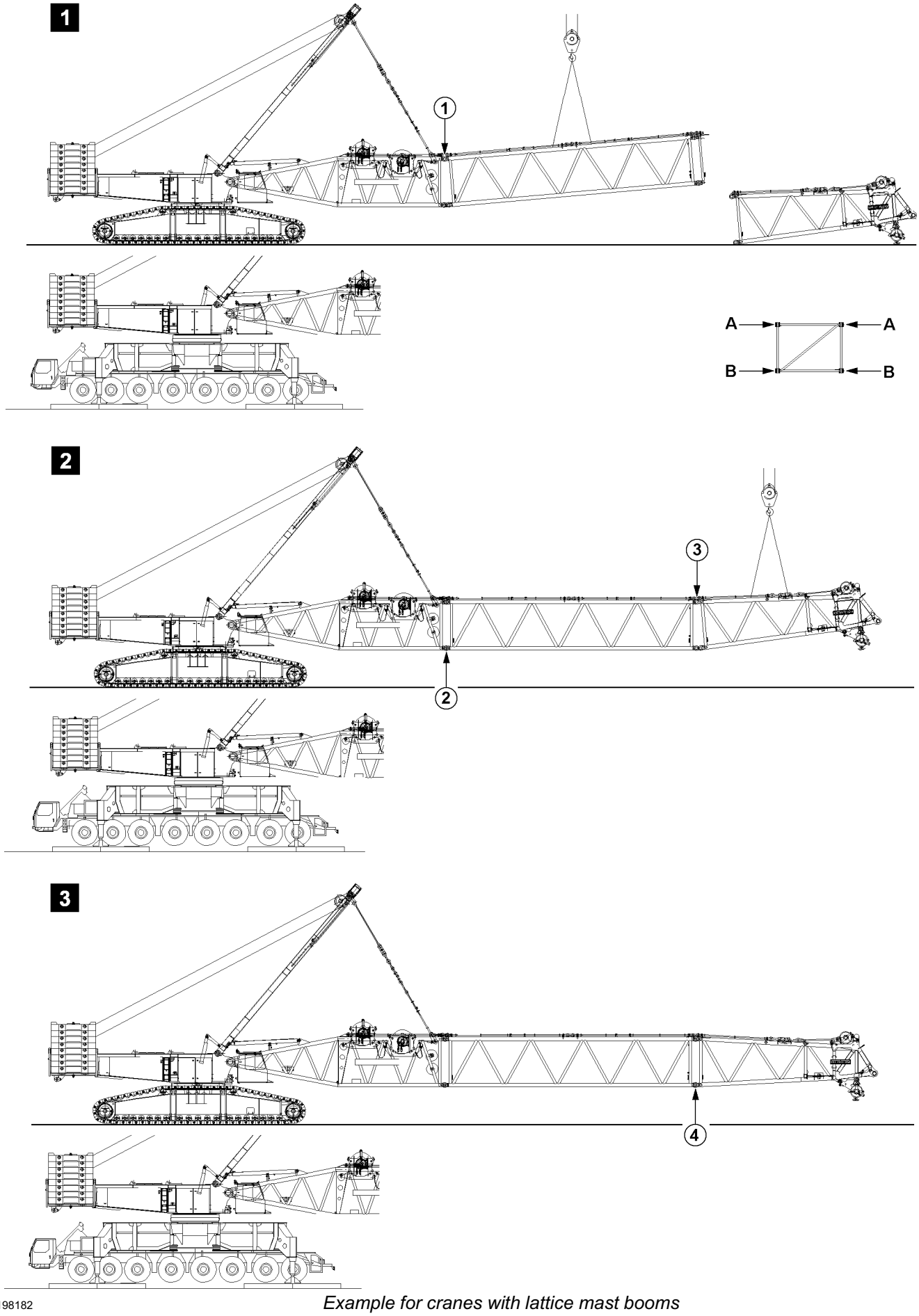
B197711 *Example for cranes with lattice mast booms*

10.3.2 Disassembly of lattice sections

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

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

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



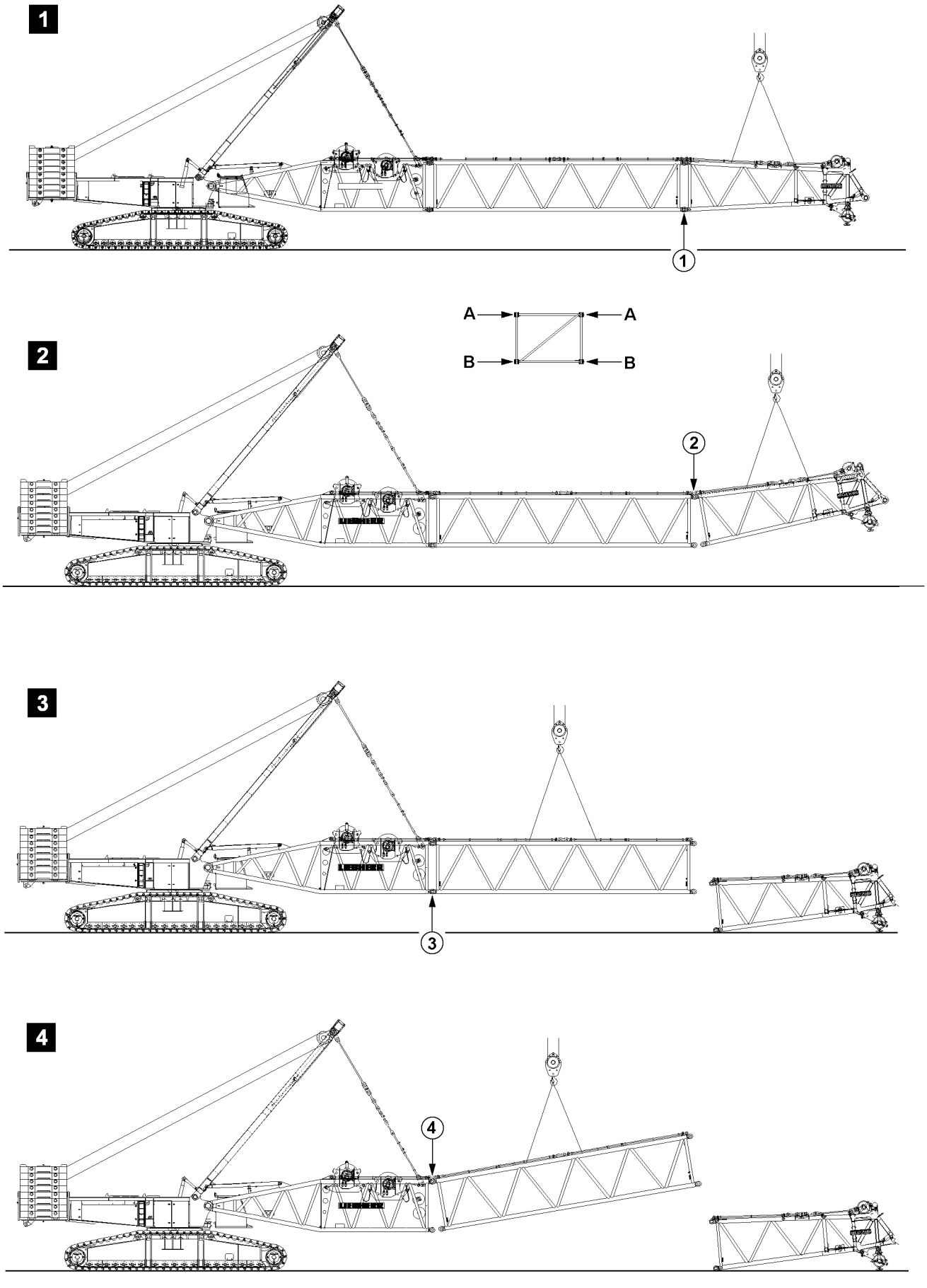
B198182 *Example for cranes with lattice mast booms*

10.3.3 Flying assembly of lattice sections

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

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

- ▶ Pin and secure pins at both sides (level **A**) at point **1**, fig. 1.
- ▶ Pin and secure pins at both sides (level **B**) at point **2**, fig. 2.
- ▶ Pin and secure pins at both sides (level **A**) at point **3**, fig. 2.
- ▶ Pin and secure pins at both sides (level **B**) at point **4**, fig. 3.



B105511

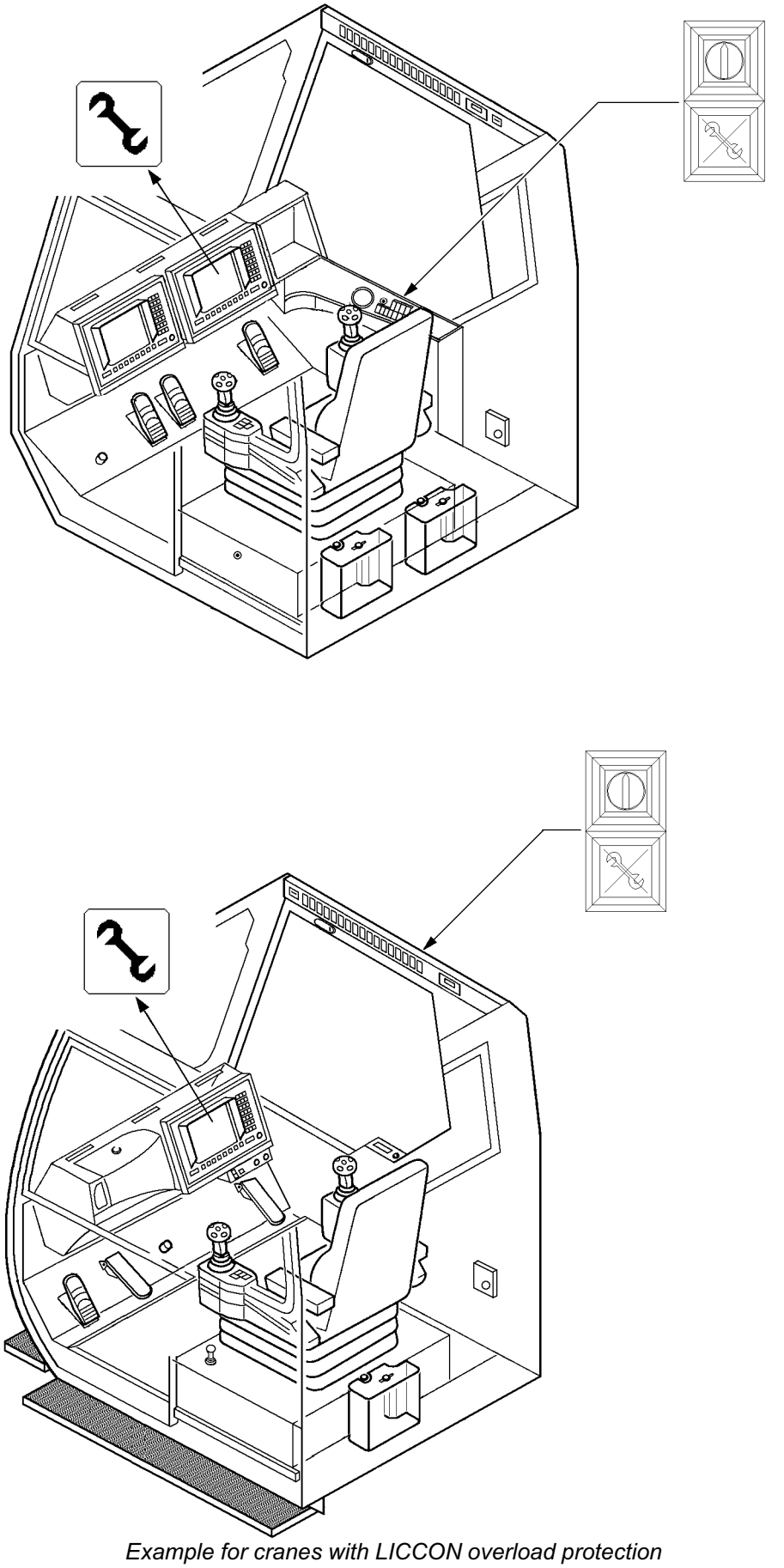
Example for cranes with lattice mast booms

10.3.4 Flying disassembly of lattice sections

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

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

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



B197717

Example for cranes with LICCON overload protection

10.4 Bypass for assembly and disassembly

Note

▶ The assembly keyed button is only installed on certain cranes.

WARNING

High risk of injury when operating crane with assembly keyed button enabled!

Operating the assembly keyed button bypasses the hoist limit switch and the overload protection!

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 killed!

This could result in high property damage!

▶ Only operate the assembly key button when performing assembly and disassembly tasks!

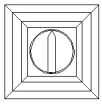
▶ All other usage of the assembly keyed button other than as described in the operating instructions is prohibited!

▶ The assembly keyed button may only be operated by persons, who are aware of the consequences of a bypass!

▶ Operating the crane with the assembly keyed button enabled is strictly prohibited!

▶ The assembly keyed button must be removed immediately and handed to an authorized person after carrying out any assembly and disassembly work!

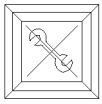
10.4.1 Crane with LICCON overload protection



▶ Actuate assembly keyed button.

Result:

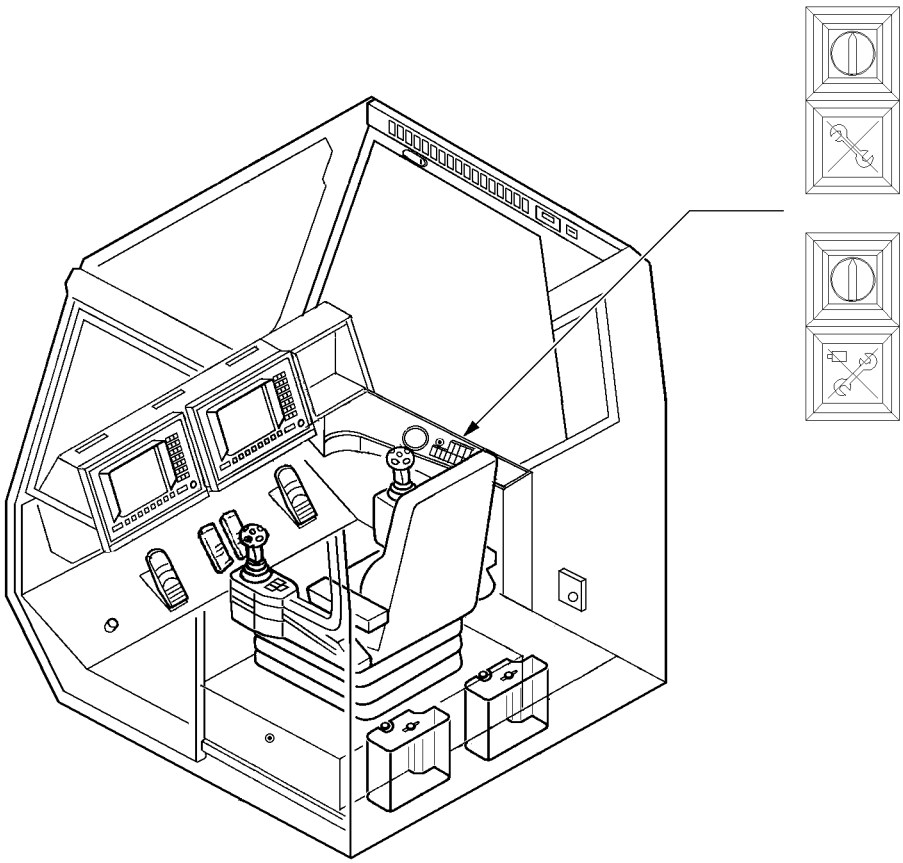
– The LICCON overload protection is inactive.
– The indicator light in the button lights up.
– The assembly symbol on the LICCON monitor blinks.
– An acoustic signal sounds.
– The red beacon on the crane cab blinks.



▶ To turn the assembly keyed button off:
Turn off the assembly keyed button by pressing the button.

Result:

– The LICCON overload protection is active.
– The indicator light in the button turns off.
– The assembly icon on the LICCON monitor turns off.
– The acoustical signal turns off.
– The red flashing beacon on the crane cab turns off.

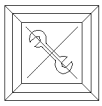


B198078 *Example for cranes with LICCON overload protection*

10.5 Bypassing during crawler assembly

Note

▶ The crawler assembly keyed button is only installed on certain cranes.



Make sure that the following prerequisites are met:

– The assembly keyed button is actuated.
– The indicator light in the button lights up.

WARNING

High risk of injury in case of actuated crawler assembly keyed button!

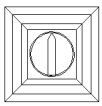
Operating the crawler assembly keyed button bypasses the overload protection! No shut off at overload will occur in assembly mode or in crane operations!

In the event of deliberate misuse, the crane can topple over!

Personnel can be killed!

This could result in high property damage!

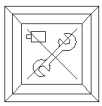
▶ The crawler assembly keyed button may only be actuated for assembly tasks!
▶ All other usage of the crawler assembly keyed button other than as described in the operating instructions is prohibited!
▶ Operating the crane with the crawler assembly keyed button enabled is strictly prohibited!



▶ Actuate the crawler assembly keyed button.

Result:

– The LICCON overload protection is inactive.
– The indicator light in the button lights up.



▶ To turn the crawler assembly keyed button off:
Turn off the crawler assembly keyed button by pressing the button.

Result:

– The indicator light in the button turns off.

10.6 Assembling / disassembly of hydraulic lines

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

WARNING

Risk of accident due to loss of pressure or leakage!

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

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

- ▶ Release the pressure in the hydraulic system before connecting and disconnecting. Turn the engine off and wait for short time.
- ▶ Assemble coupling components (sleeve and connector) and screw together using hand-tightened nut.
- ▶ Tighten hydraulic coupling by hand. Rotate hand-tightened nut until it reaches a tangible, fixed stop position.

11 Erection / take down

Make sure that the following prerequisites are met:

- On mobile cranes:
  The crane is properly supported.
- The crane is horizontally aligned.
- The counterweight has been attached to the turntable according to the load chart.
- On crawler cranes:
  The central ballast has been attached according to the load chart.
- On crawler cranes:
  The counterweight is stacked on the suspended ballast or on the ballast trailer according to the load chart.
- On mobile cranes:
  Telescopic boom is fully telescoped in.
- The boom has been attached according to the load chart specifications and the Operating instructions.
- All limit switches have been correctly installed and are fully functioning.
- All pin connections have been secured.
- The hoist rope has been correctly placed in the rope pulleys and prevented from jumping out using rope retaining pins.
- No persons are present in the danger zone.
- There are no loose parts on the telescopic boom or the auxiliary boom.
- In winter, the telescopic boom, boom and associated components (limit switches, cable drums, flashing beacon, wind speed sensor etc.) must be kept free of ice and snow.

WARNING
Risk of fatal injury!

- ▶ Incorrectly installed or non-operational limit switches and falling parts (pins, spring retainers, ice etc.) can cause accidents!

11.1 Checking the prerequisites

- ▶ Check if all prerequsites have been met.

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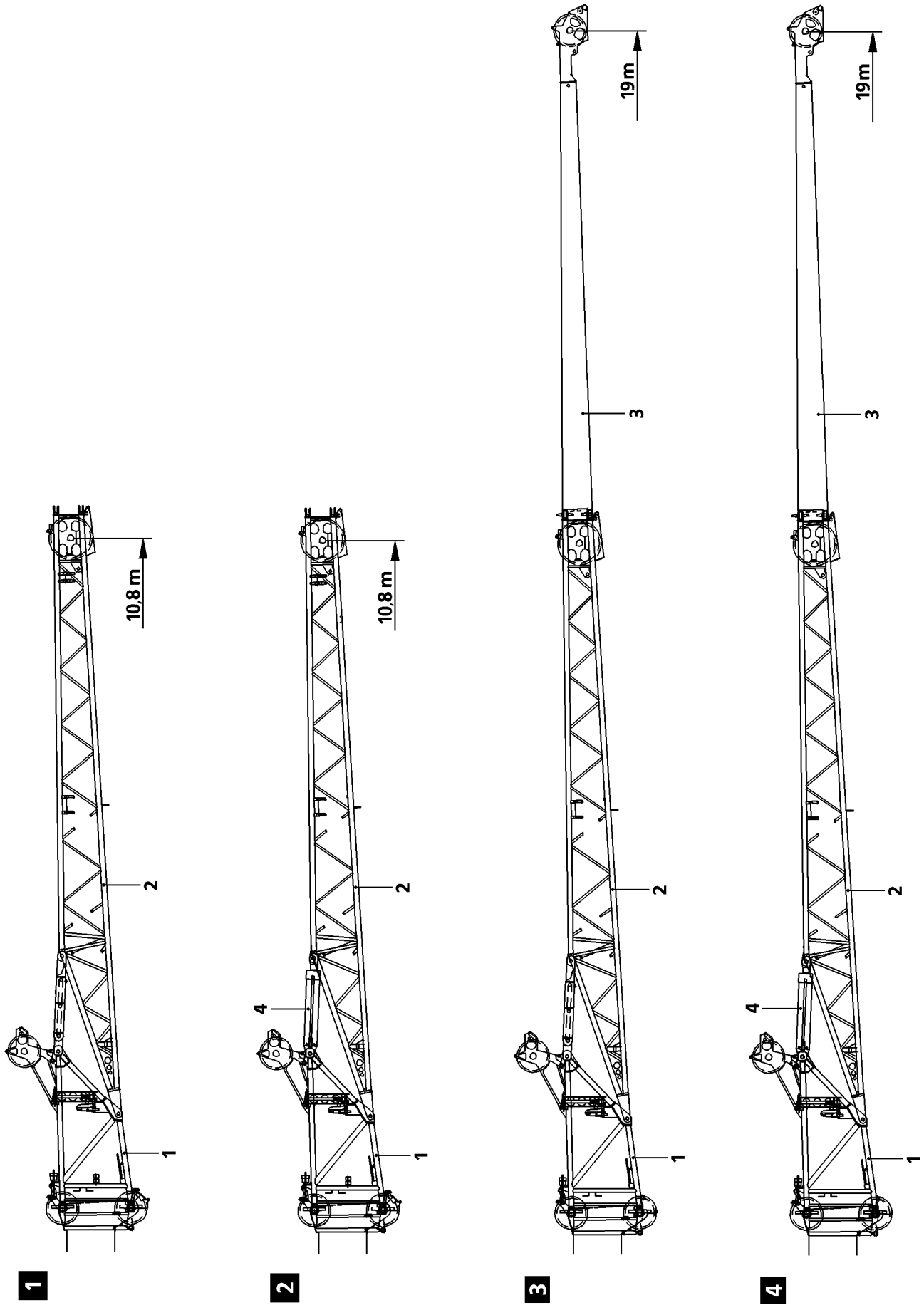


B198646

1 General

The folding jib versions for TK operation (mechanical angle adjustment) and TNZK operation (hydraulic angle adjustment) can be self-assembled on the telescopic boom.
The folding jib can be operated as a single folding jib with a height of 10.8 m or as a dual folding jib with a height of 19 m.
The folding jib with “mechanical angle adjustment” can be mounted on the telescopic boom from 0° to 20° or 40°.
The folding jib with “hydraulic angle adjustment” can be luffed under load from 0° to 40°.

1.1 Folding jib variations

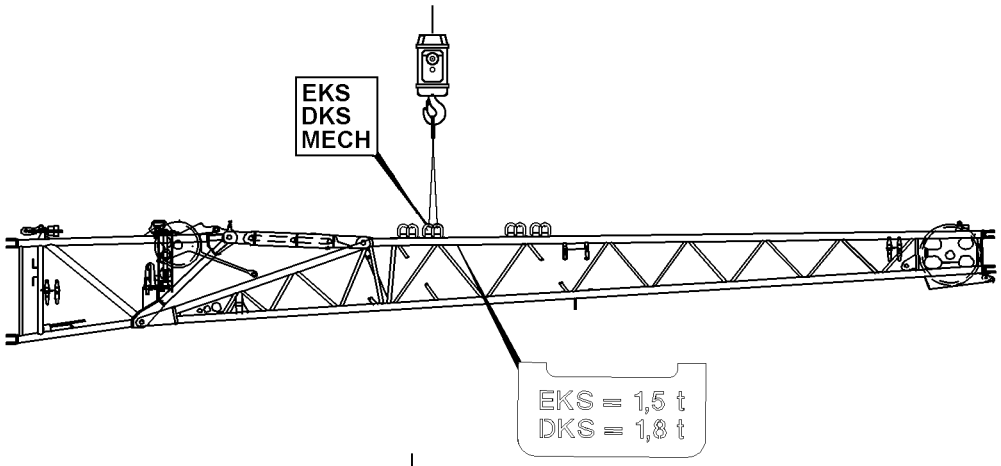
1.1.1 Single folding jib, see illustrations 1 and 2

Position	Description	Length
1	Adapter	
2	Articulated piece	
4	Pulley block	
Length of single folding jib		10.8 m

1.1.2 Dual folding jib, see illustrations 3 and 4

Position	Description	Length
1	Adapter	
2	Articulated piece	
3	Head piece	
4	Pulley block	
Length of dual folding jib		19 m

5



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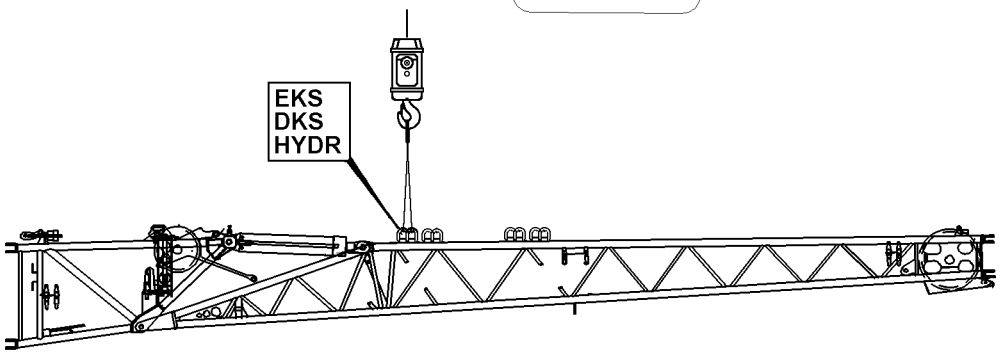

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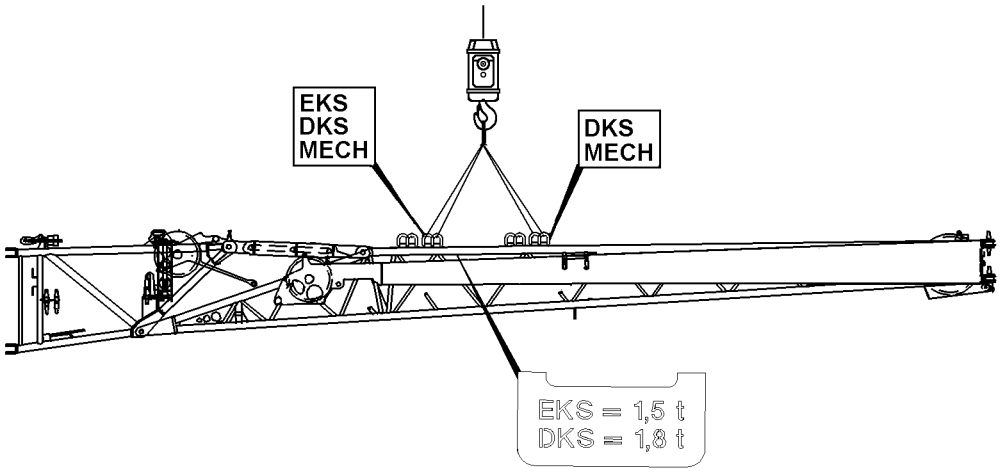

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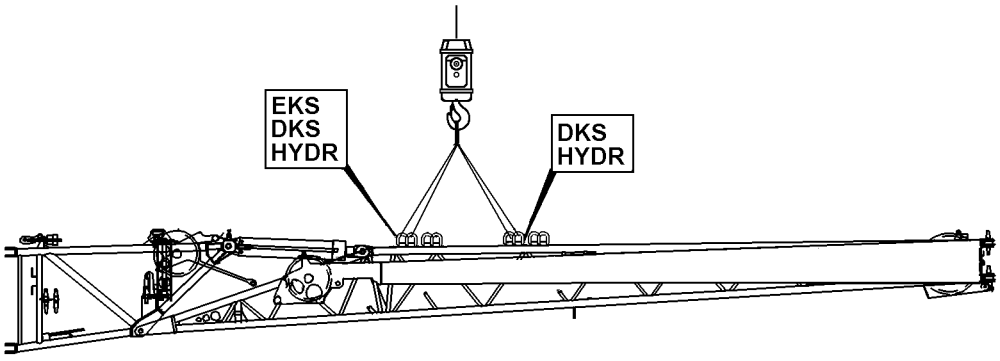

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1.2 Fastening points

With fastening points the head piece, if also transported, must be folded in and locked.
Various fastening eyes are installed on the folding jib for the different methods of transporting it. The transportation methods are separated into single or dual folding jib and/or “mechanical angle adjustment” or “hydraulic angle adjustment”.
The appropriate fastening eyes and points are marked with tags.

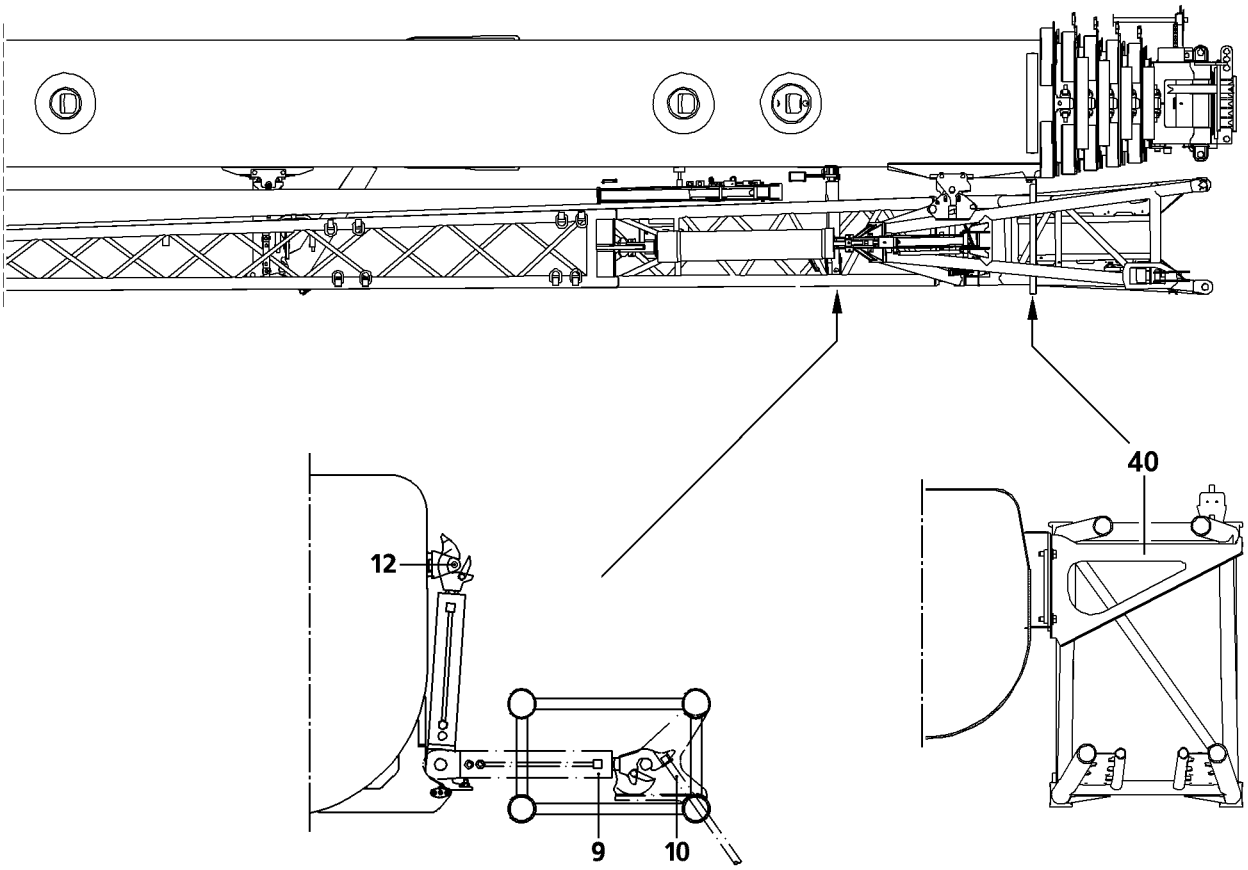
DANGER
Accident risk if incorrectly attached!
Life-threatening situations can arise if the folding jib is improperly or incorrectly fastened.
▶ Please ensure that the folding jib is attached in accordance with the fastening points as shown on the signs!

1.2.1 Single folding jib, see illustrations 5 and 6

Description	Abbreviation	Weight
Single folding jib	EKS	1.5 t
mechanical	MECH	
hydraulic	HYDR	

1.2.2 Dual folding jib, see illustrations 7 and 8

Description	Abbreviation	Weight
Dual folding jib	DKS	1.8 t
mechanical	MECH	
hydraulic	HYDR	



B103740

2 Assembly of the folding jib

In tele operation, the swing cylinder **9** can be folded up if necessary and pinned with a pin **12**.

2.1 General

DANGER
Danger of fatal injuries due to falling folding jib!
As a result of improperly mounted, damaged or non-existing catch bar **40** on the telescopic boom articulated piece, the folding jib – due to an assembly error – can fall down and cause fatal injuries.

- ▶ Before folding jib assembly, make sure that the catch bar **40** is properly mounted on the telescopic boom articulated piece and that it is not damaged.
- ▶ The catch bar **40** is a mechanical safety device. For that reason, it is prohibited to change the catch bar **40** in any way.
- ▶ Standing under the folding jib during the swing operation is prohibited!
- ▶ It is prohibited for anyone to remain in the swing range as well as the folding range of the folding jib!
- ▶ The folding jib must be secured with an auxiliary rope during the swing process!

DANGER
Danger of falling!
During assembly and disassembly, personnel must be secured with appropriate antifall guards to prevent them from falling. If this is not observed, personnel could fall and suffer life-threatening injuries.

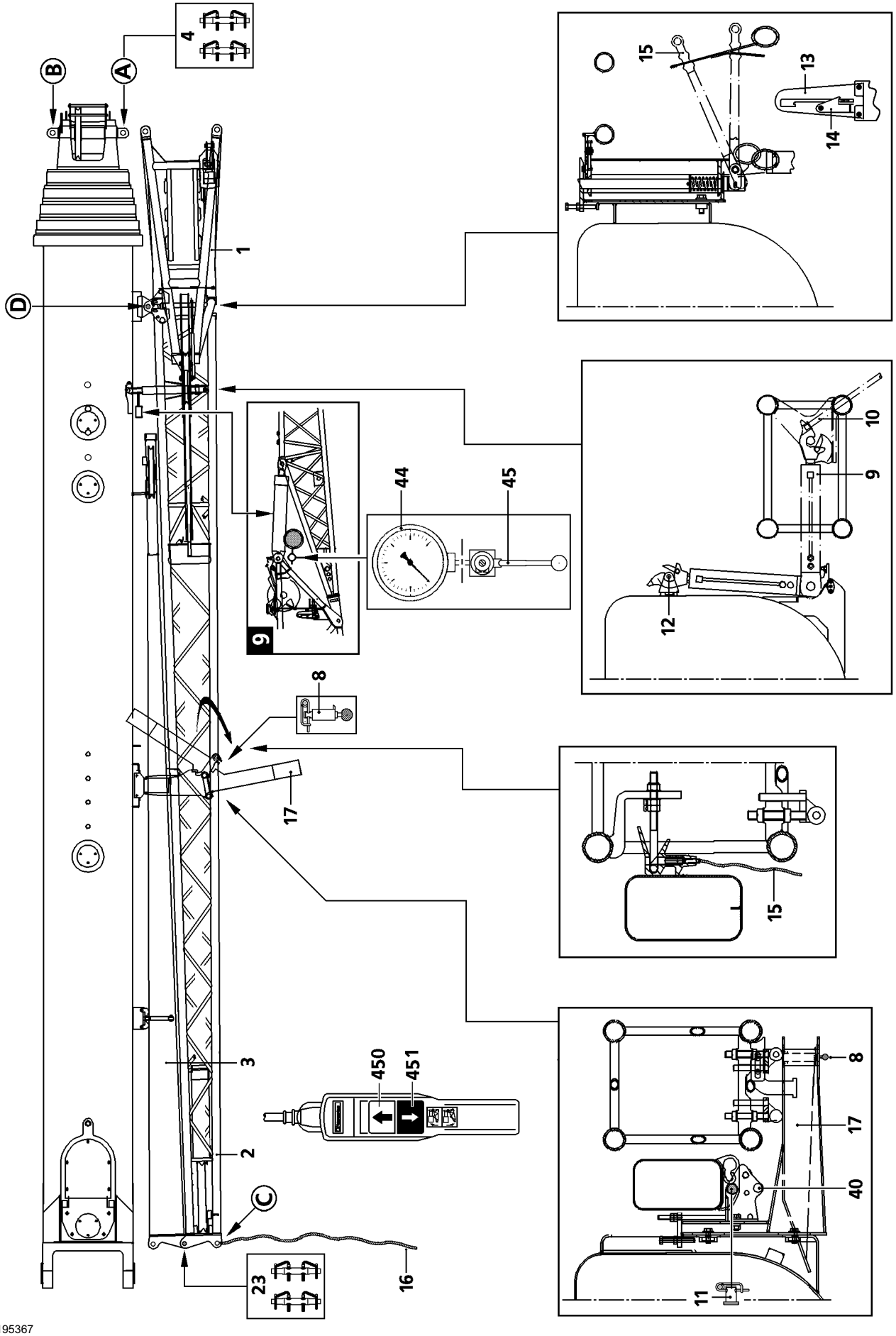
- ▶ All assembly work from a height of 2 m must generally be carried out using suitable aids (lifting platforms, scaffolding, ladders, auxiliary crane, etc.)! The height above which assembly/disassembly work must be carried out with aids depends on national regulations. The national regulations must be adhered to!
- ▶ If work cannot be carried out using these aids or from the ground, the assembly personnel must be protected from falling using suitable means (such as safety belts)!
- ▶ Do not walk on the telescopic boom or folding jib!

Ensure that the following prerequisites are met:

- – the crane is aligned in horizontal direction
- – the counterweight has been attached to the turntable according to the load chart
- – the central ballast is attached to the crane chassis in accordance with the load chart specifications
- – the telescopic boom is fully telescoped in
- – the folding jib has been secured on the telescopic boom articulated piece for transport
- – the telescopic boom has been luffed down to the rear or the side in the 0° position

DANGER
Danger of accident if the folding jib swings out by itself when it is unpinned!
If the telescopic boom is not in the 0° position, there is a danger of accidents if the folding jib swings out by itself when it is unpinned.

- ▶ Move the telescopic boom to 0° position.



B195367

2.2 Reeving out the hoist rope on the telescopic boom head

In order to speed up the subsequent reeving in of the hoist rope after assembly of the folding jib, set down the hook block at a distance from the crane, approximating to the subsequent distance of the telescoped in telescopic boom **with** assembled folding jib.

- ▶ Telescope the telescopic boom out to the corresponding length.
- ▶ Place the hook block on the ground.
- ▶ Detach the hoist rope at the rope fixed point.
- ▶ For safety reasons, remove the hoist limit switch weight and the chain.

Note

- ▶ When operating the folding jib, the hoist limit switch must be pulled mechanically and the control rope must be attached to the telescopic boom head with a snap hook.
- ▶ The telescopic boom may remain reeved if the hoist rope of winch 2 is used for folding jib operation.

- ▶ Remove the rope retaining tube at the pulley head and the end pulley.
- ▶ Fully telescope the telescopic boom in again.

2.3 Important check before swinging out the hydraulic folding jibs (TNZK operation)

DANGER

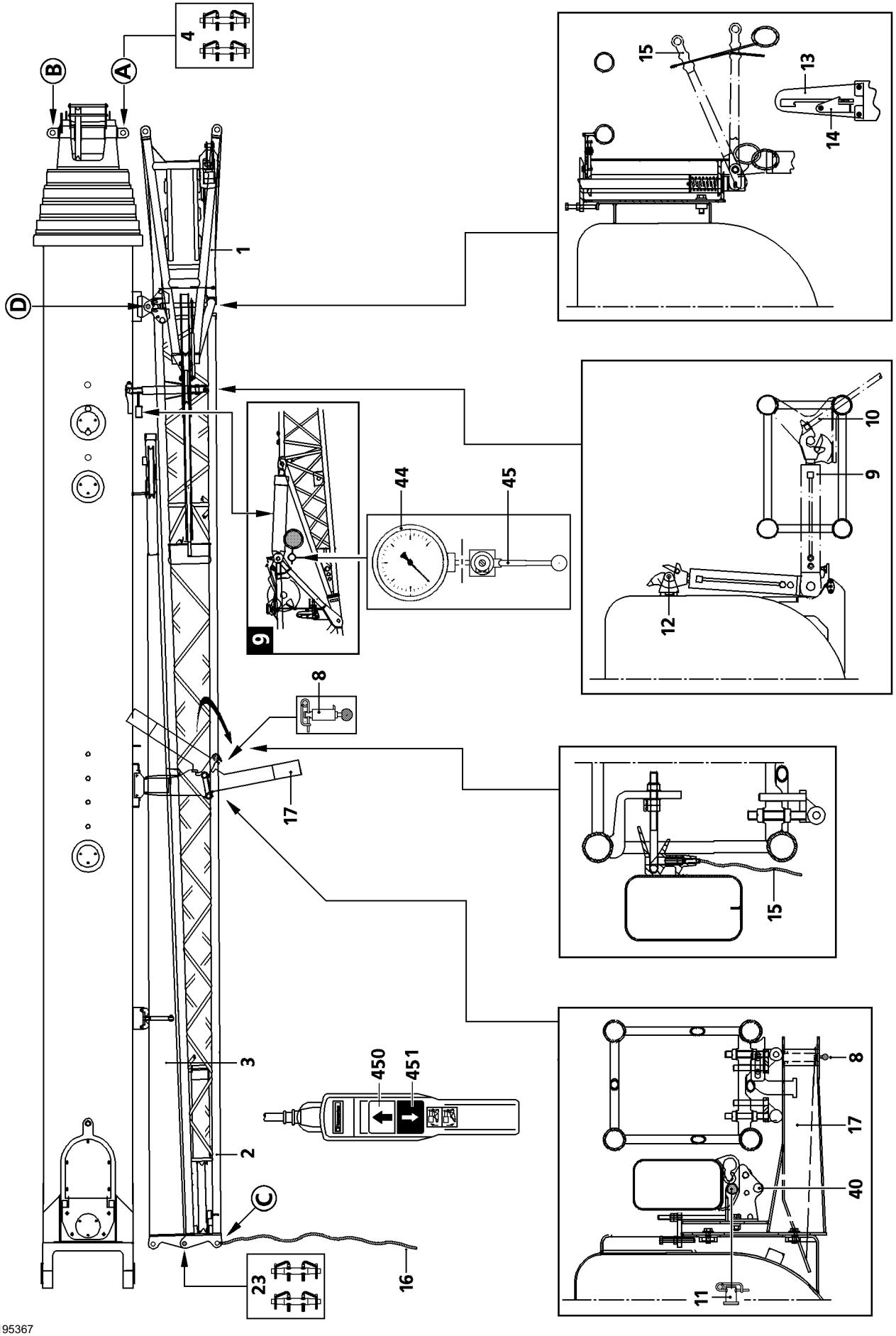
Danger of fatal injury if the folding jib folds down by itself!

When using hydraulic folding jibs (TNZK operation), prior to swinging out the folding jib, check whether a pressure of 60 bar is shown on the pressure gauge **44**. If the pressure on the pressure gauge **44** is too low, fatal accidents can occur if the folding jib folds down by itself!

- ▶ It is **expressly prohibited** to swing the folding jib out with less than 60 bar on the pressure gauge **44**.

The ball valve **45** may only be operated during maintenance operations.

- ▶ If the pressure shown on the pressure gauge **44** is too low:
  Connect hydraulic lines.
- ▶ Actuate luff up the folding jib until a pressure of at least 60 bar is shown on the pressure gauge **44**.



B195367

2.4 Assembly of the single folding jib carried on the crane

The head piece **3**, which is not required, remains pinned to the telescopic boom during single folding jib operation.

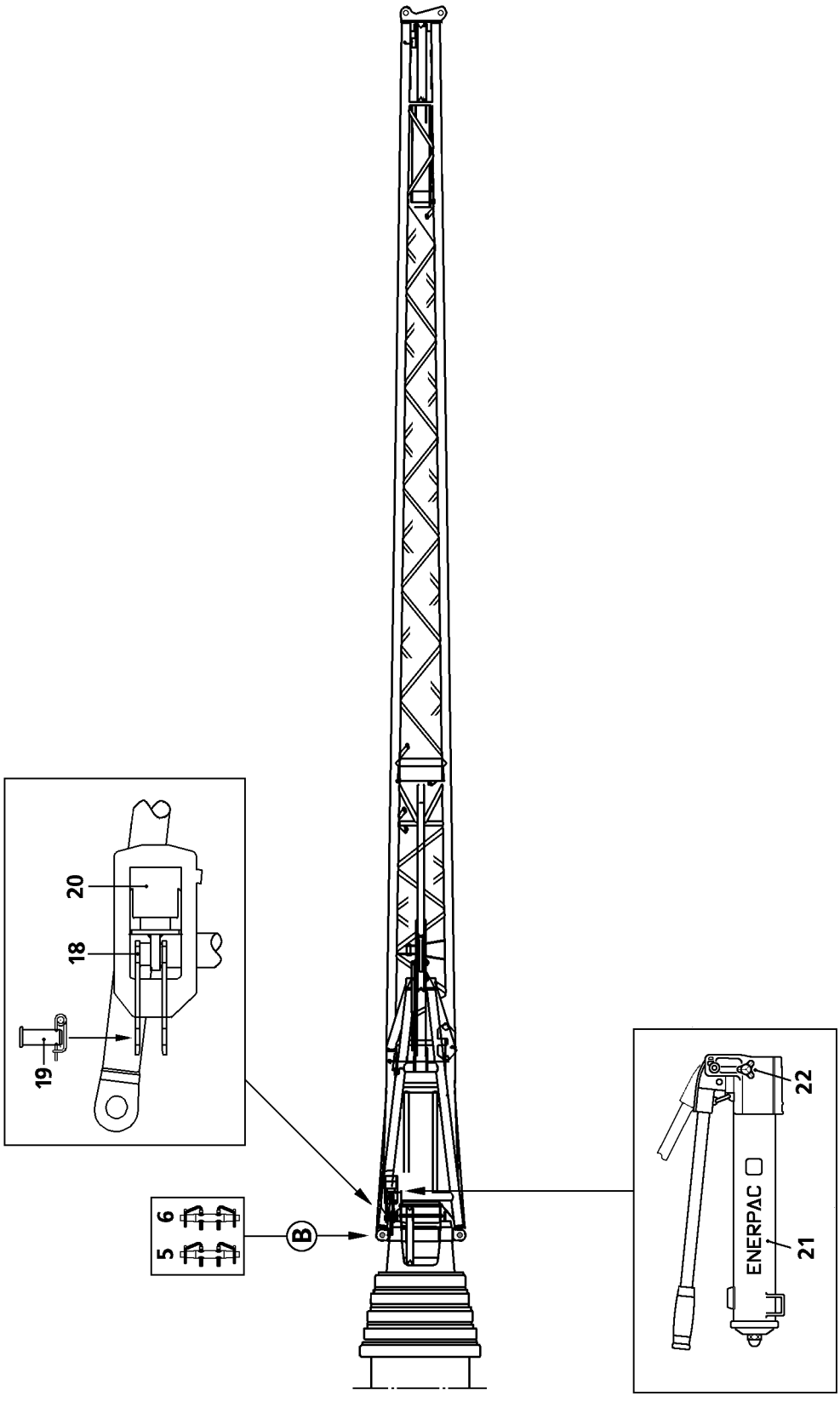
DANGER
Danger of fatal injury due to toppling head piece!
During operation with the single folding jib, the head piece **3** may not be unpinned from the telescopic boom. Otherwise there is a danger of injury from the toppling head piece **3**.
▶ Do not unpin the head piece from the telescopic boom!

When swinging the folding jib support **17** in and out, make sure that the spring-loaded pin **8** is unlocked using one hand and that the folding jib support **17** is moved overhead with the other hand.
▶ Release and unpin the spring-loaded pin **8**.
▶ Swing the folding jib support **17** out until the spring-loaded pin **8** reengages.

With “hydraulic folding jibs” (TNZK operation) the hydraulic line must be disconnected before swinging out the folding jib.
▶ If a hydraulic folding jib is carried along:
Disconnect hydraulic line to hydraulic cylinder (illustration 9).
▶ Attach the auxiliary rope **16** at point **C**.
▶ If a dual folding jib is carried along:
Release and unpin the pins **23**.
▶ If a dual folding jib is carried along:
Pull the nylon rope **15** and loosen the lock between the head piece **3** and the articulated piece **2**.
▶ Start the crane engine.
▶ Press button **451** and swing out the folding jib with swing cylinder until it can be pinned at point **A**.
▶ Insert the pins **4** at the top and at the bottom at point **A** and secure.

DANGER
Danger of fatal injury due to toppling folding jib!
Special retaining clips must be used to secure the pins **4**. The use of spring-loaded pins or safety springs on the pins **4** is not permitted. The folding jib may only be unlocked at point **D**, when the pins **4** are pinned and secured at the top and bottom at point **A**.
▶ Pin and secure pins **4** at point **A** at top and bottom.

▶ Swing the safety bracket **14** with assembly rod **10** to the side.
▶ Push lever **15** with assembly rod **10** upwards and latch into the platform.
▶ Press button **451** and swing the folding jib with swing cylinder all the way out.
▶ Unlock the swing cylinder **9** with assembly rod **10**.



B190754

DANGER
Danger of fatal injuries due to falling folding jib!
The folding jib could fall down due to an assembly error.
- ▶ Standing under the folding jib during the swing operation is prohibited!
- ▶ It is prohibited for anyone to remain in the swing range as well as the folding range of the folding jib!

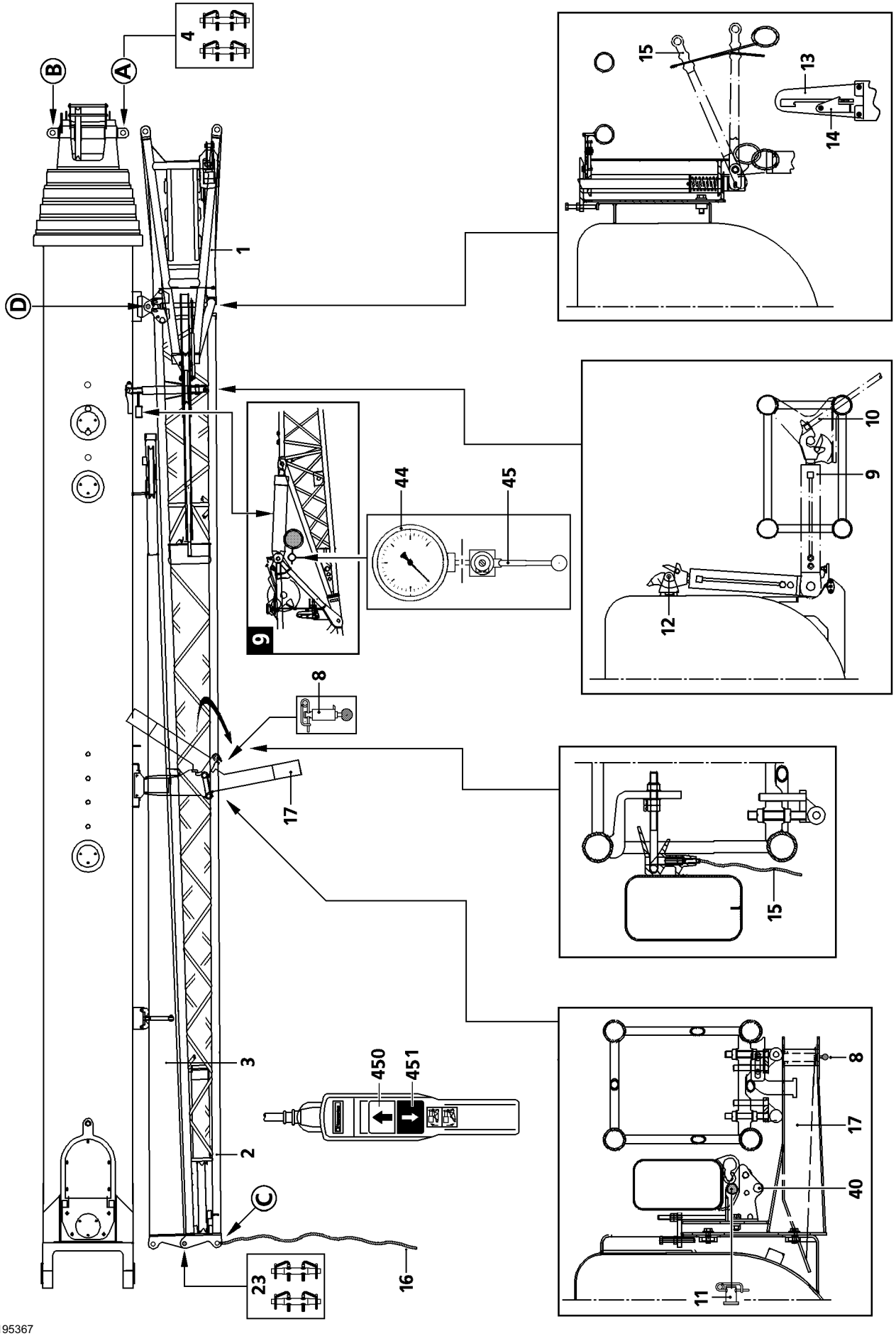
▶ Swing articulated piece **2** with auxiliary rope by 180° until it can be pinned at top and bottom at point **B**.

DANGER
Risk of accident!
- ▶ The use of spring-loaded pins or safety springs is prohibited on pin **5** and pin **6**!
- ▶ To secure the pin **5** and the pin **6**, use the special retaining clips.

▶ Pin and secure pin **5** at bottom at point **B**.

In order to pin at the top of the point **B**, the hydraulic/mechanical assembly aid **20** must be used.
- ▶ Release pin **19** and unpin from bore **18**.
- ▶ Pin and secure the assembly aid **20** to the towing bracket with pin **19**.
- ▶ Close the knob **22** on the manual pump **21**.
- ▶ Extend the hydraulic cylinder of the assembly aid **20** by operating the manual pump **21** until the bore on the eye of the folding jib is aligned with that on the telescopic boom.
- ▶ Pin and secure the pin **6** on top on point **B**.
- ▶ Open the knob **22**.

Result:
– The hydraulic cylinder of the assembly aid **20** returns to the starting position and the pin is released.



B195367

2.5 Assembly of the dual folding jib carried on the crane

2.5.1 Articulated piece assembly

When swinging the folding jib support **17** in and out, ensure that the spring-loaded pin **8** is unlocked using the first hand and that the folding jib support **17** is moved overhead by using the second hand.

- ▶ Release and unpin the spring-loaded pin **8**.
- ▶ Swing the folding jib support **17** out until the spring-loaded pin **8** locks again.

With “hydraulic folding jibs” (TNZK operation) the hydraulic line must be disconnected before swinging out the folding jib.

- ▶ If a hydraulic folding jib is carried along:
  Disconnect hydraulic line to hydraulic cylinder (illustration 9).
- ▶ Attach the auxiliary rope **16** at point **C**.
- ▶ Release and unpin pins **11** and pin into hole **40**.
- ▶ Press button **451** and swing out the folding jib with swing cylinder until it can be pinned at point **A**.
- ▶ Pin upper and lower pins **4** at point **A** and secure.

DANGER
Danger of fatal injury due to toppling folding jib!
Special retaining clips must be used to secure the pins **4**. The use of spring-loaded pins or safety springs on the pins **4** is not permitted. The folding jib may only be unlocked at point **D**, when the pins **4** are pinned and secured at the top and bottom at point **A**.

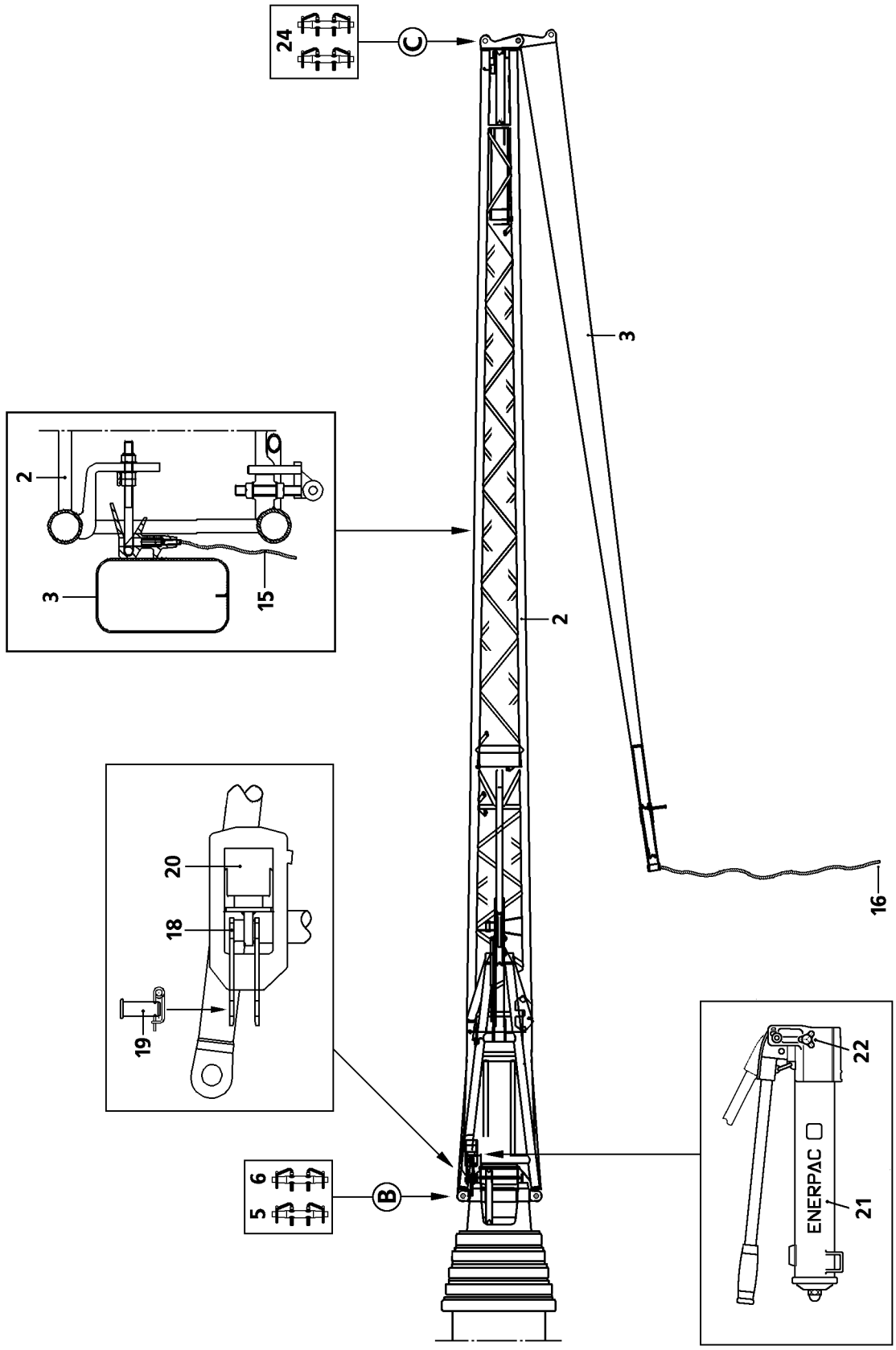
- ▶ Pin and secure pins **4** at point **A** at top and bottom.

- ▶ Swing the safety bracket **14** with assembly rod **10** to the side.
- ▶ Push lever **15** with assembly rod **10** upwards and latch into the platform.
- ▶ Press button **451** and swing the folding jib with swing cylinder all the way out.
- ▶ Unlock the swing cylinder **9** with assembly rod **10**.

DANGER
Danger of fatal injury due to toppling folding jib!
It is forbidden to stand beneath the folding jib during the swing operation, since the folding jib could topple if it was incorrectly fitted!

- ▶ No persons or objects must be present in the swinging or folding area of the telescopic boom or folding jib.

- ▶ Swing folding jib with auxiliary rope **16** by 180° until it can be pinned at top and bottom at point **B**.



B194013

2.5.2 Articulated piece assembly, continued

DANGER
Risk of accident!
- ▶ The use of spring-loaded safety pins or safety springs is prohibited on pins **5** and pins **6**!
- ▶ Special retaining clips must be used to secure pins **5** and pins **6**.

- ▶ Pin and secure pin **5** at bottom at point **B**.

In order to pin at the top of the point **B**, the hydraulic/mechanical assembly aid **20** must be used.
- ▶ Release pin **19** and unpin from bore **18**.
- ▶ Pin and secure the assembly aid **20** to the towing bracket with pin **19**.
- ▶ Close the knob **22** on the manual pump **21**.
- ▶ Extend the hydraulic cylinder of the assembly aid **20** by operating the manual pump **21** until the bore on the eye of the folding jib is aligned with that on the telescopic boom.
- ▶ Pin and secure the pin **6** on top on point **B**.
- ▶ Open the knob **22**.

Result:
– The hydraulic cylinder of the assembly aid **20** returns to the starting position and the pin is released.

2.5.3 Assembly of head piece

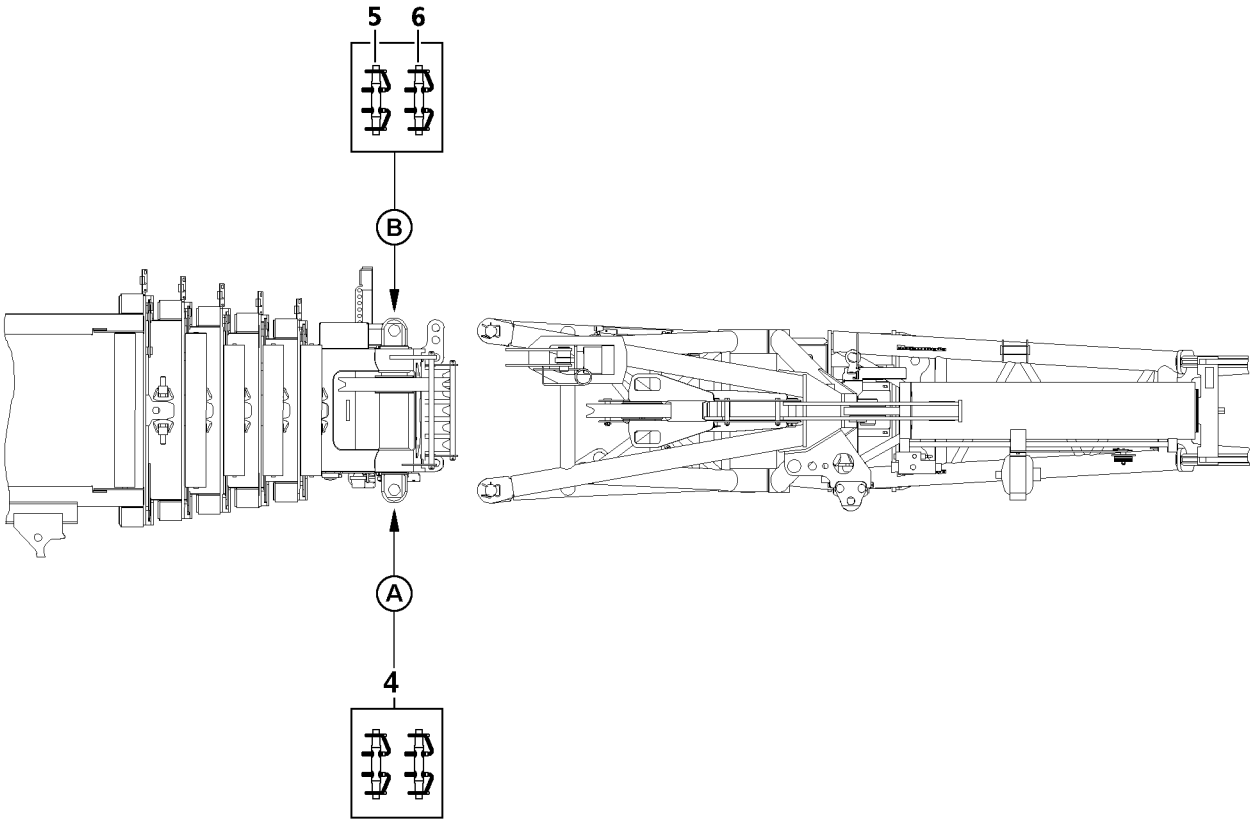
- ▶ Remove auxiliary rope **16** at point **C** and attach on head piece **3**.
- ▶ Pull nylon rope **15** and release locking mechanism between head piece **3** and articulated piece **2**.

CAUTION
Headpiece can swing out involuntarily!
- ▶ Hold head piece with auxiliary rope during unlocking procedure to prevent the head piece from swinging out involuntarily.

- ▶ Swing the head piece **3** forward by 180° until it can be pinned at point **C**.

DANGER
Danger of fatal injury due to toppling folding jib!
It is forbidden to stand beneath the folding jib during the swing operation, since the folding jib could topple if it was incorrectly fitted!
- ▶ No persons or objects must be present in the swinging or folding area of the telescopic boom or folding jib.

- ▶ Pin and secure pins **24** at top and bottom using safety clips.
- ▶ Remove auxiliary rope.



B197651

2.6 Assembly of the separately transported folding jib

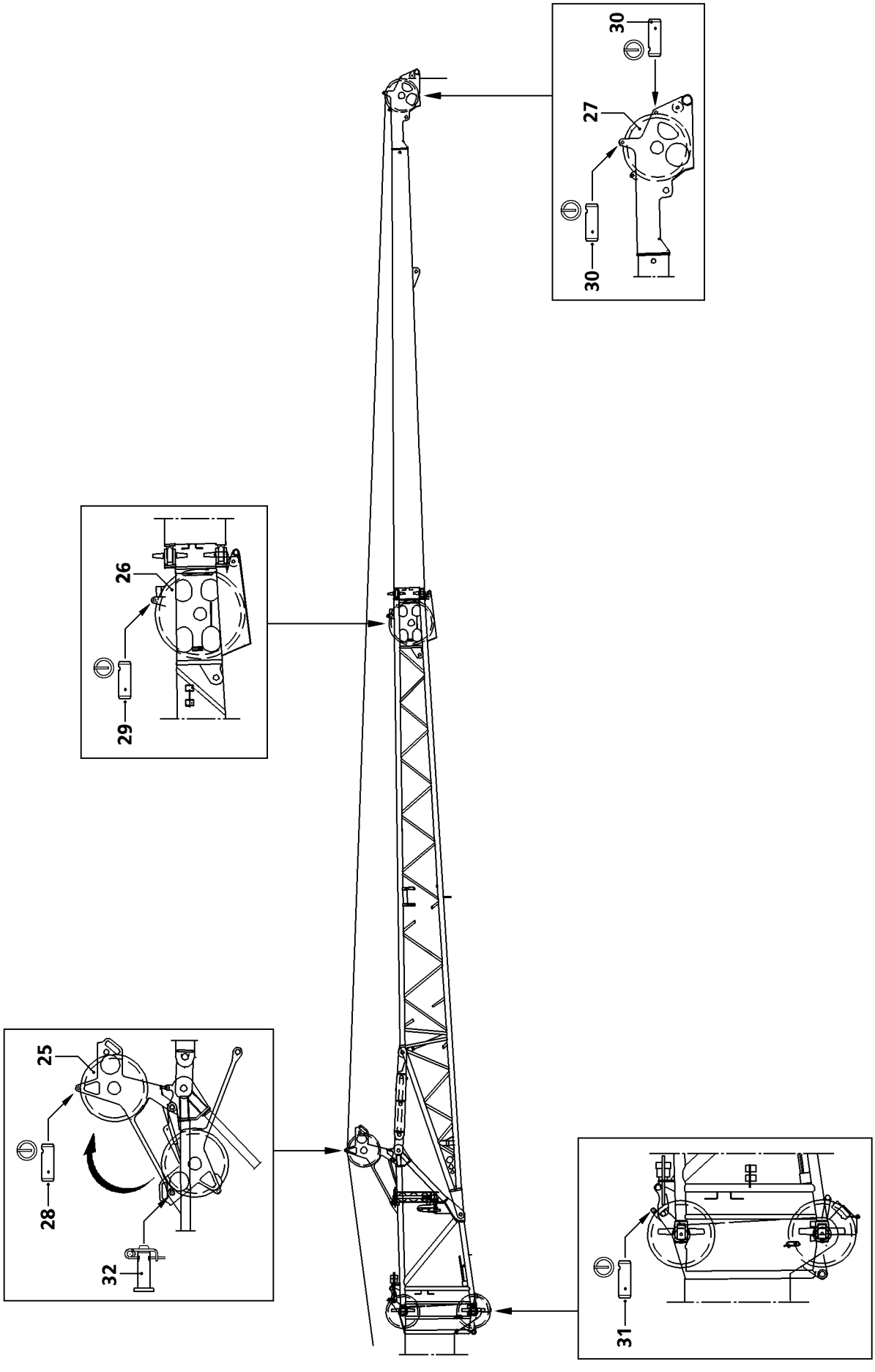
For description of fastening points, see section “Fastening points”.

- ▶ Attach the auxiliary crane to corresponding fastening points on folding jib.
- ▶ Lift the folding jib with the auxiliary crane and guide it into pin points on the telescopic boom.

DANGER
Risk of accident!

- ▶ The use of spring-loaded pins or safety springs is prohibited on pins **4**, **5** and **6**!
- ▶ Use the special retaining clips to secure pins **4**, **5** and **6**.

- ▶ Pin the folding jib to telescopic boom:
- ▶ Pin and secure pin **4** on top and on the bottom at point **A**.
- ▶ Pin and secure pins **5** and **6** on the top and bottom at point **B**.
- ▶ For further assembly of dual folding jib, see section “Assembly of head piece”.



B190759

3 Reeving in the hoist rope

DANGER
Risk of falling from folding jib!
When stepping on the folding jib, for example to reeve the hoist rope in or out, there is a risk of slipping and falling from the folding jib.
▶ Do not step on the folding jib!

3.1 Swinging the rope guide pulley into operating position

▶ Release and unpin the pins **32**.
▶ Swing rope guide pulley **25** into operating position.
▶ Pinning rope guide pulley **25** into operating position: Pin and secure pin **32**.

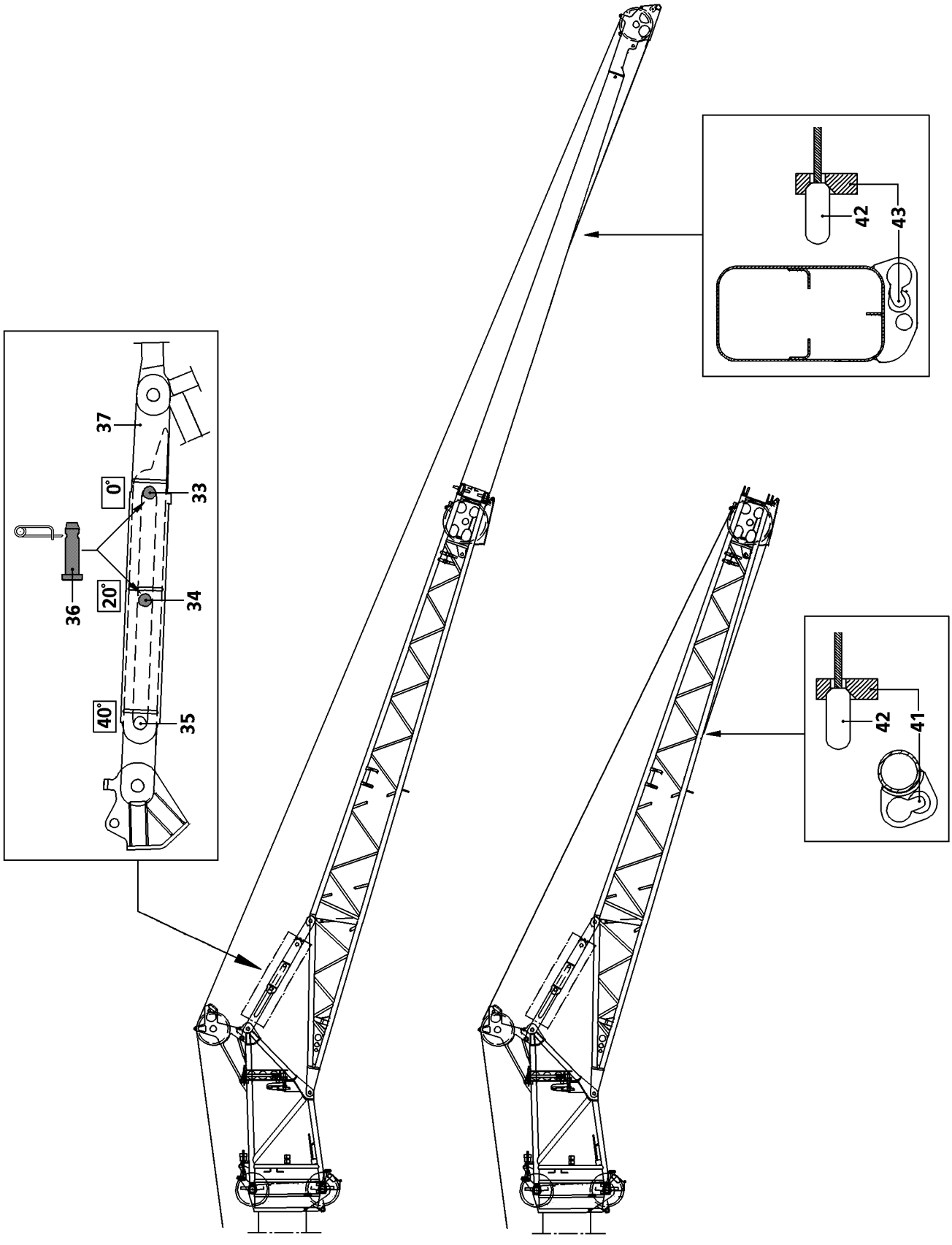
3.2 Reeving in the hoist rope

▶ Release and unpin the rope retaining pin **28** and rope retaining pin **29**.
▶ For operations with dual folding jib:
Release and unpin the rope retaining pins **30**.
▶ Place hoist rope over the rope guide pulley **25** and over the main pulley **26** at 10.8 m or over the main pulley **27** at 19 m.
▶ Pin the rope retaining pin in again and secure with linch pins.

CAUTION
Damage to hoist rope!
If the rope retaining pin **29** is pinned in during operation with the dual folding jib, the slack hoist rope may scrape against the rope retaining pin **29** and become damaged.
▶ **Do not** pin in the rope retaining pin **29** during dual folding jib operation!

▶ Reeve in the load hook or hoist rope.
▶ Attach hoist limit switch weight.

Note
▶ During folding jib operation with the hook block reeved to the telescopic boom, the load is reduced by the weight of the reeved-in hook block.



B194017

4 Changing the mechanical folding jib from 0° to 20° or 40°

There are 3 ways of changing the mechanical folding jib to 20° or 40°:

1.) Changing the folding jib with the hoist rope
2.) Changing the folding jib by supporting
3.) Changing the folding jib with hook block or load hook

Ensure that the following prerequisites are met:

– the crane is aligned in horizontal direction
– the telescopic boom is fully telescoped in
– the folding jib is attached as a straight extension in 0° position
– the telescopic boom has been swung to the rear or the side

4.1 Changing the folding jib with the hoist rope

CAUTION

Danger of damage to folding jib and hoist rope!

If the telescopic boom is telescoped out or luffed down as long as the hoist rope is tightened on the fixed assembly point, the hoist rope and the folding jib can be damaged.

▶ Do not telescope out or luff down the telescopic boom with the hoist rope attached on the fixed assembly point!

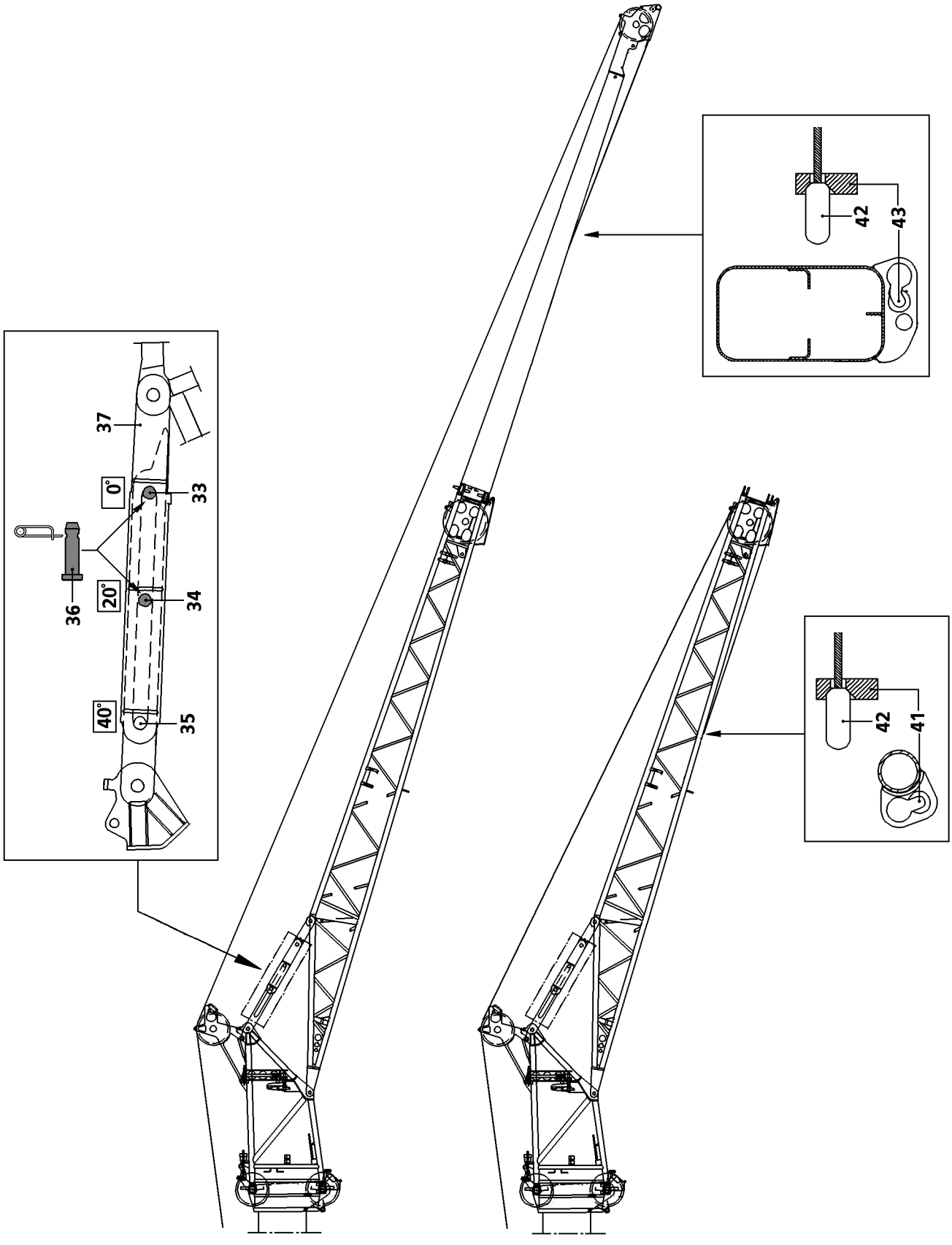
4.1.1 Preparatory work

▶ Unreeve the hoist rope on the lock.
▶ Remove the hoist limit switch weight.
▶ For operations with dual folding jib:
Insert the press fitting **42** into the fixed assembly point **43**.

or

During operation with single folding jib:

■ Insert the press fitting **42** into the fixed assembly point **41**.
▶ Tighten the hoist rope by **carefully moving** the appropriate master switch.



B194017

4.1.2 Changing the angle with hoist rope

You can operate the folding jib at three different angles. The required angle is set using the pin **36**. In the “base setting”, immediately after assembling the folding jib, the folding jib is in the 0° position.

DANGER
Danger of fatal injury!
Danger of accident if folding jib is allowed to tilt suddenly “downwards”!
- ▶ Ensure that **before unpinning** the pin **36**, the hoist rope is taut and that the folding jib is actually held in position by the hoist rope.
- ▶ **It is prohibited** to unpin the retaining pins **35** at the 40° pin holes.

Angle setting 20°

- ▶ Release pin **36** and unpin from 0° hole **33**.
- ▶ Pin the pin **36** into 20° hole **34** and secure.

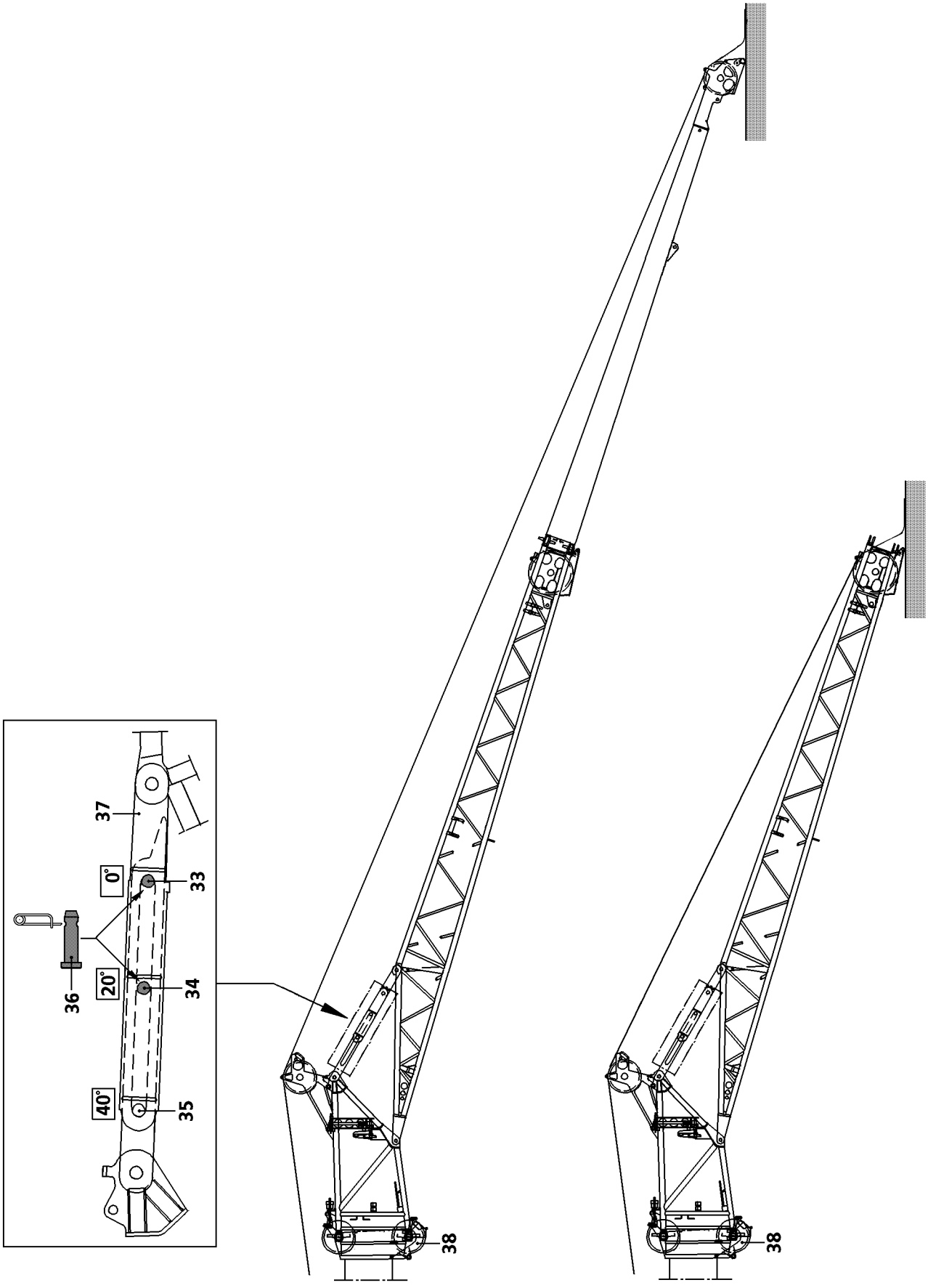
Angle setting 40°

- ▶ Release pin **36** and unpin from 0° hole **33**.
- ▶ Pin the pin **36** into pin store and secure.

Positioning the folding jib

Make sure that the pin **36** is properly pinned in and secured for the required angle setting.
- ▶ Spool out the hoist rope by carefully moving with the corresponding master switch and simultaneously luffing up the telescopic boom.

Result:
- – The lug **37** lies against the respective pin in the selected angular setting.
- – The folding jib is held by the respective pins.



B190763

4.2 Changing the folding jib by supporting

4.2.1 Preparatory work

Note

▶ The folding jib may lie on the ground or must be properly supported, if necessary.

CAUTION

Danger of equipment damage!

▶ When laying down the folding jib, make sure that the folding jib is **not** laid on the rope pulley. Otherwise it will be damaged. Also make sure that the hoist rope is **not** damaged.

▶ Completely luff down the telescopic boom until the folding jib lies the ground.

4.2.2 Changing angle with folding jib supported

You can operate the folding jib at three different angles. The required angle is set using the pin **36**. In the “base setting” - immediately after assembling the folding jib - the folding jib is in the 0° position.

DANGER

Danger of fatal injury!

Danger of accident if folding jib is allowed to tilt suddenly “downwards”!

▶ Make sure that **before unpinning** the pin **36**, the folding jib is lying on the ground or on a proper and secure support.

▶ **It is prohibited** to unpin the retaining pins **35** at the 40° pin holes.

Angle setting 20°

▶ Release pin **36** and unpin from 0° hole **33**.

▶ Pin the pin **36** into 20° hole **34** and secure.

Angle setting 40°

▶ Release pin **36** and unpin from 0° hole **33**.

▶ Pin the pin **36** into pin store and secure.

Positioning the folding jib

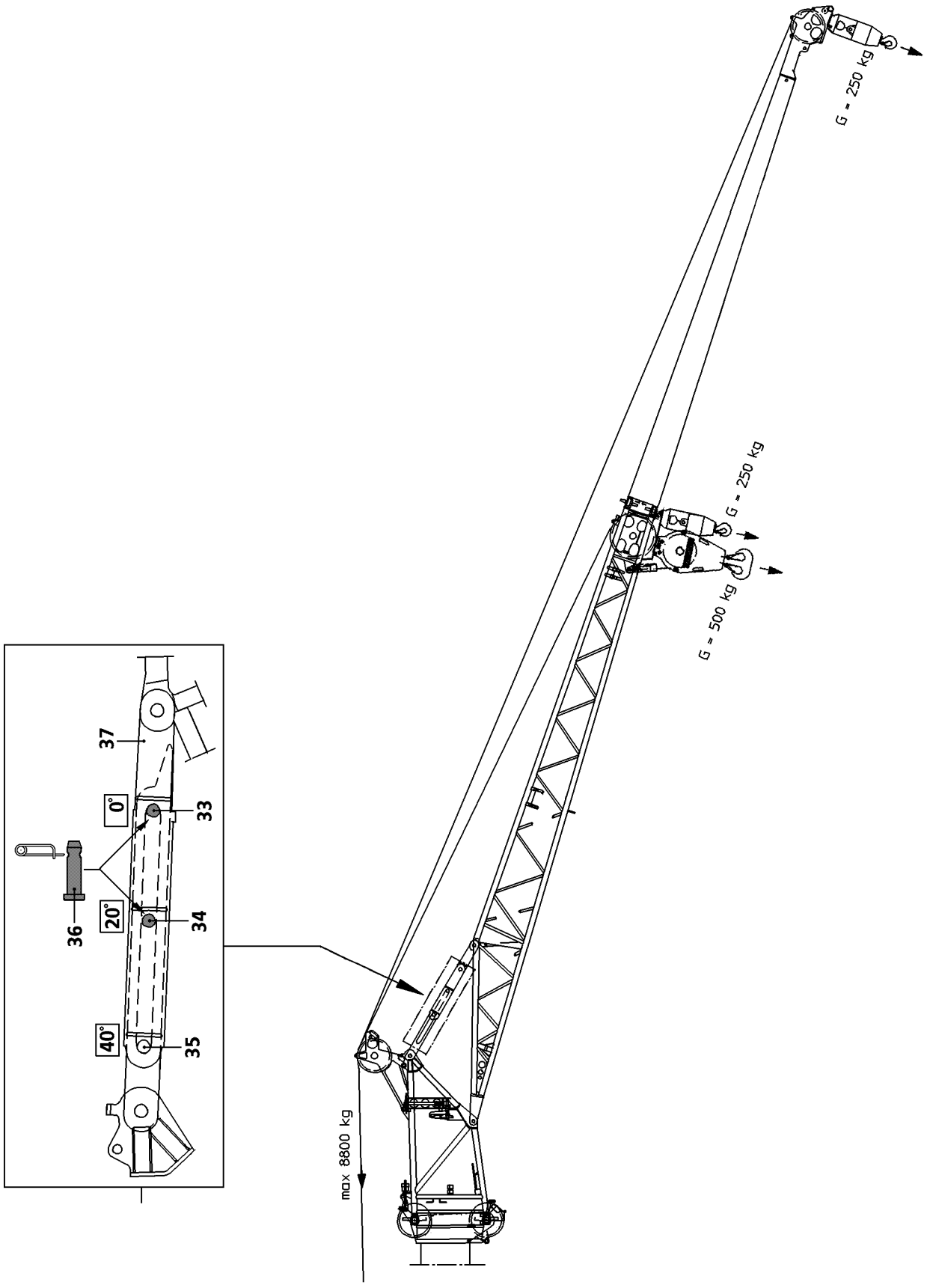
Make sure that the pin **36** is properly pinned in and secured for the required angle setting.

▶ Luff up the telescopic boom slowly and carefully.

Result:

– The lug **37** lies against the respective pin in the selected angular setting.

– The folding jib is held by the respective pins.



B194442

4.3 Changing the folding jib with hook block or load hook

For a single folding jib the changing can be done with a 1–pulley (G=450 kg) or a 3–pulley hook block (G=500 kg) or with a load hook (G=450 kg).

For a dual folding jib, the changing may only be done with a load hook (G=450 kg).

CAUTION

Damage to load hook!

Changing with a load hook is **not** possible for a rope wedge socket “with a pulley”!

▶ Use a rope wedge socket “without a pulley”!

4.3.1 Preparatory work

▶ Disassemble the hoist limit switch weight with chain.

▶ Bypass “the hoist top shut-off” on the LICCON.

CAUTION

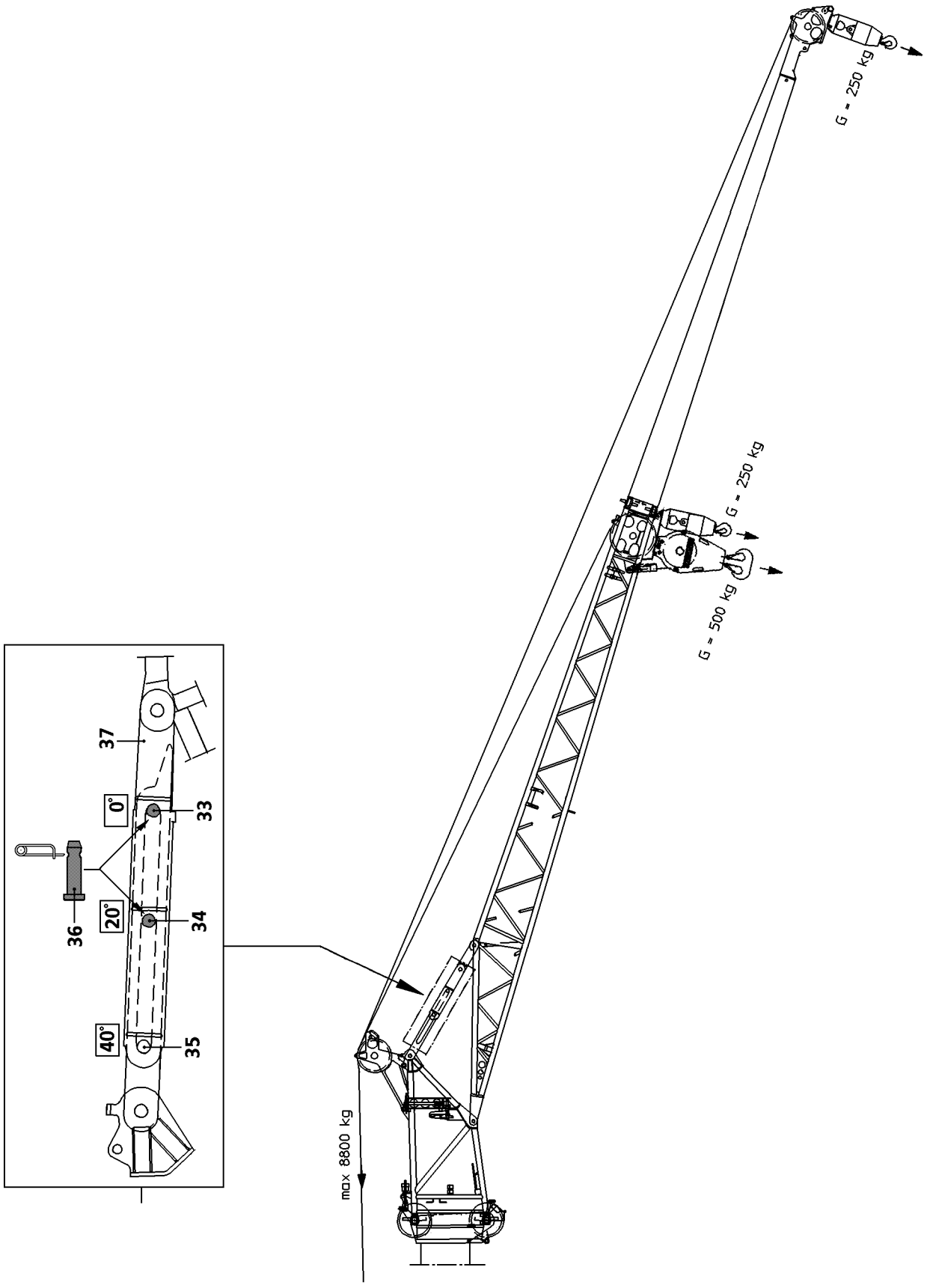
Danger of damage to folding jib and hoist rope!

If the telescopic boom is telescoped out or luffed down while the hook block/load hook is at the end position of the folding jib, the hoist rope and the folding jib can be damaged.

▶ Do not telescope out or luff down the telescopic boom with the hook block/load hook at the end position of the folding jib!

▶ By **delicately moving** the corresponding master switch, move the hook block or the load hook carefully to the stop position and tension the hoist gear (maximum permissible rope tension 8800 kg).

▶ End the bypassing “the hoist up shut-off”.



B194442

4.3.2 Changing angle with hook block or load hook

You can operate the folding jib at three different angles. The required angle is set using the pin **36**. In the “base setting”, immediately after assembling the folding jib, the folding jib is in the 0° position.

DANGER
Danger of fatal injury!
Danger of accident if folding jib is allowed to tilt suddenly “downwards”!
- ▶ Make sure that **before unpinning** the pin **36**, the folding jib is secured against falling down by the hook block or the load hook.
- ▶ Unpinning the retaining pins **35** at the 40° pinning holes is **forbidden**!

Angle setting 20°

- ▶ Release pin **36** and unpin from 0° hole **33**.
- ▶ Pin the pin **36** into 20° hole **34** and secure.

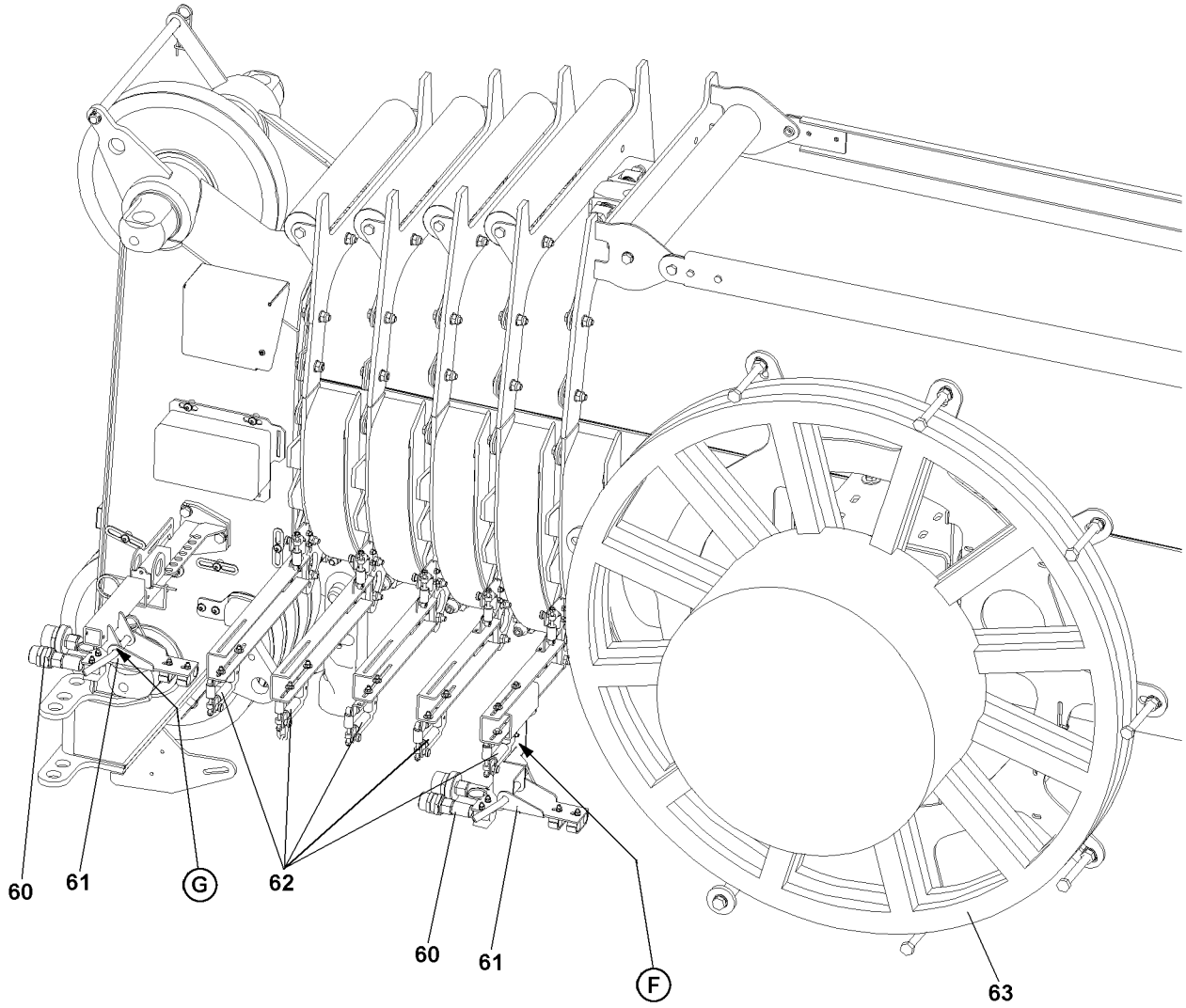
Angle setting 40°

- ▶ Release pin **36** and unpin from 0° hole **33**.
- ▶ Pin the pin **36** into pin store and secure.

Positioning the folding jib

Make sure that the pin **36** is properly pinned in and secured for the required angle setting.
- ▶ Spool out the hoist rope by carefully moving with the corresponding master switch and simultaneously luffing up the telescopic boom.

Result:
- – The lug **37** lies against the respective pin in the selected angular setting.
- – The folding jib is held by the respective pins.



B197047

5 Hydraulic connections

5.1 Establishing the hydraulic connections

A hydraulic connection to the folding jib only needs to be made if the folding jib is hydraulic (TNZK operation). Hydraulic lines cannot be incorrectly connected due to the different diameters of the hydraulic connections.

- ▶ For operation with hydraulic folding jib:
  Make hydraulic connections to the hose couplings **60** at point **G**.
- ▶ After operation with hydraulic folding jib:
  Protect connections from contamination.

5.2 Installing hose couplings in operating or neutral position

The hydraulic supply to the folding jib comes from the hose reel **63** on the telescopic boom. During longer periods of telescopic boom operation the console **61** should be installed with the hose couplings **60** in neutral position point **F**. This prevents unnecessary hydraulic hose winding and unwinding.

CAUTION
Danger of accident if hydraulic hoses snap back!
The hydraulic hoses are under spring tension. If the removed console **61** is released, it snaps back against the hose drum **63** due to the spring force. This can cause injury to assembly personnel or damage the hose drum **63**.

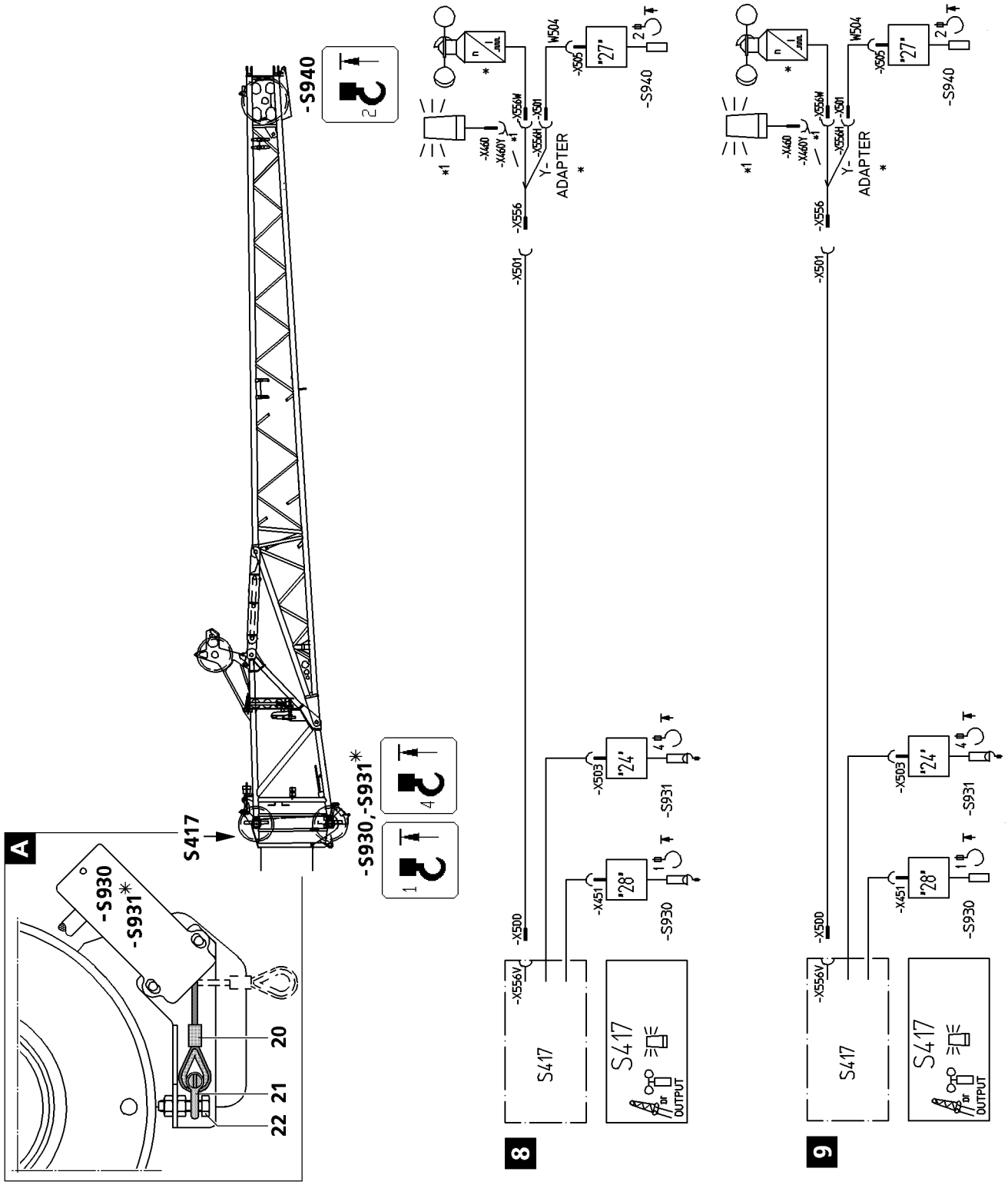
- ▶ Do not allow the removed console **61** to snap back!
- ▶ Hold the removed console **61** and then reinstall!

5.2.1 Installing hose couplings in operating position

- ▶ Remove console **61** with hose couplings **60** at point **F**.
- ▶ Place hydraulic hoses in the guides **62**.
- ▶ Properly install the console **61** with hose couplings **60** at point **G**.
- ▶ Secure hydraulic hoses in the guides **62**.

5.2.2 Installing hose couplings in neutral position

- ▶ Release hydraulic hoses from the guides **62**.
- ▶ Remove console **61** with hose couplings **60** at point **G**.
- ▶ Remove hydraulic hoses from the guides **62**.
- ▶ Properly install the console **61** with hose couplings **60** at point **F**.


A
S417
-S930
-S931*
20
21
22
-S940
-S930,-S931*
-X460
-X460Y
-X556W
-X556H
-X501
Y-
ADAPTER
-X556
-X505
W504
"27"
-S940
-X500
-X556V
-X451
"28"
-S930
-X503
"24"
-S931
S417
OUTPUT
8
9

B194018

6 Electrical connections

6.1 Mechanically operating hoist limit switch, see illustration A

If “dual hook mode” is not being used during folding jib operation, the hoist limit switch **-S930/-S931** that is not required must be operated mechanically.

- ▶ Remove the hoist limit switch weight and chain.
- ▶ Pull the hoist limit switch rope **20** and attach to the fixed point **22** with the shackle **21**.

6.2 Electrical connections on the single folding jib

6.2.1 Single hook operation, see illustration 8

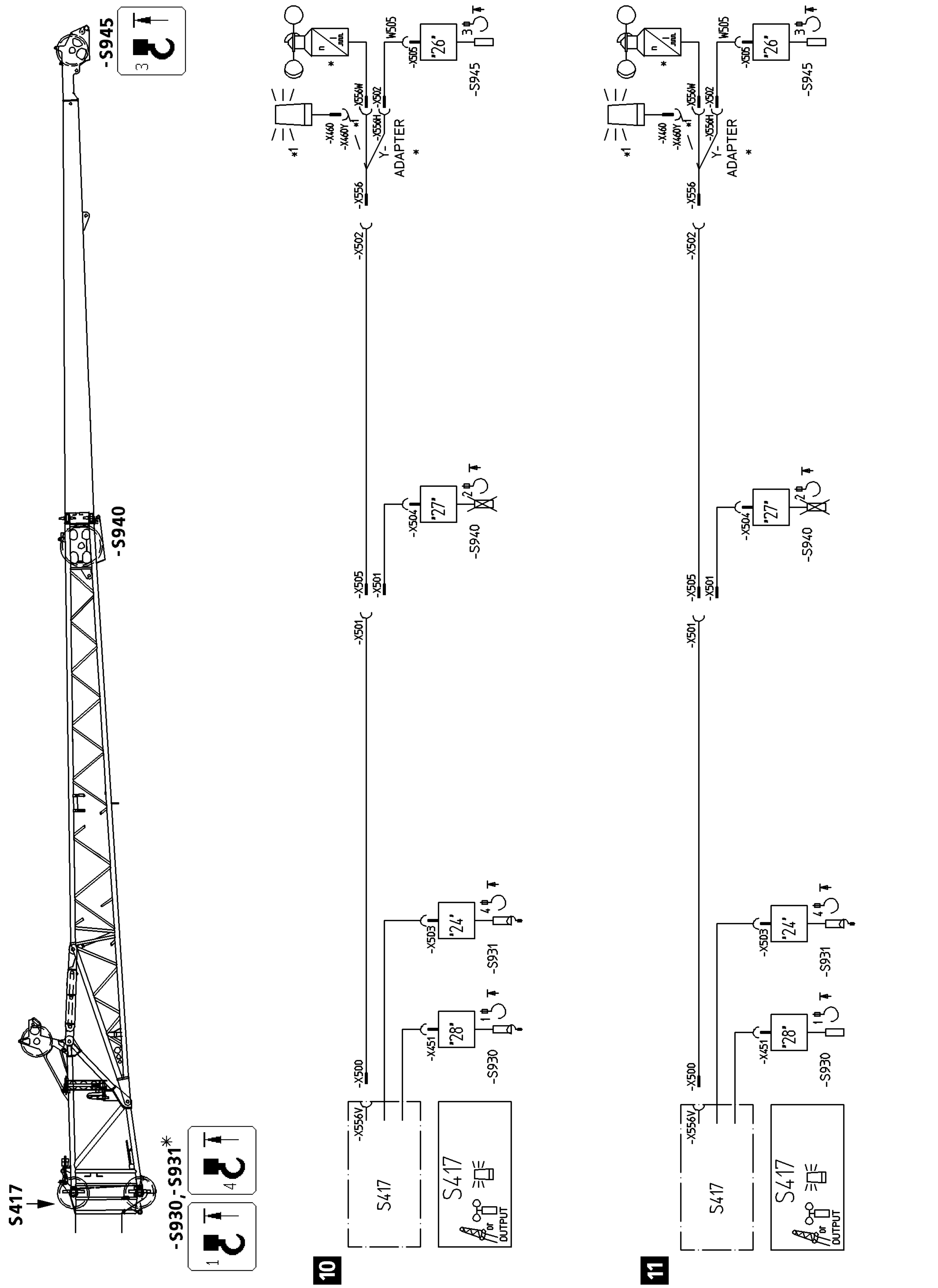
CAUTION
Danger of equipment damage!
- ▶ Only the hoist limit switch **S940** at the single folding jib is active.

- ▶ Actuate the hoist limit switch **-S930** mechanically.
- ▶ Actuate the hoist limit switch* **-S931** mechanically.
- ▶ Insert the cable plug **-X500** into the socket **-X556V**.
- ▶ Insert the adapter **-X556** into the socket **-X501**.
- ▶ Insert the hoist limit switch **-S940** with the cable plug **-X501** into the socket **-X556H**.
- ▶ Insert the wind speed sensor* with the cable plug **-X556W** into the socket **-X556**.
- ▶ Insert the flashing beacon* with the cable plug **-X460** into the socket **-X460Y**.

6.2.2 Dual hook operation, see illustration 9

CAUTION
Danger of equipment damage!
- ▶ The hoist limit switch **S930** at the telescopic boom and the hoist limit switch **S940** at the single folding jib are active!

- ▶ Actuate the hoist limit switch* **-S931** mechanically.
- ▶ Insert the cable plug **-X500** into the socket **-X556V**.
- ▶ Insert the adapter **-X556** into the socket **-X501**.
- ▶ Insert the hoist limit switch **-S940** with the cable plug **-X501** into the socket **-X556H**.
- ▶ Insert the wind speed sensor* with the cable plug **-X556W** into the socket **-X556**.
- ▶ Insert the flashing beacon* with the cable plug **-X460** into the socket **-X460Y**.


-S945
-S940
S417
-S930,-S931*
-X502
-X501
-X500
-X505
-X504
-X503
-X451
-X556
-X556V
-X460
Y-ADAPTER
W505
"26"
"27"
"24"
"28"
S417
OUTPUT
10
11

B194019

6.3 Electrical connections on the dual folding jib

6.3.1 Single hook operation, see illustration 10

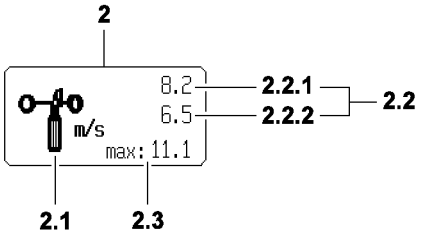
CAUTION
Danger of equipment damage!
- ▶ Only the hoist limit switch **S945** at the dual folding jib is active. The hoist limit switch **S940** on the single folding jib is unplugged.

- ▶ Actuate the hoist limit switch **-S930** mechanically.
- ▶ Actuate the hoist limit switch* **-S931** mechanically.
- ▶ Insert the cable plug **-X500** into the socket **-X556V**.
- ▶ Insert the cable plug **-X505** into the socket **-X501**.
- ▶ Insert the adapter **-X556** into the socket **-X502**.
- ▶ Insert the hoist limit switch **-S945** with the cable plug **-X502** into the socket **-X556H**.
- ▶ Insert the wind speed sensor* with the cable plug **-X556W** into the socket **-X556**.
- ▶ Insert the flashing beacon* with the cable plug **-X460** into the socket **-X460Y**.

6.3.2 Dual hook operation, see illustration 11

CAUTION
Danger of equipment damage!
- ▶ The hoist limit switch **S930** at the telescopic boom and the hoist limit switch **S945** at the dual folding jib are active! The hoist limit switch **S940** on the single folding jib is unplugged.

- ▶ Actuate the hoist limit switch* **-S931** mechanically.
- ▶ Insert the cable plug **-X500** into the socket **-X556V**.
- ▶ Insert the cable plug **-X505** into the socket **-X501**.
- ▶ Insert the adapter **-X556** into the socket **-X502**.
- ▶ Insert the hoist limit switch **-S945** with the cable plug **-X502** into the socket **-X556H**.
- ▶ Insert the wind speed sensor* with the cable plug **-X556W** into the socket **-X556**.
- ▶ Insert the flashing beacon* with the cable plug **-X460** into the socket **-X460Y**.



B197654

6.4 Function check

Ensure that the following prerequisites are met:
– all electrical connections have been made
– the LICCON computer system is running

6.4.1 Wind speed sensors

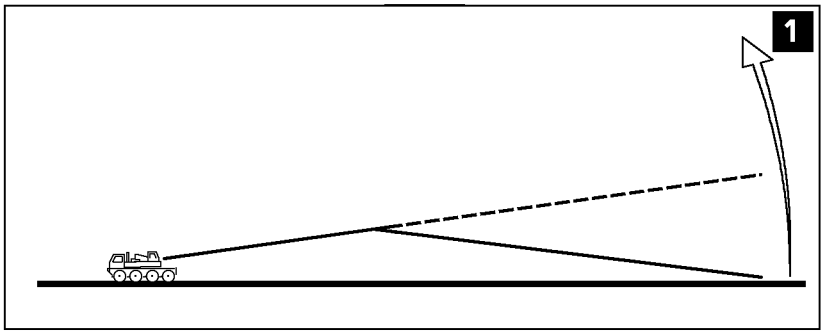
Check movement and operation by manually operating the wind sensor at the “Wind speed” **2.2** symbol element.

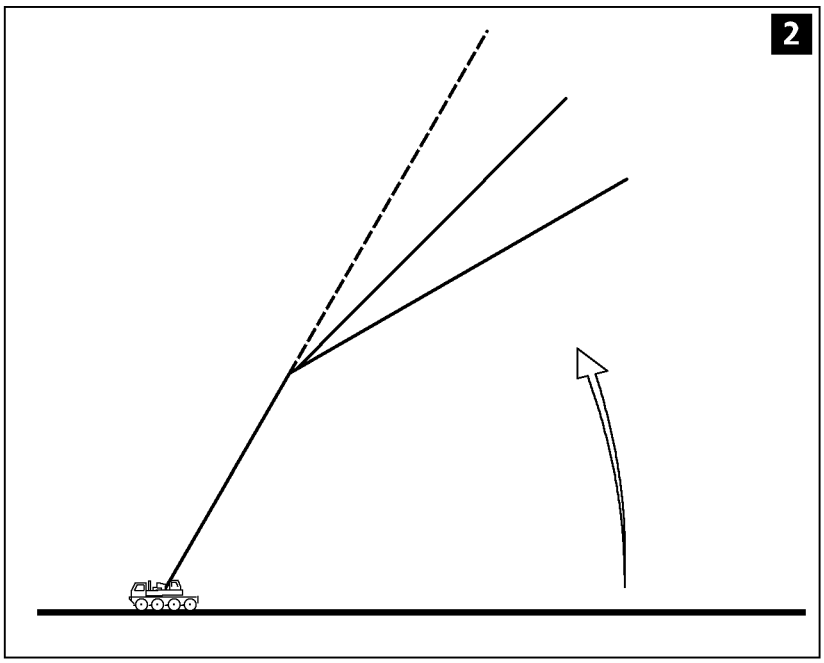
CAUTION
Danger of equipment damage!
▶ Re-check the operation of the wind sensor after every attachment.

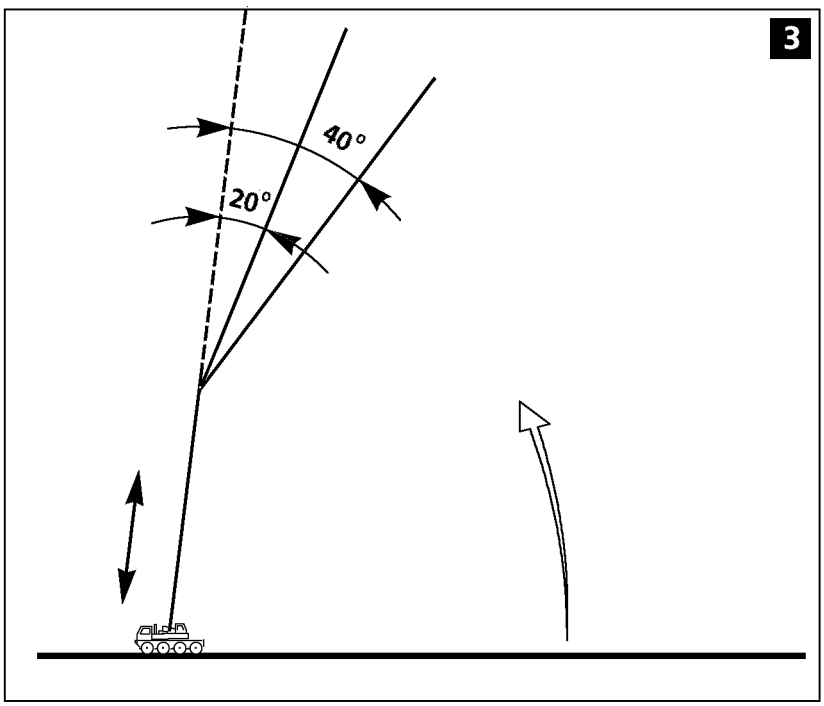
6.4.2 Hoist limit switches

Manually operate all active hoist limit switches - the relevant “Hoist top” symbol element must appear on the LICCON monitor. The hoist winch must switch off.

Note
▶ When replacing or changing the hoist limit switch (HES), the relevant HES must have the correct bus address and the correct software version in order to be detected again by the bus system (LSB).







B185908

7 Erection

7.1 Preparatory work

Ensure that the following prerequisites are met:

- the crane is aligned in horizontal direction
- the counterweight has been attached to the turntable according to the load chart
- the central ballast is attached to the crane chassis in accordance with the load chart specifications
- the telescopic boom is fully telescoped in
- the folding jib has been installed according to the load chart and the operating manual
- all limit switches are correctly installed and fully functioning
- all pin connections have been secured
- the hoist rope has been correctly placed in the rope pulleys and prevented from jumping out with the rope retaining pins
- there are no loose parts on the telescopic boom and the folding jib
- the telescopic boom, the folding jib and its components (limit switches, airplane warning light, wind speed sensor, etc.) must be free of snow and ice in the winter

DANGER
Risk of accident!
Incorrectly fitted or non-operational limit switches and falling parts (pins, spring-loaded safety pins, ice etc.) can cause injuries!

▶ Install all limit switches, pins and spring-loaded pins properly.

▶ Check if all prerequisites are met.

7.2 Erection procedure

DANGER
Danger of fatal injury!
The loads listed in the load chart may not be exceeded or fallen below, even if there is no load on the hook! If this regulation is not observed, the crane can topple over.

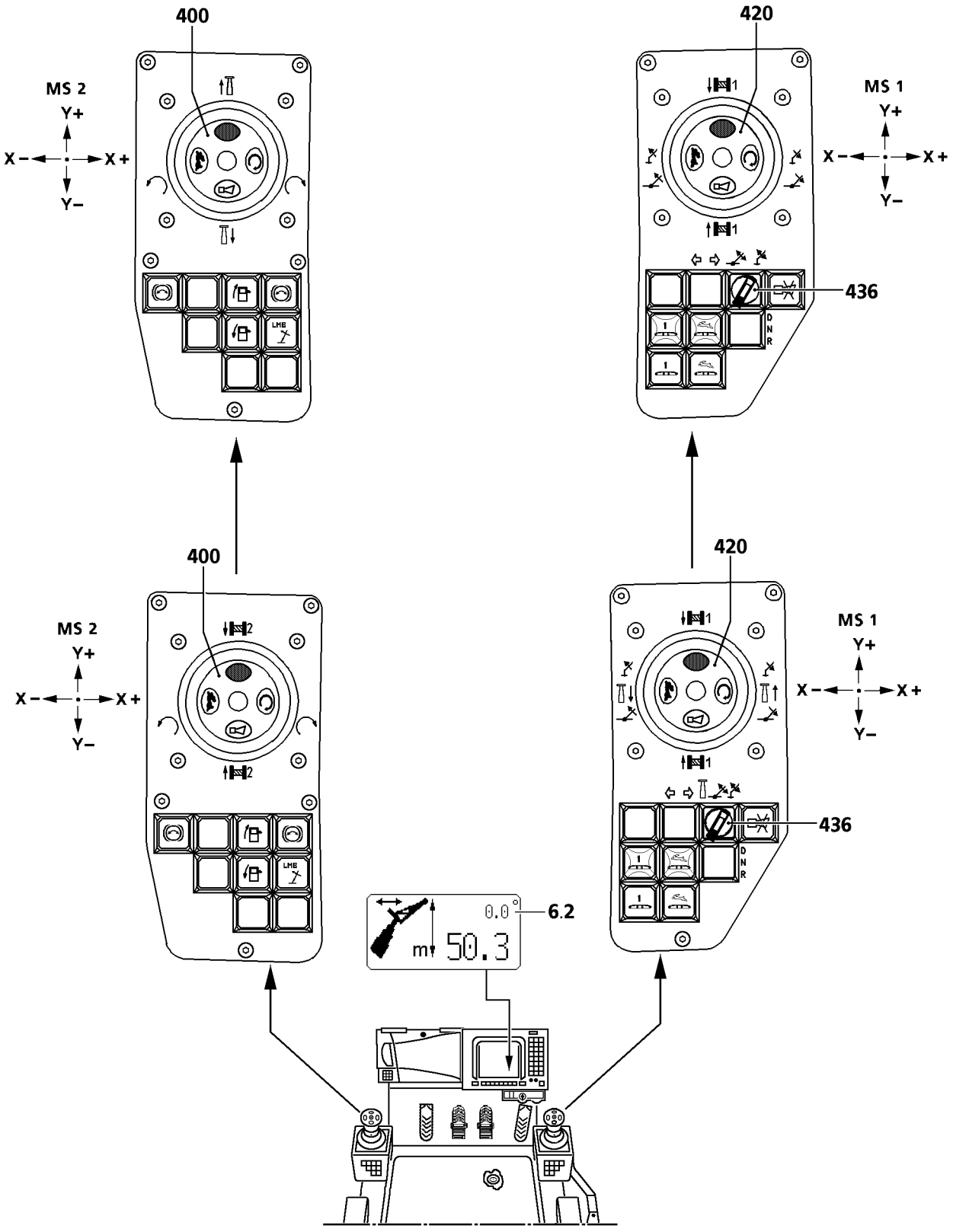
▶ Compare and check the settings on the LICCON computer system with the actual set up condition!

For adjustment of the LICCON overload protection, refer to chapter 4.02.

▶ Set the LICCON overload protection according to the required set up condition and confirm.

▶ Luff the telescopic boom with installed folding jib up until the release is issued by the LICCON.

▶ Telescope the telescopic boom out to values specified in the load chart.


400
MS 2
Y+
X−
X+
Y−
LMB
420
MS 1
Y+
X−
X+
Y−
436
D
N
R
400
MS 2
Y+
X−
X+
Y−
LMB
420
MS 1
Y+
X−
X+
Y−
436
D
N
R
0.0°
6.2
m
50.3

B198648

8 Adjusting the folding jib angle with a hydraulic folding jib

The adjustment range of the folding jib lies between 0° and 40° to the telescopic boom. It is possible to luff the hydraulically adjustable folding jib under load.

DANGER
Crane can topple over!
The crane can topple over if the maximum load carrying capacity of the crane is exceeded.
- ▶ The data in the load charts must be strictly adhered to!
- ▶ The load charts for the hydraulically adjustable folding jib are only valid for angles of 0°, 20° and 40°!
- ▶ For the adjustment angles between the nominal angles of 0°, 20° and 40°, the maximum load carrying capacity will be determined by the LICCON computer system shown on the LICCON monitor.

Ensure that the following prerequisites are met:
– the hydraulic connections have been established
– the electrical connections have been established
– the engine is running
– operating mode **TNZK** has been set and confirmed on the LICCON computer system

8.1 Angle display for folding jib

The folding jib angle **6.2** is shown on the LICCON monitor as the relative angle between the telescopic boom pulley head and the folding jib.

8.2 Luffing with hydraulic folding jib

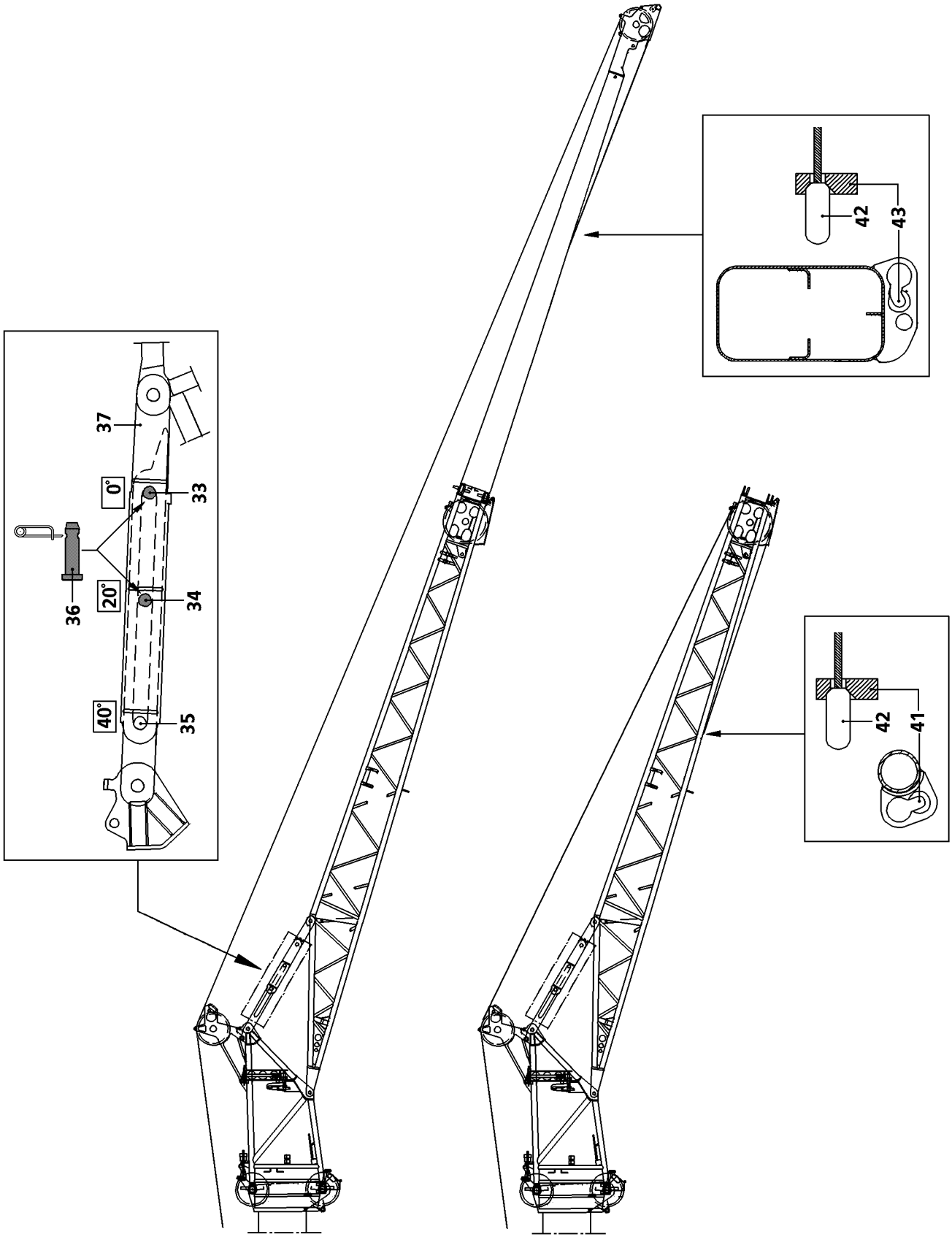
Ensure that the following preconditions are met:
– the rotary switch **436** is set to position right “luff folding jib”

▶ If the folding jib is to be luffed down:
Move master switch 1 **420** to the right in direction X+.

Result:
– The hydraulic folding jib is luffed down.

▶ If the folding jib is to be luffed up:
Move master switch 1 **420** to the left in direction X-.

Result:
– The hydraulic folding jib is luffed up.



B194017

9 Changing the mechanical folding jib from 20° or 40° to 0°

There are 3 ways of changing the mechanical folding jib to 0°:
1.) Changing the folding jib with the hoist rope
2.) Changing the folding jib by supporting
3.) Changing the folding jib with hook block or load hook

Ensure that the following prerequisites are met:
– the crane is aligned in horizontal direction
– the telescopic boom is fully telescoped in
– the folding jib is attached at an angle of 20° or 40°
– the telescopic boom has been swung to the rear or the side

9.1 Changing the folding jib with the hoist rope

9.1.1 Preparatory work

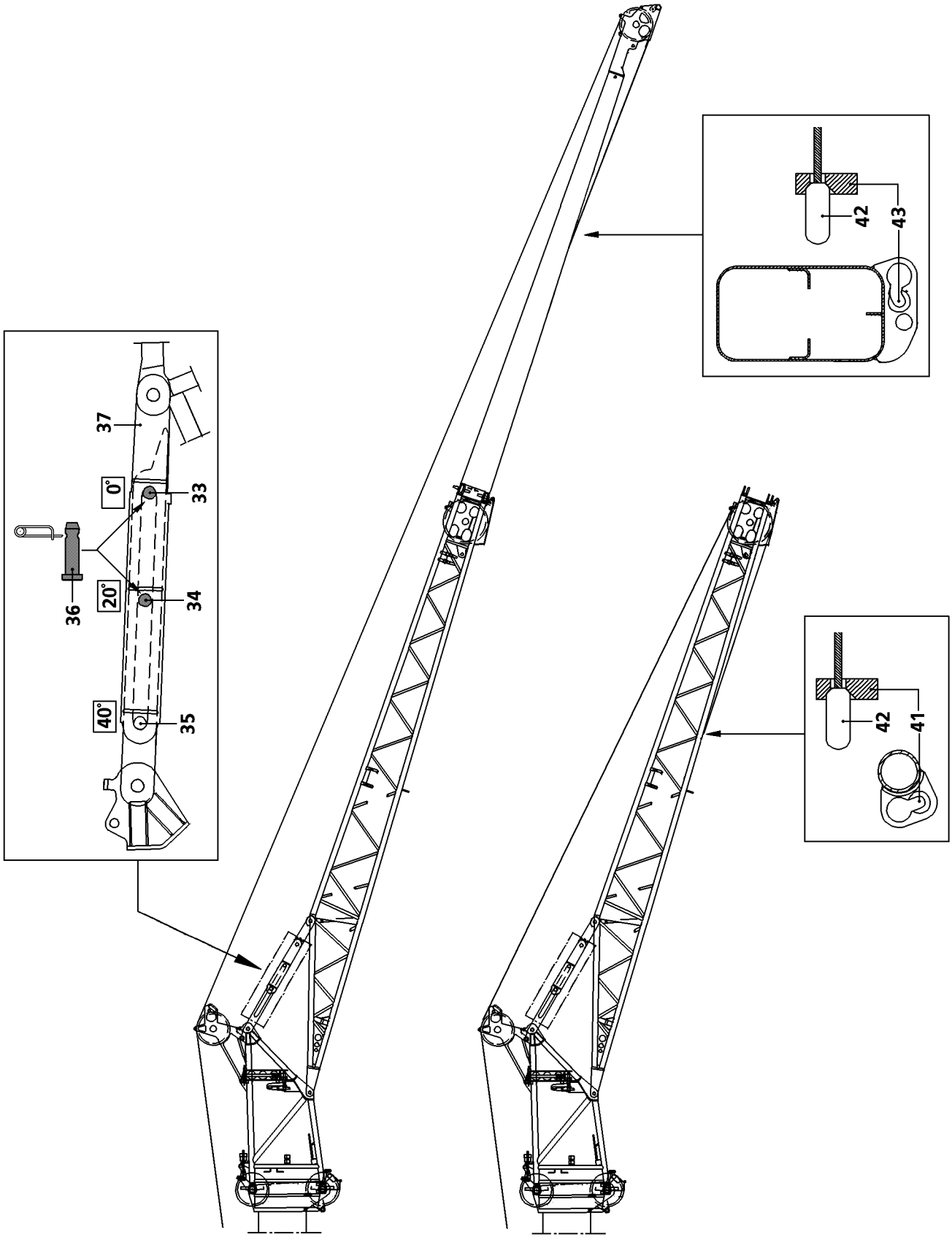
▶ Luff down the telescopic boom until the hook block can be unreeved on the head piece of the folding jib.
▶ Unreeve the hoist rope onto the hook block.
▶ Remove the hoist limit switch weight.

CAUTION
Danger of damage to folding jib and hoist rope!
If the telescopic boom is telescoped out or luffed down as long as the hoist rope is tightened on the fixed assembly point, the hoist rope and the folding jib can be damaged.
▶ Do not telescope out or luff down the telescopic boom with the hoist rope attached on the fixed assembly point!

▶ For operations with dual folding jib:
Insert the press fitting **42** into the fixed assembly point **43**.

or

During operation with single folding jib:
■ Insert the press fitting **42** into the fixed assembly point **41**.
▶ Tighten the hoist rope by **carefully moving** the appropriate manual control lever.



B194017

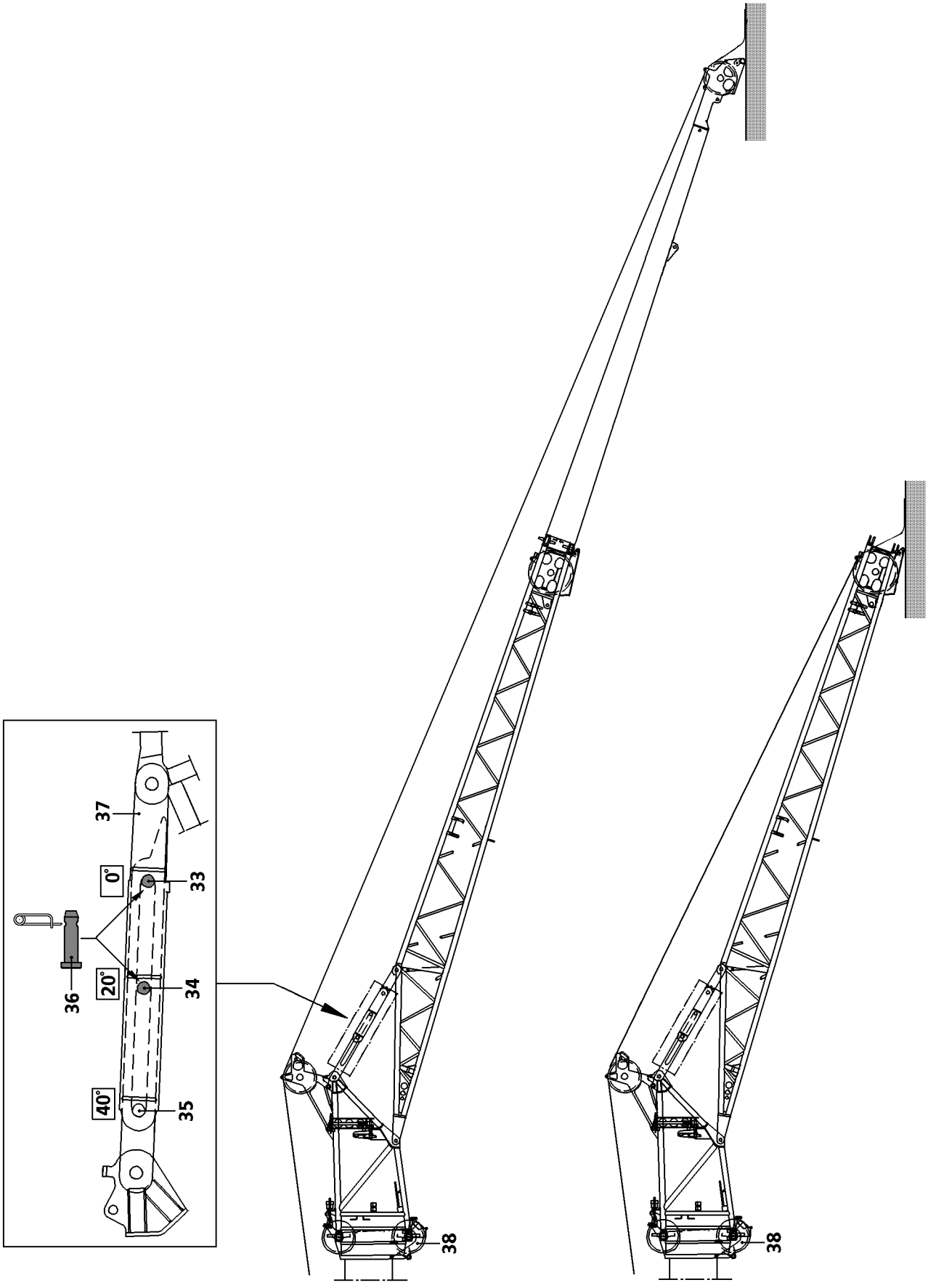
9.1.2 Changing the angle with hoist rope

CAUTION
Danger of damage to the folding jib and the hoist rope!
- ▶ As soon as the folding jib has reached the 0° position (stop at lug), the “lifting” and “luffing” movement must be stopped immediately.

- ▶ Luff down telescopic boom and simultaneously spool up the hoist rope so that the articulated piece of the folding jib is always kept at the same height, approx. 1.0 m - 1.5 m, above the ground until the 0° position (stop on pull bracket) has been reached.

DANGER
Danger of fatal injury!
Danger of accident if folding jib is allowed to tilt suddenly “downwards”!
- ▶ Ensure that **before unpinning** the pin **36**, the hoist rope is taut and that the folding jib is actually held in position by the hoist rope.
- ▶ **It is prohibited** to unpin the retaining pins **35** at the 40° pin holes.

- ▶ Release pins **36** and unpin from 20° hole **34 or** remove from the transport retainer.
- ▶ Pin the pin **36** into 0° hole **33** and secure.
- ▶ Disengage the hoist rope at the fixed assembly point.



B190763

9.2 Changing the folding jib by supporting

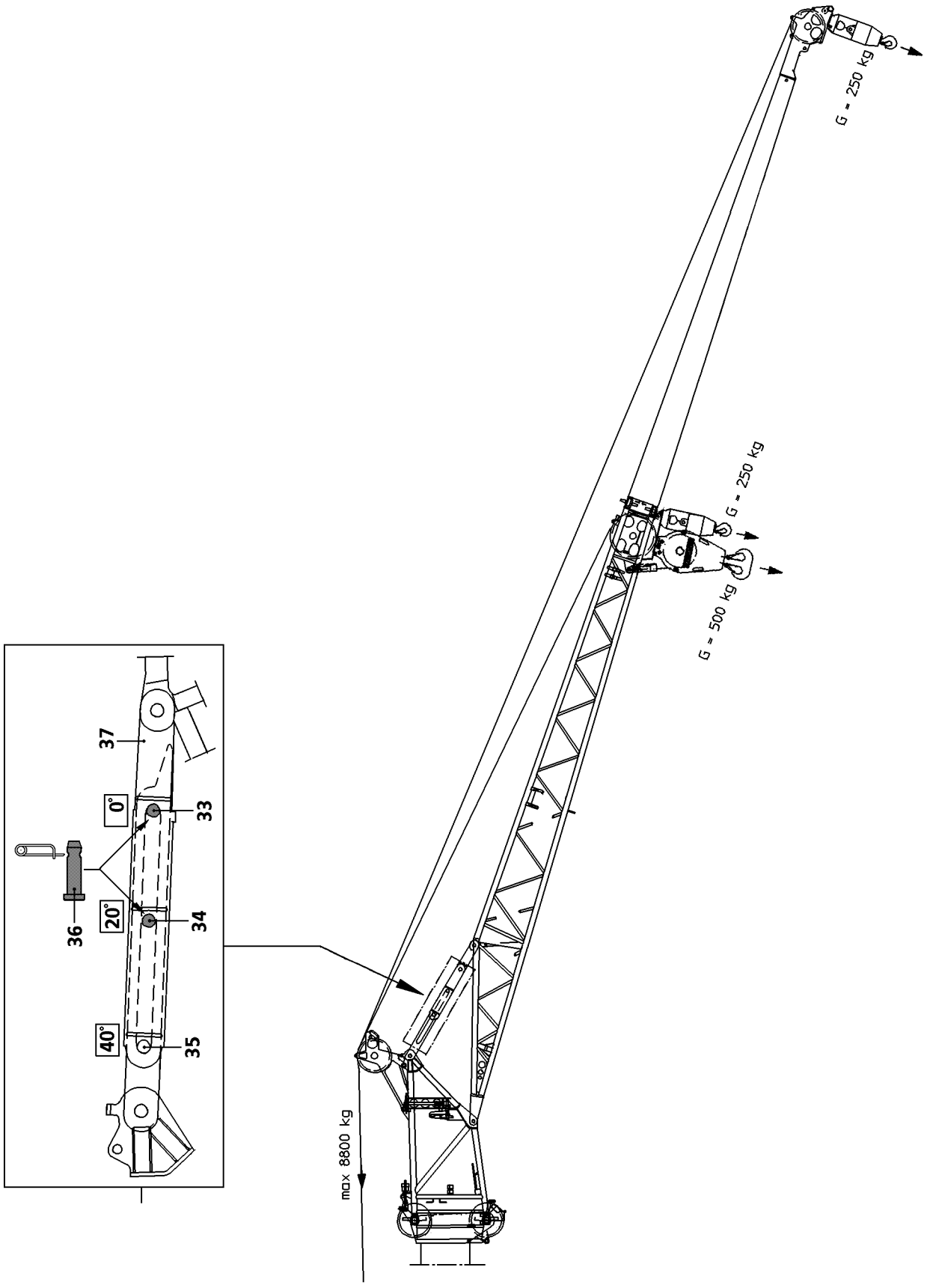
- ▶ Luff the telescopic boom down until the hook block can be unreeved.
- ▶ Remove the lock and the hoist limit switch weight.

CAUTION
Danger of equipment damage!
- ▶ When laying down the folding jib, make sure that the folding jib is **not** laid on the rope pulley. Otherwise it will be damaged. Also make sure that the hoist rope is **not** damaged.
- ▶ Make sure that the ground is firm and even, so that the folding jib does not sink into the ground when it is lowered.

- ▶ Completely luff down the telescopic boom until the folding jib lies on the ground.
- ▶ Continue to luff down the telescopic boom carefully until the 0° position (stop at lug) is reached.

DANGER
Danger of fatal injury!
Danger of accident if folding jib is allowed to tilt suddenly “downwards”!
- ▶ Make sure that **before unpinning** the pin **36**, the folding jib is lying on the ground or on a proper and secure support.
- ▶ **It is prohibited** to unpin the retaining pins **35** at the 40° pin holes.

- ▶ Release pins **36** and unpin from 20° hole **34 or** remove from the transportation retainer.
- ▶ Pin the pin **36** into 0° hole **33** and secure.



B194442

9.3 Changing the folding jib with hook block or load hook

For a single folding jib the changing can be done with a 1–pulley (G=450 kg) or a 3–pulley hook block (G=500 kg) or with a load hook (G=450 kg).
For a dual folding jib, the changing may only be done with a load hook (G=450 kg).

CAUTION
Damage to load hook!
Changing with a load hook is **not** possible for a rope wedge socket “with a pulley”!
▶ Use a rope wedge socket “without a pulley”!

▶ Disassemble the hoist limit switch weight with chain.
▶ Bypass “the hoist top shut-off” on the LICCON.

CAUTION
Danger of damage to folding jib and hoist rope!
If the telescopic boom is telescoped out or luffed down while the hook block/load hook is at the end position of the folding jib, the hoist rope and the folding jib can be damaged.
▶ Do not telescope out or luff down the telescopic boom with the hook block/load hook at the end position of the folding jib!

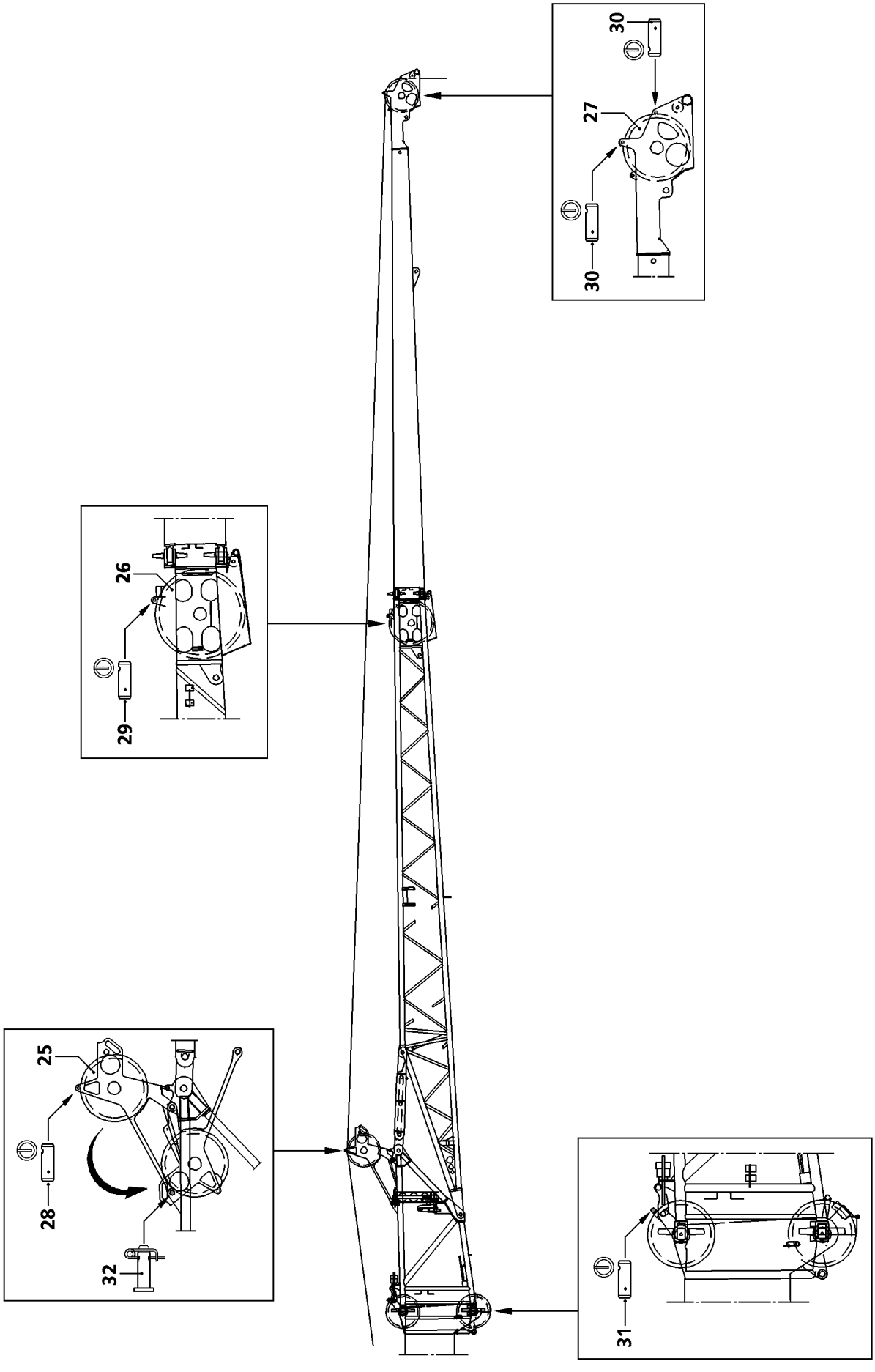
▶ By **delicately moving** the corresponding master switch, move the hook block or the load hook carefully to the stop position and tension the hoist gear (maximum permissible rope tension 8800 kg).
▶ End the bypassing “the hoist up shut-off”.

CAUTION
Danger of damage to the folding jib and the hoist rope!
▶ As soon as the folding jib has reached the 0° position (stop at lug), the “lifting” and “luffing” movement must be stopped immediately.

▶ Luff down telescopic boom and simultaneously spool up the hoist rope so that the articulated piece of the folding jib is always kept at the same height, approx. 1.0 m - 1.5 m, above the ground until the 0° position (stop on pull bracket) has been reached.

DANGER
Danger of fatal injury!
Danger of accident if folding jib is allowed to tilt suddenly “downwards”!
▶ Make sure that **before unpinning** the pin **36**, the folding jib is secured against falling down by the hook block or the load hook.
▶ Unpinning the retaining pins **35** at the 40° pinning holes is **forbidden**!

▶ Release pins **36** and unpin from 20° hole **34 or** remove from the transport retainer.
▶ Pin the pin **36** into 0° hole **33** and secure.



B190766

10 Reeving out the hoist rope

DANGER
Risk of falling from folding jib!
When stepping on the folding jib, for example to reeve the hoist rope in or out, there is a risk of slipping and falling from the folding jib.
▶ Do not step on the folding jib!

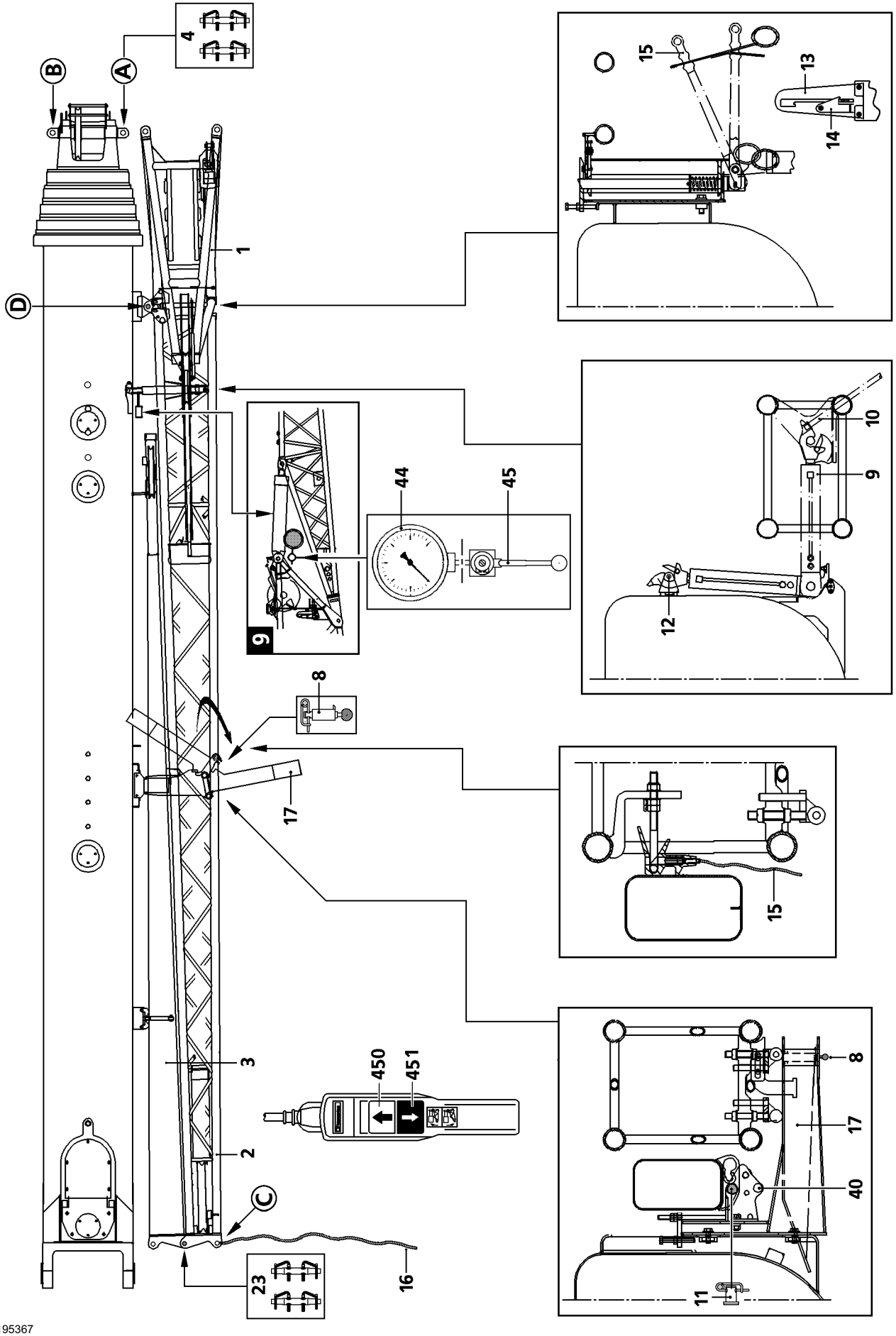
Ensure that the following prerequisites are met:
– the telescopic boom is fully telescoped in
– the hook block / load hook has been placed on the ground
– the hoist rope is detached to the rope fixed point
– the hoist limit switch weight and the chain have been removed

10.1 Pinning/unpinning the rope retaining pins

▶ Release and unpin the rope retaining pin **28** and rope retaining pin **29**.
▶ For operations with dual folding jib:
Release and unpin rope retaining pin **30**.
▶ Spool up the hoist rope.
▶ Repin the rope retaining pin **28**, rope retaining pin **29** and rope retaining pin **30** and secure with linch pins.

10.2 Swinging the rope guide pulley into transport position

▶ Release and unpin the pins **32**.
▶ Swing the rope guide pulley **25** into transport position.
▶ Pin rope guide pulley **25** with pin **32** and secure.



B195367

11 Removing the folding jib

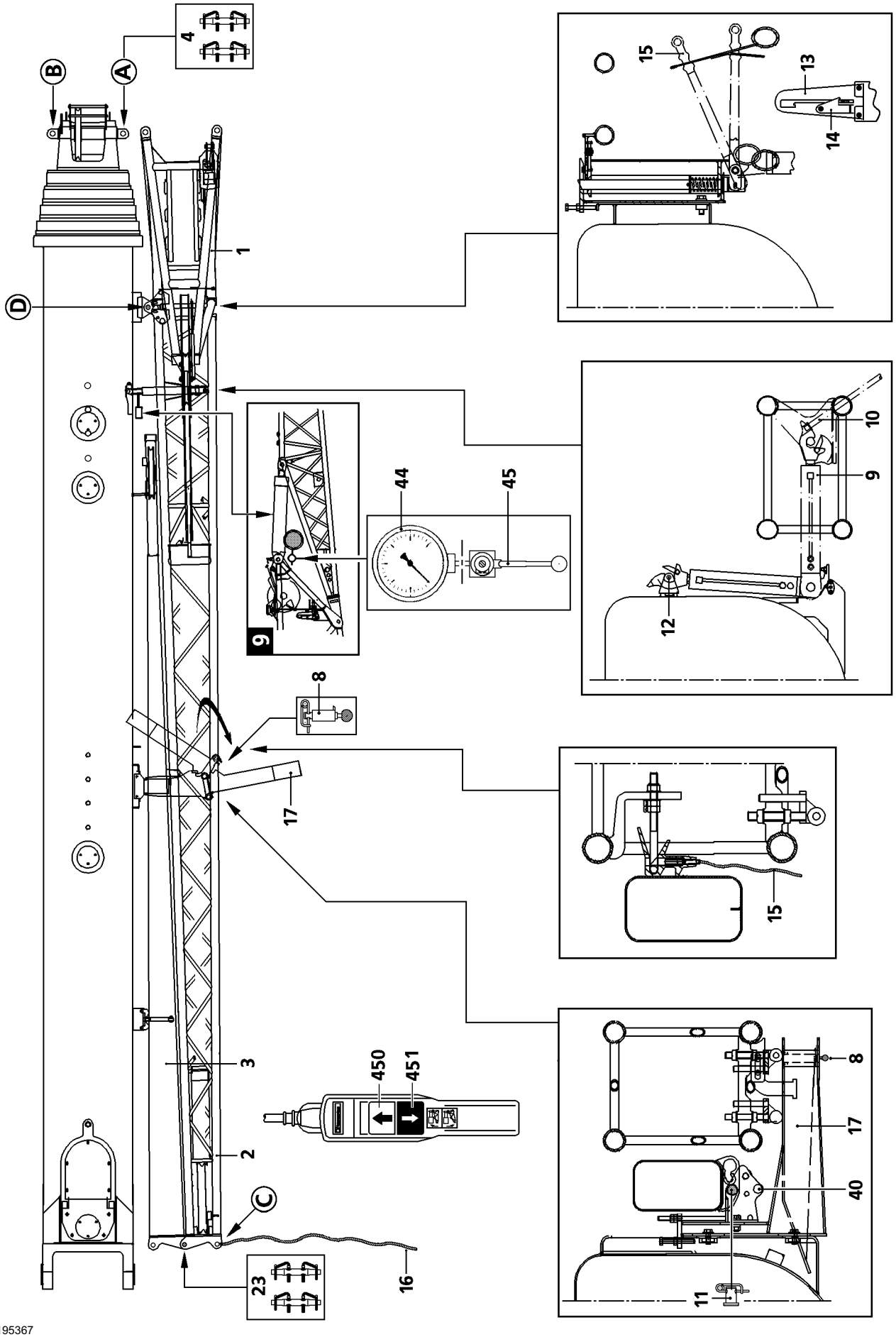
11.1 General

DANGER
Danger of fatal injuries due to falling folding jib!
The folding jib can fall down due to a disassembly error.
- ▶ Standing under the folding jib during the swing operation is prohibited!
- ▶ It is prohibited for anyone to remain in the swing range as well as the folding range of the folding jib!
- ▶ The folding jib must be secured by an auxiliary rope during the swing procedure!

DANGER
Danger of falling!
During assembly and disassembly, personnel must be secured with appropriate antifall guards to prevent them from falling. If this is not observed, personnel could fall and suffer life-threatening injuries.
- ▶ All assembly work from a height of 2 m must generally be carried out using suitable aids (lifting platforms, scaffolding, ladders, auxiliary crane, etc.)! The height above which assembly/disassembly work must be carried out with aids depends on national regulations. The national regulations must be adhered to!
- ▶ If work cannot be carried out using these aids or from the ground, the assembly personnel must be protected from falling using suitable means (such as safety belts)!
- ▶ Do not walk on the telescopic boom or folding jib!

Ensure that the following prerequisites are met:
- – the crane is aligned in horizontal direction
- – the counterweight has been attached to the turntable according to the load chart
- – the central ballast is attached to the crane chassis in accordance with the load chart specifications
- – the telescopic boom is fully telescoped in
- – the folding jib is in 0° position
- – the electrical/hydraulic connections on the folding jib have been released
- – the rope guide pulley has been folded from the operating position to the transport position
- – the telescopic boom has been luffed down to the rear or the side in the 0° position

DANGER
Danger of accident if the folding jib swings out by itself when it is unpinned!
The telescopic boom must be in 0° position, otherwise there is a risk of accidents if the folding jib swings out by itself when it is unpinned.
- ▶ Move the telescopic boom to 0° position.



B195367

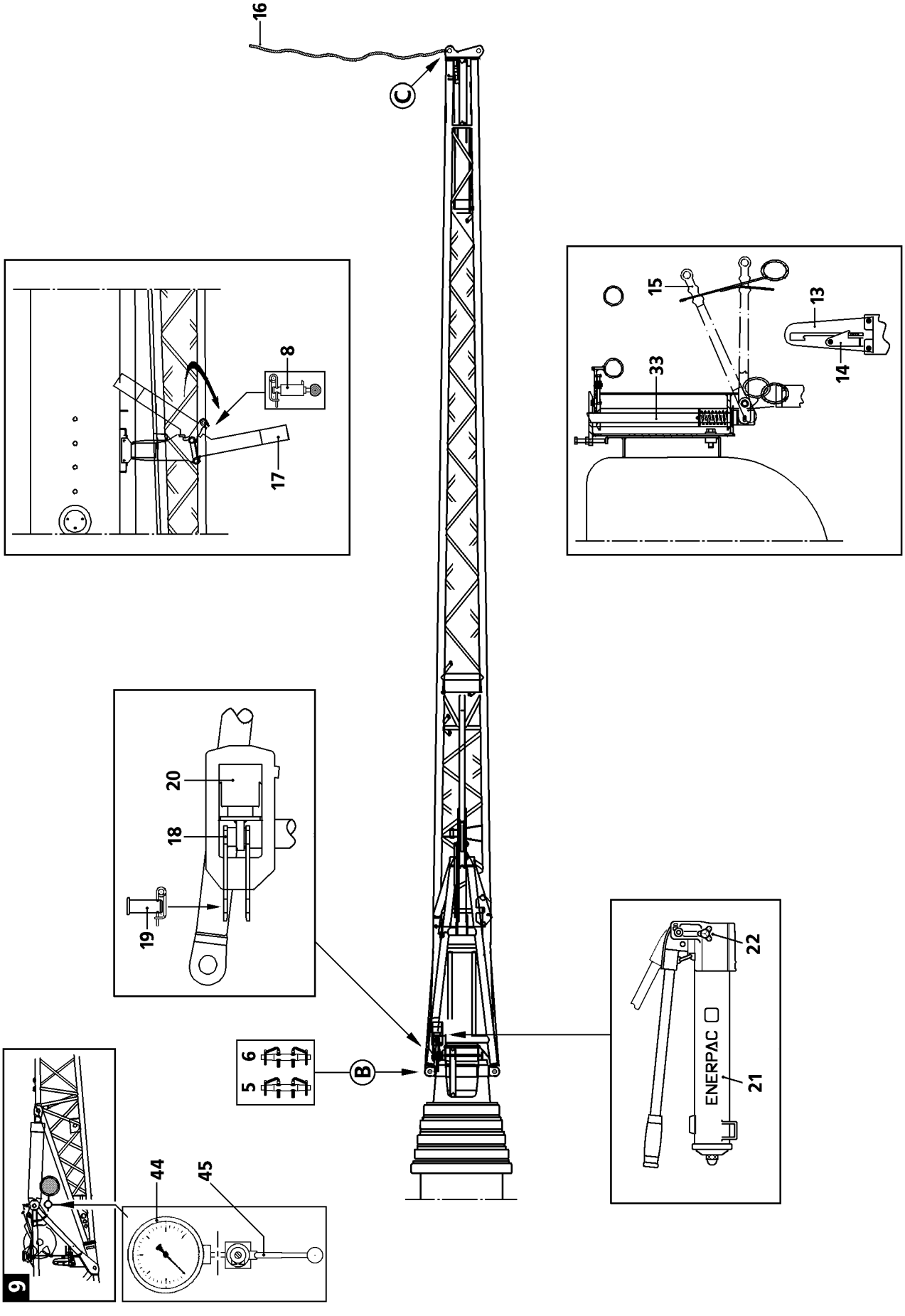
11.2 Preparatory work before swinging in the hydraulic folding jibs

Before swinging the hydraulic folding jib* in, the folding jib must be fully luffed up and held on block for approximately 15 seconds. This causes the hydraulic reservoir to fill.

▶ For operation with hydraulic folding jib:
Luff up folding jib and move on block.

Result:

– The pressure gauge **44** must then show 200 to 250 bar.



B195373

11.3 Removing the single folding jib carried on the crane

- ▶ Disengage the lever **15** with the assembly rod from the link **13** and pull downward.
- ▶ Attach the auxiliary rope **16** at point **C**.

When swinging the folding jib support **17** in and out, ensure that the spring-loaded pin **8** is unlocked using one hand and that the folding jib support **17** is moved overhead with the other hand.

- ▶ Release and unpin the spring-loaded pin **8**.
- ▶ Swing out the folding jib support **17** until the spring-loaded pin **8** engages again.

In order to remove the pin at the top of the point **B**, the hydraulic/mechanical assembly aid **20** must be used.

- ▶ Close the knob **22** on the manual pump **21**.
- ▶ Extend the hydraulic cylinder of the assembly aid **20** by actuating the manual pump **21** until the pin **6** can be unpinned.
- ▶ Release and unpin the pin **6** on top.
- ▶ Open the rotary knob **22** at the manual pump **21**

Result:

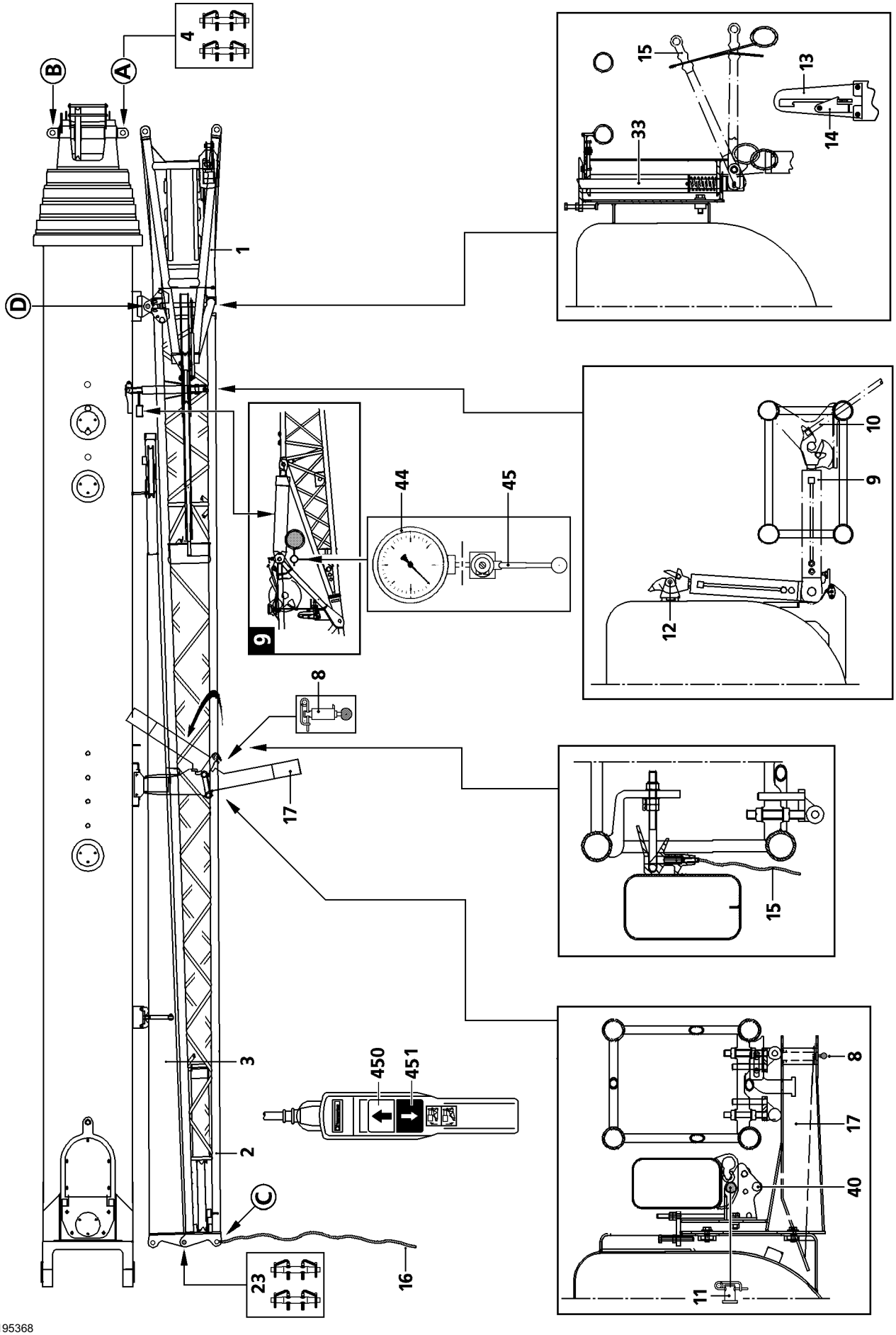
– The hydraulic cylinder of the assembly aid **20** returns to the starting position.

- ▶ Unpin the pins **19** and insert into bore **18** and secure.

DANGER
The folding jib can swing out inadvertently!
When removing the pin **5**, the folding jib may swing out unintentionally.
In order to prevent the folding jib from swinging out by itself:

- ▶ Hold the folding jib with the auxiliary rope!
- ▶ Do not lean the ladder against the folding jib!

- ▶ Release the pin **5** on the bottom and unpin.



B195368

DANGER
Danger of fatal injuries due to falling folding jib!
The folding jib can fall down due to a disassembly error.
- ▶ Standing under the folding jib during the swing operation is prohibited!
- ▶ It is prohibited for anyone to remain in the swing range as well as the folding range of the folding jib!

- ▶ Swing the folding jib back until the swing cylinder **9** is locked to the folding jib.
- ▶ Start the crane engine.
- ▶ Press button **450** and swing in the folding jib with the swing cylinder until the lock **33** engages audibly.
- ▶ Check whether the lock **33** has engaged properly.

DANGER
Danger of fatal injury when unpinning the pins **4**!
If the pins **4** are unpinned before the lock **33** has engaged, then the folding jib will fall down and possibly cause fatal injury to the installation personnel.
- ▶ The pins **4** may not be unpinned until the lock **33** has engaged and the manual lever **16** has been secured with the safety bracket **15**.

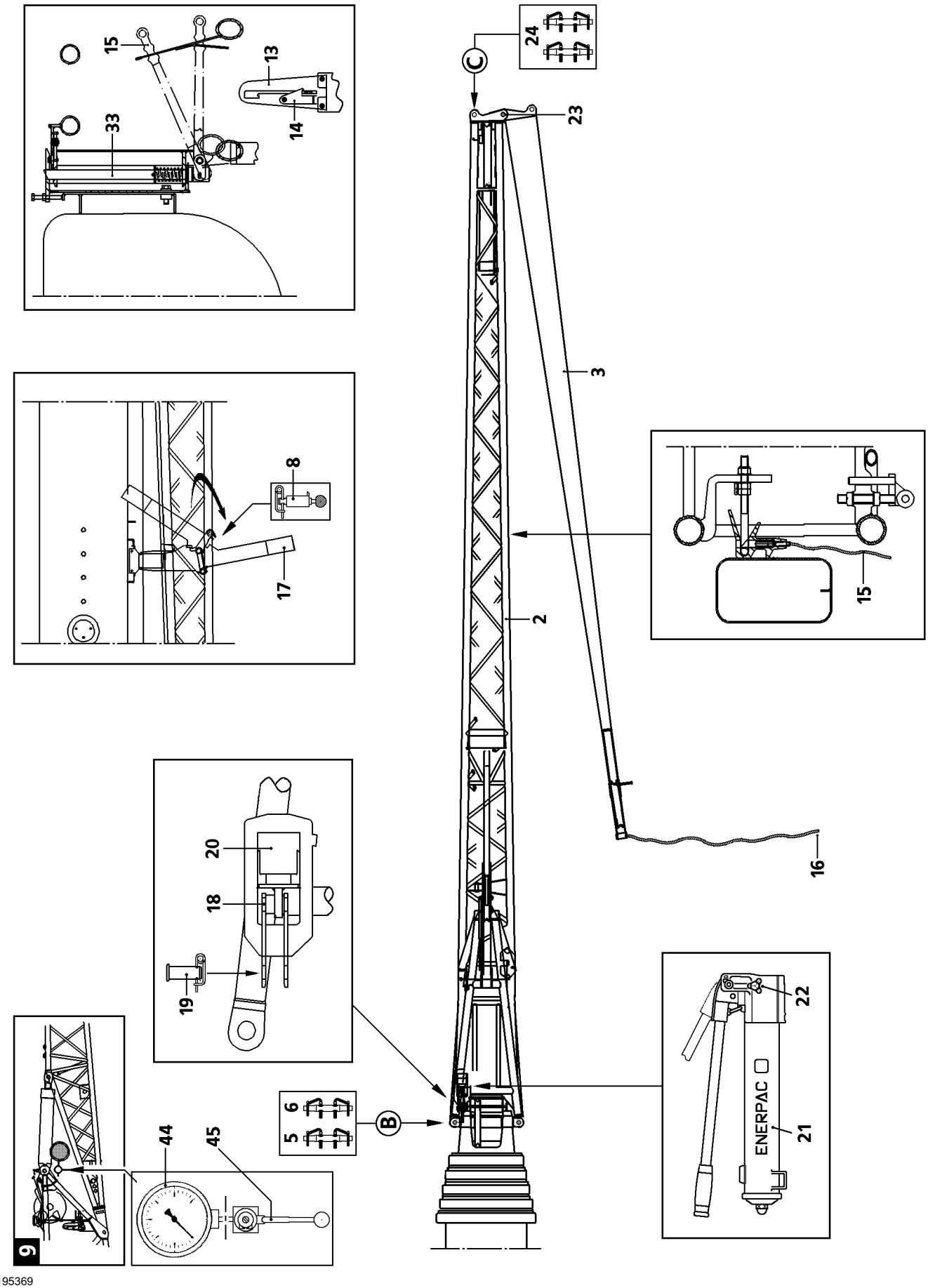
- ▶ Secure the manual lever **15** with the safety bracket **14**.
- ▶ Release the pin **4** at point **A**, unpin and insert into transport retainer.
- ▶ Press button **450** and swing the folding jib with swing cylinder in all the way.

Result:
– When the dual folding jib is being transported the articulated piece **2** is locked to the head piece **3**.

- ▶ If a dual folding jib is carried along:
  Pin and secure pin **23**.

When swinging the folding jib support **17** in and out, make sure that the spring-loaded pin **8** is unlocked using one hand and that the folding jib support **17** is moved overhead with the other hand.
- ▶ Unpin the spring-loaded pin **8** and swing in the folding jib support **17** until the spring-loaded pin **8** engages.
- ▶ Secure the spring-loaded pin **8**.
- ▶ If a hydraulic folding jib is carried along:
  Connect hydraulic line to hydraulic cylinder (illustration 9).
- ▶ Remove the auxiliary rope **16**.

Hydraulic folding jibs have an overflow tank attached to the hydraulic cylinder. The overflow tank must be emptied when it is full. Even if the folding jib is not transported on the crane.
- ▶ For operation with hydraulic folding jib:
  Empty the overflow tank on the hydraulic cylinder.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B195369

11.4 Removing the dual folding jib carried on the crane

11.4.1 Disassembly of the head piece

▶ Attach the auxiliary rope **16** on the head piece.

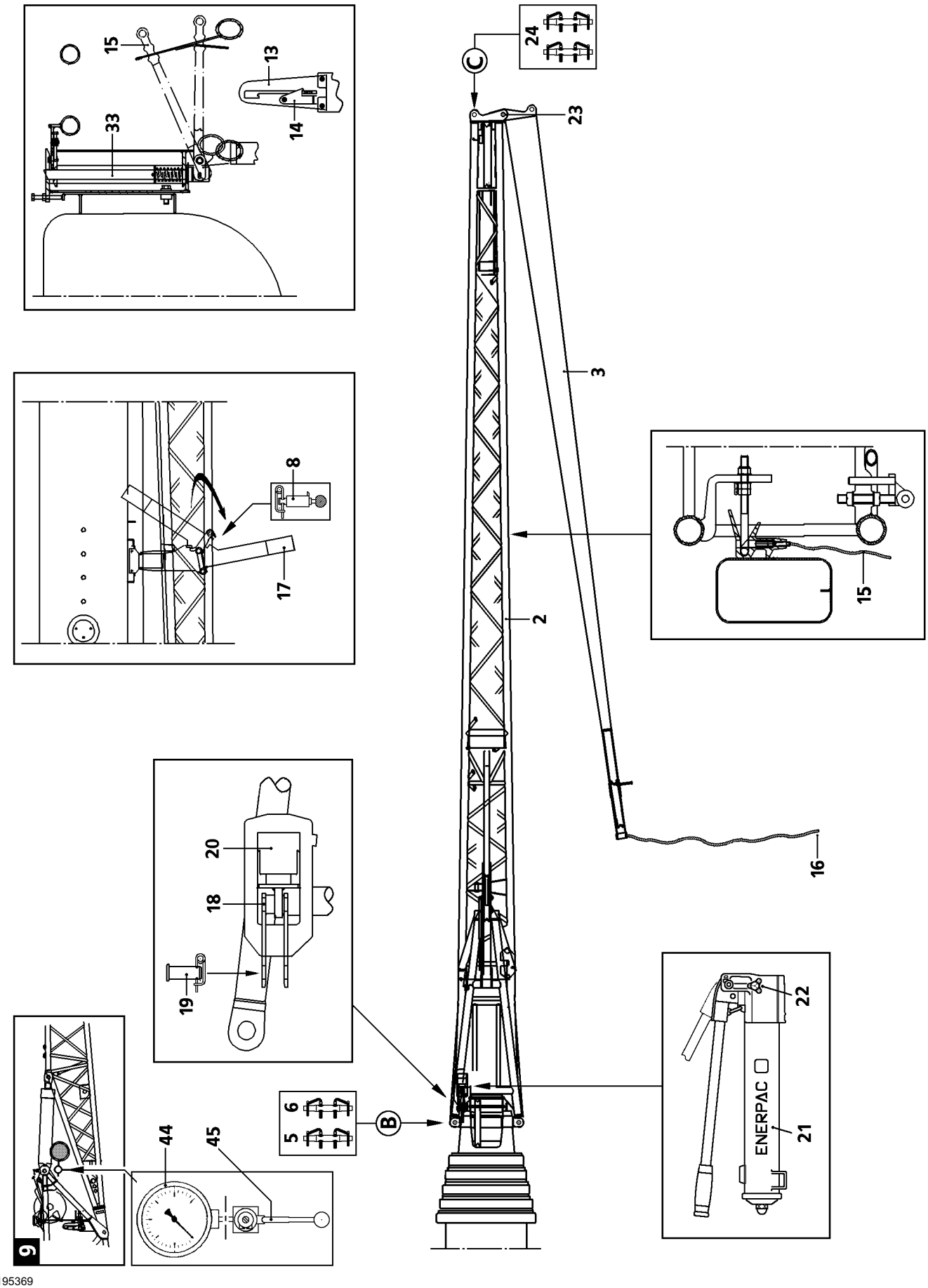
DANGER
The folding jib can swing out inadvertently!
While unpinning the pins **24**, the folding jib may swing out involuntarily.
In order to prevent the folding jib from swinging out by itself:
▶ Hold the folding jib with the auxiliary rope!
▶ Do not lean the ladder against the head piece **3**!

▶ Release and unpin the pin **24**.

DANGER
Danger of fatal injuries due to falling folding jib!
The folding jib can fall down due to a disassembly error.
▶ Standing under the folding jib during the swing operation is prohibited!
▶ It is prohibited for anyone to remain in the swing range as well as the folding range of the folding jib!
▶ The pins **23** must remain pinned.

▶ Swing in the head piece **3** until the head piece **3** is locked to the articulated piece **2**.
▶ Check whether the head piece **3** and the articulated piece **2** are properly locked together.
▶ Remove the auxiliary rope **16** from the head piece **3** and attach on point **C**.
▶ Disengage the lever **15** with the assembly rod from the link **13** and pull downward.

When swinging the folding jib support **17** in and out, make sure that the spring-loaded pin **8** is unlocked using one hand and that the folding jib support **17** is moved overhead with the other hand.
▶ Release and unpin the spring-loaded pin **8**.
▶ Swing out the folding jib support **17** until the spring-loaded pin **8** engages again.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B195369

11.4.2 Dismantling articulated piece

In order to remove the pin at the top of the point **B**, the hydraulic/mechanical assembly aid **20** must be used.

- ▶ Close the knob **22** on the manual pump **21**.
- ▶ Extend the hydraulic cylinder of the assembly aid **20** by actuating the manual pump **21** until the pin **6** can be unpinned.
- ▶ Release and unpin the pin **6** on top.
- ▶ Open the knob **22** on the manual pump **21**.

Result:

– The hydraulic cylinder of the assembly aid **20** returns to the starting position.

- ▶ Unpin the pins **19** and insert into bore **18** and secure.

DANGER

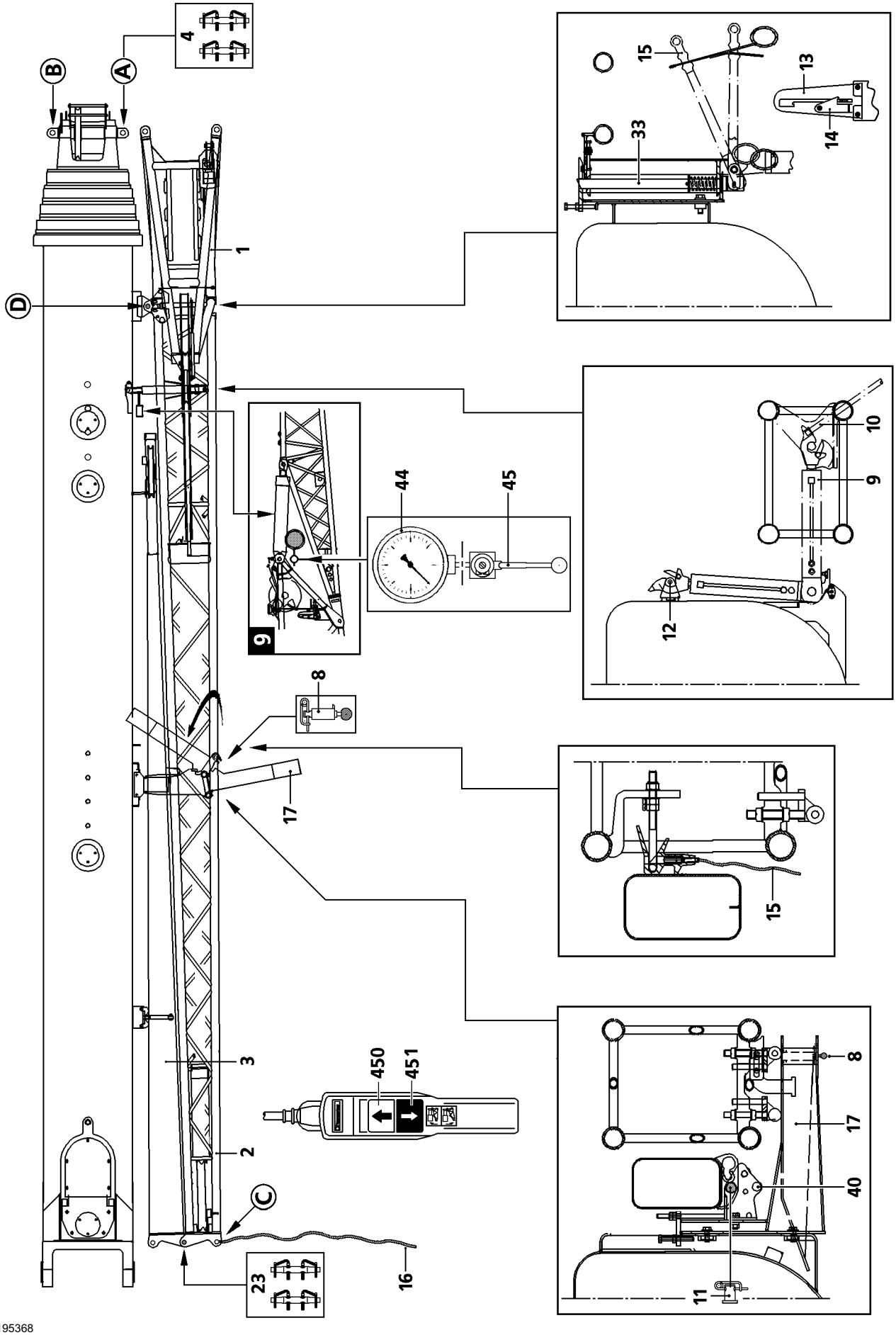
The folding jib can swing out inadvertently!

When removing the pin **5**, the folding jib may swing out unintentionally.

In order to prevent the folding jib from swinging out by itself:

- ▶ Hold the folding jib with the auxiliary rope!
- ▶ Do not lean the ladder against the folding jib!

- ▶ Release the pin **5** on the bottom and unpin.


A
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44
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451
9
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15
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40
11

B195368

DANGER
Danger of fatal injuries due to falling folding jib!
The folding jib can fall down due to a disassembly error.
- ▶ Standing under the folding jib during the swing operation is prohibited!
- ▶ It is prohibited for anyone to remain in the swing range as well as the folding range of the folding jib!

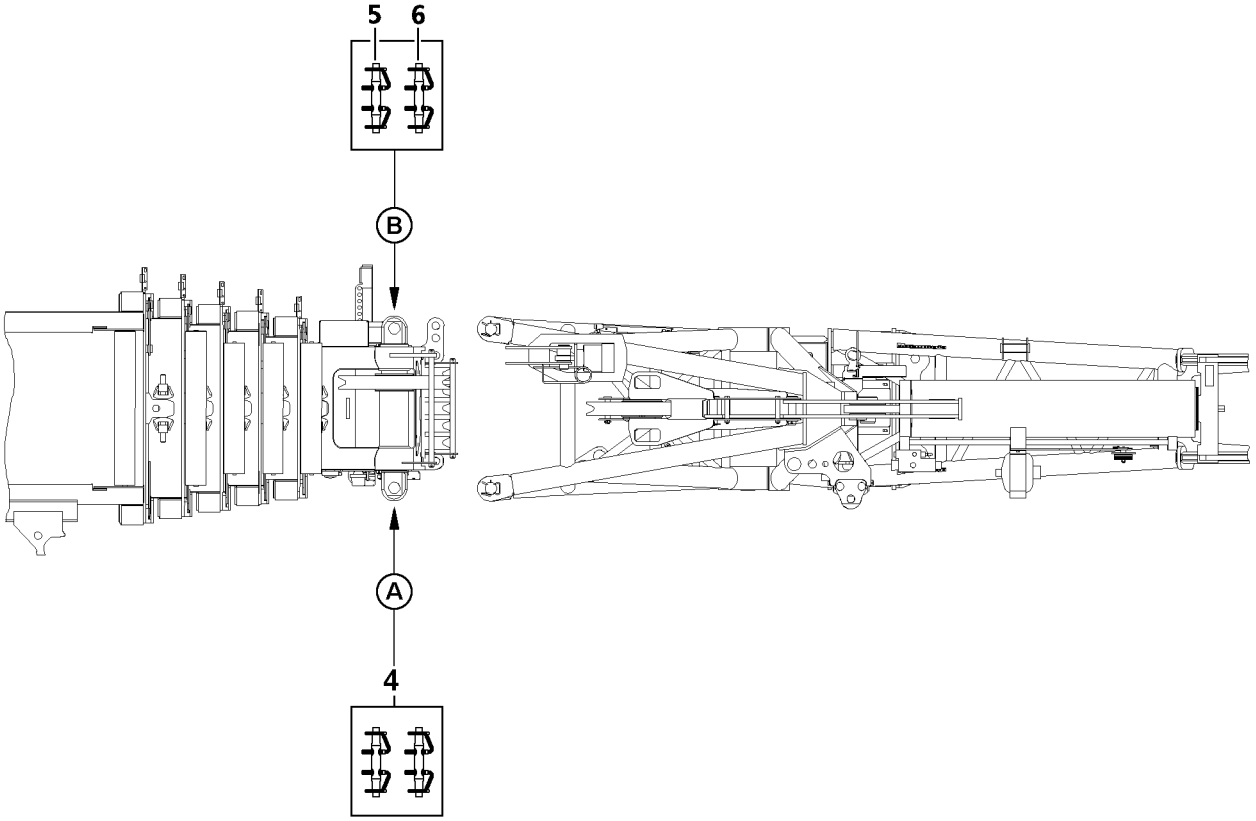
- ▶ Swing the folding jib back until the swing cylinder **9** is locked to the folding jib.
- ▶ Start the crane engine.
- ▶ Press button **450** and swing in the folding jib with the swing cylinder until the lock **33** engages audibly.
- ▶ Check whether the lock **33** has engaged properly.

DANGER
Danger of fatal injury when unpinning the pins **4**!
If the pins **4** are unpinned before the lock **33** has engaged, then the folding jib will fall down and possibly cause fatal injury to the installation personnel.
- ▶ The pins **4** may not be unpinned until the lock **33** has engaged and the manual lever **16** has been secured with the safety bracket **15**.

- ▶ Secure the manual lever **15** with the safety bracket **14**.
- ▶ Release the pin **4** at point **A**, unpin and insert into transport retainer.
- ▶ Press button **450** and swing the folding jib with swing cylinder in all the way.
- ▶ Unpin the pin **11** from hole **40**, pin folding jib with pin **11** and secure.

When swinging the folding jib support **17** in and out, make sure that the spring-loaded pin **8** is unlocked using one hand and that the folding jib support **17** is moved overhead with the other hand.
- ▶ Unpin the spring-loaded pin **8** and swing in the folding jib support **17** until the spring-loaded pin **8** engages.
- ▶ Secure the spring-loaded pin **8**.
- ▶ If a hydraulic folding jib is carried along:
  Connect hydraulic line to hydraulic cylinder (illustration 9).
- ▶ Remove the auxiliary rope **16**.

Hydraulic folding jibs have an overflow tank attached to the hydraulic cylinder. The overflow tank must be emptied when it is full. Even if the folding jib is not transported on the crane.
- ▶ For operation with hydraulic folding jib:
  Empty the overflow tank on the hydraulic cylinder.



B197651

11.5 Disassembly of the separately transported folding jib

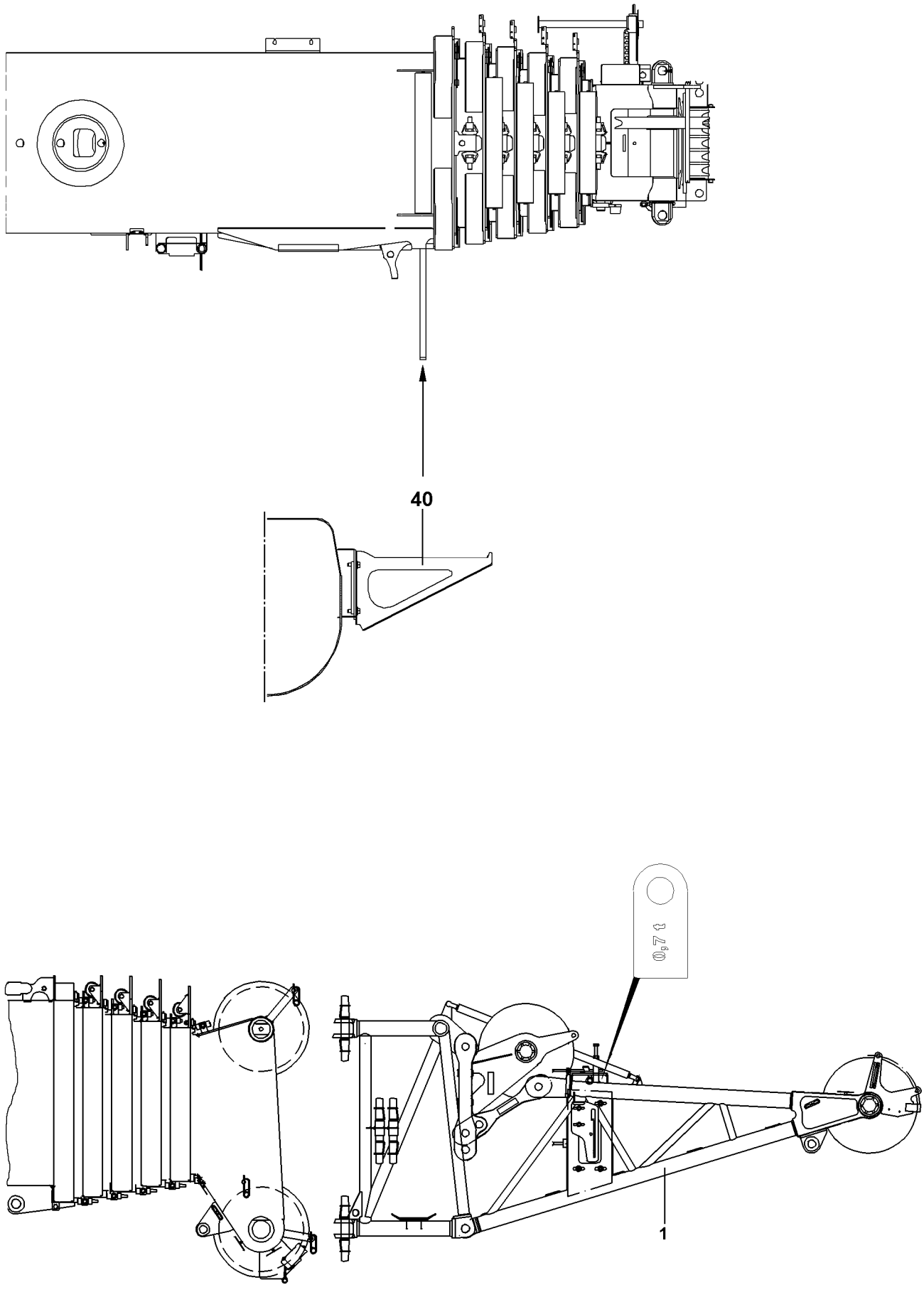
Ensure that the following prerequisites are met:
– the head piece is locked to the articulated piece
See also section “Disassembly of the head piece”

For description of fastening points, see section “Fastening points”.
▶ Attach the auxiliary crane to corresponding fastening points on folding jib.

DANGER
Danger of accident when removing the folding jib!
If the following conditions are not met, personnel can be fatally injured during the disassembly.
▶ When knocking out the pins, no one may remain under the folding jib!
▶ Attach ropes so that no sloping occurs!
▶ Only lift a weight with the auxiliary crane that corresponds to the weight of the folding jib that is being removed!
▶ The folding jib may suddenly release due to distortion!
▶ Do not remove the folding jib until it has been secured with the auxiliary crane to prevent it from falling!
▶ Do not lean the ladder against the folding jib!

▶ Tighten the ropes until the folding jib is secured to prevent it from falling.
▶ Unpin the folding jib from the telescopic boom:
▶ Release and unpin pins **4** at the top and at the bottom at point **A**.
▶ Release and unpin pins **5** and **6** at the top and the bottom at point **B**.
▶ Place the folding jib onto the transport vehicle.

Hydraulic folding jibs have an overflow tank attached to the hydraulic cylinder. The overflow tank must be emptied when it is full. Even if the folding jib is not transported on the crane.
▶ For operation with hydraulic folding jib:
Empty the overflow tank on the hydraulic cylinder.


40
1
B103741

1 General

CAUTION
The auxiliary boom can collide with the catch bar **40** for the single / dual folding jib!
▶ Remove the catch bar **40** before assembling the auxiliary boom.

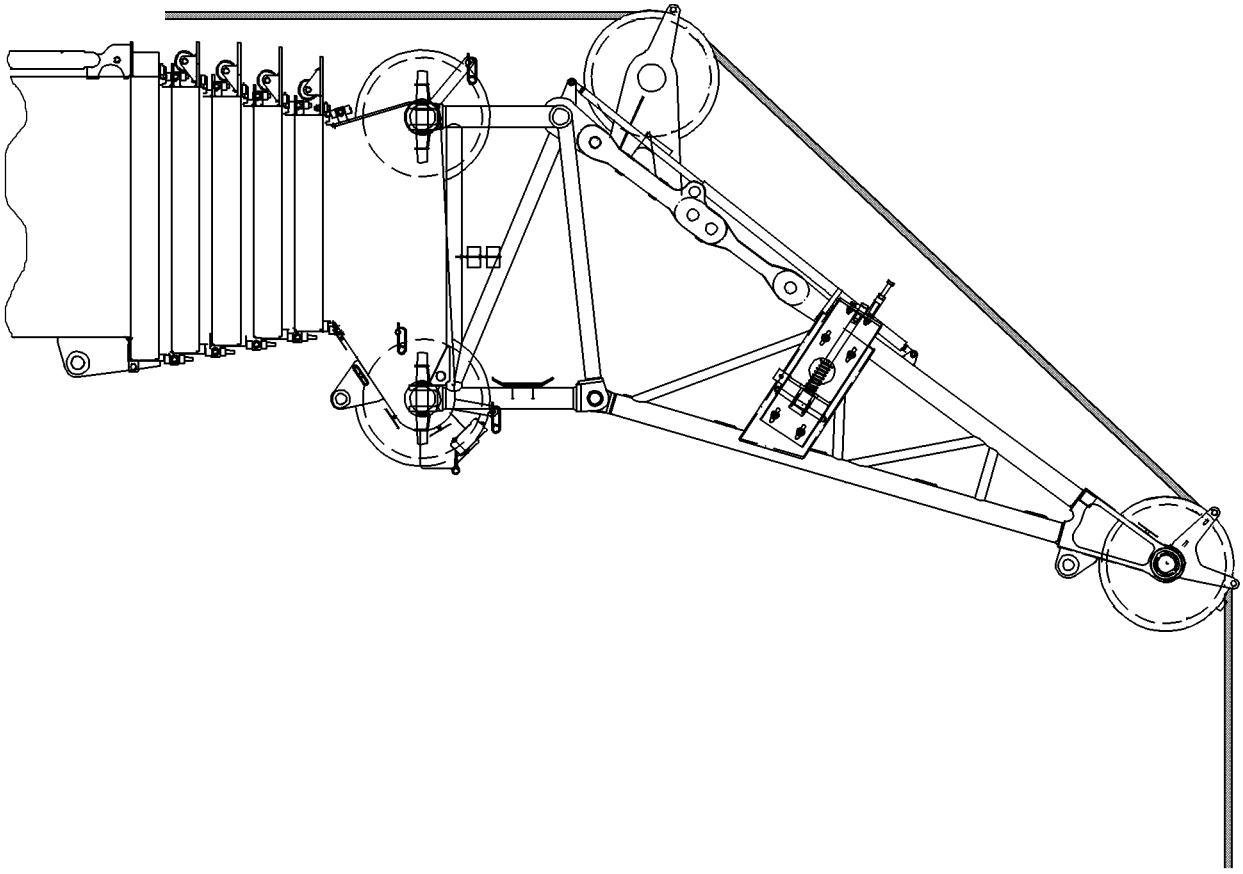
DANGER
Danger of fatal injuries due to toppling folding jib!
As a result of improperly assembled, damaged or non-existing catch bar **40** on the telescopic boom pivot section, “the folding jib” – due to an assembly error – can fall down and cause fatal injuries.
▶ Make sure that the catch bar **40** is property assembled again and not damaged “before assembling the single or the dual folding jib”, see also “chapter 5.02”.

The auxiliary boom can be self-assembled on the telescopic boom.

DANGER
Danger of accident when driving with the auxiliary boom!
▶ Before being driven on roads, the auxiliary boom must always be brought to the transportation position and mechanically secured.
▶ Make sure that the auxiliary boom is properly secured before driving the crane on public roads.

1.1 Components overview

Position	Description	Length	Weight
1	Auxiliary boom	2.9 m	0.7 t



B192467

2 Assembly of the auxiliary boom

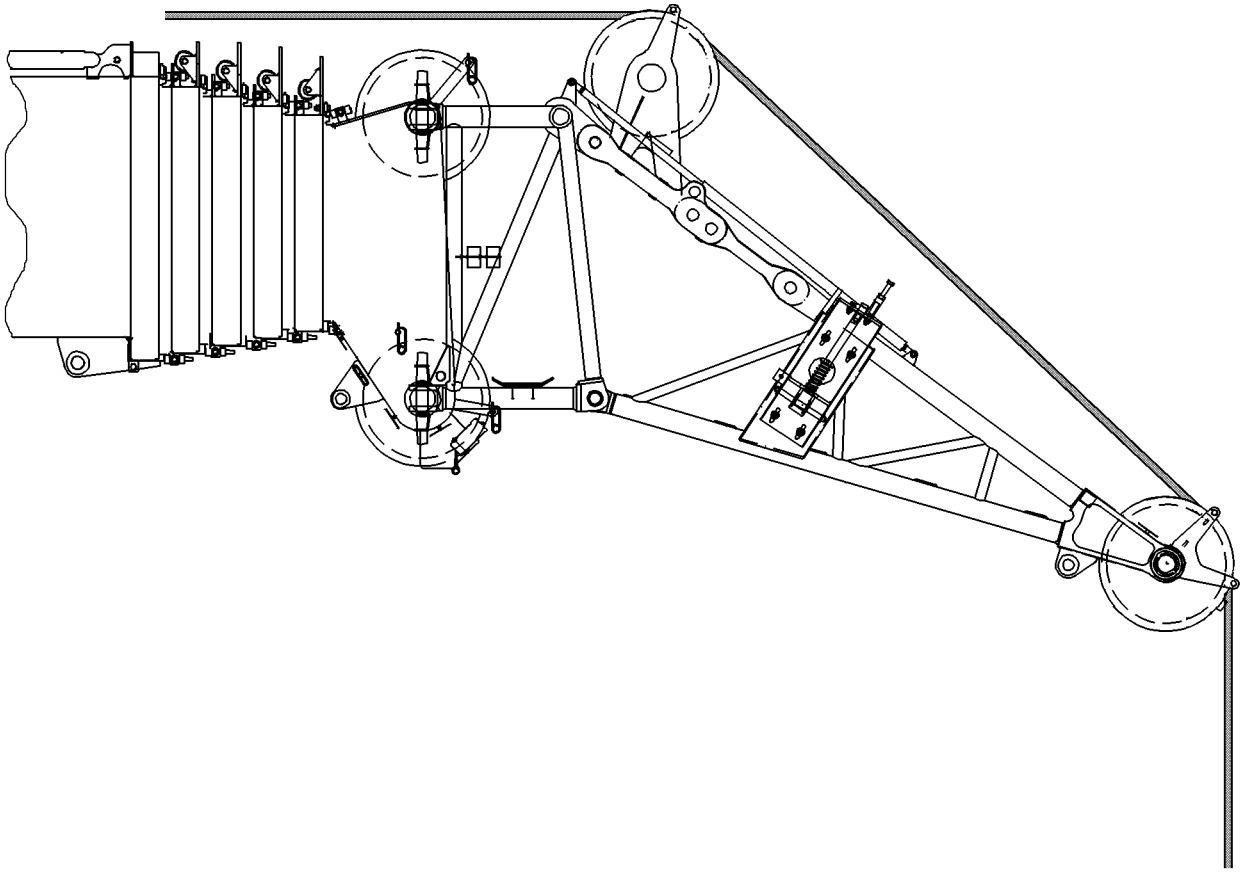
2.1 General

DANGER
Danger of fatal injury due to toppling auxiliary boom!
Due to an assembly error, the auxiliary boom could fall down.
- ▶ Standing under the auxiliary boom during the swing operation is prohibited!
- ▶ It is prohibited for anyone to remain within the swinging area or the folding area of the auxiliary boom!
- ▶ The auxiliary boom must be secured by an auxiliary rope during the swing process!

DANGER
Danger of falling!
During assembly and disassembly, personnel must be secured with appropriate antifall guards to prevent them from falling. If this is not observed, personnel could fall and suffer life-threatening injuries.
- ▶ All assembly work from a height of 2 m must normally be carried out using suitable aids (lifting platforms, scaffolding, ladders, auxiliary crane etc.)! The height above which assembly / disassembly work must be carried out with aids depends on national regulations. The national regulations must be adhered to!
- ▶ If work cannot be carried out using these aids or from the ground, the installers must be protected from falling using suitable means (such as safety belts)!
- ▶ Do not walk on the telescopic boom or auxiliary boom!

Make sure that the following prerequisites are met:
- – the crane is properly supported and horizontally aligned,
- – the counterweight has been attached to the turntable according to the load chart,
- – the telescopic boom is fully telescoped in,
- – the auxiliary boom is attached on the telescopic boom pivot section for transport,
- – the telescopic boom has been luffed to the rear or the side in the 0° position.

DANGER
Danger of accident from involuntary swinging out of the auxiliary boom when it is unpinned!
If the telescopic boom is not in the 0° position, a risk of accident exists due to involuntary swinging out of the auxiliary boom when it is unpinned.
- ▶ Move the telescopic boom to 0° position.



B192467

2.2 Reeving out the hoist rope on the telescopic boom head

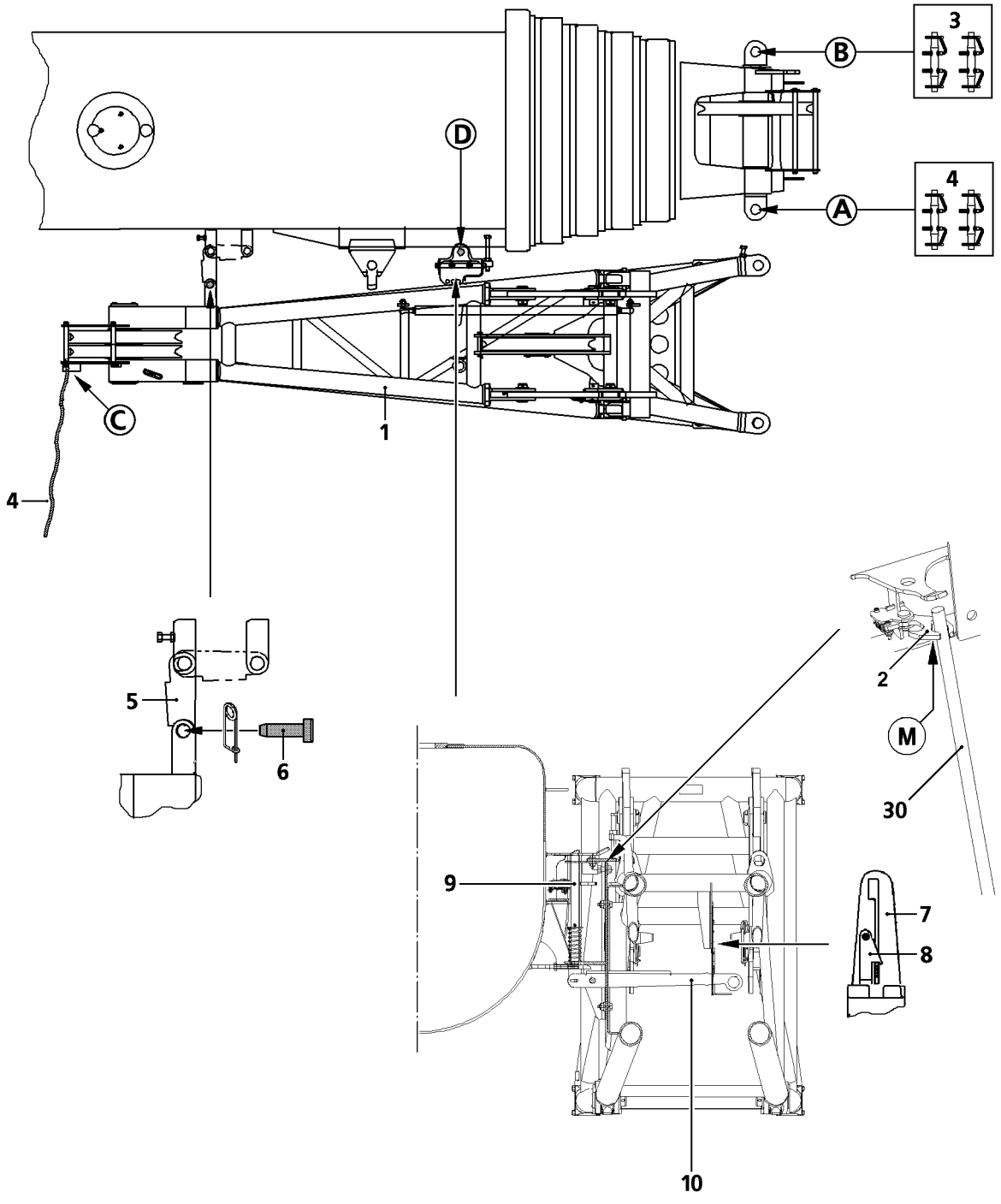
In order to speed up the subsequent reeving in of the hoist rope after assembling the auxiliary boom, the hook block can be put down at a distance from the crane approximating to the subsequent distance of the telescoped in telescopic boom **with** assembled auxiliary boom.

- ▶ Telescope out the telescopic boom to the corresponding length.
- ▶ Place the hook block on the ground.
- ▶ Disengage the hoist rope at the rope fixed point.
- ▶ Disassemble the hoist limit switch weight and the chain for safety reasons.

Note

- ▶ The hoist limit switch must be pulled mechanically and the operating cable must be attached to the telescopic boom head with the snap hook when operating the auxiliary boom.
- ▶ The telescopic boom may remain reeved in, if the hoist rope of winch 2 is used for auxiliary boom operation.

- ▶ Remove the rope retaining pipes on the pulley head and on the back pulley.
- ▶ Telescope the telescopic boom in again completely.



B107338

2.3 Swivelling auxiliary boom into operating position

- ▶ Attach the auxiliary rope **4** at point **C**.
- ▶ Release and unpin the pin **6**.
- ▶ Swivel auxiliary boom **1** out until it can be pinned at point **A**.
- ▶ Insert the pins **4** at the top and at the bottom at point **A** and secure.

DANGER
Danger of fatal injury due to toppling auxiliary boom!
Special retaining clips must be used to secure the pins **4**. The use of spring pins or spring retainers on the pins **4** is not permitted. The auxiliary boom may only be released at point **D** if the pins **4** are pinned and secured at the top and bottom at point **A**.

- ▶ Pin and secure pins **4** at point **A** at top and bottom.

- ▶ Swing the safety bracket **8** with the assembly rod to the side.
- ▶ Push the lever **10** with the assembly rod up and latch into the bracket **7**.

Note

- ▶ Open the catch claw **2** with the special assembly rod **30** from the ground.

- ▶ Guide the assembly rod **30** from below in point **M** and leverage the catch claw **2** on the side in direction of the boom head.

Result:

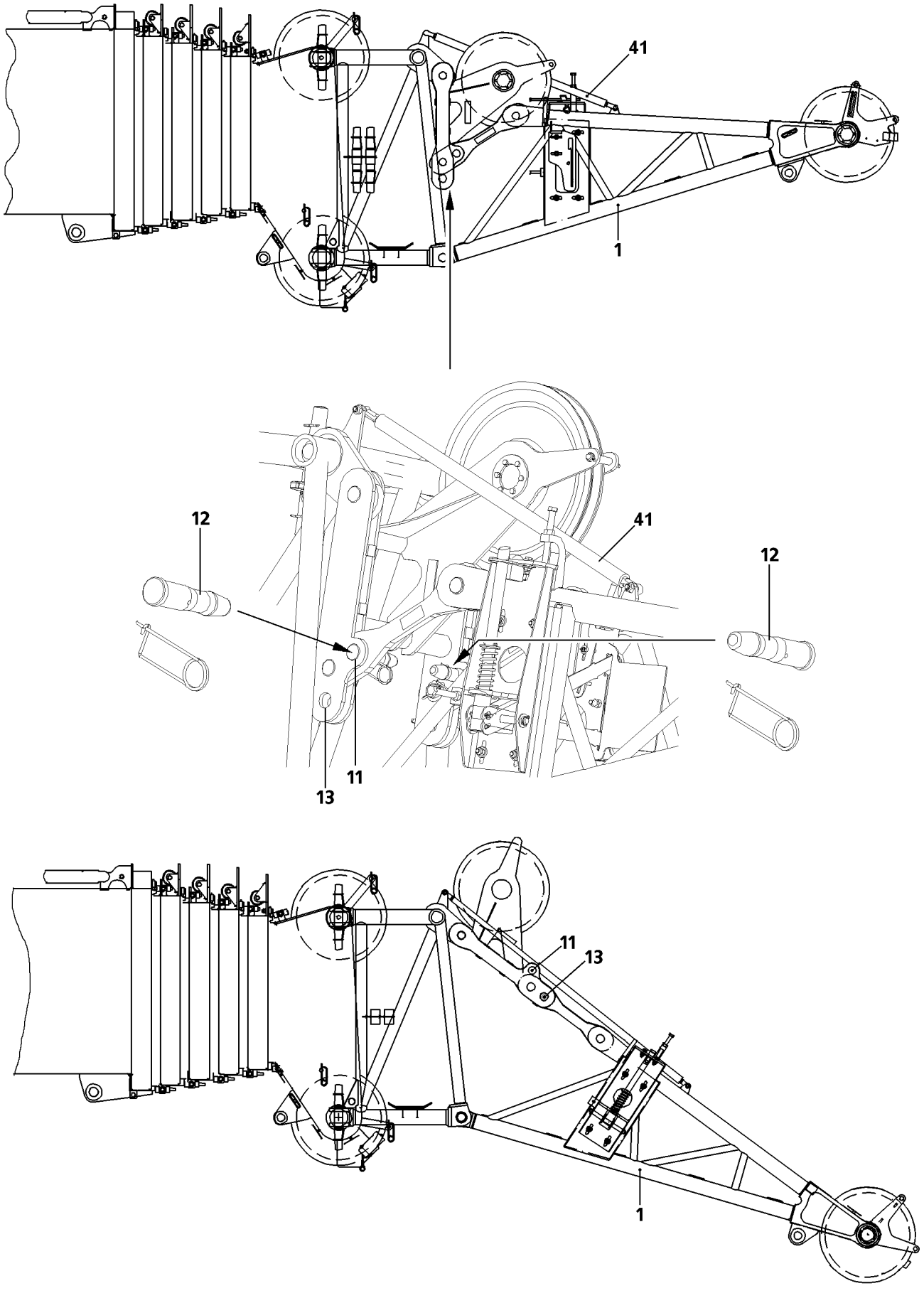
– The catch claw **2** opens and the auxiliary boom **1** is leveraged from the console of the transport retainer.

- ▶ Swing the auxiliary boom **1** out from the catch claw **2**.
- ▶ Swivel the auxiliary boom **1** with the auxiliary rope **4** by 180 ° until it can be pinned at point **B** at the top and bottom.

DANGER
Risk of accident!

- ▶ The use of spring cotters or spring retainers is prohibited on the pins **3**!
- ▶ Special retaining clips must be used to secure the pins **3**.

- ▶ Insert the pins **3** at the top and at the bottom at point **B** and secure.
- ▶ Remove the auxiliary rope **4**.



B104953

2.4 Folding the auxiliary boom into operating position

DANGER
Danger of fatal injury in case of defective pneumatic spring!
The pins **12** are easy to remove when the pneumatic spring **41** is working correctly.
If the pneumatic spring **41 is defective**, it is **not** possible to remove the pins **12**!
Defective pneumatic springs **41** no longer provide the supporting properties on the movable components on the auxiliary boom **1**!
If the pneumatic spring **41** is defective, the auxiliary boom **1** can fall down and fatally or seriously injure personnel!
There is an increased danger of accidents!

- ▶ Before unpinning the pin **12** and before actuation, check the pneumatic spring **41** for external damage!
- ▶ Do not use auxiliary boom **1** with defective pneumatic spring **41**! Replace defective pneumatic springs **41**!
- ▶ If the pneumatic spring **41** is defective, support the auxiliary boom **1** from below or hang it on an auxiliary crane.
- ▶ It is strictly prohibited for personnel or objects to remain within the movement range of the auxiliary boom **1**!
- ▶ It is prohibited for personnel or objects to remain within the danger zone of the moveable components!

DANGER
Danger of fatal injury due to toppling auxiliary boom!
Before unpinning the pins **12** it must be ensured that no persons or objects are in the danger zone, particularly beneath the auxiliary boom.

- ▶ Do not unpin pins **12** until all persons and objects have been removed from the danger zone!

- ▶ Unpin the pins **12** on both sides from the bores **11**.
- ▶ Fold the auxiliary boom **1** down until the bores align.

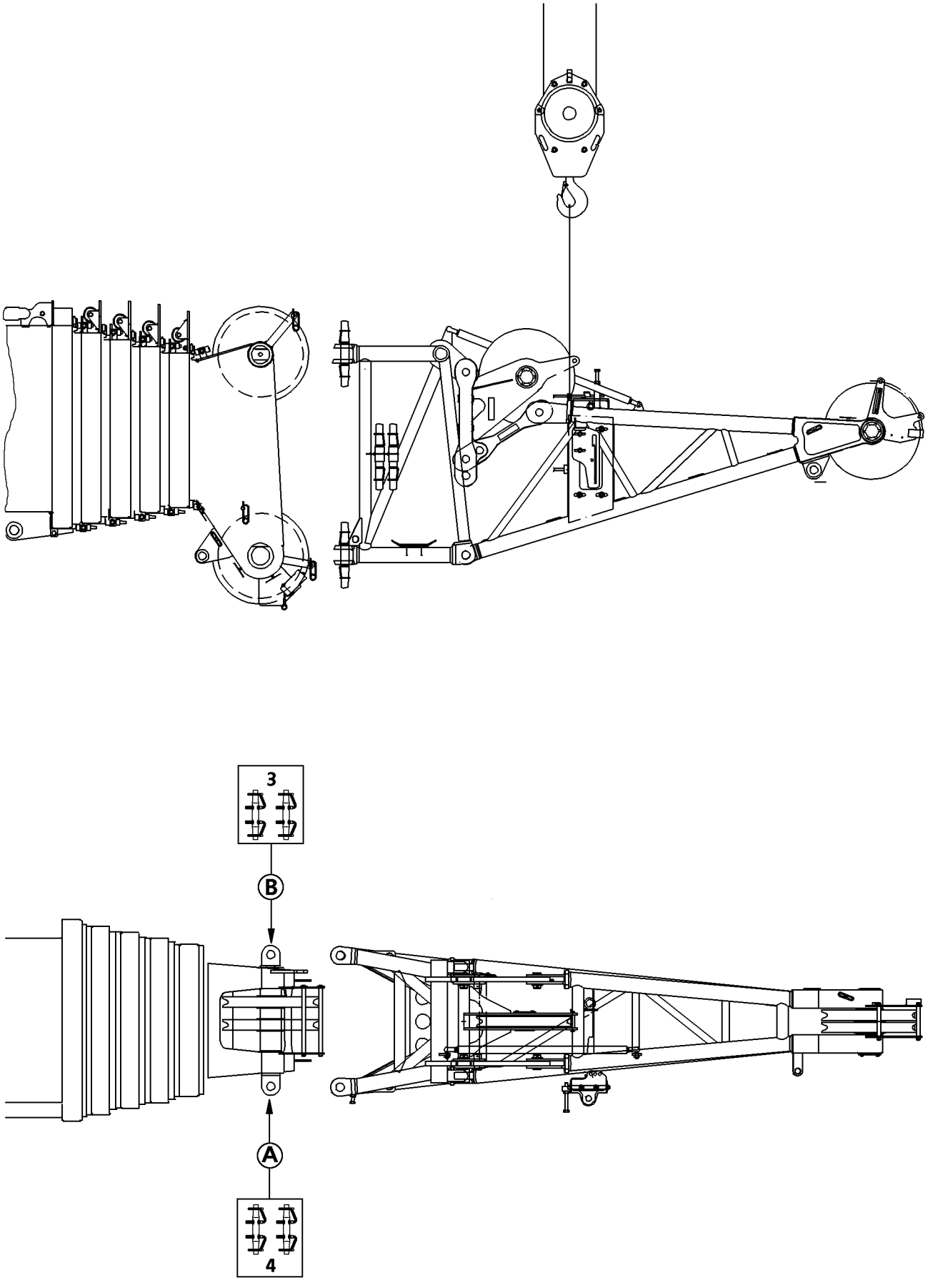
Note

- ▶ The folding procedure is simplified if a hook block is reeved in.
- ▶ The rope retaining pins must be unpinned before the folding procedure, see paragraph “Reeving the hoist rope”.
- ▶ Lift the hook block to the point where the bores align.

- ▶ Fit the pins **12** on both sides in bores **13** from “outside to inside” and secure with spring retainers.

Before starting to use the auxiliary boom **1**, the auxiliary boom **1** must be folded down and pinned.

- ▶ Check if the auxiliary boom **1** has been pinned as described in the operating instructions.



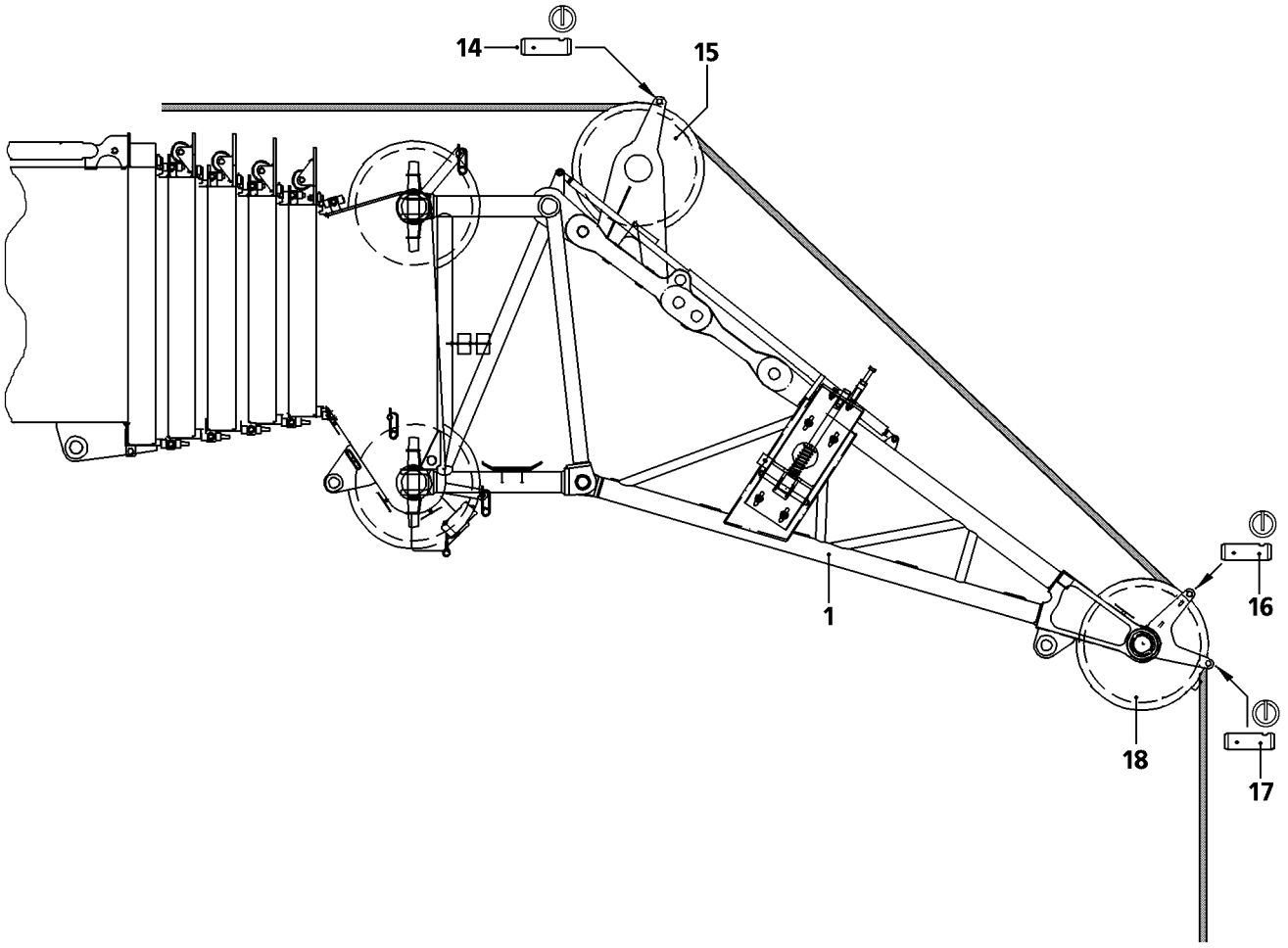
B192473

2.5 On-the-fly assembly of the auxiliary boom

- ▶ Hang the auxiliary boom on the auxiliary crane and guide in the fork heads on the telescopic boom.

DANGER
Risk of accident!
- ▶ The use of spring cotters or spring retainers is prohibited on pins **3** and pins **4**!
- ▶ To secure the pin **3** and the pin **4**, use the special retaining clips.

- ▶ Pin auxiliary boom to telescopic boom:
- ▶ Pin and secure pins **4** on top and on the bottom at point **A**.
- ▶ Pin and secure pins **3** on top and on the bottom at point **B**.
- ▶ For rest of assembly see section “Folding end section to operating position”.



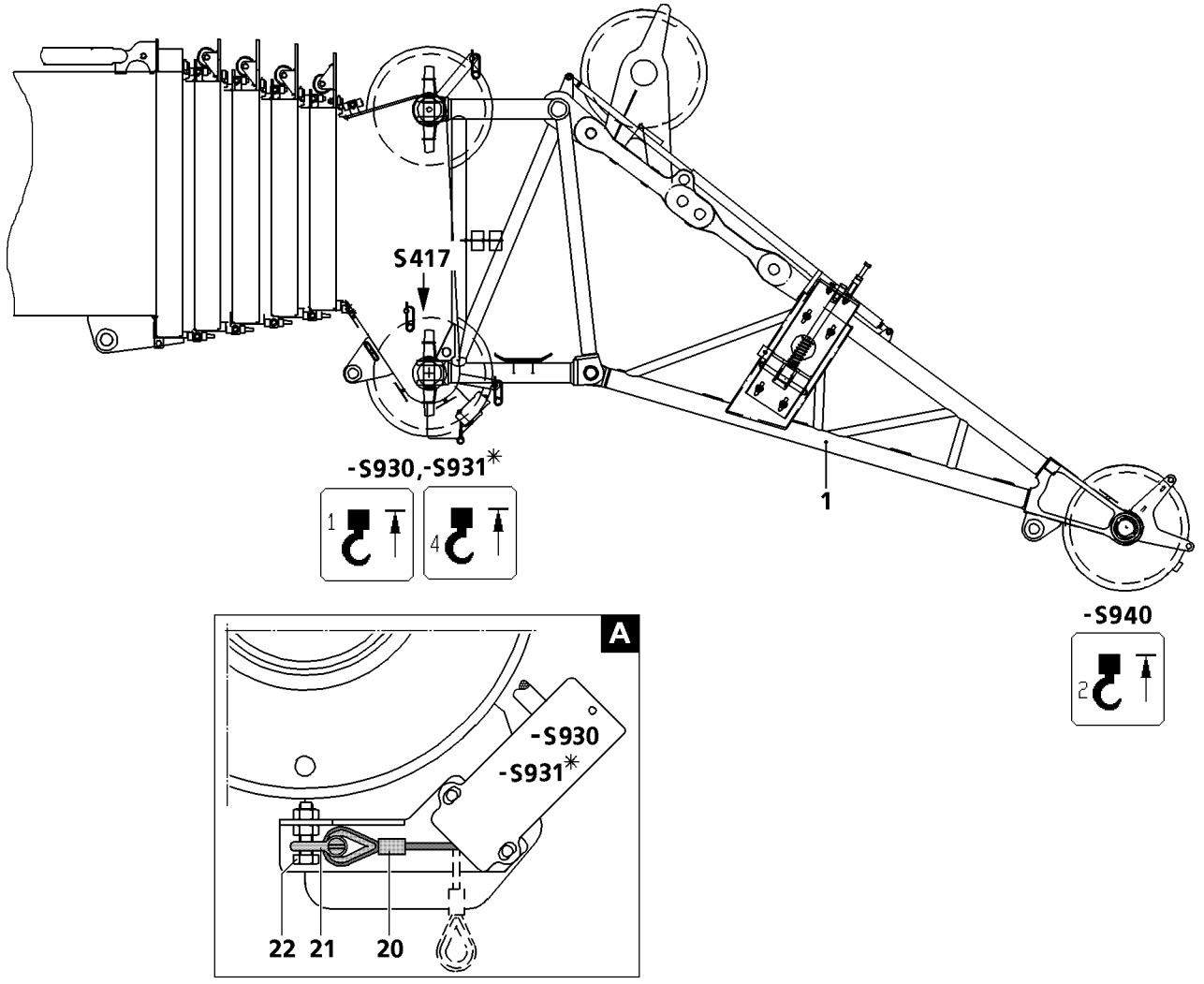
B192470

2.6 Reeving in the hoist rope

- ▶ Release and unpin rope retaining pin **14**, rope retaining pin **16** and rope retaining pin **17**.
- ▶ Run hoist rope over rope guide pulley **15** and main pulley **18**.
- ▶ Pin rope retaining pin in again and secure with linch pins.
- ▶ Reeve in the load hook or hook block.
- ▶ Attach the hoist limit switch weight.

Note

- ▶ The weight of the hook block that is reeved into the telescope boom must be deducted from the load during auxiliary boom operations with the hook block reeved into the telescope boom.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-S930
-S931*
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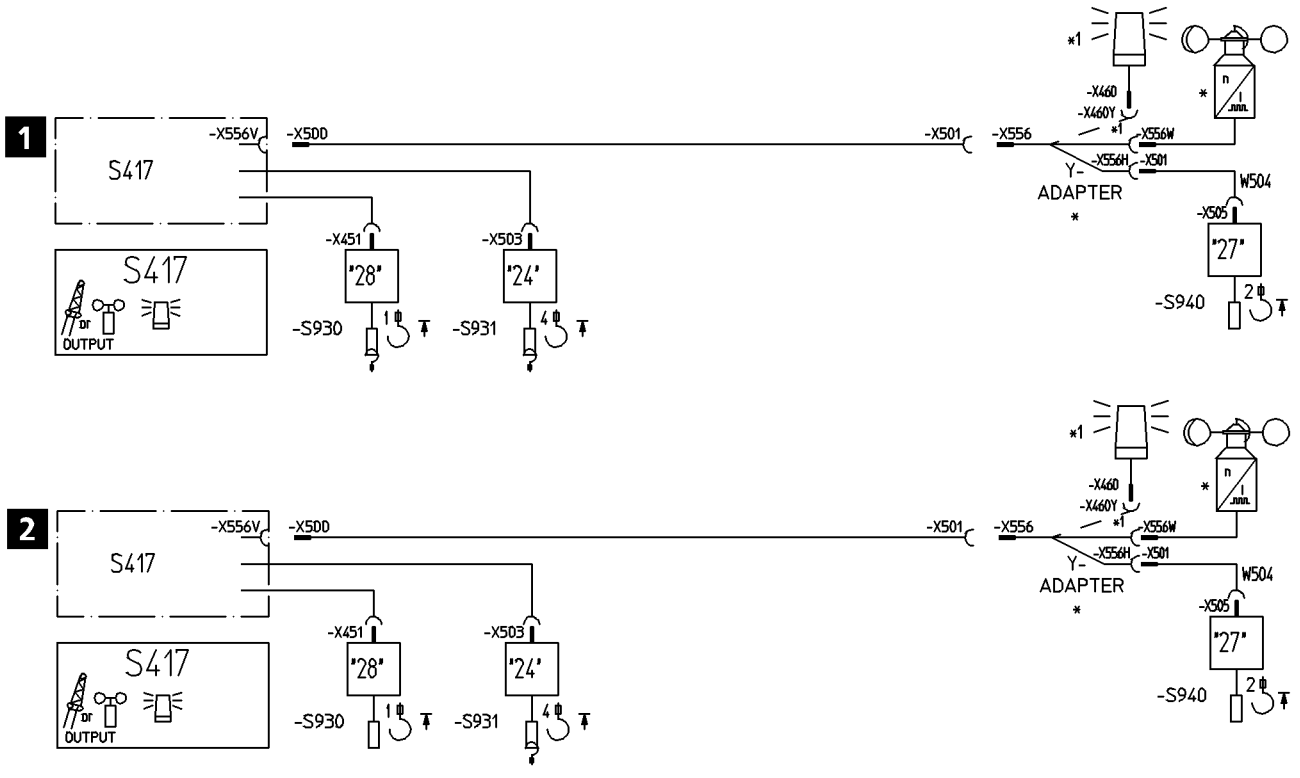

1
S417
-X556V
-X500
-X501
-X556
-X460
-X460Y
-X556W
-X556H
-X501
Y-
ADAPTER
W504
-X505
"27"
-S940
-X451
"28"
-S930
-X503
"24"
-S931
OUTPUT
2
S417
-X556V
-X500
-X501
-X556
-X460
-X460Y
-X556W
-X556H
-X501
Y-
ADAPTER
W504
-X505
"27"
-S940
-X451
"28"
-S930
-X503
"24"
-S931
OUTPUT

B194428

2.7 Electrical connections on auxiliary boom

2.7.1 Mechanically actuating the hoist limit switch, illustration A

If you are working in “single hook mode” when using the auxiliary boom, the hoist limit switch **-S930/-S931** that is not required must be operated manually.

- ▶ Disassemble the hoist limit switch weight and chain.
- ▶ Pull the hoist limit switch rope **20** and attach to the fixed point **22** with the shackle **21**.

2.7.2 Electrical connections

Single hook operation, illustration 1

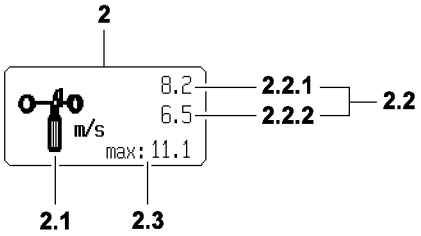
Only the hoist limit switch **S940** at the auxiliary boom is active during single hook operation.

- ▶ Actuate the hoist limit switch **-S930** mechanically.
- ▶ If installed on the telescopic boom:
  Actuate the hoist limit switch* **-S931** mechanically.
- ▶ Insert the cable plug **-X500** into the socket **-X556V**.
- ▶ Insert the adapter **-X556** into the socket **-X501**.
- ▶ Insert the hoist limit switch **-S940** with the cable plug **-X501** into the socket **-X556H**.
- ▶ Insert the wind speed sensor* with the cable plug **-X556W** into the socket **-X556**.
- ▶ Insert the flashing beacon* with the cable plug **-X460** into the socket **-X460Y**.

Two hook operation, illustration 2

During two hook operation the hoist limit switch **S930** on the telescopic boom and the hoist limit switch **S940** on the auxiliary boom are active!

- ▶ If assembled on the telescopic boom:
  Actuate the hoist limit switch* **-S931** mechanically.
- ▶ Insert the cable plug **-X500** into the socket **-X556V**.
- ▶ Insert the adapter **-X556** into the socket **-X501**.
- ▶ Insert the hoist limit switch **-S940** with the cable plug **-X501** into the socket **-X556H**.
- ▶ Insert the wind speed sensor* with the cable plug **-X556W** into the socket **-X556**.
- ▶ Insert the flashing beacon* with the cable plug **-X460** into the socket **-X460Y**.



B197637

2.7.3 Function check

Ensure that the following preconditions are met:
– all electrical connections have been made,
– the LICCON computer system is running.

Wind sensor

CAUTION
Danger of accidents due to toppling of the crane!
The wind speed can no longer be determined if a defective wind sensor is installed.
▶ Check the function of the wind sensor every time it is installed.

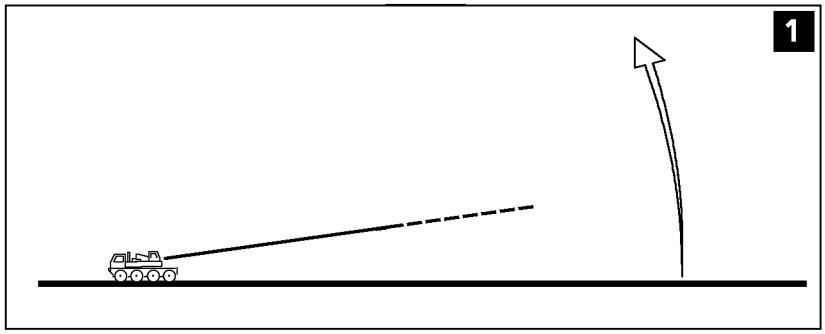
▶ Manually actuate the wind sensor.

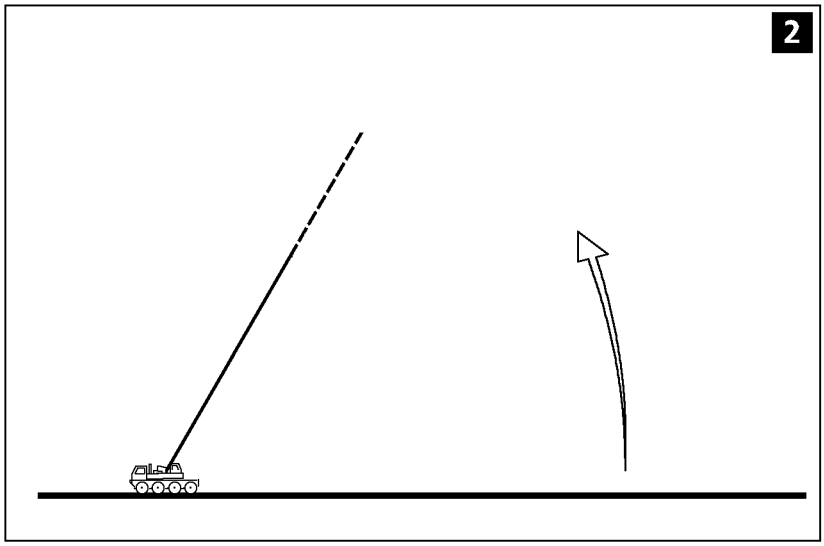
Result:
– The symbol element “Wind velocity” **2.2** appears on the monitor.

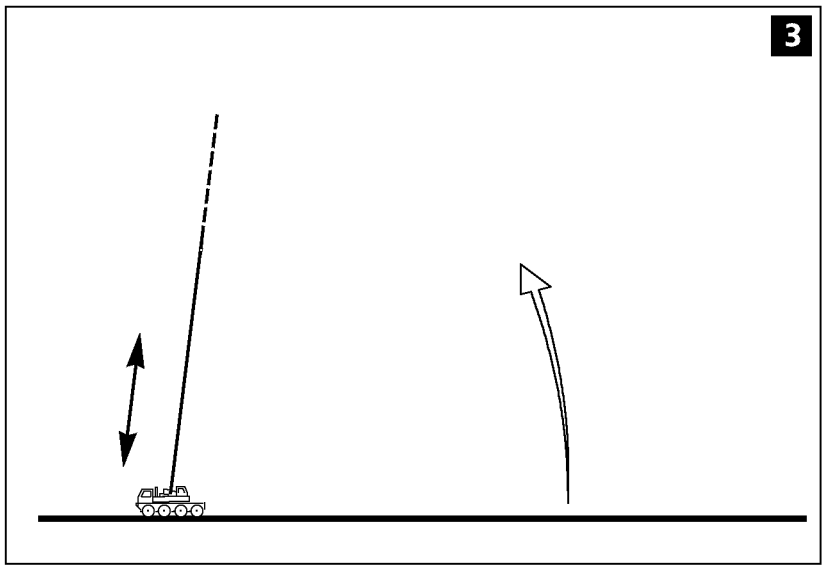
Hoist limit switch

▶ Actuate all active hoist limit switches manually.

Result:
– The appropriate symbol element “Hoist top” appears on the monitor.
– The winch switches off.







B192389

3 Erection

3.1 Preparatory work

Make sure that the following prerequisites are met:

- the crane is properly supported and horizontally aligned,
- the counterweight has been attached to the turntable according to the load chart,
- the telescopic boom is fully telescoped in,
- the auxiliary boom has been assembled in accordance with the load chart specifications and the operating manual,
- all limit switches have been correctly assembled and are fully functional,
- all pin connections have been secured,
- the hoist rope has been correctly placed in the cable pulleys and is secured with the rope retaining pins to prevent it from jumping out,
- there are no loose parts on the telescopic boom or the auxiliary boom,
- the telescopic boom, the auxiliary boom and their components (limit switches, flight warning lamp, anemometer etc.) must be free of snow and ice in the winter.

DANGER
Risk of accident!
Incorrectly assembled or non-operational limit switches and falling parts (pins, spring pins, ice etc.) can cause injuries!

▶ Assemble all limit switches, pins and cotter pins properly.

▶ Check if all preconditions have been met.

3.2 Erection procedure

DANGER
Danger of accidents due to toppling of the crane!
The radii specified in the load chart may not be exceeded or fallen below, even if there is no load on the hook! If this regulation is not observed, the crane can topple over.

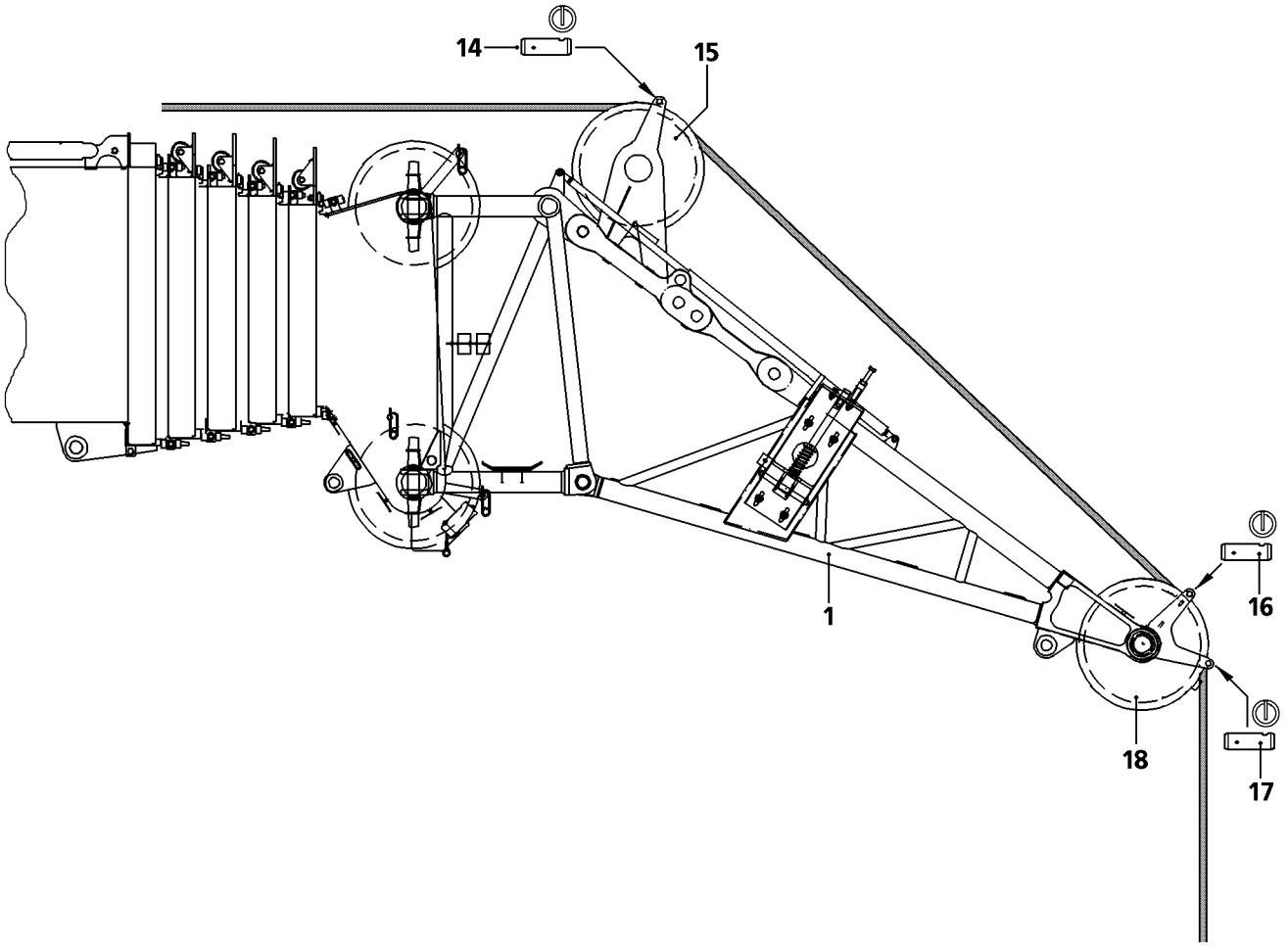
▶ Compare and check the settings on the LICCON computer system with the actual configuration status!

Adjustment of the LICCON overload protection, refer to chapter 4.02.

▶ Set and confirm the LICCON overload protection according to the required set up configuration.

▶ Luff the telescopic boom up with assembled auxiliary boom until the LICCON issues the release.

▶ Telescope the telescopic boom out to values specified in load chart.



B192470

4 Disassembling the auxiliary boom

4.1 General

DANGER
Danger of fatal injury due to toppling auxiliary boom!
The auxiliary boom may topple if it is incorrectly disassembled.
- ▶ Standing under the auxiliary boom during the swing operation is prohibited!
- ▶ The auxiliary boom must be secured by an auxiliary rope during the slewing process!
- ▶ Never stand beneath the auxiliary boom during disassembling!

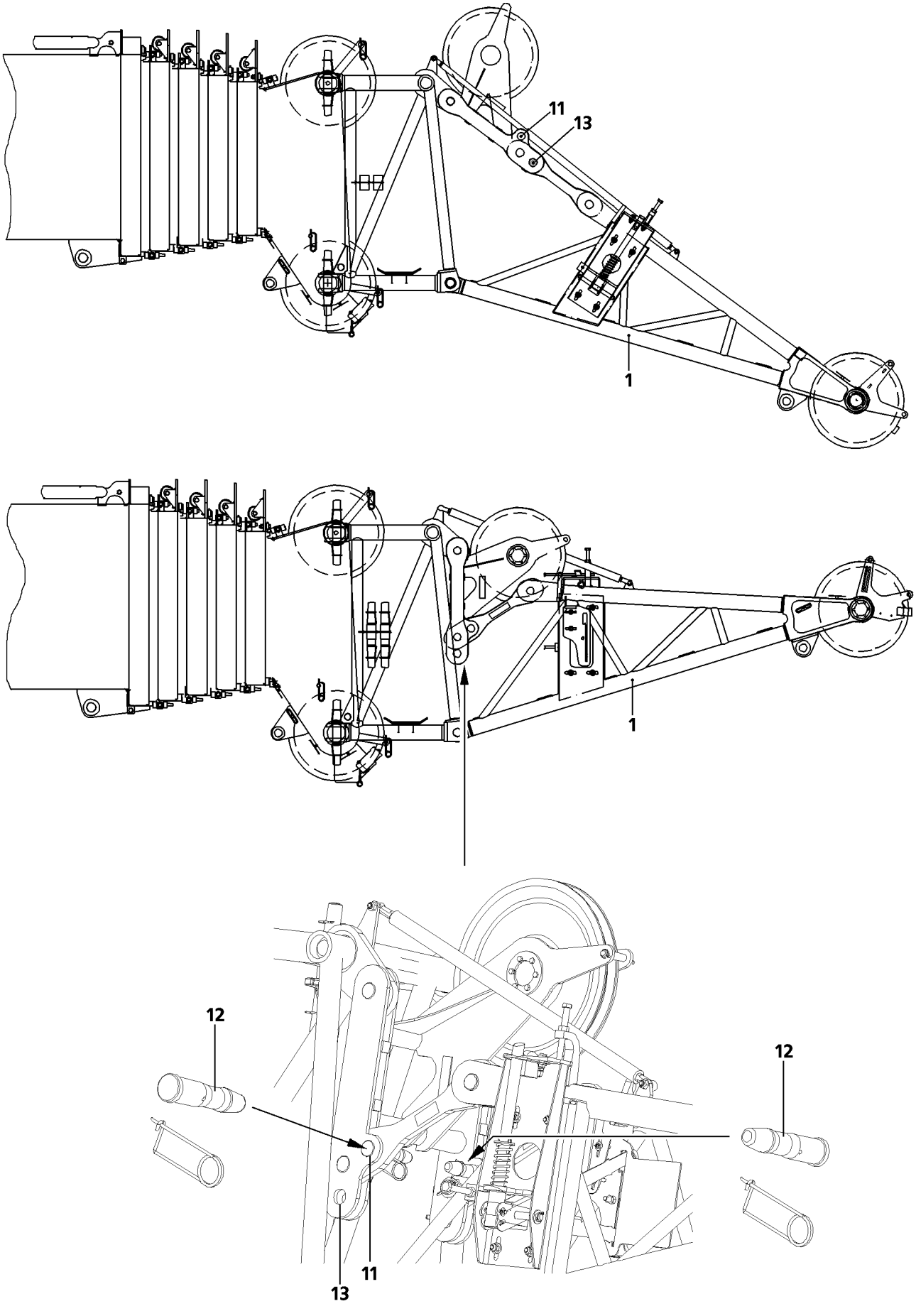
DANGER
Danger of falling!
During assembly and disassembly, personnel must be secured with appropriate antifall guards to prevent them from falling. If this is not observed, personnel could fall and suffer life-threatening injuries.
- ▶ All assembly work from a height of 2 m must normally be carried out using suitable aids (lifting platforms, scaffolding, ladders, auxiliary crane etc.)! The height above which assembly / disassembly work must be carried out with aids depends on national regulations. The national regulations must be adhered to!
- ▶ If work cannot be carried out using these aids or from the ground, the assembly personnel must be protected from falling using suitable means (such as safety belts)!
- ▶ Do not walk on the telescopic boom or auxiliary boom!

Make sure that the following prerequisites are met:
- – the crane is properly supported and horizontally aligned,
- – the counterweight has been attached to the turntable according to the load chart,
- – the telescopic boom is fully telescoped in,
- – the electrical connections at the auxiliary boom have been released,
- – the telescopic boom has been luffed to the rear or the side in the 0° position.

DANGER
Danger of accident from involuntary swinging out of the auxiliary boom!
The telescopic boom must be in the 0° position, otherwise there is a risk of accident from involuntary auxiliary boom movements when the pins are undone on the telescopic boom.
- ▶ Move the telescopic boom to 0° position.

4.2 Reeving out the hoist rope

- ▶ Release and unpin rope retaining pin **14**, rope retaining pin **16** and rope retaining pin **17**.
- ▶ Spool up the hoist rope.
- ▶ Repin the rope retaining pin **14**, rope retaining pin **16** and rope retaining pin **17** and secure with linch pins.



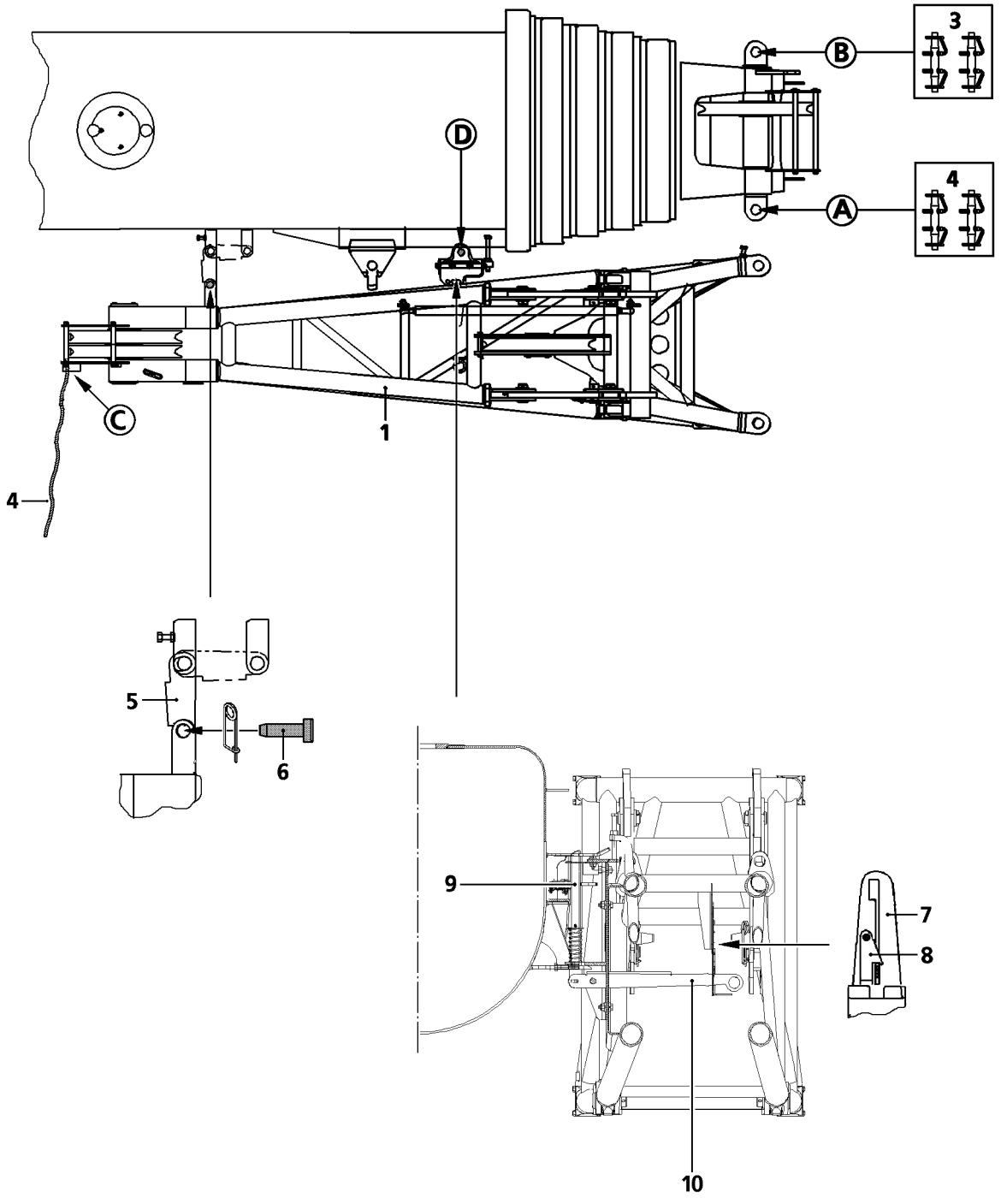
B104954

4.3 Folding the auxiliary boom into transport position

DANGER
Risk of accident!
Before the auxiliary boom **1** may be swung into transport position, the auxiliary boom **1** must be folded up into transport position and pinned.
Before unpinning the pins **12** it must be ensured that no persons or objects are in the danger zone, particularly beneath the auxiliary boom.

- ▶ Do not unpin pins **12** until all persons and objects have been removed from the danger zone!
- ▶ Insert pins **12** from the “outside to the inside”.

- ▶ Release the pins **12** on both sides and unpin them from the bores **13**.
- ▶ Fold the auxiliary boom **1** up in transport position until the bores align.
- ▶ Fit the pins **12** on both sides in bores **11** from “outside to inside” and secure with spring retainers.



B107339

4.4 Swivelling the auxiliary boom into the transport position

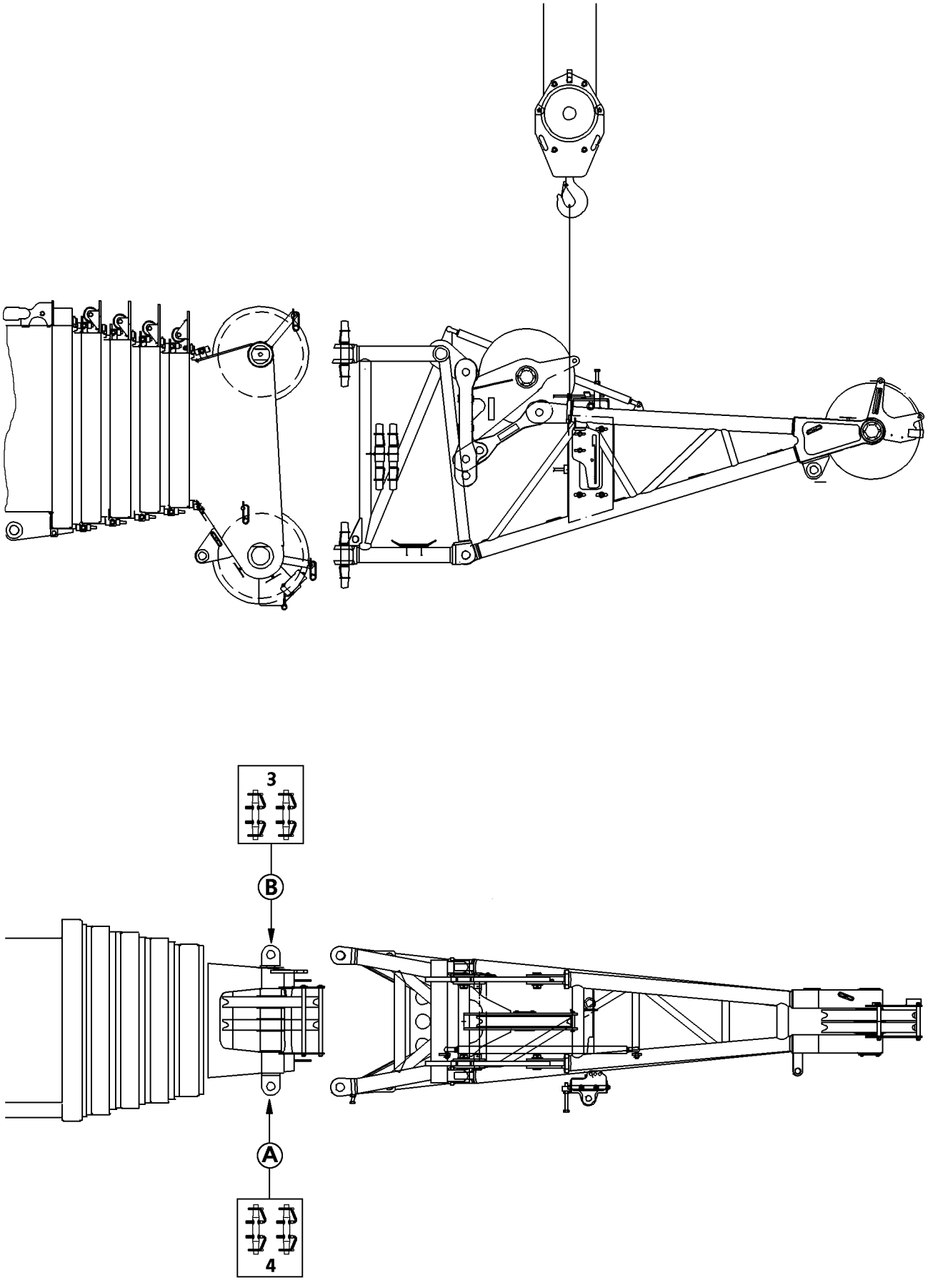
▶ Attach the auxiliary rope **4** at point **C**.

DANGER
The auxiliary boom may swing out involuntarily!
While unpinning the pin **3**, the auxiliary boom may swing out unintentionally.
In order to prevent the auxiliary boom from involuntarily swinging out:
▶ Hold down auxiliary boom using the auxiliary rope **16**!
▶ Do not lean the ladder against the auxiliary boom!

▶ Release and unpin the pin **3**.
▶ Disengage the lever **10** with the assembly rod from the bracket **7** and pull downward.
▶ Swing in auxiliary boom **1** with auxiliary rope **16** until locking **9** audibly engages.
▶ Perform a visual inspection.
▶ Secure the lever **10** with safety bracket **8**.

DANGER
Danger of accident from auxiliary boom falling down!
If the pins **4** are unpinned before the locking **9** is engaged and secured with the safety bracket **8**, the auxiliary boom will fall down!
▶ Unpin the pins **4** only if the locking **9** is engaged and secured with the safety bracket **8**.

▶ Release and unpin the pin **4**.
▶ Swing the auxiliary boom **1** in until the pin **6** can be pinned.
▶ Pin the auxiliary boom **1** with the telescopic boom: Pin and secure pin **6**.
▶ Remove the auxiliary rope **4**.



B192473

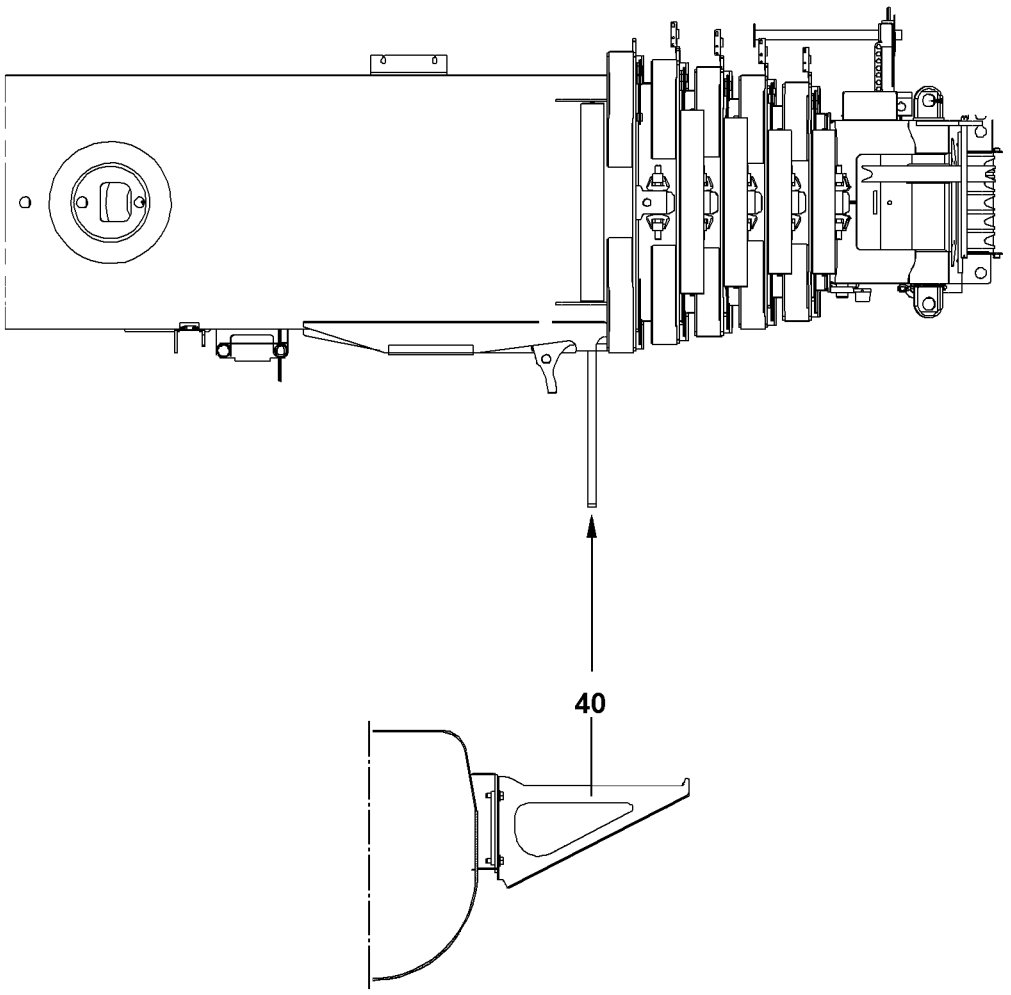
4.5 Removing the separately transported auxiliary boom

Make sure that the following prerequisites are met:
– the auxiliary boom is folded in operating position.

▶ Attach auxiliary crane to attachment point of auxiliary boom.

DANGER
Danger of accident when removing the auxiliary boom!
Failing to comply with the following conditions may result in fatal injury to the assembly personnel during disassembly.
▶ When knocking out the pins, no personnel may remain under the auxiliary boom!
▶ Attach the auxiliary crane so that no diagonal pull occurs!
▶ Match the “hoisting power” of the auxiliary crane to the “weight” of the auxiliary boom!
▶ The auxiliary boom may detach suddenly because of distortion!
▶ Do not remove auxiliary boom until it has been secured with the auxiliary crane to prevent it from falling!
▶ Do not lean the ladder against the auxiliary boom!

▶ Tighten the ropes so that auxiliary boom is prevented from falling.
▶ Unpinning the auxiliary boom from the telescopic boom:
▶ Release and unpin pins **4** at the top and at the bottom at point **A**.
▶ Release and unpin pins **3** at the top and at the bottom at point **B**.
▶ Place the auxiliary boom onto the transport vehicle.



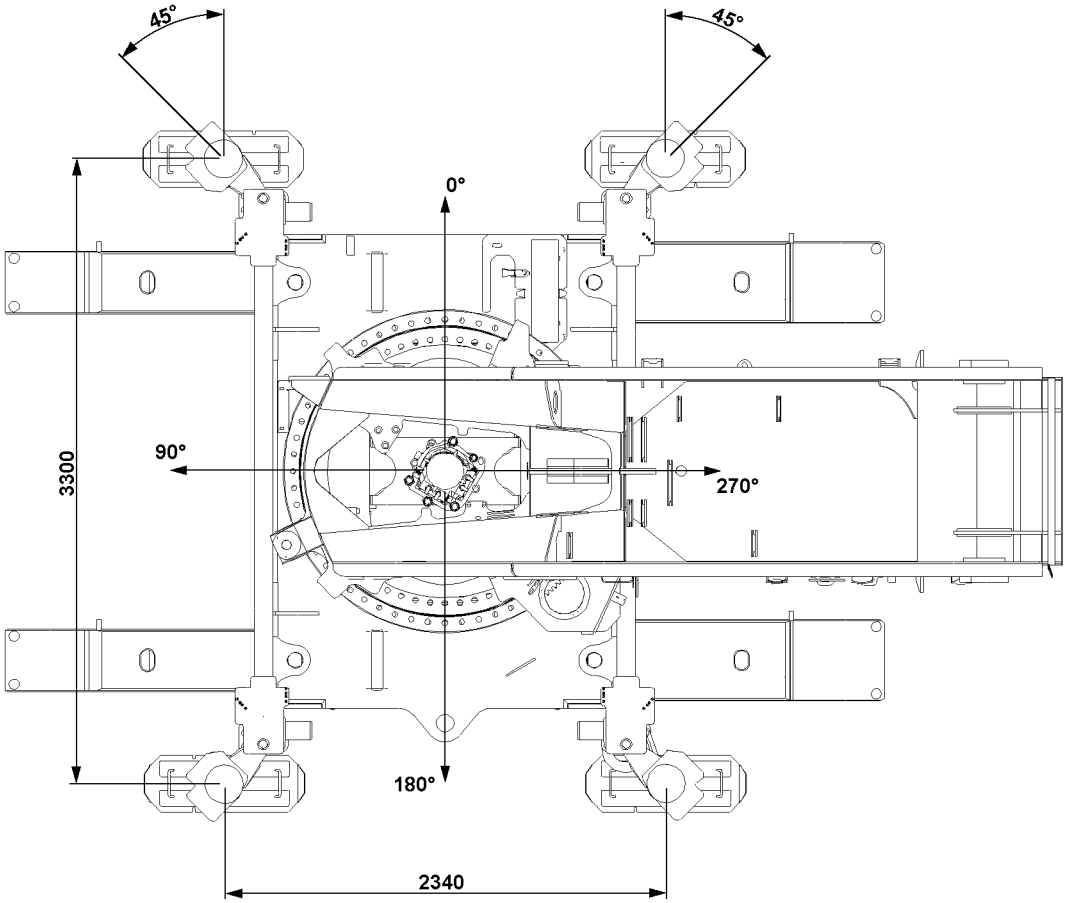
B103264

4.6 Assembling the catch bar on the telescopic boom pivot section

DANGER
Danger of fatal injuries due to toppling folding jib!
As a result of improperly assembled, damaged or non-existing catch bar **40** on the telescopic boom pivot section, the folding jib – due to an assembly error – can fall down and cause fatal injuries.

- ▶ After the auxiliary boom is removed from the telescopic boom, the catch bar **40** must be reinstalled properly.
- ▶ Make sure that the catch bar **40** property is properly assembled again and not damaged “before assembling the single or the dual folding jib”, see also “chapter 5.02”.

- ▶ Properly assemble the catch bar **40** on the telescopic boom pivot section.



B105024

1 General

DANGER
Overload or toppling the crane!
- ▶ Do not reeve a larger hook block than the one that is required to lift the maximum load specified in the load chart!
- ▶ Observe the data in the erection and take-down charts!

2 Erection and take-down chart for T operation

2.1 For support base 2.34 m x 3.30 m

DANGER
Overload or toppling the crane!
- ▶ Erection / taking down is only permitted with support base **2.34 m x 3.30 m** !
- ▶ Fit winch 2 or the replacement ballast to the turntable prior to erection / taking down!
- ▶ Depending on the state, either the folding jib or auxiliary boom are folded in the “transportation position” at the side of the articulated piece, see erection and take-down chart!

The telescopic boom T-11.5 (0/0/0/0/0) can be fully luffed down to reeve in the hook block onto support **2.34 m x 3.30 m** (hatch consoles 45 °) without crawlers, without central ballast and without turntable ballast, however, when using winch 2 or replacement ballast, observe the data given on the erection and take-down chart.

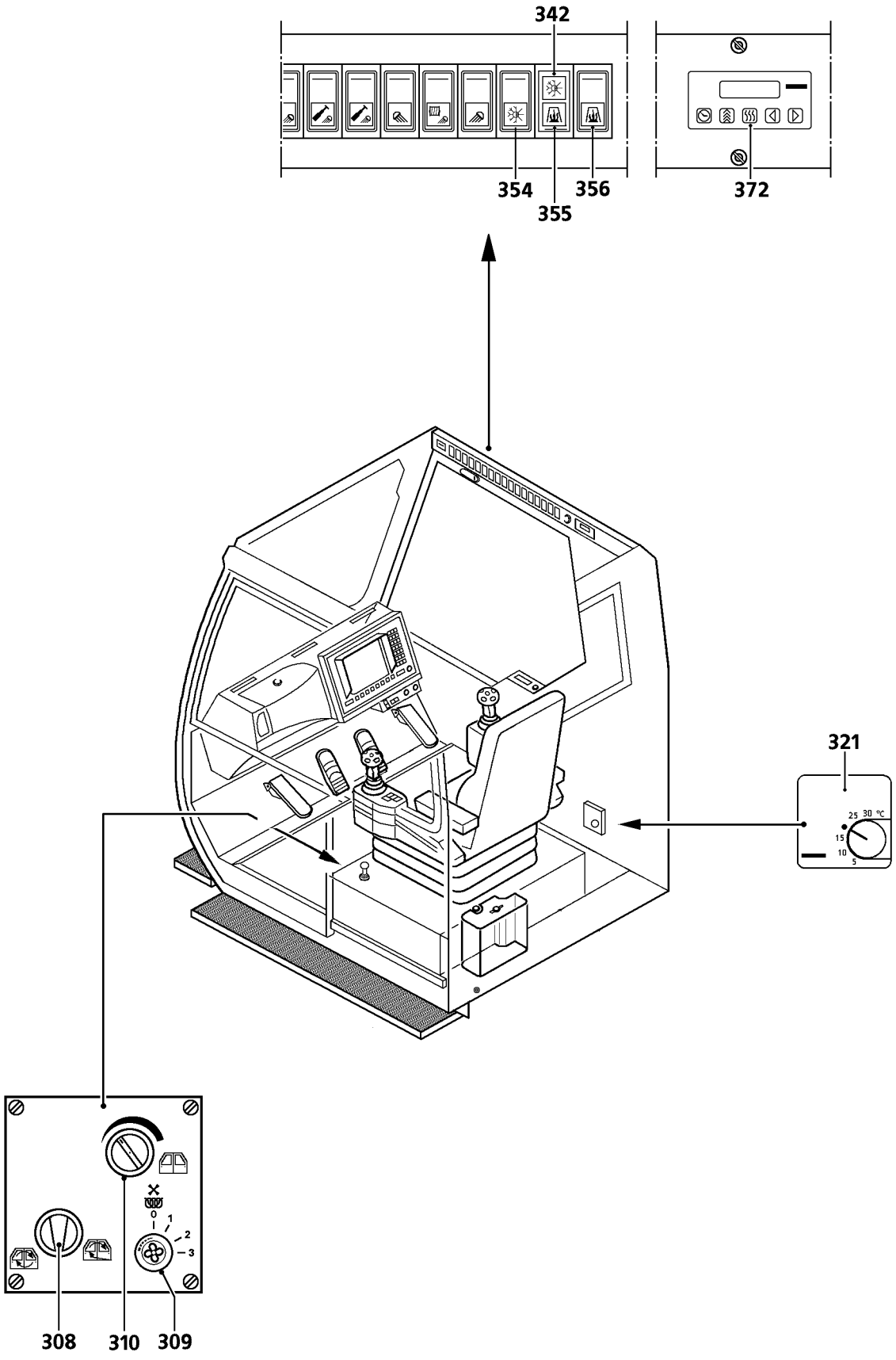
Boom position, T operation		
Folding jib or auxiliary boom at side of articulated piece in “transportation position”	**Maximum hook block weight**	
	Boom in driving direction of crawler 0 ° or 180 °	**Boom vertical to the crawler direction 90 ° or 270 °**
no	1.24 t	0.70 t
Auxiliary boom	1.24 t	0.45 t
Single folding jib	1.24 t	0 t
Dual folding jib	1.24 t	0 t

2.2 For wider track 4.15 m

The telescopic boom can be fully luffed down as far as the specified distances (LICCON-monitoring). Additional assembly parts (auxiliary boom without the like) may not be mounted in the process.

Counterweight	Boom position 360° for wider track 4.15 m
32 t / 15 t	T-52.0
26 t / 15 t	T-52.0
22 t / 15 t	T-48.8
20 t / 15 t	T-41.3
16 t / 15 t	T-37.6
10 t / 15 t	T-33.9
0 t / 15 t	T-19.0
0 t / 0 t	T-15.2

6.00 Additional equipment



B198741

1 Heating the crane operator's cab

The cab can be heated using three independent types of heating:
– engine-dependent heating
– engine-independent auxiliary heating with engine preheating, at outside temperature of up to -40 °C, WEBASTO; Thermo 90 S*
– engine-independent auxiliary heating with engine preheating, at outside temperature of less than -40 °C, WEBASTO; DBW 2020*, Air Top 2000*

Individual adjustment of the heating (for both engine-dependent and engine-independent auxiliary heating*) is carried out using the operating elements beneath the crane operator's seat and using the switches and control lights on the instrument panel.

CAUTION
Risk of damage to the heating control units* when carrying out electrical welding work on the crane.
▶ Remove the negative and positive cables from the vehicle and crane superstructure batteries and apply the positive cable respectively to the vehicle earth.

1.1 Heating operation

1.1.1 Adjusting the temperature

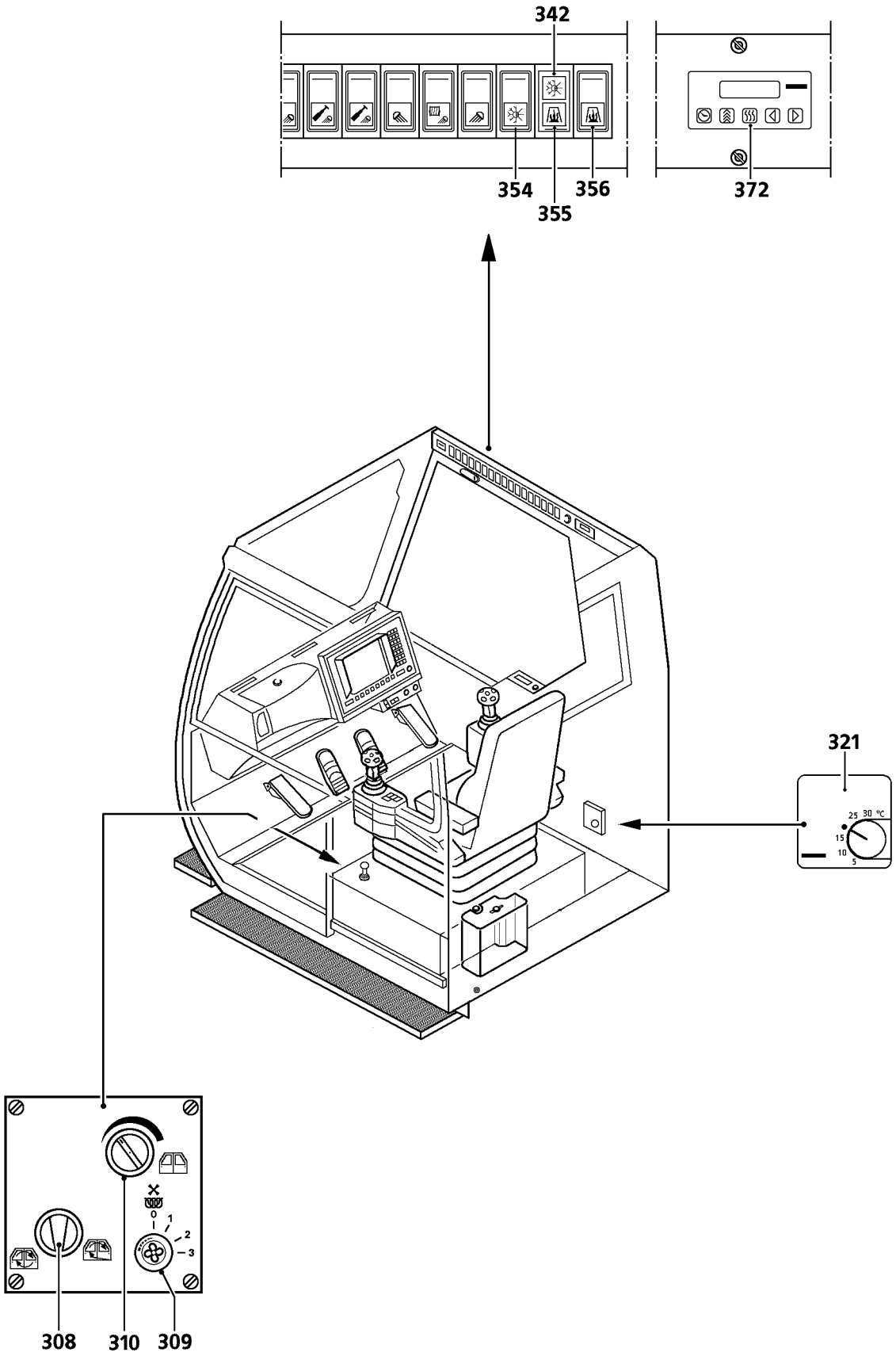
The cab is heated using the engine coolant.
▶ Adjust the control valve **310**.

1.1.2 Adjusting the ventilation

▶ Set 3-level fan switch **309**.
Result:
– Air volume will be regulated.

1.1.3 Adjusting the recirculated air/fresh air

▶ Operate changeover switch **308**.



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1.2 Operating engine-independent auxiliary heating*

The engine-independent auxiliary heating is used to heat the cab when the engine is turned off and as auxiliary heating* at low ambient temperatures if the engine-dependent heating is insufficient.
You can find a full description of the auxiliary heating* in the manufacturer's accompanying operating instructions.
In summer, run the auxiliary heating* once a month for approx. 15 to 20 minutes.
Carry out maintenance work on the auxiliary heating* in accordance with the manufacturer's accompanying operating instructions.

1.2.1 Starting up

CAUTION
Risk of damage to auxiliary heating!
▶ Fill all units with sufficient operating materials for winter operation in accordance with the lubricant chart.

DANGER
Risk of poisoning and suffocation in enclosed areas.
▶ Only operate the heating device with preselect clock in enclosed areas such as garages or workshops if waste gas suction is present.

DANGER
Danger of explosion!
In areas where combustible fumes or dust could form, e.g. in the vicinity of storage areas for fuel, coal, wood dust or grain or similar and in the vicinity of filling stations or tank farms, there is a risk of explosion.
▶ Switch off the heating device.

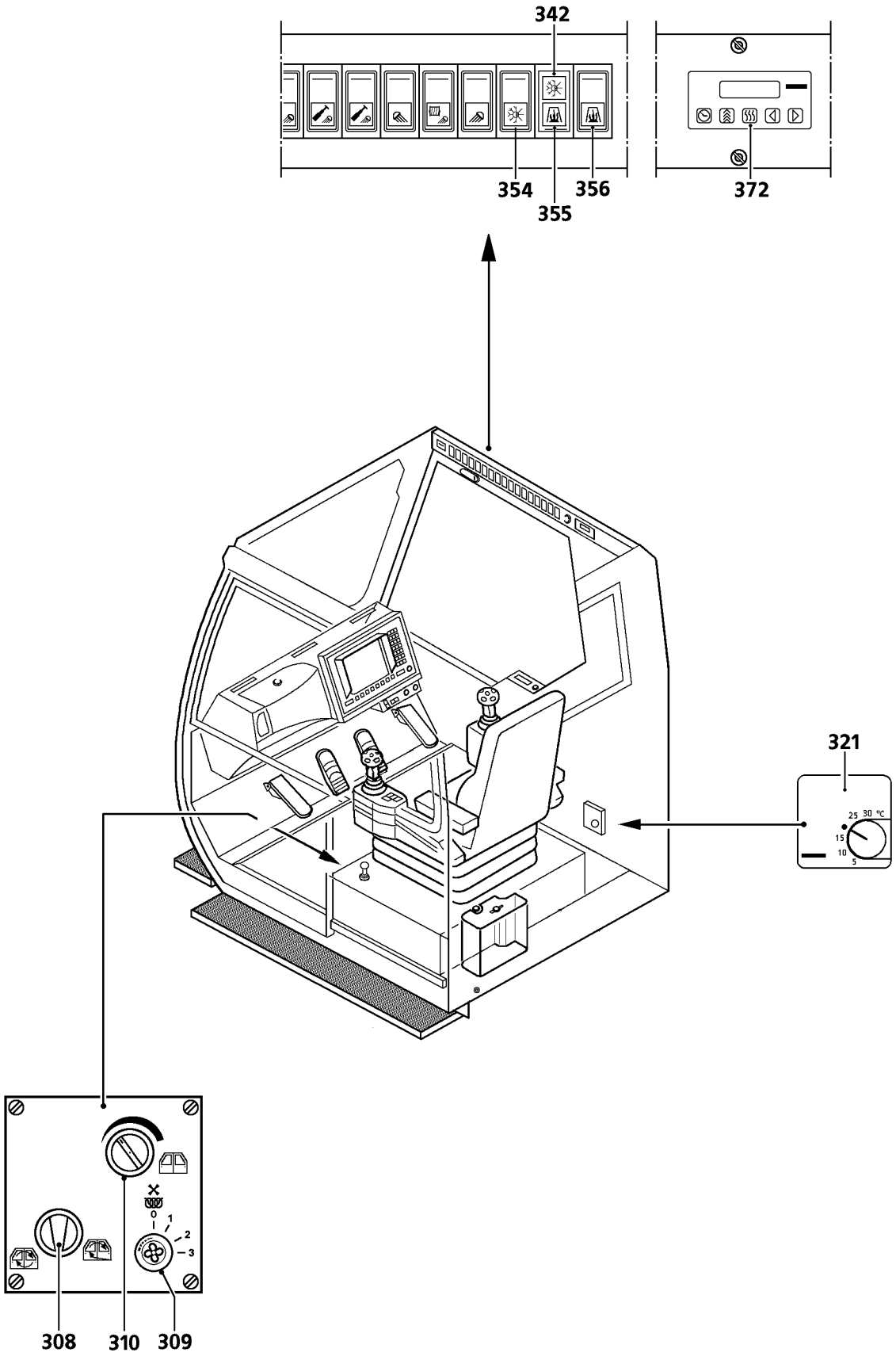
▶ Set control valve **310** at “warm”.
▶ Press switch **356**.
Result:
– The function control on the switch **356** illuminates.
– The control light **355** illuminates.

1.2.2 Switching off

▶ Press switch **356**.
Result:
– The function control on the switch **356** goes out.
– Each time the auxiliary heating is switched off, tracking takes place for up to 150 seconds.

CAUTION
Danger of equipment damage!
▶ Only switch off the main battery switch once the heating device has finished tracking.

– Once tracking is completed:
the control light **355** extinguishes



B198741

1.2.3 Operation with preselect clock*

You can find a full description of the preselect clock **372** in the manufacturer's accompanying operating instructions.

▶ Set the required switch-on time, temperature and duration of heating operation on the preselect clock **372**.

▶ Open or close the air vent as desired.

Result:

– Upwards or downwards air distribution will be selected.

▶ Set control valve **310** at “warm”.

1.2.4 Operating thermostat*

Ensure that the following preconditions are met:

– the control valve **310** is set to “warm”

▶ Turn the thermostat **321** to the desired temperature.

1.2.5 Venting the system

When draining off the engine coolant, the contents of the heating system will also be drained because the engine and heating operate as one circuit. When refilling, the system should be carefully deaerated.

▶ Fill the coolant above the equalising reservoir of the engine cooling circuit in accordance with the lubricant chart.

▶ Start the engine as described in Chapter 3.04.

▶ Set control valve **310** at “warm”.

▶ Observe the equalising reservoir for air bubbles.

Result:

– The engine is deaerated as soon as no more air bubbles occur.

▶ Once no more air bubbles appear in the equalising reservoir:
Set control valve **310** at “cold”.

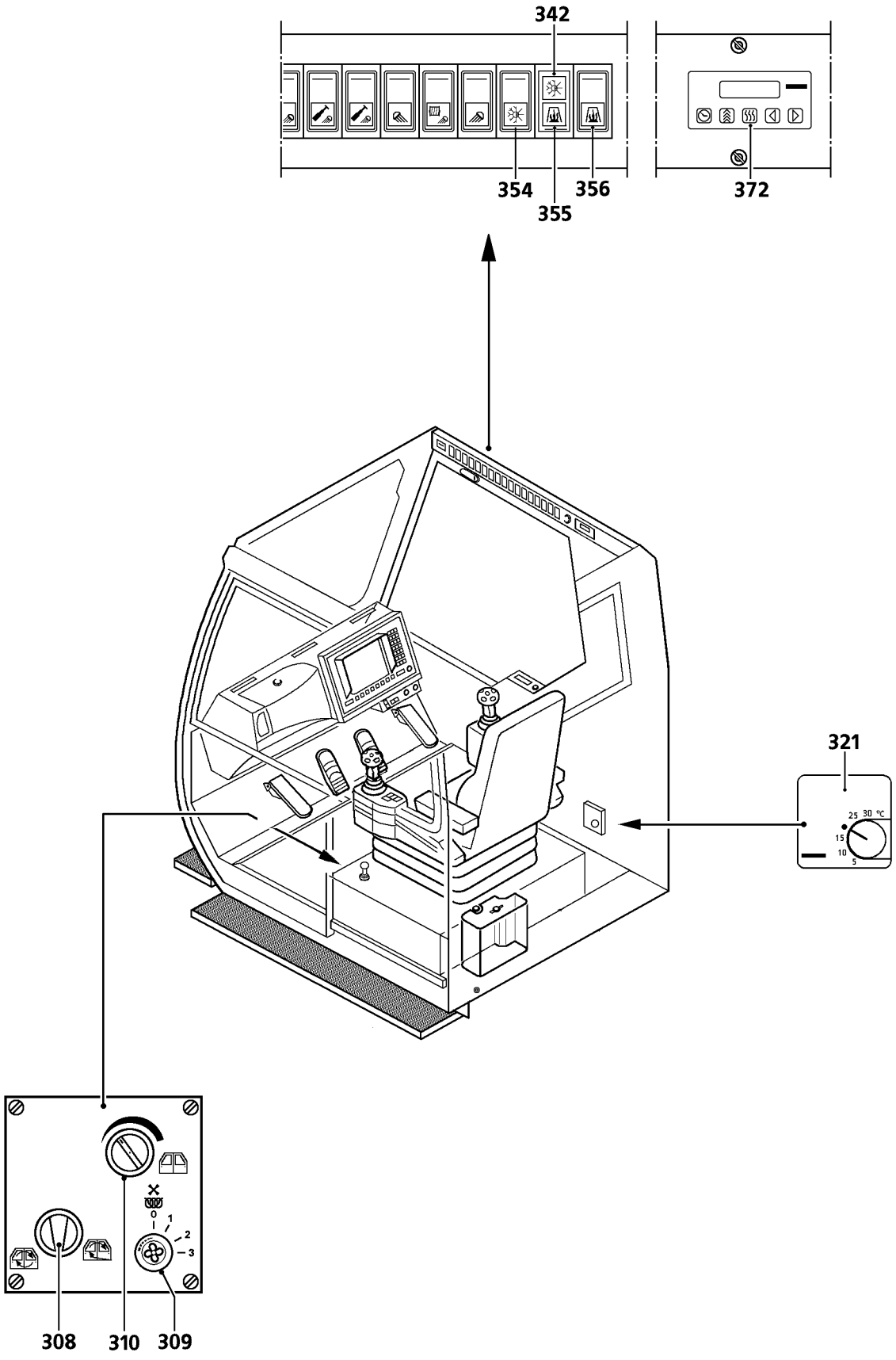
Result:

– The heating circuit will be deaerated.

▶ Observe the equalising reservoir for air bubbles.

Result:

– The heating circuit is deaerated as soon as no more air bubbles occur.



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1.3 Operating engine-independent auxiliary heating for engine pre-heating*

At ambient temperatures of under -20 °C, the crane engine must be preheated using engine preheating which is operated with diesel fuel.
You can find a full description of the engine preheating in the manufacturer's accompanying operating instructions.

1.3.1 Starting up

CAUTION
Risk of damage to auxiliary heating!
▶ Fill all units with sufficient operating materials for winter operation in accordance with the lubricant chart.

DANGER
Risk of poisoning and suffocation in enclosed areas.
▶ Only operate the heating device with preselect clock in enclosed areas such as garages or workshops if waste gas suction is present.

DANGER
Danger of explosion!
In areas where combustible fumes or dust could form, e.g. in the vicinity of storage areas for fuel, coal, wood dust or grain or similar and in the vicinity of filling stations or tank farms, there is a risk of explosion.
▶ Switch off the heating device.

▶ Set control valve **310** at “cold”.
▶ Press switch **356**.

Result:
– The control light **355** illuminates.
– Engine preheating is switched on.

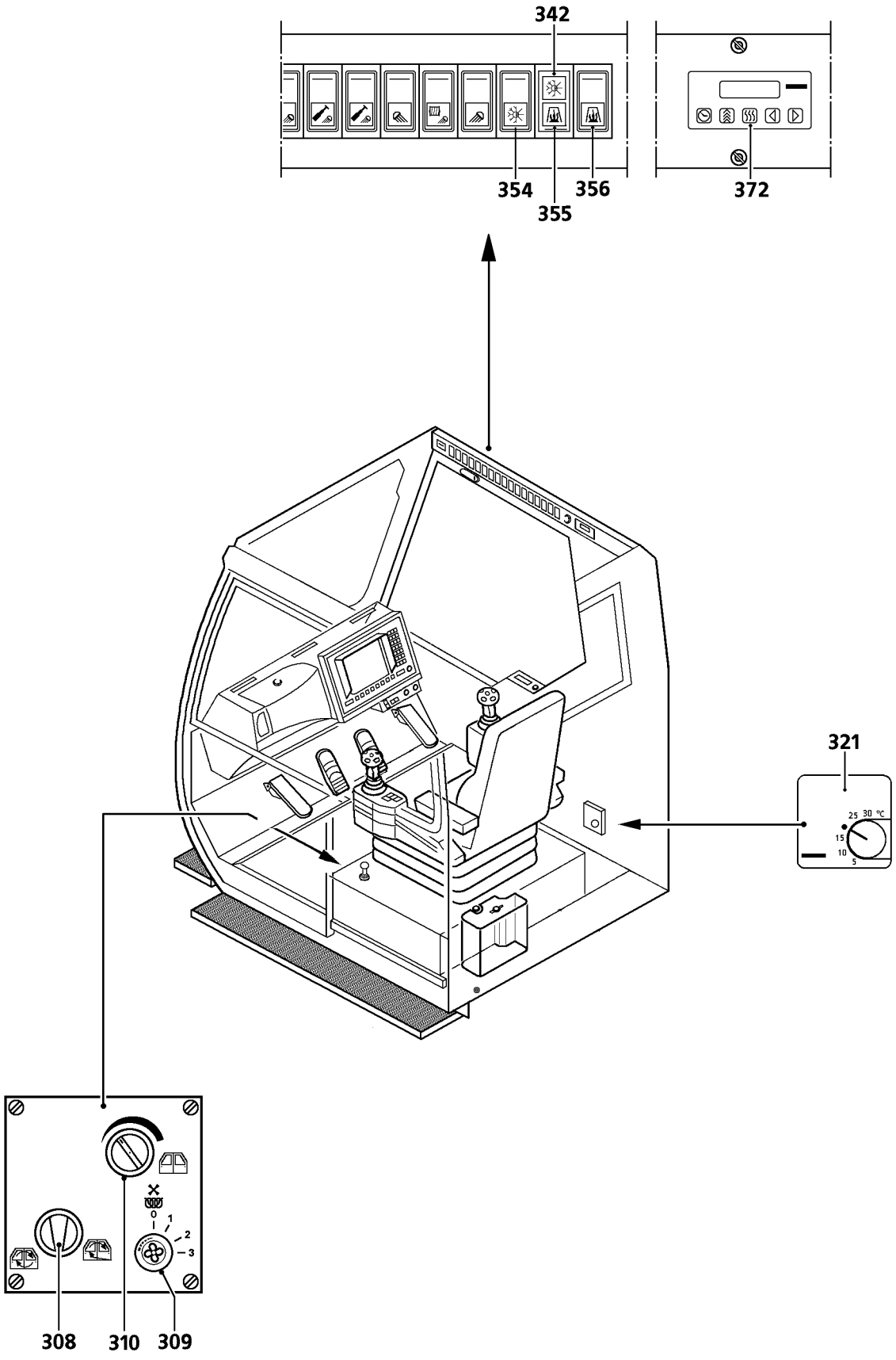
1.3.2 Switching off

▶ Press switch **356**.

Result:
– The control light **355** extinguishes.
– Engine preheating is completed.

CAUTION
Danger of equipment damage!
▶ Only switch off the main battery switch once the heating device has finished tracking.

– The engine preheating will track for up to 150 seconds.



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1.3.3 Starting up with preselect clock*

You can find a full description of the preselect clock* **372** in the manufacturer's accompanying operating instructions.

▶ Switch on the main battery switch **15**.

▶ Set control valve **310** at “cold”.

▶ Use the preselect clock* **372** to switch on the engine preheating.

Result:

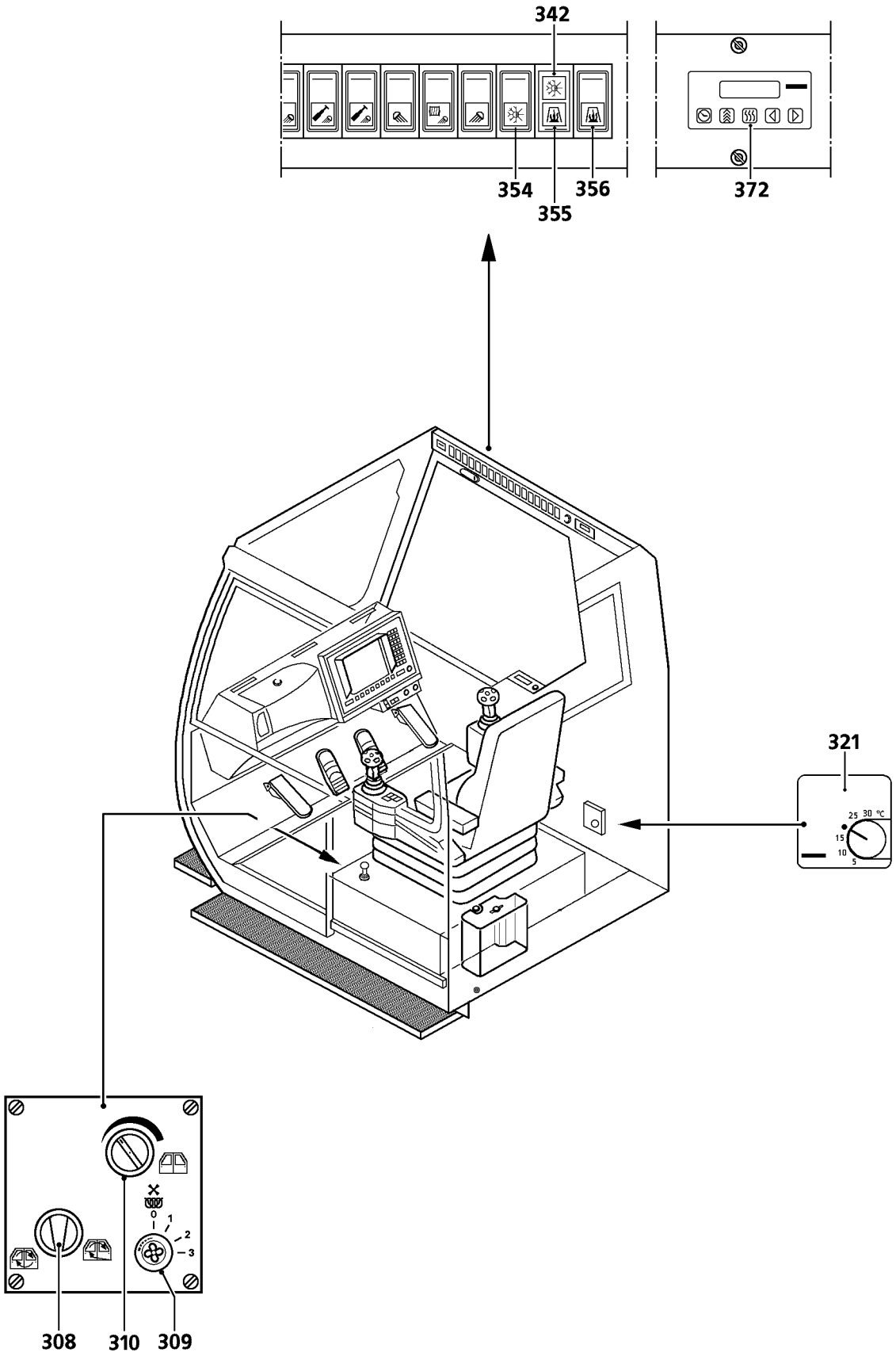
– Engine preheating flow switches on and runs for approx. 10 to 25 seconds.
– Engine preheating starts after 10 to 25 seconds.
– Engine preheating runs in automatically adjustable mode.

1.3.4 Switching off with preselect clock*

▶ Once the preheating period is over:
Switch off the preselect clock* **372**.

Result:

– Engine preheating is completed.



B198741

1.4 Air conditioning system* operation

You can find a full description of the air conditioning system* in the manufacturer's accompanying operating instructions.
Carry out maintenance work on the air conditioning system* in accordance with the manufacturer's accompanying operating instructions.

1.4.1 Starting up

Ensure that the following preconditions are met:
– the main battery switch is switched on
– the engine is running
– the air intake opening for recirculated air operation is clear

▶ Open or close the air vent as desired.

Result:
– Upwards or downwards air distribution will be selected.

▶ Close both windows and the cab door.
▶ Set the changeover switch **308** for fresh air/recirculated air to recirculated air operation.
▶ Press switch **354**.

Result:
– The control light **342** illuminates.
– Air conditioning system* is switched on and ready to operate.

▶ Open the appropriate air vent for upwards air distribution.
▶ Switch on fan using rotary switch **309**.
▶ Adjust temperature with the control valve **310**.

B195219

1 General

WARNING
Increased risk of accident during emergency operation!
If the following general danger notes are not observed, there is an increased danger of accidents since an optical check is no longer possible on the LICCON monitor.

- ▶ In case of a problem or failure of the LICCON computer system, every step must be carried out and checked with utmost caution and care.
- ▶ All crane movements must be carried out with extreme caution!
- ▶ Telescoping must be constantly monitored by a second person!
- ▶ The crane operator must be in visual contact with the second person!
- ▶ Observe general danger notes!

General danger notes

1.) **All safety devices are automatically bypassed during emergency operation.**
2.) **Emergency operation of the crane superstructure may only be carried out:**
   - **To remove a dangerous situation.**
   - **After consultation with LIEBHERR Service.**
   - **By authorized persons who are aware of the risks of emergency operation.**
   - **To carry out load reducing movements.**
3.) **The danger zone must be blocked off.**
4.) **No persons or objects may remain in the danger zone**.

Note
In order to carry out emergency operations, it is necessary to have the engine running and the hydraulic system of the superstructure functioning. If this is not the case, the crane must be taken down by using auxiliary cranes. The boom may only be luffed down if the stability of the crane permits this.

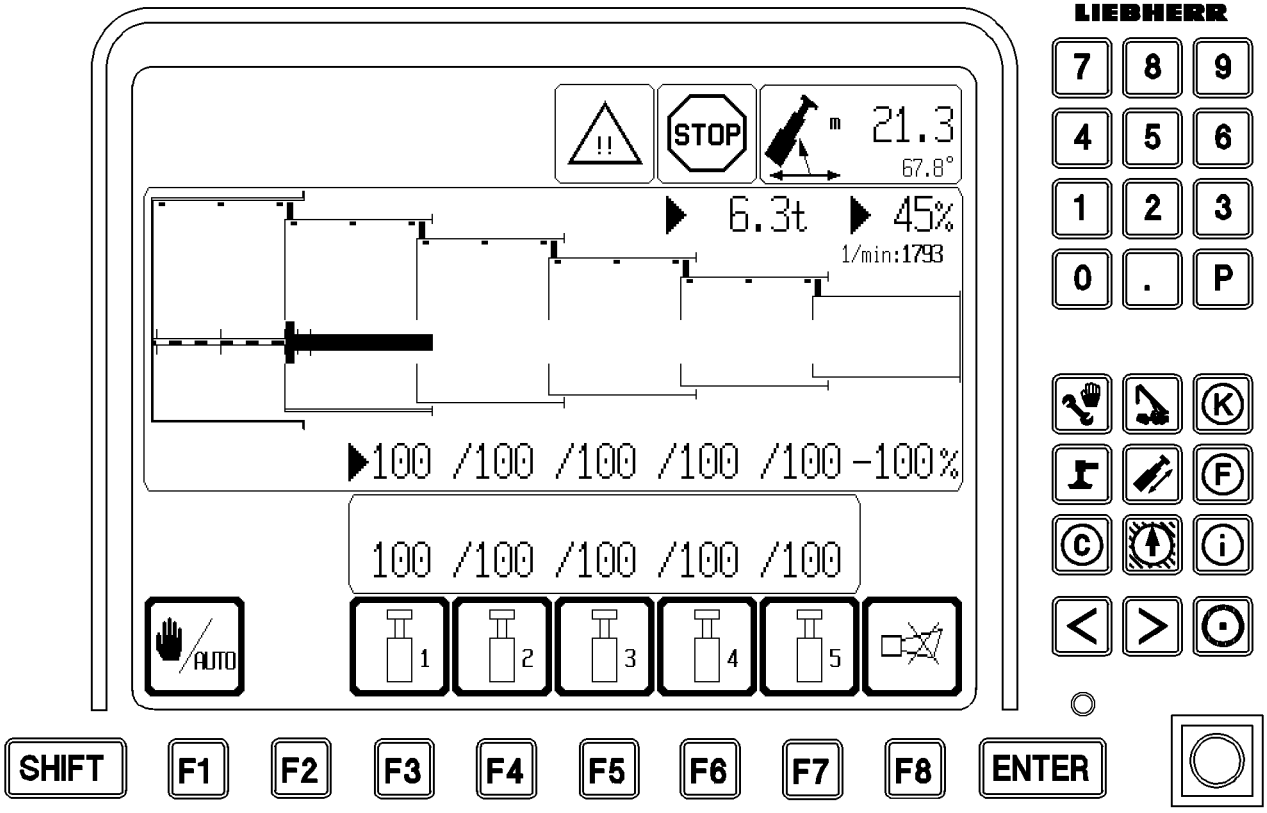
- ▶ The information provided in the operating instructions and the erection and take down charts for taking down the telescopic boom or the equipment must be observed.

1.1 First measures in emergency operation

Note
- ▶ In emergency operation, the crane superstructure must always be taken down first.

The following work must be carried out first in emergency operation:

1.) Set down the load to relieve the boom.
2.) Retract the telescopic boom.
3.) Place down the equipment.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6.3t
45%
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100 /100 /100 /100 /100 -100%
100 /100 /100 /100 /100
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F4
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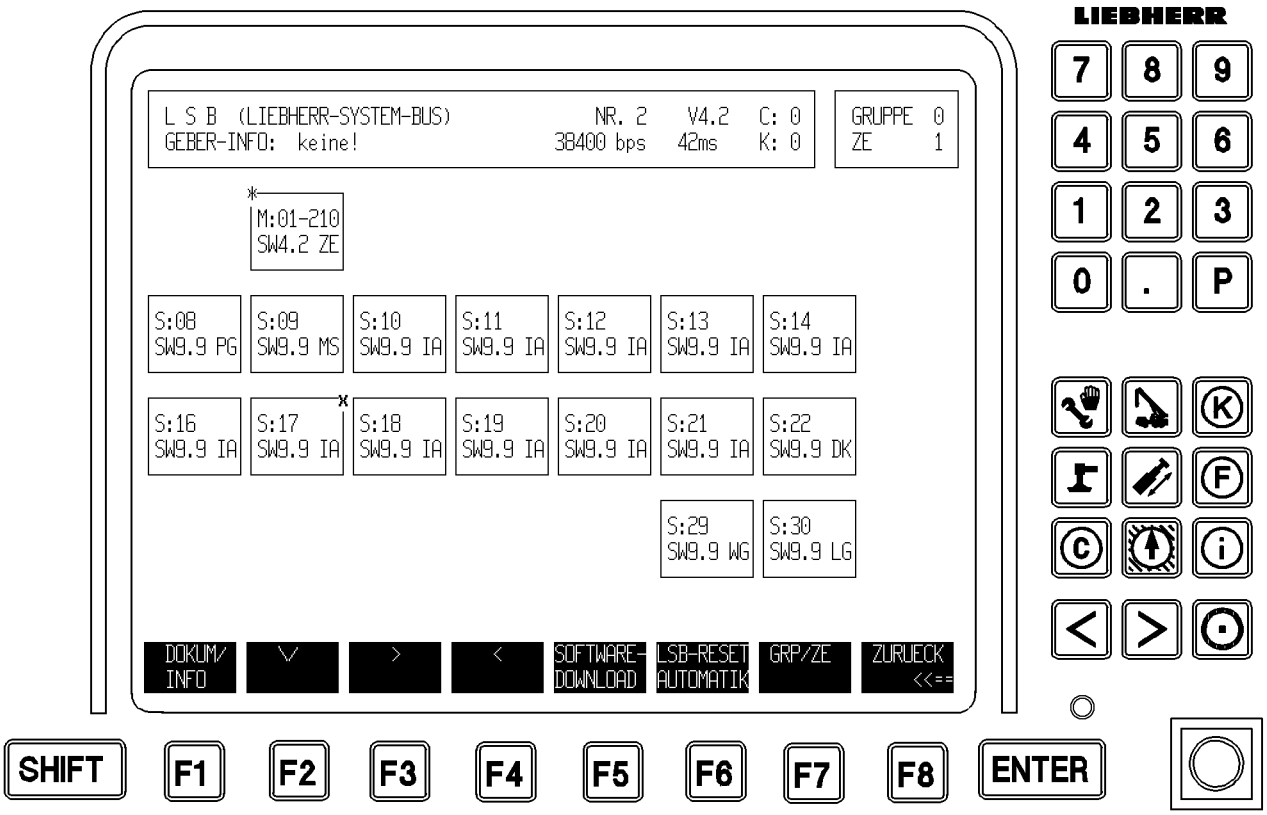
LIEBHERR
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GRUPPE 0
ZE 1
M:01-210
SW4.2 ZE
S:08 SW9.9 PG
S:09 SW9.9 MS
S:10 SW9.9 IA
S:11 SW9.9 IA
S:12 SW9.9 IA
S:13 SW9.9 IA
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S:19 SW9.9 IA
S:20 SW9.9 IA
S:21 SW9.9 IA
S:22 SW9.9 DK
S:29 SW9.9 WG
S:30 SW9.9 LG
DOKUM/ INFO
SOFTWARE- DOWNLOAD
LSB-RESET AUTOMATIK
GRP/ZE
ZURUECK
7 8 9
4 5 6
1 2 3
0 . P
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER

B197769

2 Failure of an inductive sensor

WARNING
Danger of accidents in case of failure of one or more inductive sensors!
▶ It is imperative that the next **Liebherr Service location** or **Liebherr-Werk Ehingen** is contacted!

In case of failure of one or several inductive sensors, the LICCON computer system can no longer determine the exact position of the telescoping cylinder, the telescoping lock or the telescopic pinning.
Result:
– Telescoping is no longer or only partially possible.

3 LICCON-System-Bus 2 (LSB 2) defective

WARNING
Risk of accident!
▶ It is imperative that the next **Liebherr Service location** or **Liebherr-Werk Ehingen** is contacted!

3.1 Possible cause

– Input pcb not connected to central processing unit (CPU 1).
– Supply bus circuit board defective.
– LSB power source or CPU interface interrupted.
– Electrical connection interrupted.

Result:
– Neither automatic nor manual telescoping is possible.

3.2 How will the error be recognized on the operating screen?

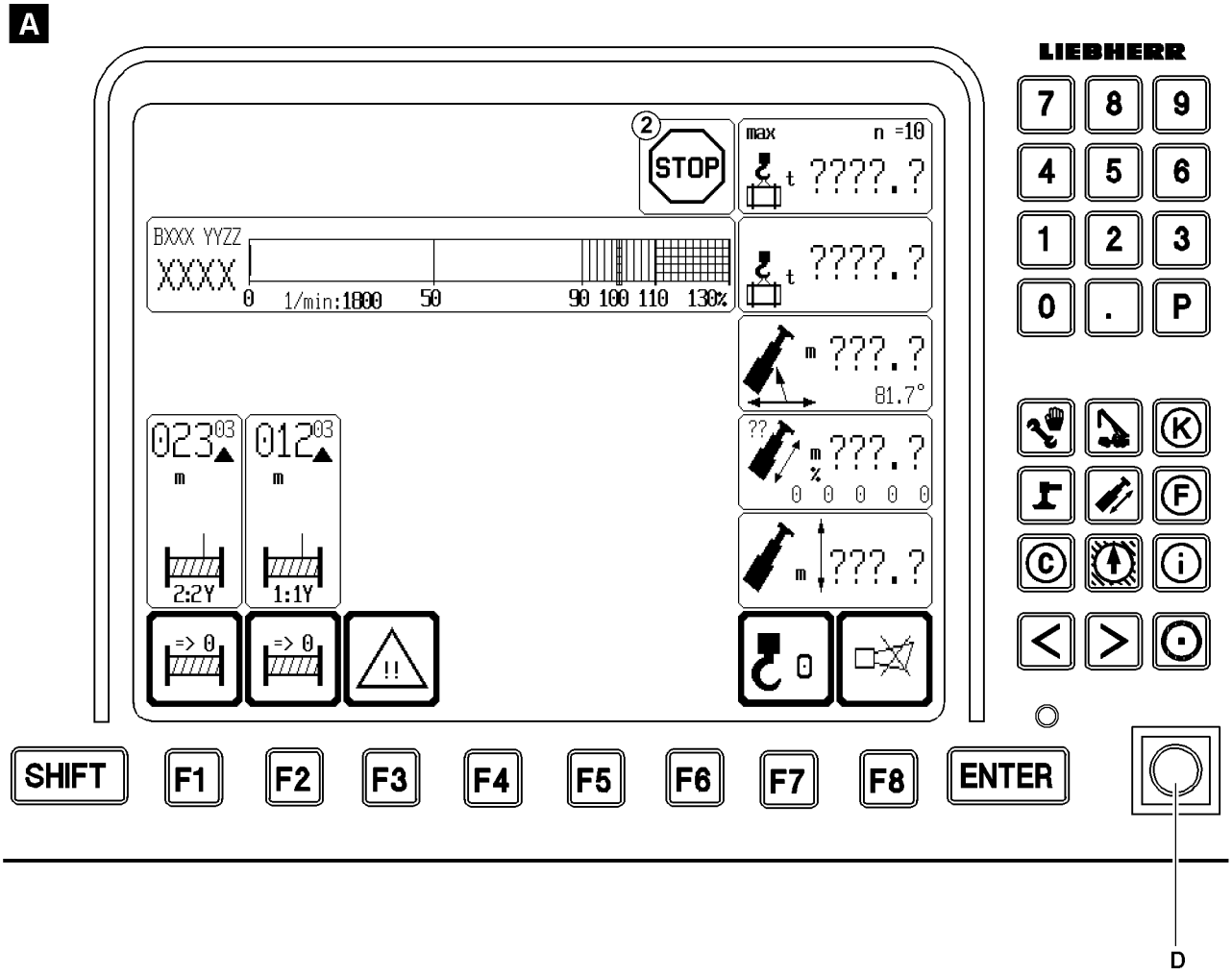
– Number value in icon “Maximum load carrying capacity” is 0.0.
– Number value in icon “Current load carrying capacity” is incorrect.

3.3 How will the error be recognized on the telescoping screen?

– Telescopic sections are not pinned.
– Telescoping cylinder not locked.

3.4 Error recognition in LSB overview

– Transmitter, inductive sensors for telescoping are not assembled on the bus, even though they are required.**“O”** .
– Transmitter is available, but an error in its configuration was recognized.**“X”** .


A
LIEBHERR
7
8
9
4
5
6
1
2
3
0
.
P
K
F
C
i
2
STOP
max
n =10
t ????.?
BXXX YYZZ
XXXX
0
1/min:1000
50
90 100 110 130%
t ????.?
m ???.?
81.7°
023 03
012 03
m
m
2:2Y
1:1Y
?? m ???.?
% 0 0 0 0 0
m ???.?
=> 0
=> 0
!!
0
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
D

B105674

4 Defective sensor

4.1 Length sensor defective

If the length sensor on the telescoping cylinder fails, the boom length can no longer be calculated when the telescopic boom is unpinned. If the telescopic boom is pinned, the telescopic boom length value will continue to be displayed on the LICCON monitor. If the telescopic boom length is missing, it is not possible to calculate the radius, pulley head height and “current load”. Without the telescopic boom length, it is not possible to access the load chart. The consequence is that there is no “maximum load” and no “maximum permitted wind speed”. Flashing question marks are shown for all values where no value is to be calculated, see illustration **A**. The shut-off is also indicated by an acoustic signal and a flashing STOP symbol **2** on the LICCON monitor.
The following crane movements are shut off by this sensor defect:

– Raise hoist gear 1 and 2.
– Telescope the telescopic boom out.
– Telescope the telescopic boom in.
– Luffing the telescopic boom up.
– Luffing the telescopic boom down.
– Hydraulic folding jib up.
– Hydraulic folding jib down.

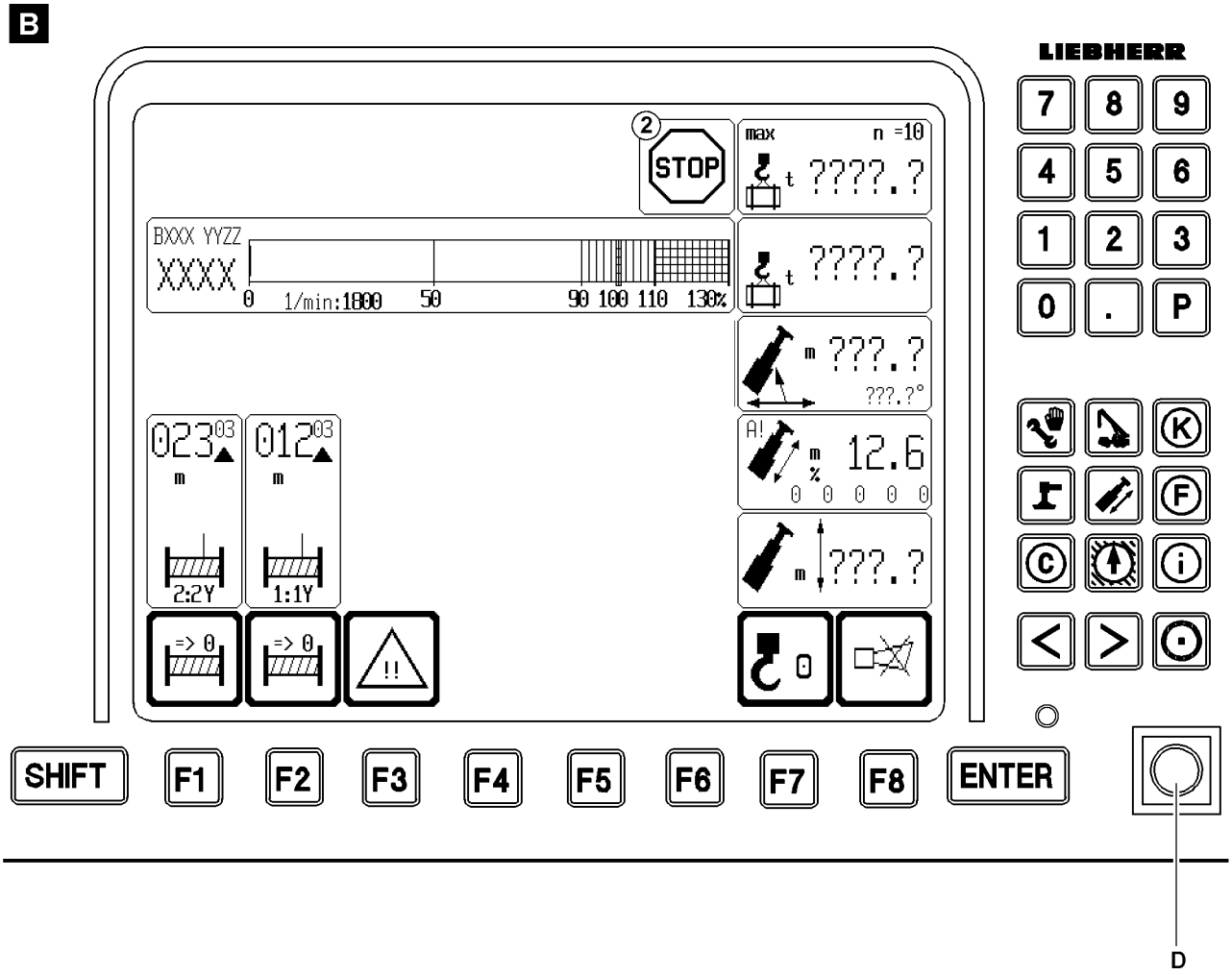
The following crane movements are still possible:

– Lower hoist gear 1 and 2.
– Turning the crane superstructure.

The shut off can be bypassed, see section “Bypass sensor defect”.

DANGER
Increased accident risk when 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 killed!
This could result in high property damage!

▶ It is only permitted to bypass the overload protection during assembly or in emergencies!
▶ The bypass may only be made by persons who are aware of the consequences of their actions!
▶ 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!


B
LIEBHERR
7
8
9
4
5
6
1
2
3
0
.
P
K
F
C
i
2
STOP
max
n =10
t ????.?
BXXX YYZZ
XXXX
0
1/min:1000
50
90 100 110 130%
t ????.?
m ???.?
???.?°
023 03
m
2:2Y
012 03
m
1:1Y
A!
m
% 12.6
0 0 0 0 0
m ???.?
=> 0
=> 0
!!
0
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
D

B105675

4.2 Angle sensor defective

If both angle sensors fail, it is not possible to calculate the radius, pulley head height and “current load”. It is therefore not possible to calculate the “maximum load” and “maximum permissible wind speed”. The boom length will still be displayed. Flashing question marks are shown for all values where no value is to be calculated, see illustration **B**. The shut-off is also indicated by an acoustic signal and a flashing STOP symbol **2** on the LICCON monitor.
The following crane movements are considered defective and shut off by this sensor:

– Raise hoist gear 1 and 2.
– Telescope the telescopic boom out.
– Telescope the telescopic boom in.
– Luffing the telescopic boom up.
– Luffing the telescopic boom down.
– Hydraulic folding jib up.
– Hydraulic folding jib down.

The following crane movements are still possible:

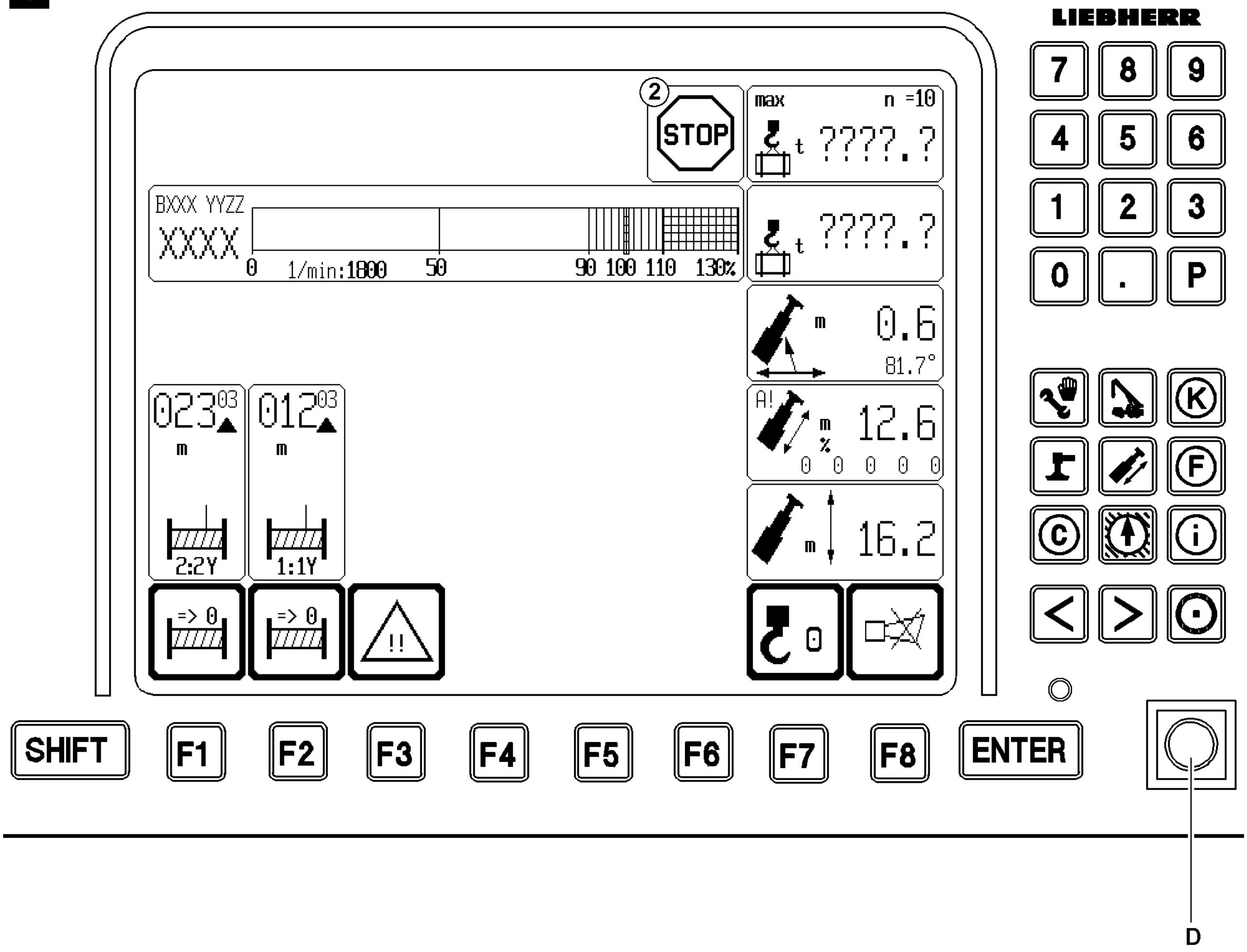
– Lower hoist gear 1 and 2.
– Turning the crane superstructure.

The shut off can be bypassed, see section “Bypass sensor defect”.

DANGER
Increased accident risk when 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 killed!
This could result in high property damage!

▶ It is only permitted to bypass the overload protection during assembly or in emergencies!
▶ The bypass may only be made by persons who are aware of the consequences of their actions!
▶ 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!

C


LIEBHERR
STOP
2
max
n =10
????.?
????.?
BXXX YYZZ
XXXX
0
1/min:1800
50
90 100 110 130%
0.6
81.7°
12.6
16.2
023
012
2:2Y
1:1Y
7
8
9
4
5
6
1
2
3
0
.
P
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
D

B105676

4.3 Faulty pressure sensor on luffing cylinder

If the pressure sensor on the luffing cylinder fails, it is not possible to calculate the “current load”. It is therefore not possible to calculate the “maximum load” and “maximum permissible wind speed”. The boom length, radius and pulley head height will still be displayed. Flashing question marks are shown for all values where no value is to be calculated, see illustration **C**. The shut-off is also indicated by an acoustic signal and a flashing STOP symbol **2** on the LICCON monitor.
The following crane movements are considered defective and shut off by this sensor:

– Raise hoist gear 1 and 2.
– Telescope the telescopic boom out.
– Telescope the telescopic boom in.
– Luffing the telescopic boom up.
– Luffing the telescopic boom down.
– Hydraulic folding jib up.
– Hydraulic folding jib down.

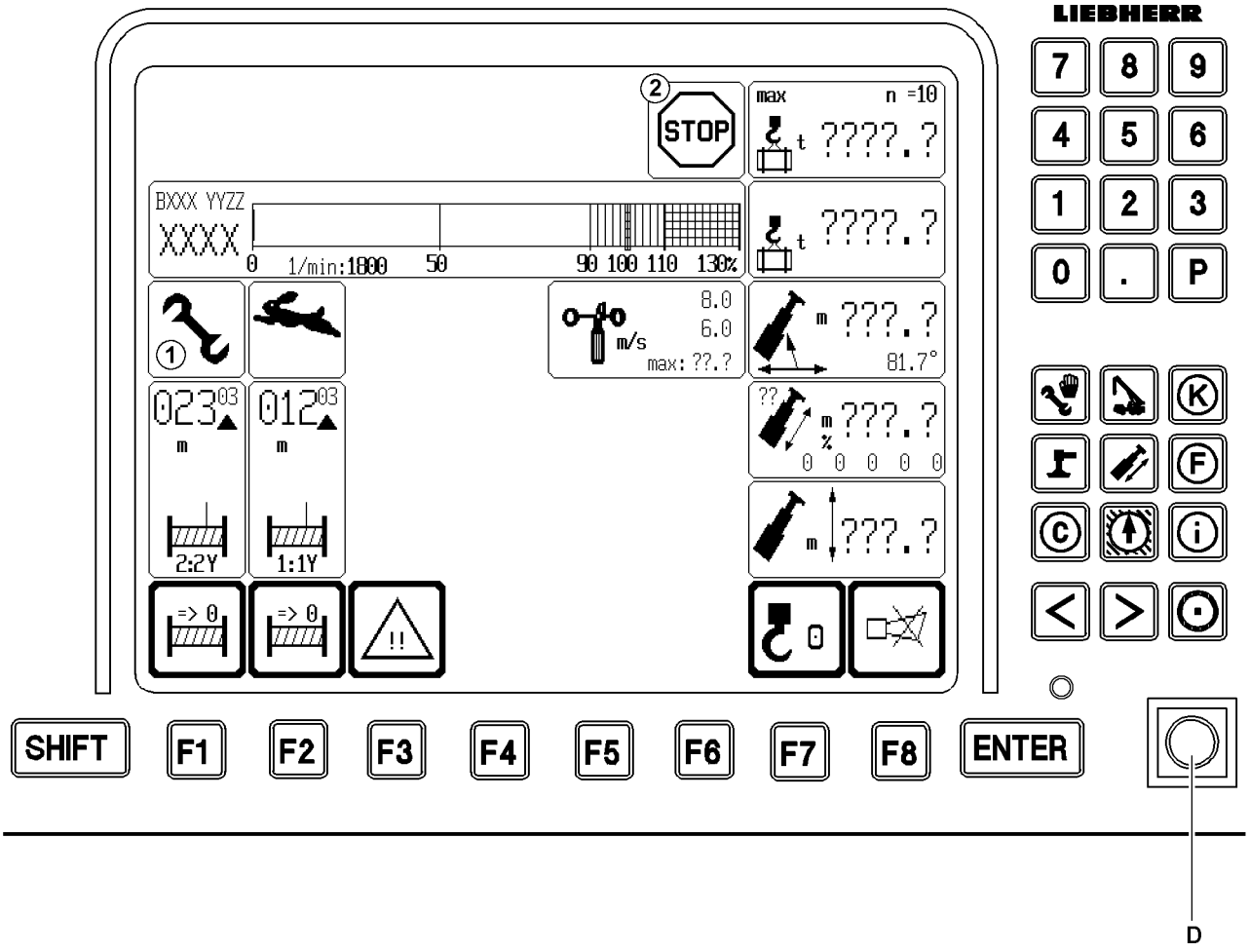
The following crane movements are still possible:

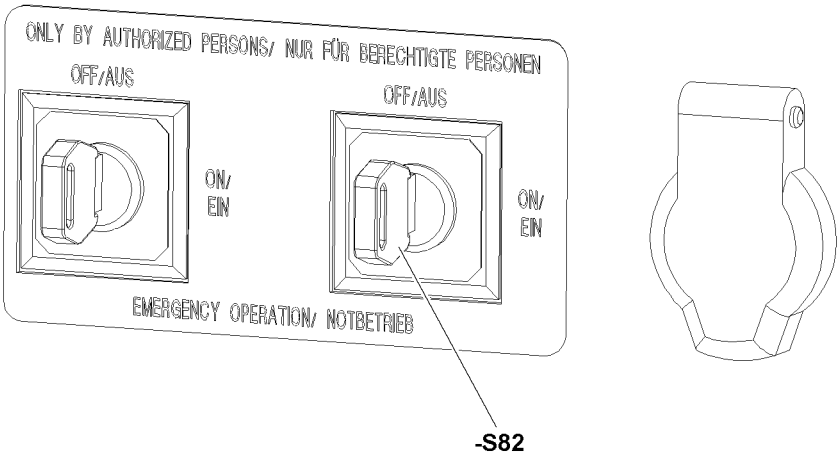
– Lower hoist gear 1 and 2.
– Turning the crane superstructure.

The shut off can be bypassed, see section “Bypass sensor defect”.

DANGER
Increased accident risk when 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 killed!
This could result in high property damage!

▶ It is only permitted to bypass the overload protection during assembly or in emergencies!
▶ The bypass may only be made by persons who are aware of the consequences of their actions!
▶ 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!


LIEBHERR
STOP
max n =10
????.?
BXXX YYZZ
XXXX
0 1/min:1000 50 90 100 110 130%
8.0
6.0
max: ??.?
81.7°
023 03
012 03
2:2Y
1:1Y
=> 0
=> 0
!!
7 8 9
4 5 6
1 2 3
0 . P
K
F
C
SHIFT
F1
F2
F3
F4
F5
F6
F7
F8
ENTER
D


ONLY BY AUTHORIZED PERSONS/ NUR FÜR BERECHTIGTE PERSONEN
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EIN
EMERGENCY OPERATION/ NOTBETRIEB
-S82

B107332

4.4 Bypass sensor defect

4.4.1 Operating the bypass key button D on the LICCON monitor

Ensure that the following prerequisite is met:
- the master switches have **not** been operated,
- one of the shut offs is active:
  - length sensor defective,
  - angle sensor defective,
  - faulty pressure sensor on luffing cylinder.

▶ Turn the bypass key button **D** to the right and hold.

Result:
- The assembly icon **1** on the LICCON monitor blinks.
- An acoustic signal sounds.
- The red flashing beacon on the crane cab blinks.
- The working speed is reduced for all functions, except for the slewing gear and the hydraulic folding jib*.

Troubleshooting

When the shut off “length sensor defective”, “angle sensor defective” and “pressure sensor on luffing cylinder defective” cannot be bypassed with the bypass key button **D**?

▶ Bypass them with key button **-S82** in the control cabinet.

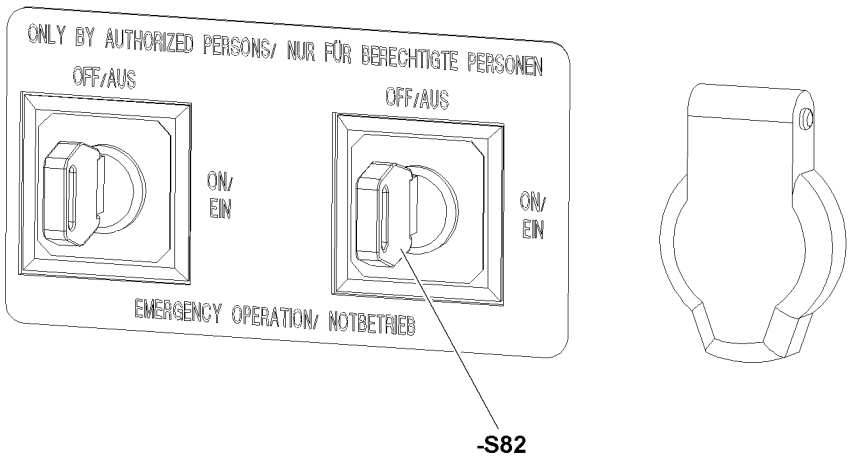
▶ See section “Bypass of load moment limiter emergency operation with key button -S82* ”.

The bypass function turns off:
- If the bypass key button **D** is no longer pressed.
- If the bypass key button **D** is actuated but all master switches are in neutral position for 10 seconds.

▶ Do no longer press the bypass key button **D**.

Result:
- The assembly symbol **1** on the LICCON monitor extinguishes.
- The acoustic signal is turned off.
- The red flashing beacon on the crane cab extinguishes.
- The working speed is no longer reduced*.


!!
3


ONLY BY AUTHORIZED PERSONS/ NUR FÜR BERECHTIGTE PERSONEN
OFF/AUS
ON/
EIN
OFF/AUS
ON/
EIN
EMERGENCY OPERATION/ NOTBETRIEB
-S82

B107333

4.4.2 Bypass of “Load moment limiter emergency operation” with key button -S82*

Ensure that the following prerequisite is met:
- the master switches have **not** been operated,
- one of the shut offs is active:
  - length sensor defective,
  - angle sensor defective,
  - faulty pressure sensor on luffing cylinder.

▶ Turn the key button **-S82** to the right to the stop and release.

Result:
- The LICCON overload protection is inactive.
- The Assembly / bypass load torque limitation symbol **3** in the LICCON monitor blinks.
- An acoustic signal sounds.
- The red flashing beacon on the crane cab blinks.
- The working speed is reduced for all functions, apart from the slewing gear and the hydraulic folding jib.

The bypass is active for maximum 30 minutes. Then it turns off automatically after the last deflection of a master switch.

Note

▶ If a movement is initiated via the master switch shortly before the maximum bypass time of 30 minutes is over, then the bypass time is extended until the master switch is again in zero position.

The bypass function turns off:
- When all master switches are for 10 seconds in neutral position after the last deflection.

▶ The bypass function turns off.

Result:
- The LICCON overload protection is active.
- The Assembly / bypass load moment limitation icon **3** in the LICCON monitor turns off.
- The acoustic signal is turned off.
- The working speed is reduced until the master switches are in neutral position, after turning the bypass off.
- The red beacon on the crane cab turns off after ignition off.

▶ If the bypass is to be reactivated:
Turn the key button **-S82** to the right to the stop and release.

B195219

5 Telescoping lock defective

If telescoping is not possible, then the telescoping lock may be defective.

WARNING
Increased danger of accidents in case of defective telescoping lock!
There is an increased risk of accident if the following danger notes are not observed!
- ▶ “Emergency control telescoping” may only be carried out by authorized expert personnel trained on **Liebherr-Werk Ehingen mobile cranes**, who know the dangers of emergency operation!
- ▶ It is imperative that the next **Liebherr Service location** or **Liebherr-Werk Ehingen** is contacted!
- ▶ All crane movements must be carried out with extreme caution!
- ▶ Telescoping must be constantly monitored by a second person!

5.1 How is the error recognized?

– Telescoping is not functioning.

Possible causes:
– The valves are mechanically defective.
– The electrical connection is interrupted.
– The valves can no longer be supplied with power.

6 The electrical connection of a cable drum is interrupted

WARNING
Danger of accidents if electrical connection is interrupted!
Manual telescoping is **no** longer possible if electrical connection is interrupted!
No report is shown regarding the position of the telescoping lock!
- ▶ It is imperative that the next **Liebherr Service location** or **Liebherr-Werk Ehingen** is contacted!

6.1 How is the error recognized?

– Manual telescoping is **not** possible.
– System error message in the screen for determining errors.
– LICCON test system, LSB overview (CPU1). No sensors for telescoping are available on the bus, although required.

7.00 Service and maintenance

B195219

1 General

WARNING
Danger of fatal injury due to damaged mobile crane components!
If mobile crane components, which were damaged, for example due to maintenance errors, are not replaced immediately, personnel can be fatally injured!
- ▶ Maintain mobile crane components according to the data in the maintenance intervals, the maintenance guidelines and the lubrication chart!
- ▶ Replace damaged mobile crane components immediately!

NOTICE
Damage of mobile crane components!
If mobile crane components are not maintained according to the maintenance intervals and maintenance guidelines in the individual chapter, or if other lubricants are used than specified in the lubrication chart, the respective mobile crane components can be damaged and/or fail.
The warranty for the respective mobile crane components will be voided!
- ▶ Maintain mobile crane components according to the data in the maintenance intervals, the maintenance guidelines and the lubrication chart!

1.1 Liebherr Customer Service for you

Liebherr mobile cranes - whether truck-mounted, mobile or crawler cranes - are technically advanced products, which prove their worth daily even under tough conditions.
The high technical standards of these cranes provide functional security, resistance to failure and easy maintenance.
Liebherr is continuously developing the drive and control components. The combination of well proven units and modern manufacturing methods produces cranes that are safe to operate and easy to maintain.
Several hundred cranes are built every year for the international market, supported by international service.
Liebherr's “After Sales Service” plays an important role in ensuring the operational readiness and high availability of the cranes.
With Liebherr, service begins when the crane is handed over. Your crane operators will be professionally trained in line with their level of knowledge, and we devote much time to this.
We also train your workshop staff in all crane-specific matters, because we know that they can deal with more than just minor repairs themselves. Often there are specialists who can quickly and reliably carry out crane repairs.
We also have specialist service advisers who can help you to fix your on-site problems creatively. This contact by telephone saves time and money. In the event of problems, get in touch as soon as possible.
Our service technicians are also specialists with years of experience and can be deployed from local support points. Naturally these experts have specialized knowledge and special tools.
But before you call on these people, it is worth making full use of the facilities for getting advice mentioned above.

Note
Customer entitlement for warranty and fair dealings!
Only original Liebherr replacement parts have been tested for crane operation and they can be installed without any safety risk.
- ▶ The buyer only has a claim to warranties and possible refunds if only original Liebherr replacement parts are used for Liebherr mobile cranes.

Note
Exclusion of liability!
- In the event that replacement parts are used that are not original Liebherr parts, Liebherr-Werk Ehingen GmbH disclaims all liability, both for system functionality and the replacement parts.

2 Cleaning and care of the crane

2.1 Care instructions for sound absorption (soundproofing)

Sound absorption in the area of engines and other noise sources is an integral part of the entire construction. It is your task to limit the noise generation of vehicles and the sound level in the workplace to the legally specified values in connection with sound absorption and the design of the equipment. They are therefore an integral part for the construction permits for the machines. They may not be removed, and if damaged, they must be replaced by original replacement parts.

From a construction point of view, they have been designed to be maintenance-free. They have been equipped with surfaces that repel dirt, oil and water. They are fire-resistant and some of them are fireproof, depending on the location.

For these reasons, these parts do not need any care. Any small dirt deposits can be disregarded, as the acoustic effectiveness of the parts is not reduced.

More severe contamination should be removed with suitable tools (soft plastic scrapers).

Tools with sharp edges are not suitable. Steam cleaners can be used with extreme caution, always maintain sufficient distance with the steam jet and use low water pressure. **Do not** use solvents for cleaning.

Contamination with solvents as well as large amounts of foreign mattery, such as oil (motor oil, gear oil or hydraulic oil) an fuels is dangerous, as these can easily catch fire. Fire will severely degrade the behavior of the sound absorption materials.

If such contamination of the affected sound absorption occurs, **remove immediately** and replace with **original parts**.

2.2 Care instructions for the driver's cab and the crane cab

The steering wheel, center console, dashboard cover, floor cover and dirty upholstery in the driver's cab and the crane cab should only be cleaned with warm water mixed with a little dish detergent.

Do not use any scouring agents.

3 Shutting down

3.1 During transportation or when interrupting work

NOTICE
Risk of corrosion to the hydraulic cylinders!

Take down the crane equipment if the crane will be out of operation for a long period of time.

The hydraulic cylinders (support cylinders, luffing cylinder, telescoping cylinder) may corrode in aggressive environmental conditions, for example in coastal locations where the air is especially salty.

- Take down the crane equipment!
- Fully retract the hydraulic cylinders on the crane!
- Protect exposed sections of the piston rod to prevent corrosion, such as applying grease to these sections!
- In particular, grease exposed sections of the piston rod of the luffing cylinder!

4 Maintenance and inspection guidelines

WARNING
Danger of accidents during maintenance and inspection!
When working on components to be maintained or inspection, for example checking and addition service fluids, there is a risk of severe injuries, burns, accidents and fire!
For that reason, the following warning notes and generally valid safety regulations must be strictly observed!
Components, which need to be inspected or services are dangerous areas!

- Maintenance work should only be carried out by authorized and especially trained personnel!
- Unauthorized persons must remain outside the danger zone!
- Turn the engine in the crane superstructure and the crane chassis off!
- Apply the parking brake for the crane chassis!
- Pull the ignition key on the crane superstructure and the crane chassis and hand it to an authorized person!
- Do not carry out any maintenance or inspection work during travel and crane operation!

During inspection or maintenance, you can get severely burnt on hot surfaces of components! This applies especially for the exhaust system or the travel gear.

- Let any components to be maintained or inspected cool off!
- Do not spill any service fluids over the hot components!
- Avoid short circuts in the electrical system, especially on the battery!
- Never reach into the cooler fan when the engine is warm. The cooler fan could turn on suddenly!
- Never open the cap on the coolant reservoir as long as the engine is warm! The cooling system is under pressure!
- To protect face, hands and arms from steam of hot coolant, cover the cap with a large rag when opening!

If inspection work must be carried out while the engine is running, there is a significant danger from turning parts and from the ignition system!

- Be especially careful!

When work on the fuel system or on the electrical system is necessary, the following safety guidelines must additionally be observed:

- Disconnect the battery from the power supply!
- Do not smoke!
- Do not work near open flames!
- Keep a functioning fire extinguisher ready!

NOTICE
Damage of components!
In case of incorrect maintenance, severe functional defects and damage on the components can occur!

- Add correct and sufficient service fluids during maintenance!
- For all maintenance work, observe utmost cleanliness to prevent dirt from entering the inside of the components!
- Check components in regular intervals for leaks!
- Have leaking components sealed immediately and properly!

Note

- The maintenance and inspection work on the crane chassis is carried out based on operating hours or by kilometers travelled.
- The maintenance and inspection work on the crane superstructure is carried out based entirely on operating hours.

Observe the following chapters when performing maintenance and inspection of the crane:

– Chapter 7.02 Maintenance intervals - Crane chassis [1]
– Chapter 7.03 Maintenance intervals - Crane superstructure [1]
– Chapter 7.04 Maintenance guidelines - Crane chassis [2]
– Chapter 7.05 Maintenance guidelines - Crane superstructure [2]
– Chapter 7.06 Lubrication chart, fill levels
– Chapter 7.07 Service fluids and lubricants

[1] These chapters contain a list of service intervals for all maintenance work. Only the relevant work is to be carried out.
[2] For individual components, the manufacturer's specifications must be observed.

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1 Crane chassis maintenance and inspection plan

	first maintenance after	regular maintenance, every			minimum maintenance	checks	
		500 h 3 months	1000 h 6 months	2000 h annual	annual	daily	weekly
Hydraulic hose lines							
Check for leaks and damage						X	
A safety check should be performed by experts					X		
Travel gear							
Checking the oil level		X					
Oil analysis			X		X		
Oil change	500 h		X[2]				
Check mounting screws for tight seating				X			
Turas wheel and chassis engine, check that fixing screws are tight				X			
Check that the transmission and hydraulic connections are tight		X					
The condition and tightness of the hydraulic hoses should be checked by experts			X		X		
Crawler travel gear							
Check the chassis components (chain links, chain separators, chain bushes, base plates, track rollers, support rollers, leading wheels) for wear		X					X
Check the leading wheel guides for signs of wear			X				
Check that support rollers, track rollers, leading wheels are tight							X
Check leading wheels				X			
Clean and grease sliding surfaces on sliding component		X					

	first maintenance after	regular maintenance, every			minimum maintenance annual	checks	
		500 h 3 months	1000 h 6 months	2000 h annual		daily	weekly
Clean the crawler chassis [1]							X
Make sure that screws, nuts and fixing pins are tight		X					
Check the chain tension and if necessary, re-tension[1, 3]			X			X	
Check all hydraulic cylinders (support cylinders* , track adjustment cylinders*) to ensure they are not leaking and have been tightened correctly		X					

[1] earlier if necessary
[2] Carry out an oil analysis. Depending on the result, it may be necessary to change the oil
[3] Tension the crawler chain, see chapter 7.04

	regular maintenance, every			minimum maintenance annual
	10 h	100 h	1000 h	
Crawler chain				
Check for correct mounting and damage	X			
Check pad tension, re-tension if necessary	X			
Central lubrication system				
Check grease supply of central lubrication system	X			
Nitrogen clamp				
Check pre-tension pressure for nitrogen clamp				X

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1 Crane superstructure maintenance and inspection plan

	First maintenance	Regular maintenance, every				Minimum maintenance	Checks	
	to	125 h	250 h	500 h	1500 h	Annually	Daily	Weekly
Diesel engine								
Checking the oil level For all other maintenance tasks, follow the instructions of the engine manufacturer							X	
Check the coolant level in the equalising reservoir							X	
Replace coolant						Every 2 years		
Air filter								
Check monitoring device							X	
Clean or change (follow the instructions of the engine manufacturer)								
Rotary connection								
Lubricate gearing			X					
Lubricate the rotary connection						X[1]		
Make sure that bolts are tight	250 h				X	X		
Check tilting free play					X	X		
Rope winches								
Check for leaks							X	
Checking the oil level								X
Check the mounting screws for tight seating	250 h			X		X		
Oil change					3000 h	Every 4 years		

	First maintenance	Regular maintenance, every				Minimum maintenance	Checks	
	to	125 h	250 h	500 h	1500 h	Annually	Daily	Weekly
Hoist gear brake								
Check for leaks							X	
Checking the oil level						X		
Oil change					4000 h	Every 4 years		
Drive shafts								
Check flange bolts		X						
Lubricate		X				X		
Lattice components								
Check for cracks and damage						X		
Guy rods								
Check for cracks and damage						X		
Relapse supports								
Lubricate bearings				X		X		
Relapse cylinder								
Check for leaks	X[2, 6]							
Check pretension pressure (nitrogen)	X[2, 6]			X		X		
Check oil level	X[2, 6]			X		X		
Pneumatic springs								
Check function	X[2, 5, 6]			X		X		
A-bracket bearing								
Lubricate				X				
Counterweight								
Check tightening torque of mounting screws	1000 km			or 10,000 km		X		
Ballasting								
Lubricate bearings			X			X		
Press on pulleys of cable winches								
Grease guides			X			X		
Rope pulleys								

	First maintenance	Regular maintenance, every				Minimum maintenance	Checks	
	to	125 h	250 h	500 h	1500 h	Annually	Daily	Weekly
Check for wear and damage					X	X		
Lubricate rope pulleys					X	X		
Crane ropes								
Check, grease if necessary			X			X		
Hook blocks								
Grease hook				X		X		
Check distance gap (y)				X		X		
Crane operator's cab								
Check armatures / instruments for function							X	
Check control lights for function							X	
Check fluid level in expansion tank of engine control							X	
Crane cab, extendable or inclinable								
Check for correct function				X		X		
Lubricate bearings				X		X		
Overload protection								
Check for correct function							X	
Electrical system								
Check cable connections and battery acid levels						X[3]		
Fuel system								
Check for leaks							X	
Check condition and mountings						X		
Drain off water and sediments						X		
Slewing gear								
Check for leaks							X	
Checking the oil level								X
Check the mounting screws for tight seating	250 h			X		X		

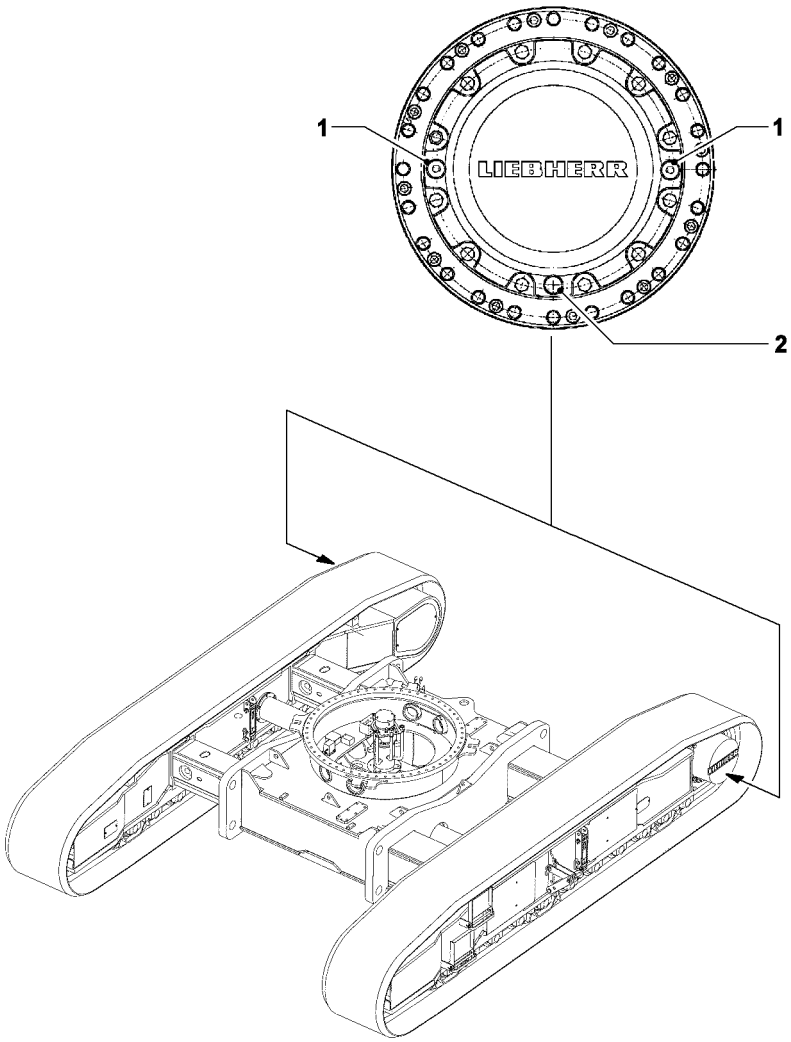
	First maintenance to	Regular maintenance, every 125 h	250 h	500 h	1500 h	Minimum maintenance Annually	Checks Daily	Weekly
Oil change					4000 h	Every 4 years		
Turntable locking mechanism								
Check for correct function				X		X		
Lubricate				X		X		
Pump distributor gear								
Check for leaks							X	
Checking the oil level								X
Oil change	500 h				X	X		
Hydraulic hose lines								
Check for leaks and damage							X	
Check for safe condition by expert						X		
Hydraulic system								
Checking the oil level							X	
Check for leaks								X
Replace servo pressure and replenish pressure filter inserts	250 h			X		X		
Replace return filter inserts (only for cranes with open hydraulic circuit)	250 h			X		X		
Replace bleeder filter of hydraulic tank	250 h			X		X		
Check hydraulic oil, required degree of purity: 20/18/15 (take oil sample and have it checked by oil supplier)	500 h				X	X		
Hydraulic cylinder								
Check for leaks								X
Hydraulic pressure accumulator (nitrogen)								
Check pretension pressures				X[4]		X[4]		

	First maintenance to	Regular maintenance, every 125 h	250 h	500 h	1500 h	Minimum maintenance Annually	Checks Daily	Weekly
Air pressure system								
Check for leaks								X
Check operating pressure								X
Check shut off pressure								X
Check operation of automatic drain valve								X
Replace air drier granule elements						X		
Clean air drier preliminary filter						X		
Central lubrication system								
Check for correct function				X				
Emergency control								
Check for correct function						X		
Telescopic boom with cable mechanism								
Check telescopic boom for distortions and cracks						X		
Grease the sliding surfaces of the telescopic boom bearing		X				X		
Lubricate change over pulleys of telescoping mechanism		X				X		
Check mounting screws on change over pulleys for tight seating		X				X		
Check rope mechanism, readjust, if necessary	250 h			X				
Dismantle and check boom					20000 h	Every 10 years		
Pneumatic boom lock								
Clean air filter with compressed air		X				X		

	First maintenance	Regular maintenance, every				Minimum maintenance	Checks	
	to	125 h	250 h	500 h	1500 h	Annually	Daily	Weekly
Check locking pins				X		X		
Lubricate locking pins					X	X		
Telematik telescopic boom system								
Check telescopic boom for distortions and cracks						X		
Check hydraulic system components for leaks						X		
Check telescoping cylinder for proper condition				X		X		
Check push out rod for proper condition				X		X		
Check locking pins and locking bores for proper condition				X		X		
Check inner and outer sliding surfaces for proper condition				X		X		
Lubricate sliding surfaces						X[5]		
Grease guide rails on telescoping cylinder						X[5]		
Dismantle and check boom					20000 h	Every 10 years		
Telescopic boom guying								
Check for distortions and cracks						X		
Lubricate grease fitting on the TA / TY-guying						Every 3 months[5, 6]		
Check the oil level on the guy winch								Every 6 months
Change the oil on the guy winch						Every 4 years		
Derrick ballast								

	First maintenance to	Regular maintenance, every 125 h	250 h	500 h	1500 h	Minimum maintenance Annually	Checks Daily	Weekly
Check frame, suspension and guide section for distortion and cracks						X		
Check wheels for condition and tight seating						X		

[1] Every 3 months if the crane is not moved.
[2] Carry out a visual inspection before every startup in service.
[3] In hot climates twice a year.
[4] Note chapter 7.05, Crane superstructure maintenance instructions.
[5] when necessary
[6] during assembly



B198739

1 Travel gear transmission

CAUTION
Danger of transmission damage!
▶ Maintain extreme cleanliness during all work on the travel gear transmission, to prevent dirt from entering the transmission.

1.1 Gear oil

1.1.1 Checking the oil level

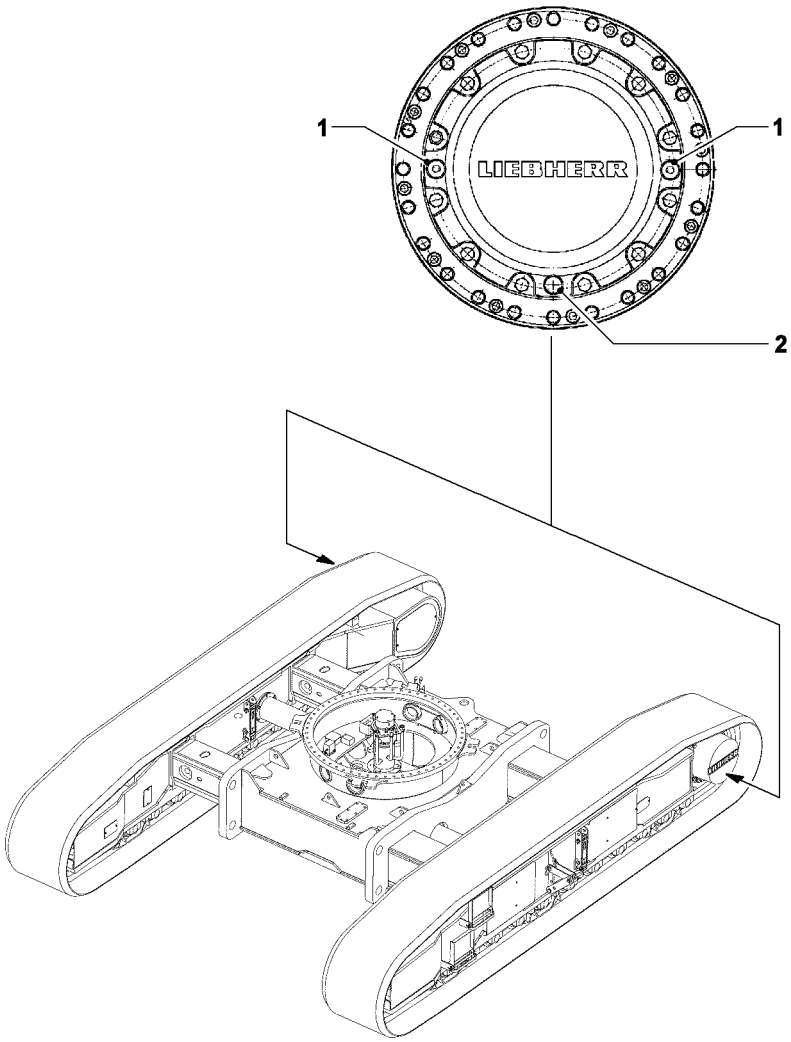
Ensure that the following prerequisites are met:
– the crane is horizontal
– the travel gear transmission must be stationary
– the **LIEBHERR** text on the travel gear transmission is horizontal

Note
▶ In order to get a reliable oil level check, make sure that the travel gear transmission is stationary for at least two minutes before you start to check the oil level. This ensures that the oil has returned to the oil chamber completely.

▶ Carefully unscrew the oil level screw **1**.
▶ If oil runs out of the inspection opening **1**, or the oil level is up to the lower edge of the inspection opening **1**, then the oil level in the travel gear transmission is correct.

CAUTION
Danger of gear damage!
▶ If the fluid level has dropped below the inspection opening **1**, it is essential to top up the transmission fluid as shown in the lubrication chart until the fluid level is again up to the lower edge of the inspection opening.

▶ Screw in the oil level screw **1** and tighten.



B198739

1.1.2 Changing the oil

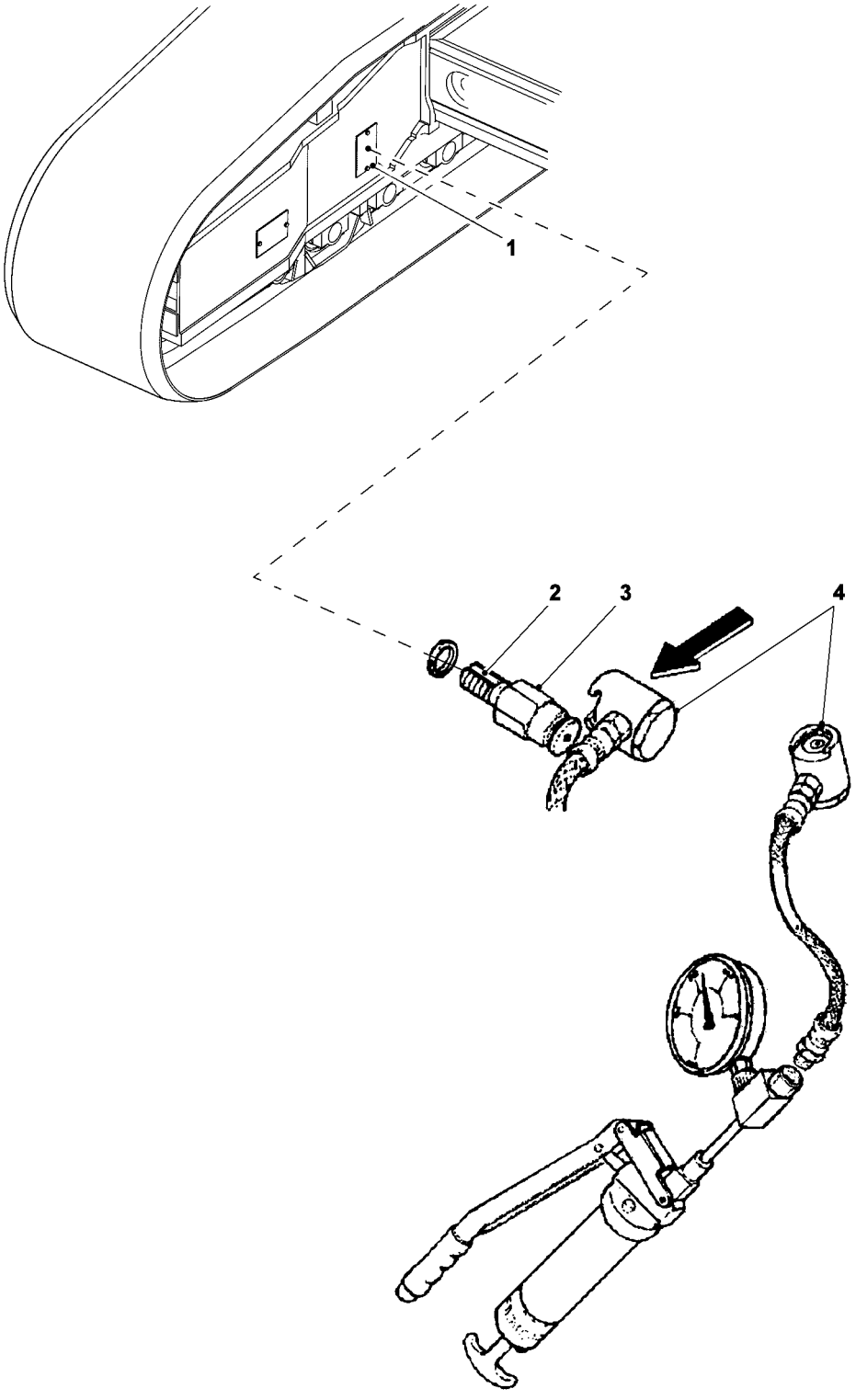
Ensure that the following prerequisites are met:
- the crane is horizontal
- the travel gear transmission must be stationary
- the **LIEBHERR** text on the travel gear transmission is horizontal
- travel gear transmission at operating temperature
- an oil collecting container is ready to hold “used oil”

Note
- ▶ When selecting the oil collecting container, make sure that the oil collecting container is of sufficient size to hold all the used oil.
- ▶ Filling quantity of the travel gear transmission, see chapter 7.06.

- ▶ Unscrew the oil level screw(s) **1** for bleeding.
- ▶ Remove the oil drain plug **2** and drain oil into a suitable container.

Note
- ▶ Let the travel gear transmission run completely at idling speed.

- ▶ Clean the oil drain plug **2** and the sealing surfaces.
- ▶ Install the oil drain plug **2** with new seal and tighten.
- ▶ Top up with oil as shown in the lubrication chart using the oil level screw **1** until the oil level “is up to the edge” of the hole or starts to overflow.
- ▶ Screw in oil level screw(s) **1** with new gasket and tighten.



B198740

2 Crawler travel gear

The caterpillar tracks must be tensioned by means of clamping cylinders that are extended with a lever grease gun.
To slacken the caterpillar tracks, reduce the pressure in the clamping cylinder.

2.1 Tensioning the caterpillar track

Ensure that the following prerequisites are met:
– the crane is horizontal
– the lever grease gun with pressure gauge is to hand

2.1.1 Tensioning procedure

▶ Unscrew the cover **1** on the inside of the crawler carrier.
▶ Attach the hose **4** of the lever grease gun to the lubricating nipple **3** of the clamping cylinder up to the stop position (push).
▶ Activate the lever grease gun until the pressure gauge shows a pressure of about **160 bar** to **180 bar** .

Result:
– The caterpillar track will be tensioned.

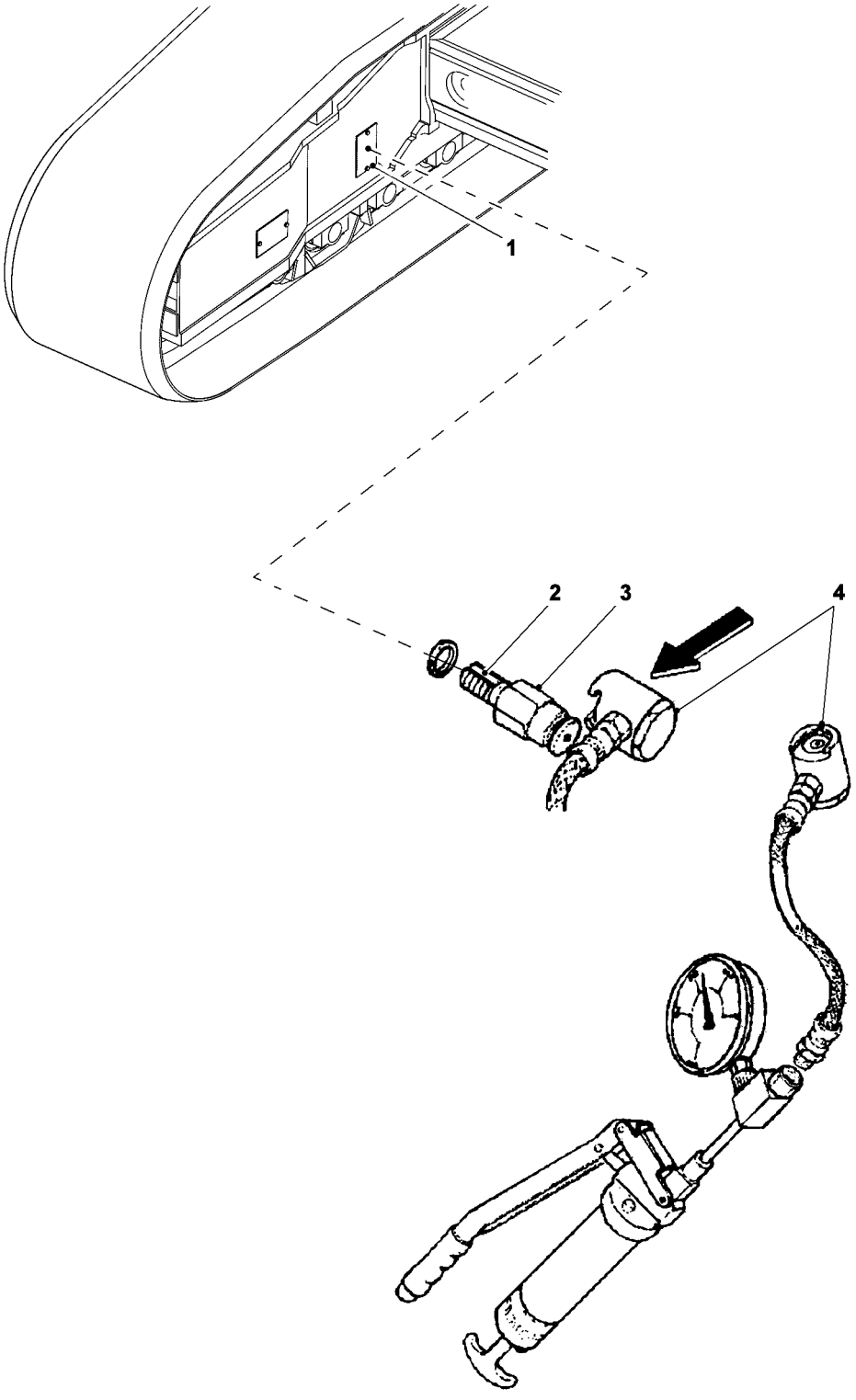
▶ Remove the pressure hose **4** from the lubricating nipple

Troubleshooting
The pressure hose **4** does not detach from the lubricating nipple **3**?
The pressure in the pressure hose **4** is too high.
▶ Carefully loosen the pressure hose **4** on the lever grease gun, so that the pressure in the pressure hose is reduced.

▶ Remove the pressure hose **4** from the lubricating nipple **3**.
▶ Screw back the cover **1** on the inside of the crawler carrier.
▶ After the tensioning procedure, drive the caterpillar track by about one track length straight ahead forwards and backwards.

Result:
– The tension in the lower track area evens out.

Note
▶ If necessary, repeat the tensioning procedure on the caterpillar track.



B198740

2.2 Slackening the caterpillar track

WARNING
Risk of injury due to excess pressure!
Incorrect procedures when slackening the caterpillar track can lead to severe injuries to the face and especially the eyes from grease shooting out.
- ▶ When loosening the lubricating nipple, do not look straight into the opening.
- ▶ The steps for the slackening procedure described below must be adhered to.

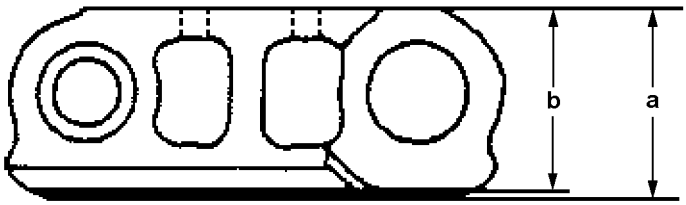
2.2.1 Slackening procedure

- ▶ Unscrew the cover **1** on the inside of the crawler carrier.
- ▶ Loosen the lubricating nipple **3** with extreme caution.
- ▶ Unscrew the lubricating nipple **3** carefully 2 or 3 thread turns, until grease can extrude from the groove **2**.
- ▶ Tighten the lubricating nipple **3** again.
- ▶ Screw back the cover **1** on the inside of the crawler carrier.

2.3 Wear and tear data about the crawler track travel gear

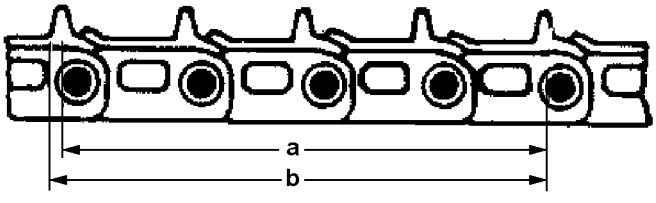
CAUTION
Damage to the crawler chassis!
If components are not replaced when reaching the wear limit, the crawler chassis can be badly damaged!
- ▶ Components that have reached the wear limit must be replaced by new components!

2.3.1 Chain link



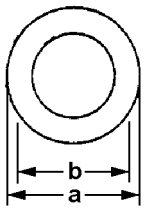
Component	Dimensions	
	new	Wear limit
	a	b
Chain link	126 mm	110 mm

2.3.2 Chain separator



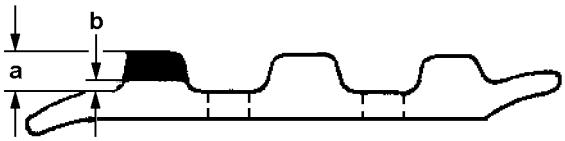
Component	Dimensions	
	new	Wear limit
	a	b
Chain separator	866 mm	883 mm

2.3.3 Chain bush



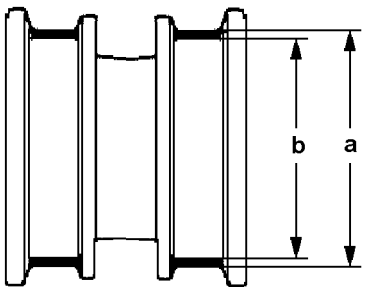
Component	Dimensions	
	new	Wear limit
	a	b
Chain bush	Ø 71,42 mm	Ø 64.5 mm

2.3.4 Support plate



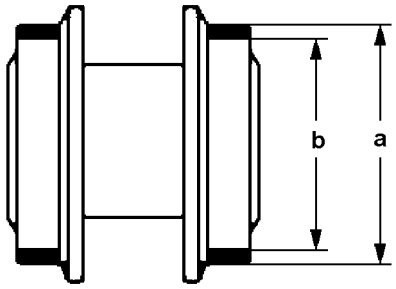
Component	Dimensions	
	new	Wear limit
	a	b
Base plate	26.5 mm	12 mm

2.3.5 Roller



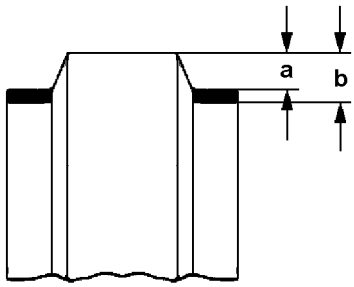
Component	Dimensions	
	new	Wear limit
	a	b
Roller	Ø 200 mm	Ø 184 mm

2.3.6 Support roller

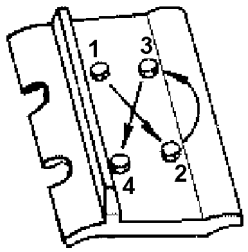


Component	Dimensions	
	new	Wear limit
	a	b
Support roller	Ø 140 mm	Ø 125 mm

2.3.7 Leading wheel



Component	Dimensions	
	new	Wear limit
	a	b
Leading wheel	24.5 mm	30 mm



2.4 Fitting the base plates

The screws used to attach the base plates must be retightened 50 operating hours after the base plates were fitted.

The regular maintenance intervals for the screws are given in chapter 7.02.

The tightening torque is 1000 Nm.

- ▶ Tighten the screws in the order given on the diagram.

2.5 Checking pre-tension pressure in nitrogen clamp

The crawler carriers are equipped with nitrogen clamps. Although the nitrogen clamps do not require any maintenance, check the pre-tension pressures once a year.

The pre-tension pressure in the nitrogen reservoirs must be 180 bar.

DANGER

Danger of explosion!

- ▶ The pressure in the nitrogen cylinder must be less than the maximum permitted operating pressure of the reservoir or the pressure gauge. Otherwise fit a pressure reducer between the cylinder and the filling device.
- ▶ Do not use air or oxygen to fill the nitrogen clamp!
- ▶ The pre-loading pressure in the nitrogen clamps must always be checked by authorized and trained personnel using appropriate equipment! The national pressurized container regulations most also be complied with!

- ▶ Check the pre-tension pressure in the nitrogen reservoirs using a testing and filling device and correct if necessary.

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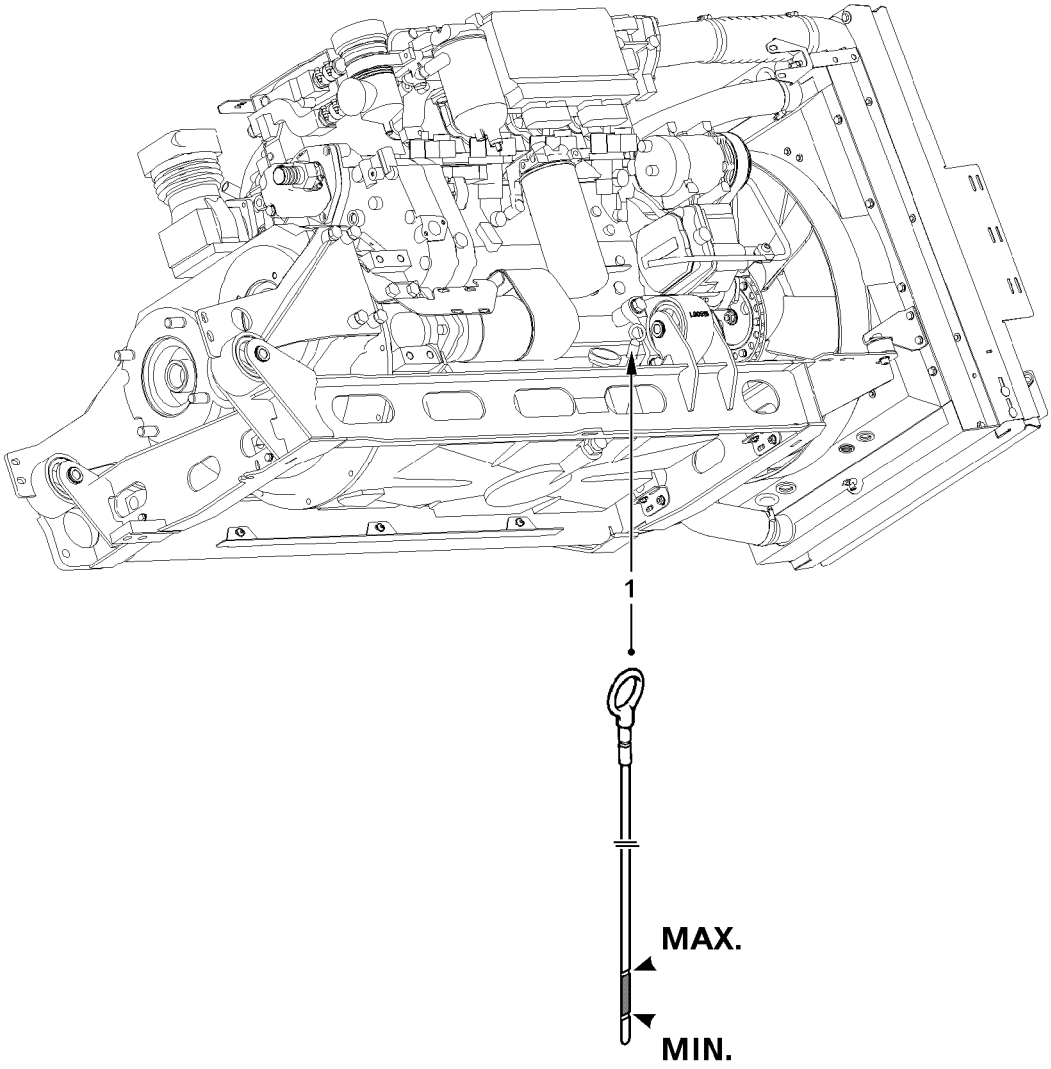


B198426

1 Crane engine

Under no circumstances must fuel lines be stepped on during maintenance or repair work!

DANGER
Danger of fire!
- ▶ Please ensure that the engine area is kept free of diesel fuel.
- ▶ Extreme cleanliness is vital, particularly during filter changes and deaerating. Wipe up any spilled fuel!
- ▶ When changing the filter it is advisable to put down some waste wool before undoing the filter to pick up fuel.

1.1 Engine oil

1.1.1 Checking the oil level

Ensure that the following prerequisites are met:
– the crane is horizontal
– the engine has been turned off and the oil has collected in the oil sump

- ▶ Remove and wipe off oil dipstick **1**.
- ▶ Re-insert oil dipstick **1** and pull out again.

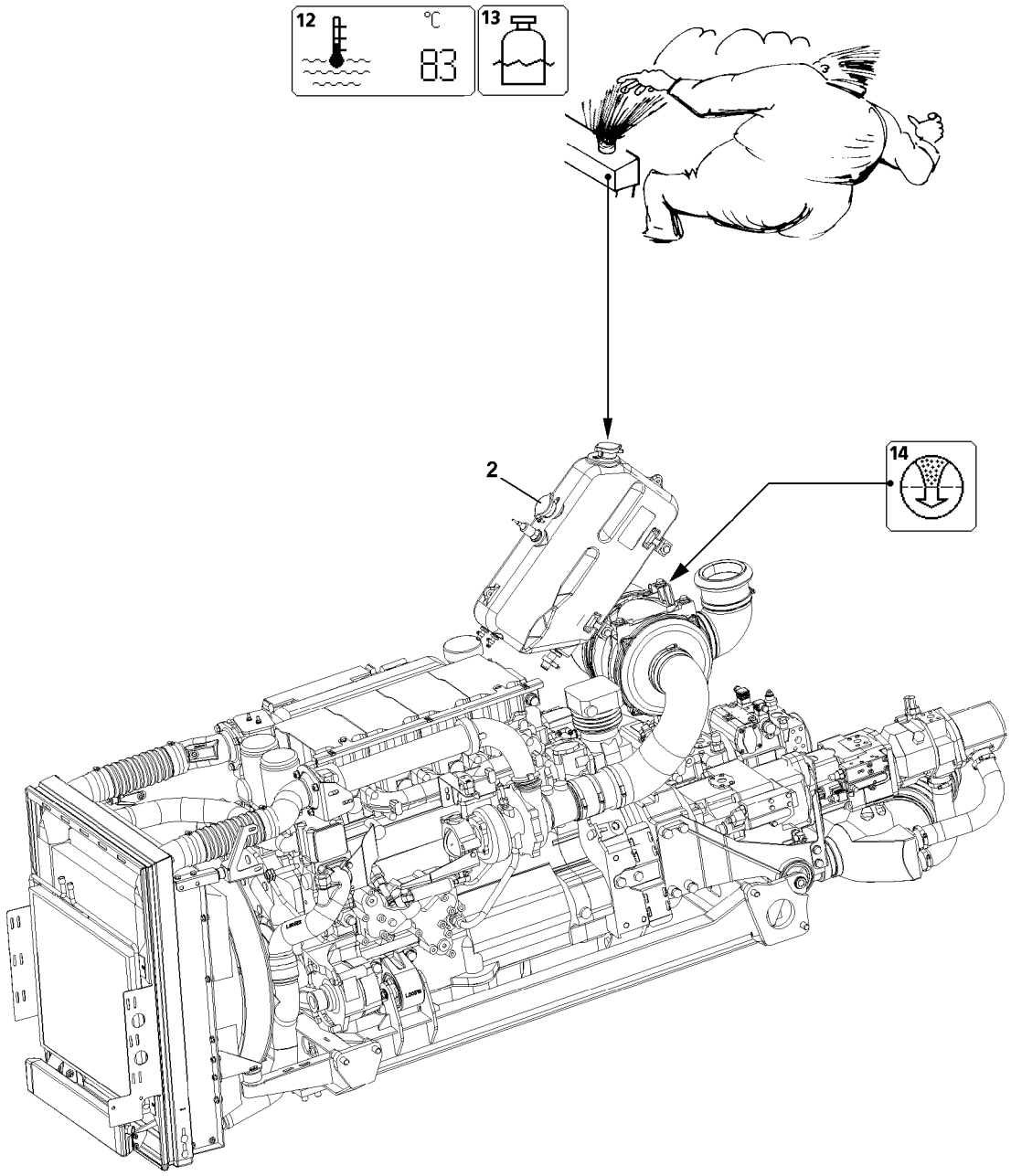
The oil level must be between the Min. and Max. marks on the oil dipstick **1**.
- ▶ Check oil level.

CAUTION
Danger of damaging the engine!
If the oil level has dropped below the Minimum mark, top up engine oil as shown in the lubrication chart until the oil level is between the Minimum and Maximum marks.
- ▶ Top up engine oil and check again.

- ▶ Re-insert oil dipstick **1**.

1.1.2 Changing the oil

Refer to separate operating instructions “LIEBHERR diesel engines”.



B198427

1.2 Engine coolant

The coolant level is monitored by the LICCON computer system. If the coolant level is too low the “Low coolant level” **13** icon appears on the LICCON monitor.
The crane's engine coolant temperature can be read on the LICCON monitor in [°] on the “Engine coolant temperature” icon.

DANGER
Danger of burning!
▶ Engine must be cold when performing coolant check.

▶ Turn sealing cap **2** on filler neck of water cooler expansion tank to the 1st detent.
▶ Release excess pressure.
▶ Remove sealing cap **2**.
▶ Check the coolant level.

Top up water cooler equalizing reservoir with coolant as shown in lubrication chart, always using filler neck.
▶ Top up coolant to overflow level if necessary.

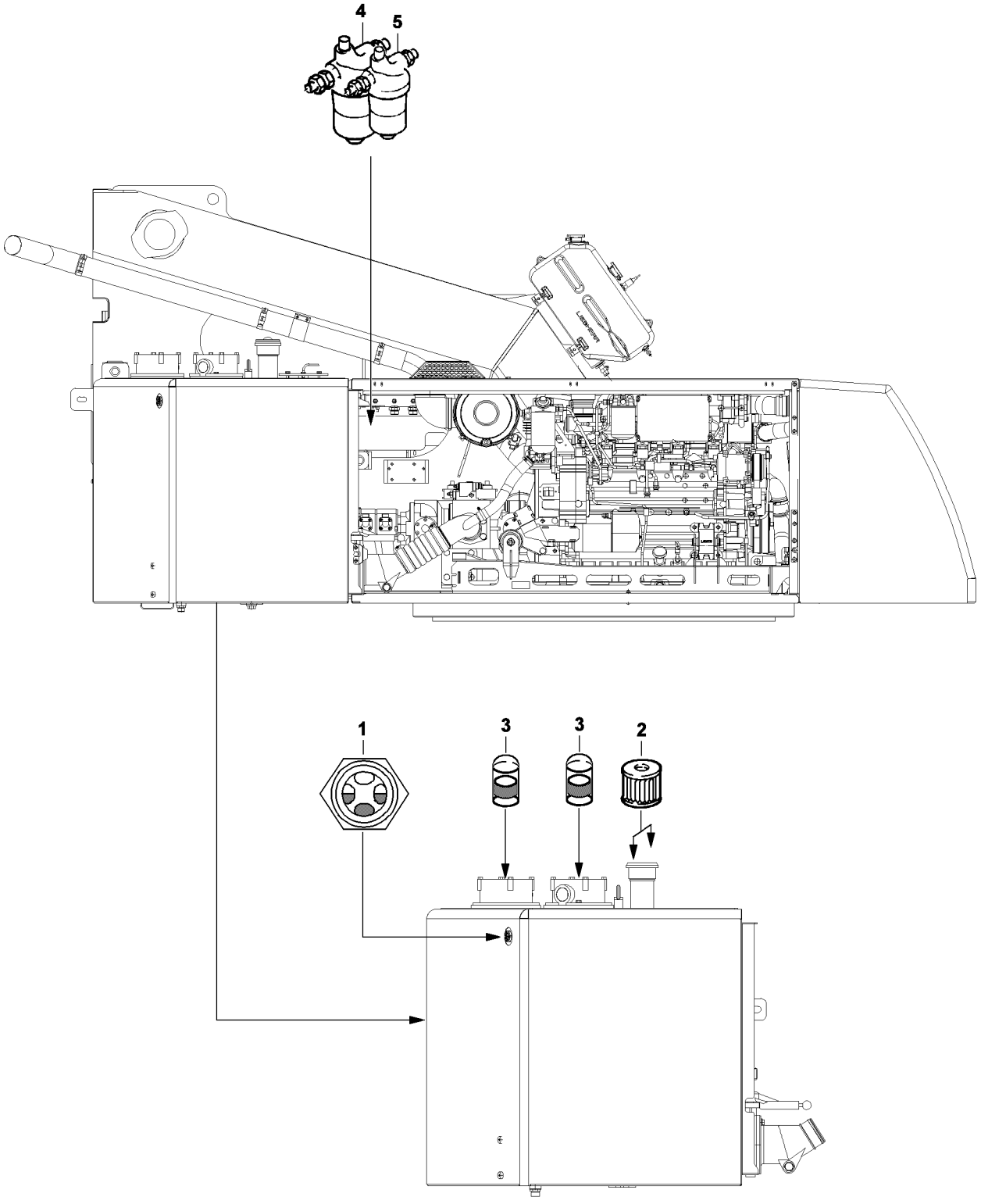
1.3 Air filter

The air filters are monitored by the LICCON computer system. If the vacuum increases in the intake line due to soiled filter units, the “Air filter soiled” **14** icon is displayed on the LICCON monitor.
▶ If the “Air filter soiled” **14** icon is displayed:
Clean or replace filter unit.

1.4 Diesel particle filter*

DANGER
Danger of fire from diesel particle filter*!
▶ The diesel particle filter* must only be regenerated under the supervision of the operator!

The operation and maintenance of the diesel particle filter* must be carried out in accordance with the separate operating manual from the diesel particle filter* manufacturer.



B199439

2 Hydraulic system

CAUTION
Damage to the hydraulic system!
If the hydraulic system is contaminated when working on the hydraulic system, then the hydraulic system can be damaged and fail.
- ▶ Always keep up most cleanliness when working on the hydraulic system!
- ▶ This applies especially for filter changes, refilling of hydraulic oil or changing of components!

2.1 Hydraulic tank

2.1.1 Checking the oil level

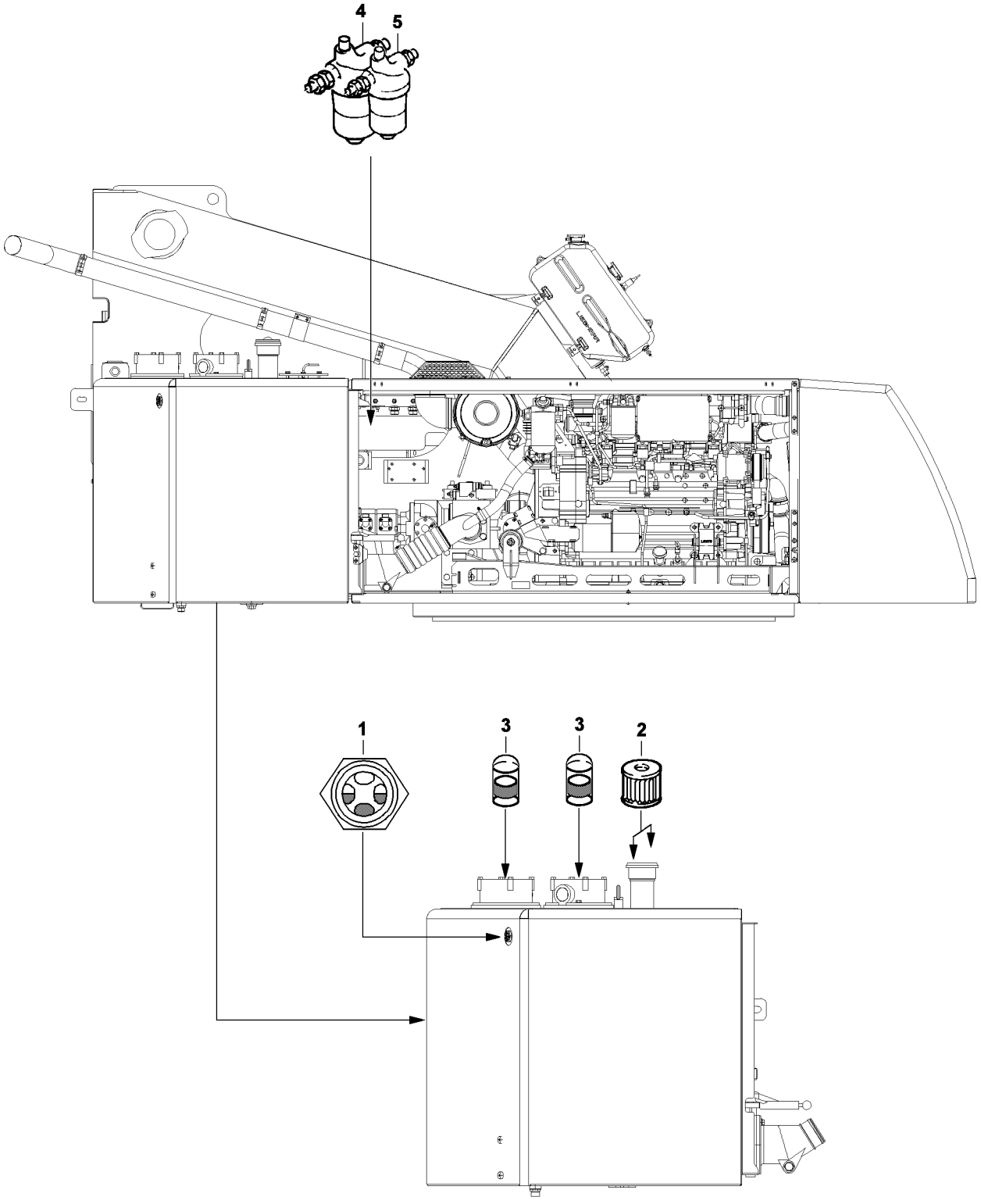
Ensure that the following prerequisites are met:
– the crane is horizontal
– the luffing cylinder and the telescoping cylinder are fully retracted

The oil level must be in the middle of the oil level inspection window **1**.
- ▶ Checking oil level in oil level inspection window **1** of hydraulic fluid reservoir.

Troubleshooting
No oil visible in the oil level inspection window **1**?
- ▶ Top up oil as shown in lubrication chart using a fine-meshed filter until oil level is in middle of oil level inspection window **1**.

2.1.2 Checking the aeration/vent filter

- ▶ Open screw-on cover.
- ▶ Check filter **2** for impurities (visual inspection).
- ▶ In the event of heavy soiling:
  Replace filters **2**.
- ▶ Close screw-on cover.
- ▶ Start engine.
- ▶ Perform all crane movements slowly.
- ▶ Check oil level again and add oil if necessary.



B199439

2.1.3 Return-line filter

The return-line filters **3** are equipped with a maintenance indicator. If the red bar mark is visible when the oil is warmed up and ready for operation, the filter unit must be replaced.

- ▶ Unscrew and remove both filter covers.
- ▶ Remove filter units.
- ▶ Rinse out filter cones.
- ▶ Clean sealing surfaces of covers and filter cones.
- ▶ Insert new filter units.
- ▶ Oil rubber sealing rings in covers.
- ▶ Put on both filter covers and screw tight.
- ▶ Start engine and check filters for leaks.
- ▶ Check oil level and add oil if necessary.

2.2 Pressure filters in crane hydraulics

The pressure filter **4** and pressure filter **5** are equipped with a maintenance indicator. If the red bar indicator is visible when the oil is warmed up and ready for operation, the filter cartridge must be replaced.

- ▶ Turn off the engine.
- ▶ Release filter cartridge and collect escaping oil in a suitable container.
- ▶ Unscrew, remove and dispose of filter cartridge.
- ▶ Clean the sealing surface on the filter bracket.
- ▶ Oil the rubber sealing ring on the new oil filter cartridge.
- ▶ Screw on and tighten new filter cartridge.
- ▶ Start engine and check for leaks.
- ▶ Perform all crane movements slowly.

Result:

– This deaerates the hydraulic system.

- ▶ Check oil level again and add oil if necessary.

2.3 Diaphragm reservoirs

Various diaphragm reservoirs have been installed in the hydraulic system. The pre-loading pressures are specified in the hydraulic circuit diagram and on the individual diaphragm reservoirs. The pre-loading pressure must be measured separately in each diaphragm reservoir.

CAUTION

Risk of damaging the hydraulic system!

If the outside temperature fluctuates considerably, e.g. after transportation to extremely hot or cold countries or in countries with considerable differences between the summer and winter temperatures, the gas reservoir pressures may change.

- ▶ Check gas reservoir pressures and correct if necessary.

Ensure that the following prerequisites are met:

– the crane engine is turned off
  This relieves the diaphragm reservoir at the fluid side.

DANGER
Danger of explosion!
The pressure in the nitrogen cylinder must be below than the maximum permitted operating pressure of the reservoir or the pressure gauge. Otherwise fit a pressure reducer between the cylinder and the filling device.
▶ Do not use air or oxygen to fill the diaphragm reservoir.

The pre-loading pressure in the hydraulic reservoirs must be always be checked by an expert with appropriate training and equipment. The national pressurized container regulations most also be complied with.
▶ Check pre-loading pressure using a testing and filling device and correct if necessary.

2.4 Hydraulic hoses

The hydraulic hoses must be checked in accordance with ISO 9927-1 by an **experienced technician** or **expert mechanic**, as required depending on the duration of use and the operating conditions, but at least once per annum.
Experienced technicians are persons who have adequate knowledge of cranes because of their professional background and experience and are adequately familiar with the relevant settings to detect deviations from the correct situation (i.e. specially trained personnel).
Expert mechanics are mechanics who have experience in the design, construction or maintenance of cranes and have adequate knowledge of the relevant settings and standards and the necessary equipment to perform an inspection, and are in a position to assess the safety standards of the crane and decide which action needs to be taken to ensure that the crane can continue to be operated safely.

Note
Note
▶ The applicable national regulations must also be complied with!

2.4.1 Checking the hydraulic hoses within area of responsibility of the German employer's liability insurance associations

At least once per annum, an **expert** must check whether the hydraulic hoses are in a safe condition. The crane must be inspected by an **authorized inspector** every four years from the day it was first licensed. After the 12th year of operation, the crane must be inspected annually by an authorized inspector.
The **expert** or **authorized inspector** must document in the crane inspection log the fact that the hydraulic hoses can continue to be used in the crane!
An expert is someone whose technical training and experience means that he has adequate knowledge in the field of hydraulic hoses and hose systems and is adequately familiar with the relevant national work safety regulations, accident prevention regulations, directives and generally accepted technical regulations (e.g. DIN standards, VDE regulations, technical regulations of other EU member states or other countries that have signed the European Economic Community agreement) that he is in a position to assess whether hydraulic hoses and hose systems are safe to work with.
An authorized inspector is someone employed by supervisory authorities. In Hamburg this is the Amt für Arbeitsschutz (work safety office) and in Hessen it is the technical supervisory offices or an authorized inspector employed by the professional associations.

2.4.2 Examples of possible faults in hose systems

DANGER
Risk of fire or accident!
If problems are discovered during checking they must be remedied immediately or suitable measures 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 (hose material cracking)
- Deformation that differs from the natural shape of the hose or hose system when depressurized or pressurized or when the hose is bent (e.g. layer separation, bubbling, crushing or kinking)
- Leaks
- Failure to follow installation instructions
- Damage or deformation of hose fittings that inhibit the operation and strength of the fitting or the hose / fitting connection
- Hose slipping out of fitting
- Fitting corrosion that inhibits operation and strength
- Storage time or usage period exceeded

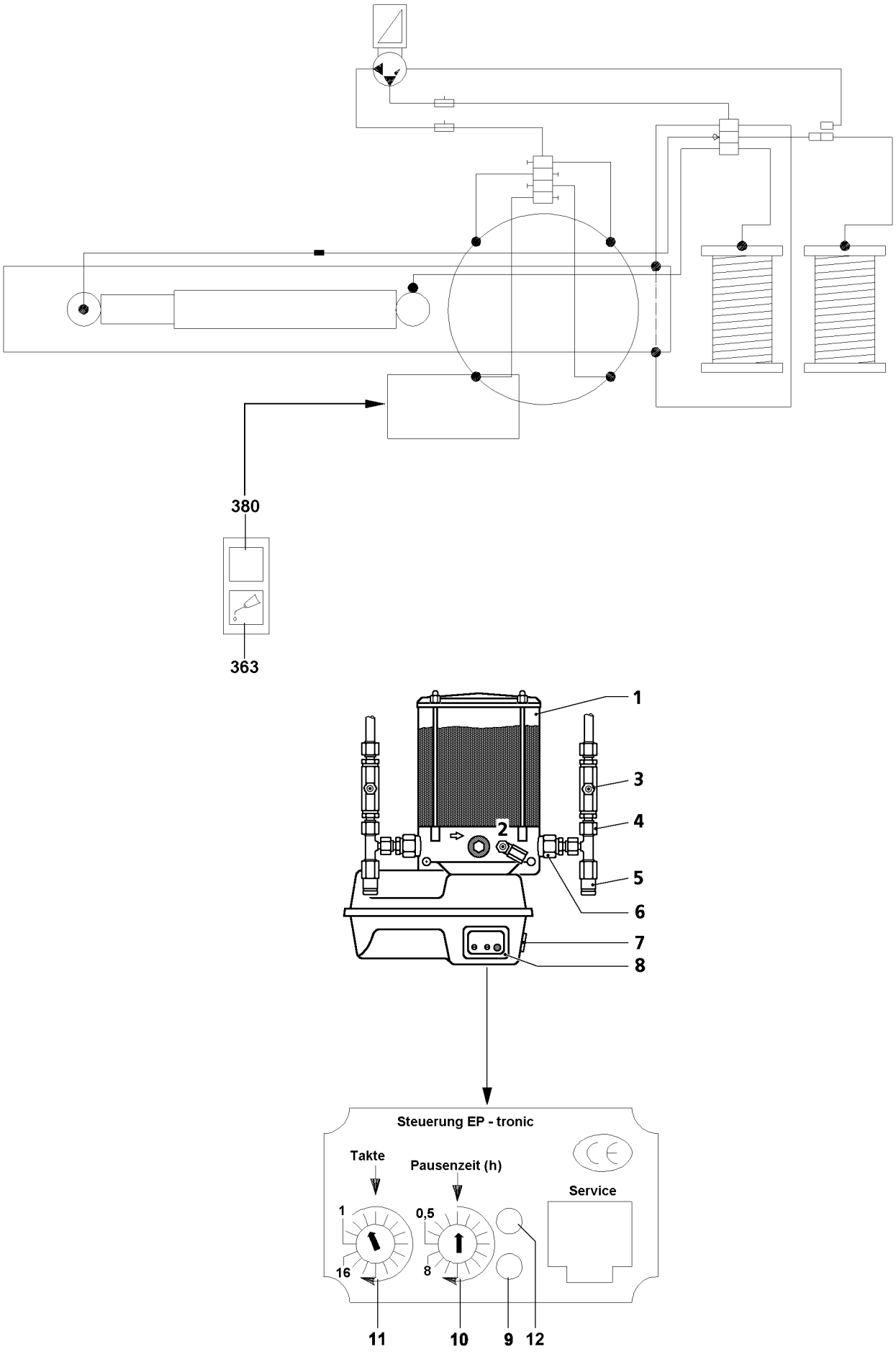
2.4.3 Hose system maintenance

- It is advisable to check all hoses, hose systems and screw-in connections daily, but at least every two weeks for leaks and external signs of damage.
- Damaged parts must be replaced immediately! Oil spray can lead to injuries and fires!
- Hydraulic lines and hoses must not be repaired!
- Hoses that have already been used in a hose system must not be re-installed in hose systems.
- Always use original LIEBHERR spare parts when replacing hoses and hose systems.
- Always ensure that the hoses are free of torsion when routing. If high-pressure hoses are being used, attach screw of clamps or full flange at both ends of 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.
- Only then must any fastening clamps in the middle of the hose be attached and tightened.
- Route the hoses such that chafing with other hoses or other structures is prevented. Maintain a minimum clearance of approximately ½ the outer diameter of the hose from other parts. The clearance must never be less than 10 to 15 mm.

2.4.4 Replacing the hose systems

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

This must be documented in the crane's inspection log by the **expert** or the **authorized inspector**.
The service life of a hose system may not exceed six years, including a storage period of a maximum of two years (observe 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.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10
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12

B102859

3 Central lubricating system

The crane superstructure is equipped with a central lubrication system. All lubricating points (refer to the guide on the left), the roller slewing ring, the bearing of the telescopic boom articulation piece, the bearings of the luffing cylinder and the hoisting winches are automatically supplied with the correct grease quantity.
If the crane has not been moved for more than 3 months, it must be greased at 3-monthly intervals using an external greasing pump until grease exits from all greasing points. Then the relevant crane movement must be repeated several times and the greasing procedure repeated.
– Cycle number: 4 cycles
– Turn signals: 2.5 h

Note
▶ Cleaning in cleaning plants or with a steam cleaner is permitted!

3.1 Components of the system

– Grease container **1**
– Grease fitting **2**: Filling the central lubricating pump
– Grease fitting **3**: Filling the lube lines
– Pump outlet **4**
– Pressure relief valve **5**
– Pump element **6**
– Pushbutton **7**
– Controls **8**
– LED **9** (green)
– Latched switch **10**: Interval time (h)
– Latched switch **11**: Cycles
– LED **12** (red)

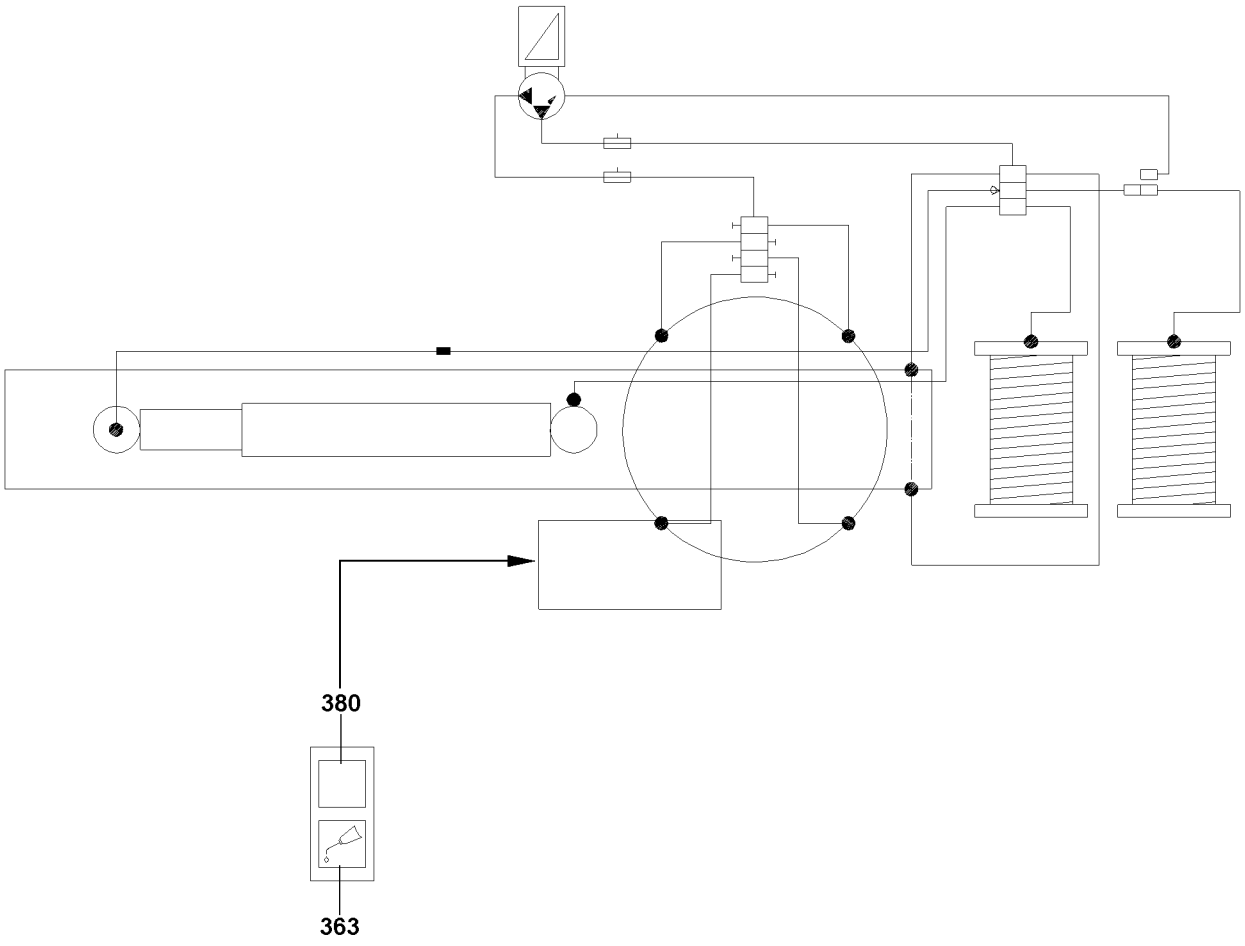
3.2 Adjusting the lubrication and interval timing

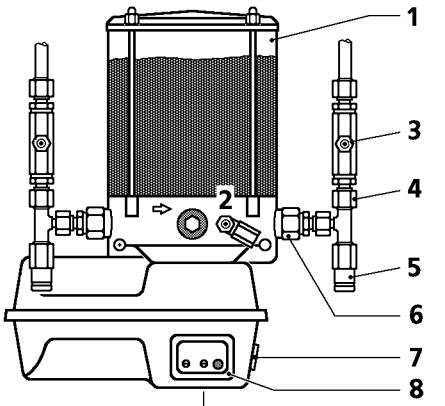
The LED **9** on the engine protection housing flashes in a 0.5 second cycle during the lubrication process. The lubrication and interval time is set at the factory. The times may possibly be changed by using the latched switch **10** and latched switch **11**.
▶ Turn on the engine ignition.

Result:
– When turning on the ignition, the LED **9** lights up for approximately 2 seconds and displays the operation readiness of the control unit **8**.

3.3 Function check

Trigger 2 to 3 additional lubricating pulses with the ignition turned on, in order to determine if lubricant escapes from all lubricating points.
The lubricant escapes through the relief valve **5** with the system blocked, but otherwise properly functioning electric pump. This serves to secure the system and to monitor the system.


380
363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2
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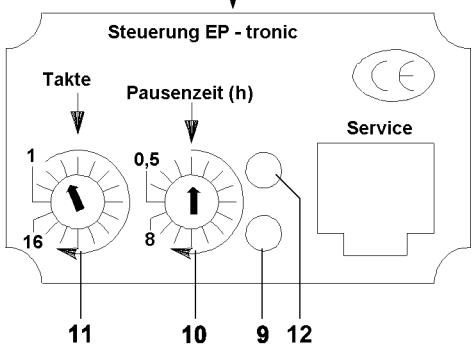

Steuerung EP - tronic
Takte
Pausenzeit (h)
Service
1
16
0,5
8
11
10
9
12

B102859

3.4 Cycle control

The central lubrication system is progressively monitored. This means that a proximity switch converts the piston strokes of the central lubricating system distributor into electrical control signals and relays them to the control unit. If the control signals are not present or incomplete the control light **363** displays a malfunction or a failure by flashing.

3.4.1 Flashing code - cycle control

During operation

– Ignition on, ready for operation:
  Control light **363** illuminates for 1.5 s and goes off.
  Warning light **380** illuminates for 1.5 s and goes off.
– Active lubrication:
  The control light **363** lights up for 0.5 s and is 0.5 s off and so on.
  The warning light **380** is not illuminated.

In case of fault

– Error monitoring time cycle input, lubrication time larger monitoring time cycle input
  The control light **363** lights up for 1 s and is 1 s off and so on.
  The warning light **380** lights up for 1 s and is 1 s off and so on.
– Error CPU, Error memory
  The control light **363** does not illuminate.
  Warning light **380** illuminates for 0.5 s and is off for 0.5 s etc.

3.5 Intervention in the automatic lubrication (intermediate lubrication)

Intermediate lubrication processes can be carried out after crane washing, or the grease lines are re-filled with grease after a repair.

▶ Push red button **7** on the engine protection housing of the pump while the ignition is on.

3.6 Filling the grease container

CAUTION
Risk of damage from inadequate lubrication!

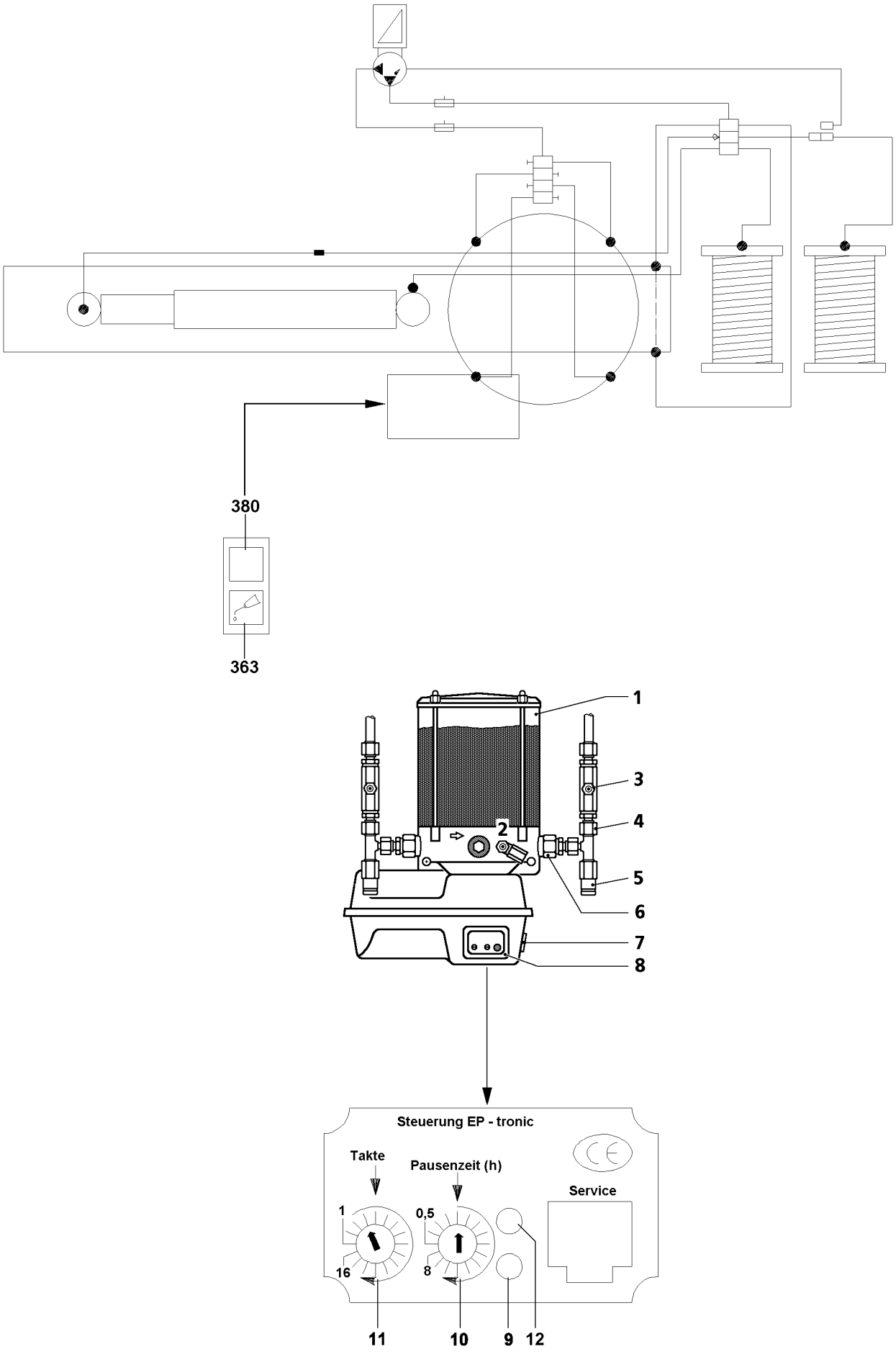
▶ There must be plenty of grease in the grease container **1** at all times.
▶ Pay attention to cleanliness when filling the grease container **1**!

▶ Fill the grease container **1** with a grease pump via the grease fitting **2** on the central lubrication pump.

3.7 Bleeding the system

If the grease container **1** has been emptied it may be necessary to bleed the system.

▶ Fill the grease container **1**.
▶ Unscrew main line from pump outlet **4**.
▶ Trigger the additional lubricating pulse until a bubble-free lubricant escapes at the pump outlet **4**.
▶ Connect main line again.
▶ Release additional lubricating process.


380
363
1
3
4
2
5
6
7
8
Steuerung EP - tronic
Takte
Pausenzeit (h)
Service
1
16
0,5
8
11
10
9
12

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3.8 Filling the lubricant lines

CAUTION
Risk of damage from inadequate lubrication!
The lubricant lines must be filled after making any repair to a greased components. If this is not observed, the component may run dry.

- ▶ Sufficient grease must be available in the grease lines after every repair on greased assembly units.
- ▶ Pay attention to cleanliness when filling the grease lines!

▶ Fill using an external grease pump via the lubricating nipple **3**.

or

- ■ Push red button **7** on the engine protection housing of the pump while the ignition is on.

3.9 Central lubricating system, troubleshooting

Problem	Cause	Remedy
Pump is not working	integrated electronic control defective, electrical line interrupted, pump defective	replace lower part of motor protection housing, replace electrical line, replace pump
Pump operates, but does not deliver	air cushion in delivery piston has dropped below minimum fill level, pump element defective	bleed pump, fill reservoir, replace pump element
No grease collar on all lube points	pump not operating, interval time too high or cycle time too short, system blocked	see “Pump not operating” , reduce interval time or increase number of cycles, refer to “Grease emerges on pressure relief valve”
No grease collar on several lube points	supply lines to secondary distributors broken or leaking, screw connections leaking	replace lines, tighten or replace screw connections
No grease collar on one lube point	associated lube line broken or leaking, screw connection leaking	replace line, tighten or replace screw connection
Pump speed reduced	higher system pressure, lower ambient temperature	check system / bearing points, no damage: try 1 or 2 intermediate greasing operations

Problem	Cause	Remedy
Grease emerges on pressure relief valve	system pressure too high, progressive distributor blocked, system blocked, defective valve spring	check system, replace distributor, repair blocked / seized bearing point, replace pressure relief valve
Red LED lights up in 0.5 second interval	Error CPU / memory	consult LIEBHERR or BekaMax customer service
Yellow LED and red warning light blink in 1 second interval	defect in the monitoring period from cycle start	proximity switch is defective, possibly consult Liebherr or BekaMax customer service

4 Slewing ring connection

4.1 Greasing the slewing ring

Perform lubrication with extreme care before and after long operating intervals, particularly before and after any winter break, in order to provide the best possible corrosion protection.
If the crane has not been moved for more than 3 months, it must be greased at 3-monthly intervals using an external greasing pump until grease exits from all greasing points. Then the relevant crane movement must be repeated several times and the greasing procedure repeated.

▶ Grease exterior of slewing ring

4.2 Tilting free play of roller slewing ring

The wear of the roller slewing ring connection is determined by measuring the “tilt play” with the ring installed.

Note

▶ The determination of the “tilt play” must be carried out according to the **test instructions** of **Liebherr-Werk Ehingen GmbH**.

▶ Contact the Service Dept. at **Liebherr-Werk Ehingen GmbH** for **test instructions**.

DANGER

Danger of accident if tilt play of roller slewing ring connection is too large!
If the permissible tilt play of 2.0 mm is exceeded, then safe crane operation is no longer possible.

▶ Replace the roller slewing ring connection if the tilt play is larger than 2.0 mm!

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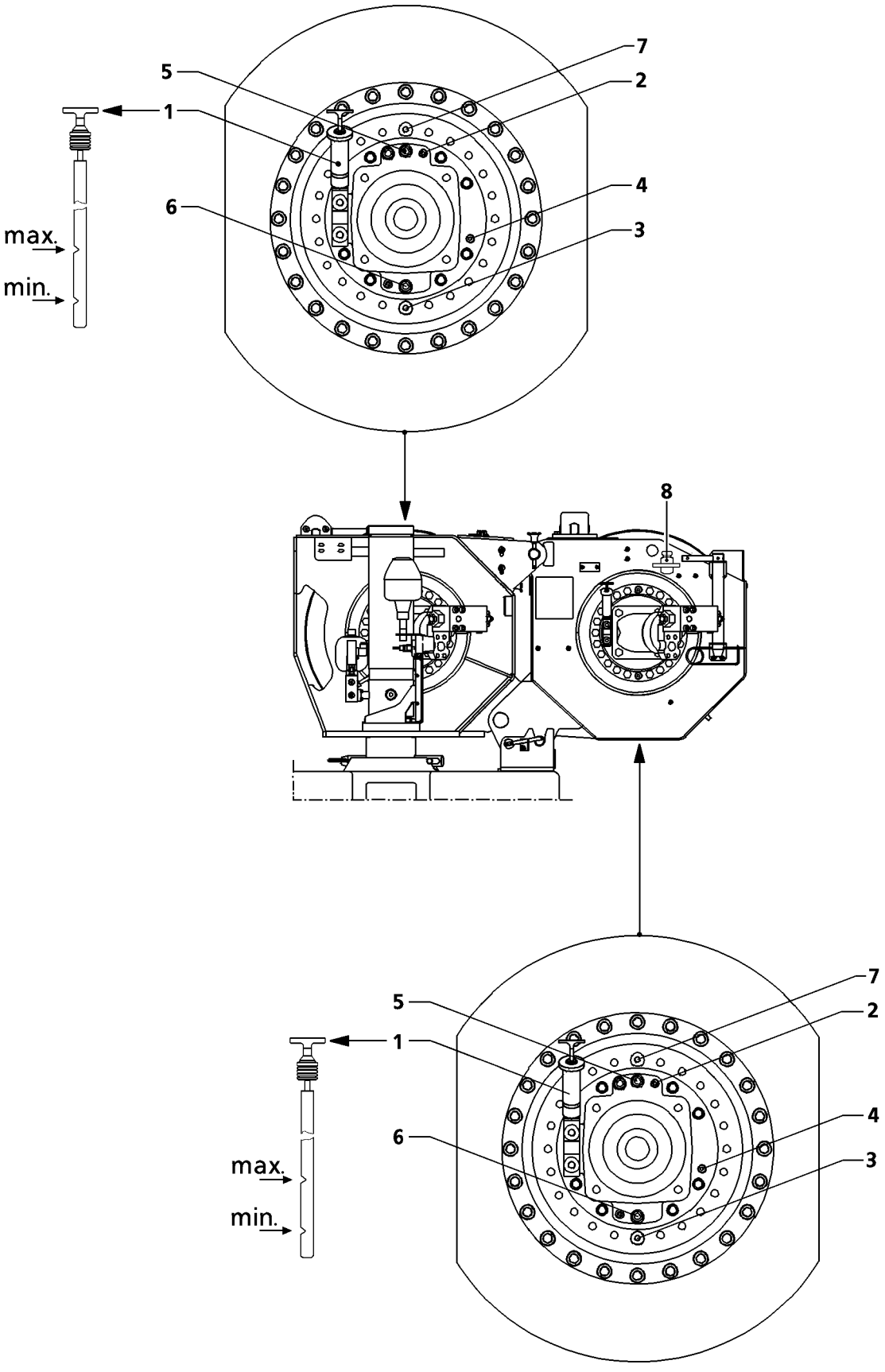

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5 Winches

Please maintain extreme cleanliness during all work to prevent dirt from entering the transmission system.

5.1 Winch 1 / winch 2

5.1.1 Overflow container 8

When the oil heats up in the hydraulic motor of winch 2, the oil can enter the overflow container **8** via a non-return valve, but cannot flow back into the hydraulic system after cooling. For this reason the oil that has collected in the overflow container **8** must be disposed of at regular intervals.

5.2 Hoist gear transmission

Ensure that the following prerequisites are met:
– the hoist gear is inactive
– the crane is horizontal

5.2.1 Checking the oil level

▶ Remove and wipe off oil dipstick **1**.
▶ Re-insert oil dipstick **1** and pull out again.

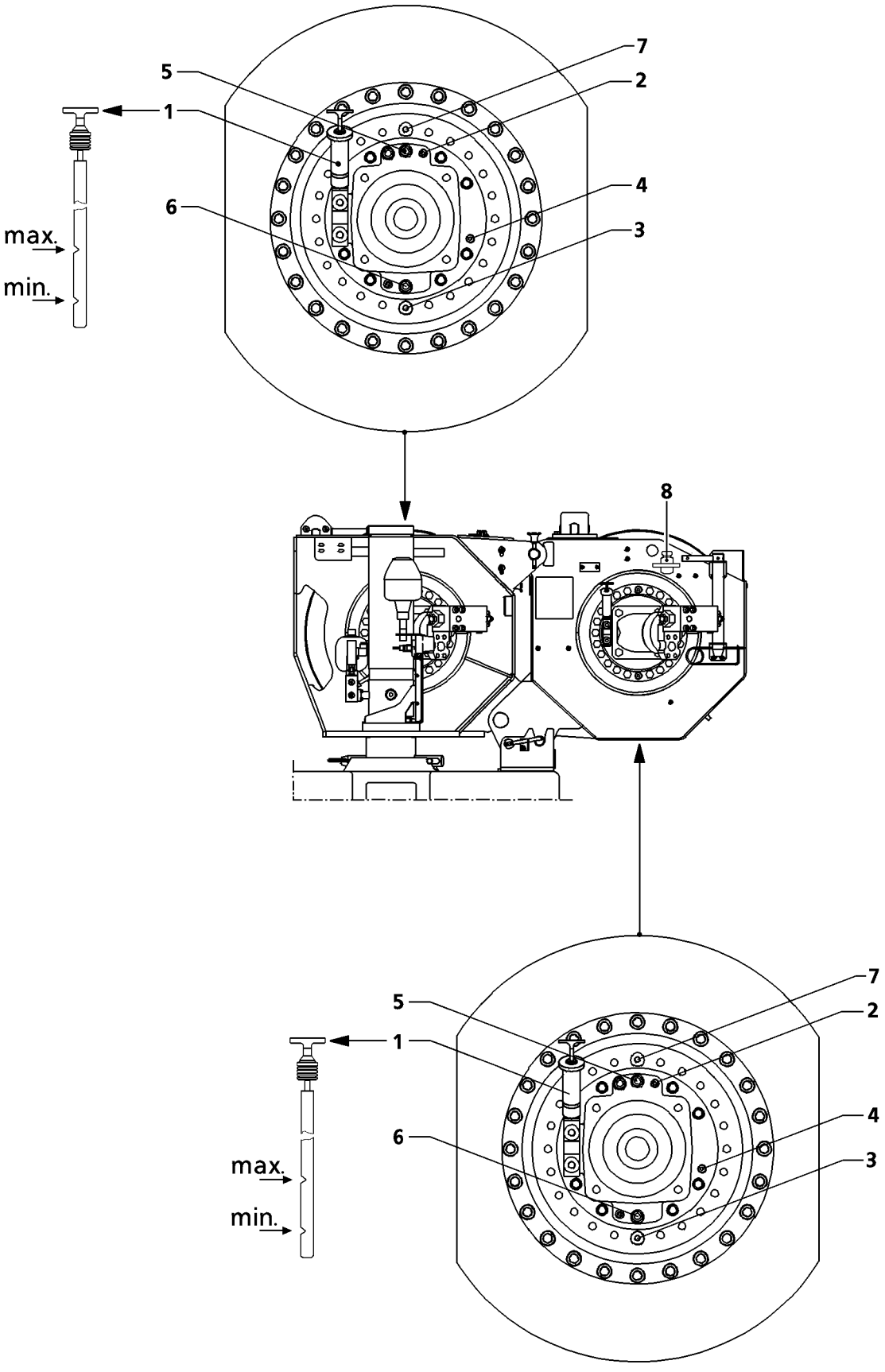
The oil level must be between the Min. and Max. marks on the oil dipstick **1**.
▶ Check oil level.

CAUTION
Danger of gear damage!
If the oil level has dropped below the Minimum mark, top up engine oil as shown in the lubrication chart until the oil level is between the Minimum and Maximum marks.
▶ Top up oil and check again.

▶ Re-insert oil dipstick **1**.

5.2.2 Changing the oil

▶ Unscrew the vent screw **2**.
▶ Unbolt oil drain plug **3** with sealing ring and drain oil into a suitable container.
▶ Screw in oil drain plug **3** with new sealing ring and tighten.
▶ Unbolt oil filler plug **7**.
▶ Replenish with oil at oil filler plug **7** in accordance with lubrication chart.
▶ Screw in and tighten the vent screw **2** and the oil filler plug **7**.
▶ Check oil level as described above.



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5.3 Hoist gear brake

Ensure that the following prerequisites are met:
– the hoist gear is inactive
– the crane is horizontal

5.3.1 Checking the oil level

▶ Unbolt the screw **4**.

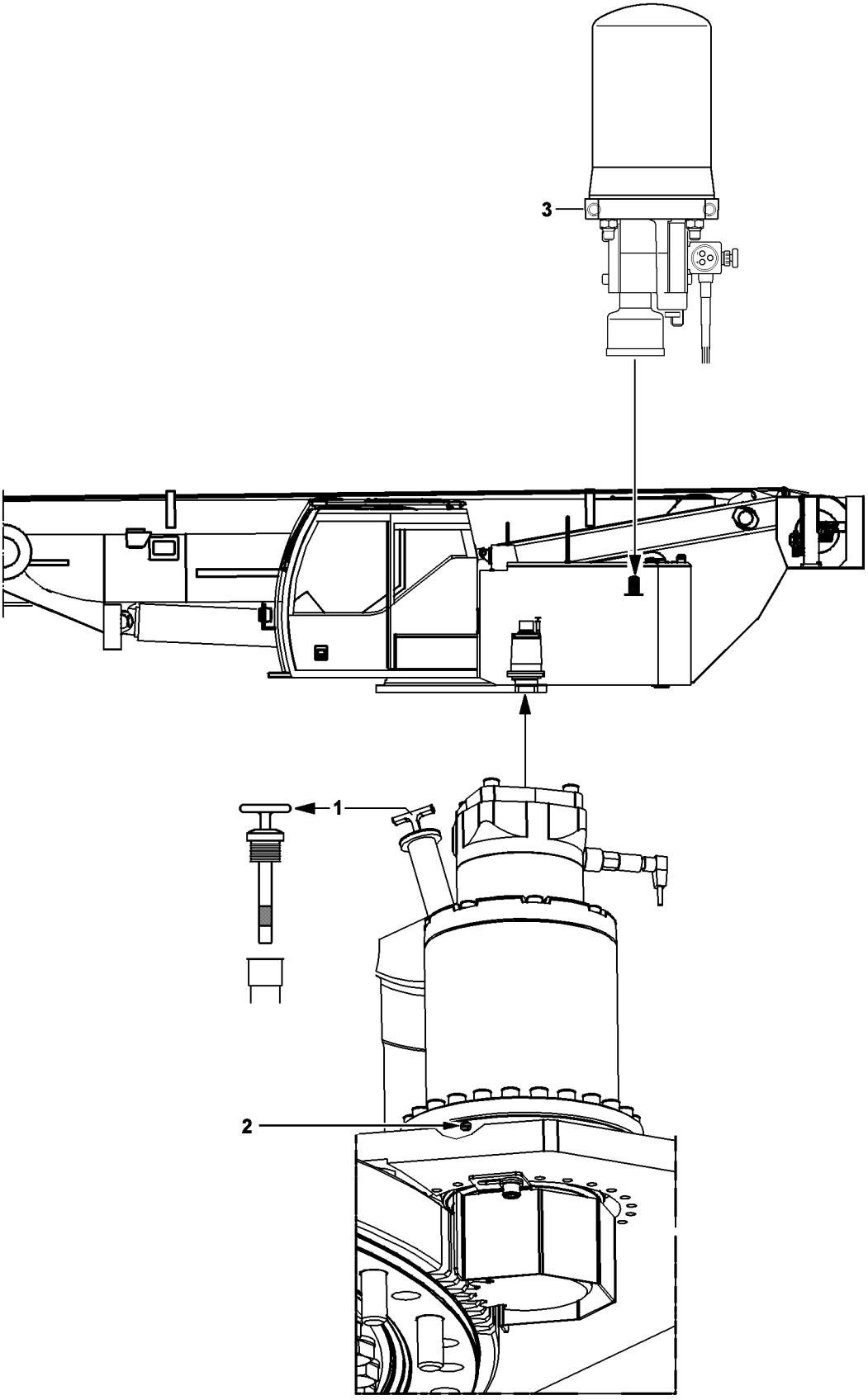
Oil level must be up to the edge of the hole.
▶ Perform visual inspection.

CAUTION
Danger of gear damage!
▶ If the oil level has dropped, top up with the oil specified in the lubrication chart up to the overflow of the filler plug.

▶ Clean sealing surfaces on the housing and on the plug.
▶ Screw in and tighten the screw **4** again.

5.3.2 Changing the oil

▶ Unbolt oil filler plug **5** and clean sealing surface.
▶ Unbolt oil drain plug **6** with sealing ring and drain oil into a suitable container.
▶ Clean oil drain plug **6** and sealing surface on the housing.
▶ Screw in oil drain plug **6** with new sealing ring and tighten.
▶ Top up with oil at the oil filler opening as shown in the lubrication chart, until the oil begins to overflow at the opening **4**.
▶ Clean oil filler plug **5** and screw in again using the new sealing ring and tighten.
▶ Check oil level as described above.



B198737

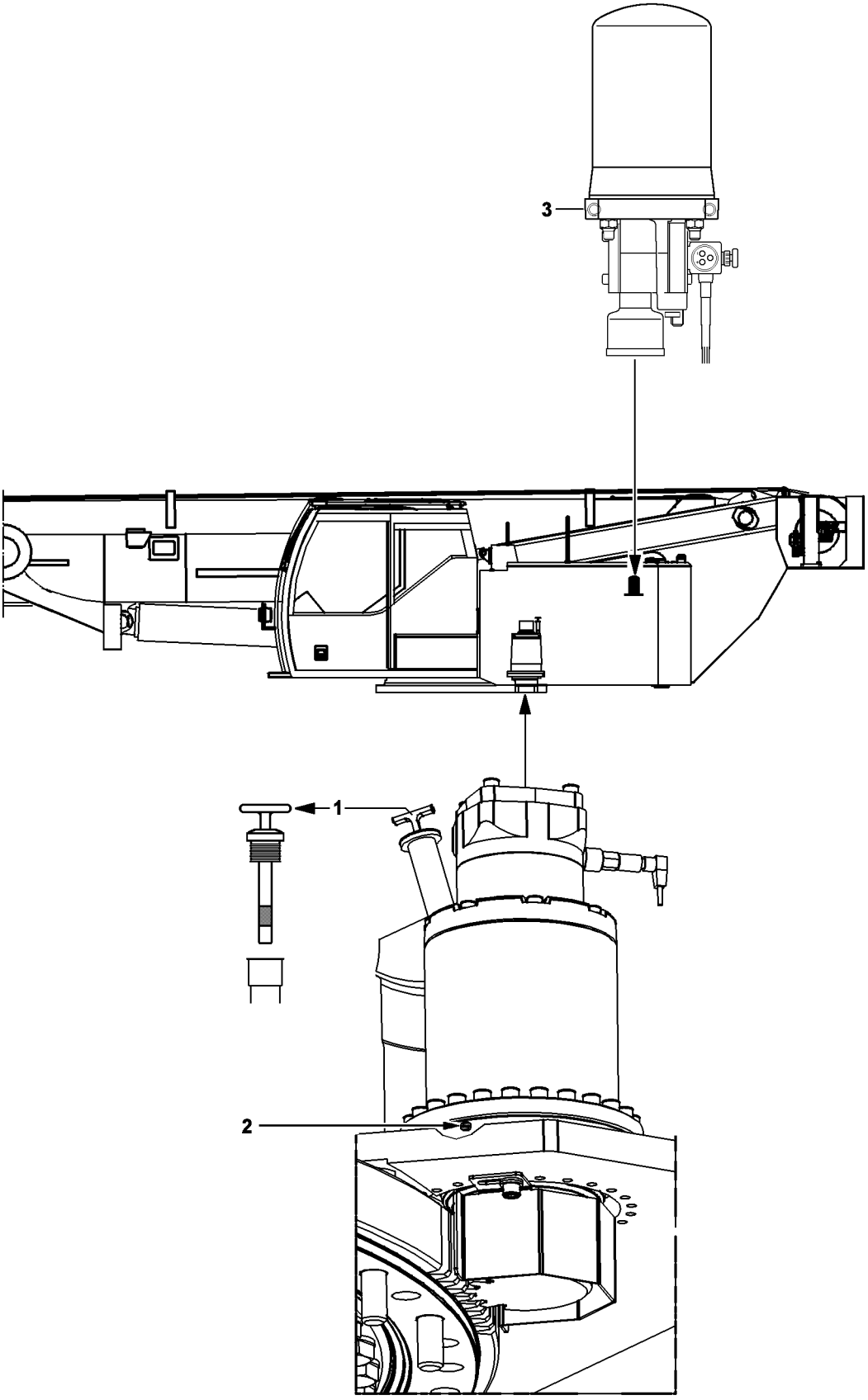
6 Air drier of the compressed air system of the crane's superstructure

The air drier **3** of the compressed air system of the crane's superstructure is maintenance-free.

6.1 Replacing the granular cartridge

CAUTION
Danger!
The granular cartridge is under spring tension.
▶ Caution when replacing the granular cartridge.

▶ Replace granular cartridge once per year.



B198737

7 Slewing gear transmission

Please maintain extreme cleanliness during all work to prevent dirt from entering the transmission system.

7.1 Checking the oil level

Ensure that the following prerequisites are met:
– the crane is horizontal

▶ Remove and wipe off oil dipstick **1**.
▶ Re-insert oil dipstick **1** and pull out again.

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

CAUTION
Danger of gear damage!
If the oil level has dropped below the lower notch, top up oil as shown in the lubrication chart until the oil level is between the two notches.
▶ Top up oil and check again.

▶ Re-insert oil dipstick **1**.

7.2 Changing the oil

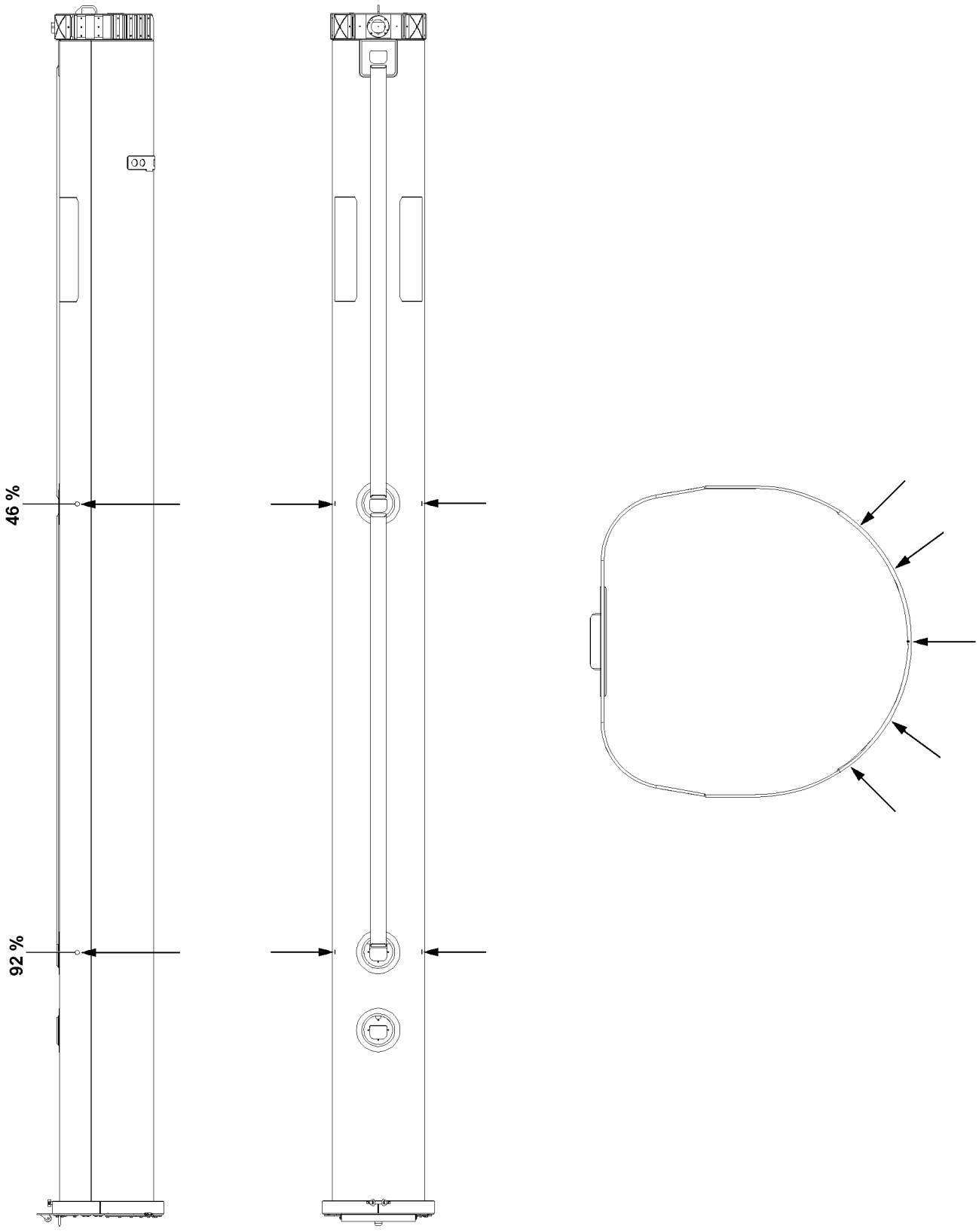
Ensure that the following prerequisites are met:
– the crane is horizontal
– the transmission has warmed up

▶ Open oil filler opening by unscrewing the oil dipstick **1**.
▶ Unscrew oil drain plug **2** with the sealing ring and drain oil.
▶ Clean oil drain plug **2** and sealing surface on the housing.
▶ Screw in oil drain plug **2** with new sealing ring and tighten.
▶ Pour in oil as shown in the lubrication chart at the oil filler opening until the oil level is between the two notches on the oil dipstick **1**.
▶ Close oil filler opening by screwing in the oil dipstick **1**.
▶ Check oil level as described above.

8 Electrical system - lighting

Maintain electrical system and lighting in crane superstructure in accordance with the maintenance information in chapter 7.04.

CAUTION
Loss of the settings if the power supply has been interrupted!
▶ The winch and the slewing gear must be re-calibrated after the power supply has been interrupted from the central unit or the power unit in the crane superstructure (for example, clamping off the battery).



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9 Telescopic boom

9.1 Greasing the telescopic boom

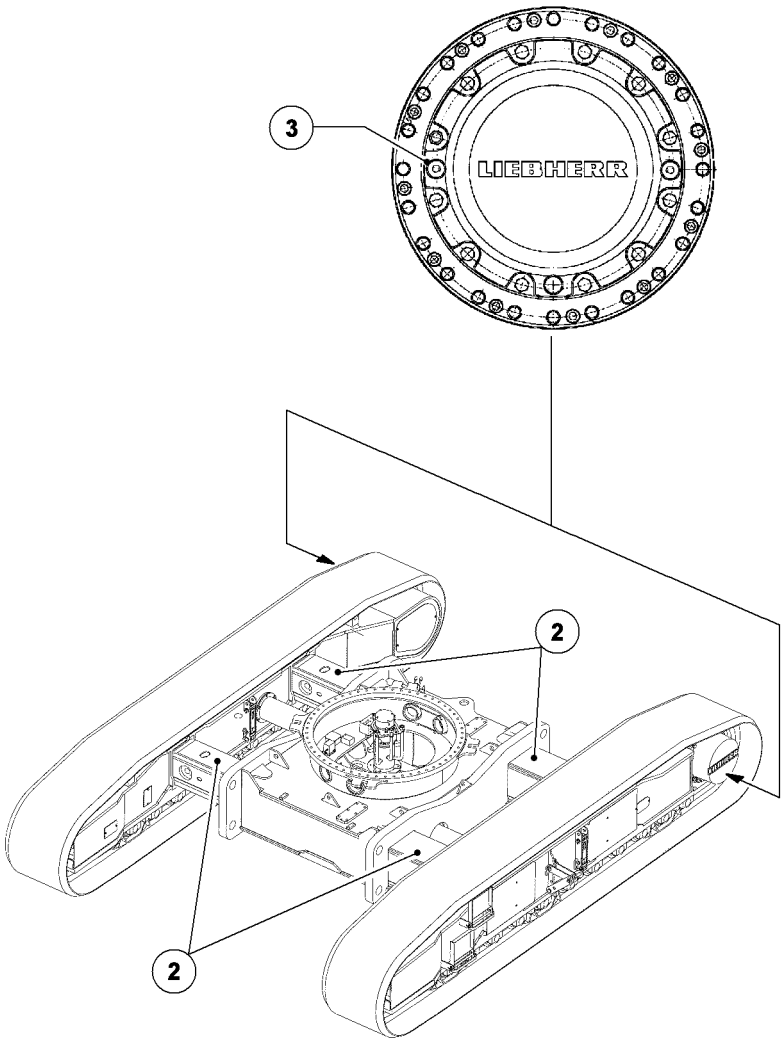
Ensure that the following prerequisites are met:
- The crane is properly supported and level.
- The counterweight has been attached to the turntable in accordance with the load chart.
- The LICCON overload protection has been adjusted as per the information in the load chart.

The inner sliding surfaces of the telescopic sections (plastic sliding bearing plates) are lubricated using lubricating nipples in the bearing shoes.
These lubricating nipples can be accessed from the outside via inspection openings at both sides of the articulated piece and the telescopic sections.

- ▶ Telescope out telescopic section 5 to 92 % and pin in position.
- ▶ Unpin telescopic cylinder, retract into telescopic section 4 and pin to telescopic section 4.
- ▶ Telescope out telescopic section 4 until the lubricating nipples of telescopic section 5 become visible in the inspection openings at 92 %.
- ▶ Lubricate telescopic section 5 at the inspection openings.
- ▶ Retract telescopic section 4 to 0 % and pin telescopic cylinder in position.
- ▶ Telescope out telescopic cylinder and pin to telescopic section 5.
- ▶ Telescope in telescopic section 5 to 46 % and pin in position.
- ▶ Unpin telescopic cylinder and retract into telescopic section 4.
- ▶ Pin telescopic cylinder with telescopic section 4.
- ▶ Telescope out telescopic section 4 until the lubricating nipples of telescopic section 5 become visible in the inspection openings at 46 %.
- ▶ Lubricate telescopic section 5 at the inspection openings.
- ▶ Telescope in telescopic sections 4 and 5 to 0 %.
- ▶ Lubricate telescopic sections 4, 3 and 2 in the same way as telescopic section 5.
- ▶ Pin telescopic cylinder into telescopic section 1.
- ▶ Telescope out telescopic section 1 to 46 %, pin and lubricate.
- ▶ Telescope out telescopic section 1 to 92 %, pin and lubricate.

Use the special grease that is specified in the lubrication chart to grease the inner and outer sliding surfaces of the telescopic sections.
After spraying on the special grease, allow to harden for 4 to 8 hours.

- ▶ Spray special grease onto the outer sliding surfaces of the telescopic sections.



B198732

1 Crane chassis

Lubrication chart legend:

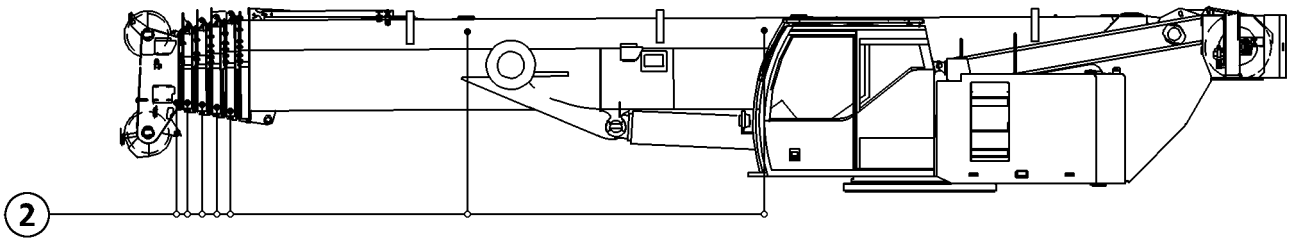
2 Lubricating grease
3 Gear oil

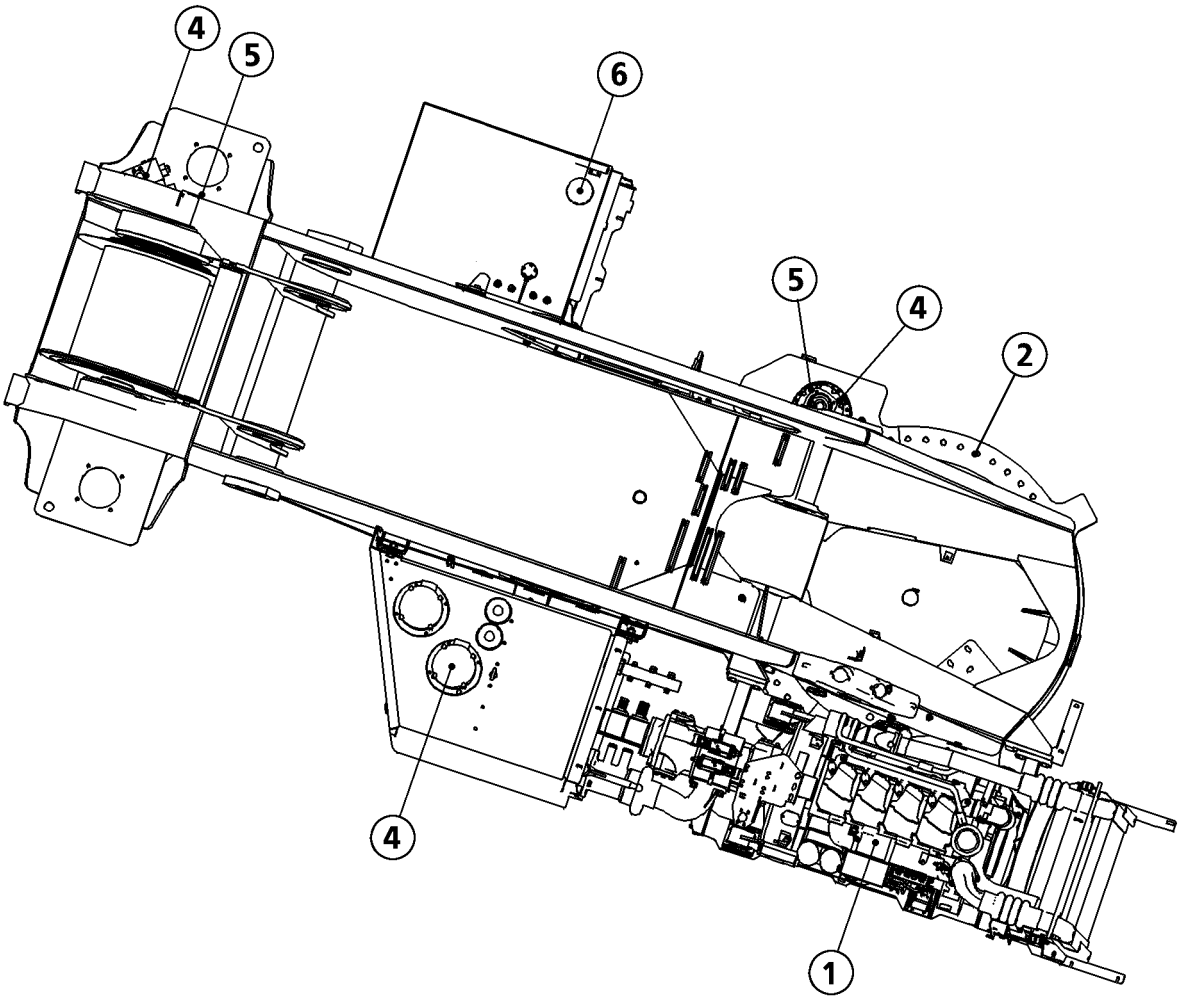
Fill chart
The specified filling quantities are orientation values. The markings on the dipsticks, inspection openings and viewing glasses are decisive for filling.

CAUTION
Danger of damage!
▶ Do not mix synthetic oils with mineral oils.

Assembly	Medium	Dosage
Travel gear	Gear oil	12.0 l
Beams (travel track adjustment)[1]	Lubricating grease	as necessary

[1] Before conversion from wide track to reduced or retracted track, the beams must be thoroughly cleaned, followed by **careful** lubrication with grease of the sliding surfaces.





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2 Crane superstructure

Lubrication chart legend:

1 Engine oil
2 Lubricating grease
3 Gear oil
4 ATF
5 Synthetic gear oil
6 Diesel fuel

Fill chart
The specified filling quantities are orientation values. The markings on the dipsticks, inspection openings and viewing glasses are decisive for filling.

CAUTION
Danger of damage!
▶ Do not mix synthetic oils with mineral oils.

Assembly	Medium	Dosage
Crane engine	Engine oil	25.0 l
Crane engine	Coolant	35.0 l
Fuel tank	Diesel fuel	727.0 l
Winch 1	Synthetic gear oil	5.0 l
Winch brake, winch 1	ATF	0.2 l
Winch 2	Synthetic gear oil	5.0 l
Winch brake, winch 2	ATF	0.2 l
Slewing gear transmission	Synthetic gear oil	3.7 l
Slewing gear brake	ATF	0.2 l
Hydraulic fluid reservoir of the crane hydraulic system [1]	ATF	653.0 l
Central lubricating system	Special grease	2.0 kg
Friction bearing of boom	Special oil spray	3.0 kg
Slewing ring	Adhesive grease	0.5 kg

[1] When the oil level is checked, all hydraulic cylinders must be retracted. The oil level must be in the middle of the inspection glass.

B195219

1 Service fluids and lubricants required for LIEBHERR cranes

1.1 List of service fluids and lubricants

Note

- To improve the cold start ability of the Diesel engine at an ambient temperature below -10 °C, we recommend the use of the following engine oil:
- Viscosity grade SAE 5W-30 according to specification ACEA E4.
- **LWE Id. No.: 10425711**!

	Usage	**Ambient temperature for driving and crane operation**	
		-25 °C to +50 °C	**-40 °C to +30 °C**
1	Diesel engine	**LWE Id. No.: 8612240** SAE 10W-40 API CG-4 ACEA E4-96, E4-96 **below -20 °C** with pre-heating	**LWE Id. No.: 8612240** SAE 10W-40 API CG-4 ACEA E4-96, E4-96 **below -20 °C** with pre-heating
2	Drive axle with differential locks, planetary gear and attached transfer gearbox	**LWE Id. No.: 861901008** SAE 90 API GL 5 ZF TE-ML 05	**LWE Id. No.: 10425142** SAE 75W-90 API GL 5 ZF TE-ML 05
3	Axle drive ZF DK-7	**LWE Id. No.: 861901008** SAE 90 API GL 5 ZF TE-ML 05	**LWE Id. No.: 10425142** SAE 75W-90 API GL 5 ZF TE-ML 05
4	Vehicle transfer gearbox KESSLER VG 1800 / 2400 /2550 / 2600 / 3750 W 3750 ZF Passau, STEYR PUCH VG 1200 / 1600 / 2000 / 3800	**LWE Id. No.: 861901008** SAE 90 API GL 5 ZF TE-ML 19	**LWE Id. No.: 10425142** SAE 75W-90 API GL 5 ZF TE-ML 19
5	Drop box ZF Passau, STEYR PUCH	**LWE Id. No.: 861901008** SAE 90 API GL 5 ZF TE-ML 19	**LWE Id. No.: 10425142** SAE 75W-90 API GL 5 ZF TE-ML 19
6.1	Pump distributor gear	**LWE Id. No.: 861901008** SAE 90 API GL 5	**LWE Id. No.: 10425142** SAE 75W-90 API GL 5
6.2	Pump distributor gear	**LWE Id. No.: 10425142**	**LWE Id. No.: 10425142**

	Usage	Ambient temperature for driving and crane operation	
		-25 °C to +50 °C	**-40 °C to +30 °C**
	LTC cranes	SAE 75W-90 API GL 5	SAE 75W-90 API GL 5
7.1	Load transmission ZF torque converter WG 120, WG 150 WG 180, WG 181, WG 200, WG 201	**LWE Id. No.: 8612240** SAE 10W-40 API CG-4 ACEA E2-96, E3-96, E4-96 ZF TE-ML 03 **below -20 °C** run warm as described in the operating instructions	**LWE Id. No.: 861900608** ATF II D ALLISON C4 ZF TE-ML 03 **below -20 °C** run warm as described in the operating instructions
7.2	Load transmission ZF torque converter WG 251* ZF ERGOPOWER WG 210, WG 260, WG 310 * also for ambient temperatures above -10 °C	**LWE Id. No.: 861900608** ATF II D ZF TE-ML 03 **below -20 °C** run warm as described in the operating instructions	**LWE Id. No.: 861900608** ATF II D ZF TE-ML 03 **below -20 °C** run warm as described in the operating instructions
8	Load transmission CLARK	**LWE Id. No.: 8612240** SAE 10W-40 API CG-4 ACEA E2-96, E3-96, E4-96 ZF TE-ML 03 **below -20 °C** run warm as described in the operating instructions	**LWE Id. No.: 861900608** ATF II D ALLISON C4 ZF TE-ML 03 **below -20 °C** run warm as described in the operating instructions
9	Drop box ALLISON	**LWE Id. No.: 8612240** SAE 10W-40 API CG-4 ACEA E2-96, E3-96, E4-96 ZF TE-ML 03 **below -20 °C** run warm as described in the operating instructions	**LWE Id. No.: 861900608** ATF II D ALLISON C4 ZF TE-ML 03 **below -20 °C** run warm as described in the operating instructions
10.1	Automatic transmission ALLISON	ATF Dexron III ALLISON C4	**LWE Id. No.: 861903708** CASTROL Transynd

	Usage	Ambient temperature for driving and crane operation	
		-25 °C to +50 °C	**-40 °C to +30 °C**
	CLBT 740, CLBT 750, CLBT 754, CLBT 755, HT 755, HD 4560	**below -20 °C** run warm as described in the operating instructions	**below -20 °C** run warm as described in the operating instructions
10.2	Automatic transmission ZF	**LWE Id. No.: 861900608** ATF II D ZF TE-ML 03 **below -20 °C** run warm as described in the operating instructions	**LWE Id. No.: 861900608** ATF II D ZF TE-ML 03 **below -20 °C** run warm as described in the operating instructions
11	Automatic transmission ZF AS-Tronic ZF TC-Tronic ZF TC-Tronic HD	**LWE Id. No.: 10218305** ZF-Ecofluid M ZF TE-ML 02	**LWE Id. No.: 10218305** ZF-Ecofluid M ZF TE-ML 02 **below -20 °C** pre-heat gearbox as described in the operating instructions
12.1	Torque converter transmission ZF TC HD	**LWE Id. No.: 10218305** ZF-Ecofluid M ZF TE-ML 02	**LWE Id. No.: 10218305** ZF-Ecofluid M ZF TE-ML 02 **below -20 °C** pre-heat gearbox as described in the operating instructions
12.2	Torque converter transmission ZF TC 2	**LWE Id. No.: 861900608** ATF II D ZF TE-ML 14	**LWE Id. No.: 861900608** ATF II D ZF TE-ML 14
13	Shift transmission ZF ECO-Split	**LWE Id. No.: 861004208** Engine oil or gear oil ZF TE-ML 02	**LWE Id. No.: 10425142** SAE 75W-90 ZF TE-ML 02
14	Rope winch	**LWE Id. No.: 861901208** ISO VSG 220 PGLP 220, DIN 51 502 do not mix with mineral oils!	**LWE Id. No.: 861901208** ISO VSG 220 PGLP 220, DIN 51 502 do not mix with mineral oils!
15	Slewing gear	**LWE Id. No.: 861901208** ISO VSG 220 PGLP 220, DIN 51 502 do not mix with mineral oils!	**LWE Id. No.: 861901208** ISO VSG 220 PGLP 220, DIN 51 502 do not mix with mineral oils!
16	Winch Telescopic boom guying	**LWE Id. No.: 861901208** ISO VSG 220	**LWE Id. No.: 861901208** ISO VSG 220

	Usage	Ambient temperature for driving and crane operation	
		-25 °C to +50 °C	**-40 °C to +30 °C**
		PGLP 220, DIN 51 502 do not mix with mineral oils!	PGLP 220, DIN 51 502 do not mix with mineral oils!
17.1	Crane hydraulics Crane chassis and crane superstructure	**LWE Id. No.: 861900608** ATF II D	**LWE Id. No.: 10038346** AVILUB Artic 32
17.2	Crane hydraulics LTC cranes	**LWE Id. No.: 10293807** Liebherr Hydraulic Plus Arctic	**LWE Id. No.: 10293807** Liebherr Hydraulic Plus Arctic
18	Brake system if hydraulically actuated	**LWE Id. No.: 861000108** DOT 4 SAE J 1703e	**LWE Id. No.: 861000108** DOT 4 SAE J 1703e
19	Clutch actuator	**LWE Id. No.: 861000108** DOT 4 SAE J 1703e	**LWE Id. No.: 861000108** DOT 4 SAE J 1703e
20	King pin bearing Gear shaft if not maintenance-free	Special regulations: LIEBHERR **LWE Id. No.: 861301308** Special grease 9610 PLUS	Special regulations: LIEBHERR **LWE Id. No.: 861301308** Special grease 9610 PLUS
21	Slide and roller bearing roller bearing joint	Special regulations: LIEBHERR **LWE Id. No.: 861301308** Special grease 9610 PLUS	Special regulations: LIEBHERR **LWE Id. No.: 861301308** Special grease 9610 PLUS
22	Central lubrication system Crane superstructure	Special regulations: LIEBHERR **LWE Id. No.: 861301308** Special grease 9610 PLUS	Special regulations: LIEBHERR **LWE Id. No.: 861301308** Special grease 9610 PLUS
23	Boom lock	Special regulations: LIEBHERR **LWE Id. No.: 861301308** Special grease 9610 PLUS	Special regulations: LIEBHERR **LWE Id. No.: 861301308** Special grease 9610 PLUS
24	Rotary connection Roller bearing	Special regulations: LIEBHERR **LWE Id. No.: 861301308** Special grease 9610 PLUS	Special regulations: LIEBHERR **LWE Id. No.: 861301308** Special grease 9610 PLUS
25	Support pad with equalization	Special regulations: LIEBHERR **LWE Id. No.: 861303608** Special grease 9613 Plus	Special regulations: LIEBHERR **LWE Id. No.: 861303608** Special grease 9613 Plus

	Usage	Ambient temperature for driving and crane operation	
		-25 °C to +50 °C	-40 °C to +30 °C
26	Plastic slide bearing Sliding beam	Special regulations: LIEBHERR **LWE Id. No.: 861303608** Special grease 9613 Plus	Special regulations: LIEBHERR **LWE Id. No.: 861303608** Special grease 9613 Plus
27	Plastic slide bearing Telescopic boom	Special regulations: LIEBHERR **LWE Id. No.: 861303608** Special grease 9613 Plus	Special regulations: LIEBHERR **LWE Id. No.: 861303608** Special grease 9613 Plus
28	Outer slide bearing Telescopic boom Guide rail on telescoping cylinder	Special regulations: LIEBHERR **LWE Id. No.: 861303308** Special grease 1336 with solvent LM (spray grease)	Special regulations: LIEBHERR **LWE Id. No.: 861303308** Special grease 1336 with solvent LM (spray grease)
29	Inner slide bearing Telescopic boom (only during assembly)	Special regulations: LIEBHERR **LWE Id. No.: 861303308** Special grease 1336 with solvent LM (spray grease)	Special regulations: LIEBHERR **LWE Id. No.: 861303308** Special grease 1336 with solvent LM (spray grease)
30	Gear ring rotary connection Slewing gear pinion	**LWE Id. No.: 861301508** Adhesive grease OGPF 2 S-30, DIN 51 502 (water-resistant)	**LWE Id. No.: 861301508** Adhesive grease OGPF 2 S-30, DIN 51 502 (water-resistant)
31	Running rope	**LWE Id. No.: 861301508** Adhesive grease OGPF 2 S-30, DIN 51 502 (water-resistant)	**LWE Id. No.: 861301508** Adhesive grease OGPF 2 S-30, DIN 51 502 (water-resistant)
32	Radiator fluid Diesel engine and heating system	**LWE Id. No.: 861600508** Radiator protection fluid LIEBHERR-standard 50 % anti-corrosion fluid / antifreeze 50 % water	**LWE Id. No.: 861600508** Radiator protection fluid LIEBHERR-standard 50 % anti-corrosion fluid / antifreeze 50 % water
33.1	Drive transmission crawler crane	see nameplate	see nameplate
33.2	Drive transmission crawler crane LTR 1100	**LWE Id. No.: 861901008** SAE 90 API GL 5	**LWE Id. No.: 10425142** SAE 75W-90 API GL 5
34	Towing winch	see nameplate	see nameplate

	Usage	Ambient temperature for driving and crane operation	
		-25 °C to +50 °C	**-40 °C to +30 °C**
35	Towing winch rope	Special regulations: **LWE Id. No.: 861008608** Motorex TW-Fluid	Special regulations: **LWE Id. No.: 861008608** Motorex TW-Fluid

8.00 Inspections of cranes

B195219

1 General

This crane was tested at the manufacturer's facilities prior to shipment in accordance with the latest ISO, FEM and DIN Standards and BGV D6 (BGG 905).
The safety level achieved during initial commissioning may not be attainable during operation.
Examples of the root cause of such deviations include; e.g., wear and tear, corrosion, effects of external forces, changes in the environment and changes to the mode of operation.
The operator is responsible for taking the necessary steps to ensure that the maximum level of safety is maintained.
The crane operator is therefore obligated to have the crane inspected by an **expert**, at intervals depending on the operational conditions but at least once per year, from the first day of vehicle registration.
The crane must be inspected by an **authorized inspector** every four years after it has been licensed.
The crane must be annually inspected by an **authorized inspector** after its twelfth year of operation.
To ensure the high safety standard of the crane, we recommend - no later than the 12th year, in the 20th year, in the 26th year and then every 4 years - to have the crane undergo a general inspection by an **authorized inspector**. At that time, in addition to the usual scope of inspection, all load carrying parts of the crane - the complete steel structure with all welding seams as well as all components and connecting devices - are to be subjected to a complete inspection. The following procedural notes for repeat inspections are to be observed for that.

WARNING
There is a risk of weakening the supporting components when major changes or repairs are made to the crane!
▶ In such cases, the operator must have the crane inspected by a competent expert before putting it back into service!

Respective local regulations also apply.
Expert: Is a person whose technical training and experience means that he has adequate knowledge in the field of inspecting technical equipment. He is adequately familiar with the relevant national work safety regulations, accident prevention regulations, and standards that he is able to evaluate the operational safety of the equipment (for example cranes). Responsible employees from specialist workshops and customer service engineers may be considered as experts.

Note
▶ Experts are not authorized inspectors!

Authorized inspector: Is a person whose technical training and experience means that he has explicit knowledge in the field of inspecting technical equipment. He is adequately familiar with the relevant national work safety regulations, accident prevention regulations, and standards that he is able to evaluate the operational safety of the equipment (for example cranes). He is to test the technical equipment and is able to certify the equipment as safe. Authorized inspectors can be active engineers.

Note
▶ Authorized inspectors are legally recognized experts who have received special training!

Periodic inspection are principally a visual inspection, wherein the inspector (either type) appraises the condition of the crane and its components.
The purpose of the inspections is to avoid accidents by detecting deficiencies in a timely fashion. Any deficiencies determined by the inspectors must be documented, remedied, and subsequently reinspected.
A number of important examples of items that are particularly important during the periodic crane inspections are listed in the following: We wish to advise that the authorized inspectors / experts take sole responsibility for the crane inspections that they carry out.

Note

- The inspection may not be solely limited to the following positions shown in the sample construction illustrations. Rather the **entire** crane structure must be subjected to a careful inspection!

A checklist for periodic inspections recommended for LIEBHERR vehicles and crawler cranes is included in the appendix to assist the inspectors.
If the inspector has any questions they should be directed to Liebherr-Werk Ehingen GmbH's technical department.

WARNING
Risk of accident!

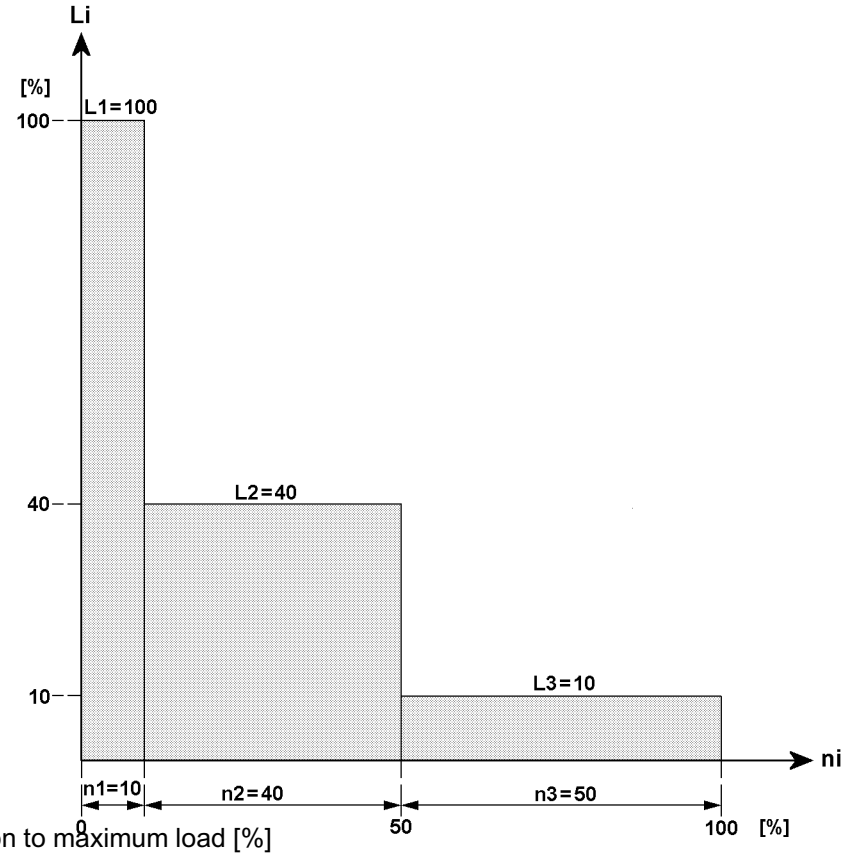
- Adhere to the following inspection guidelines and intervals.

2 Inspection of carrying crane structures, especially steel structures

DANGER
Risk of fatal injury!
The crane structures, particularly steel constructions have to be checked by an expert or authorized inspector at least once a year. If this is not the case, they could fail and cause fatal injury or seriously damage the crane!

- Crane structures, particularly steel constructions must be checked by an expert or an authorized inspector at least once a year!
- Shorten the inspection intervals if the crane is subjected to above-average duty cycles, for example when handling large material quantities or frequently erecting long boom systems.
- If the crane was subjected to excessive operating loads; e.g., due to an unusual impact, the crane structure, especially the steel structures must be inspected immediately!

Crane structures, especially steel structures, such as booms, turntables, chassis, support equipment (e.g., sliding beams or folding outriggers) must be carefully inspected, at the very least during the annual recommended crane inspections. Even though welding joints are not normally situated at maximum load locations, it is nevertheless important that they be inspected with particular care during the periodic inspections.
If paint damage with corrosion (rust) is found on load carrying parts of the crane structure, especially on telescopic booms, lattice booms, lattice jibs, pull rods etc., then the rust must be removed, primered and painted.
During an electrolyte process, such as corrosion in combination with water, an atomic hydrogen is created, which causes to hydrogen induced corrosion with resulting cracks on high tensile fine grain construction steel.
If disassembly and assembly work on the crane is required to carry out the inspections, then they must be carried out by taking the manufacturer's data into account or in coordination with the crane manufacturer.
We would like to point out that the framework of mobile cranes is designed for a limited number of stress work cycles. This also determines the utilization or service life of the framework. The service life is not determined solely by the number of stress cycles. It also depends on the loads (load spectrum) applied during the time in operation.
Liebherr mobile and crawler cranes are designed for assembly operation and can only perform a limited number of stress cycles. They are designed for special movement characteristics. For example: Continuous deployment of drive forces, occasional operation and load conditions according to DIN 15018:1984 Part 3 or EN 13000:2004.
Example of a duty cycle according to the grouping for Liebherr mobile and crawler cranes:



Li: Load proportion in relation to maximum load [%]
ni: Load cycles in relation to maximum number [%]

Note

- The life of Liebherr mobile and crawler cranes can drastically reduce, for example when used in magnet, grab or material handling applications.

For that reason, the steel structures and the welding joints must be subjected to an intensive inspection by the authorized inspector 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 diagrams are samples of the load-bearing weld designs. 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 diagrams are provided to assist the inspector. The sketches are only examples and are not necessarily 100% complete!

2.1 Repair welds

If defects such as cracks or permanent deformation are detected on load-bearing steel components, they should be immediately reported to **Liebherr-Werk Ehingen GmbH** (hereinafter called LWE), **Customer Service Department**.
Furthermore, the defect must immediately be appraised by an authorized inspector in accordance with standard welding practice rules. The inspector must immediately ascertain whether or not the crane can continue to be safely operated until the time of the repair.
The following items apply to the repair weld:

– Repair welds may only be carried out by the following persons or companies:
  - **LWE** personnel, or third-party personnel contracted by **LWE**, with appropriate qualifications according to EN 287-1 for the subject material (3.2) and welding method.
  - Companies whose suitability is verified according to DIN18800, Part 7, DIN 15018, and DIN 4132 with an endorsement for cranes, crane runways and the following high and ultra-high-tensile fine-grained construction steel:
    Metal sheeting S690QL1 W.No.1.8988
    Metal sheeting S690QL W.No.1.8928
    Metal sheeting S700MC W.No.1.8974
    Metal sheeting S960QL W.No.1.8933
    Metal sheeting S960MC W.No.–
    Metal sheeting S1100QL W.No.1.8942
    S770QL W.No.1.8938 pipe
    S890QL1 W.No.1.8925 pipe
    Experience in repairing mobile and crawler cranes using the appropriate materials and application of welding methods in accordance with MAGM (135), especially manual arc welding E (111), are absolutely essential.
– Repair instructions that identify the basic material, along with the required welding accessories and supplementary materials, must be requested from **LWE** before starting the repair. The required non-destructive tests must be carried out and documented.
– The repair weld must be carried out in accordance with the latest revision of **LWE's** internal welding guideline ISR B 010!
– The repaired structural component must subsequently be subjected to a load test.
  The required test loads and boom configurations shall be obtained from **LWE**, Customer Service!
  Successful test results shall be documented in the crane inspection log!
– We also refer to observing the accident prevention regulations “Principles for testing cranes by authorized inspectors or experts in accordance with UVV **Cranes** BGV D6 and BGG 905”!

WARNING
Danger of serious personnel injury and equipment damage!
▶ Comply absolutely with all recommendations, particularly welding specifications!

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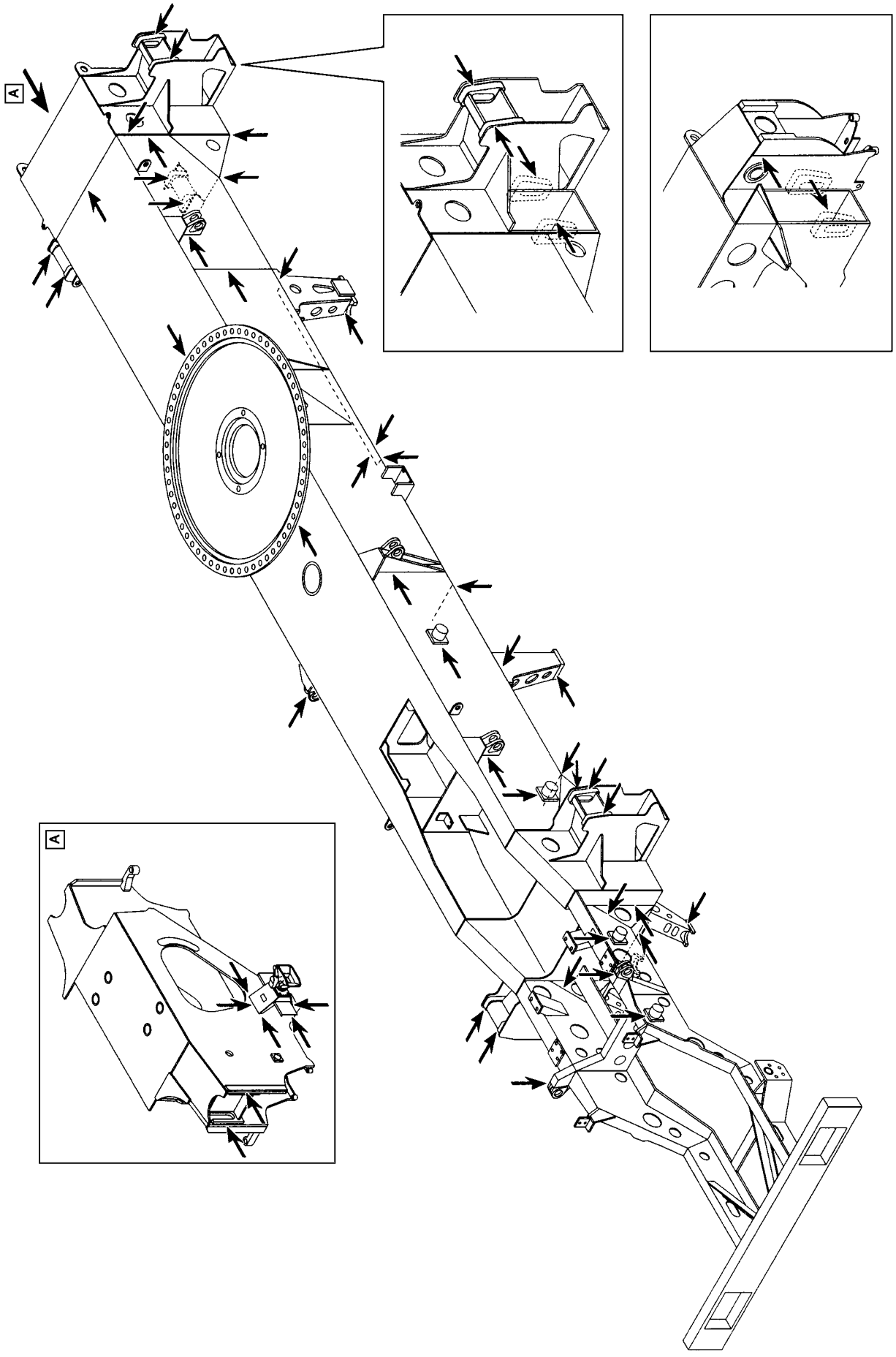
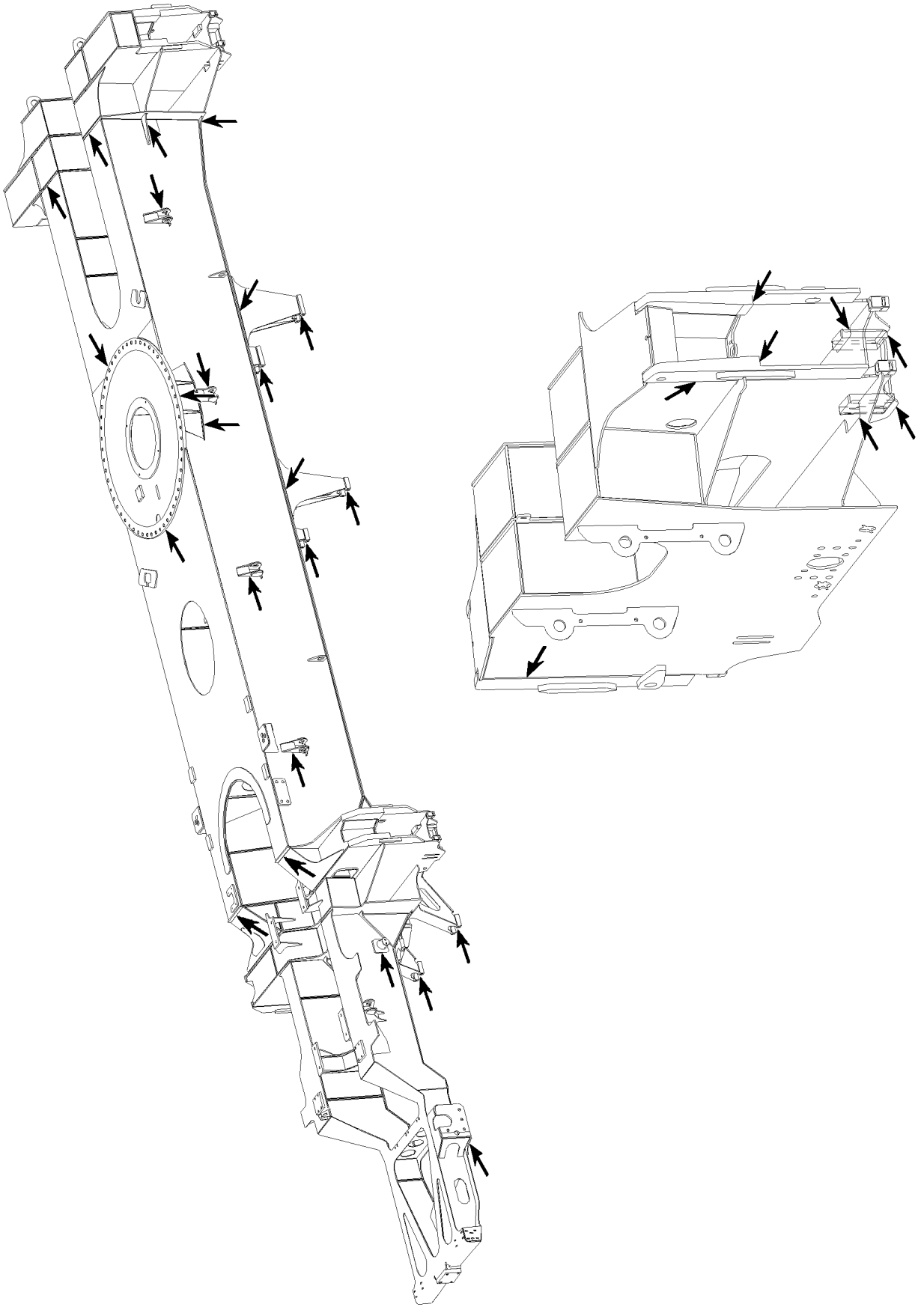


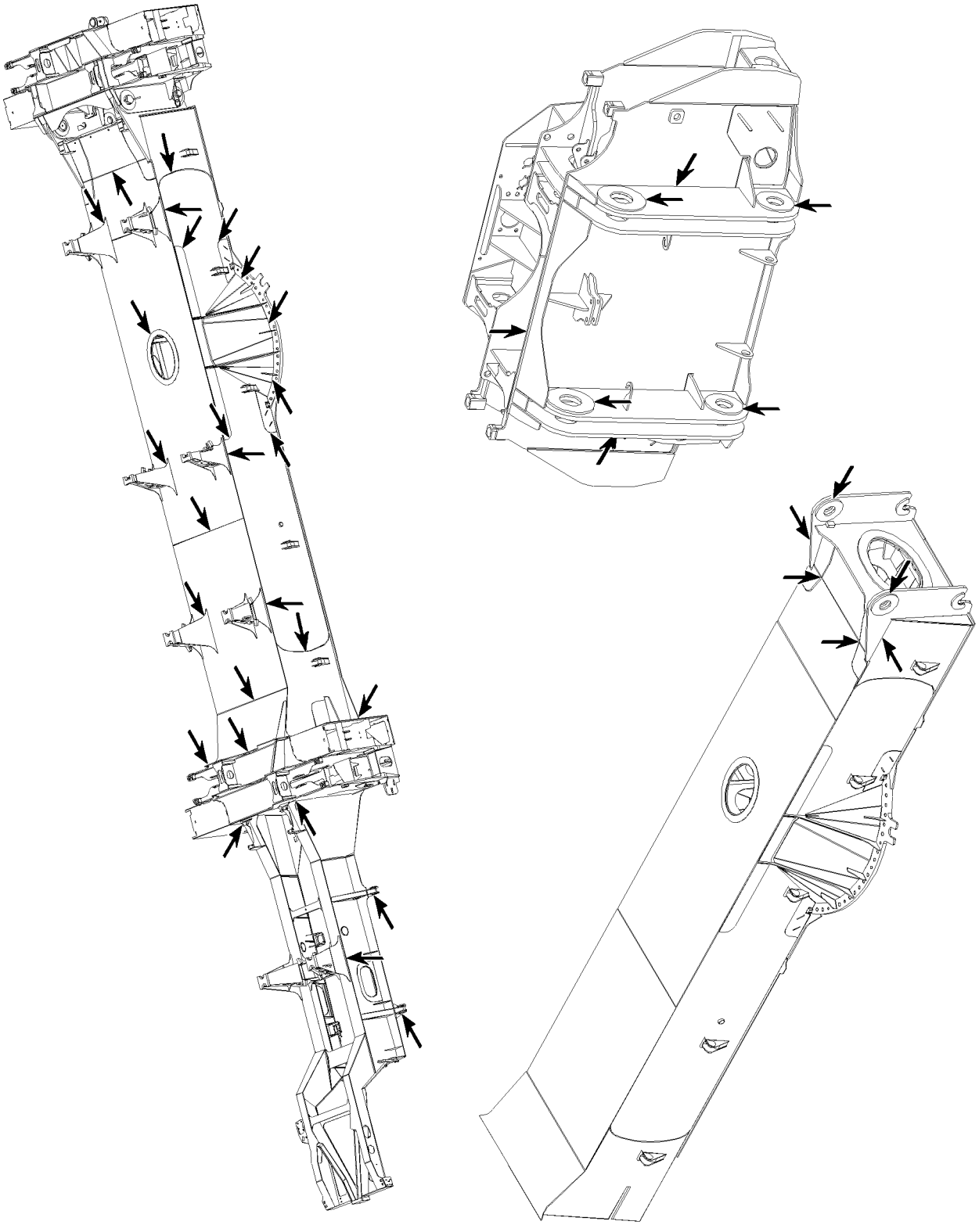
B185046

Example for vehicle frame



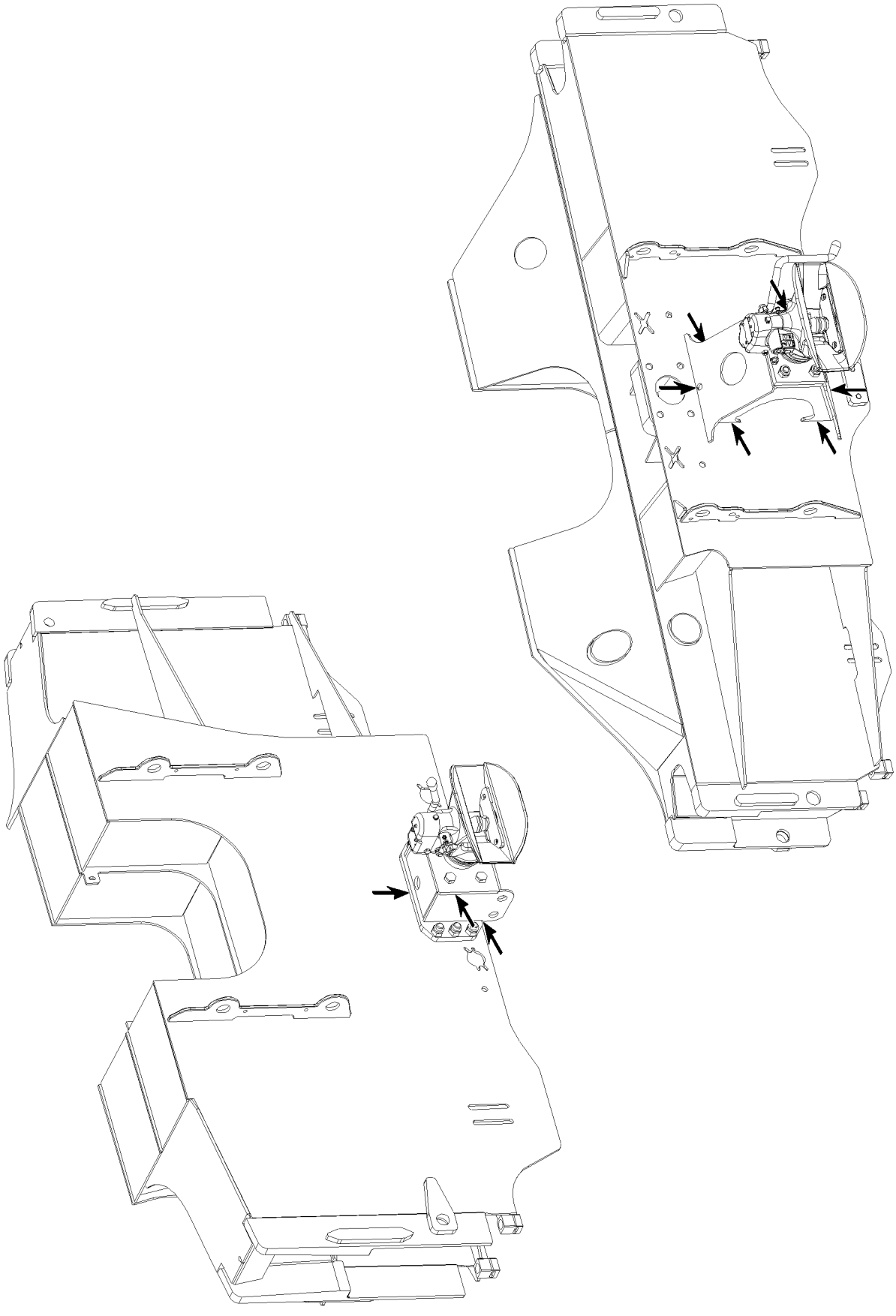
B105702

Example for vehicle frame



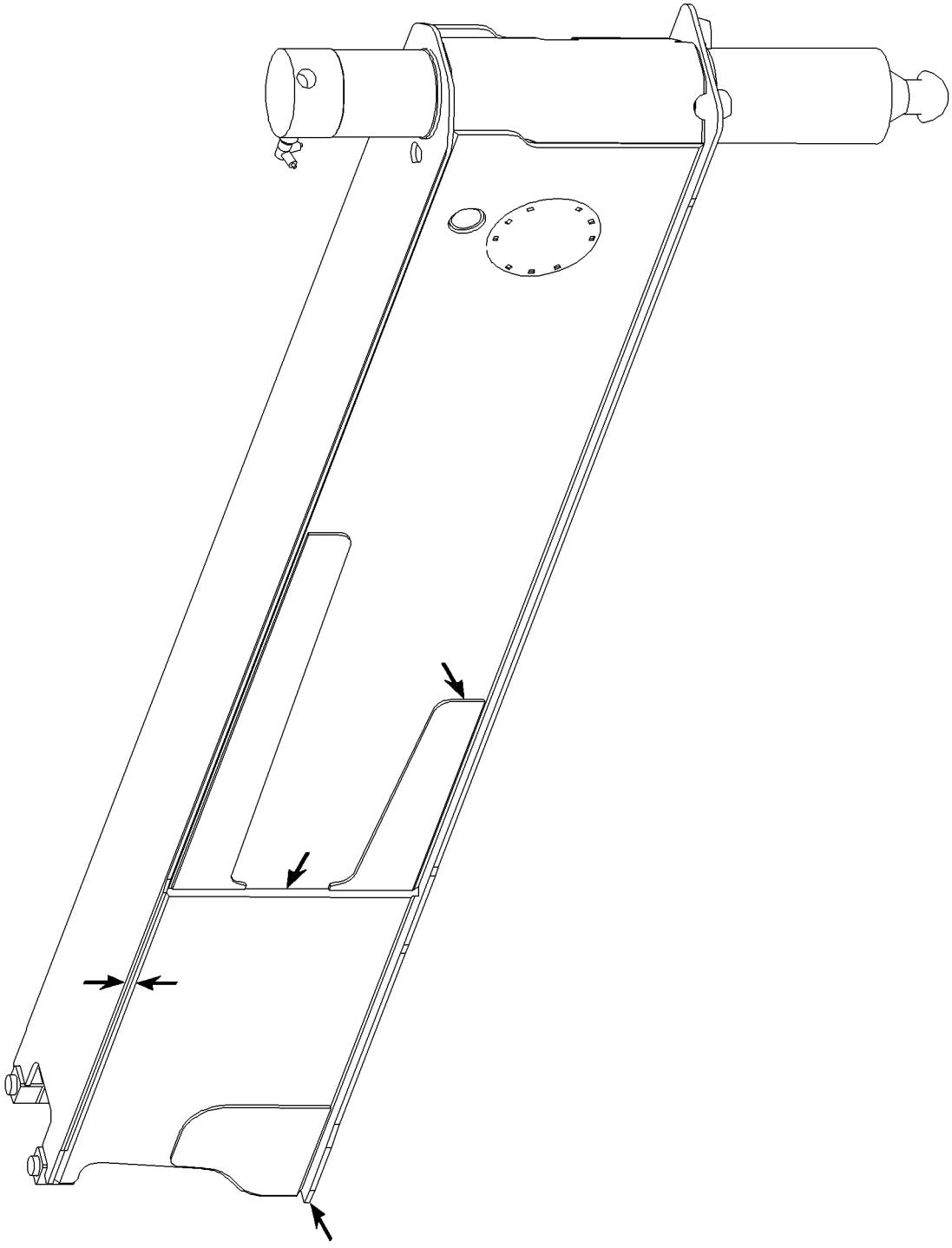
B105719

Example for vehicle frame

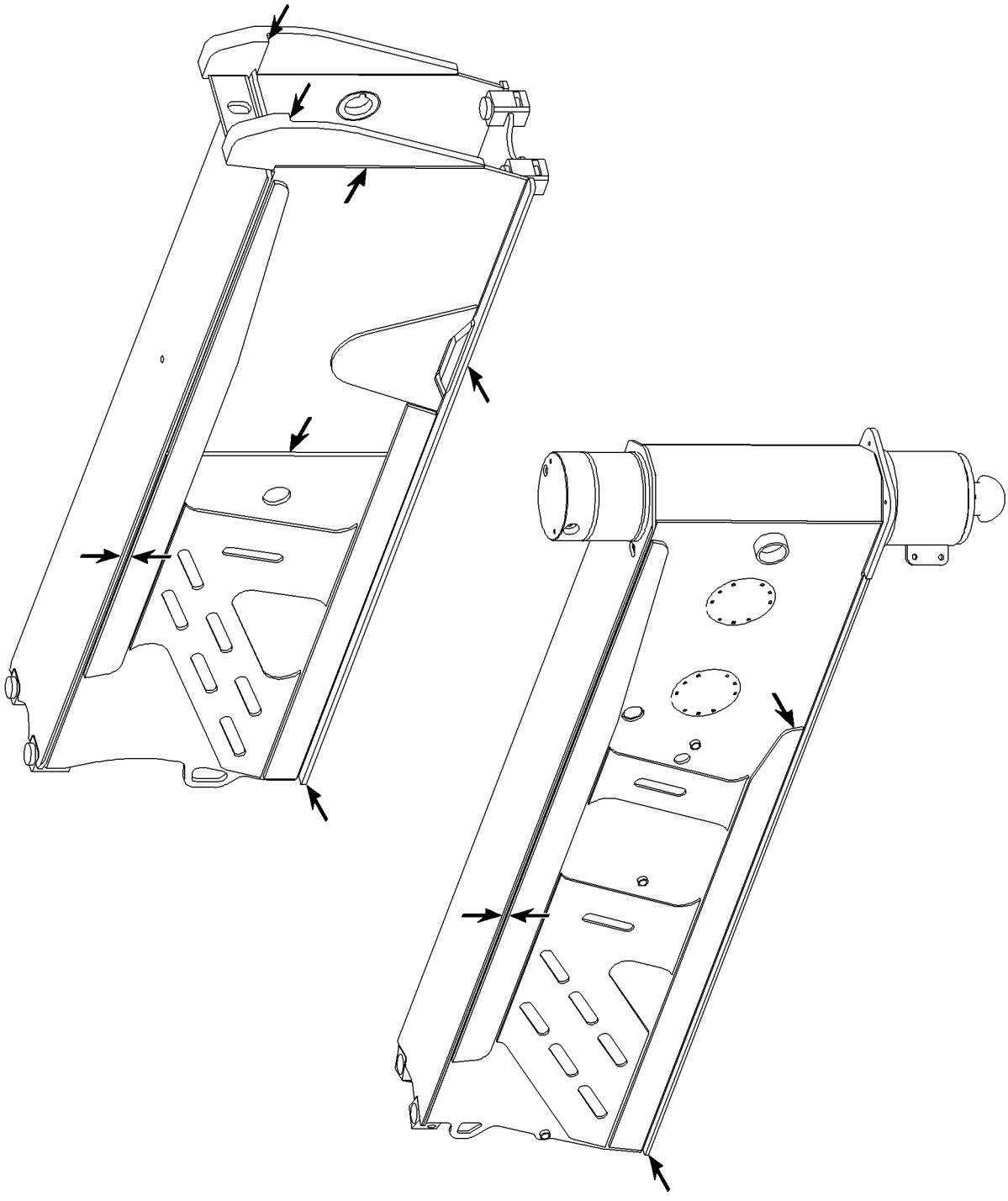


B105687

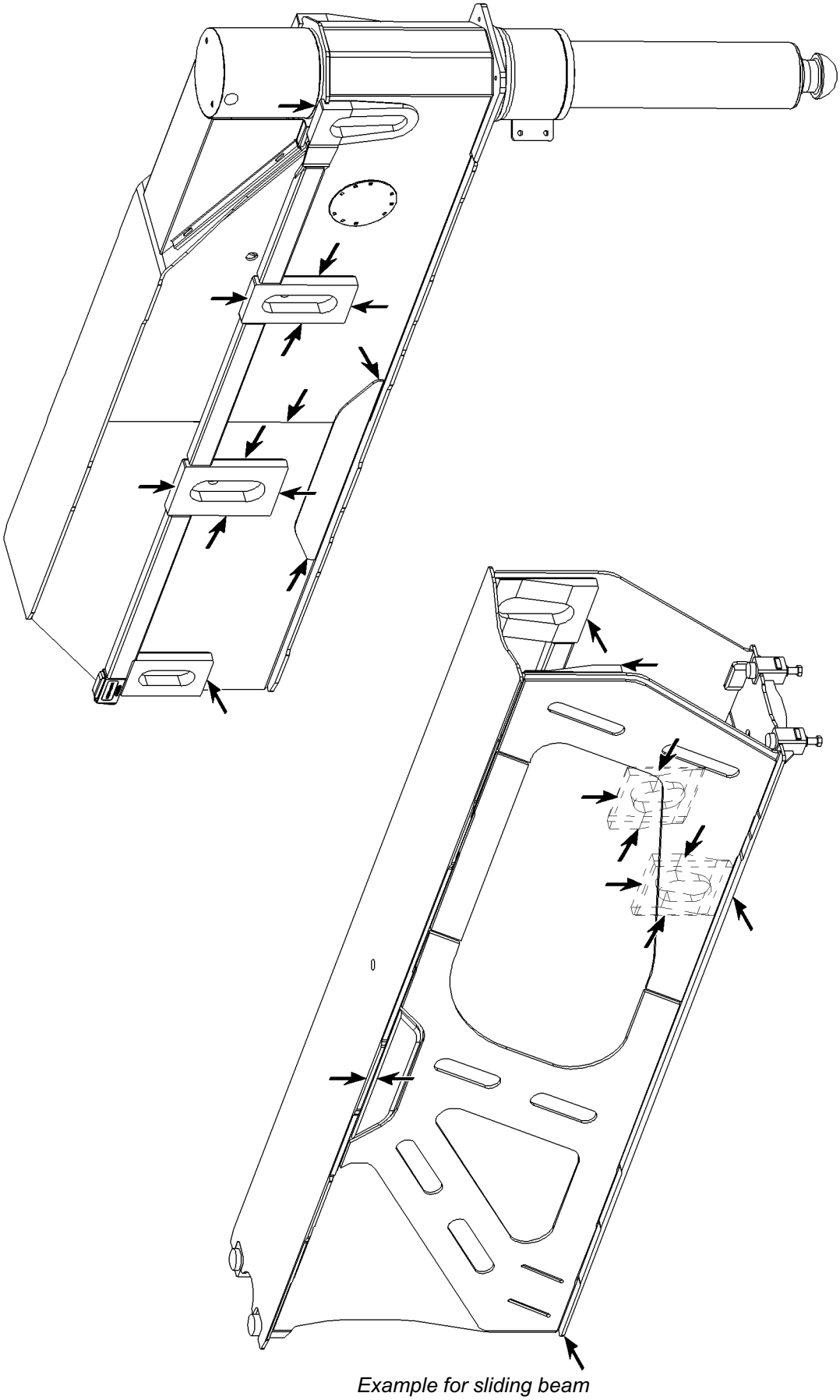
Example for tow coupling



B105698 *Example for sliding beam*

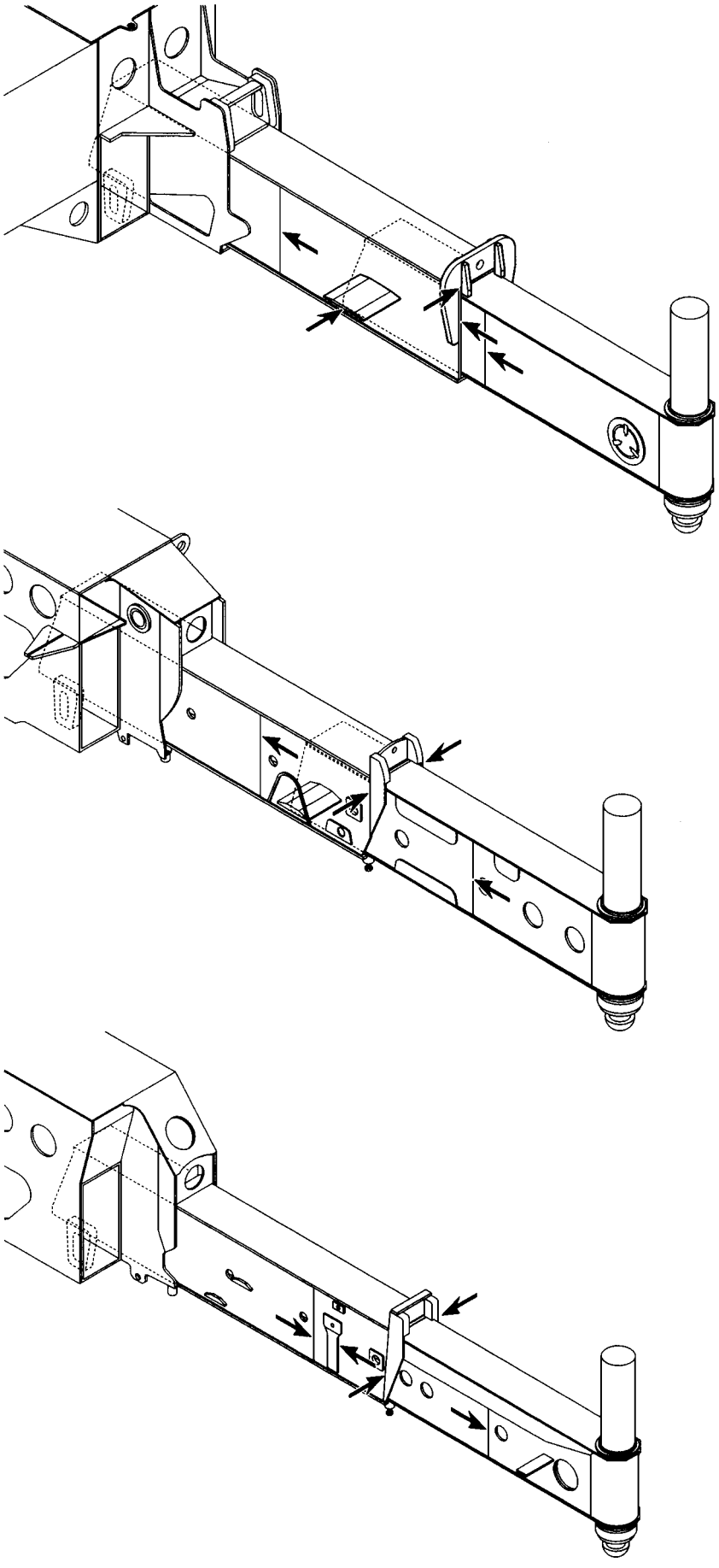


B105717 *Example for sliding beam*



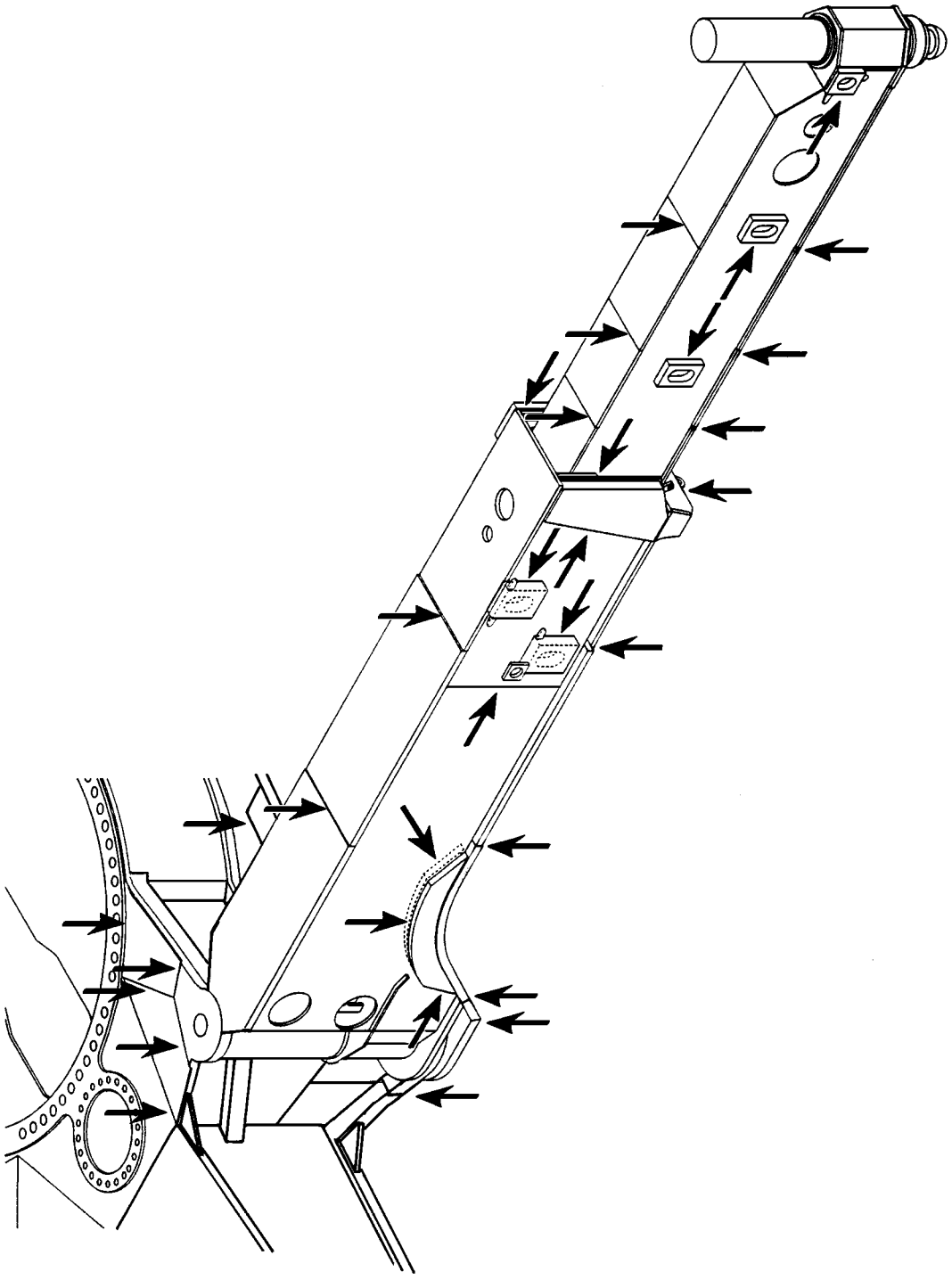
B105718

Example for sliding beam

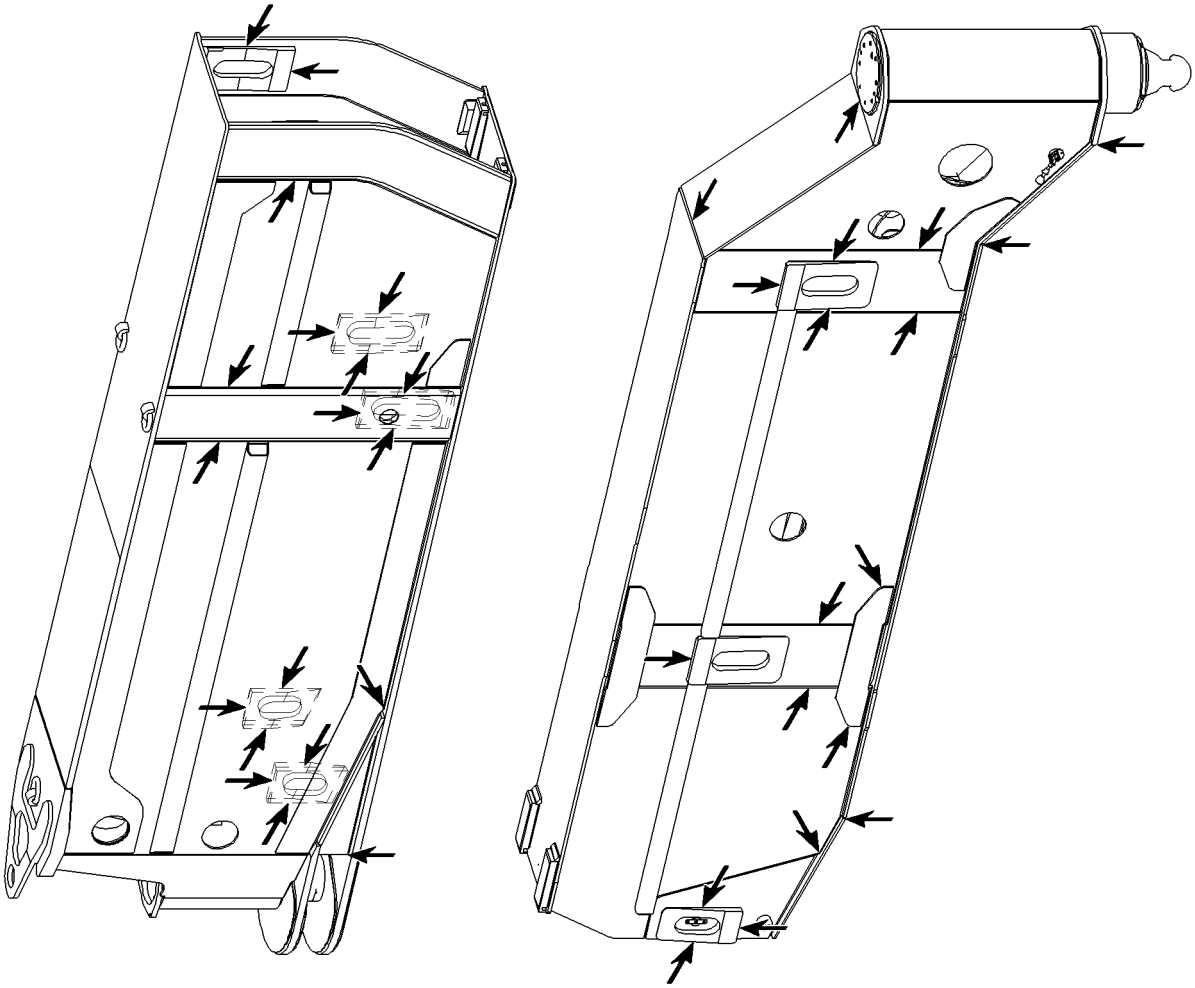


B185047

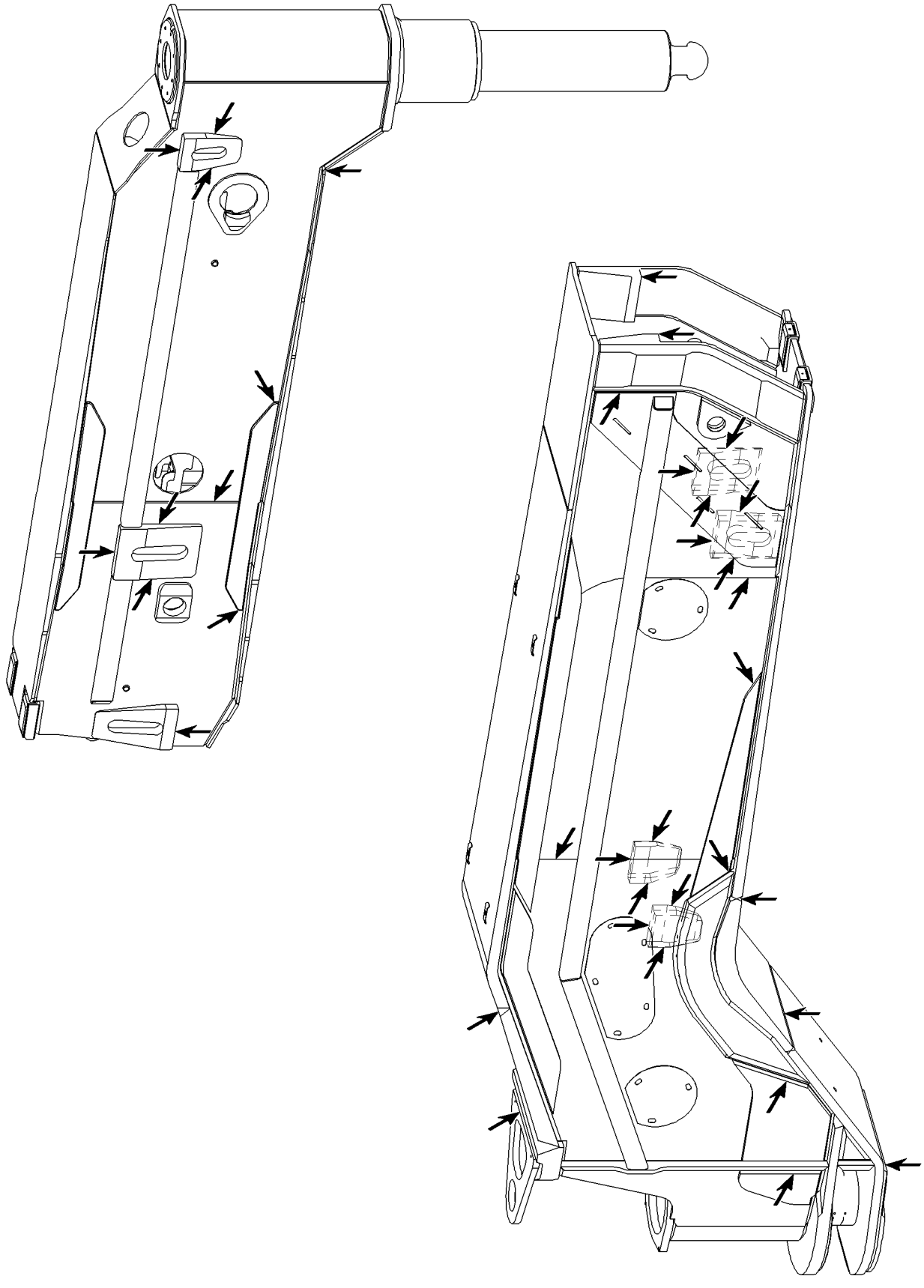
Example for sliding beam



B185060 *Example for slewing sliding beam*

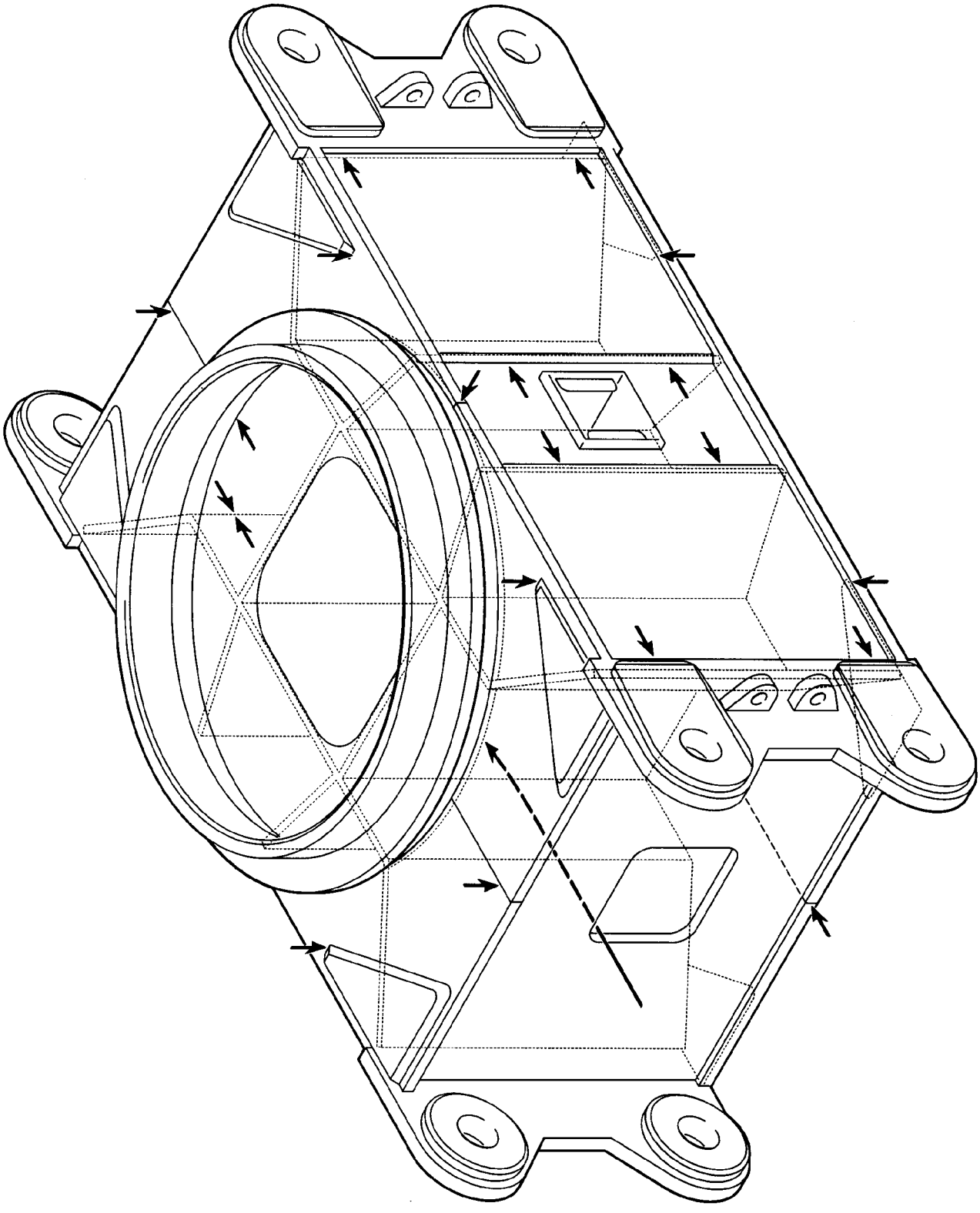


B105690 *Example for slewing sliding beam*

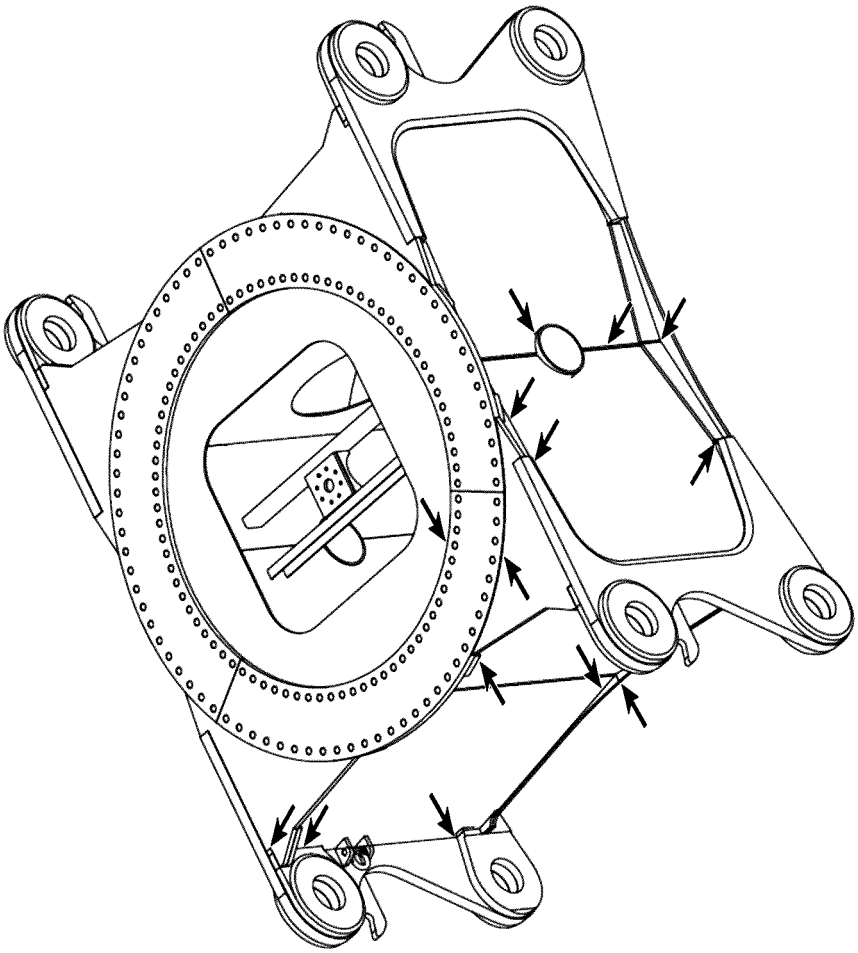


B105704

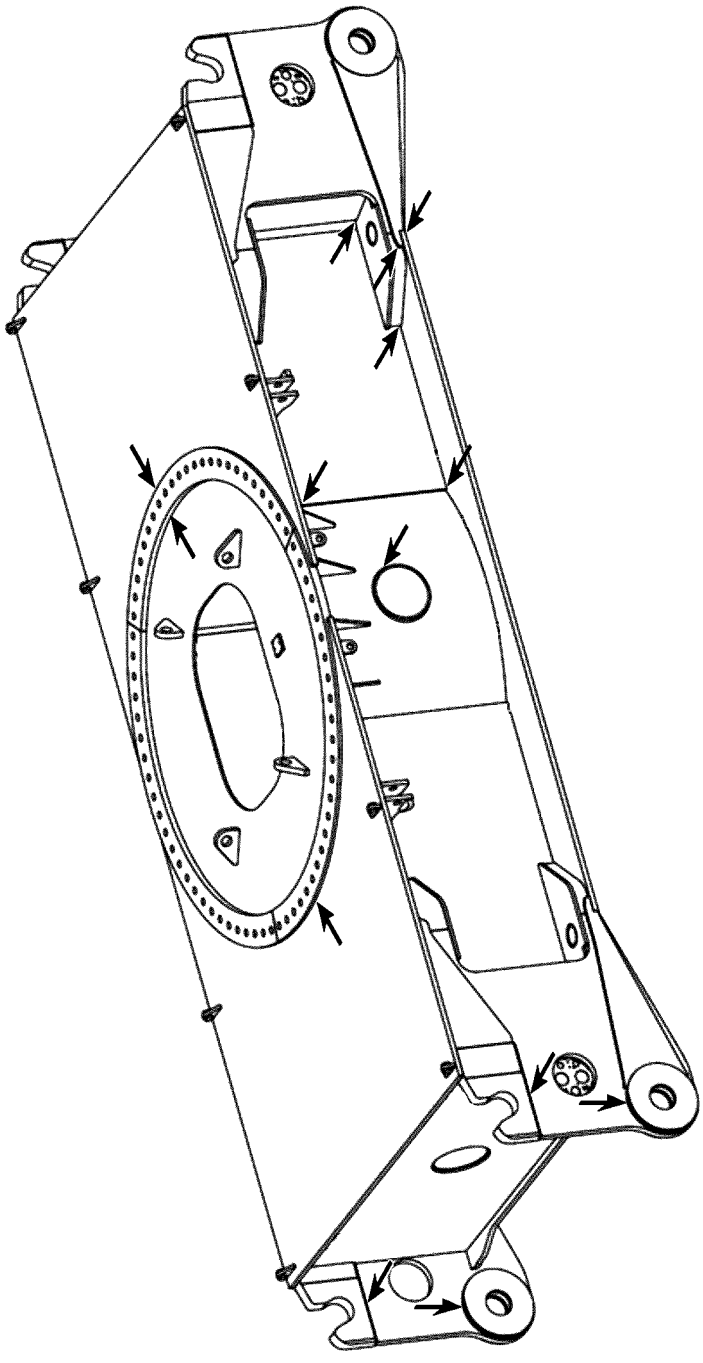
Example for slewing sliding beam



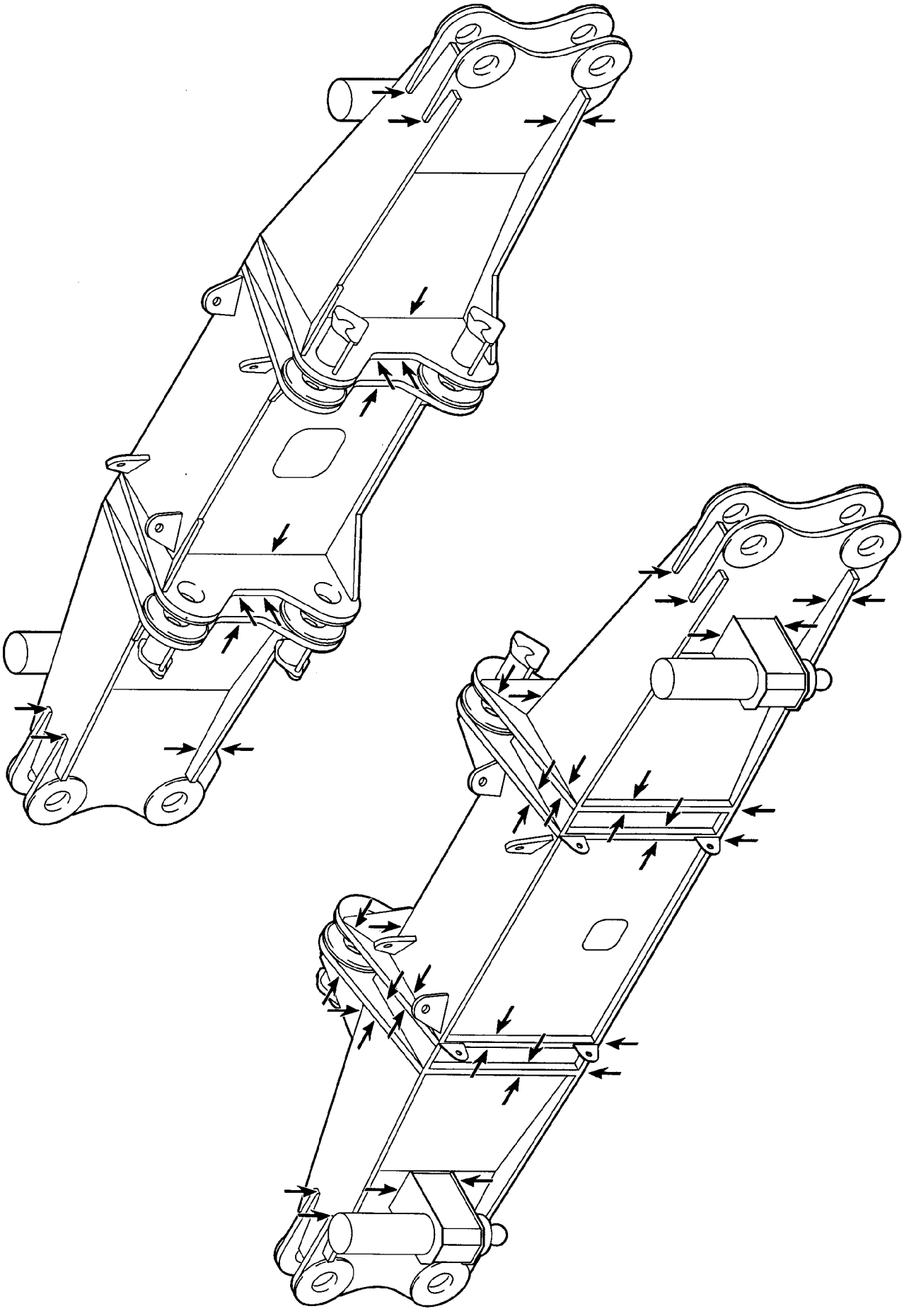
B187347 *Example for crawler center section*



B105725 *Example for crawler center section*

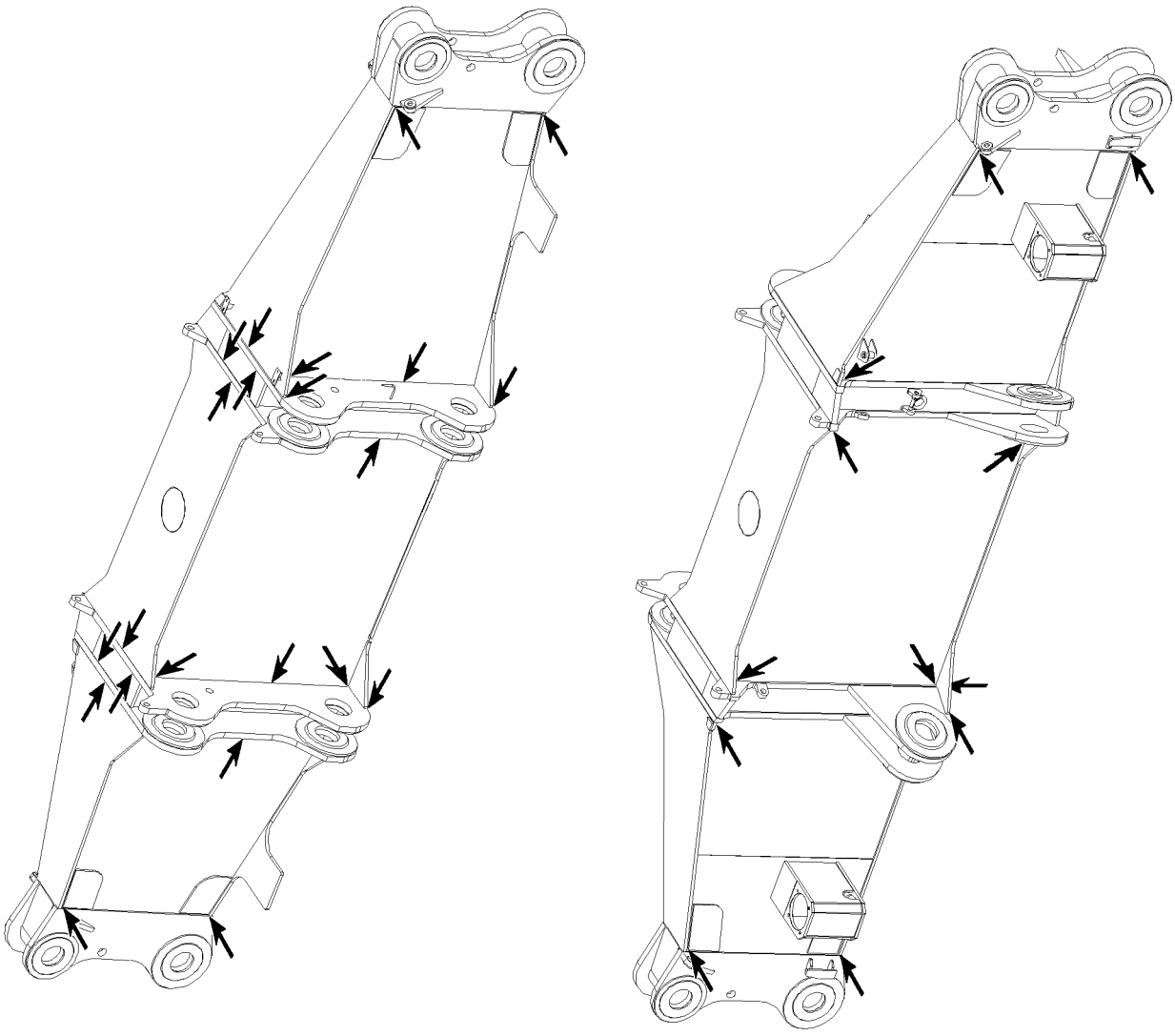


B105726 *Example for crawler center section*

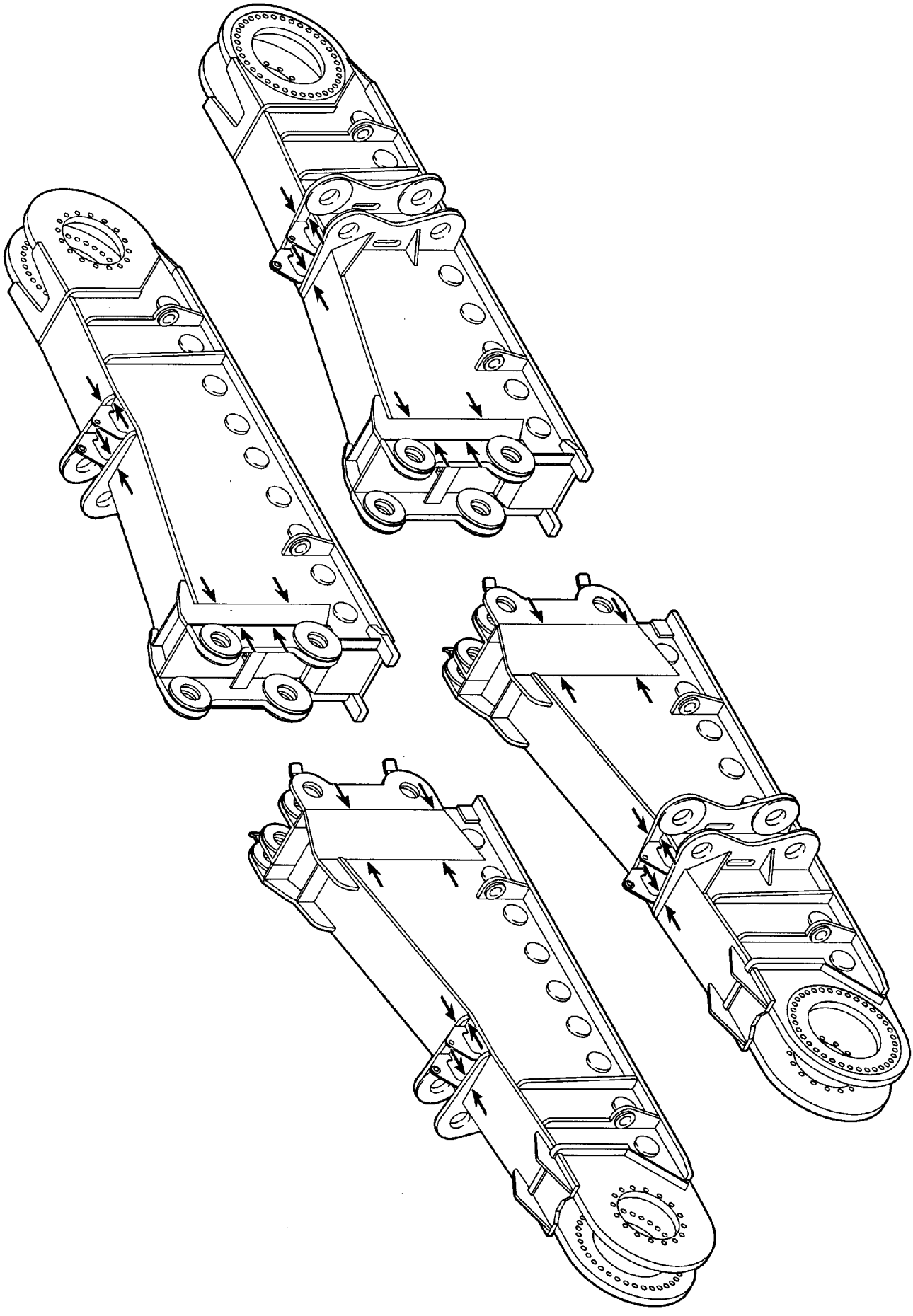


B187348

Example for cross carrier

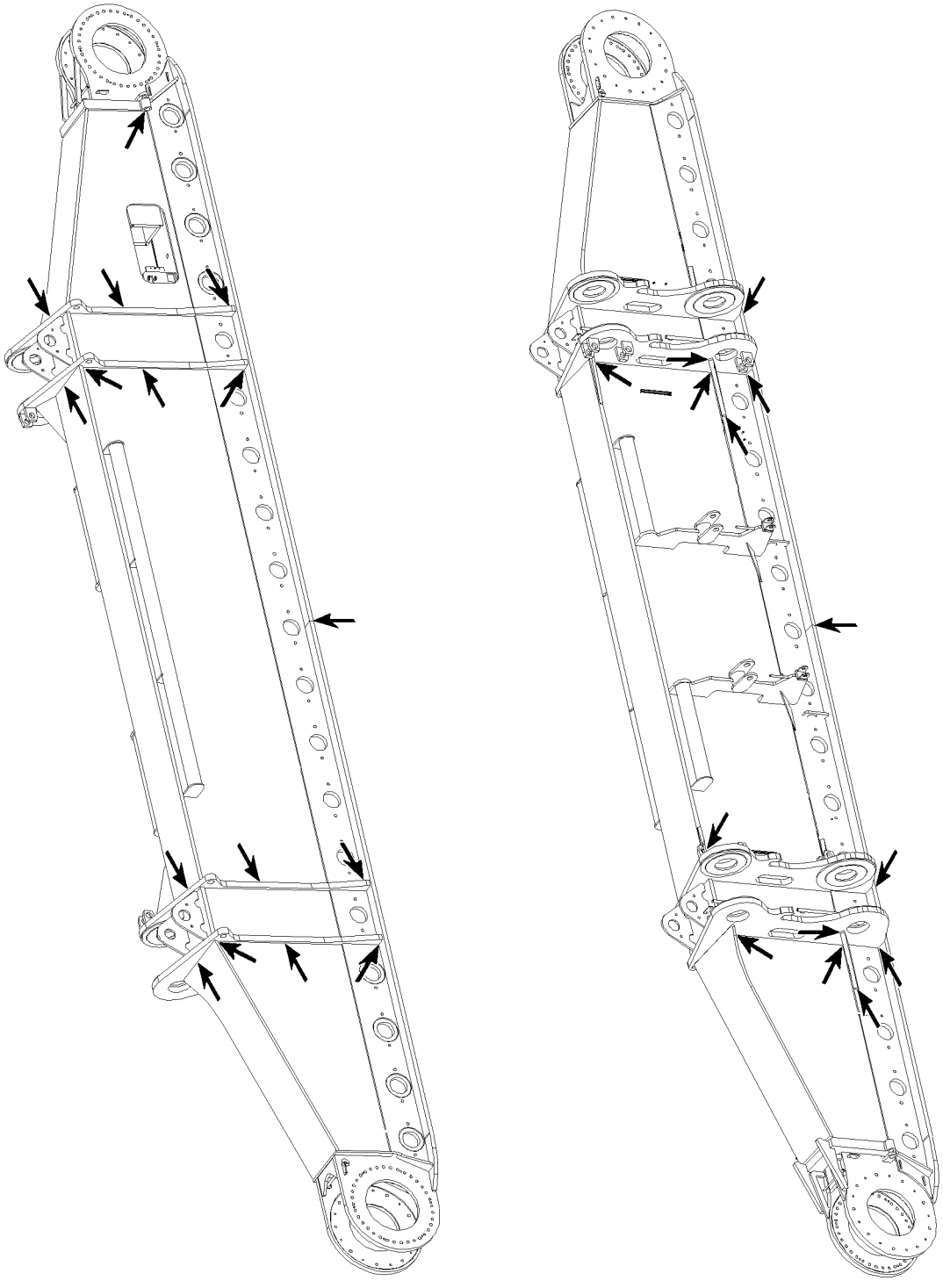


B105727 *Example for cross carrier*



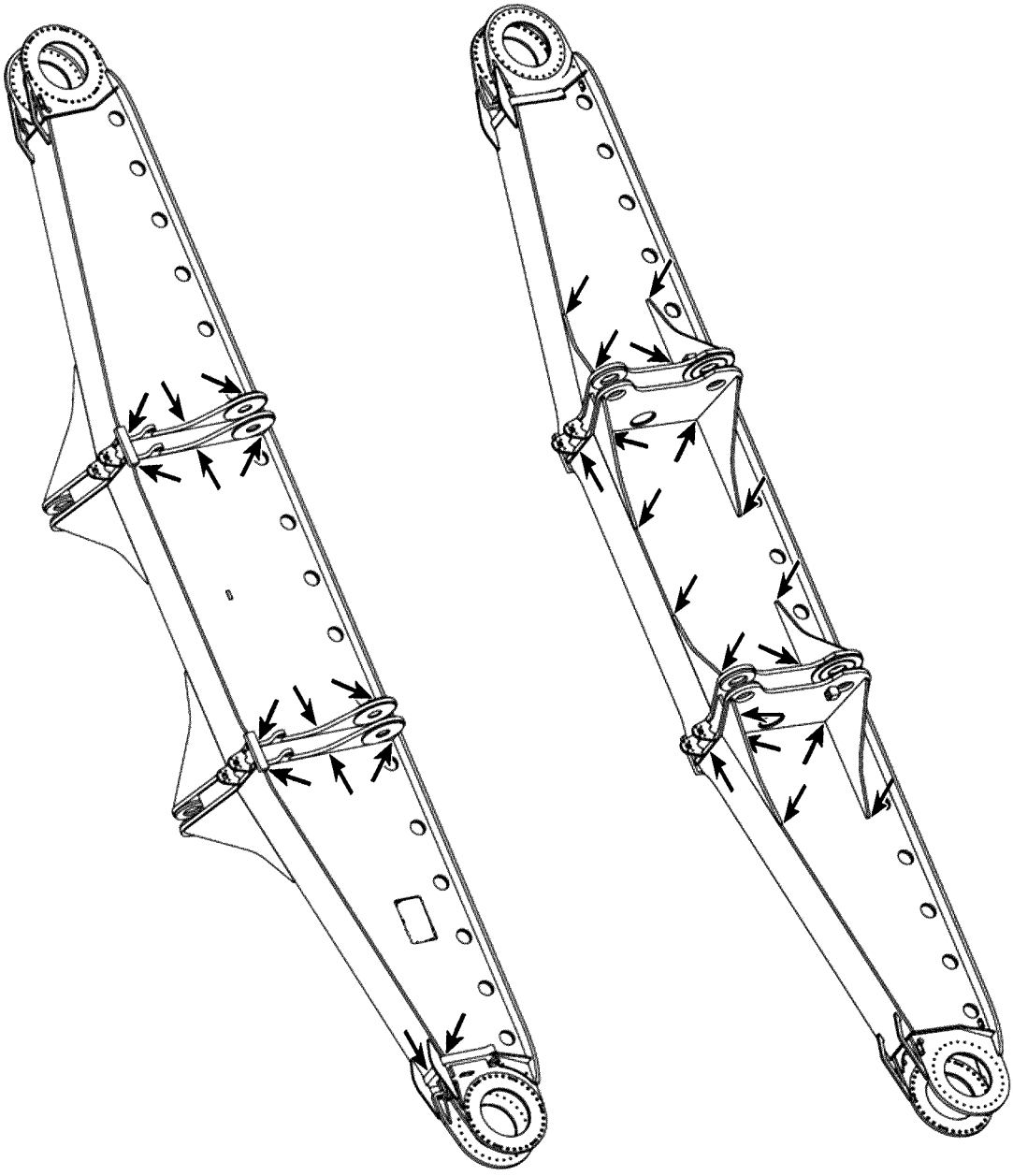
B187349

Example for crawler carrier

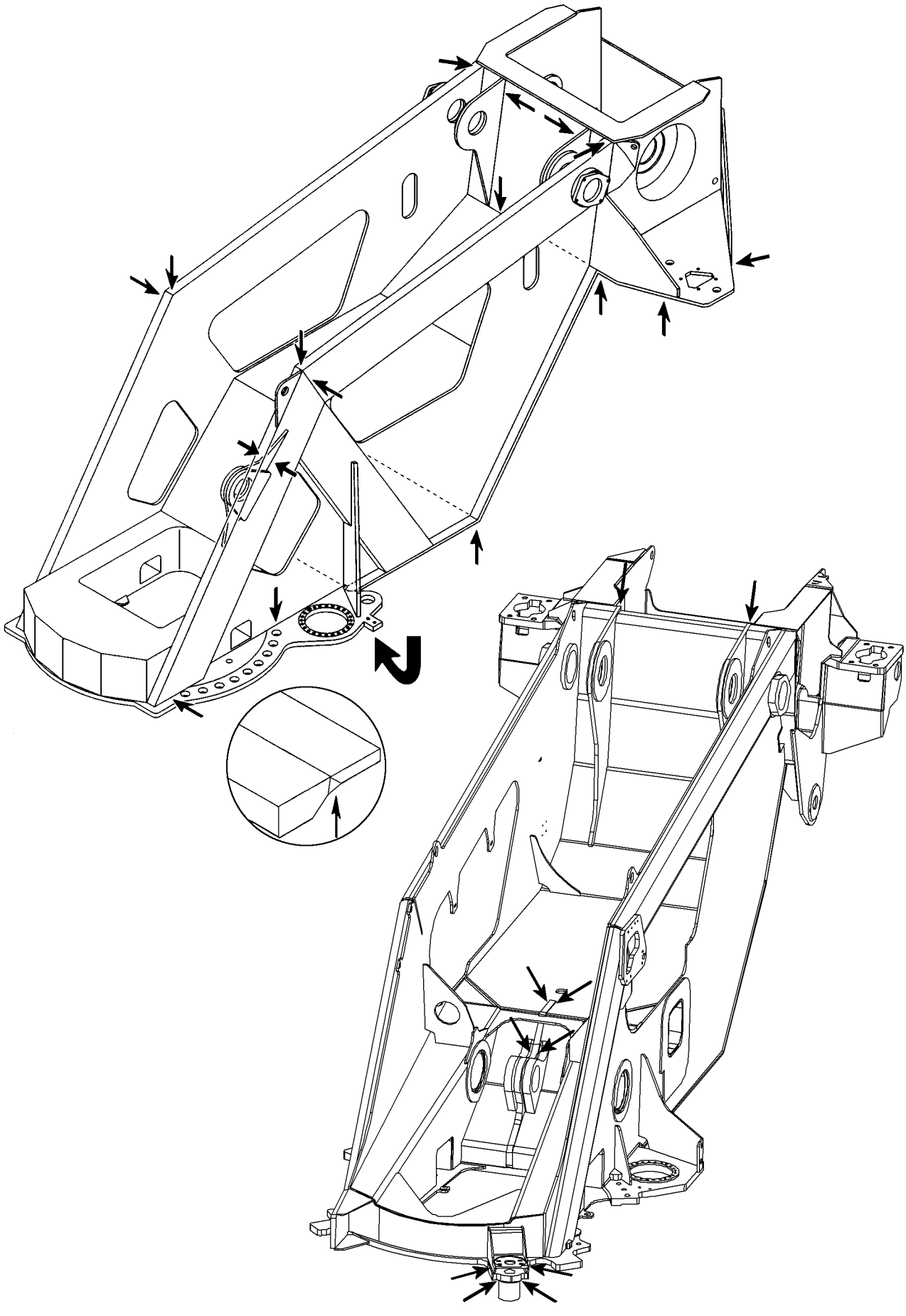


B105728

Example for crawler carrier

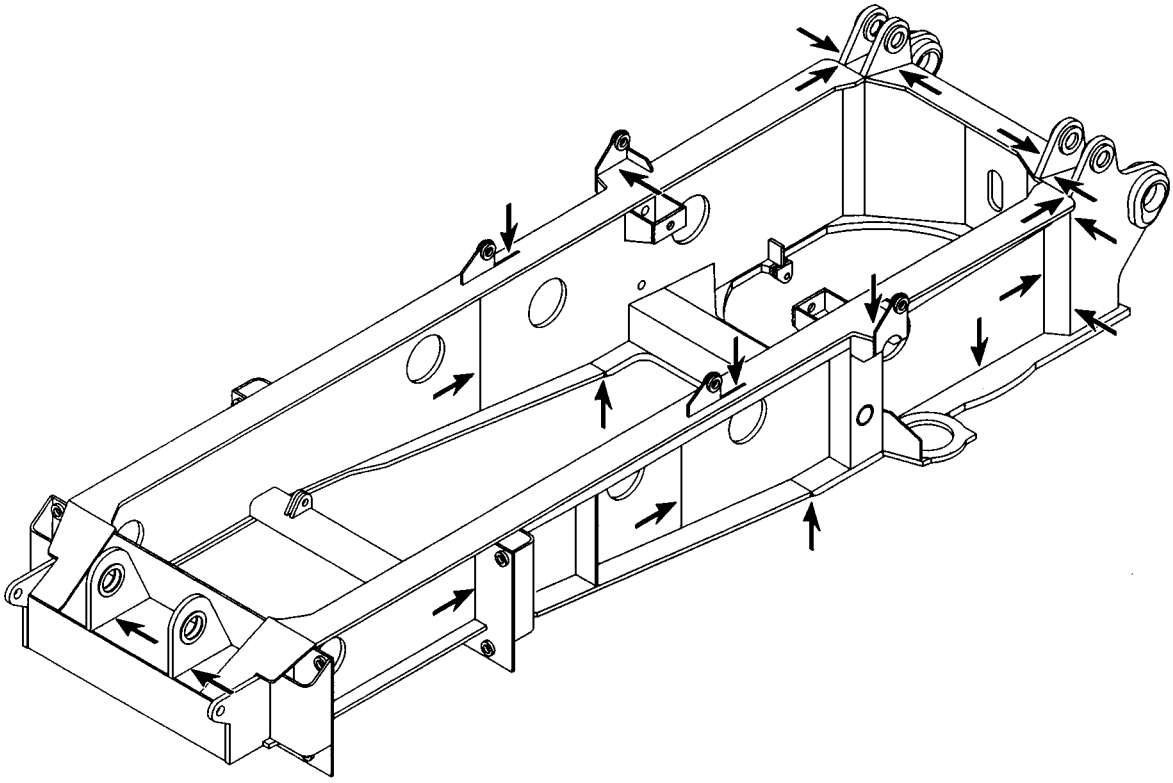


B105729 *Example for crawler carrier*



B185048

Example for turntable frame



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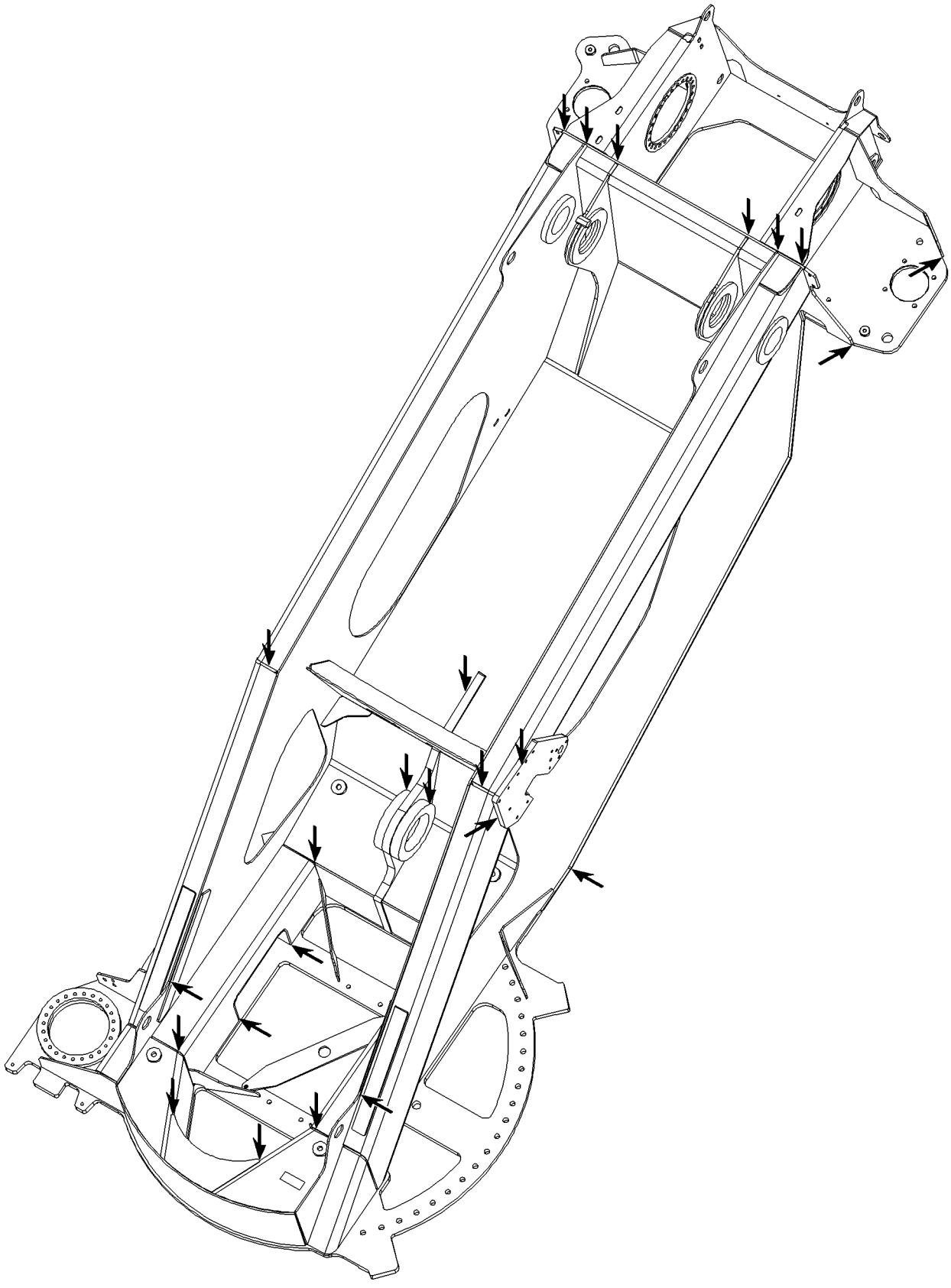

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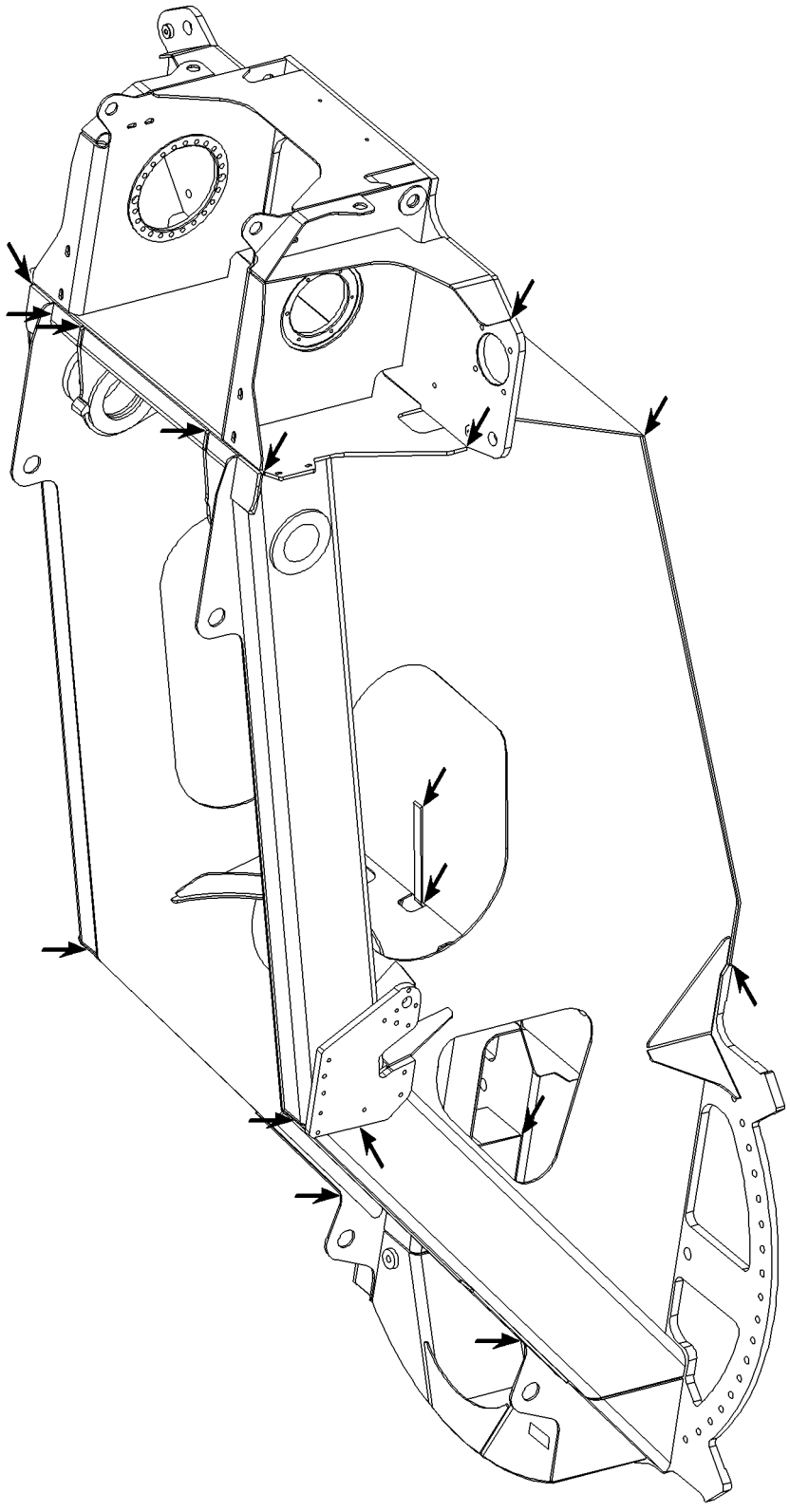

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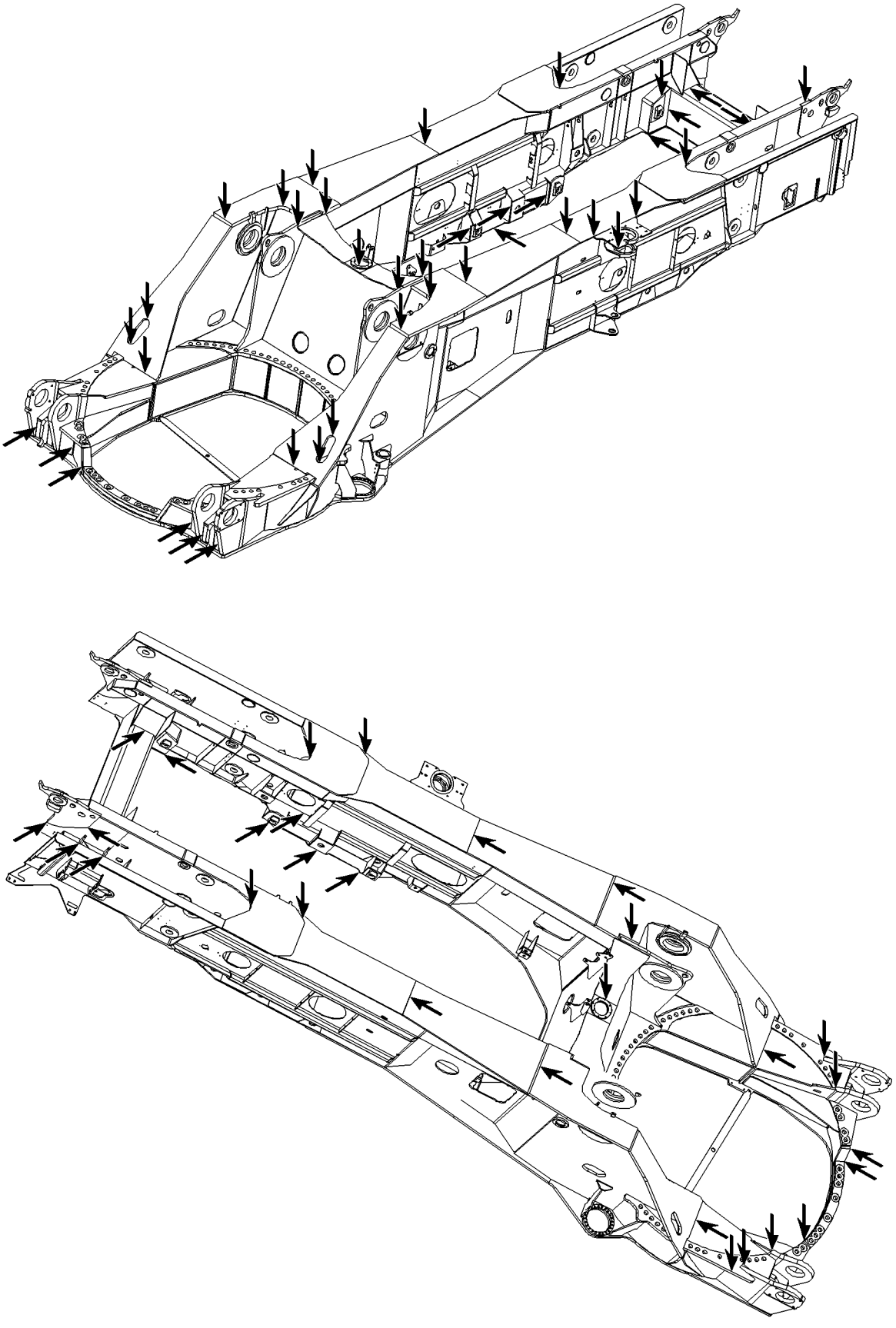

B105706

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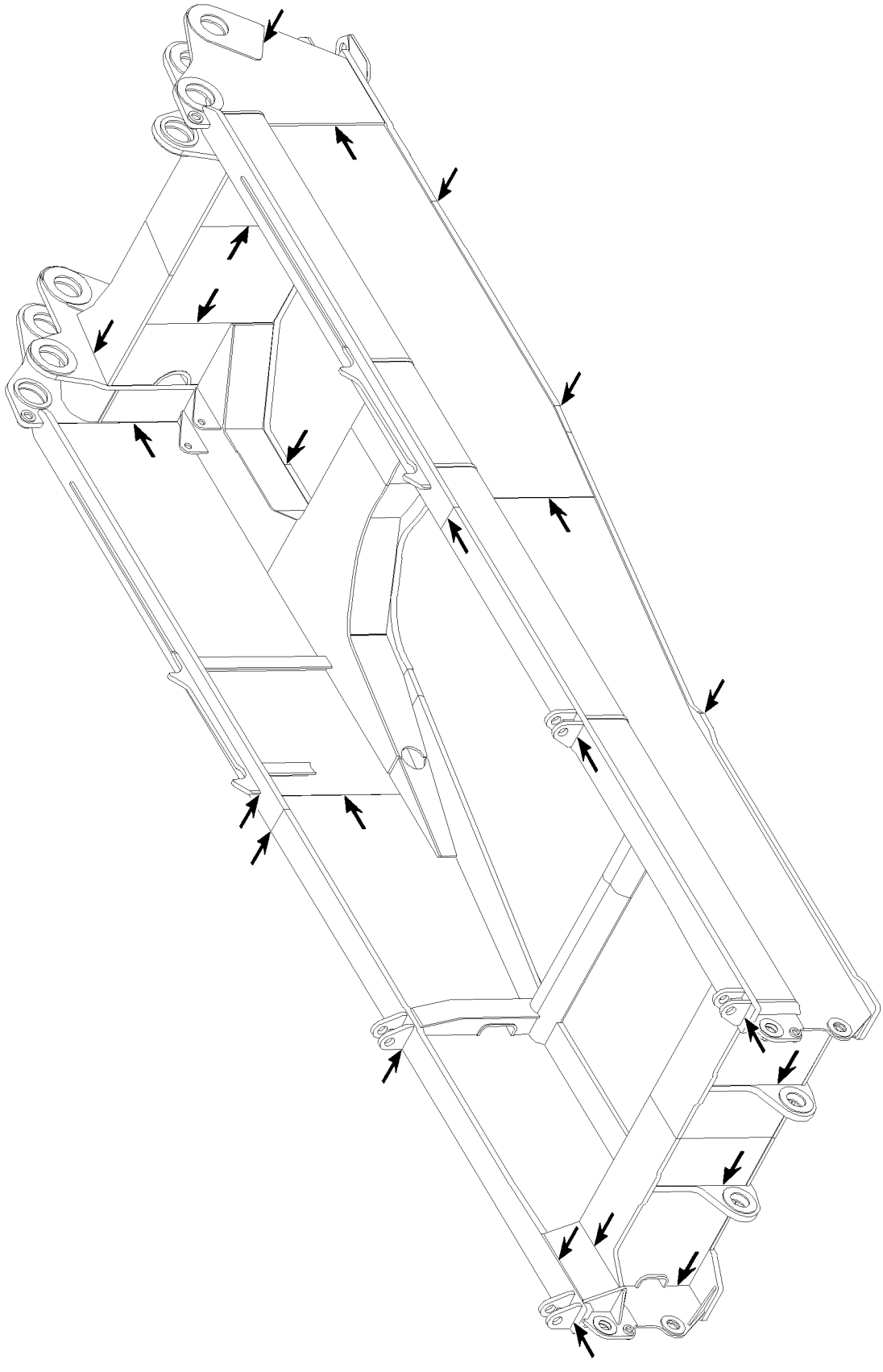

B105694

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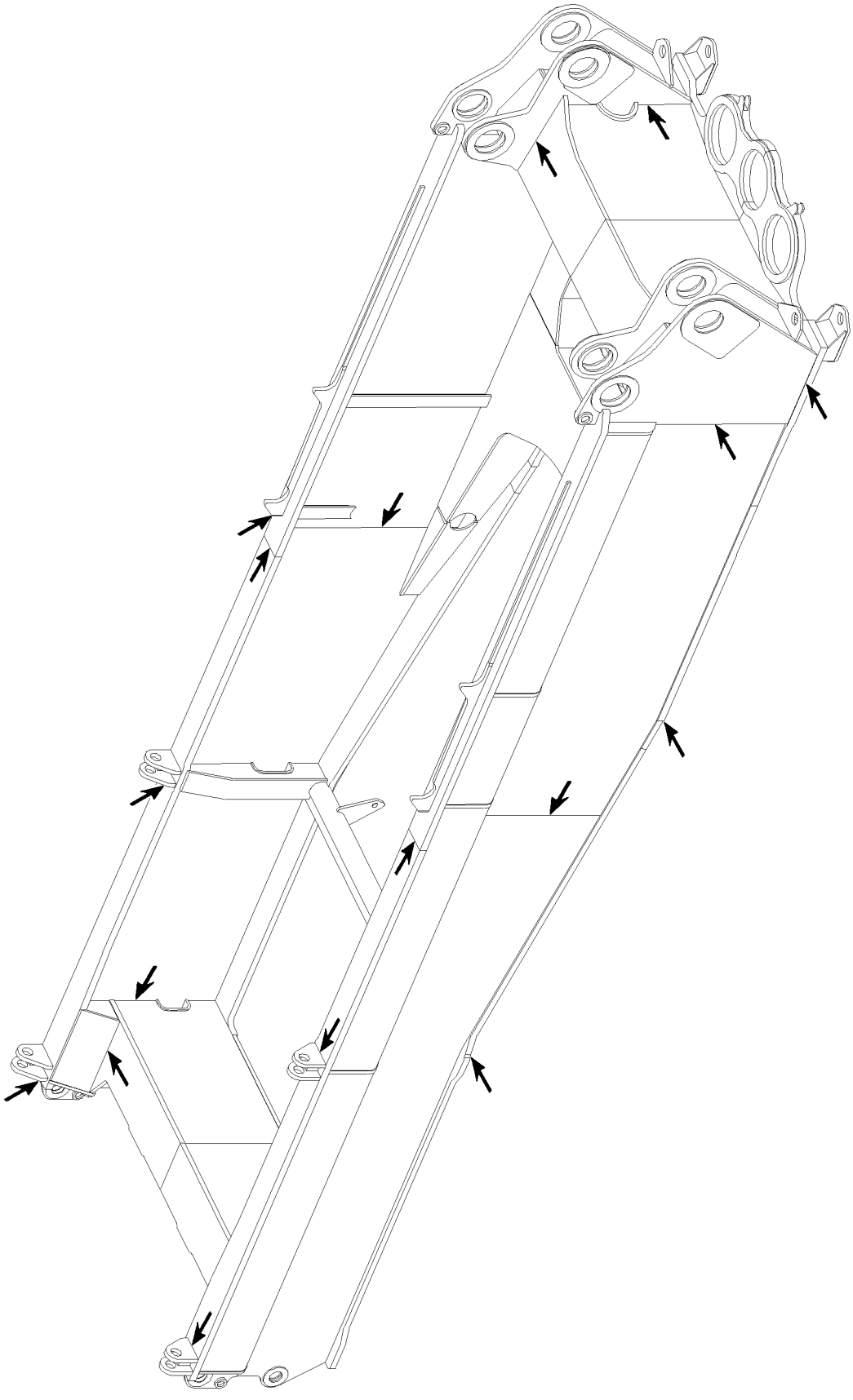

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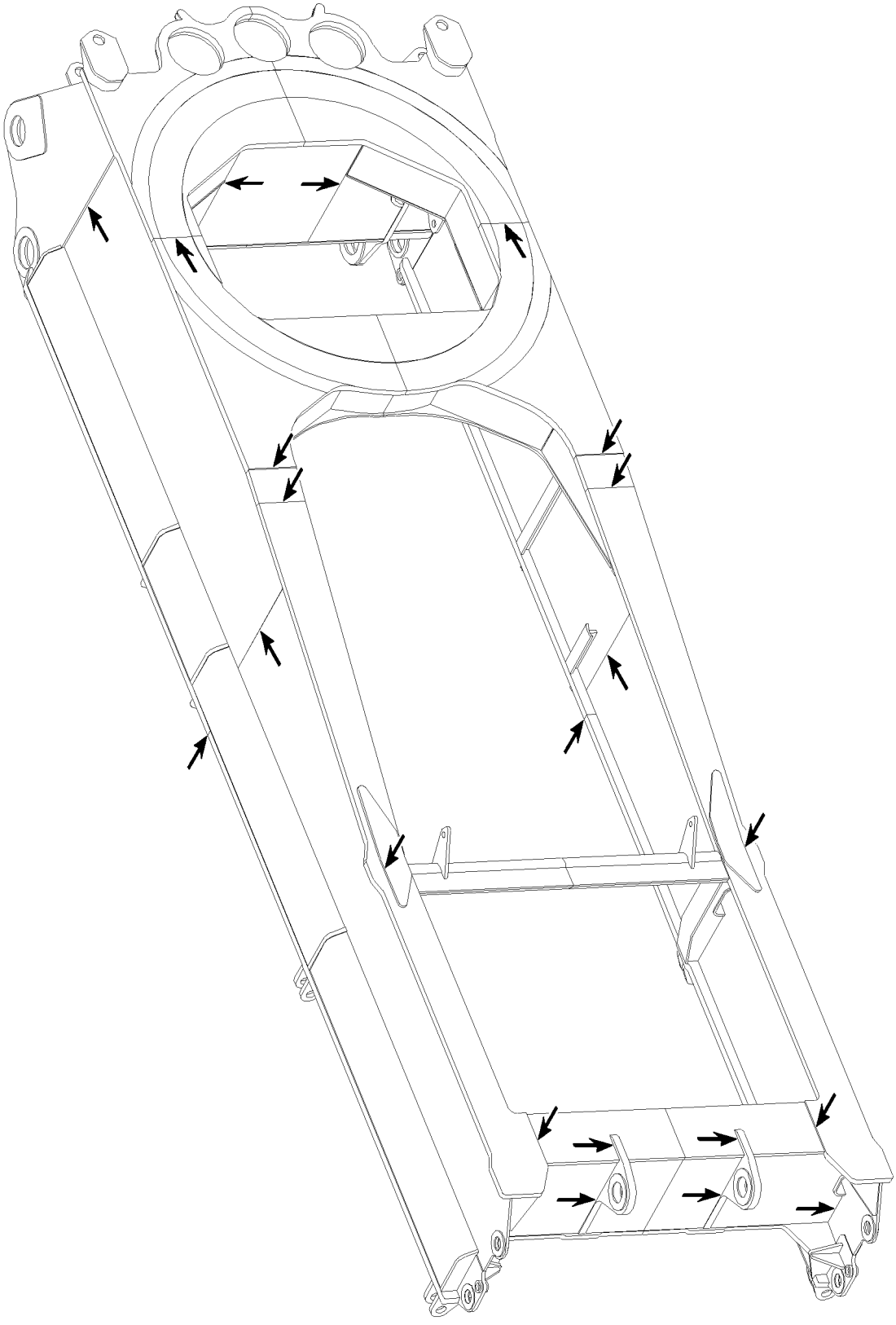

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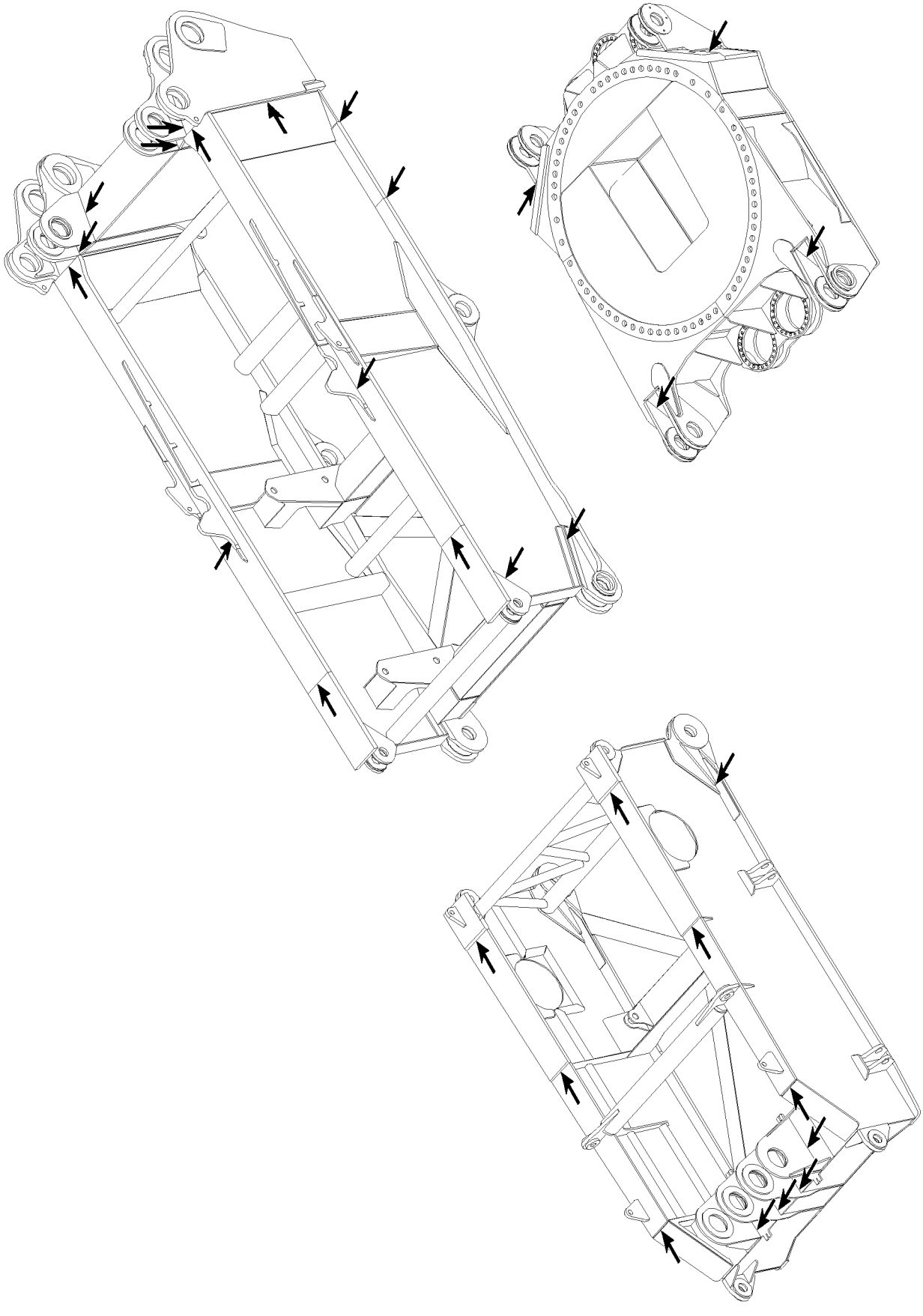

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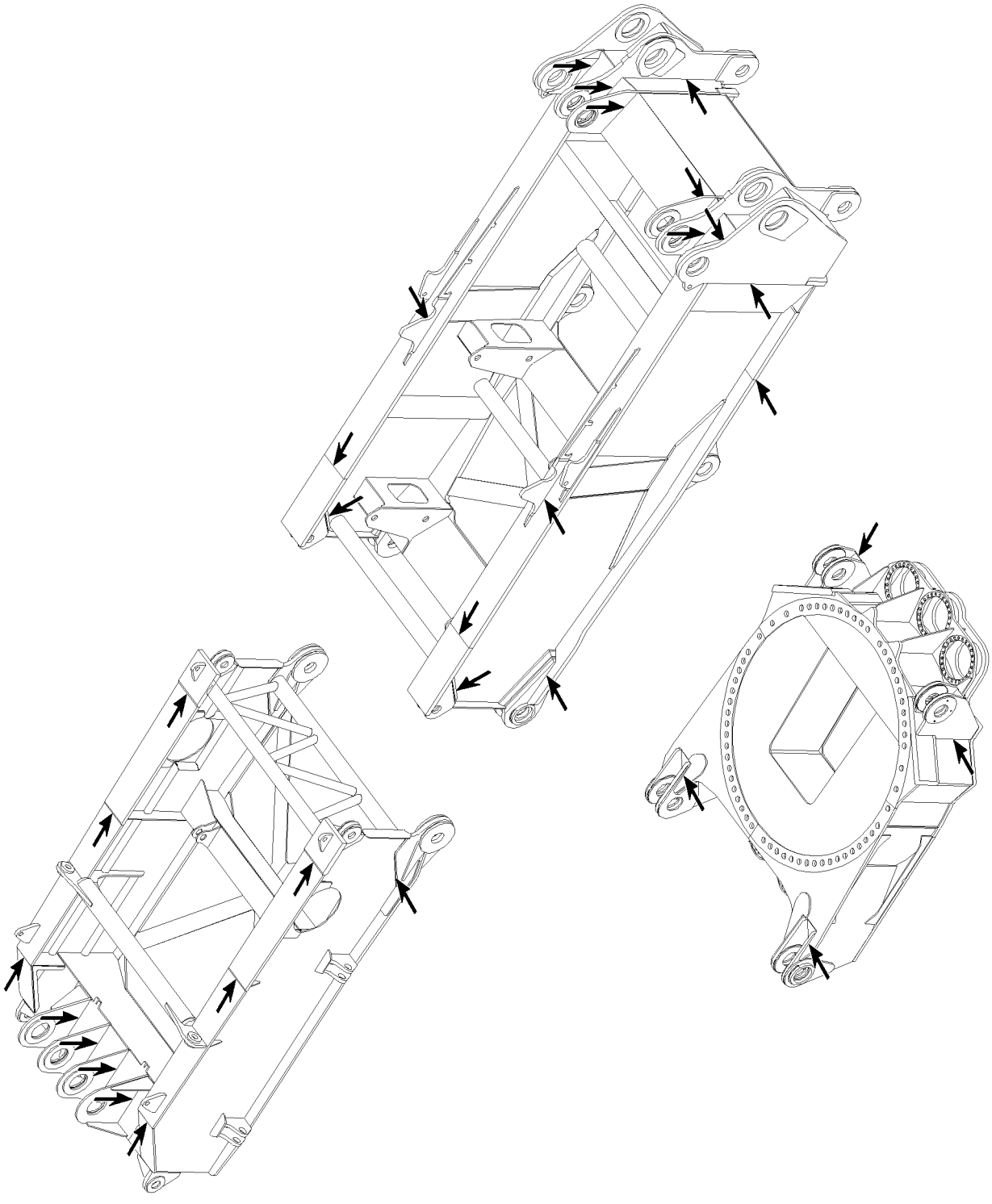

B105692

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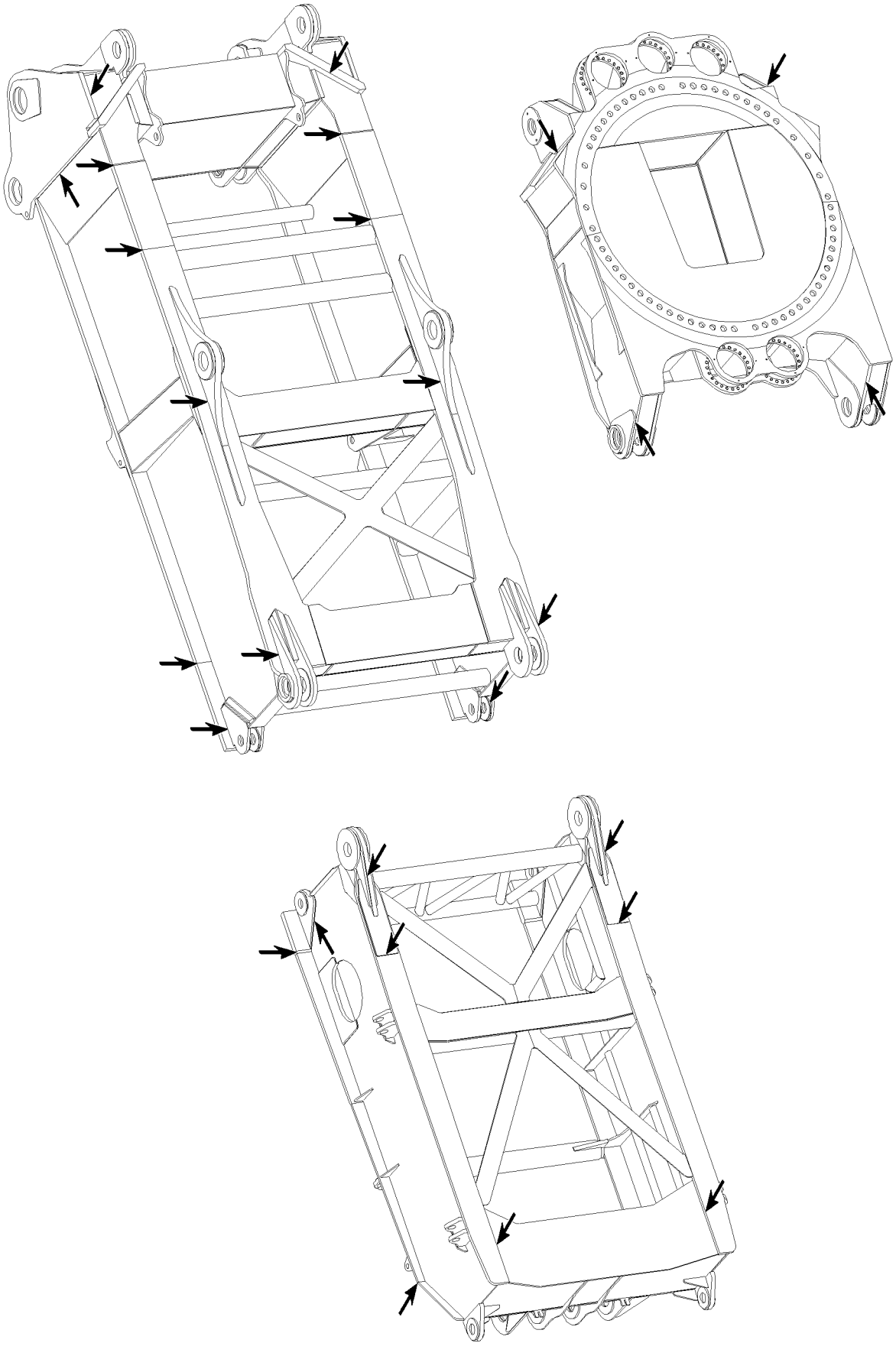
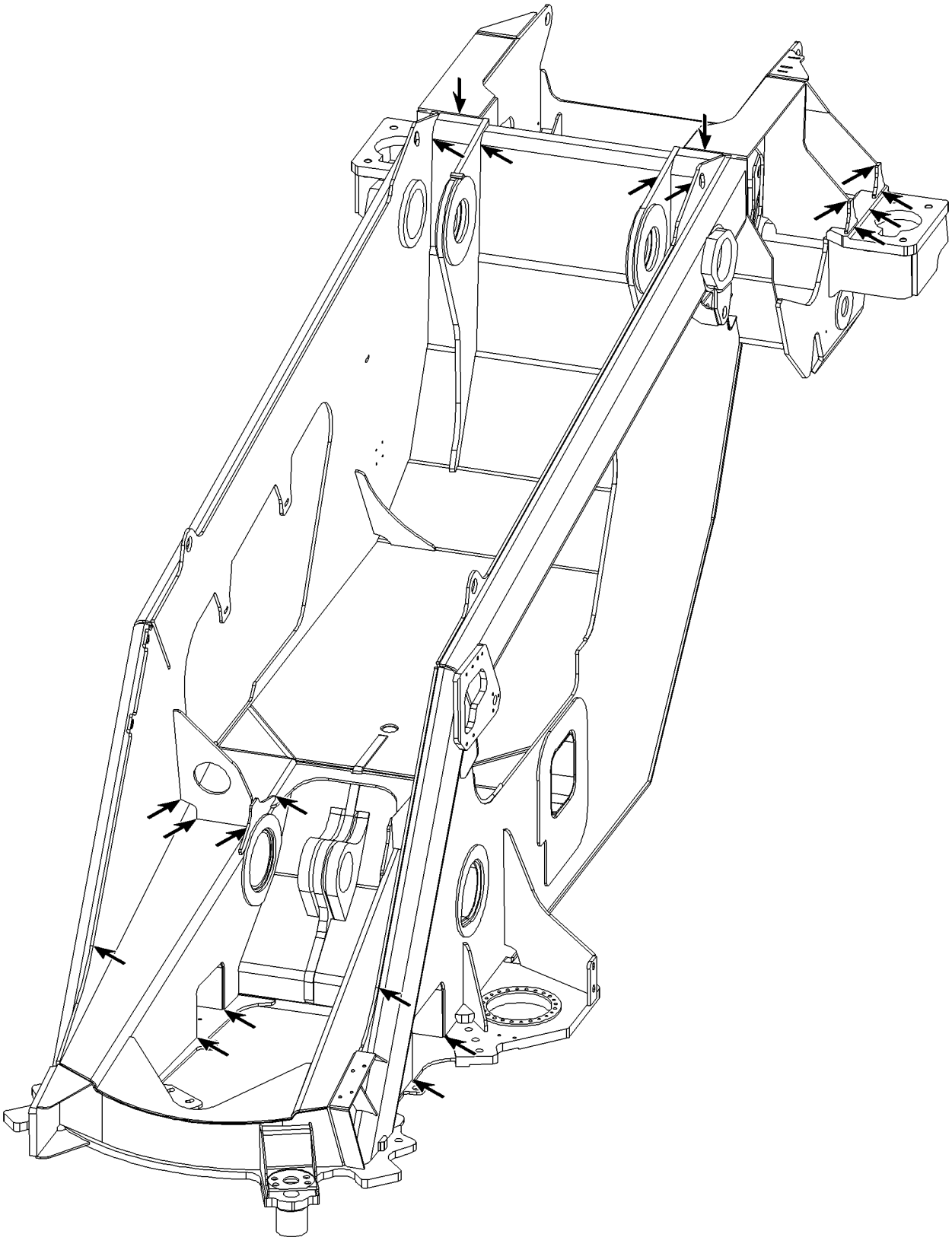
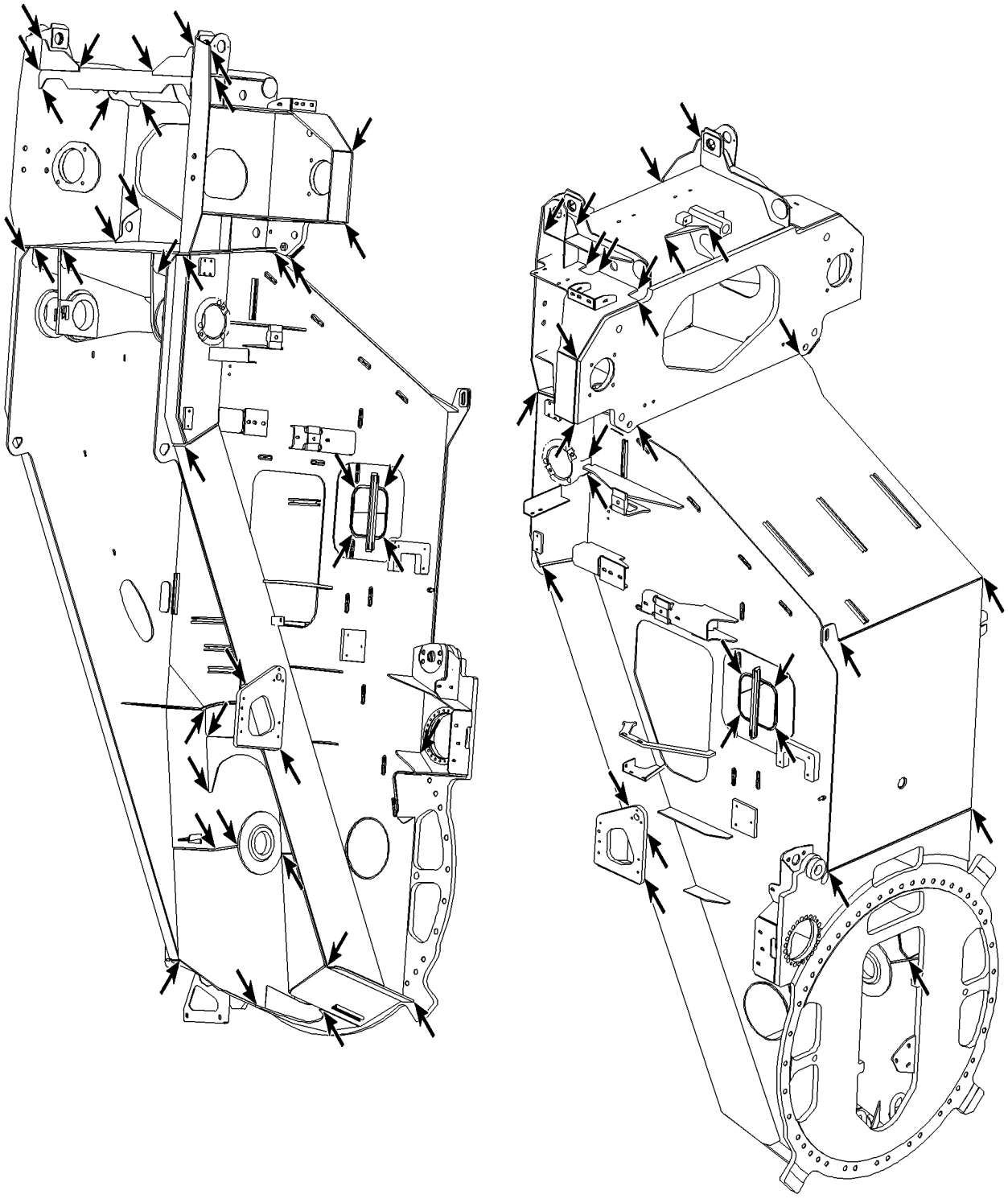


B105693

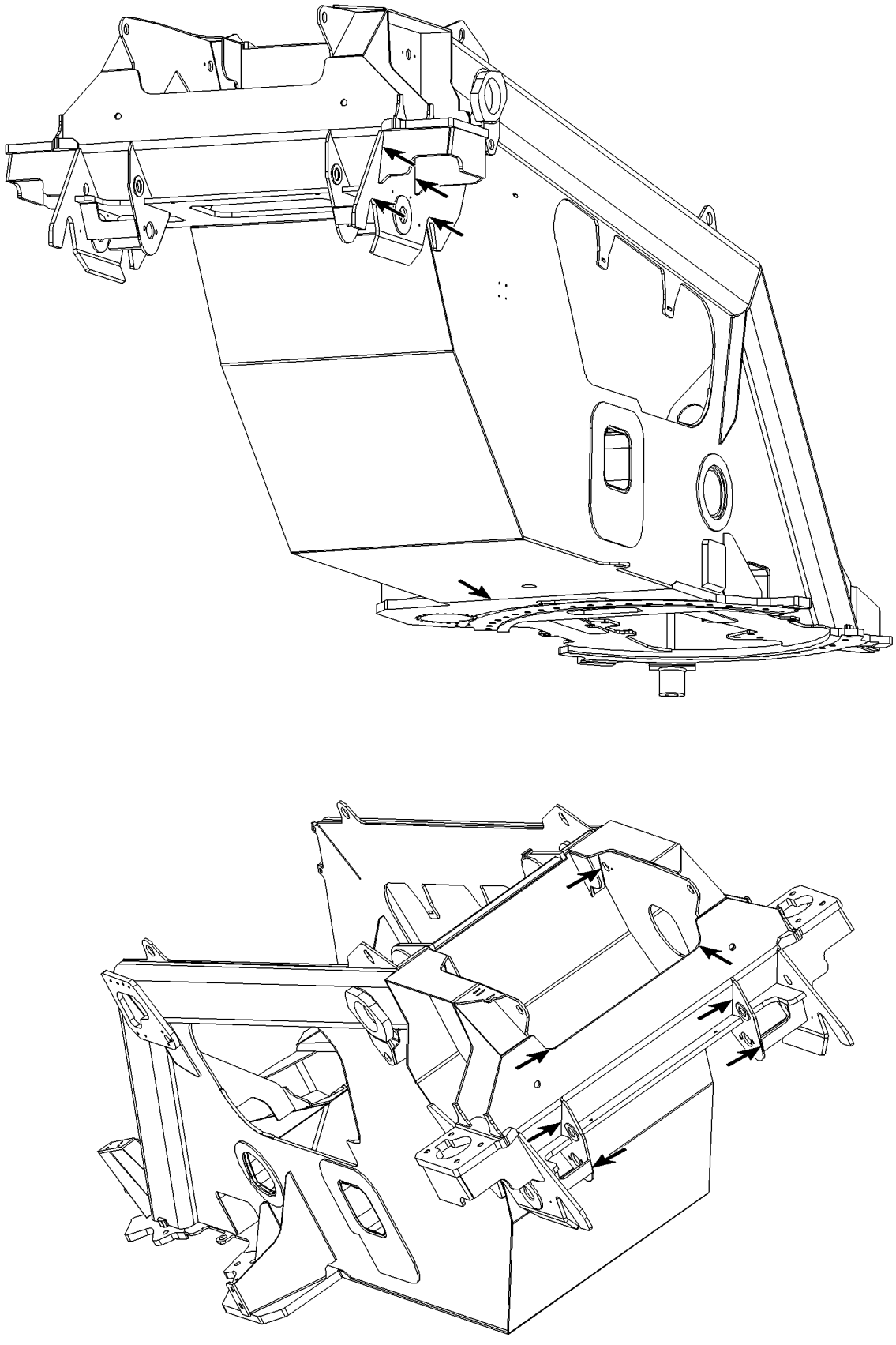
Example for turntable frame



B105722 *Example for turntable frame*

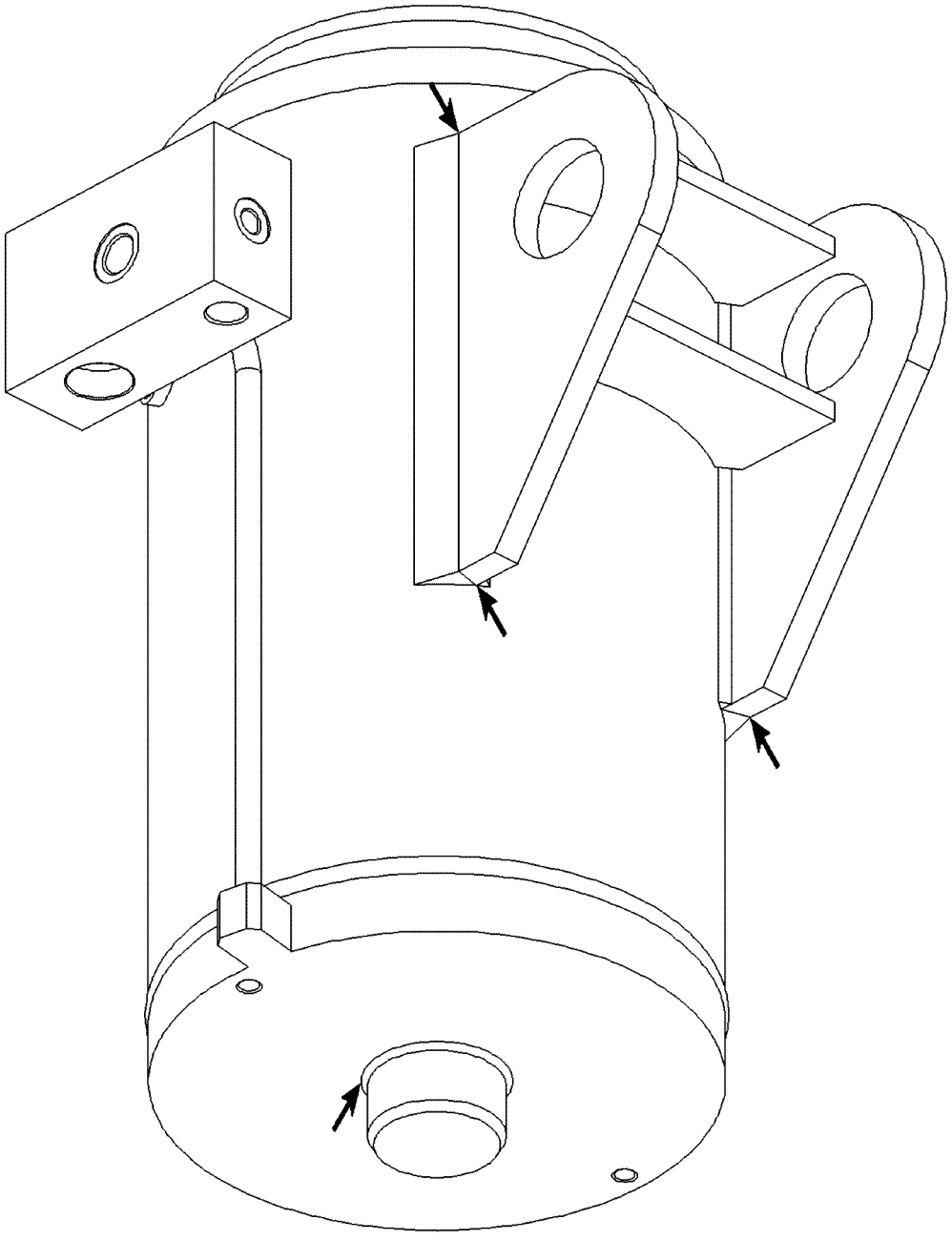


B105932 *Example for turntable frame*

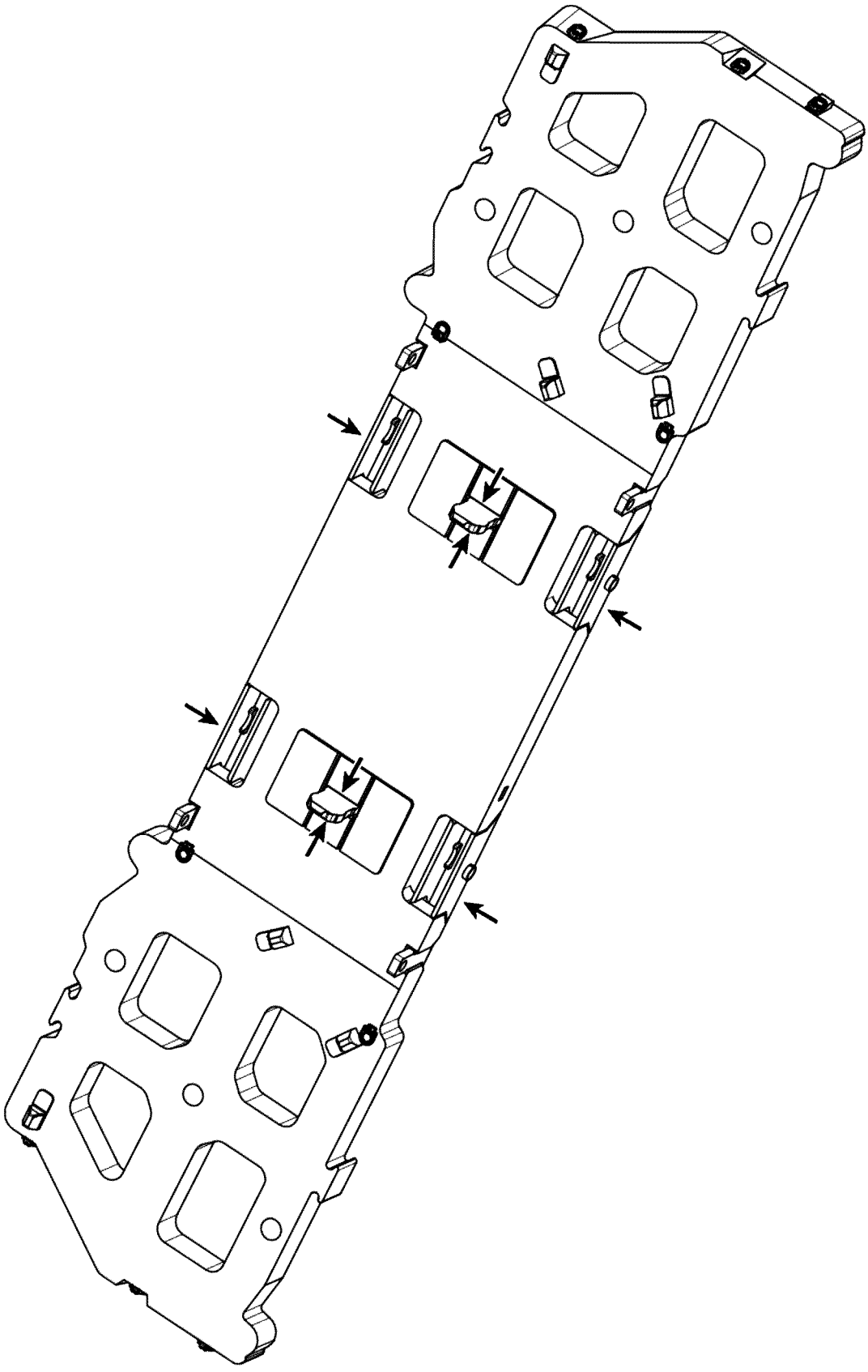


B105723

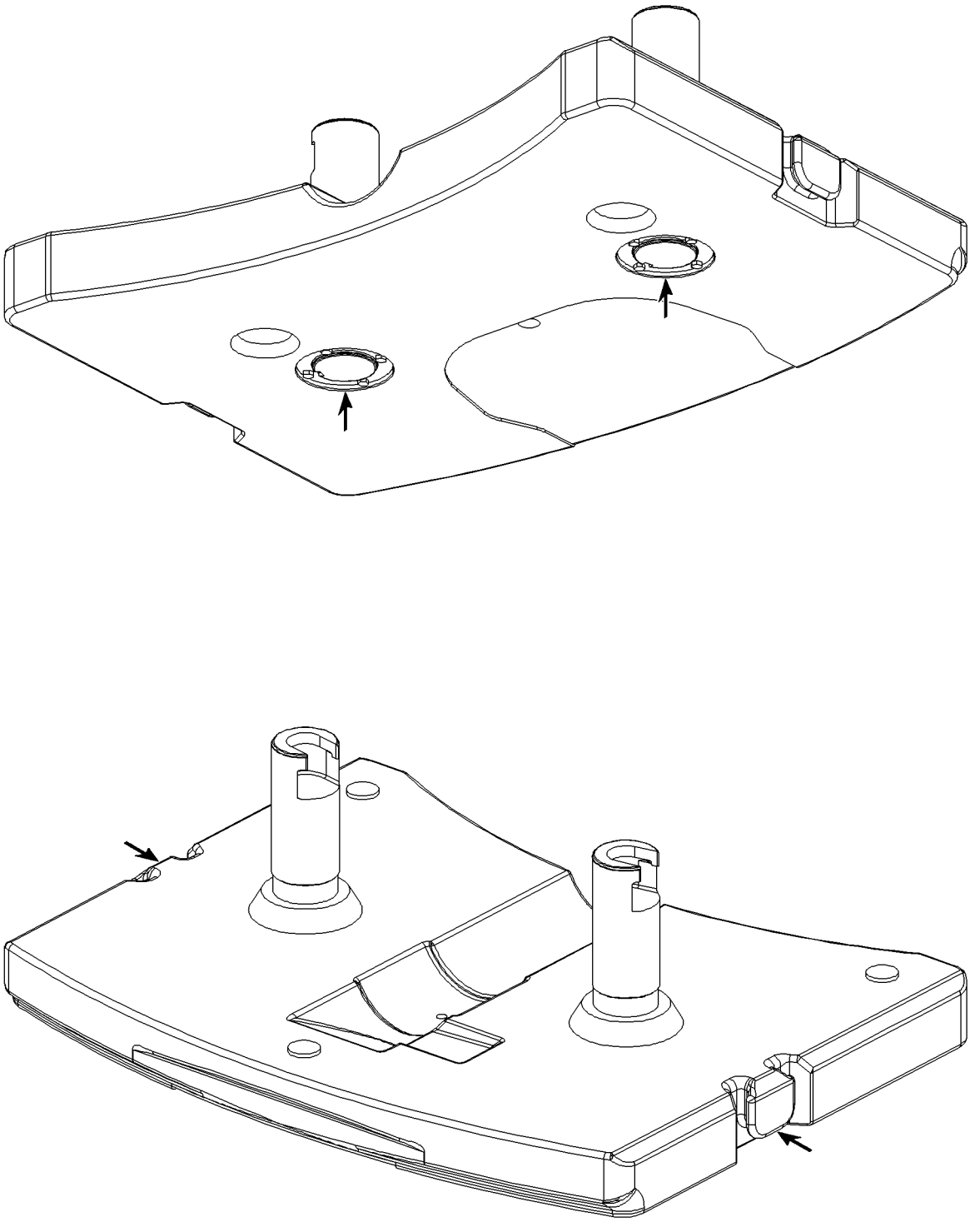
Example for turntable frame



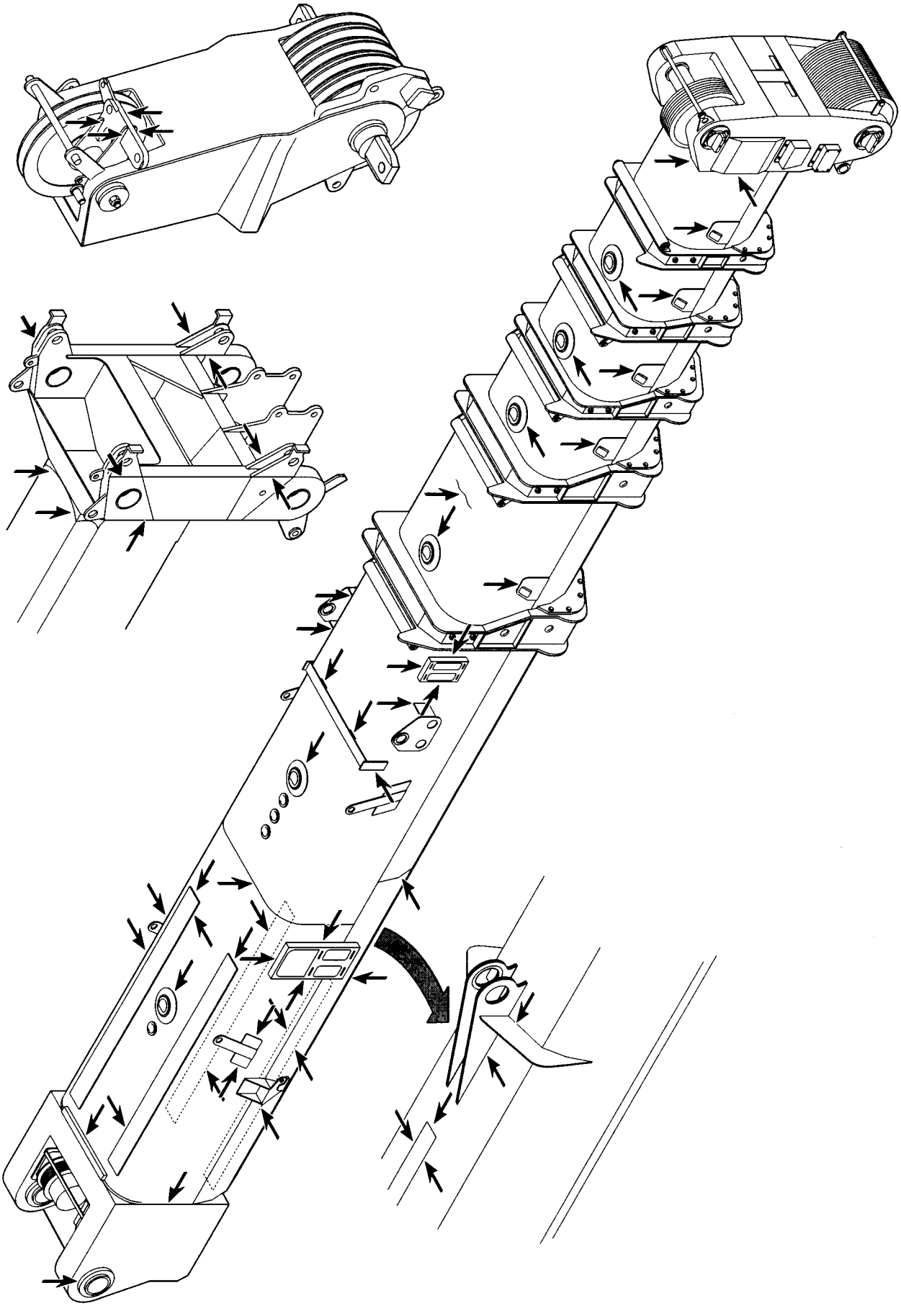
B105801 *Example for ballasting cylinder*



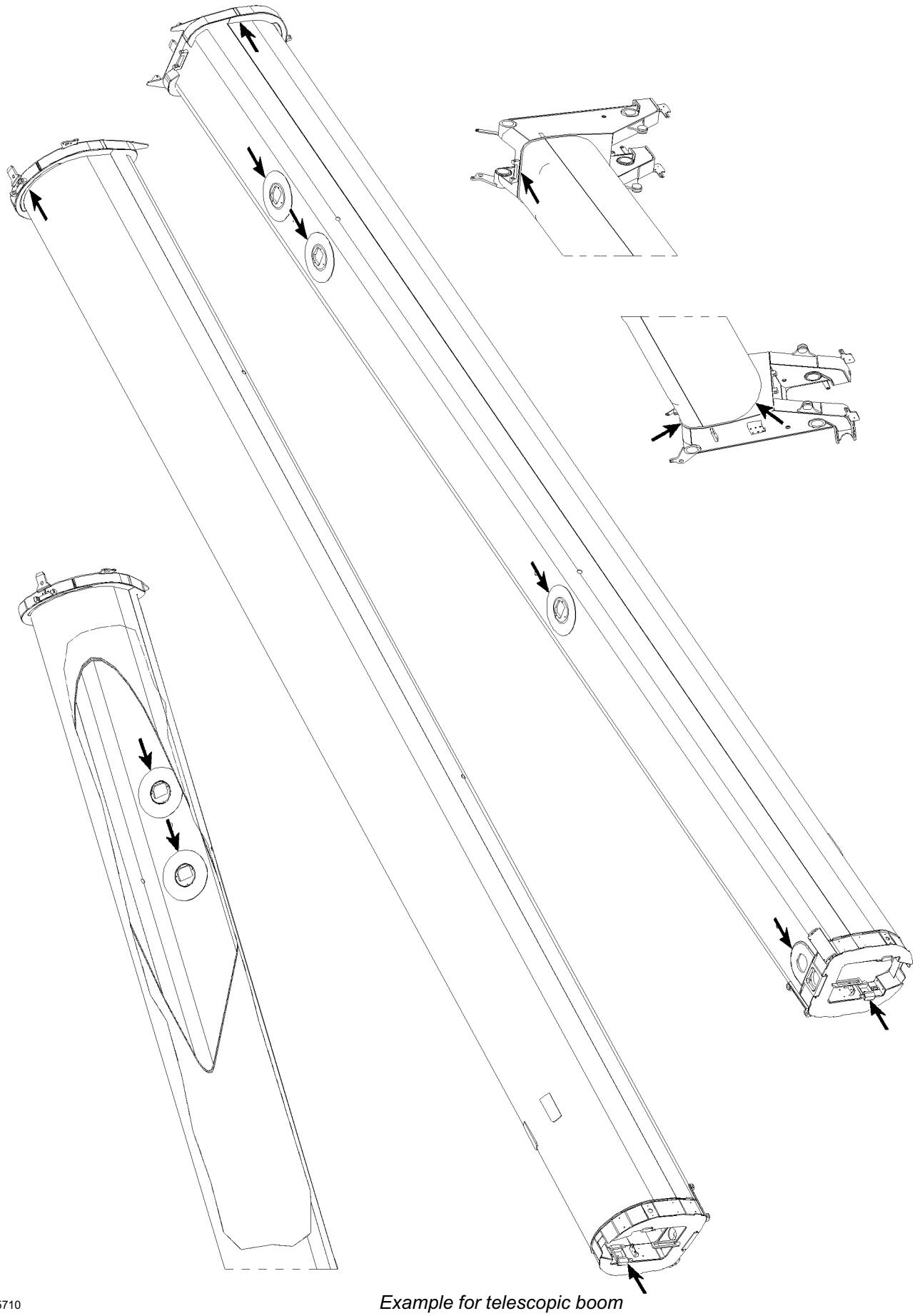
B105705 *Example for mounting plate*



B105807 *Example for base plate*

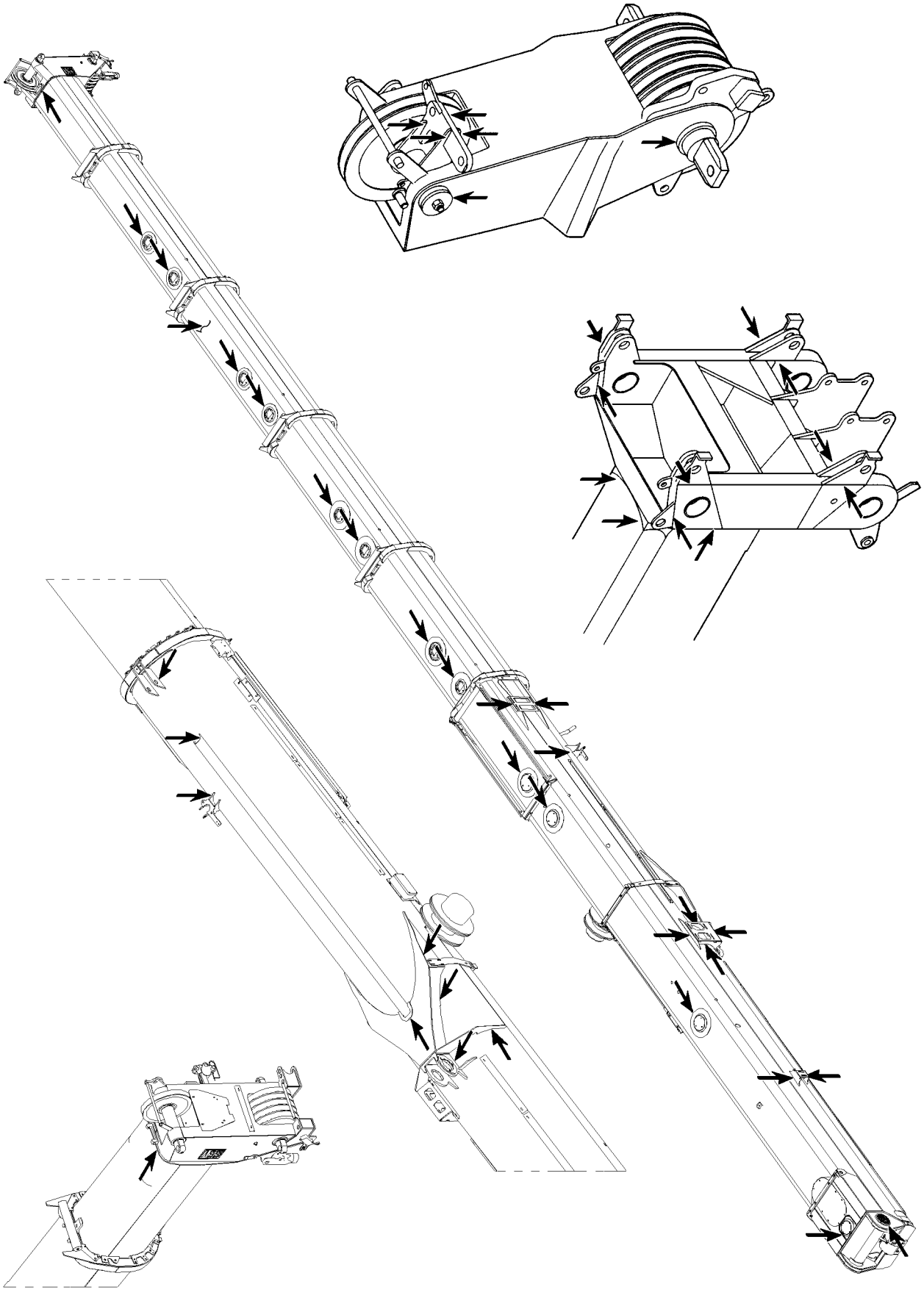


B185050 *Example for telescopic boom*



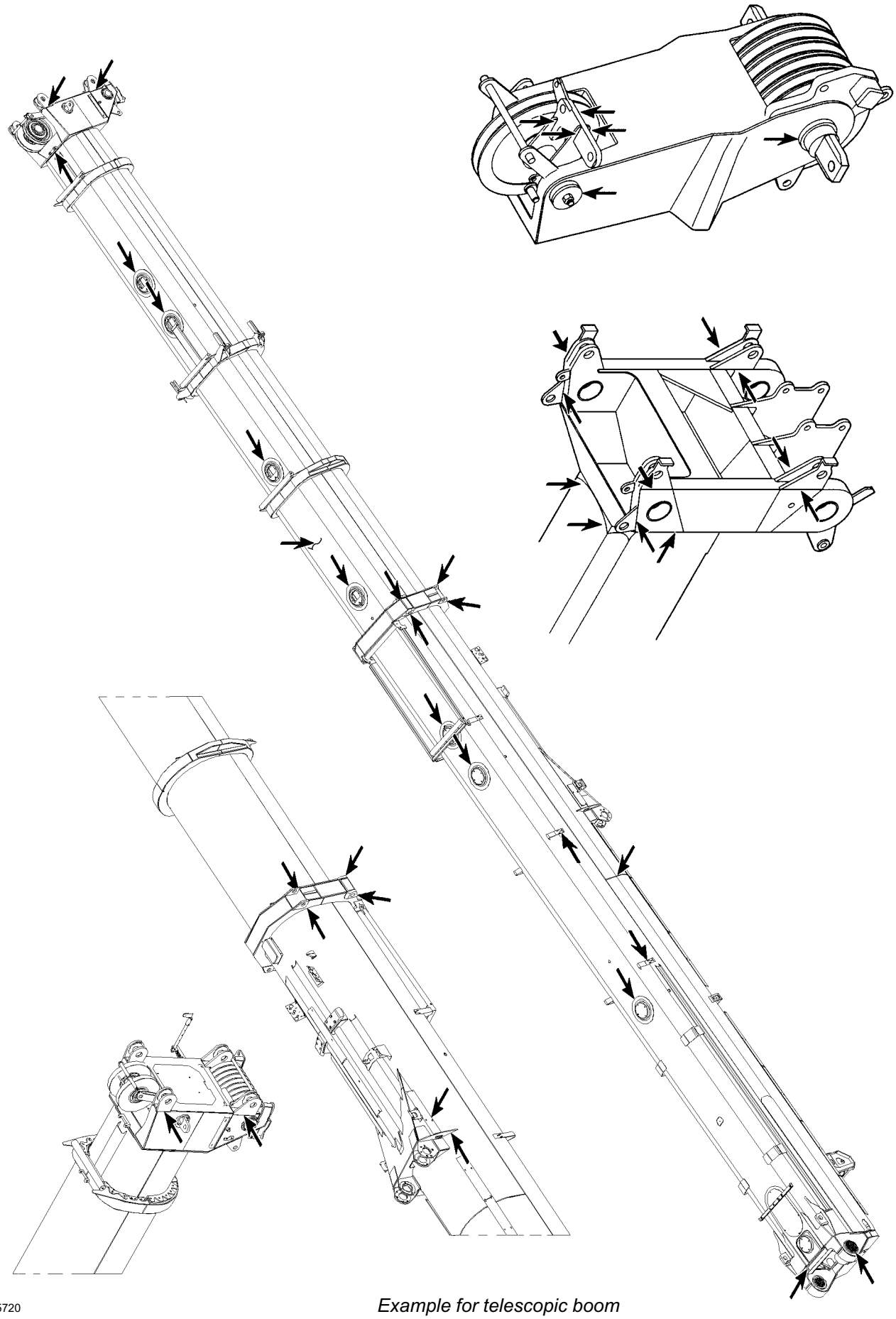
B105710

Example for telescopic boom



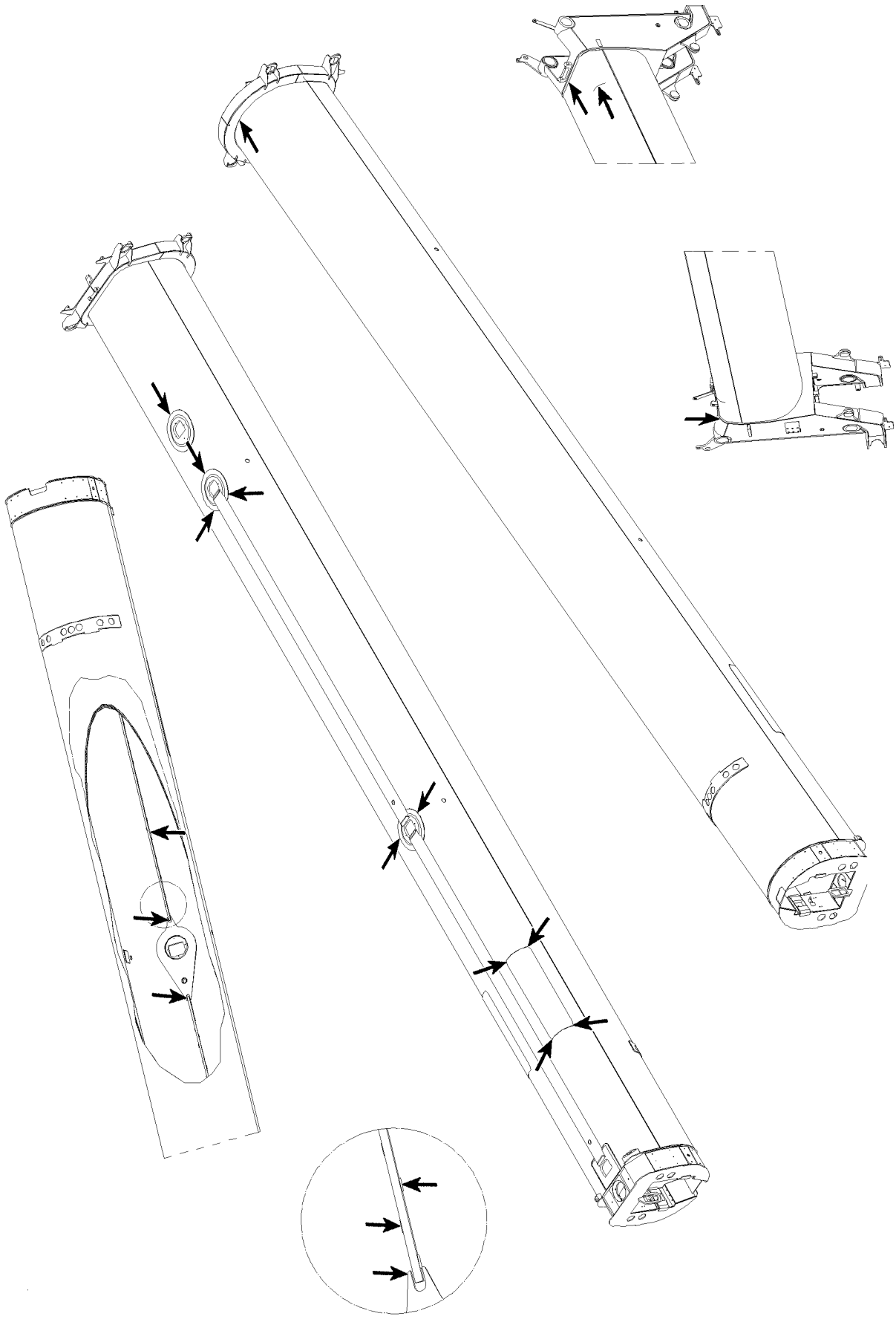
B105711

Example for telescopic boom



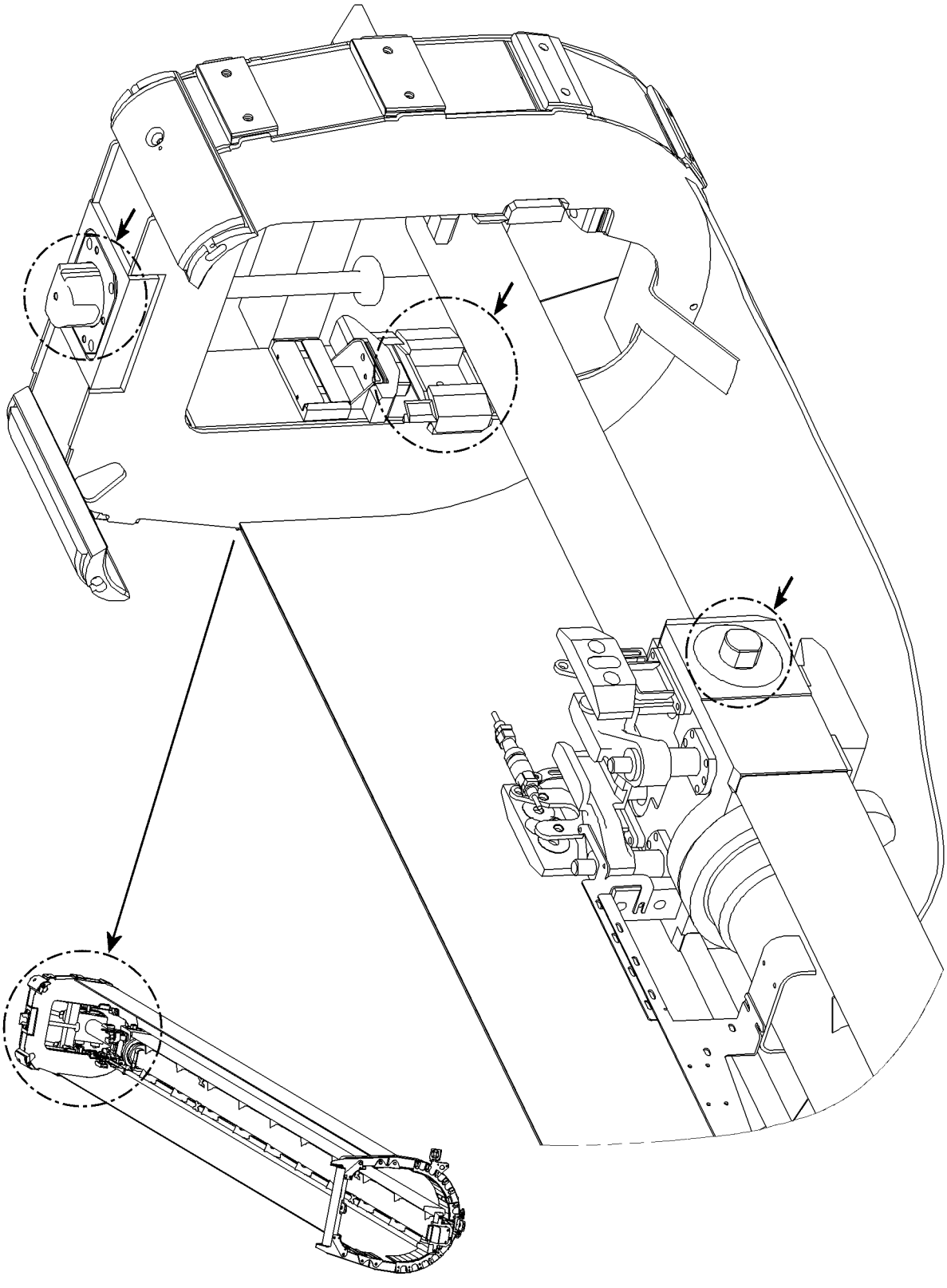
B105720

Example for telescopic boom

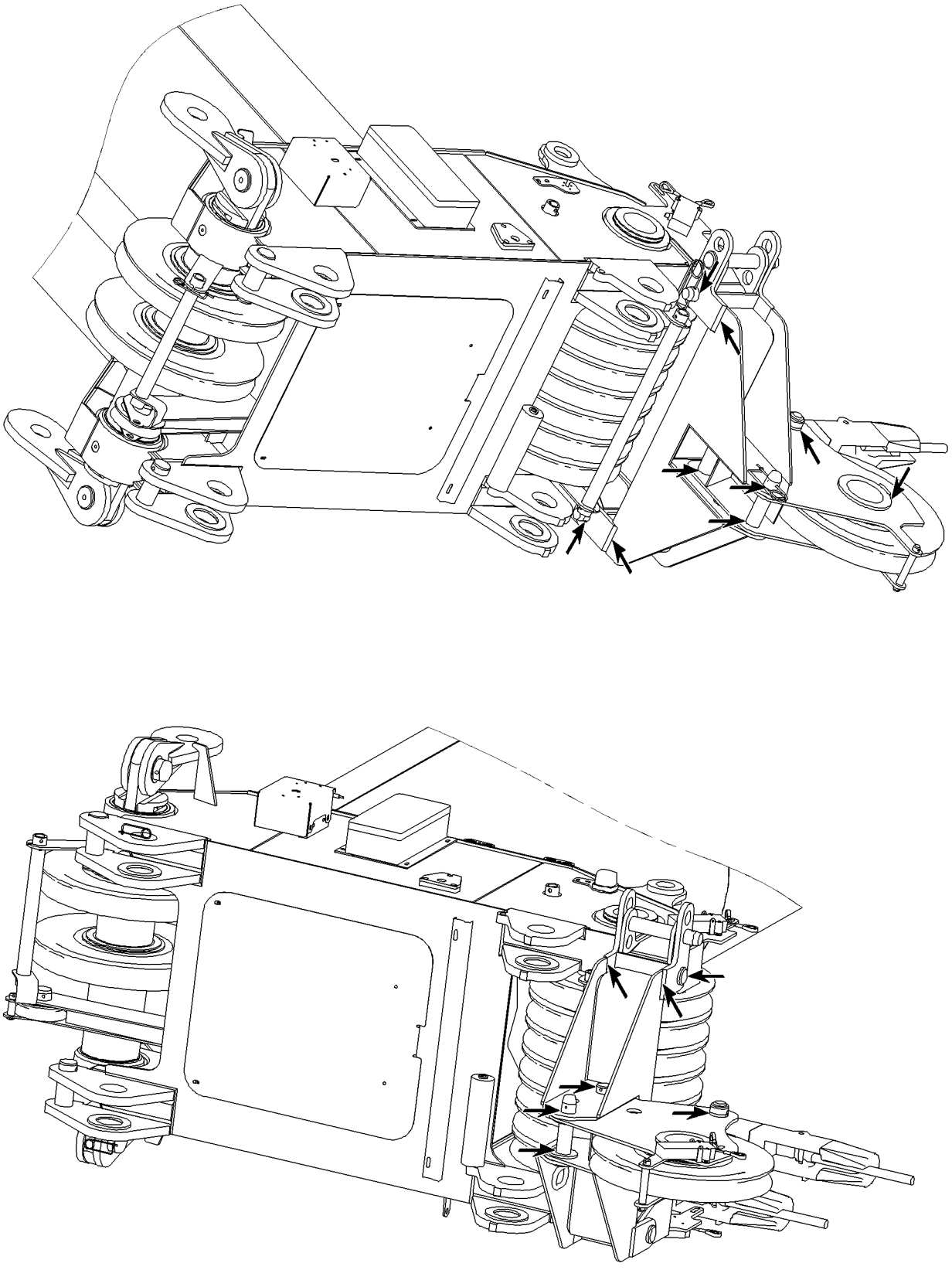


B105721

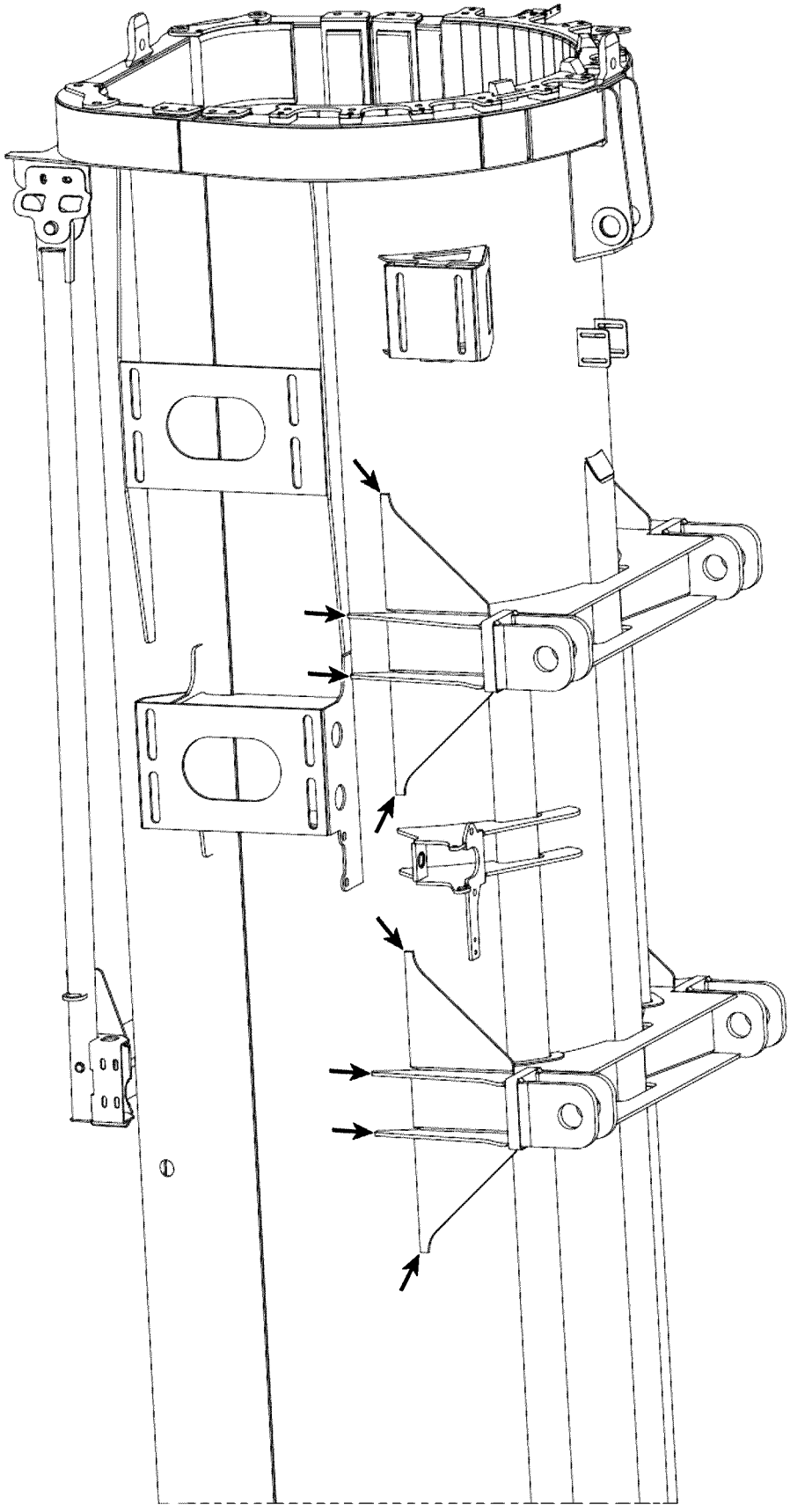
Example for telescopic boom



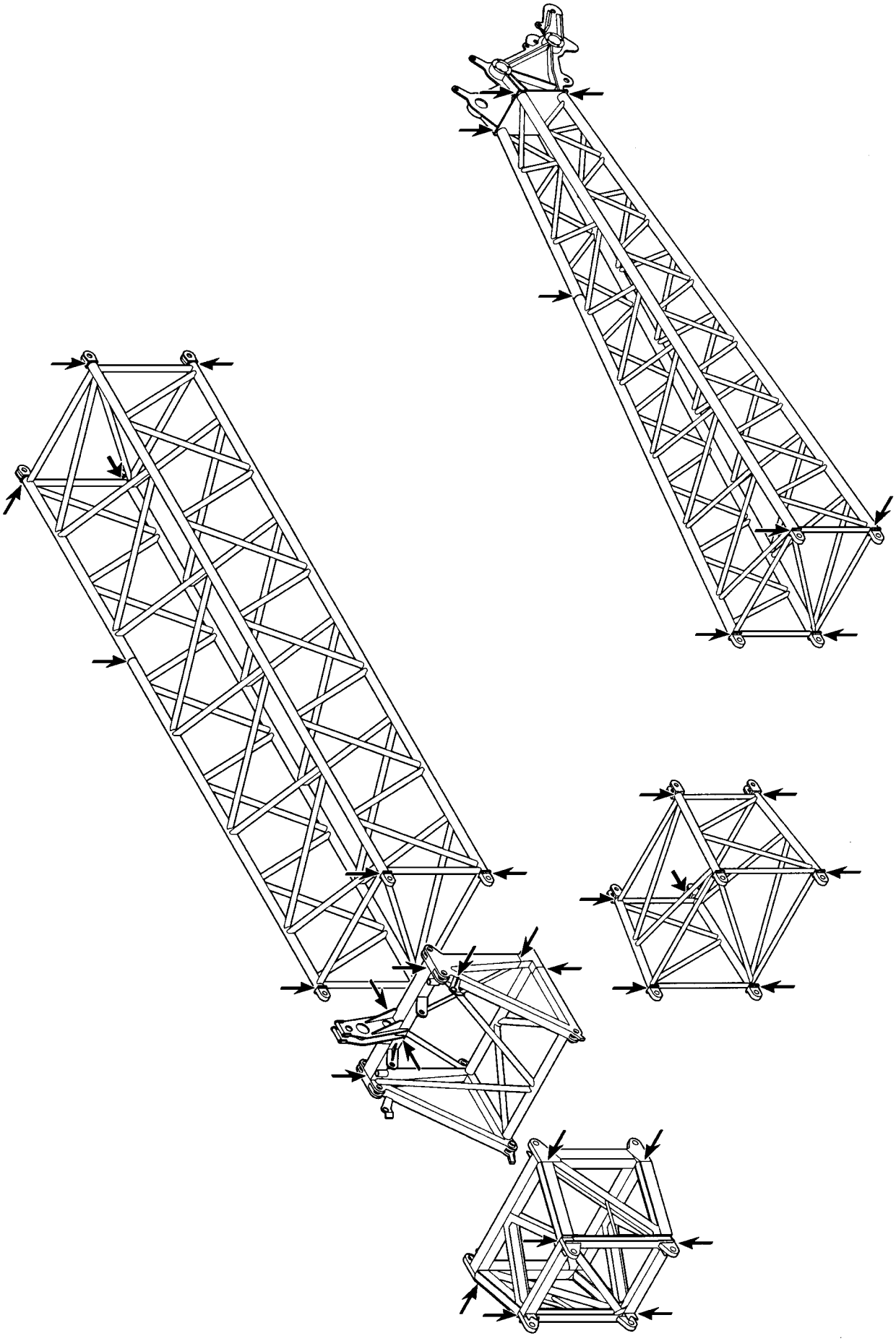
B105891 *Example for push out mechanics telescopic boom*



B105892 *Example for boom nose*

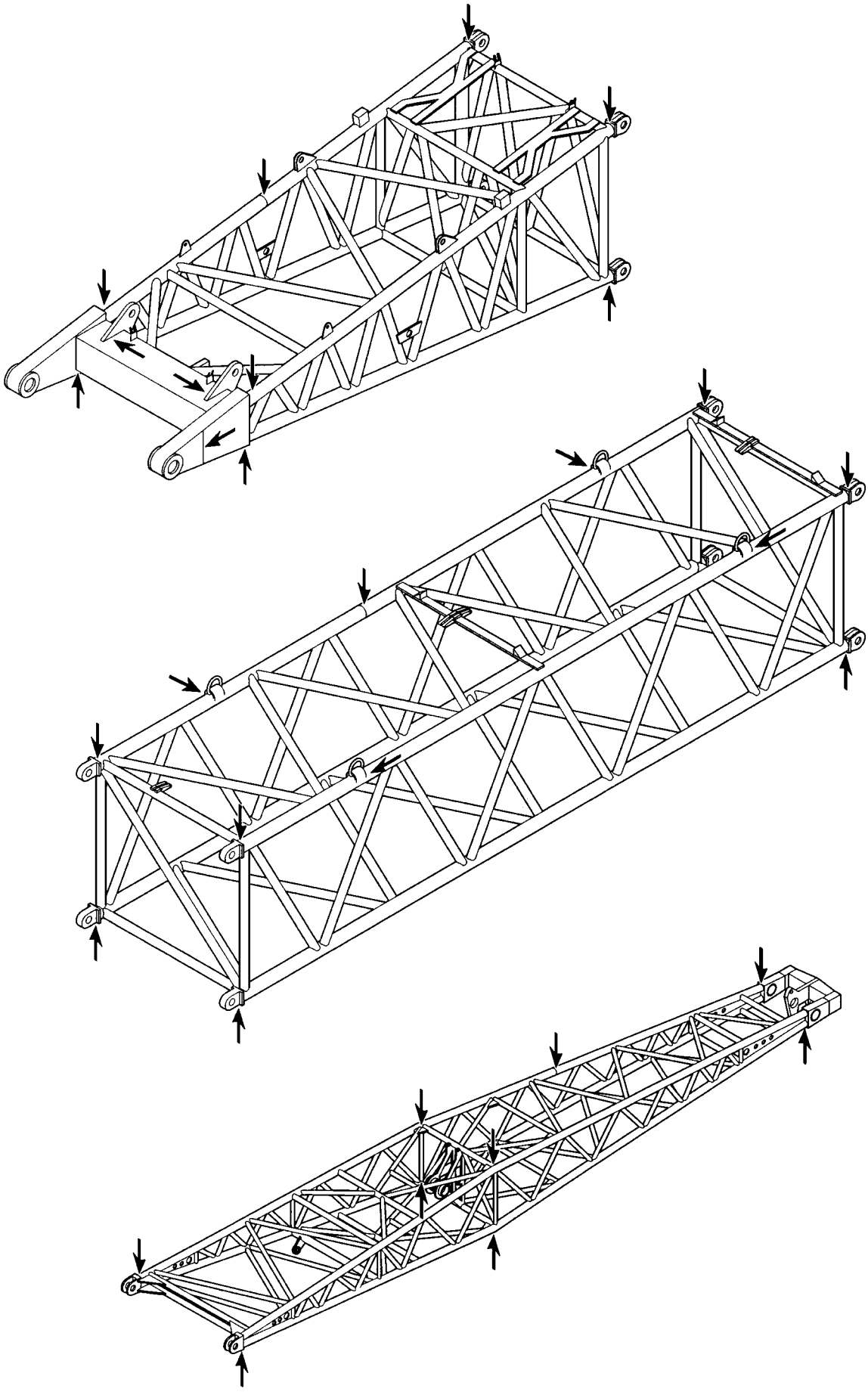


B105689 *Example for dolly console*



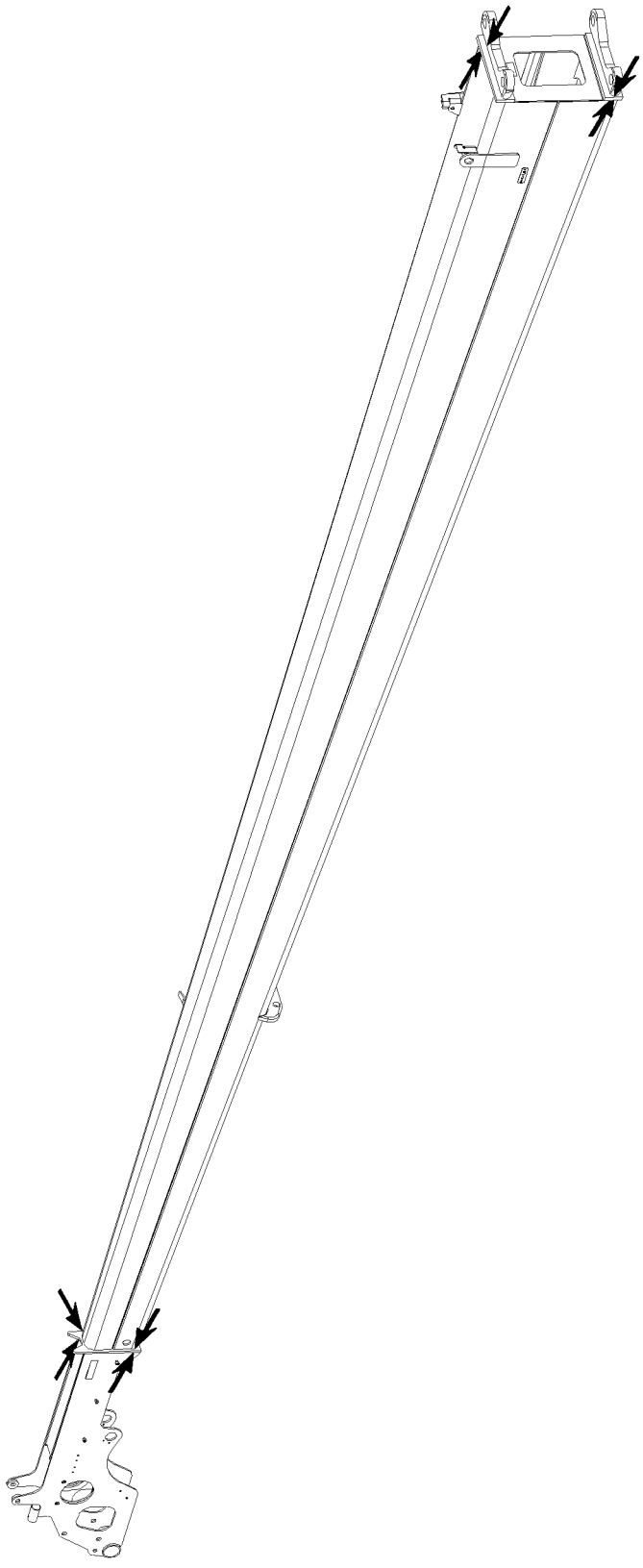
B185051

Example for lattice jib



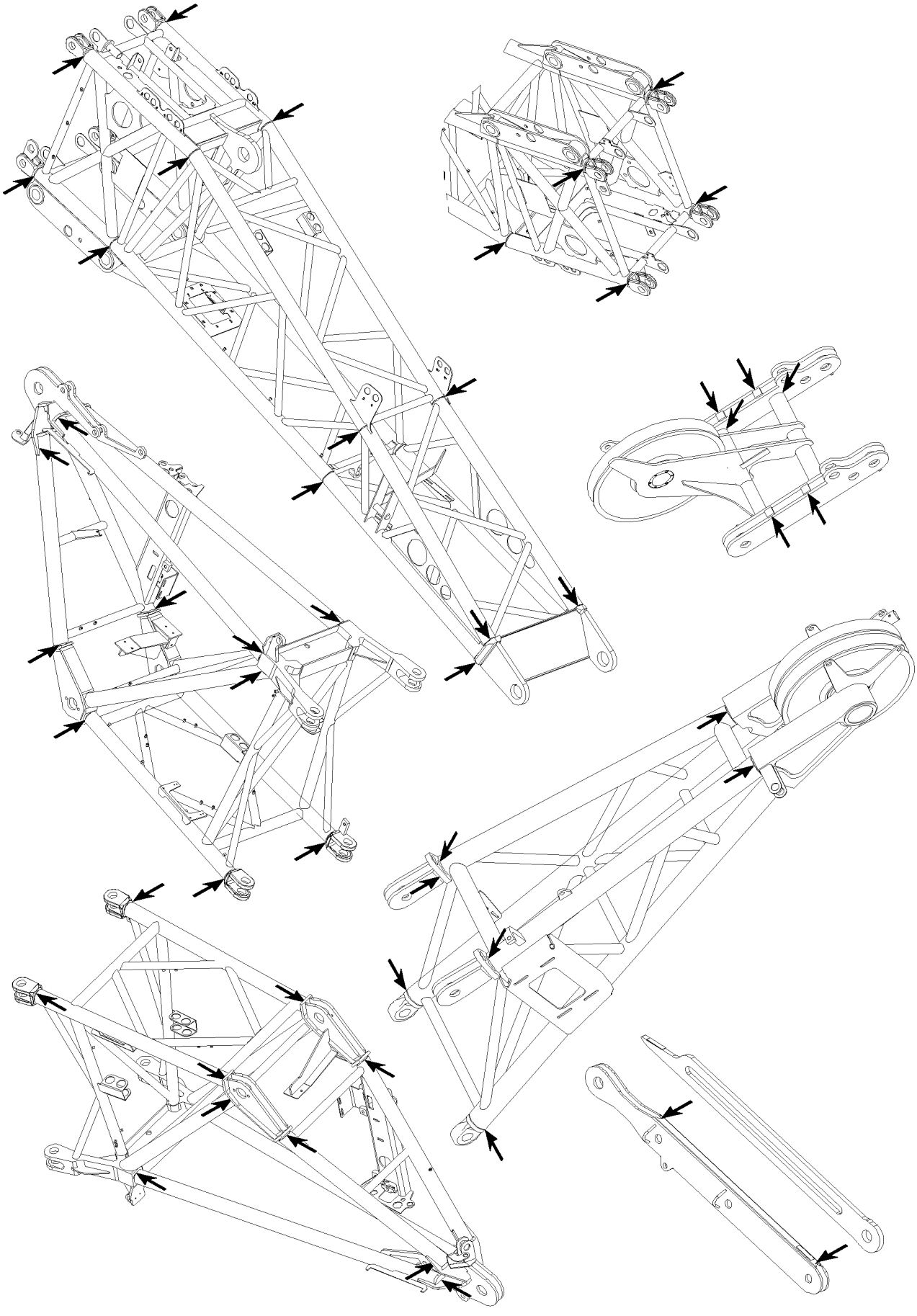
B185052

Example for NA / WA frame



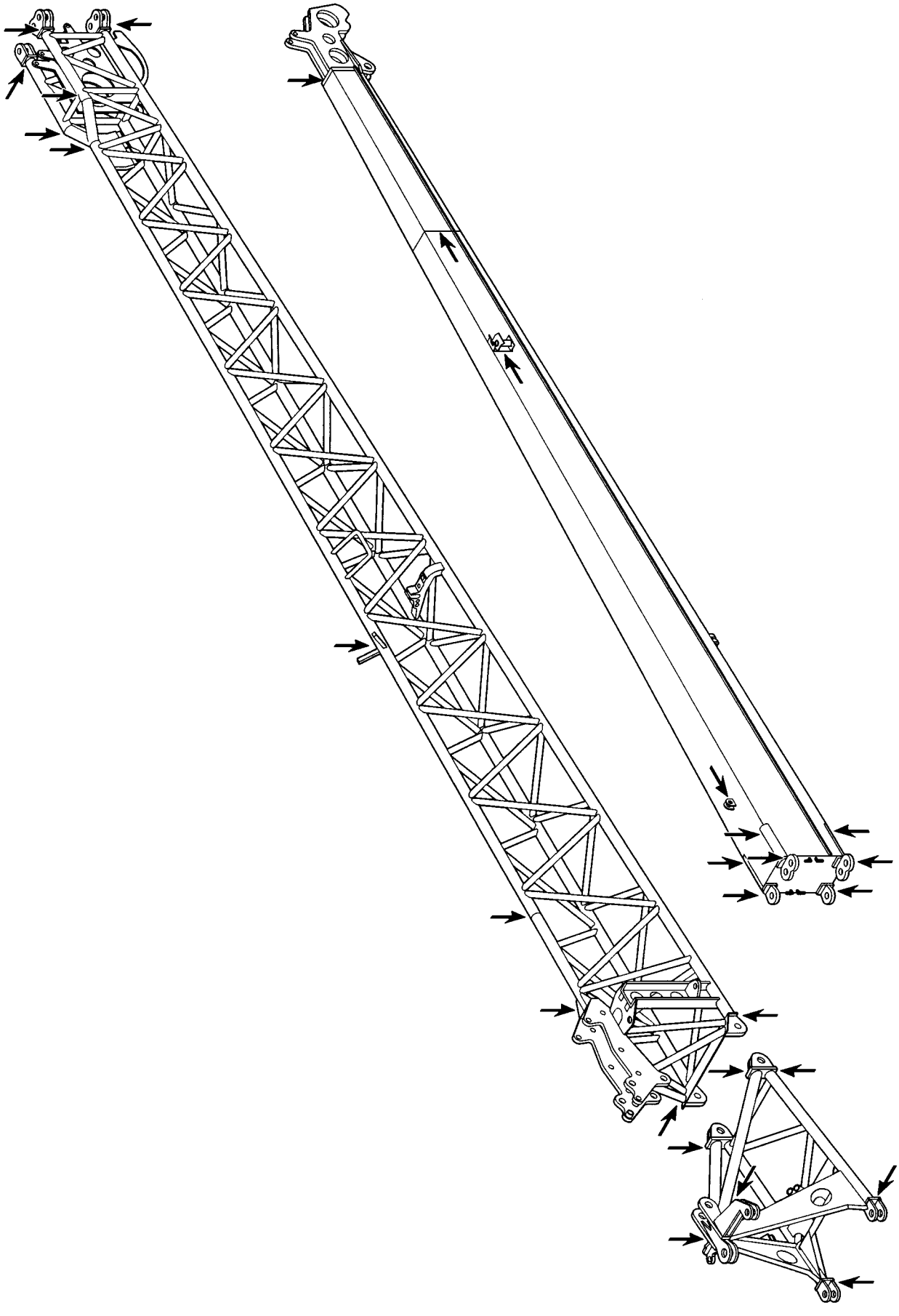
B105713

Example for end section



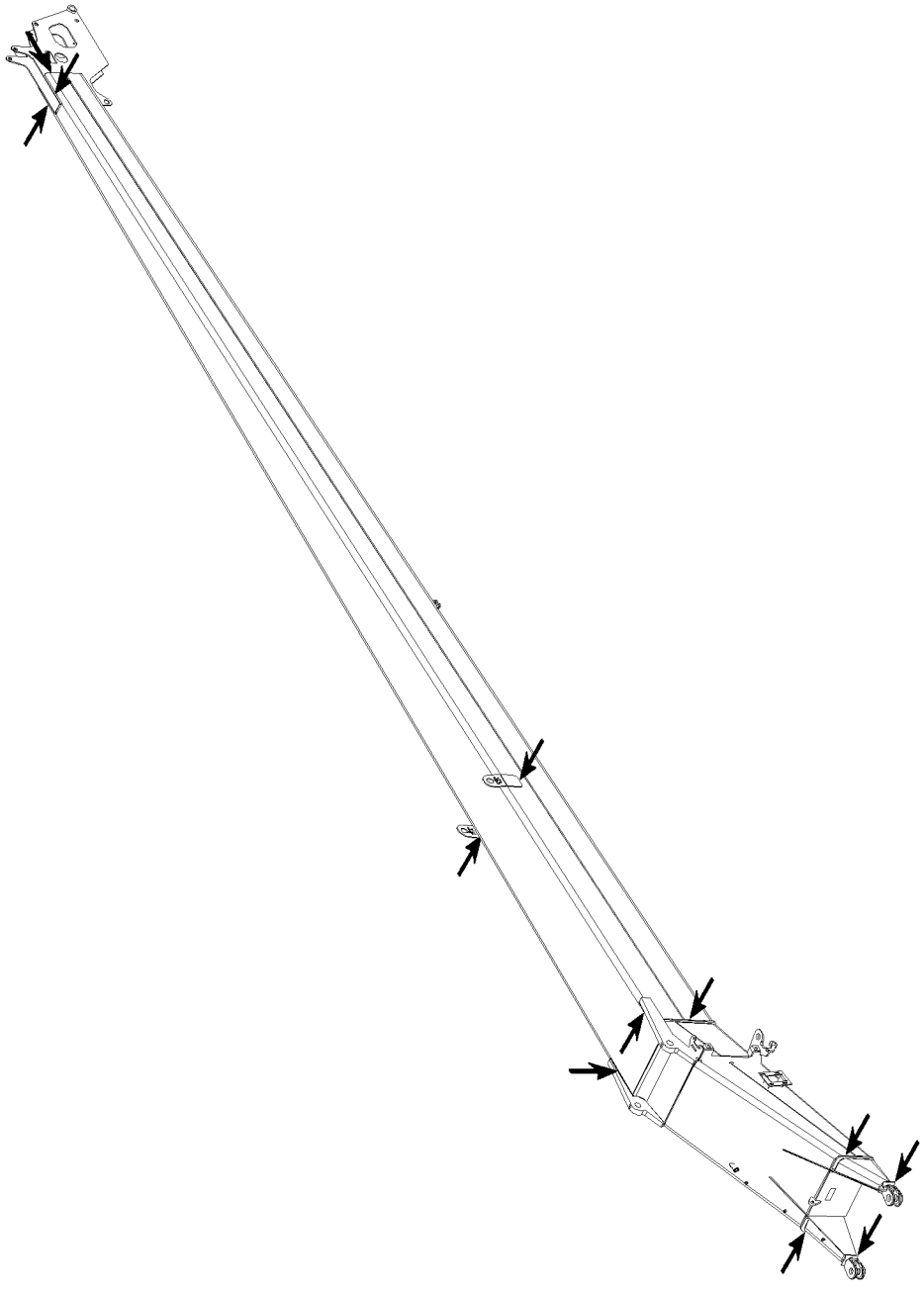
B105836

Example for pivot section, adapter and boom nose

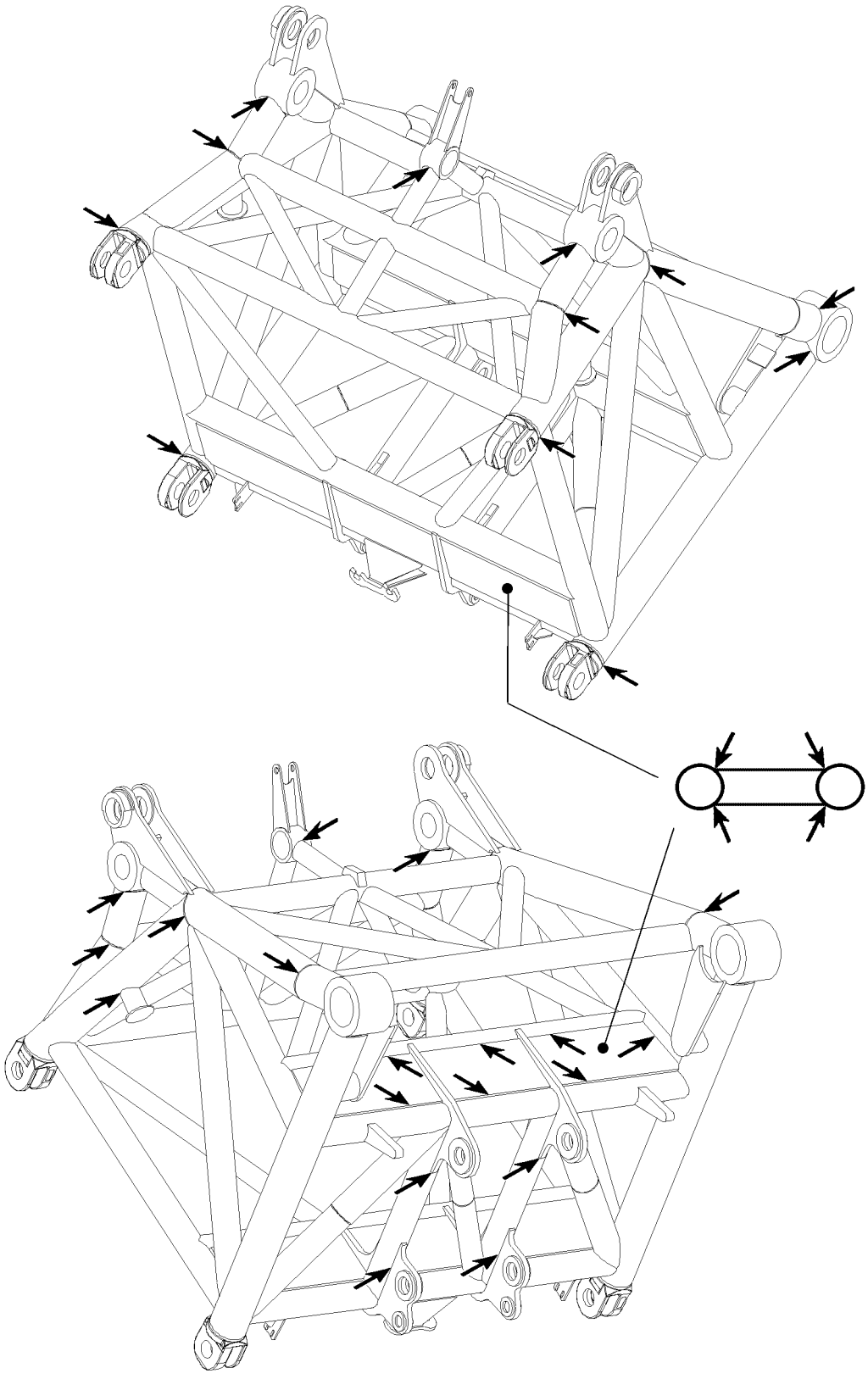


B185058

Example for folding jib

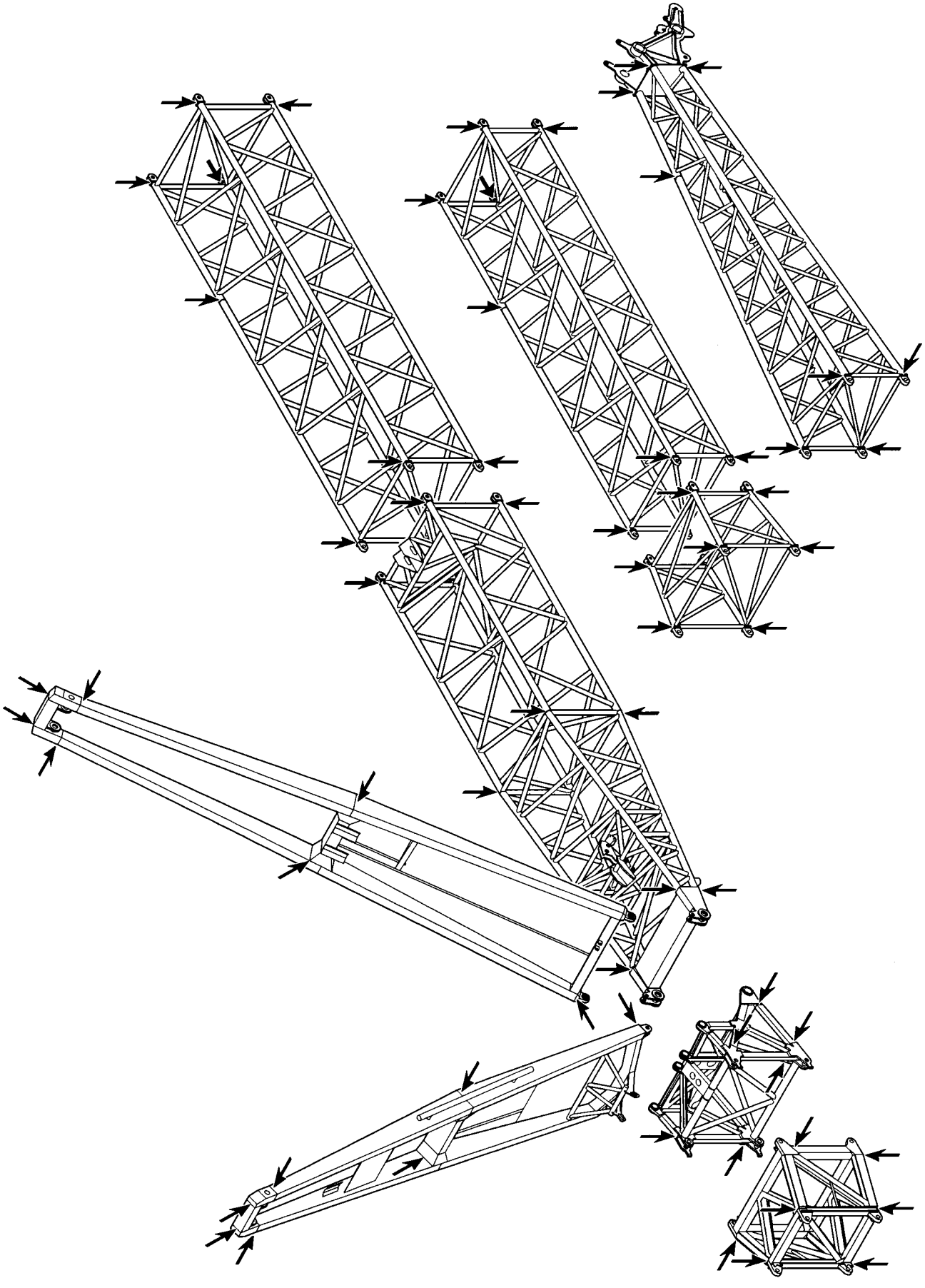


B105697 *Example for folding jib*



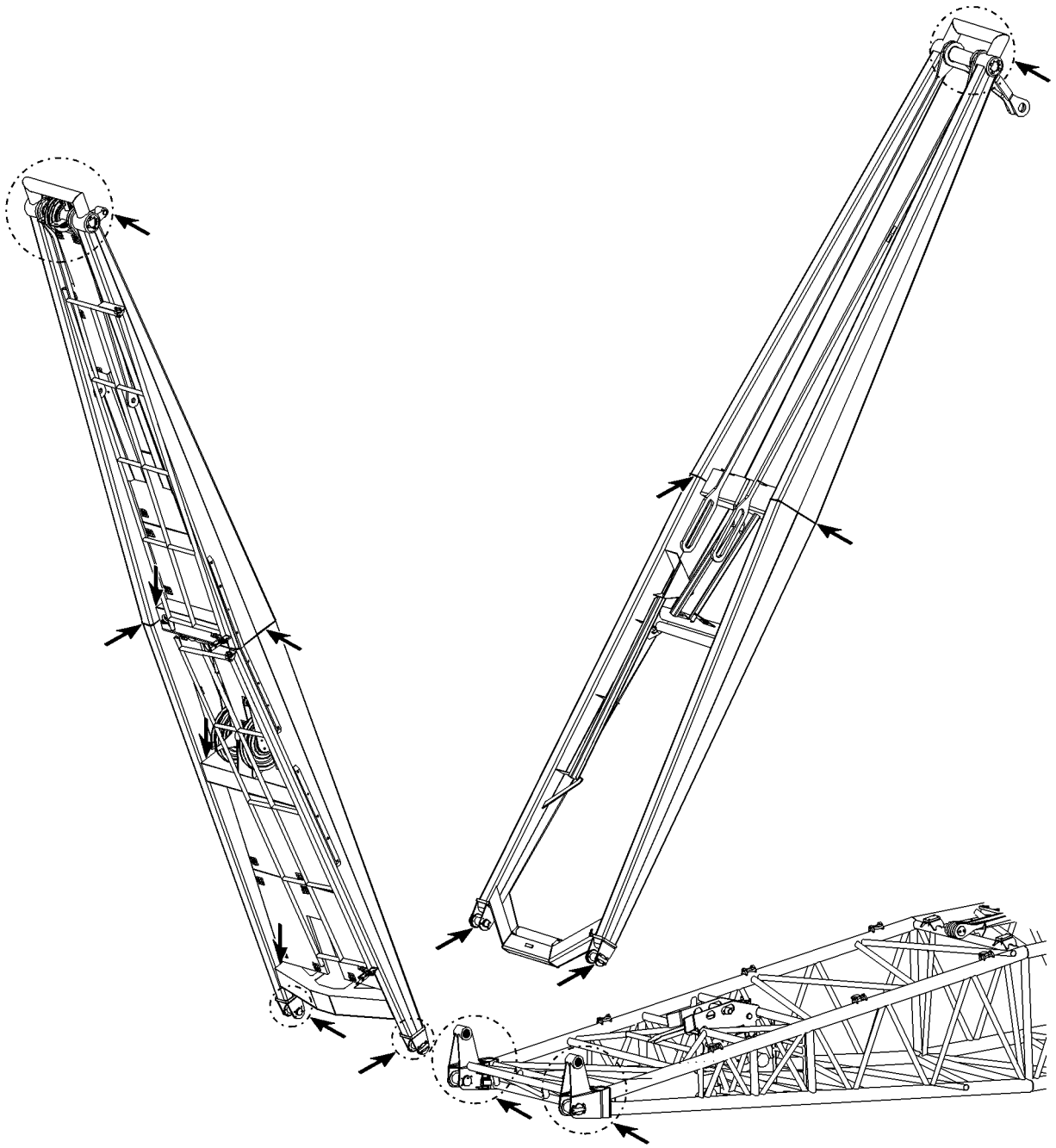
B105732

Example for W-connector head



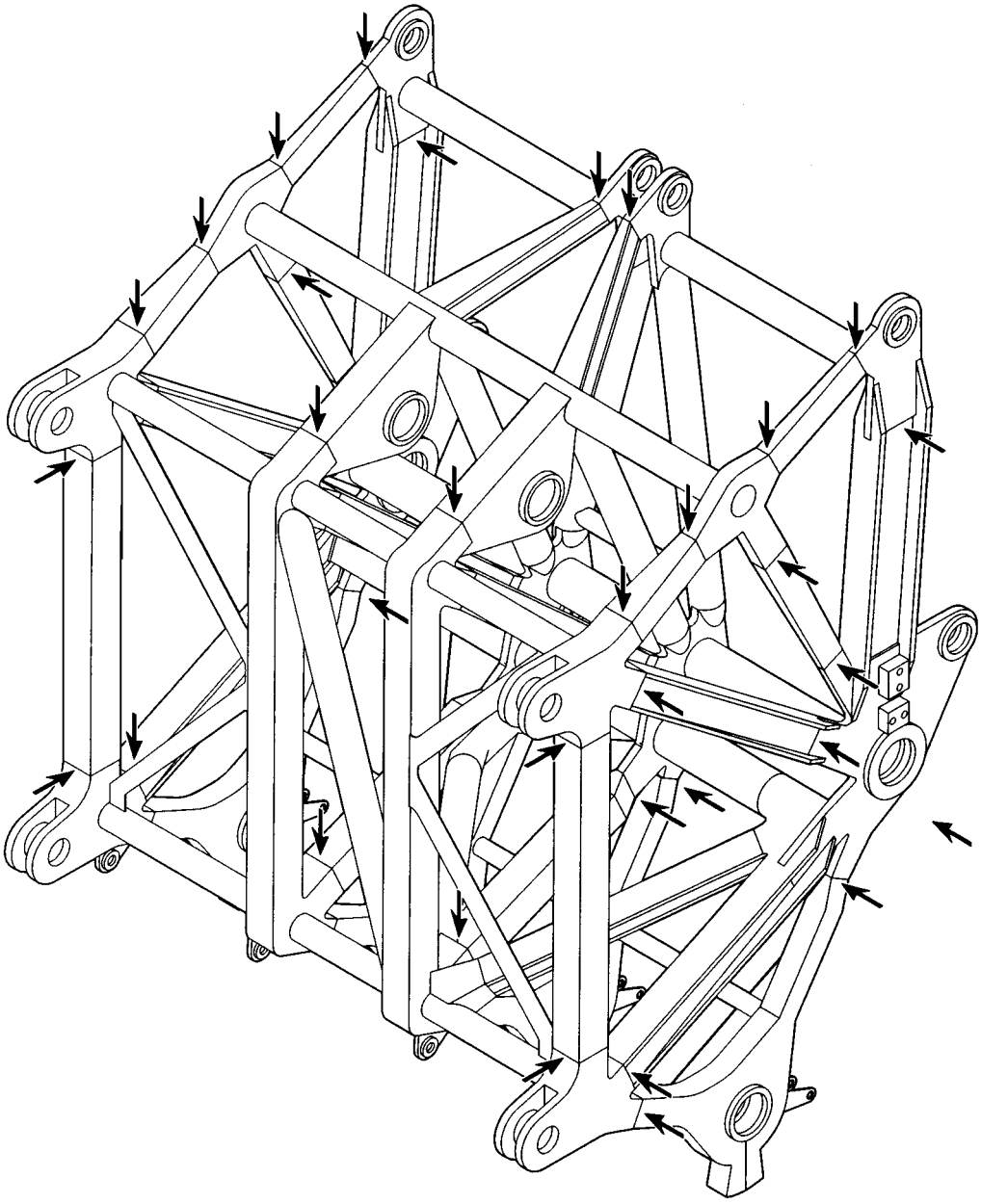
B185053

Example for assembly unit with lattice jib

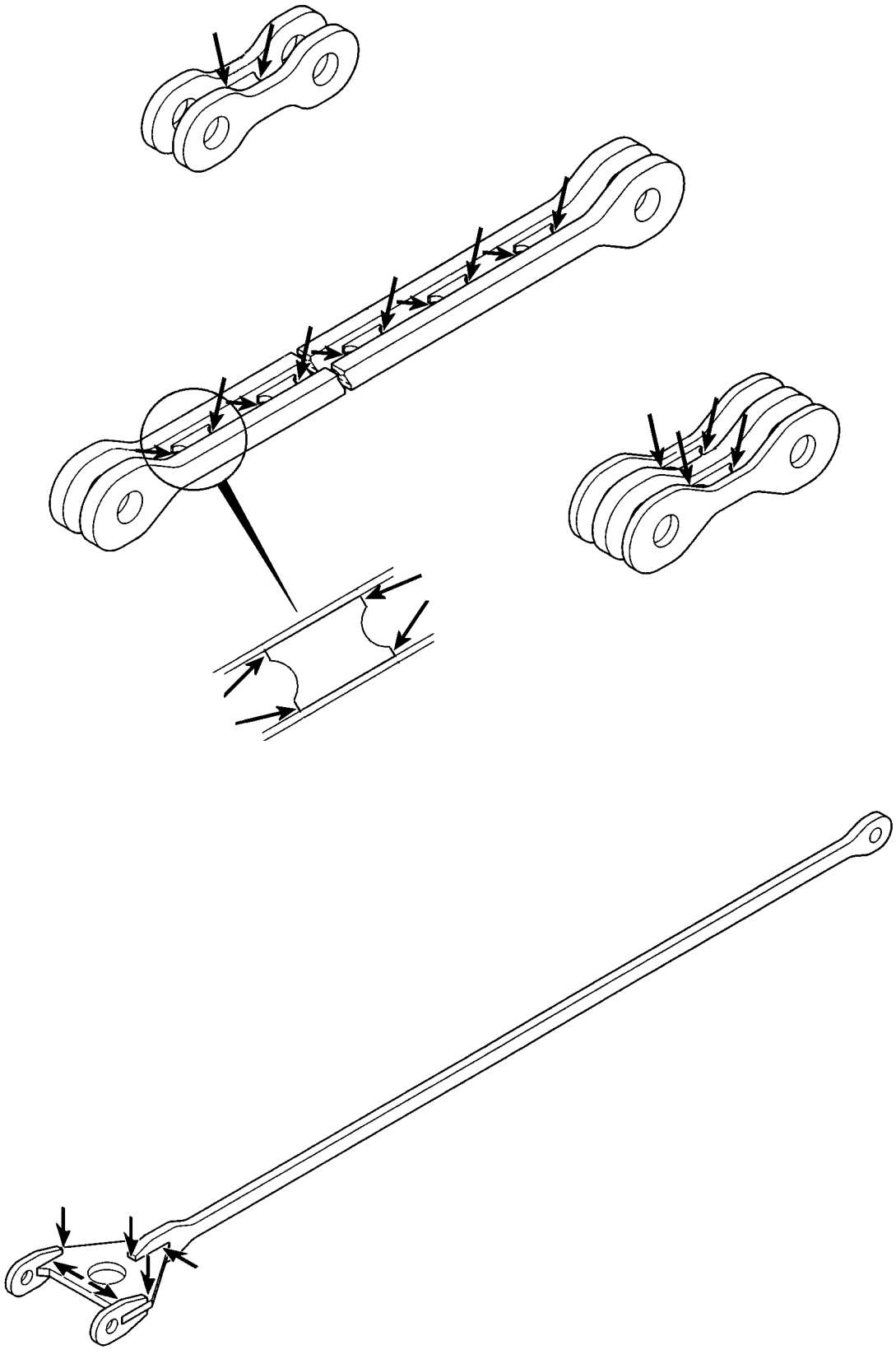


B105838

Example for NA frames

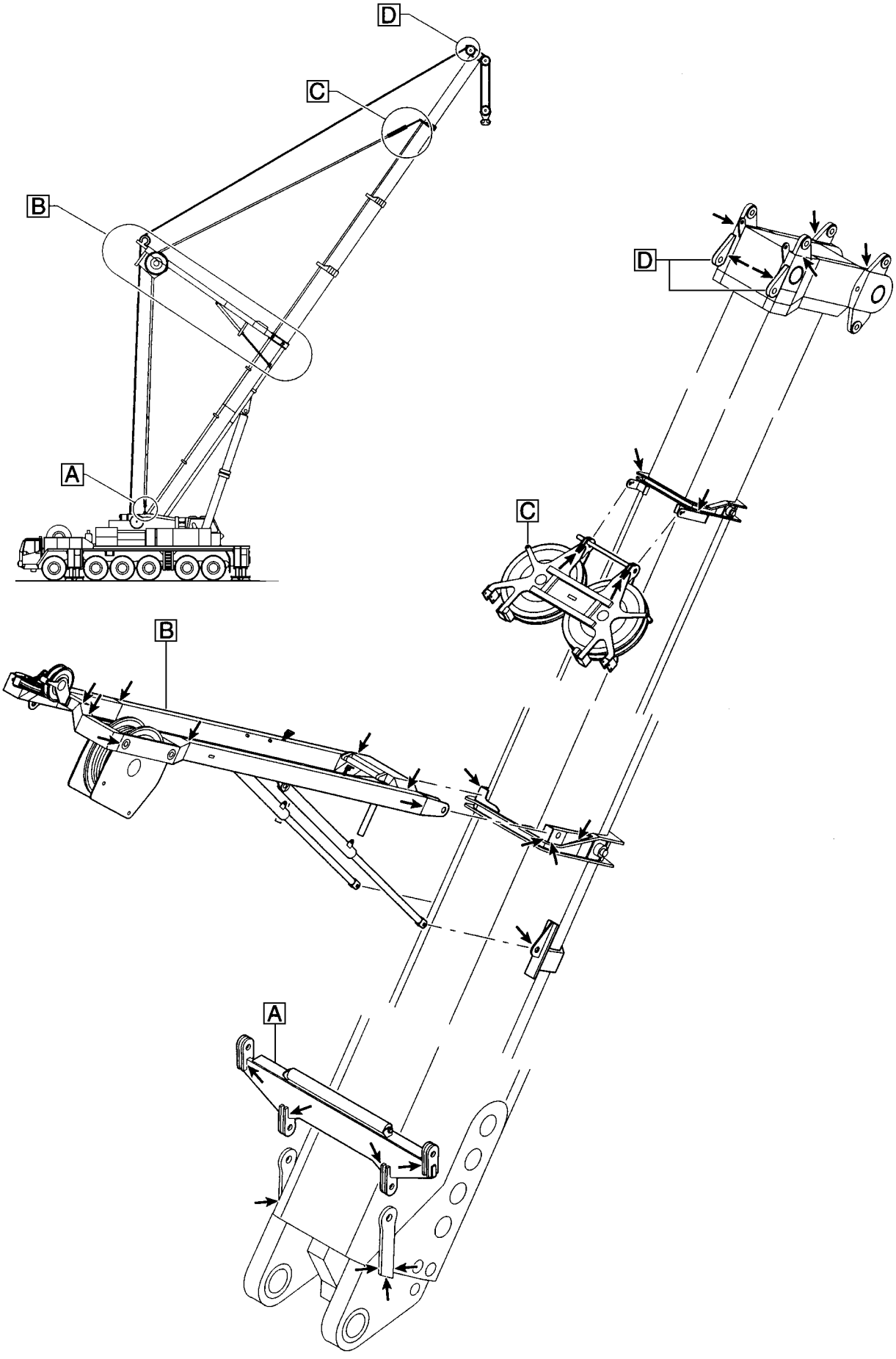


B185054 *Example for pulley head*



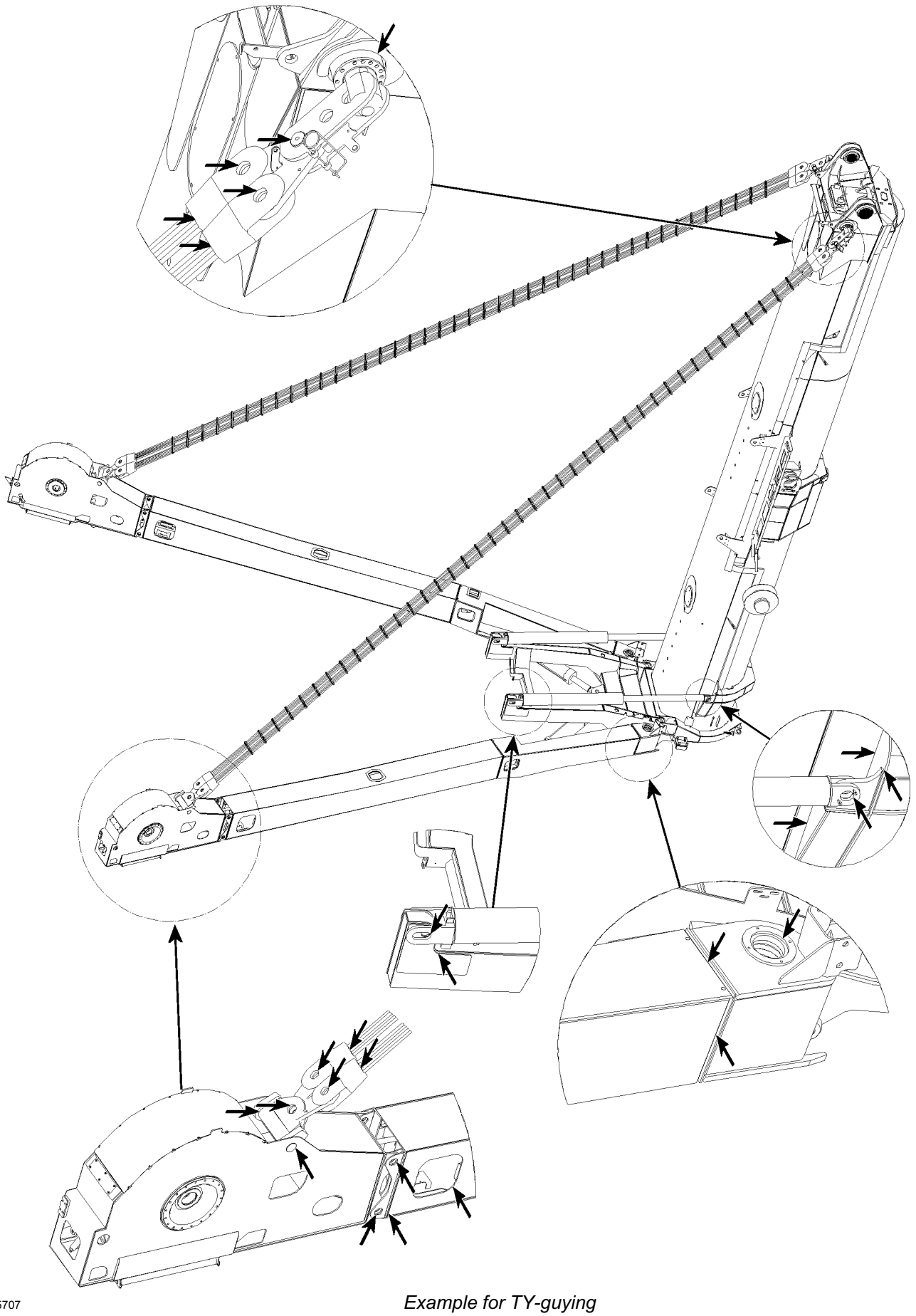
B185055

Example for guy rod



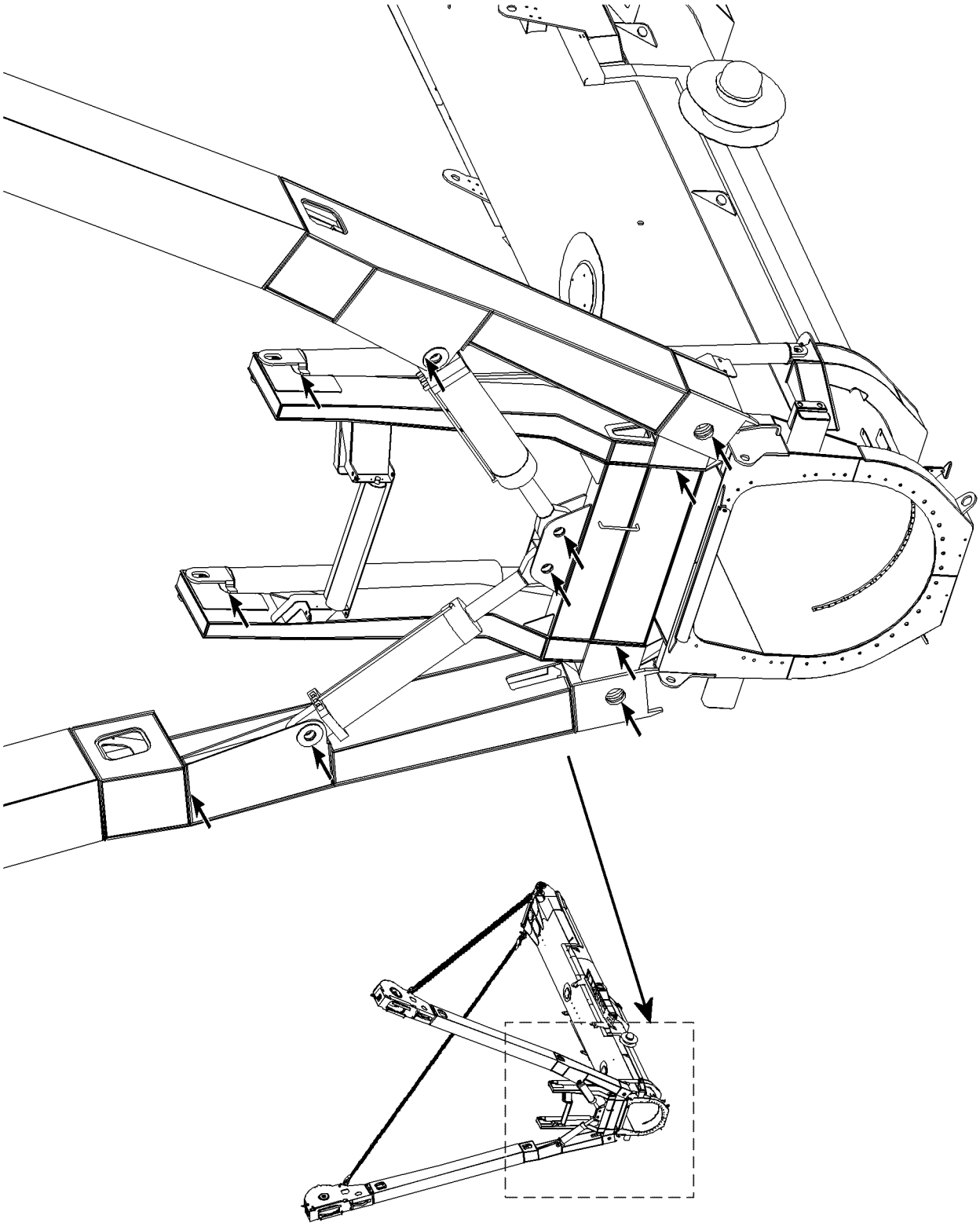
B185059

Example for TA-guying



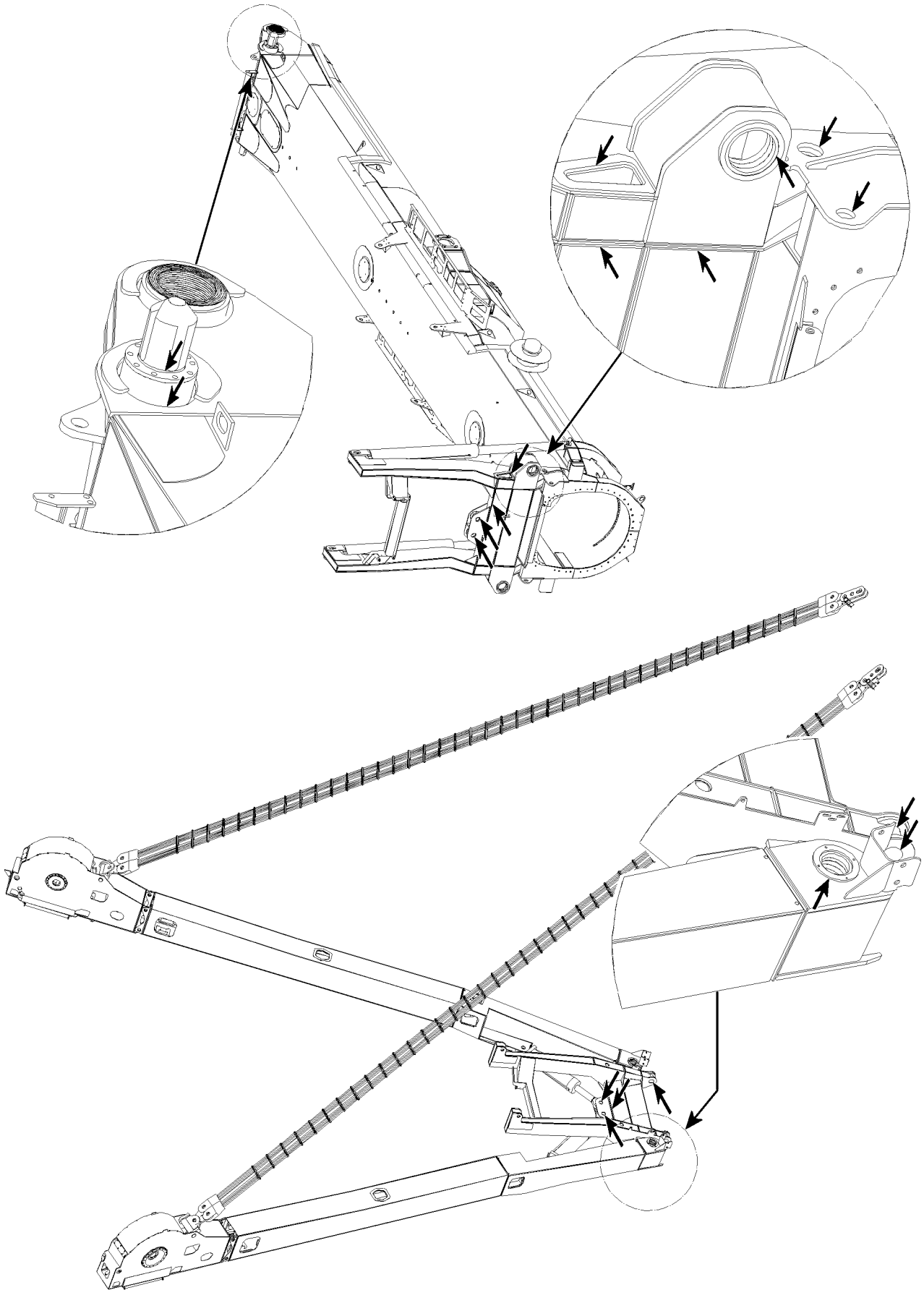
B105707

Example for TY-guying



B105708

Example for TY-guying



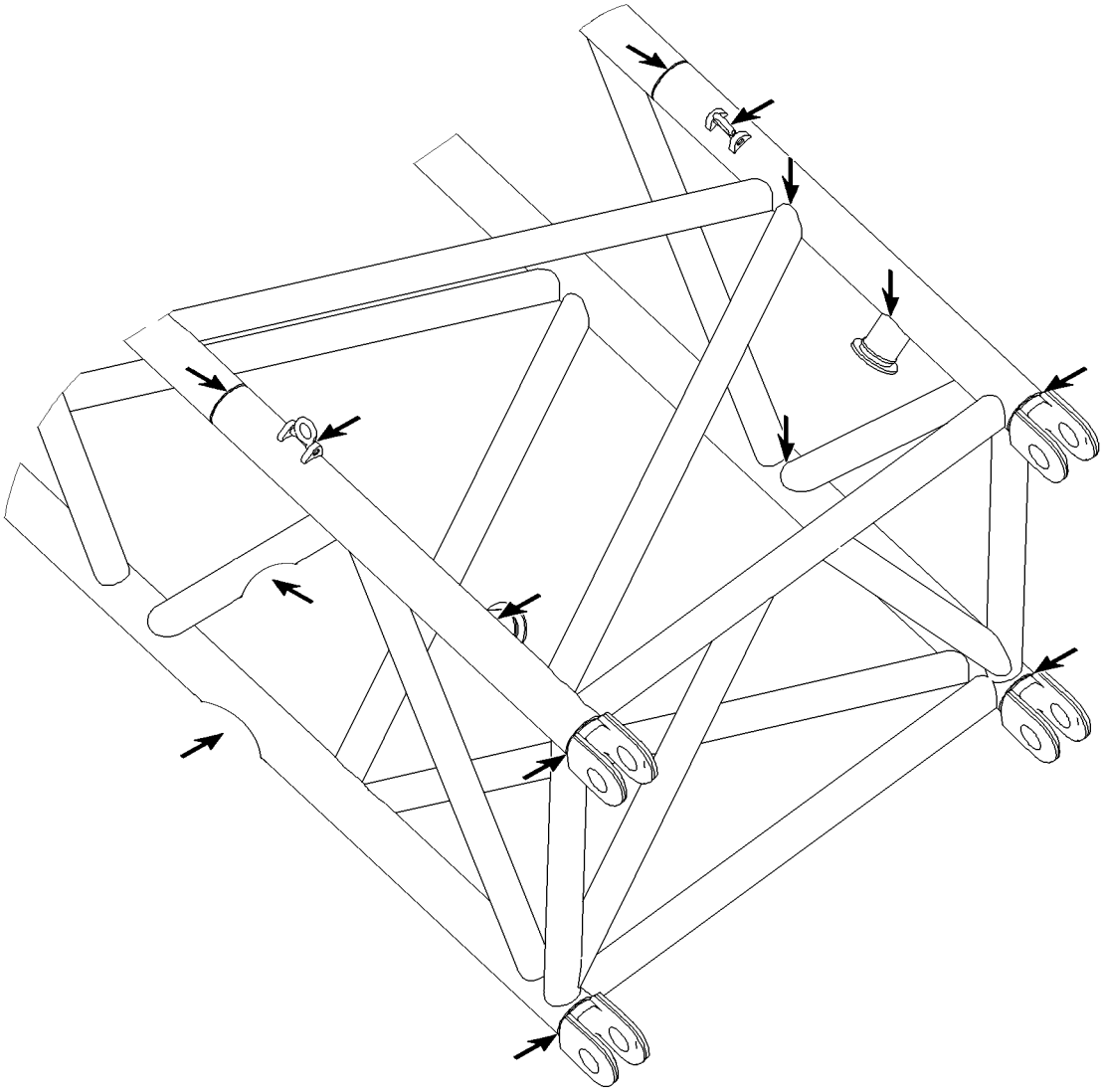
B105709

Example for TY-guying

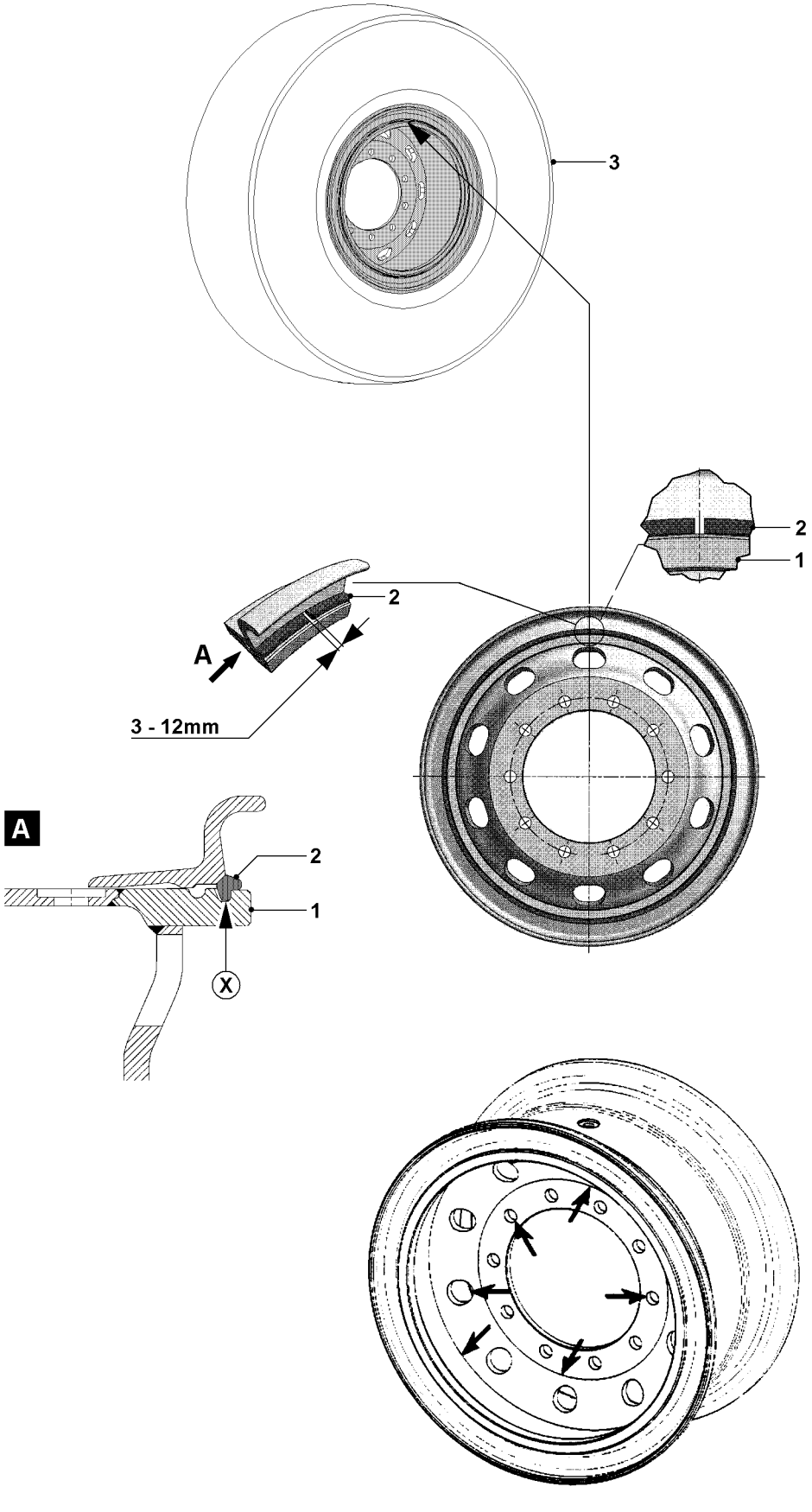
2.2 Inspection of lattice sections

Note

- The illustration is only an example and is valid for all lattice sections.
- Check all diagonal and frame pipe connections!



Example for lattice sections



B107378

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 or gravel)!

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 figure **A**.
- – The gap of the assembled lock ring **2** is outside the permitted tolerance range of 3 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 figure **A**,
- – the gap at the lock ring **2** is between 3 and 12 mm.

WARNING
Risk of fatal injury!
When checking the tire inflation pressure on the vehicle or after fitting tires, please ensure beforehand that the clamp collar **2** is correctly assembled 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.

Note
- ▶ Always check the tire pressure when the tires are cold.
- ▶ The specified tire pressure must be within the tolerance range of ±0.2 bar.

Observe the tire pressure, which is approved for the tire assembled on the crane. See Crane operating instructions, chapter 1.03.
– Check the tire pressure.

3.3 Inspection of disk wheels

The disk wheel is one of the most important safety relevant components on the vehicle.
The disk wheel is a welded steel structure and must be inspected according to section 2.
In addition, at least during the annual specified inspection of cranes, the outside and the inside of the disk wheel must be inspected for cracks and condition, taken the below listed points into account. The color penetration procedure is recommended for the crack inspection.
In particular, the disk wheels must be inspected for cracks that are developing in the base material, as well as at the locations indicated by the arrows.
Any disk wheels that show evidence of cracks or crack formation must be replaced immediately.
After a mileage of maximum 40,000 km, the operator must routinely inspect the disk wheel regardless of the actual duty cycle.
The following safety and maintenance guidelines are the manufacturer's recommendations for avoiding safety risks caused by damaged disk wheels. In addition, the manufacturer can only provide a warranty in case of a claim if these guidelines have been observed.

Note
- ▶ Tires may only be changed by authorized and trained specialists!
- ▶ This applies both to dismounting and mounting of the tire on the disk wheel **1**!

Workshop personnel or authorized and trained specialists should check the wheels at the rim and the disk wheel for the following when changing the tires:
– Excessive rust or corrosion.
– Bent rim flanges.
– Cracks in the disk wheel.
– Cracks in the brake drum fastening on the inside or outside of the disk wheel.
– Weld seam connection on inside or outside of disk wheel.
– Damage to side and locking rings.
– Damaged wheel bolts or nuts.
– Worn out pin holes.
– Matching disk wheel parts.

WARNING
Risk of overload breakage!
Disk wheels with worn bolt holes must be scrapped immediately. Repairing these highly-stressed disk wheel components causes structural changes in the material, which can lead to premature overload breakage!
- ▶ No welding work is permitted on rims and disk wheels, particularly repairs to worn bolt bores!

– If damaged disk wheel parts are discovered during the inspection:
  Remove and replace any damaged disk wheel components.
– If paint damage or minor rust formation is found:
  Make good the wheels by removing the rust using commercially available paint. Pay special attention to having a perfect surface in the tire seating areas.

4 Inspecting the hoist and luffing winches

The hoist and luffing winches are designed using integrated planetary gears. These gears are sized for long service life and the drive shafts and gears are rated for endurance.
Even though the hoist and luffing winches are designed for long life, an external visual inspection is not adequate, since their life can be significantly affected by bad maintenance (insufficient oil), using oil that does not meet specification requirements, defective seals, improper operation or overloading. The inspection must therefore be carried out by an expert according to the following requirements.

4.1 Inspections

4.1.1 Inspection intervals

1000 hours of operation, minimum once per year

4.1.2 Inspecting oil level

Re-check oil level using the dipstick. For hoist and retraction winches without a dipstick, we recommend that the oil is drained and the amount compared to the specified oil quantity.

4.1.3 Evaluating oil color

Assume that the oil has been overheated if it is black and/or a burnt oil smell is detected. Change the oil.

4.1.4 Checking for foreign substances

This inspection should be carried out by a qualified laboratory. The used oil is to be dribbled on special filter fleece. Visual inspection using a magnifying glass may reveal coarse particles. If particles are detected, all the oil's properties must be examined by a qualified laboratory.

4.1.5 Evaluation of foreign substances found in the oil

A qualified laboratory shall be used to assess the oil.
The maximum permissible quantity of foreign material measured by weight is 0.15% of total oil weight.
Maximum permissible foreign particle size from fine abrasion is 0.25 microns.
If above values are exceeded, the gearbox must be dismantled to determine the root cause of the excessive abrasion. Damaged components must be replaced and the gear refilled with fresh oil.

NOTICE
Risk of equipment damage!
▶ Repairs may only be carried out by specialists with appropriate equipment knowledge.

4.1.6 Visual inspection

The gearboxes shall be checked for leakage, since loss of oil, in addition to polluting the environment, can lead to gearbox failure.

4.1.7 Inspecting the gearbox brakes

Check the brakes each time the gearboxes are inspected.
Proceed as follows:
– Attach a load, which creates the maximum rope pull in the upper layer of the winding, and raise it just off the ground.
– Remove the plug on the brake lifting magnet.
  This causes the brake to remain engaged when operated.
– Operate the winch to lower it.

Note

- The brake should not slip, i.e. the winch should not turn. If the brake slips, contact the Service Dept. at Liebherrwerk Ehingen.
- Only operate the crane after it has been checked and approved for use by the customer service department at Liebherr Werk Ehingen!

NOTICE

Risk of equipment damage!

- Only qualified personnel with specialized knowledge shall be used to assess gearboxes and brakes.

4.1.8 Documenting the completed inspection and tests

The results of the annual inspections and maintenance work, including the steps taken, shall be documented by the competent or authorized inspector, including attachments from the inspection labs and qualified service companies if any.
This documentation shall be filed in the crane inspection log under the heading "Periodic inspections".

4.2 Requirements for monitoring the winches

4.2.1 Design life

The designer of your crane used a theoretical total operating time when designing and sizing the winches. This resulted in the design life of the equipment.
Your crane winches are classified according to ISO 4301/1 as follows:

Winches	Classification
Power train group:	M3
Load spectrum:	L1
Load spectrum factor Km:	0,125
Theoretical service life D:	3200 hrs.

Note

▶ The “design life” is not equal to the real (true) life of a winch!

The actual life of the winch is affected by many additional outside factors; for example:

– Overloads caused by unapproved use of the crane.
– Inadequate maintenance: Oil is not changed in a timely manner.
– Improper operation:
  • Extreme acceleration or braking of the load.
  • Load falling onto the cables.
– Improper maintenance:
  • Using the wrong type of oil.
  • Too much or too little oil.
  • Contamination during oil changes.
– Assembly errors during repair and maintenance.
– Undetected leakage.
– Incorrectly set safety devices.
– Hidden damage from accidents.
– Extreme environmental conditions:
  • Extreme temperatures.
  • Corrosive atmosphere.
  • Dust and dirt.

4.2.2 Actual usage component of the design life

The crane operator is obligated to carry out an inspection of the crane at least once a year.
At this time, the actual usage component of the design life shall be calculated. If necessary, the crane operator must contract an authorized inspector.
The actual operating conditions (duty cycle) and the winch operating hours at each inspection interval are required to determine the proportion of the design life that has actually been used. The operator is responsible for the documentation in the crane inspection log.

Determining the operating conditions (duty cycle)

The crane’s duty cycle is split into groups, please refer to ISO 4301/1.
One of the following duty cycles shall be selected and recorded in the crane inspection log for the respective inspection interval based on knowledge of the actual operating conditions. A more precise determination of the load spectrum is permissible.

Duty cycle class: Light L1

Definition:

Power train or parts thereof are subjected to maximum loading in exceptional cases, but normally only operate at very light loads.

Operating time rates:

10% of the time at maximum load (dead load and 1/1 working load).

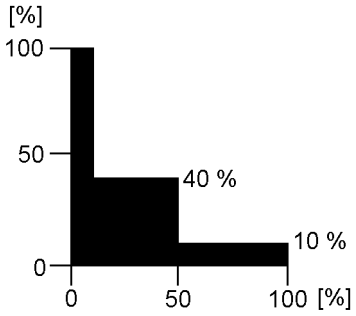
40% of the time with dead load and 1/3 working load.

50% of the time only with dead load.

Factor of load spectrum:

Km = 0.125

Graphic view:



Note

- Duty cycle L1 with duty cycle factor Km = 0.125 is normally applied to cranes used for assembly operations.

Duty cycle class: Medium L2

Definition:

Power train or parts thereof are subjected to maximum loading relatively often, but normally only operate at light load.

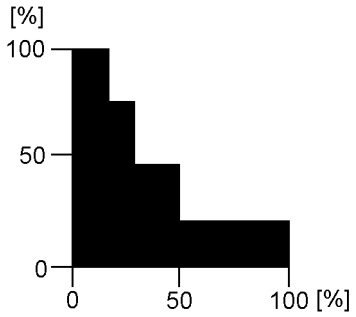
Operating time rates:

1/6 of the time at maximum load (dead load and 1/1 working load).
1/6 of the time with dead load and 2/3 working load.
1/6 of the time with dead load and 1/3 working load.
50% of the time only with dead load.

Factor of load spectrum:

Km = 0.25

Graphic view:



Duty cycle class: Heavy L3

Definition:

Power train or parts thereof are frequently subjected to maximum loading and normally operate at medium load.

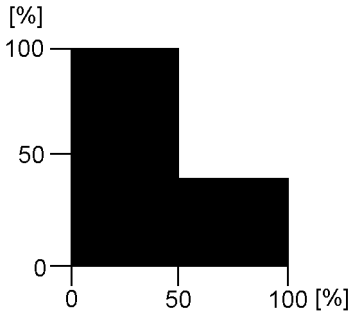
Operating time rates:

50% of the time at maximum load (dead load and 1/1 working load).
50% of the time only with dead load.

Factor of load spectrum:

Km = 0.5

Graphic view:



Duty cycle class: Very heavy L4

Definition:

Power train or parts thereof are regularly subjected to near maximum load.

Operating time rates:

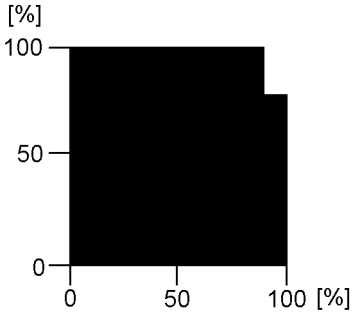
90% of the time at maximum load (dead load and 1/1 working load).

10% of the time only with dead load.

Factor of load spectrum:

Km = 1

Graphic view:



Determining the effective operating hours T_i

The effective operating hours calculated using the following method shall be entered into crane inspection log for the respective inspection interval.
There are four different scenarios:

1.) Operating hour meter installed on every winch.
If an operating hour meter is installed on every winch, the effective operating hours T_i can be read directly during each inspection.

2.) Operating hour meter installed for the overall crane drive.
The winch proportion of the total superstructure operating hours must be estimated.
For cranes used in assembly operations, the operating time for the hoist winches can be estimated at 20% of the total operating hours of the superstructure.

3.) One operating hour meter is used for both the crane engine and the crane drive.
The winch proportion of the total crane operating hours must be estimated.
For cranes used in assembly operations, the operating time for the superstructure can be estimated at 60% of the total operating hours of the crane. If the hoist winch proportion is estimated at 20% of the superstructure operating hours (see previous item), then the result in relation to the **total** operating hours of the crane is: 12%.

4.) No operating hour meter installed.
In this case the operator must estimate and document the actual operating hours of the winch.
The approximate percentages stated above normally apply to main hoist winches. For auxiliary hoist winches or boom control winches, the proportion of the total operating hours can be significantly less and should therefore be estimated by the operator.

Determining the actual usage proportion of the design life

For an inspection interval i (max. 1 year), the actually used proportion S_i of the theoretical design life is derived from the formula:

$$S_i = \frac{Km_i}{Km} \times T_i$$

Abbreviation	Explanation
S_i	Used proportion of the theoretical service life.
Km	Load spectrum factor that was used to calculate the winch rates. This factor is provided in the Operating instructions.
Km_i	Load spectrum factor for inspection interval i according to section “Determining the operating conditions” .
T_i	Effective operating hours for inspection interval i according to section “Determining the effective operating hours T_i” .

The actually used hours proportion is subtracted from the remaining design life D_i after each inspection interval (see example).
If the remaining design life is not long enough to cover the next projected operating period, a general overhaul of the winch is required.

If the design life D has been reached (see chapter on “Design life”), the winch may only be operated after conducting a general overhaul.
A general overhaul of the winch is required not later than 10 years after commissioning.
The general overhaul shall be arranged by the operator and carried out by the manufacturer or the manufacturer's authorized representatives and must be documented in the inspection log. After the general overhaul, the manufacturer or the manufacturer's authorized representative will define a new theoretical service life D.
If the design life has not been reached after 10 years, continued operation of the winch without a general overhaul is acceptable, provided that the crane's authorized inspector has confirmed the accuracy of the actual usage calculation by signing the crane inspection log at each authorized inspection interval.
In such a case, the crane authorized inspector must thoroughly inspect the winch. This comprises at least:

– Outer visual inspection (leakage, damage, deformation, etc.).
– Oil inspection, particularly looking for metal residues.
– Load test at minimum and maximum cable tension, at maximum speed in both cases. At least one layer must be spooled up. Pay particular attention to any unusual noises during this load test.

The crane's authorized inspector must confirm this inspection in the crane inspection log and must make a statement regarding suitability of the winch for continued operation. The next inspection must take place at the end of the 12th operating year and annually thereafter.

4.2.3 Example

According to the manufacturer's operating manual, a mobile crane with a separate operating hour meter for the crane engine and the crane drives classified as follows:

– Power train group: M3
– Load spectrum: Light L1
– Factor of load spectrum: Km = 0.125
– Design life: D = 3200 h

Actual usage proportion S of the design life is calculated using the individual inspection intervals as follows:

First inspection (first year)

The crane was used for assembly work during the elapsed year:
Duty cycle L1, in other words $Km_1 = 0{,}125$.
The superstructure operating hour meter indicates 800 hours. The winch was operated about 20% of the time; i.e. $T_1 = 160$ h.
The actual usage proportion S of the design life at the time of the first inspection is therefore:

$$S_1 = \frac{0{,}125}{0{,}125} \times 160\ \text{h} = 160\ \text{h}$$

Remaining design life:
$D_1 = 3200\ \text{h} - 160\ \text{h} = 3040\ \text{h}$.
The above values are recorded in the crane inspection log.

Second inspection (second year)

The crane was used at a harbor for unloading work:
Duty cycle L3, in other words $Km_2 = 0.5$.
The superstructure operating hour meter indicates 2000 hours; i.e., during this period:
2000 h - 800 h = 1200 h (800 h were used during the first year of operation).
The winch was operated about 40% of the time; i.e. $T_2 = 480$ h.
The actual usage proportion S_2 of the design life at the time of the second inspection is therefore:

$$S_2 = \frac{0{,}5}{0{,}125} \times 480\ \text{h} = 1920\ \text{h}$$

Remaining design life:
$D_2 = 3040\ \text{h} - 1920\ \text{h} = 1120\ \text{h}$.

Third inspection (third year)

The crane was used for assembly work and occasionally at a harbor for unloading work:
Duty cycle L2, in other words $Km_3 = 0.25$.
The superstructure operating hour meter indicates 3000 hours; i.e., during this period:
3000 h - 2000 h = 1000 h (2000 h were used during the first two years of operation).
The winch was operated about 30% of the time; i.e. $T_3 = 300$ h.
The actual usage proportion S_3 of the design life at the time of the third inspection is therefore:

$$S_3 = \frac{0,25}{0,125} \times 300 \text{ h} = 600 \text{ h}$$

Remaining design life:
$D_3 = 1120$ h -600 h = 520 h.

4.2.4 Table for theoretically determining the remaining service life

Table 1 includes an example.
The theoretical remaining service life should be documented in table 2.

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Chart to determine the remaining theoretical service life of winch No. 1 (Main hoist winch)

Crane type: LTM 1050
Fabrication No.: 0010 540 08
Put in service : 12345
Serial number of winch according to data tag: 0815
Last general overhaul performed on: .....
Configuration data of winch (see Operating Manual):
Drive gear group: M 3
Load collective: Q 1 (L1)
Factor of load collective Km: 0.125
Theoretical service life D: 3200 hrs.

S_i = Used part of theoretical service life since last inspection
D_i = Remaining theoretical service life
D_{i-1} = Remaining theoretical service life after previous inspection
Km = Factor of load collective, which was taken for calculation of winch. This factor is to be taken from the Operating Manual
Km_i = Factor of load collective in inspection interval i
T_i = Effective operating hours in inspection interval i

(*) In the following pages, carry over the last line from the previous page.

Inspection interval No. (max. annually) i	Date of initial service / data of inspection	Operating conditions since last inspection (load collective)	Factor of load connective Km_i	Total crane operating hours [h]	Operating hours of super-structure [h]	Operating hours of super-structure since last inspection [h]	Operating hours of winch [h]	Operating hours of winch since last inspection T_i [h]	Used part of theoretical service life D: $S_i = \frac{Km_i}{Km} \times T_i$ [h]	Remaining theoretical service life $D_i = D_{i-1} - S_i$ [h]	Name of inspector	Signature	Remarks	Name of expert	Signature
(*) 0	10.06.90	-	-	-	0				0	3200					
1	05.06.91	L1	0,125	-	800	800	-	160 (20 % of 800)	160	3040	Müller				
2	20.05.92	L3	0,5	-	2000	1200	-	480 (40 % of 1200)	1920	1120	Huber				
3	18.05.93	L2	0,25	-	3000	1000	-	300 (30 % of 1000)	600	520	Maier				
4															

C A U T I O N : Perform general overhaul at least once every 10 years. In case of deviation, see guidelines in this chapter.

General overhaul last performed on : .....

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Chart to determine the remaining theoretical service life of winch No. ....

Crane type: .....
Fabrication No.: .....
Put in service: .....
Serial number of winch according to data tag: .....
Last general overhaul performed on: .....
Configuration data of winch (see Operating Manual): .....
Drive gear group: M.....
Load collective: Q.....(L.....)
Factor of load collective Km: .....
Theoretical service life D: .....

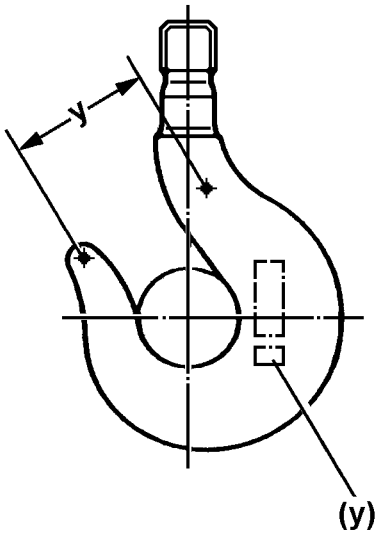
S_i = Used part of theoretical service life since last inspection
D_i = Remaining theoretical service life
D_{i-1} = Remaining theoretical service life after previous inspection
Km = Factor of load collective, which was taken for calculation of winch. This factor is to be taken from the Operating Manual
Km_i = Factor of load collective in inspection interval i
T_i = Effective operating hours in inspection interval i

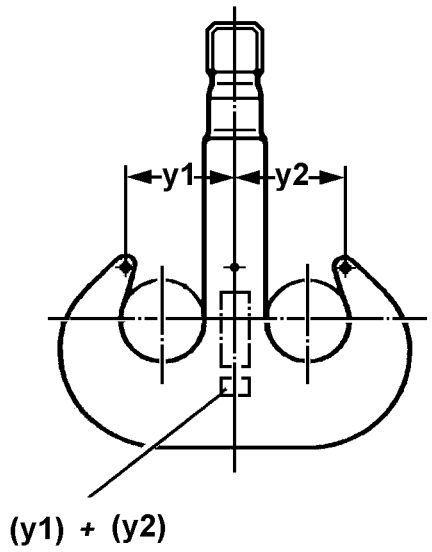
*) In the following pages, carry over the last line from the previous page.

Inspection interval No. (max. annually) i	Date of initial service / data of inspection	Operating conditions since last inspection (load collective)	Factor of load connective Km_i	Total crane operating hours [h]	Operating hours of super-structure [h]	Operating hours of super-structure since last inspection [h]	Operating hours of winch [h]	Operating hours of winch since last inspection T_i [h]	Used part of theoretical service life D: $S_i = \frac{Km_i}{Km} \times T_i$ [h]	Remaining theoretical service life $D_i = D_{i-1} - S_i$ [h]	Name of inspector	Signature	Remarks	Name of expert	Signature
(*)															

C A U T I O N : Perform general overhaul at least once every 10 years. In case of deviation, see guidelines in this chapter.

General overhaul last performed on : .....





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5 Inspecting load hooks

The load hooks must be inspected annually by a competent inspector.
The purpose of the inspections is to avoid accidents by detecting deficiencies in a timely fashion.
Any deficiencies determined by the inspector must be documented, corrected, and subsequently reinspected.

5.1 Inspection and monitoring procedure

5.1.1 Deformation

The hook should be inspected for distortion as required, but at least once a year; e.g., at the hook jaw.
The original dimensions, (y) or (y1) and (y2), are given on the load hook itself.
Measure between the punch marks.

DANGER
Risk of accident!
Hook jaw distortion may not exceed 10% of the original dimensions (y) or (y1) and (y2).
- ▶ Do not use a load hook that exhibits greater distortion.
- ▶ Advise the Liebherr-Werk Ehingen GmbH Customer Service Department.

5.1.2 Corrosion

DANGER
Risk of accidents caused by thread corrosion / wear and tear!
- ▶ Stop using the load hook.
- ▶ Advise the Liebherr-Werk Ehingen GmbH Customer Service Department.

Unscrew the nut from the hook shank so that the threads can be inspected for corrosion and wear and tear.

6 Inspecting the rope feed mechanics in the telescopic boom

- For inspection of rope end mounts, see Crane operating instructions, chapter 7.05.
- For inspection of the pre-tension on the intake ropes, see Crane operating instructions, chapter 7.05.
- For inspection of ropes for damage according to DIN 15020 or ISO 4309, see Crane operating instructions, chapter 8.04.

7 Inspection of locking system of telescopic boom

7.1 For cranes with pneumatic boom locking system

- For inspection of function, see Crane operating instructions, chapter 8.11.
- For inspection of pin wear pattern, see Crane operating instructions, chapter 8.11.
- For inspection of wear, see Crane operating instructions, chapter 8.11.
- For inspection of safety control, see Crane operating instructions, chapter 8.11.

7.2 For cranes with telescopic boom system Telematik

- Inspection of piston rod for grooves.
- Inspection of wear pattern on cylinder pinning and tele pinning.
- Inspection of guide rails for distortion of contour.
- Inspection of plastic guide on cylinder bottom for damage.
- Inspection of screws on push out cylinder for tight seating.

8 Inspecting the safety controls on the relapse supports

Inspection of the safety control or limit switches on the relapse supports and the boom A-frames, see Crane operating instructions, chapter 8.12.

9 Inspection of the nitrogen reservoir

Inspect the nitrogen storage tank for specified gas pressure, particularly for relapse supports and suspension storage tanks (comply with specifications), see Crane operating instructions, chapters 7.04, 7.05, 8.13, 8.14.

10 Inspecting the cable pulleys

DANGER
Risk of accident when damaged or cracked!
▶ Replace rope pulley immediately.

Inspect the rope pulleys all around once a year for damage and cracks.
If rope pulleys are subjected to any impacts (e.g., with buildings) or are otherwise overloaded, they must be immediately visually inspected for damage or cracks.
Also check for wear in the rope groove. Replace the pulley if the bottom of the rope groove has been run down up to 1/4 of the rope diameter.

11 Inspecting the overload protection operation

Position the longest boom at minimum and maximum radius: Check the load indicator, using the hook block as a test load.
The indicator reading shall not deviate more than 10% off the true load value at these two extreme positions.
Measure the indicated radius for the longest boom at its minimum radius and at a boom angle of 45°.
The indicator reading shall not deviate more than 10% off the measured projection.

12 Inspecting the roller slewing ring

For tilt play dimension, see Crane operating instructions, chapter 7.05.

13 Inspecting the mounting of the load bearing equipment

Check that the mounting bolts for the roller slewing ring, winches, slewing gears and hitch are properly seated.

Slewing ring connection mounting bolts are pre-stressed at the factory, so that no loosening of the bolted connections will occur during normal crane operation.

However, the bolted connection may become overloaded and the bolts may be permanently stretched if the crane is overloaded or if a fixed load is pulled free. It is therefore important to check these screws for tight seating during the annual crane inspection or after an overload.

Completely remove loose bolts, plus the two adjacent ones, and immediately check for damage. Inspect the screws, particularly for cracks or permanent distortion. If a screw has been stretched by more than 0.2% (in relation to its original length) or if cracks or other damage are detected, then the damaged screws must be replaced. If the screws have been stretched or there is other damage, then the adjacent screws must also be replaced.

14 Inspecting the oil and fuel reservoirs

Oil and fuel reservoirs shall be inspected at least once a year and checked all around for leakage during the periodic inspections every four years.

Repairs shall only be carried out by trained and knowledgeable specialists.

Improper repairs; e.g., welding, hard or soft soldering is not permitted, particularly if the Customer Service Department at Liebherr-Werk Ehingen GmbH has not been consulted!

15 Inspection of the auxiliary reeving winch, towing winch and spare wheel winch

Determine the design life of the auxiliary reeving, towing and spare wheel winches from their respective original manufacturer.

16 Appendix

The following is a checklist to assist the inspector during the periodic inspections of Liebherr mobile and crawler cranes.

16.1 Inspection recommendations for periodic inspections of Liebherr mobile and crawler cranes

Company:	**Checked by:**
Crane manufacturer: LIEBHERR	**Crane type:**
Serial number:	**Stock number:**
Construction year:	**Date:**
Inspector's signature for No. 1 to 20:	

1. Inspection category: Crane document						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Crane inspection log						
Operating and installation instructions						
Crane control log						
Load chart manual						
Job planner						

2. Inspection category: Signs / labeling						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Factory tag						
Load data						
Operating specifications label						
Prohibition and command signs						
Other safety signs						

3. Inspection category: Travel gear[1]						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Frame[2]						
Supports[3]						
Axles						
Wheels						

3. Inspection category: Travel gear[1]						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Tires						
Bearings						
Gear						
Universal drive shaft						
Leaf springs / springs						
Shock absorbers						
Steering						
Brakes						
Hydraulic axle suspension						

4. Inspection category: Chassis[1]						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Coverings						
Treads						
Counterweight holders[2]						
Suspension equipment						
Ladders						
Hook block mounting[2]						
Boom support[2]						

5. Inspection category: Chassis - driver's cab[1]						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Doors						
Windows / windshields						
Windshields wiper						
Mirrors						
Seat						
Heater						
Ventilation						
Sound-proofing						
Trip recorder						
First aid kit						

5. Inspection category: Chassis - driver's cab[1]						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Spare bulbs						
Hazard warning triangle						
Safety vest						

6. Inspection category: Chassis - drive[1]						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Combustion engine						
Exhaust system						
Fuel tank						
Filter						
Sound-proofing						
Engine mount						
Oil levels						
Fuel lines						

7. Inspection category: Chassis - hydraulics[1]						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Oil reservoir						
Filter						
Pumps						
Motors						
Valves						
Lines						
Hoses						
Cylinder						
Pressure limiting valves						

8. Inspection category: Chassis - pressurized air system[1]						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Compressor						
Filter						
Air tanks						
Valves						

8. Inspection category: Chassis - pressurized air system[1]						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Lines						
Hoses						
Cylinder						

9. Inspection category: Chassis - electrical system[1]						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Motors						
Generators						
Battery						
Switch						
Lines						
Fuses						
Resistors						
Illumination						
Brake lights						
Indicator lights						
Tail lights						
Working lights						
Signaling systems						
Indicator lights						
Battery switch						
Limit switches: Transmission, steering, drivetrain						
Support pressure indicator[2]						

10. Inspection category: Chassis - control devices[1]						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Engine regulation						
Gear						
Couplings						
Circuits						
Brakes						
Steering						
Indicator displays						
Engine shut off line						

10. Inspection category: Chassis - control devices[1]						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Control of supports[2]						
Axle suspension						
Crane leveling						
Rear axle steering						

11. Inspection category: Superstructure						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Frame						
Coverings						
Treads						
Bearings						
Counterweights						
Relapse retainer						
Rotary connection: Tilt play						
Rotary connection: Mounting screws						
Rotary connection: Gearing						
Slewing gear: Mounting screws						
Slewing gear: Gearing						

12. Inspection category: Superstructure - crane operator's cab						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Doors						
Windows / windshields						
Windshields wiper						
Mirrors						
Seat						
Heater						
Ventilation						
Sound absorber						
Joystick for working functions						
Gear shifts						
Safety: Crushing / shear locations						

13. Inspection category: Superstructure - Retaining and protection devices						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Grab handles and accesses						To the cab and to the power train
Coverings						
Covers						
Hatches						

14. Inspection category: Superstructure - engine						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Combustion engine						
Exhaust system						
Fuel tank						
Filter						
Sound-proofing						
Engine mount						
Fuel lines						

15. Inspection category: Superstructure - hydraulic system						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Oil reservoir						
Filter						
Pumps						
Motors						
Valves						
Lines						
Hoses						
Cylinder						
Pressure limiting valves						
Lowering brake valves						
Brake control: Hoist gear						
Brake control: Slewing gear						

16. Inspection category: Superstructure - electrical system						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Motors						
Generators						
Batteries						
Switch						
Lines						
Fuses						
Resistors						
Illumination						

17. Inspection category: Superstructure - control systems						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Engine regulation						
Gear						
Flexible couplings						
Circuits						
Engine shut off line						
Monitoring indicators						

18. Inspection category: Superstructure - rope drives						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Winch 1[3]						
Winch 2[3]						
Winch 3[3]						
Winch 4[3]						
Rope pulleys						
Rope end connection						
Rope for winch 1						
Rope for winch 2						
Rope for winch 3						
Rope for winch 4						
Guy ropes						

19. Inspection category: Superstructure - load hook						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Pulleys						
Rope guards on pulleys						
Axle support						
Load hook						
Load hook mounting						
Hook retention						

20. Inspection category: Superstructure - safety and switching systems						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Hoist emergency limit switch I						
Hoist emergency limit switch II						
Lowering emergency limit switch I						
Lowering emergency limit switch II						
Boom emergency limit switch I						
Boom emergency limit switch II						
Luffing jib: Boom limit switch I						
Luffing jib: Boom limit switch II						
Load moment limiter						
Angle display: Boom						
Angle display: Luffing jib						
Angle display: Slewing gear						
Safety devices: Control						
Operating range limiter						
Pressure sensors						
Speed sensor						
Wind sensor						
Sliding beam monitoring						
Support pressure indicator						
Incline display						
Length indicator: Radius, boom length						
Emergency off system						
Engine stop						

21. Inspection category: Boom						
Component inspected	**A**	**B**	**C**	**D**	**E**	**Comments**
Weld structure						
Rope pulleys						
Luffing cylinder						
Telescoping cylinder						
Boom extension ropes						
Boom retraction ropes						
Boom bearings						
Boom pinning						
Guy rods						
Relapse cylinders						

Inspection criteria:
A = Present / complete
B = Condition / maintenance
C = Function
D = Repair / replace
E = Reinspection required

Evaluation:
Satisfactory = x
Unsatisfactory = -
Not required = 0

Comments:
[1] Inspection of the crane carrier vehicle road worthiness is also fulfilled if it has already been certified by the road traffic department certification authority. For cranes that are not certified for use on public roads, an expert or authorized inspector must conduct the required tests to validate the vehicle's road worthiness.
[2] These inspections must be carried out by an authorized inspector even if it has passed the road traffic department test and is certified.
[3] Inspection of the winches regarding the used portion of the theoretical service life.

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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.
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 rope is of another type, then 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 they can accommodate the spare rope correctly (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. Unless 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.

2.4 Inspection

2.4.1 Frequency

Daily inspection

If possible, all visible parts of the ropes must be checked for general wear and distortion every working day. Special attention must be paid to the rope end connections. Any suspected changes in the condition of the rope must be reported and the rope must be inspected by a trained expert inspector in accordance with the section “Points to check on the rope”.
In the event that the lower rope layers on the drum are used infrequently or not at all, periodically unwind and rewind the entire drum under pretension. A rope is most cost-effective if it is used over its entire length. For that reason, it is recommended to use an appropriate rope length when operating the crane over longer periods.

Note

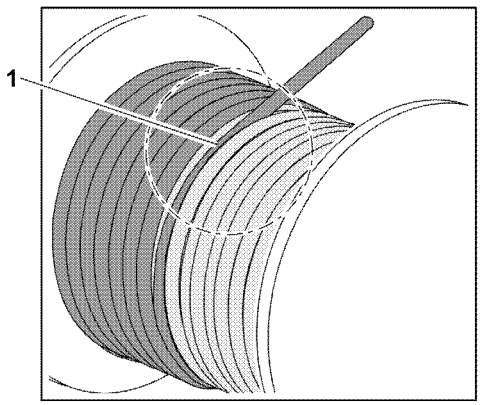
▶ If a rope is newly placed, then it must be pretensioned and placed with a pretension of at least 10% of the maximum rope pull.

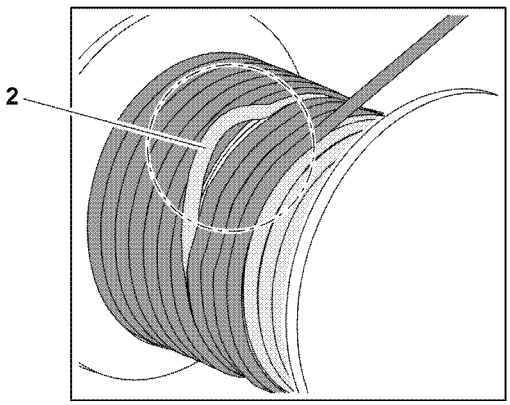
Special inspection as described in section “Points to check on the rope”

The rope must be checked after any events that may have led to damage to the rope and / or the rope ends and whenever the rope is taken back into service after being taken down and then re-installed.

2.4.2 Checking the spooling behavior of the rope on the cable drum

To avoid spooling errors and associated rope damage, it is necessary to check the spooling behavior daily. If spooling errors are determined, the rope must be reeled off until there are only 3 rope coils on the winch. Thereafter, the rope is to be tensioned with a pretension of at least 10% of the maximal rope pull and then placed again.





Possible spooling errors:
– Cutting into the lower rope layers **1**
– Loop formation in the lower rope layers **2**

2.4.3 Points to check on the rope

General

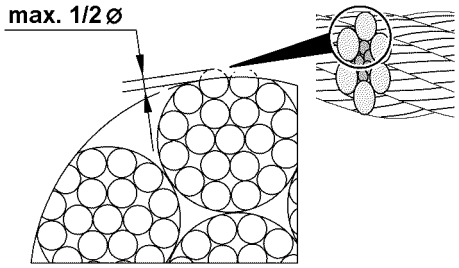
Although the entire length of the rope must be checked, particular attention must be paid to checking the following areas:

– At the rope end points on both sides, for movable as well as fixed ropes.
– The part of the rope that runs through the block or over rope pulleys; particular attention must be paid to parts of the rope that are on rope pulleys when under load (see appendix 1) in systems that carry out repeated movements.
– Parts of the rope that run over a compensation pulley.
– All parts of the rope that can be subjected to wear caused by external elements (e.g. protruding hatch surrounds).
– All parts of the rope that are subjected to the effects of heat.
– On the contact positions of the ropes when spooling up.
– Check the inside of the rope for corrosion and material fatigue.

The results of the inspection must be entered in the inspection log for the system (for typical example see section entitled “Rope inspection log” and appendix 2).

Checking the rope in the uphill pitch zones of the rope coil for flat sections

In the cross area of the coiled up rope layers, the rope is under more strain and can therefore be flattened. To void flat sections, the rope can be shortened on the rope drum fixed point.



If the wires in the outer braids are flattened to no more than maximum half the wire diameter:

– Shorten the rope by a length of 1/3 of the rope drum circumference and reset.

DANGER

Rope breakage!

If the following measures are not observed, the rope can break, the load can fall down and fatally injure personnel!

▶ Take the rope down when the take down criteria is reached, as described in section “Take down criteria”!
▶ Take the rope down when the wires in the outer braids are flattened by more than half the wire diameter!

Rope suspension and connection systems - except loops

The rope must be examined at the exits of the rope suspension and connection system, since this area is particularly susceptible to initial signs of material fatigue (wire breaks) and corrosion. The rope suspension and connection systems must also be examined for signs of deformation or wear.
Rope suspension and connection systems with pressure sleeves must undergo the same checking, and the sleeve must be checked for cracks in the sleeve material and possible slippage of the rope in the sleeve.
Detachable rope suspension systems (cotters, rope clamps) must be checked for wire breaks inside and beneath the mount or fastening; it must also be examined whether the cotters and screwed-on rope clamps are firmly connected to the rope. This check should also ensure that the requirements of the rope suspension and connection systems standards and procedural guidelines are complied with.

2.5 Take-down criteria

The safe use of the rope is assessed in accordance with the following criteria:

1.) Number of wire breaks
2.) Broken wire nests
3.) Wire break increase rate
4.) Strand breaks
5.) Rope diameter reduction, including the reduction caused by damage to the rope core
6.) External and internal wear
7.) External and internal corrosion
8.) Deformation
9.) Damage caused by the effects of heat or arc welders

These individual factors must be taken into consideration in accordance with the relevant criteria during all examinations. However, rope quality deterioration frequently results from a combination of the individual factors, meaning that a worsening effect occurs that can be detected by an expert and that influences the decision as to whether the rope has reached its rope removal limit and whether it can continue to be used.
The checker must investigate whether the deterioration has been caused by a fault in the system; if this is the case remedial action should be recommended before fitting a new rope.

2.5.1 Number of wire breaks

The number of wire breaks must be determined by visually inspecting the entire length of the rope. If a wire break is found, sections that are 30 × d (d = nominal rope diameter) in length are marked at both sides of this point. These sections must be examined extremely carefully. All wire breaks are now carefully counted in each section. Please compare the number of visible wire breaks with appendix 4. If the number of visible wire breaks is less than the number specified in the table, the area in which the most broken wires are found is marked to a length of 6 × d. Count the number of visible wire breaks again and compare the result with appendix 4. If the number of visible wire breaks is less than the number specified in the table, the rope does not have to be taken down yet.

Note
Defining the interval until the next inspection
▶ The interval until the next inspection is set depending on the number of visible wire breaks.

2.5.2 Broken wire nests

If the wire breaks are extremely close together and form wire nests, the rope must be taken down. If the frequency of such wire breaks occurs over a rope length of less than **6d** or is concentrated on one strand, taking the rope down is recommended, even if the number of wire breaks is less than the maximum number specified in the tables.

2.5.3 Wire break increase rate

For applications in which the main reason for damage to the rope is material fatigue, the first wire breaks will not occur until a certain time has elapsed, but the number of wire breaks will increase rapidly at ever-decreasing intervals.
Careful checking and logging of the increased number of wire breaks over time is recommended in these cases.

2.5.4 Strand breaks

If an entire strand breaks, the rope must be taken down.

2.5.5 Reduction in rope diameter caused by damage to core rope

The rope diameter can be reduced as a result to damage to the core because of:

1.) Internal wear and notching
2.) Internal wear due to friction between individual strands and wires in the rope, particularly if it is subjected to bending
3.) Steel core breakage
4.) Break in internal layers of multi-strand ropes

If the rope diameter (average of two diameter measurements) is reduced by 3% of the nominal diameter (rotation resistant ropes) or 10% of the nominal diameter of other ropes due to these factors, the ropes must be taken down, even if no wire breaks are visible.

Note
Diameter of new ropes
▶ New ropes can have an actual diameter that is greater than the nominal diameter, meaning that proportionally greater wear is possible.

2.5.6 External wear

Abrasion of outer wires of outer rope strands as a result of rubbing contact under pressure with the grooves in the rope reels and drums. This condition is particularly evident in moving ropes in the areas in which they come into contact with rope pulleys when the load is being moved and braked, and manifest themselves as flattened surfaces on the outer wires. Abrasion is exacerbated by a lack of or incorrect lubrication as well as the effects of dust.
Wear reduces the breaking strain of steel ropes because the cross section of the steel is reduced. The rope must be taken down if the actual rope diameter has reduced by 7% or more because of outer wear, even if no wire breaks are visible.

2.5.7 External and internal corrosion

Corrosion is a particular problem in maritime climates and atmospheres that are polluted by industrial emissions, reducing breaking strain and accelerating material fatigue because of the reduction in the rope material cross section, leading to irregular surfaces that are the starting point for stress cracks. Extreme corrosion can reduce the elasticity of the rope.

1.) External corrosion
Corrosion of the outer rope wires can be determined by visual inspection.
2.) Internal corrosion
This condition is more difficult to detect than external corrosion.

Note
Internal corrosion
▶ If there are any signs of internal corrosion the rope must be checked by a competent expert.

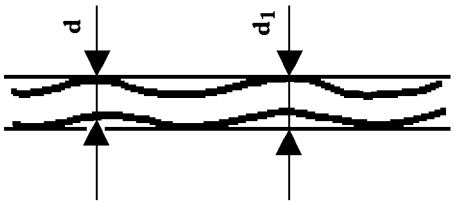
DANGER
Occurrence of internal corrosion!
▶ If the suspicion of extreme internal corrosion is confirmed, the rope must be taken down immediately.

2.5.8 Rope deformation

A visible change to the rope structure is referred to as “rope deformation” and can cause a change at the deformation point that results in irregular rope tension.
A distinction is made between the following important types of rope deformation on the basis of the rope appearance (see following sections):

1.) Corkscrew-like deformation
2.) Basket formation
3.) Strands protruding from the rope
4.) Wire loop formation
5.) Flattening
6.) Reverse bends or knots
7.) Kinks

Corkscrew-like deformation (see appendix 3, table 1)



Corkscrew-like deformation

If there is any corkscrew-like deformation the rope must be taken down if the following condition is net:

$$d_1 > \frac{4\,d}{3}$$

d = nominal diameter of rope
$\mathbf{d_1}$ = rope sheath diameter of the distorted rope

Basket formation (see appendix 3, table 2)

If there are kinks in the rope, it must be replaced immediately.

Strands protruding from the rope (see appendix 3, table 3)

The rope must be replaced immediately if this kind of deformation occurs.

Wire loop formation (see appendix 3, tables 4 and 5)

In this case, certain wires or groups of wires protrude from the rope at the side facing the rope pulley in the form of loops - this is normally the result of sudden strain. If serious deformation occurs, the rope must be taken down.

Flattening (see appendix 3, tables 8 and 9)

Flattening is the result of mechanical damage; if it is pronounced the rope must be replaced.

Reverse bends or knots (see appendix 3, tables 6 and 7)

If the rope has any reverse loops or knots it must be taken down immediately.

Kinks (see appendix 3, table 10)

Kinks are angled deformations in the rope caused by external influences. If there are kinks in the rope, it must be replaced immediately.

2.5.9 Damage caused by the effects of heat or arc welders

Steel ropes that have been subjected to extremely high temperatures, which can be detected externally because of the colouring that it causes, must be taken down.

3 Operating behavior of steel ropes

Exact logging of information by the checker can be useful for predicting the behaviour of a certain type of steel rope on a crane. This information is useful for planning and adapting maintenance instructions and controlling the stocking of spare ropes. The use of such a prediction system should not cause the examinations to be less strict or the rope usage time to be extended beyond the criteria that are specified in the previous sections of this guideline for monitoring and taking down of crane ropes.

4 Condition of equipment that is functionally associated with the rope

Note
Groove radius
▶ The radius must not be smaller than the actual diameter of the rope.

Rope drums and pulleys must be checked at regular intervals in order to ensure that all these components rotate correctly in their bearings. Stiff or blocked rope pulleys wear rapidly and unevenly and cause serious rope abrasion. Ineffective compensation pulleys can lead to irregular rope tension. The radius at the bottom of the rope grooves of all rope pulleys and the drum must be suitable for the nominal diameter of the rope. If the radius has become too big or too small the rope groove must be reworked or the rope pulley replaced.

5 Rope inspection log

The user must provide a log for each of the regular inspections in which all rope inspection information is recorded. Typical example of a log - see appendix 2.

6 Rope storage and marking

Clean, dry rope storage facilities must be provided in order to prevent damage to ropes that are not in use; it must also be ensured that the ropes can be clearly and unambiguously assigned to their checking logs.

7 Wire ropes and rope end connections

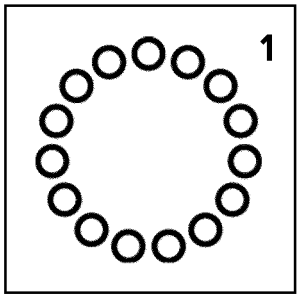
DANGER
Risk of accident!
▶ Correct choice and use of the wire rope and the rope end connections are a decisive precondition for proper and accident-free crane operation.

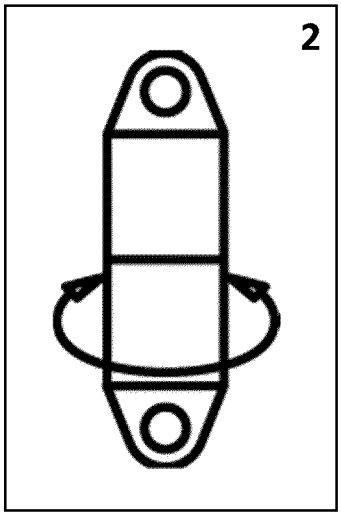
The wire ropes and rope end connections selected in accordance with their usage. It must be determined whether a rotation-resistant or non-rotation free rope is required. The type of rope that is selected then determines the type of rope end connections that are used.

7.1 Rotation-resistant ropes and their rope end connections

Rotation-resistant ropes are special ropes that produce extremely little torque and twisting at the rope end connection when they are under strain.

Note
▶ Rotation-resistant ropes are used as **hoist ropes**.





Typical rotation-resistant wire rope structures are ropes with 15 to 18 outer strands. Rotation-resistant ropes are symbolically depicted with 15 outer strands (circles) (see table **1**).
Rotation-resistant ropes can be optionally used with the following rope end connections:

– Rope end connection **rotating** in the form of a PFEIFER link **with** swivel or spin stabiliser / swivel.
– Rope end connection **non-rotating** in the form of a PFEIFER link **without** swivel or gib and cotter.

If possible, preference should be given to the use of a twisting rope end connection to reduce torsional stress with **rotation-resistant ropes** (see table **2**).

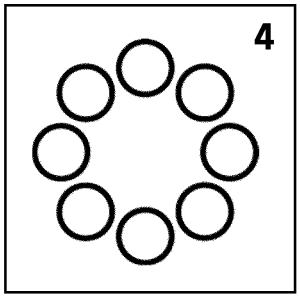
DANGER
Danger of serious personnel injury and equipment damage!
▶ **Never** use rotating rope end connections with non-rotation free ropes!

Note
Usage warning notes
▶ The usage warning notes on the rotating PFEIFER link with pulley indicates that this rope end connection may **not** be used for non-rotation free ropes (see table **3**)!

7.2 Non-rotation free ropes and their rope end connections

Non-rotation free ropes generate high torque levels at the rope end connection when they are under load. For this reason, the rope ends must be protected from twisting using an appropriate rope end connection to prevent the rope from unscrewing under strain!

Note
▶ Non-rotation free ropes are used as **guy ropes** or **control ropes**.

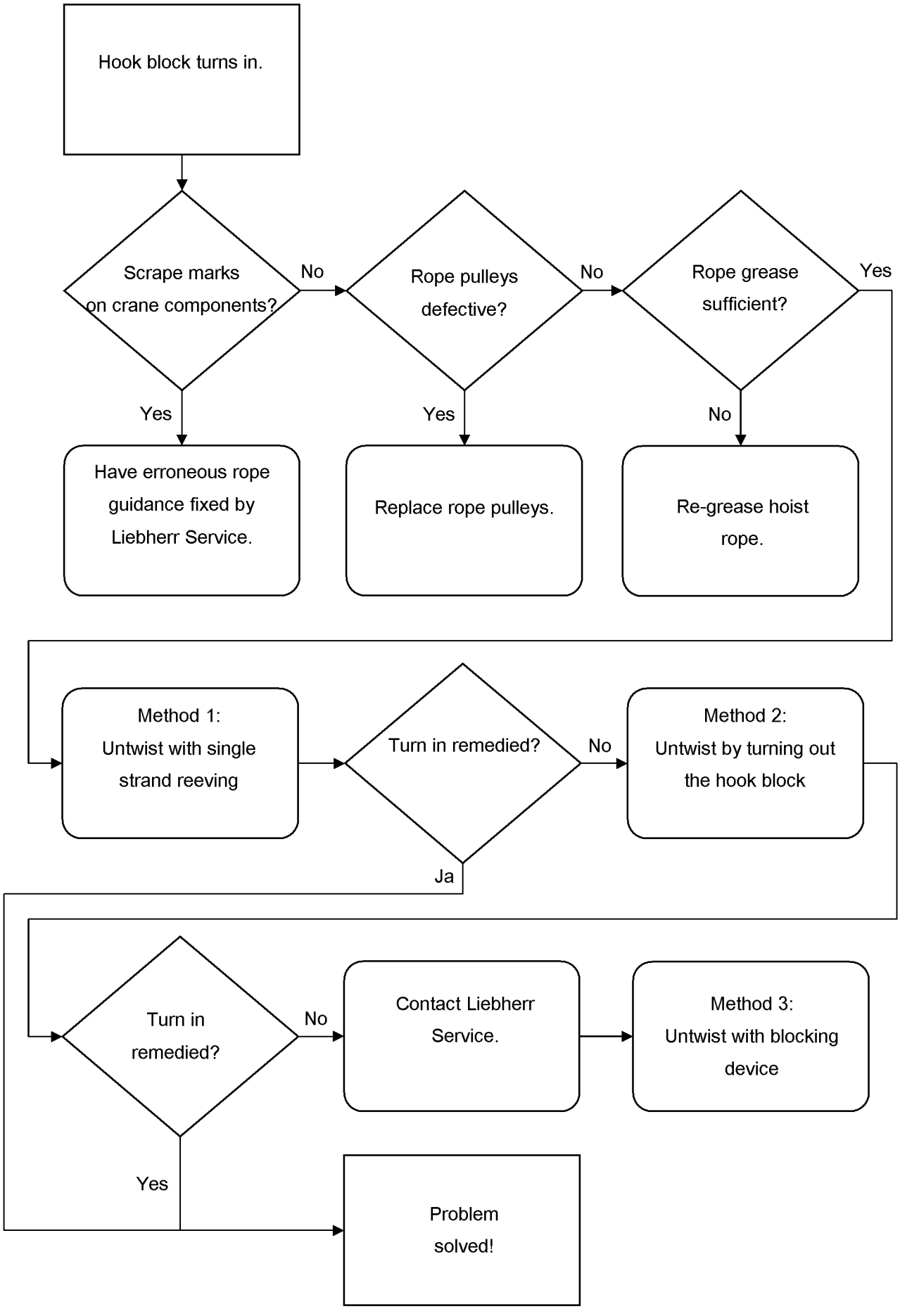


Typical non-rotation free wire rope structures are ropes with 8 to 10 outer strands. Twisting ropes are symbolically depicted with 8 outer strands (circles) (see table **4**).
Non-rotation free ropes can only be used with the following rope end connections:

– Rope end connection **non-rotating** in the form of a PFEIFER link **without** swivel or gib and cotter. A non-rotating rope end connection is also the mount of the rope on the fixed point of the winch drum.

DANGER
Danger of serious personnel injury and equipment damage!
▶ **Never** use rotating rope end connections with non-rotation free ropes!
▶ Never install a twist compensator / swivel!

Note
Usage warning notes
▶ The usage warning note on PFEIFER links without swivel and cotter indicates that this rope end connection may **not** be used for non-twist free ropes **in combination** with a twist compensator / swivel (see table **5**)!


Hook block turns in.
Scrape marks on crane components?
No
Rope pulleys defective?
No
Rope grease sufficient?
Yes
Yes
Yes
No
Have erroneous rope guidance fixed by Liebherr Service.
Replace rope pulleys.
Re-grease hoist rope.
Method 1: Untwist with single strand reeving
Turn in remedied?
No
Method 2: Untwist by turning out the hook block
Ja
Turn in remedied?
No
Contact Liebherr Service.
Method 3: Untwist with blocking device
Yes
Problem solved!

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8 Twisting caused by stretching in rotation-resistant ropes and its remedy

For procedure, see illustration opposite.

WARNING
Damage to the rope!
▶ Please proceed with extreme caution when performing the following actions.
▶ Please heed the following instructions to the letter.

8.1 General

The cause for the turn-in of the hook block can have various reasons. For that reason, check the crane first for the following features.

– Scrub marks: Are hoist rope scrub marks present on the crane components? If scrub marks are present, check the hoist rope pathway and rectify.
– Rope pulleys: Has the groove diameter become too small, or do the rope pulleys exhibit a negative profile?
  • Groove diameter dimensional stability must be present.
  • The rope groove must be uniformly smooth without a hoist rope negative profile.
  • If this is not the case, the rope pulley must be exchanged.
– Rope greasing: Has the hoist rope been sufficiently greased? If the rope surface is dry, the hoist rope must be re-greased.

If the crane does not display other features, the hoist rope must be spun out. Following, two methods are described by which the hoist rope can be spun out. The methods must be applied in the described sequence.

8.2 Turning out extremely rotation-resistant hoist ropes

8.2.1 Method 1: Spinning out with one strand reeve

1.) Reeve in the one strand hoist rope.
2.) Extend the boom to the maximal boom length and hook height.
3.) Lower hooks to approximately 1 m above the ground and allow the hoist rope to spin out.
4.) With an empty hook block, carry out one complete hoist cycle.
5.) Lower the hook again to approximately 1 m above the ground and allow the hoist rope to spin out again.
6.) Reeve the number of strands of hoist rope carefully and spin free where the twisting of the hook block is largest.
7.) Carry out at least two complete hoist cycles at maximum boom length and hook height, in order to divide the spin out onto the entire rope length.

If the hook block turns in further, method 2 must be used.

8.2.2 Method 2: Spin out by turning out the hook block

1.) The hook block is reeved with the largest number of strands are twisted.
2.) Extend the boom completely and lower the hook block.
3.) Attach a load of approximately 10 % of the nominal rope pull on the hook block.
4.) Before lifting the load, an assistant must carry out the following measures: Rotate the twisted hook block to a straight position by hand until the rope strands no longer touch each other.
5.) Rotate the hook block further by a complete revolution, the rope strands touch each other again.
6.) Hold the hook block in the prescribed position until the load lifts off the ground.
   - **NOTICE:**
     When the hook block comes under load, it will attempt to rotate back to a straight position. Release the hook block.
7.) Move the load until approximately 15 m before the uppermost hook position of the completely extended boom.
8.) Lower load and set it down. The twisting should now be remedied.

If the hook block turns in further, then the process must be repeated. If the problem is not remedied by this, contact Liebherr Service.

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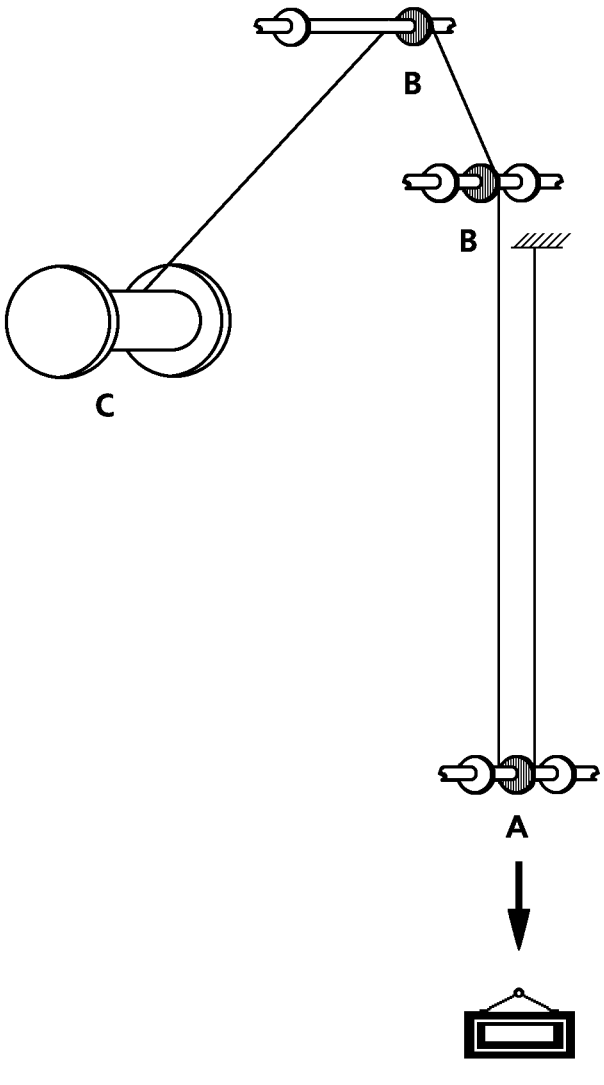

Fig. 1

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A Hook block **B** Rope pulley **C** Rope drum

9 Appendix 1

Diagram of possible defects, with reference to different areas that must be considered during inspection:

1.) Check rope end connection at rope drum
2.) Examine for incorrect spooling up, which causes deformation (crushing) and wear, which can have serious consequences at rope crossing points
3.) Examine for wire breaks
4.) Examine for corrosion
5.) Look for deformation as a result of hook block loading
6.) Inspect parts of rope that run over rope pulleys for wire breaks and wear
    - Rope suspension and rope mountings:
    - Check for wire breaks and corrosion
    - Also inspect parts of rope that run on or next to compensating pulleys
7.) Look for deformation
8.) Check rope diameter
9.) Carefully check length of rope that runs through the hook block, particularly the part that rests on the rope pulley under load
10.) Check for wire breaks and surface wear
11.) Check for corrosion

Datasheet for ropes	Machine: ..... Application: .....
Construction:	Date fitted: .....
Direction of rope lay: RH / LH [1]	Date discarded: .....
Type of lay: Ordinary / Langs [1]	
Nominal diameter:	Minimum breaking load: .....
Tensile grade:	Working load: .....
Quality: ungalvanized / galvanized [1]	
Type of core:	Diameter measured: .....
steel / natural or synthetic textile / mixed [1]	under a load of: .....
Preformation:	
Length of rope:	
Type of termination:	

Visible broken wires		**Abrasion of outer wires**	**Corrosion**	**Reduction of rope diameter**	**Positions measured**	**Overall assessment**	**Damage and deformations**
Number in length of **6 d**	Number in length of **30 d**	Degree of deterioration [2]	Degree of deterioration [2]	%		Degree of deterioration [2]	Nature

	Date: ..... Signature: .....
Rope supplier:	Number of working hours: .....
Other observations:	Reasons for discard: .....

[1] Delete as applirope
[2] In these columns, describe the latter as: slight, medium, high, very high, discard.

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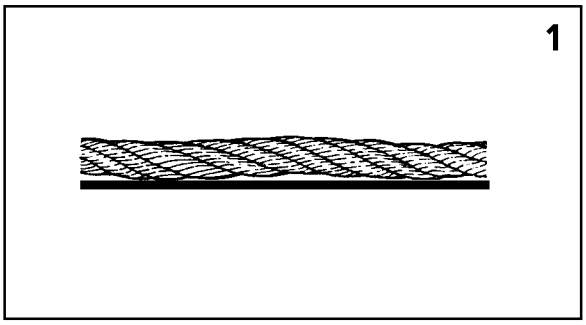
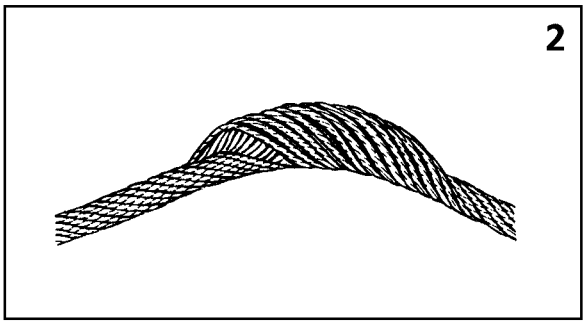
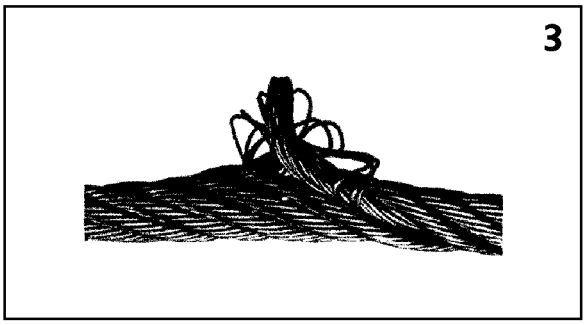
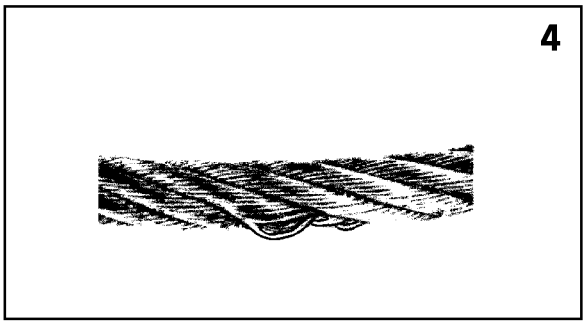
10 Appendix 2

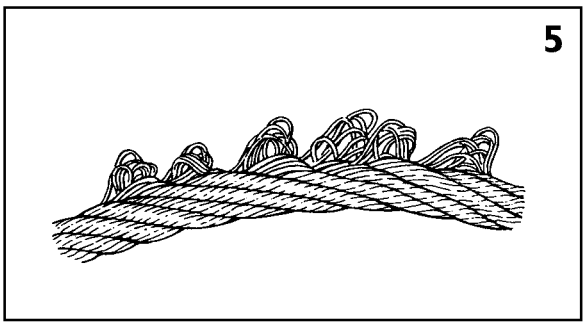
Typical example for an inspection log

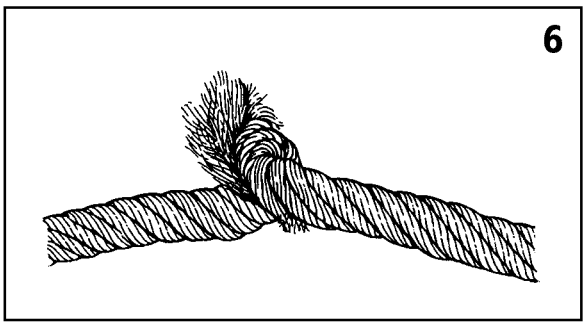


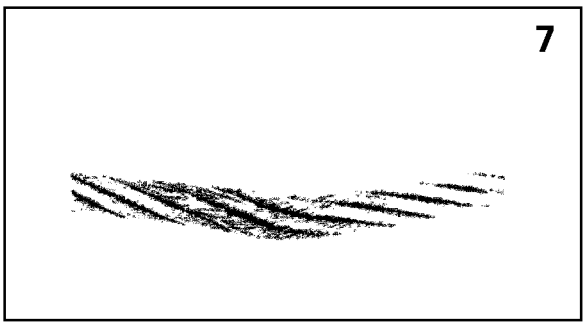


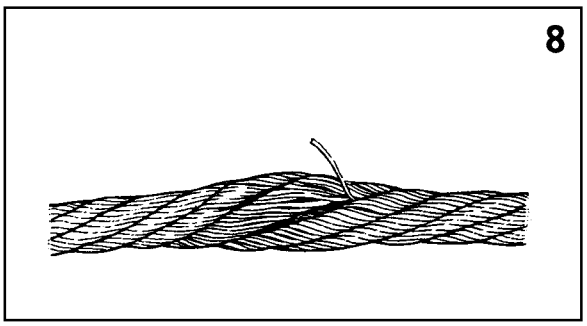


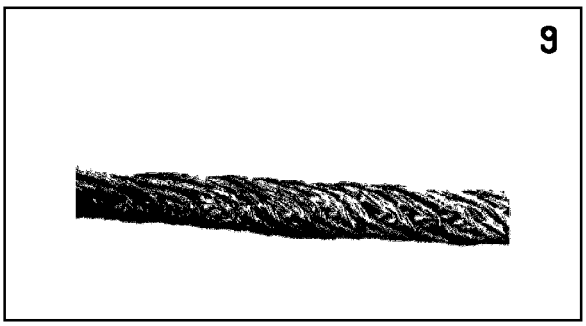


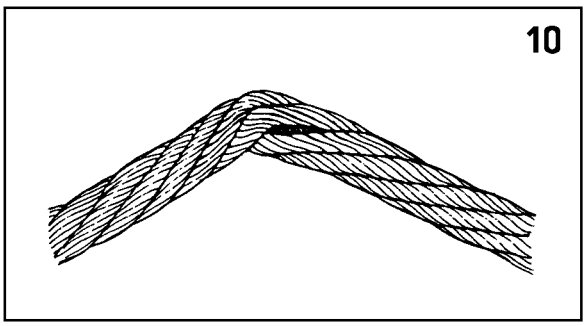












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11 Appendix 3

Note
Depiction of deformation
The deformation that is depicted on many pictures is exaggerated in order to show it more clearly.
▶ The ropes that are shown would have had to be taken down long before they reached this stage.

Typical examples of damage that can occur to wire ropes:

– Picture **1**:
  Corkscrew-like deformation: deformation where rope is in the form of a spiral along its longitudinal axis.
  The rope must be taken down if the deformation exceeds the value that is mentioned in chapter "Take-down criteria", section entitled "Corkscrew-like deformation".
– Picture **2**:
  Basket formation on a multi-strand rope.
  Reason for immediate rope take-down.
– Picture **3**:
  Steel core rope exit, generally in combination with basket formation in the immediate vicinity.
  Reason for immediate rope take-down.
– Picture **4**:
  Only one strand is affected by loop formation, although the examination of a longer section of rope shows that the deformation is visible at regular intervals; normally deformation along the length of a lay.
  Reason for immediate rope take-down.
– Picture **5**:
  Serious worsening of the previous problem (see picture **4**) (typical of hoist rope in a ram system).
  Reason for immediate rope take-down.
– Picture **6**:
  A serious reverse bend or knot.
  Note the destroyed lay that leads to the exit of the fibre layer.
  Reason for immediate rope take-down.
– Picture **7**:
  A wire rope that has been kinked during installation but still taken into operation, and now suffers from localised wear and substandard rope tension.
  Reason for rope take-down.
– Picture **8**:
  Crushing as a result of local mechanical damage causing imbalance beneath the strands, resulting in wire breaks.
  Reason for rope take-down.
– Picture **9**:
  Crushing of a multi-strand rope caused by incorrect spooling up on the rope drum.
  Note increase in length of outer strands of lay. Here too, imbalance would occur under load.
  Reason for rope take-down.
– Picture **10**:
  Example of serious kinking.
  Reason for rope take-down.

12 Appendix 4

Guideline for number of wire breaks in accordance with ISO 4309
for power train classification groups M1, M2, M3 and M4

12.1 Wire ropes

12.1.1 Hoist ropes

Rope diameter	Number of visible broken wires requiring rope removal, over a length of	
	6 x rope diameter	30 x rope diameter
see chapter 1.03	2	4

12.1.2 Assembly ropes

Rope diameter	Number of visible broken wires requiring rope removal, over a length of	
	6 x rope diameter	30 x rope diameter
see chapter 1.03	2	4

12.1.3 Guy ropes, control ropes

Rope diameter	Number of visible broken wires requiring rope removal, over a length of	
	6 x rope diameter	30 x rope diameter
see chapter 1.03	6	13

9.00 General notes

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1 Daily checking

The following checks are to be carried out daily and before each start-up:
- Check that all oil and fuel lines are leak-free and dry.
- Check that the injection pump, fuel and oil filters are leak-free.
- Check that the hydraulic units, fan drive hydraulic motors and their supply lines are leak-free.
- Check that the exhaust system and exhaust flange are leak-free.
- Check whether the exhaust flap retention flap is free.
  The return springs that open the exhaust flaps must function properly, because seized, and therefore closed exhaust flaps during engine operation will result in considerable overheating.
- Inspect electrical wiring and ensure that there is sufficient clearance to hot exhaust system piping and that it is properly fastened and that there is no insulation damage.
- Inspect the soundproofing mats for soiling from solutions and large quantities of oil or fuel, as well as other damage.
  Immediately remove any soundproofing mats that are excessively damaged or soiled and replace them with new ones.
  Observe the care instructions in the maintenance chapter regarding sound damping when cleaning the engine or gearbox room.

2 Repair and maintenance tasks

Note

▶ Repair and maintenance tasks are to be carried out carefully!

Take particular precautions regarding cleanliness when replacing diesel and oil filters. Remove any diesel fuel or oil that has leaked. Perform a test run on the systems to ensure that there are no leaks.
The diesel engine V-room must be inspected regularly, and any oil or diesel fuel must be cleaned up, particularly after repairs and servicing. Any fuel that has collected in V-room can spread throughout the engine room while the crane is travelling on the road and can ignite if it comes into contact with hot surfaces.
We stress that all electrical wiring must be installed according to the regulations and must be properly fastened. Immediately repair any wiring insulation that exhibits signs of chafing or brittleness as a result of operational activities. Any wiring that is not in perfect condition is to be immediately and professionally replaced.
We would like to particularly emphasise that over time fuel and oil lines can become brittle or porous as they age. Any hoses that appear to be excessively porous should be replaced immediately, see crane maintenance chapter.

3 Important servicing

The following service tasks are to be carried out regularly:
- Grease drive shafts with LIEBHERR special grease.
- Regularly check that the drive shaft bolts are properly seated.
- Check gearbox and engine oil levels regularly.
  Add oil as required during normal operation. If oil consumption or loss is unusually high, determine the cause and correct.

4 Maintenance notes for replacement parts

The following is to be considered when replacing drive components such as engine, gearbox or axles:

– Before re-starting, be sure to refill with the correct type of oil to the centre of the min. - max. markings.
  Refer to the nameplate and operating materials and lubricants to determine the oil type.
– Conduct initial maintenance according to chapter “Maintenance intervals”; thereafter, maintain in accordance with the specified maintenance intervals.
– Maintain break-in instructions, see chapter 2.02.

5 Instructions for travel operation

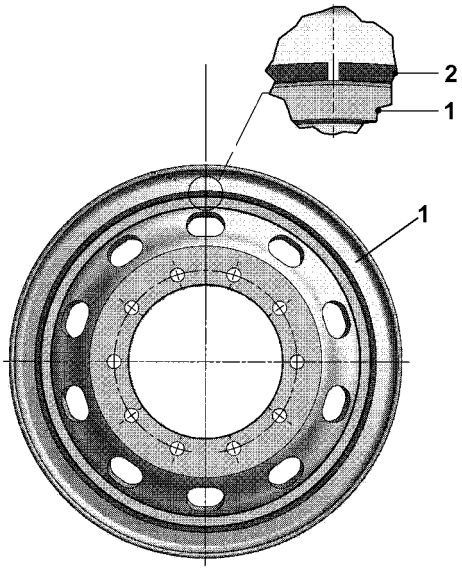
NOTICE
Engine damage!
If the permissible engine speed in exceeded, the engine can be seriously damaged!
▶ Do not exceed the permissible engine rpm!

6 Disposal of fuels and greases

Note
Engine, gearbox and hydraulic oils, brake fluids, grease and fuels are dangerous waste materials!
▶ These materials must be disposed of separately!
▶ These materials may not be disposed of in the ground or in any bodies of waters: wastewater systems, sewers or groundwater!
▶ Comply with the regulations specified by local authorities before disposing of any of these items or substances!

Note
Radiator fluid for diesel motors and heating systems are dangerous waste materials!
▶ Undiluted antifreeze / anti-corrosion agents must be handled as dangerous waste materials!
▶ Follow the regulations of the local authorities when disposing of used cooling fluids (mixture of antifreeze / anti-corrosion agents solution and tap water).

7 Tires



7.1 Wheel checks

DANGER
High accident risk!
If the clamp collar **2** is not properly installed, it can be violently ejected when the tire is inflated, causing death!
- ▶ If the clamp collar **2** is not correctly seated, please obtain the assistance of an authorised trained specialist!
- ▶ Do not make any alteration to the tire pressure!

- ▶ Visually check the side ring and clamp collar **2** for correct positioning!

DANGER
High accident risk!
- ▶ In the event of insufficient profile or damage to the tires, exchange tires for new ones!
- ▶ Maintain correct tire pressure! See chapter 1.03.
- ▶ If the tire pressure has sunk below 3 bar, the tire may only be pumped up by qualified and trained personnel!
- ▶ Replace damaged disk wheels **1** with new ones immediately!

- ▶ Check depth of tread.
- ▶ Check tires for damage.
- ▶ Check tire inflation pressure.
- ▶ Check wheel disks **1** for damage.

7.2 Tire changes

Note
- ▶ Tires may only be changed by authorized and trained specialist personnel!
- ▶ This applies both to dismounting and mounting of the tire on the wheel disk **1**!

7.3 Wheel changes

7.3.1 In event of tire failure

Note
The following is to be considered in the event of tire failure!
- ▶ Pay attention to road traffic when stopping!
- ▶ The steering wheel could vibrate. Hold on to the steering wheel tightly with both hands!
- ▶ Select the flattest possible surface for undertaking a wheel change! Select the site in such a way that the road traffic is obstructed as little as possible and you will not be endangered when changing the wheel!
- ▶ Secure the vehicle and the breakdown site!
- ▶ “Free-standing” crane operation is absolutely forbidden!

WARNING
Toppling wheel!
The wheel can topple over when changing the wheel and seriously injure personnel!
- ▶ Secure the wheel against toppling!
- ▶ Only actuate the support when no wheels are leaned against a sliding beam or support cylinder!
- ▶ Step away quickly if a wheel threatens to topple!
- ▶ Exchange wheels with the help of an assisting person if possible!

- ▶ Engage parking brake, see chapter 3.04.
- ▶ Lock the axle suspension, refer to chapter 3.03.
- ▶ Loosen wheel nuts on faulty wheel.

DANGER
Crane can topple over!
- ▶ Select a support base where the mobile crane cannot topple over!

- ▶ Support mobile crane insofar as the wheels can be changed, see chapter 3.05.

Wheels that are on their side are extremely difficult to lift up. For this reason, do not put the wheels down when changing a wheel.
- ▶ Lift spare wheel using the crane, put down next to defective wheel and prevent from rolling away or toppling over.
- ▶ Unscrew wheel nuts and dismount defective wheel.

DANGER
Defective spare wheel!
- ▶ Visually inspect the disk wheel **1**, the side ring, the clamp collar **2** and the tire!
- ▶ Never mount a defective spare wheel!
- ▶ Only mount wheels that are approved for the vehicle!

- ▶ Mount spare wheel.

Note
- ▶ The tightening torque for the wheel nuts is 600 nm.

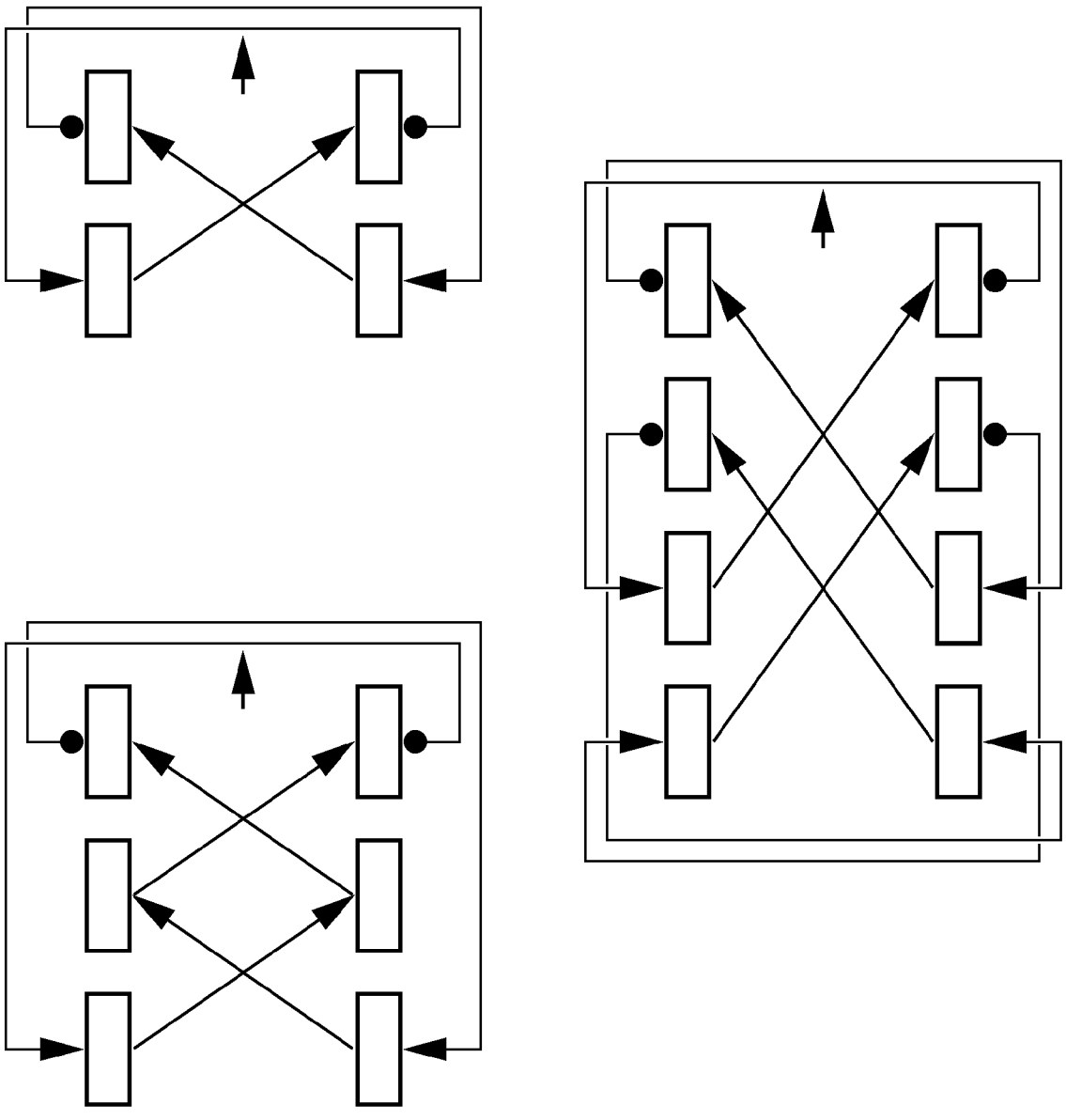
- ▶ Remount wheel nuts and tighten in a crosswise pattern with 600 Nm.
- ▶ After the first 50 and the first 100 travelled kilometres:
  Ensure that wheel nuts are tight, re-tighten if necessary.

7.3.2 Changing the wheels with one another

Crane vehicle tires are subjected to differing loads during operation.

Tire rotation is recommended to ensure that all the vehicle's tire wear uniformly. Tires should be rotated as soon as uneven wear patterns are detected. Reliable, are intervals between 5,000 km and 10,000 km. Tires should be rotated in a crosswise pattern (see following diagrams). The location should also be selected so that tires that are evenly worn are installed in locations where the wear pattern is uneven.

This process has a positive impact on driving comfort and tire life.



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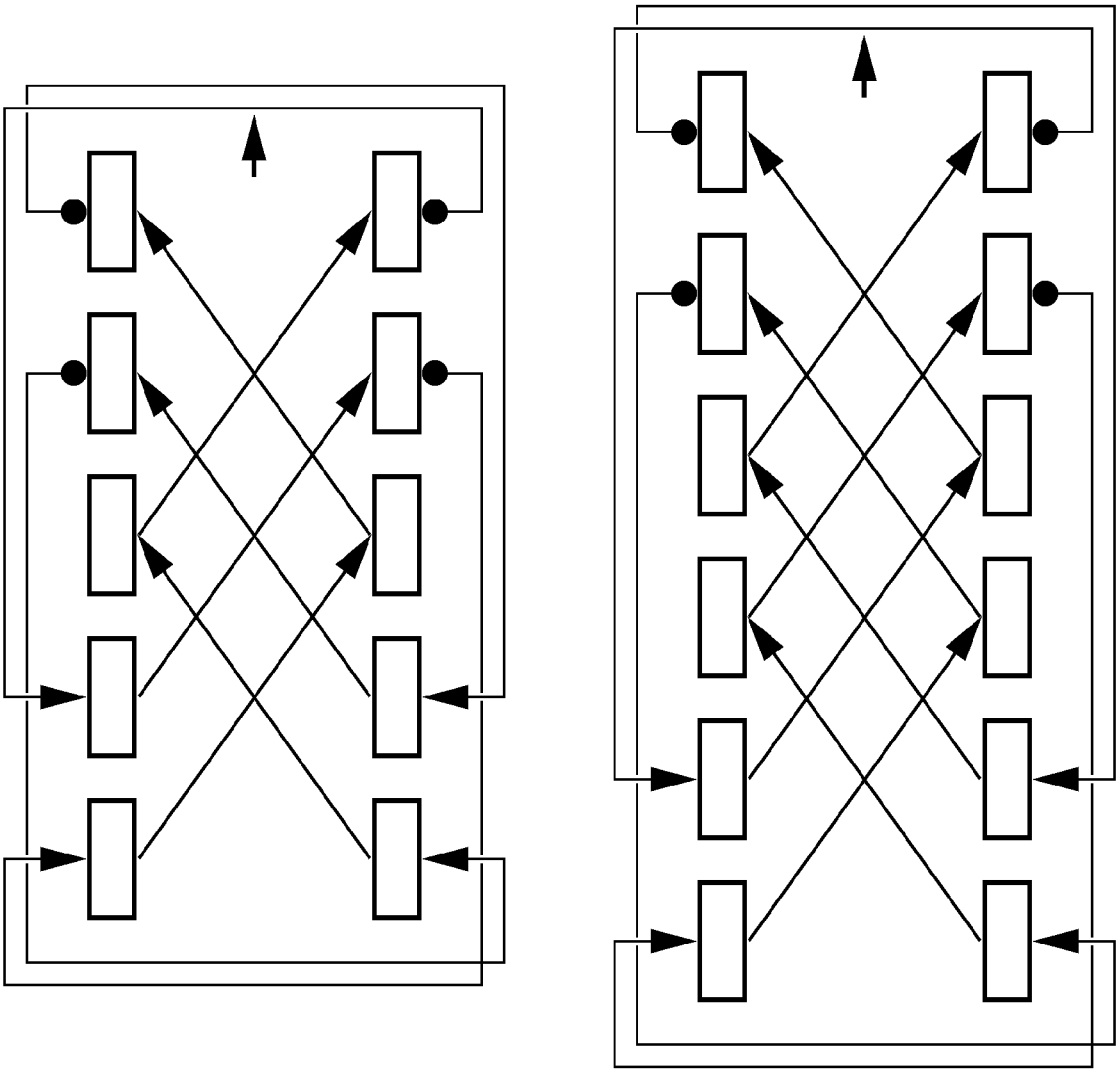

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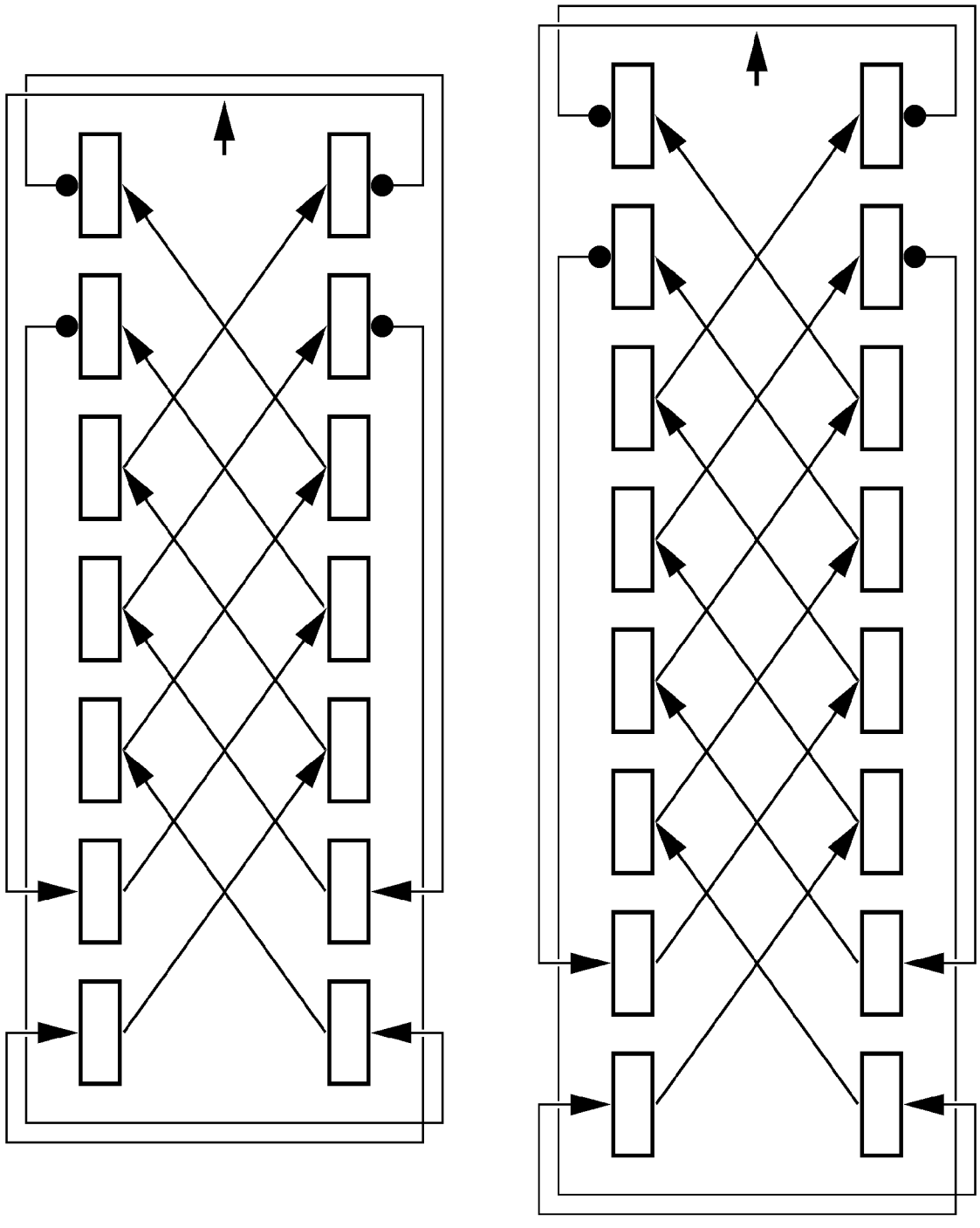

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