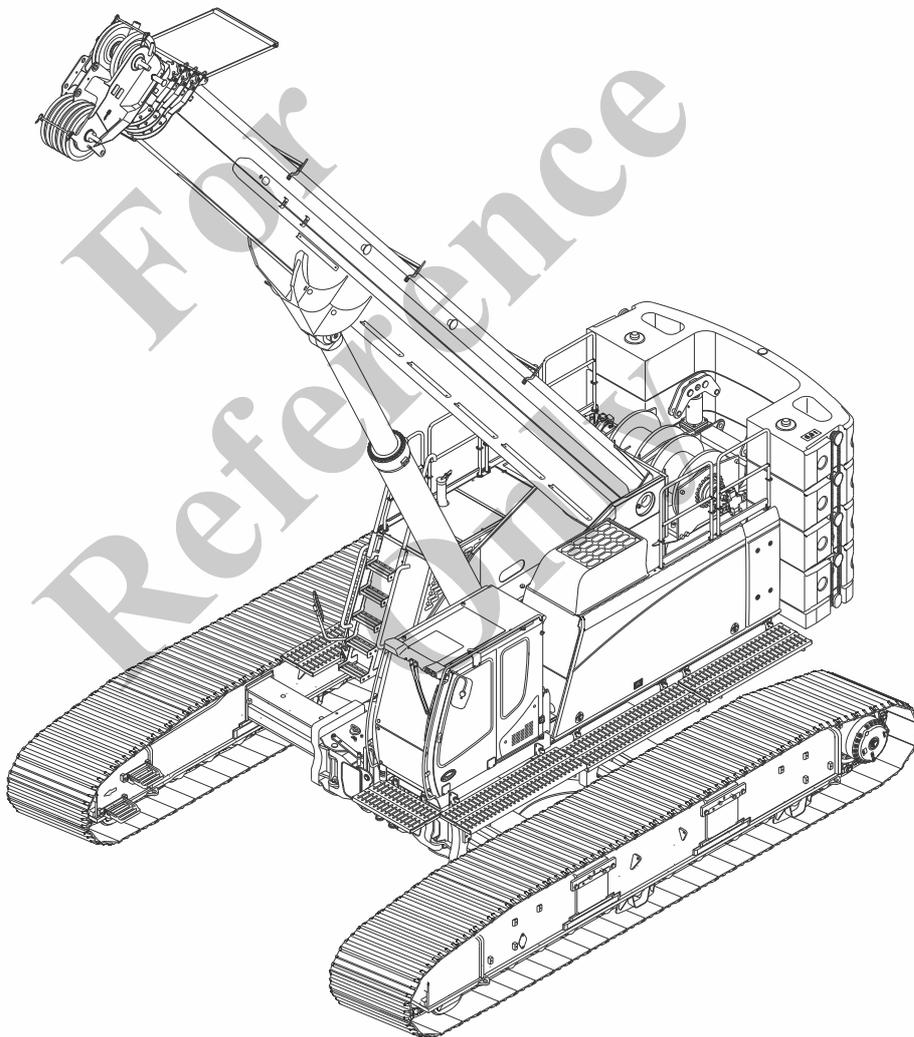


Operating manual

GHC130

 Read the manual completely prior to first operation!



00122

Use of the manual

- Read this manual carefully all the way through before you work with the machine.
- Always keep this manual in the cab for future use.
- In the event of sale, disposal or loan, the manual must accompany the machine!

Presentation of informative notes

Informative notes that make the work easier or contribute to better understanding in handling the machine are presented in the following manner:



Indicates notes that draw your attention to special features.



Indicates a cross-reference to other documents.

Presentation of handling instructions

Handling instructions are presented in tabular form as follows:

1	Press switch (1).
2	Activate control lever (2).
3	Unfasten bolt (3).

Presentation of listings

- Text. Text. Listings are marked with bullet points.
-
- Text. Text. Sub-points in listings or procedures are marked with dashes.

Target group

The machine has been developed for demanding tasks. Persons working on or with the machine must be trained or instructed for this purpose.

Operation and work must only be executed by trained personnel. Start-up, maintenance, transport, and assembly/disassembly must only be performed by trained specialists.

Detailed information on the prior knowledge and qualifications required of the operator can be found in Chapter 1 SAFETY of this manual.

What documents are part of the machine?

The following documents are considered as part of the machine:

- This manual
- Spare parts catalog
- Service booklet
- Electrical system and hydraulic system diagrams



Information

The complete scope of supply is specified in the order confirmation.

How are the instructions organized?

The manual is divided into 10 chapters:

- 1: Safety
Here you will find general safety instructions that must always be observed.
- 2: Structure
The main components of the machine are presented in Chapter 2.
- 3: Technical data
Here you will find basic machine information, for example safe working loads.
- 4: Start-up:
This chapter contains instructions on daily machine maintenance and start-up.
- 5: SENCON machine diagnostics system 2.0
Here you will find instructions on how to use the SENCON 2.0.
- 6: Operation
This chapter contains information on control elements and work operation.
- 7: Setup tasks
Chapter 7 contains procedures for mounting and dismounting components, for example, MOUNTING THE FLY BOOM.
- 8: Transport:
Dimensions and weights of the machine are found in chapter 8.
- 9: Troubleshooting
This chapter contains instructions on recognizing the causes of faults and how to correct them.
- 10: Appendix
Here you will find additional information, e.g., about the supplemental documentation.

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For Reference Only

1 Safety

1.1 Presentation of safety information

This operating manual contains warnings to alert you to hazardous situations.

Safety alert symbol



This is the safety alert symbol. It alerts the user of potential hazards of personal injury. To avoid injury and death, all safety instructions following this symbol must be observed.

Signal word

The signal word indicates the severity and the probability of occurrence of the danger if the instruction is not complied with.



DANGER, this signal words indicates a hazardous situation that will cause severe injury or death if not avoided.



WARNING, this signal words indicates a hazardous situation that may cause severe injury or death if not avoided.



CAUTION, this signal words indicates a hazardous situation that may cause light or medium injury if not avoided.



NOTICE, this signal word indicates important but not safety-relevant information (e.g. risk of property damage).

Warnings in this operating manual



WARNING

Warnings indicating a hazardous situation that could result in injury are always introduced with the safety alert symbol and the signal word.

NOTICE

Warnings indicating a hazardous situation that could result in property damage are introduced by the signal word.

1.2 Danger sources

The machine has been built in accordance with the state of the technology and the recognized safety regulations. Nevertheless, there may be dangers during its use to personnel, machines and other material assets, if...

- the machine is not used as intended,
- the machine is not operated or maintained by trained personnel,
- the safety instructions are not complied with,
- the machine has defects,
- the attached tools do not comply with the relevant safety regulations,
- the attached tools have defects.

1.3 National and international regulations

National and international regulations apply in addition to the safety instructions in this manual.

For example, in the Federal Republic of Germany:

- Winches, Lifting and Pulling Equipment (BGV D8)
- Cranes (BGV D6)
- Crane Inspections (BGG 905)

Information

If national regulations in the country of operation deviate from our recommendations, the more stringent procedure should be followed.

1.4 Intended use

The machine must only be used for construction operation within the limits specified by the classification according to Section 1.6 and in accordance with the ambient conditions.

Assembly, disassembly, maintenance, fault diagnosis and transport are part of the intended use if these tasks are performed by authorized personnel in accordance with the instructions and rules in this operating manual.

Only persons that have been trained or instructed in their task area are permitted to be near the machine or in its working range. Particular importance must be placed on imparting knowledge of possible hazards when instructing or training these persons.

Intended use always requires that:

- all instructions, safety notices, and rules for avoiding hazards in the operating manual are complied with during operation and during assembly, disassembly, service, maintenance, and fault diagnosis,
- the acoustic and visual warning signals are perceived and responded to in accordance with regulations,
- the warning, prohibition and information signs attached to the machine are complied with,
- the working range of the machine is carefully monitored,
- the permissible ambient conditions are taken into consideration,
- personal protective equipment is used if so required in the operating manual or if necessary for other reasons,
- the machine operator has an unobstructed view of the load and hoisting accessories or of the working equipment and surroundings, and/or communication between the machine operator and other authorized persons present is assured,
- the load-bearing capacity and evenness of the ground is suitable for the work, and the permissible inclinations are taken into consideration,
- all maintenance and repair tasks are performed at the specified intervals and by authorized persons.

Comply with the capacity specifications of the machine, as well as the equipment in accordance with Chapter 3 TECHNICAL DATA.

Any other use or use beyond this is considered non-intended use.

 **WARNING**

Danger of injury due to falling objects!

Risk of personal injury due to heavy objects falling onto the operator station.

- If there is danger of heavy falling objects, only deploy the machine if the driver seat is protected by a protective roof (FOPS). The protective roof is available from Manitowoc CraneCare as an option.

Target group

The machine has been developed for demanding tasks. Persons working on or with the machine must be trained or instructed for this purpose.

Operation and work must only be carried out by trained personnel. Start-up, maintenance, transportation and assembly/dismantling must only be carried out by trained specialists.

**Embankments
and excavations**

The crane must be set up with a sufficient safety distance to embankments and excavations. The distance depends on the type of ground.

WARNING**Personal injury and material damage due to the machine slipping!**

The machine slips off of the embankment.

- Place the machine at a minimum distance of 2 m from the edge of the embankment.
- Pay attention to the condition of the ground:
 - For overgrown ground (or non-rolling ground), the safety distance (A) must be equal to the depth of the excavation (B), embankment angle $\alpha < 45^\circ$.
 - For ground fill (or hilly), the safe distance (A) must be two times the excavation depth (B), slope angle $\alpha < 30^\circ$.

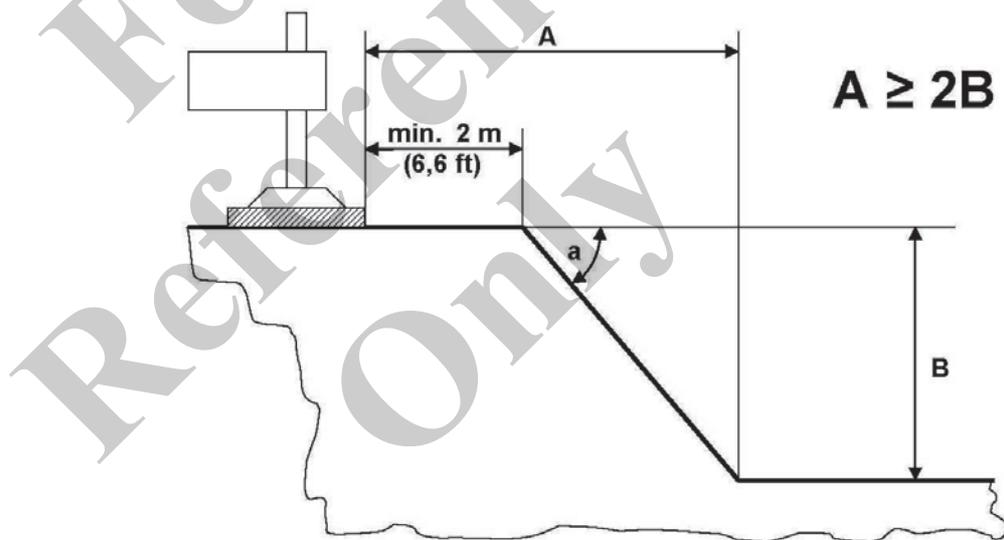


Fig. 1 Determination of the distance from embankments and excavations

1.5 Impermissible use

Impermissible operating methods

The operational safety of the machine is only ensured if used as intended and according to this operating manual.

The capacity information specified in Chapter 3 TECHNICAL DATA must not be exceeded.

Impermissible use in crane operation

The types of machine use in crane operation that are impermissible are stated below:

- Exceeding permissible safe working loads
- Using other than original Manitowoc parts
- Use in impermissible ambient conditions
- Operating error by untrained and uninstructed personnel
- Inadequate equipment for the application (for example, protection of the cab against falling objects through protective grating)
- Working on an insufficiently firm ground
- Failure to perform the necessary inspection and maintenance tasks
- Lifting, moving, and transport of persons
- Pulling loads at angles
- Dragging loads on the ground
- Operation in an explosive environment
- Pulling jammed loads free

These situations must always be avoided. Actions to the contrary can result in severe injury and extensive material damage. Impermissible use excludes any liability on the part of the manufacturer. The risk is borne solely by the user.

Unauthorized conversion and production of spare parts

Conversions and modifications of the machine are not permitted. This applies also for the installation and use of safety devices and safety valves, as well as for welding on load-bearing parts.

Genuine spare parts and Manitowoc accessories ensure the safety of personnel. Parts and equipment from other manufacturers are not tested by Manitowoc and are therefore not approved. The use of other components can alter the machine's characteristics and pose a safety hazard.

If other components are used, Manitowoc will not be liable for any resulting consequences.

1.6 Crane categorization

As specified in the standard, the crane is a mobile crane for assembly operation.

Overall crane

The crane is categorized in crane group A1 and is designed and calculated for collective class Q1 and operating class U2 in accordance with ISO 4301 Part 1 and 2.

Crane group A1: Crane for general lifting tasks, not used in continuous operation.

Collective class Q1: Cranes that very rarely lift the SWL (safe working load) and usually only lift light loads.

Operating class U2: Occasional operation, maximum number of load cycles at 63,000.

Use of the crane outside the safe working loads, application and ambient conditions determined by calculation and tests results in significantly reduced service life or premature damage.

The rope winches of the crane are categorized in accordance with ISO 4301 Part 1 and 2 as follows:

Hoisting gear

Driving gear group M5 - collective class L2 - operating class T5

1.7 Requirements on personnel



Danger of material damage and personal injury due to untrained personnel

Personnel who have not been trained or instructed cause malfunctions. Such malfunctions may cause severe personal injury.

- Any personnel that is undergoing training or instruction work on the machine must be under constant supervision of a specialist when performing work.
- Work on the machine's electrical equipment must only be carried out by a qualified electrician.
- Work on travel gear, braking and steering systems must only be carried out by appropriately trained technicians.
- Work on hydraulic equipment must only be carried out by personnel with specific knowledge and experience in hydraulic systems.

- Assign responsibilities for operation and maintenance.
- Observe the permitted statutory minimum age.

Owner	The owner (entrepreneur/enterprise) is whoever operates the product and uses it in accordance with its intended use or allows the product to be operated by suitable and instructed personnel.
Operating personnel	Operating personnel are those persons authorized by the owner to operate the product.
<i>Excerpt from OSHA regulations (USA)</i>	Machine operators must have the following qualifications: <ul style="list-style-type: none">● Successful completion of a practical driving test for this machine.● A minimum vision acuity (with or without corrective lenses) of 20/30 Snell in one eye and 20/50 Snell in the other eye.● The ability to distinguish colors (red, yellow, green), if required for the work in question.● Adequate hearing (with or without hearing aid).● A disabling heart problem or epilepsy is a valid reason for rejection as a machine operator.
Specialized personnel	<p>Specialized personnel are those persons authorized by the owner to fulfill qualified tasks, such as installation, setup, repair, maintenance, and troubleshooting. The following groups of people are included in the definition of the term 'specialized personnel':</p> <ul style="list-style-type: none">● Specialist Due to technical training and experience, the specialist can safely operate the product in accordance with the applicable standards. A specialist is able to recognize and avert potential dangers during the work.● Instructed person An instructed person has been instructed in the following points and is capable of implementing this instruction:<ul style="list-style-type: none">– The tasks assigned to the person– Recognizing and avoiding potential dangers associated with improper behavior– The necessary protective devices and measures, applicable regulations and accident prevention guidelines– The respective operating conditions● Expert An expert has the following knowledge to assess if the machine is in a state that allows safe work:<ul style="list-style-type: none">– Technical training and adequate knowledge of the machine– Applicable occupational health and safety regulations and accident prevention regulations– Acknowledged guidelines and standard engineering practice

1.8 Work operation

DANGER

Danger to life due to uncontrolled movement of loads and machine parts!

Persons on or next to the machine will be injured due to uncontrolled movements of the machine or of the load.

- Always engage the running gear parking brake before switching off the machine.
- Secure the machine against rolling off, for example with wheel chocks.
- Park the machine on level ground, do not park it too close to excavations or embankments under any circumstances.
- Lower suspended loads to the ground.
- If a storm is approaching, put the machine in park position, (see section 3.2).
- Always stop the engine when leaving the machine, and safeguard it against unauthorized start-up.

Danger zone

Persons can be exposed to significant hazards in the working range (danger zone) of the machine. The working range corresponds to the slewing range with load attached or with work equipment installed, including attachments. The working range shifts with the travel movements.

Causes of hazards include:

- Work movements of the machine, such as slewing, lifting/lowering and luffing of loads, load suspension devices or work equipment
- Swinging of the load and/or the load suspension devices (for example, bottom hook block)
- Swinging of projecting components (for example, counterweight)
- Travel movements of the machine
- Movement of the work equipment
- Falling payload, loads or other objects

 **DANGER****Danger to life due to moving parts in the work area of the machine!**

Persons in the work area of the machine will be caught and injured by moving machine parts.

- Ensure that only trained personnel are present in the work area.
- The machine operator must give warning signals if persons are endangered.
- Stop all tasks immediately if unauthorized persons are in the danger zone.

 **DANGER****Danger of falling due to overloaded walkways / gallery!**

If walkways or the gallery fall people will be severely injured.

- The maximum load permitted on the walkways / gallery is 200 kg (440 lb) per grating segment.
- Check the walkways / gallery for cracks and general damage every 3 months and have them repaired immediately.

 **WARNING****Danger of injury due to crushing between the machine and stationary fixtures!**

Persons can be crushed between the cab and a stationary fixture.

- Maintain a minimum distance of 500 mm between the machine and the stationary fixture.
- If the minimum distance cannot be maintained, provide suitable barrier measures in the danger zone.
- If you do not have a clear and unobstructed view of the work area, obtain the assistance of a banksman.
- Ensure that you can communicate with the banksman.


WARNING
Danger of injury due to the machine overturning!

Persons can be caught and injured by a machine that is overturning. The danger zone corresponds to the height of the equipped machine with the boom at a steep angle.

- Observe the notices, regulations and instructions in this operating manual concerning the following areas:
- Load-bearing capacities
 - The required condition and safe load-bearing capacity of the ground
 - Ground inclination
 - Distance from embankments and excavations
 - Concealed deficiencies of the ground (old basement, vault, etc.)
 - Permissible wind speeds
 - Travel with and without load (permissible incline, ground conditions, uppercarriage and boom position)

Personal protective equipment

Operating personnel are obligated to wear the personal protective equipment prescribed by national regulations when working on the machine (for example hard hat, hearing protection, protective gloves, safety footwear).

At working heights of 2.00 m or more, Manitowoc recommends the use of a safety harness to prevent falling. At working heights above 3.00 m, using a safety harness is a legal requirement.

Hook-in points are marked by the appropriate sign shown on the left.

Minimizing noise

Housings, coverings, cab doors and windows must be kept closed while using the crane to decrease noise levels (unless otherwise required for safety reasons). Operating elements must be activated gently.

Noise emissions

The continuous sound pressure level (LpA) of the machine is measured in the driver seat with the cab closed. The continuous sound pressure level is below 70 dB. The wearing of hearing protection is not absolutely required. The measurements are taken as specified in Directive 2000/14/EC.


Information

A warning sign is placed in the cab (information about dB level) if the continuous sound pressure level (LpA) of the machine exceeds 70 dB. Hearing protection must be kept in the cab for a continuous sound pressure level (LpA).

Vibration The machine operator is protected against mechanical vibration with a shock-cushioning seat that can be adjusted for the operator's weight. The seat height and backrest are adjustable. The optimal work position can be set for each individual driver. The alarm values for hand-arm vibration (2.5 m/s²) and for full-body vibration (0.5 m/s²) are not exceeded.

Problems Report problems or damage immediately to a responsible person! Prevent the machine from misuse or unintentional use. Repairs must only be performed by qualified specialists.

Lightning Cabs of construction machines offer safe protection against lightning strikes. The lightning current flows through the cab to the ground.



Danger to life due to lightning strike!

Risk of personal injury if there is a lightning strike while having contact with metal parts that are in direct contact to the chassis.

➤ During a storm, do not touch any metal parts that are in direct contact with the chassis.

Tasks in the vicinity of power lines

- Before starting work, clearly mark the power lines in the area of the construction site while being supervised when doing so!
- Always assume that overhead lines are live.
- Operate the machine so that neither parts of the machine nor attached loads project into the danger zone.
- Maintain a safe distance to the overhead lines. If national regulations do not require other values, maintain the following minimum distances (does not apply for the USA):

Safety distances to overhead lines (not for the USA)

Nominal voltage (volts)	Safety distance (meters)
to 1000 V	1.00
over 1000 V to 110 kV	3.00
over 110 kV to 220 kV	4.00
over 220 kV to 380 kV	5.00

**Safety distances
to overhead lines
for the USA**

Nominal voltage (volts)	Safety distance m (ft)
to 750 V	4 (1.22), with lowered boom
over 750 V to 50 kV	6 (1.83), with lowered boom
over 50 kV to 345 kV	10 (3.05), with lowered boom
over 345 kV to 750 kV	16 (4.87), with lowered boom
over 750 kV to 1 MV	20 (6.10), with lowered boom
to 50 kV	3.05 (10)
over 50 kV to 200 kV	4.60 (15)
over 200 kV to 350 kV	6.10 (20)
over 350 kV to 500 kV	7.62 (25)
over 500 kV to 750 kV	10.67 (35)
over 750 kV to 1 MV	13.72 (45)

- Use a banksman to monitor the safety distance.
- The insulating elements fitted to the machine, protective cages, or proximity warning devices are no substitute for the specified minimum distances.
- In windy conditions, the overhead power lines and the work equipment can swing outwards and consequently reduce the distance.

High voltage contact

In the case of high-voltage contact, the following rules apply:

- Do not exit the operator cab.
- Warn those outside against approaching or touching the machine.
- If possible, move all work equipment or the entire machine out of the danger zone.
- Arrange for power to be switched off.
- Only exit the machine after the touched or damaged line has been de-energized.

In an emergency: If you must exit the machine, for example, danger of fire, do not touch the machine and the ground simultaneously. Jump off the machine with your feet together.

1.8.1 Boarding or exiting the crane safely

- Enter and exit machine only when it is at a standstill. Use the access steps and/or ladders intended for this purpose:
 - If necessary, clean access steps and ladders prior to use.
 - Do not carry any objects when climbing up or down.
Lift equipment items onto the machine with a rope or hoist.
 - Do not use operating elements in the cab as grip handles.

1.8.2 Emergency exit

Cab

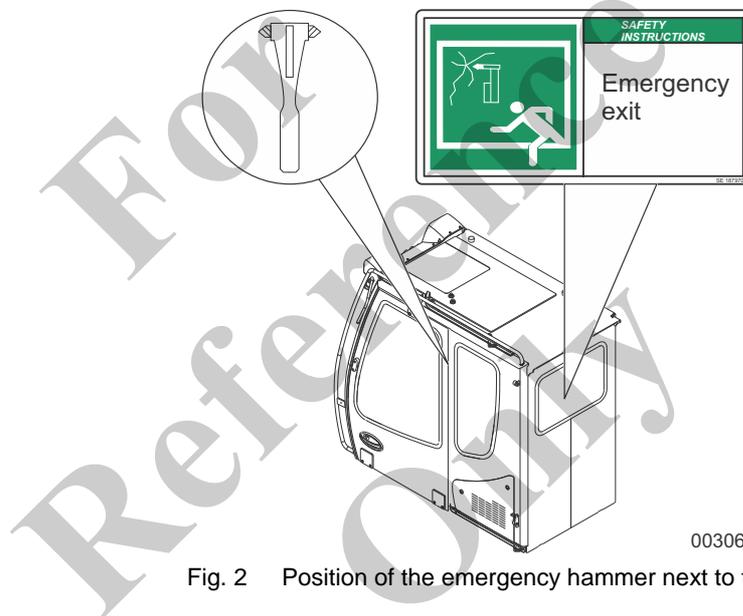


Fig. 2 Position of the emergency hammer next to the operator door



Information

In the event of an emergency exit, use the emergency hammer (1) to break the rear window.

1.8.3 Regulations for applications planning

When planning an application, the following anticipatory inspections must be performed by the owner:

- Inspection for conformity of the anticipated application with the technical data of the machine, for example, with the anticipated crane application: Required safe working load, working radius, hook height
- Inspection of the external conditions, for example, effects of wind, snow, unfavorable temperatures, visibility
- Inspection of suitability of use for all parts such as components, supplemental parts, sling devices, sling ropes, etc.
- Inspection of ground conditions at the work site for safe working load for the maximum load stress
- Inspection of the site of operation for the presence of other conditions that require special precautionary measures or special equipment
- Inspection of the site of operation for special hazards, for example, due to pipelines and high-voltage lines, etc.
- Check whether additional special protective measures are required for the forthcoming operation

If danger of heavy items dropping exists, the machine must only be used if the driver's area is covered by a protective roof (FOPS). The protective roof is available from Manitowoc CraneCare as an option.

1.8.4 Ramming tasks or pulling sheet pile walls

Strong vibration can occur when performing pile driving tasks and pulling sheet pile walls. This can cause premature material fatigue and cracks in load-bearing steel constructions. Vibrations on the pile driver must not be permitted to transfer to the boom. The machine can only be operated with a functioning load moment limiter (LML) used with the proper operating modes and load lift charts. Do not bypass the load moment limiter (LML) when performing ramming tasks or pulling sheet pile walls.

For
Reference
Only

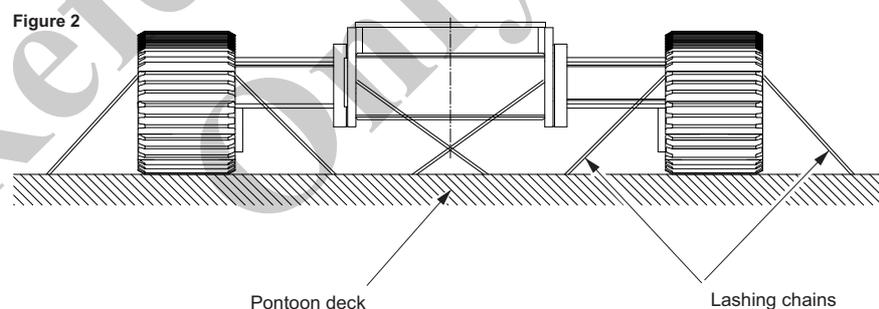
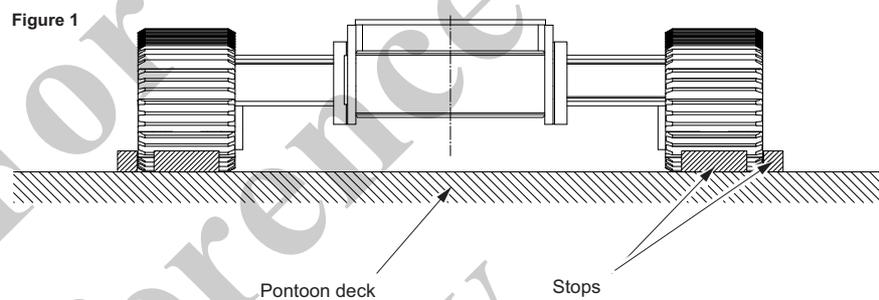
1.8.5 Deployment on a pontoon

If the following requirements are met, the machine can be deployed on a pontoon.

General requirements

- Secure the machine on the pontoon to prevent it from shifting.

1	Attach sturdy stops on the pontoon (Fig. 1).
2	Alternatively, lash the machine using the optional eyes on the undercarriage (Fig. 2).



- All safe working loads only apply to freely suspended loads and to the wind speeds specified.
- Driving with a load is not permitted.
- The pontoon provides sufficient load-bearing capacity and is sufficiently dimensioned. This is the responsibility of the company operating the machine.

Deployment scenarios

The following deployment scenarios are possible. Additional requirements must be met.

- 1) The pontoon is stabilized and in a horizontal position:
 - The standard load charts without incline apply.

- 2) The pontoon is stabilized, however, inclined up to a maximum of 4°:
 - The optional load charts with an incline of 2° and 4° apply.
 - Choose the reeving in accordance with the standard load charts.
 - If necessary, adjust control engineering features to prepare the machine for this application (e.g. slewing gear deactivation or heeling level). This can be done optionally. For this purpose, please contact the Manitowoc CraneCare in advance.

- 3a) The pontoon is not stabilized. There is no or a very light swell (e.g. in inland waters):
 - The optional load charts with an incline of 2° and 4° apply.
 - Choose the reeving in accordance with the standard load charts.
 - If necessary, adjust control engineering features to prepare the machine for this application (e.g. slewing gear deactivation or heeling level). This can be done optionally. For this purpose, please contact the Manitowoc CraneCare in advance.

- 3b) The pontoon is not stabilized. There is a heavy swell (e.g. in offshore applications):
 - For this application, special offshore standards and special load charts may apply.
 - Coordinate the deployment with the Manitowoc CraneCare ahead of time.

1.8.6 Start-up

A thorough inspection of the machine must be performed prior to every start-up.

- Prior to start up, perform the inspection tasks as specified in Section 4.2.
- Check protective devices for completeness, functionality, and proper fastening.
- Wear personal protective equipment (for example hard hat, hearing protection, protective gloves, safety footwear), if required by work conditions.
- Do not wear any jewelry or loose clothing.
- Secure loose items such as tools or other accessories.
- Agree on hand signals with the banksman.
- Obtain information on first aid and rescue facilities.
- Ensure that no one is in the danger zone.
- Do not start up the machine if defects are detected.
- Ensure that all control levers are in the neutral position.
- Start the machine only as described in the operating manual in accordance with Section 4.4.
- Check the safety devices (brakes, signaling and lighting equipment) of the machine.
- Check the operating elements and protective devices for proper function during slow travel.
- Pay attention to the weather forecast. Safe operation of the crane is only ensured up to the maximum permitted wind speed.

1.8.7 Operation

- Prior to start up, perform the inspection tasks as specified in Section 4.2.
- The following applies to all tasks: Only carry out the task if the work area has a firm, level ground with sufficient load-bearing capacity.
- Do not drag loads over the ground.
- Ensure that no one is in the danger zone.
- Maintain a safe distance to overhead lines.
- Only operate the machine from the driver seat or with the remote radio control (available as an option).
- Only transport persons with an elevating work platform.
- Take environmental conditions, for example, poor visibility, wind speeds, et cetera, into account.
- Use the specific load lift charts for the machine.
- The weight of the load must be known!
- Use sling gear (such as ropes, chains) properly. The bottom hook block must be positioned vertically over the center of gravity of the load.
- Observe the capacity specifications. Check whether attachment points and sling ropes have a sufficient load-bearing capacity.
- If a banksman is assisting, follow the banksman's signals.
- Position the boom in the direction of travel if moving over long distances. Hook in the bottom hook block and secure it.

1.8.8 Travelling

- If visibility is poor, ensure that a banksman is used to give the required signs when reversing.
- Use the reversing camera when reversing.
- Before moving onto ramps or inclines, obtain the maximum permissible values from Manitowoc CraneCare.

1.8.9 Decommissioning

- If wind speeds exceed the permissible values, depending on the equipment status, crane operation must be stopped (in accordance with Chapter 3.5).
- Before exiting the cab:
 - Completely lower the cab.
 - Park the machine on safe ground. If necessary, move the machine back from the edge of the excavation site.
 - Lower attached loads.
 - Secure the working equipment.
 - Pull the safety lever back.
 - Lock tires/undercarriage.
 - Switch off the engine.
- Lock the cab. If necessary, safeguard it with warning lights.
- Pay attention to the weather reports. Prepare for approaching storms and/or thunderstorms.

1.8.10 Setup tasks

- Setup tasks must only be carried out by trained and instructed specialists.
- Wear personal protective equipment (for example hard hat, hearing protection, protective gloves, safety footwear), if required by work conditions.
- Set-up work requires at least three persons (machine operator, banksman, assistant).
- Only carry out the tasks if the work area has a firm, level ground and has a sufficient load-bearing capacity.
- Ensure that no one is in the danger zone.
 - During the setup procedure and before completing all fastening tasks, all persons must stay clear of the danger zone where loads could fall or under suspended loads.
 - During the setup procedure, maintain a sufficient safety clearance from areas where the risk of shearing and crushing is imminent.
- Observe the relevant accident prevention regulations for working with load suspension equipment.
- When removing components or dismantling equipment, always use load suspension devices with a sufficient safe working load.
- Attach components only with the designated lifting straps.

- Perform all setup tasks step-by-step in the specified sequence.
- Do not climb onto equipment parts (for example boom sections, ballast parts) that are hanging from a crane.

1.9 Maintenance



Danger to life due to sudden movement or unintentional starting of the machine!

Persons on or in the work area of the machine will be caught and injured by the machine.

- Park the machine on safe ground. If necessary, move the machine back from the edge of the excavation site.
- Lower attached loads and boom to the ground.
- Apply the brake.
- Switch off the machine and safeguard it against unauthorized restart before starting the tasks.
- Use wheel chocks to secure the machine against rolling off.

Safety instructions

- The maintenance work stated must only be performed by trained and instructed specialists.
- Wear personal protective equipment (for example hard hat, hearing protection, protective gloves, safety footwear).
- Observe the statutory accident prevention and safety regulations.
- Lower attached loads and boom to the ground.
- Pull the left safety lever back.
- Switch off the machine and safeguard it against unauthorized restart before starting maintenance tasks.
- Attach a warning sign on the operating elements.
- Do not smoke and do not use any open flames.
- Use safe access ladders or work platforms.
- Maintain a safe distance from rotating and moving parts.
- Depressurize the hydraulic system before starting maintenance tasks.
- Only trained Manitowoc service personnel are allowed to adjust the hydraulic valves.
- Dispose of hydraulic oil in accordance with regulations.
- Wear protective gloves when working with steel wire ropes.
- Only use genuine Manitowoc spare parts.
- Only use the oils and lubricants specified in the lubricant table.

- Lift heavy components with hoists.
- Keep the cab clean and orderly.
- If necessary, use the optional battery disconnect switch to interrupt the current supply.
- Before performing any work in the area of the battery, cover the battery with insulating material. Do not place tools on the battery.
- Reattach all protective devices after completion of maintenance tasks.
- Perform a function check.
- Only the crane owner or his representative may release the machine for operation, after maintenance tasks.
- Work on the machine's electrical equipment must only be carried out by a qualified electrician.
- Have tasks on travel gear, braking and steering systems carried out exclusively by specialists who have been trained for these tasks.
- Work on hydraulic equipment must only be carried out by personnel with specific knowledge and experience in hydraulic systems.
- No welding tasks whatsoever may be carried out on the device without consultation with the manufacturer.

1.10 Transport

- In Germany:
Loading and transport tasks must be carried out exclusively by authorized specialists in accordance with VBG 40, §48 and the German Motor Vehicle Safety Standards (StVO) §22.
- Comply with the relevant regulations for securing loads.
The respective transport company is always responsible for the transport of machine and accessories.
- When loading and transporting, safeguard the machine and its working equipment against unintentional movements.
- Clean mud, snow and ice from the running gear of the machine so that ramps can be accessed without danger of slipping.
- Provide the ramps of low-bed trailers with wooden planks.
- Check the conditions of the route before starting the transport.
- Only transport the machine using the designated lashing and lifting points.
- Ensure that the machine does not pose any hazards for other traffic participants.
- Wear personal protective equipment (for example hard hat, protective gloves, safety footwear).

- Report any damage that occurred during transport to Manitowoc CraneCare immediately.

1.11 Responsibilities of the owner

Recurring checks

Inspection by an expert

The machine must be thoroughly inspected by an expert:

- before start-up and before operating the machine after significant modifications
- at least once a year
- intermittently depending on use and operating conditions

An expert in this context is a person who

- has extensive knowledge of this machine and the relevant regulations and guidelines due to technical training and
- from Manitowoc

and who can assess the safe working condition of this machine.

Inspection by an authorized expert

The following cranes must be tested by an authorized expert every 4 years:

- motorized mobile cranes
- Mobile motorized derricks
- Truck-mounted cranes

The inspection by an authorized expert must be executed in the 13th year of operation and every year thereafter.

Faults that are detected in recurring inspections must be eliminated within a suitable time-frame depending on how serious a safety hazard they pose.

Technical condition of the machine

The owner is subject to a constant obligation to observe the overall technical status (apparent defects and damage, as well as changes in the operating behavior).

Do not start up the machine if defects are detected.

Observe the mandatory intervals for routine checks.

All damage and incidents are subject to mandatory logging and data storage regulations.

Specific dangers

The machine owner must check whether the operation implies specific dangers, for example due to toxic gases, ground condition, etc., and adopt appropriate measures to avoid or limit such dangers.

- International use** If the machine is used outside of Germany, the following must be observed:
- Observe the safety regulations of the respective country of use.
 - Ensure that the operators have the necessary qualifications for the intended tasks.
 - Ensure that the content of this manual is read and completely understood. In accordance with the EC Machinery Directive, a manual must be available in the language of the destination country. If necessary, purchase the manual in the appropriate official language from Manitowoc CraneCare.
- Dangers of non-compliance with the safety instructions** Non-compliance with the safety instructions is dangerous and can be hazardous to persons as well as to the environment and the machine. Non-compliance with the safety instructions invalidates all claims for damages.
- Fire extinguisher and first-aid kit** The machine is provided with places for a fire extinguisher and first-aid kit. The owner is obligated to equip the machine with these items. If fire extinguishers or first-aid kits are missing, purchase these items from Manitowoc CraneCare.
- ### 1.12 Protective devices
- Do not remove the protective devices.
 - Check protective features for completeness and proper fastening each time before switching on the machine. Protective devices include engine hatches, doors, protective gratings, cladding, fire extinguishers and first-aid kits.
 - Reinstall all protective devices properly after completion of assembly or maintenance tasks.
 - Replace damaged protective devices by new ones.
- Load moment limitation (LML)** The machine is equipped with load moment limitation (LML). The load moment limitation is controlled by the SENCON machine diagnostics system. For more information see chapter 5.

1.13 Machine labelling

The machine is provided with specific warning and information signs.

- Do not remove the signs.
- Ensure that all signs and labels are undamaged and legible.
- Clean soiled labels with soap and water if necessary, do not use fuel or solvents.
- Replace damaged, scratched or illegible signs and labels by new ones.



Information

Signs and labels are available from Manitowoc CraneCare (see Spare parts catalog).

Rating plate



Fig. 3 Organization of the rating plate

1	Machine type
2	Machine number

1.14 Warnings and information signs



Information

An overview and descriptions of the warning and information signs on the machine are located in the appendix.



For Reference Only

2 Overview

2.1 Overall machine

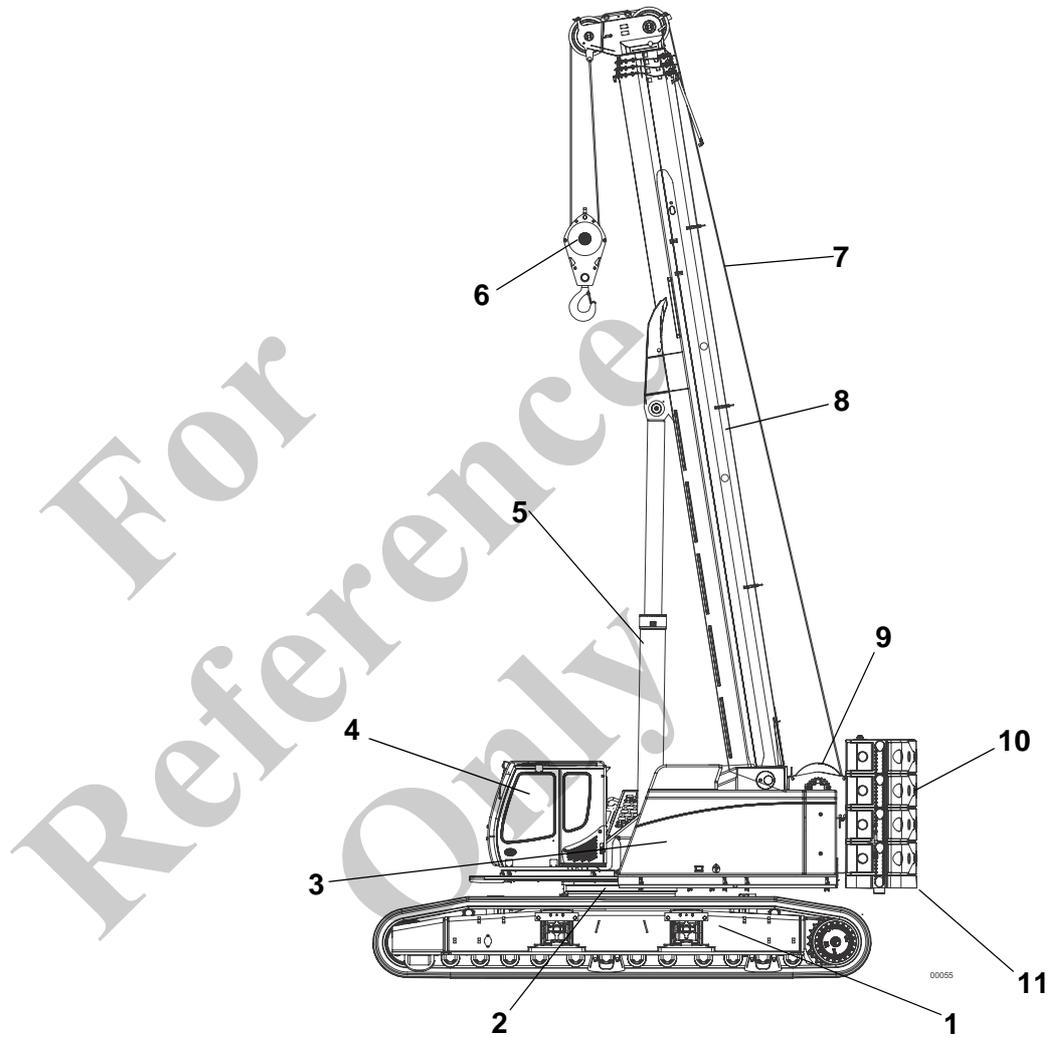
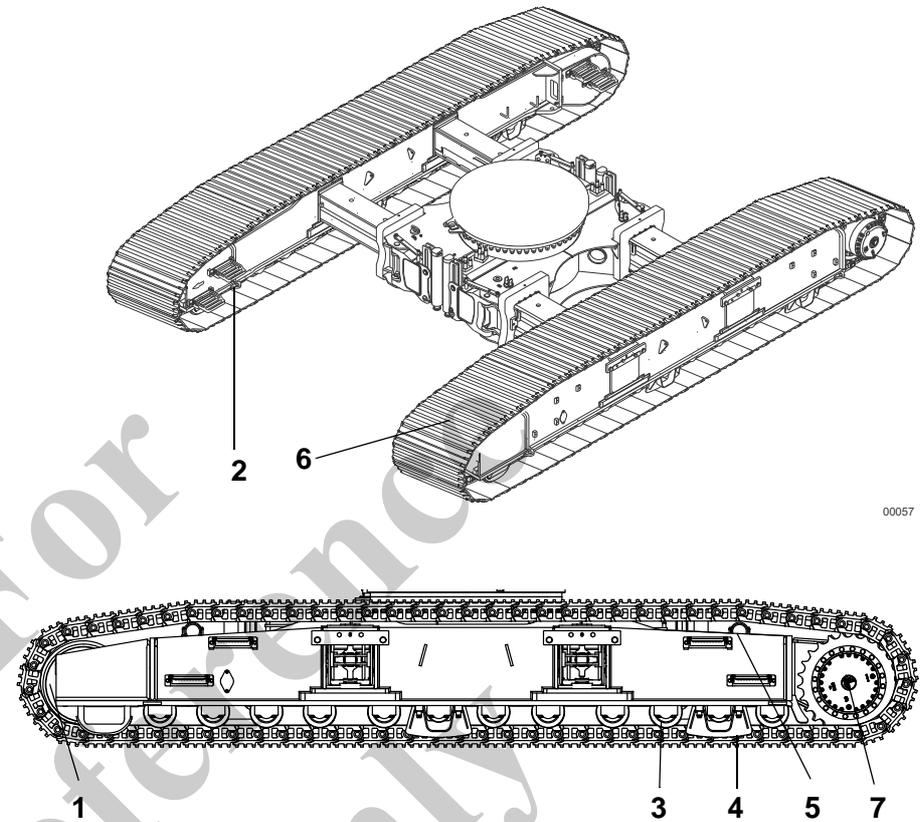


Fig. 4 Components of the machine

1	Undercarriage	7	Hoisting rope
2	Rotary connection	8	Boom
3	Uppercarriage	9	Winch 1 right Winch 2 left
4	Cab	10	Counterweight (ballast)
5	Luffing cylinder	11	Ballast bracket
6	Bottom hook block		

2.2 Undercarriage



00057

Fig. 5 Components of the undercarriage

1	Idler (forward direction of travel)	5	Carrier roller
2	Access ladder, folding	6	Crawler track
3	Track roller	7	Drive wheel (reverse direction of travel)
4	Chain guide		

2.3 Cab

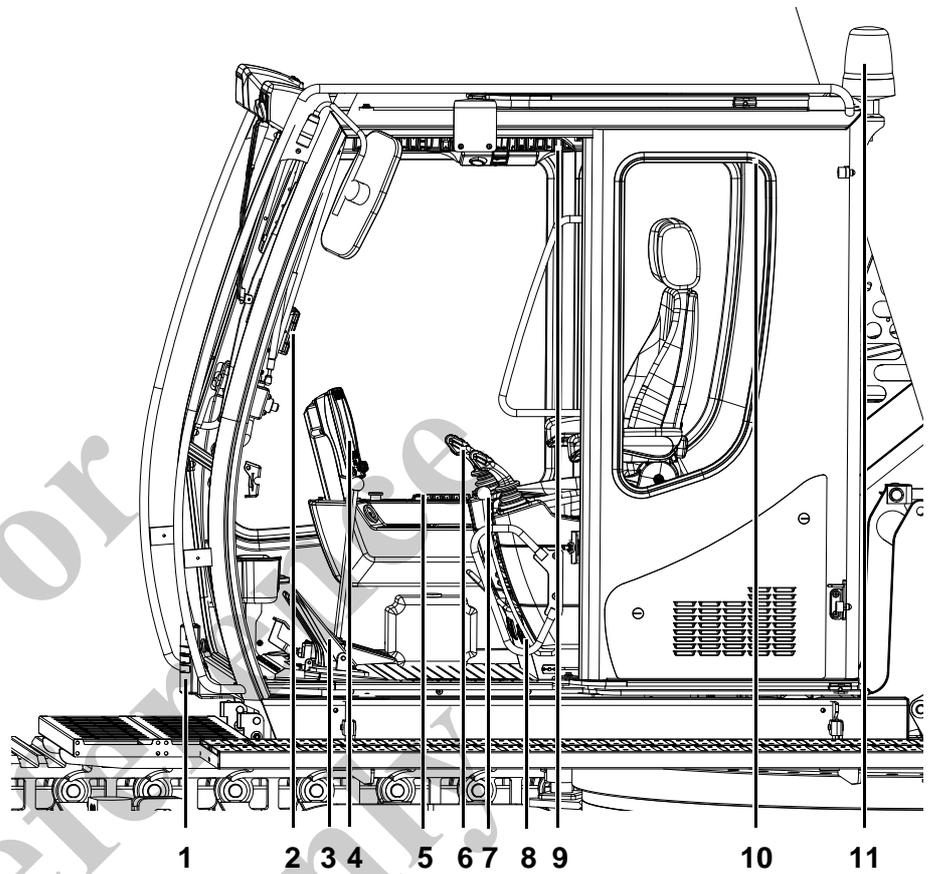


Fig. 6 Components of the cab

1	Visual and acoustic warning system - LML	7	Safety lever
2	Camera system	8	Heating/air-conditioning system
3	Pedals	9	Control panel, top right
4	SENCON diagnostic and control system	10	Radio
5	Control panel, right	11	Beacon
6	Control levers, left and right		

2.3.1 Pedals

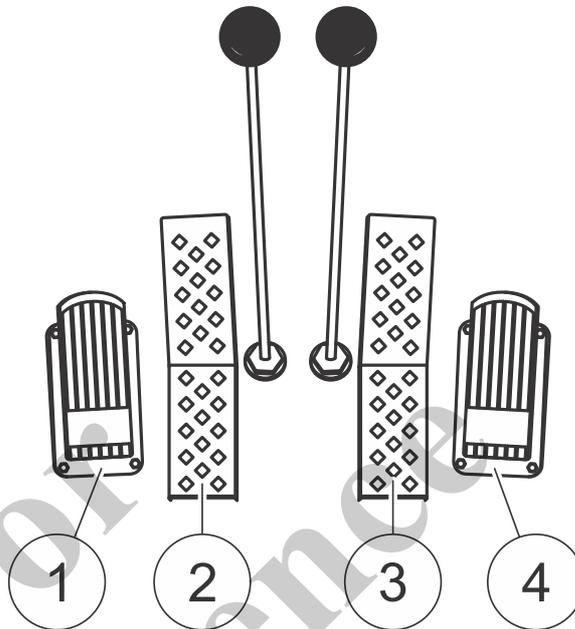


Fig. 7 Pedals in the cab

1	Slewing gear service brake/auxiliary positioning brake
2	Drive pedal, left, with hand lever
3	Drive pedal, right, with hand lever
4	Throttle pedal

2.4 Uppercarriage

Left

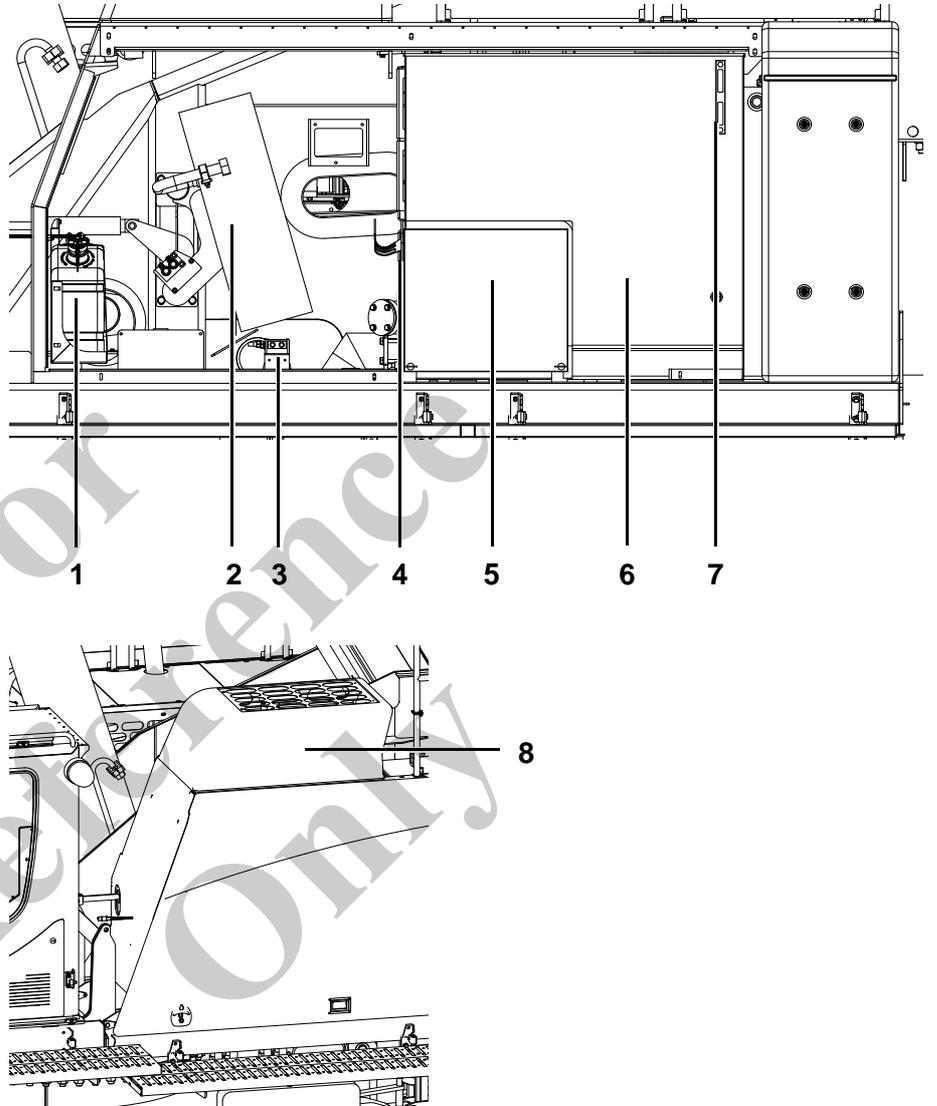


Fig. 8 Service access door, left

1	DEF tank (Tier 4f engines)	5	Electrical system switch cabinet
2	Control block	6	combination tank
3	Fuel pump (option)	7	Hydraulic oil level indicator
4	Bypass switch - LML	8	Hydraulic oil cooling system

Right

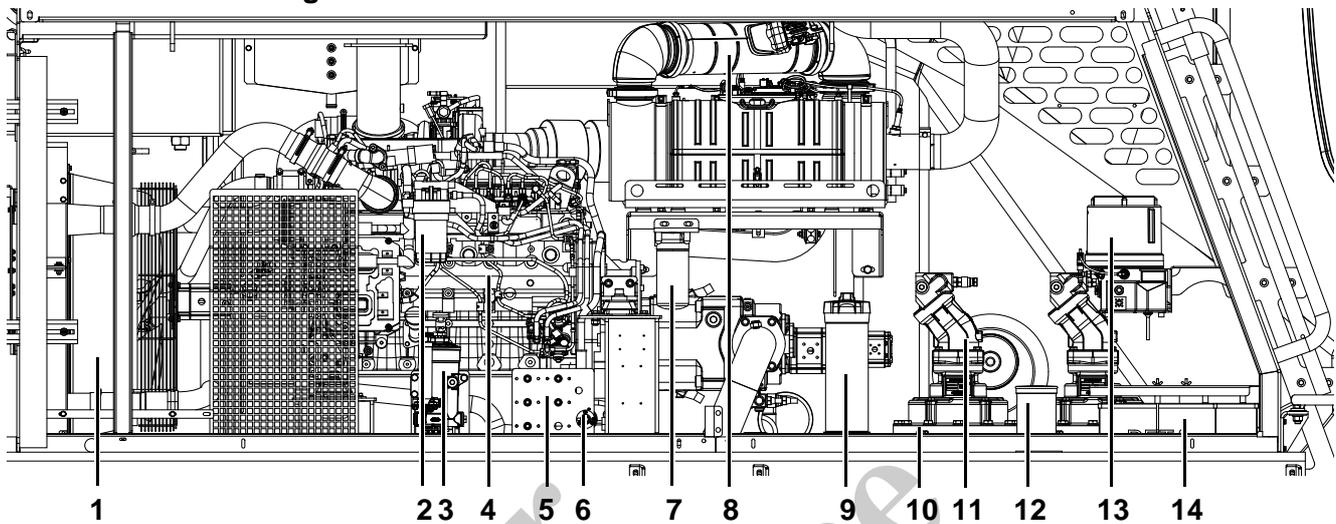


Fig. 9 Maintenance hatch, right

1	Radiator	8	Exhaust aftertreatment system (Tier 4f engines)
2	Diesel fine filter	9	HydroClean filter (option)
3	Diesel prefilter	10	Lubricating nipple bar
4	Drive engine	11	Slewing gear
5	Fuses	12	Slewing ring pinion lubricant pump (option)
6	Battery disconnect switch	13	Central lubrication system (option)
7	engine oil filter	14	Batteries

2.5 Telescopic boom

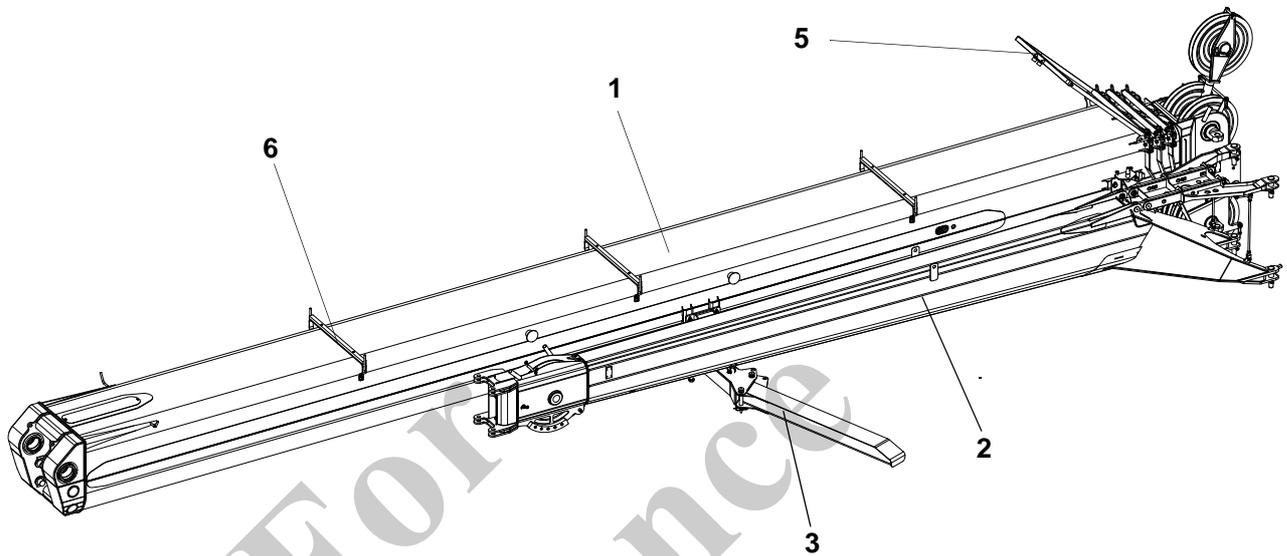


Fig. 10 Fly boom components

1	Basic body with telescoping sections
2	Fly boom
3	Ramp for fly boom
4	Sheave for fly boom
5	Rope grab
6	Rubbing strip

2.6 Winch

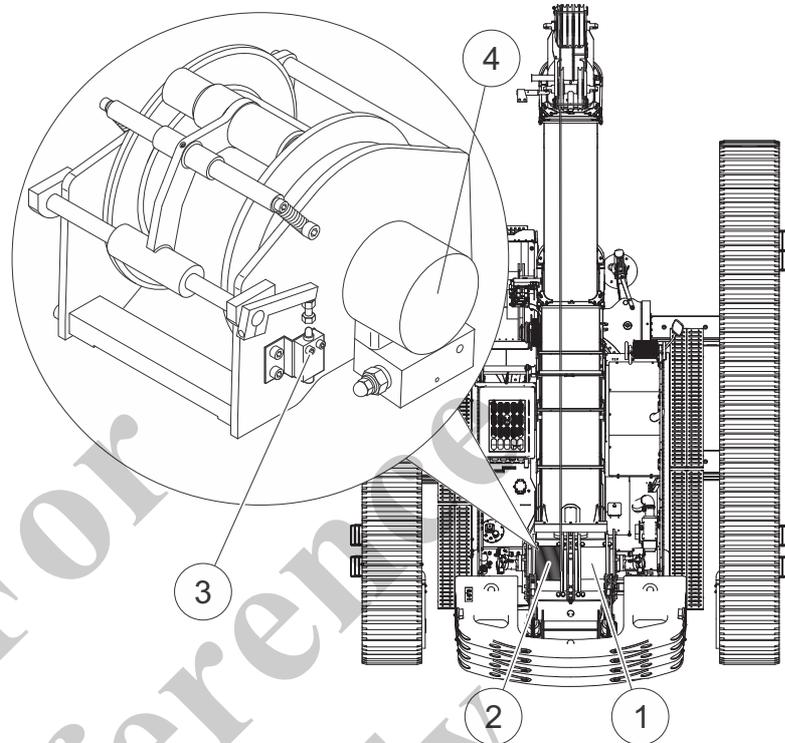


Fig. 11 Components of the winch

1	Winch 1
2	Winch 2
3	Lowering limit switch
4	Winch motor with lowering brake valve

Allocation of attachments to winches

Winch 1: Main boom, auxiliary jib, heavy-duty jib, fly boom 8 m, fly boom 15 m

Winch 2: Main boom

2.7 Counterweight (ballast)

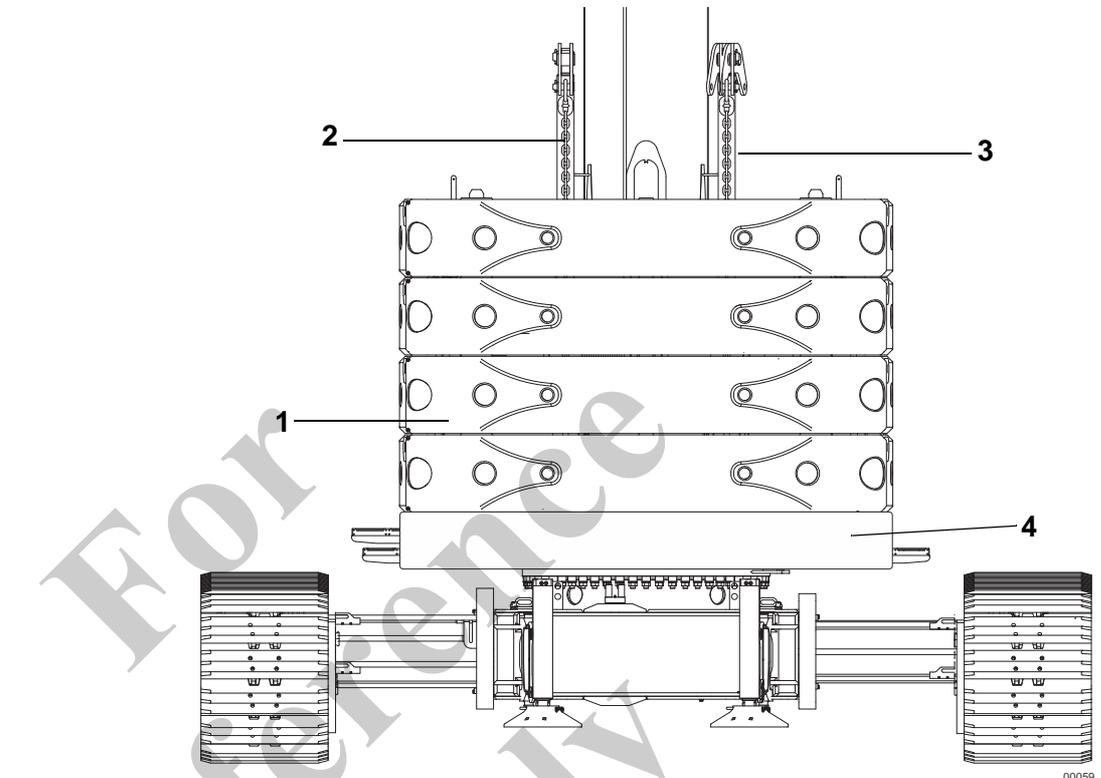


Fig. 12 Components of the counterweight

1	Ballast blocks (4 x 6.9 t)
2	Ballast chains (2x)
3	Ballast cylinder (2x)
4	Ballast bracket (5.4 t)

For
Reference
Only

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3 Technical data

The technical data of the basic machine is listed in Section 3.1. Section 3.7 contains the load ratings of the machine.



Information

Shipping dimensions and weights for the basic machine are provided in Chapter 8.4 TRANSPORT DIMENSIONS AND WEIGHTS. Specific data concerning attachment systems can be found in the operating manuals for the respective component.

3.1 Basic machine

Drive engine

Tier 3a



	Cummins diesel engine QSB 6.7
Power (according to ISO9349)	164 kW (223 hp) at nominal speed 2000 rpm
Displacement	6.700 cm ³
Cylinder	6



US EPA Tier 4f / EU Stage IV:

	Cummins QSB 6.7 diesel engine
Power (in accordance with 9349)	168 kW (228 hp) at rated speed of 2,000 rpm
Displacement	6685 cm ³
Cylinders	6



US EPA Tier 4f / EU Stage V:

	Cummins diesel engine B 6.7
Power (in accordance with 9349)	168 kW (228 hp) at rated speed of 2,000 rpm
Displacement	6685 cm ³
Cylinders	6

Permitted inclinations of engine:

Left	Right	Front	Rear
30°	30°	30°	30°



Information

If the inclination is excessive, the oil level in the engine can no longer be guaranteed to be sufficient. If you require a greater angle, please contact Manitowoc CraneCare in advance.

Additional information on the drive engine is available in the operating manual provided by the engine manufacturer.



Information about diesel engine exhaust emissions

Manitowoc places the highest value on quality. As a result, the diesel engine installation and the engine cooling system of the device have been developed, tested and manufactured to meet the demanding requirements imposed on the device. This means that the device not only has an optimal service life, but that it is also certified as being compliant with statutory exhaust emission limits.

For Reference Only

**Information**

Changes to the delivered device on

- Engine,
- Engine cooling system, incl. cooling air ducts,
- Air filter system,
- Exhaust aftertreatment system,
- Exhaust system

result in invalidation of the certification of the diesel engine exhaust emissions, and thus in the invalidation of the operating license for the diesel engine and also invalidation of any claims against Manitowoc.

Electrical system

The electrical system has an operating voltage of 24 V.

**Information**

Ensure that the available output of the alternator is not exceeded when retrofitting additional current consumers (for example headlights).

Hydraulic system

Operating pressure, 330 bar maximum

Slewing gear

Slewing speed 0 - 2.0 rpm

Travel speed

max. 0 - 2.5 km/h

Ambient temperature

-20°C (-4°F)... +40 °C (104 °F)

**Information**

If a machine will be run at ambient temperatures outside the specified temperature range, special temperature packages are available (option).

Please contact Manitowoc CraneCare if you have any questions.

3.2 Permissible ground pressure



Risk of personal injury and material damage due to the machine falling over!

If the machine's ground pressure exceeds the load-bearing capacity of the ground at the operation site, then the ground may give in, causing the machine to fall over. This can cause severe injury.

- If there are substantiated doubts concerning the load-bearing capacity of the ground at the site, execute a soil analysis before deploying the machine.

The machine can exert a specific maximum force on the ground depending on the width of the crawler tracks. To ensure the safe operation of the machine, the load-bearing capacity of the ground must be at least as high as the maximum ground pressure.

Maximum ground pressure of the machine during operation	Crawler track width	Maximum ground pressure (kg/cm ²)
	900 mm	5.7

Maximum ground pressure of the machine during set-up	Set-up status	Maximum ground pressure (kg/cm ²)
	Supported, outrigger pads with 550 mm diameter	15.1
	Supported, outrigger pads with 550 mm diameter with optional plastic underlay support (serial number 093397)	3.2

**Determining
the load-bearing
capacity of the ground**

The following table provides an orientation for the load-bearing capacity of the ground. The guidelines in the following table must be taken into consideration for applications planning. The load-bearing capacity of the ground must be at least as high as the maximum ground pressure.

Type of ground	Permitted ground pressure in (kg/cm ²)
A) Backfilled ground that has not been artificially packed	0 - 1
B) Natural, obviously untouched ground	
1) Mud, peat, vertisol, topsoil	0
2) Non-binding, sufficiently solid, seasoned ground	
- Fine to medium sand	1.5
- Coarse sand to gravel	2.0
3) Cohesive soil	
- soggy	0
- soft	0.4
- firm	1.0
- semi-solid	2.0
- solid	4.0
4) Rock that has not been weathered, with few fissures and well preserved	15 - 30
C) Artificially packed surface	
1) Asphalt	5 - 15
2) Concrete- Concrete group I	50 - 250
- Concrete group II	350 - 550

3.3 Diesel fuel

The Manitowoc factory filling for diesel fuel conforms to EN 590 with a sulphur content of <10 mg/kg.



Information

The use of sulphur-free fuel in accordance with EN 590 or ASTM D975 S15 is strictly required for engines subject to EU Stage IV and US EPA Tier 4 Final emission standards.

The fuel quality requirements are indicated on a label on the diesel tank filler neck that is shown below.



Fig. 13 Information label concerning the use of sulphur-free fuel

NOTICE

Engine damage due to use of fuels with increased sulphur content!

Fuels with increased sulphur content can cause severe damage to the engine and the exhaust aftertreatment system. This can invalidate the emission certification of the diesel engine and have legal consequences for the owner.

- Only use fuels with a sulphur content of maximum 15 mg/kg.



Information

The use of fuels with a sulphur content greater than 15 mg/kg is permitted under certain circumstances for engines subject to EU Stage II or IIIa and US EPA Tier 2 or 3 emissions standards. This however requires the use of an engine oil with special properties matched to this requirement.

Engine oil filled at the Manitowoc factory is not suitable for this use and must be replaced.



Observe the instructions in the operating manual provided by the engine manufacturer.

3.4 Engine oil

The Manitowoc factory filling for engine oil is selected for use with sulphur-free diesel fuel with a sulphur content of <15 mg/kg.



Information

The use of low-ash ACE E9-08 or API CJ-4 engine oils is strictly required for engines subject to EU Stage IIIb and US EPA Tier 4 Final emission standards.



Observe the instructions in the operating manual provided by the engine manufacturer.

NOTICE

Engine damage due to use of wrong engine oil!

The use of impermissible engine oils will cause damage to the exhaust aftertreatment system in engines subject to EU Stage IV and US EPA Tier 4 Final emission standards. This can invalidate the emission certification of the diesel engine and have legal consequences for the owner.

- The use of low-ash ACEA E9-08 or API CJ-4 engine oils is strictly required for engines subject to EU Stage IV and US EPA Tier 4 Final emission standards.



Information

The use of engine oils with a specification other than ACEA E9-08 or API CJ-4 is permissible for engines of exhaust level EU Stage II or IIIA and US EPA Tier 2 or 3.

3.5 Permissible wind speeds



Danger of severe to fatal injuries and severe structural damage on the boom if the limit values of the permissible wind speeds are exceeded.

If the limit values of the permissible winds speeds are exceeded, severe to fatal injuries or severe structural damage to the boom can occur.

- Do not exceed the specified limit values of the permissible wind speeds.
- Operate the crane safely within the limit values specified below.

Information



- Applying judgement and experience, the operator must keep the effects of the wind on the lifted load within limits because the actual wind sail area of the load is not known.
- Gusts of wind must be taken into account when determining wind speeds.
 - Permissible wind speed of the 3-second gust: 14.1 m/s
 - Permissible average wind speed at a height of 10 m: 10 m/s
- The wind speeds must be measured at the highest point of the boom (boom head or fly boom head, if present).
- All notices and instructions in this operating manual must be observed.

When operating the crane, the displayed wind speed must always be compared with the permissible wind speed.

Wind speed can be measured with the optional anemometer. The necessary safety measures (such as setting down the boom) must be executed before the preset limit values are reached.

	Boom length	Wind - in operation	Wind - not in operation
Main boom (HA)	12.6 m – 40.2 m	14.0 m/s	20.0 m/s
Main boom with fly boom (SA8):	20.6 m – 48.2 m	14.0 m/s	20.0 m/s
Main boom with fly boom and fly boom extension (SA15)	27.6 m – 55.2 m	14.0 m/s	20.0 m/s
Main boom with lattice boom extension (HAV12)	24.6 m – 52.2 m	14.0 m/s	20.0 m/s
Main boom with 2 lattice boom extensions with fly boom and fly boom extension (SA15V12)	39.6 m – 67.2 m	14.0 m/s	20.0 m/s

3.5.1 Procedure when reaching the limit value "wind - in operation"

1	Set down the attached load.
2	Place the boom at 70°.
3	Switch off the machine.

3.5.2 Procedure when reaching the limit value "wind - not in operation"

1	Set down the attached load.
2	Telescope in the boom.
3	Completely lower the boom.
4	Switch off the machine.

For Reference Only

3.6 Dimensions of the basic machine

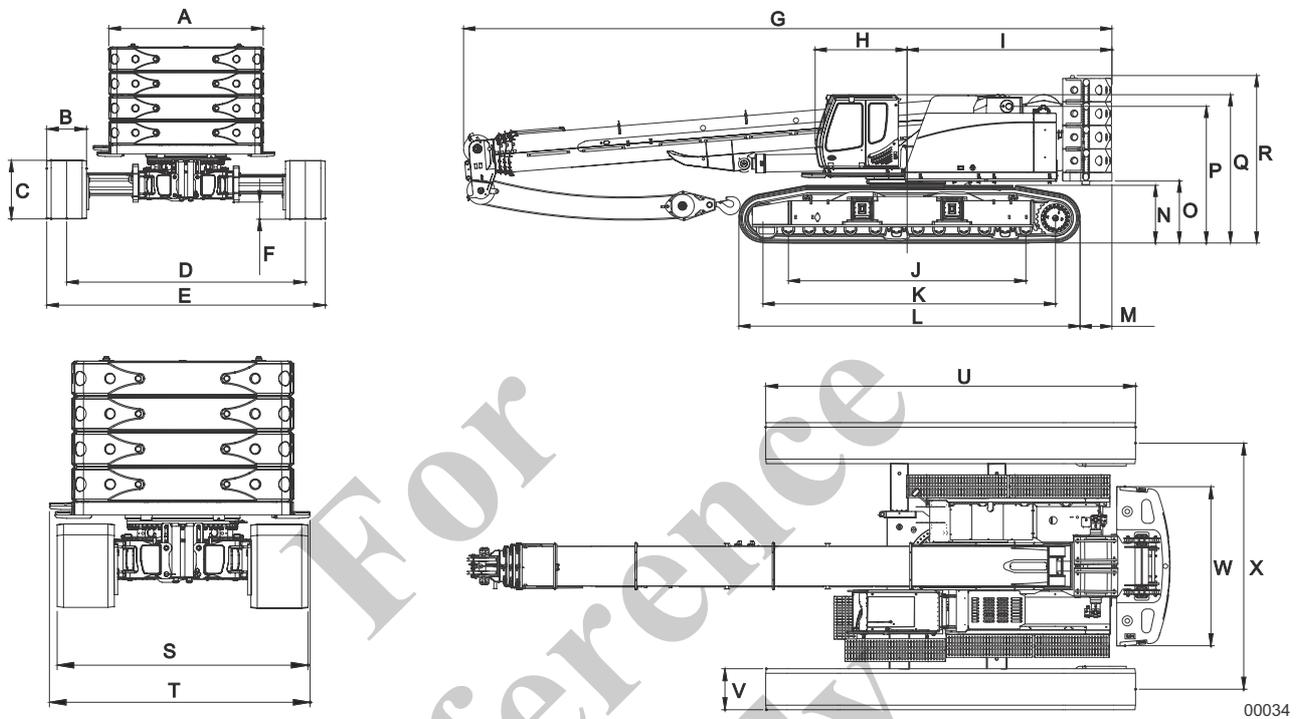


Fig. 14 Dimensions of the basic machine

	Dimensions in mm (inches)		Dimensions in mm (inches)		Dimensions in mm (inches)
A	3 490 (137.4)	I	4 830 (190.2)	Q	3 526 (138.8)
B	900 (35.4)	J	5 600 (220.5)	R	3 982 (156.8)
C	1 336 (52.6)	K	6 900 (271.7)	S	3 950 (155.5)
D	5 400 (212.6)	L	8 049 (316.9)	T	4 105 (161.6)
E	6 300 (248.0)	M	750 (29.5)	U	8 049 (316.9)
F	390 (15.4)	N	1 371 (54.0)	V	900 (35.4)
G	15 292 (602.0)	O	1 472 (58.0)	W	3 490 (137.4)
H	2 169 (85.4)	P	3 249 (127.9)	X	5 400 (212.6)

3.7 Working loads



Information

The load ratings

- apply for
 - the machine standing on level and solid ground ($\pm 0.3^\circ$)
 - maximum undercarriage track width
- with due consideration of the following standard:
 - ASME B30.5
- are specified in tons (t) and are applicable for 360 degrees.

Adverse conditions

Limit or reduce load ratings to compensate for adverse conditions. Adverse conditions are e.g.:

- Soft or uneven ground
- Steep slopes
- Wind
- Lateral loads
- Oscillating loads
- Jerking or sudden stopping of the load
- Inexperience of operating personnel
- Driving with the load

Permissible rope winch

Per strand in crane operation:

At a rope diameter of 26 mm | 12,500 kg

Safe working load reduction due to attached fly boom

The lifting capacities must be reduced with the fly boom mounted on the basic body.

Length - main boom [m]	Safe working load reduction (kg)
12.6	520
15.7	420
18.9	350
22.0	300
28.0	240
34.2	200
40.2	170

3.8 Safe working load reduction due to load-handling devices

The weight of load-handling devices such as bottom hook block, suspension gear, and hoisting rope reduces the safe working load and must be subtracted from the safe working load.

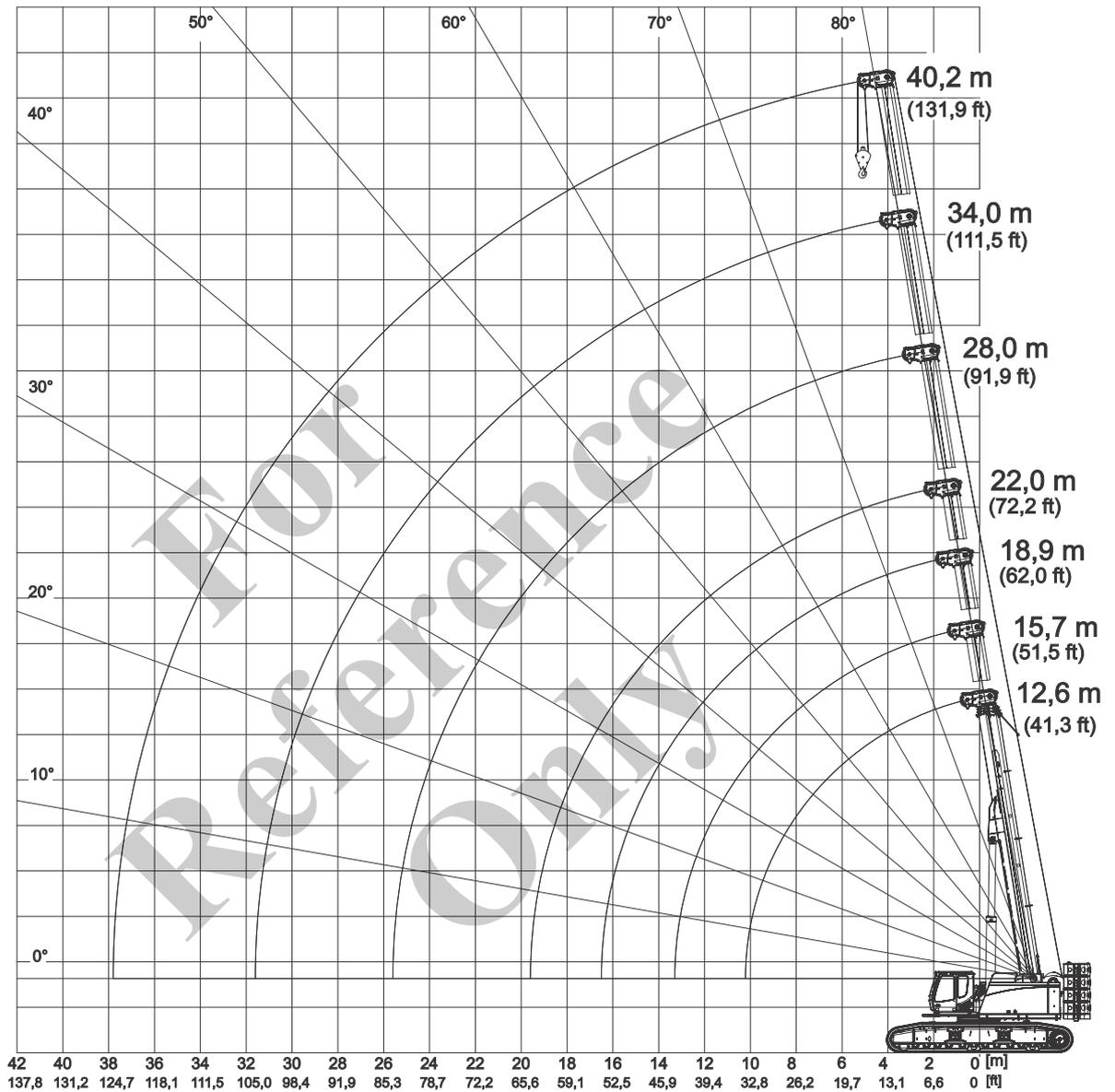
To determine the weight of the hoisting rope to be subtracted, multiply the length of the hoisting rope between bottom hook block and pulley head by the number of rope lines.

Hoisting rope weights

Rope diameter (mm)	Weight in (kg/m)
14	1.0
16	1.3
18	1.6
20	2.0
22	2.4
26	3.4
28	4.0
34	5.9
36	6.6

For Reference Only

3.8.1 Working diagram - main boom



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Fig. 15 Work range of the machine depending on boom length and the boom angle

3.9 Conversion factors

Pressure

1 bar	100 kPa	14.5 psi
10 psi	68.95 kPa	0.6895 bar

Flow rate

1 l/min	0.0353 cfm	0.2642 gal/min (US)
1 gal/min (Brit.)	0.1605 cfm	
1 gal/min (US)	3.78541 l/min	

Length

1 mm	0.03934 in	
1 m	39.34 in	3.281 ft
1 in	25.4 mm	
1 ft	0.3048 m	304.8 mm
1 km	39340 in	3280.8 ft
1 km	1093.6 yd	0.62137 mile
1 mile	1.609 km	1,609 m

Liquid measure

1 l	0.26 gal (US)
1 gal (US)	3.785 l

Weight

1 kg	2.205 lb	35.27 oz
1 lb (US)	0.454 kg	16 oz

Power

kW	= hp x 0.746
hp	= kW x 1.341

Temperature

°C	= (°F -32) x 5/9
°F	= (°C x 9/5) + 32

3.10 Hooks

The machine can be equipped with different winches and the associated hooks. The following technical data relates to the possible features of the machine type.

Winch capacity: 125 kN

Hoisting rope diameter: 26 mm (1.02 in)

Capacity	Hook weight in kg (lbs)
15 t	250 (551)
40 t – 1 sheave	500 (1102)
60 t – 2 sheaves	600 (1323)
80 t – 3 sheaves	1 000 (2205)
120 t – 5 sheaves	1 100 (2425)

For Reference Only

For
Reference
Only

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4 Start-up

Thoroughly inspect the device before every use.

- Prior to start up, perform the inspection tasks as specified in Section 4.2.
- Check protective devices for completeness, functionality, and proper fastening.
- Wear personal protective equipment (for example hard hat, hearing protection, protective gloves, safety footwear), if required by work conditions.
- Do not wear any jewelry or loose clothing.
- Secure loose items such as tools or other accessories.
- Agree on hand signals with the banksman.
- Obtain information on first aid and rescue facilities.
- Enter and exit machine only when it is at a standstill. Only use the provided access steps and ladders.
 - If necessary, clean access steps and ladders prior to use.
 - Do not carry any objects when climbing up or down. Lift equipment items onto the machine with a rope or hoist.
 - Do not use operating elements in the cab as grip handles.
- Ensure that no one is in the danger zone.
- Do not start up the machine if defects are detected.
- Ensure that all control levers are in the neutral position.
- Start the machine only as described in Section 4.4 of the operating manual.
- Check the machine's safety devices (signaling and lighting devices).
- Ensure that the operating elements and protective devices are working correctly.
- Read Chapter 4 START-UP before starting up the machine.

4.1 Initial start-up

The initial start-up of the machine is carried out by Manitowoc or by a trained and authorized specialist.

If the machine was shut down for a prolonged period (> 6 months), contact Manitowoc CraneCare before start-up.

4.2 Checks before start-up

- Familiarize yourself with the machine and its equipment. Read this operating manual before start-up, in particular Section 4 START-UP.
- Only carry out work for which you have been trained and which is within your working range.

CAUTION

Danger of injury due to machine malfunction!

Uncontrolled machine behavior results in personal injury and material damage.

- Report all irregularities to the responsible person before start-up.
- Only operate the machine after ensuring that it is in full working order.

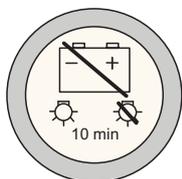
Checklist

- Are all protective covers and warning signs in place on the machine and undamaged?
- Is the machine clean enough to ensure that no danger areas exist due to contamination (danger of slipping, falling, poor visibility)?
- Are the windows clean and free of ice and snow?
- Is the stability of the machine ensured?
- Is the running gear undamaged?
- Is the correct counterweight (ballast) installed?
- Are the boom sections undamaged?
- Have all necessary maintenance tasks been carried out according to the maintenance schedule?
- Do all fluid fill levels (coolant, grease, diesel fuel, hydraulic oil, engine oil, fuel, windshield washer fluid, slewing gear, winches, DEF (AdBlue), etc.) show sufficient fill quantities?
- Are all bolt/screw connections - particularly on the cab - undamaged and tightened?
- Are all cab fastening and connection elements undamaged and tightened?
- Does the machine have sufficient fuel in the tank?

- Are the V-belts undamaged and tensioned?
- Are you aware of the operating and environmental conditions?
- Is the load weight known?
- Is an experienced person available for signaling, if required?
- Are the machine and sling devices appropriate for the loads to be attached? Observe the instructions in Section 3 TECHNICAL DATA.
- Are danger zones (overhead lines, ditches, etc.) marked and secured in the operating area?
- Are the side maintenance access doors on the uppercarriage closed?
- Is anyone in the danger zone?
- Are all winch functions working properly?
- Are all safety devices (brakes, signal and lighting devices) working correctly?
- Is the machine horizontally aligned?
- Does the SENCON show an error message?
- If necessary, switch on the optional battery disconnect switch or connect the battery terminals.

For Reference Only

4.3 Switching on the battery disconnect switch



- 1 | Open the right service door.

- 2 | Press the battery disconnect switch.
 - The battery switch lights up.
 - The electrical system of the machine is connected to the battery.

- 3 | Close the right-hand service door.

For
Reference
Only

4.4 Machine start

- After switching the machine off, wait for at least 15 seconds before a restarting it.
- Keep the service doors closed.
- Before starting the engine, ensure that no one is in the danger zone.
- The exhaust emission of diesel engines is a health hazard. Only run the engine outdoors or in well-ventilated areas.
- Do not switch on the machine if a warning sign is present at the control elements.
- Adjust driver seat and mirror to the correct position.
- Fasten the seat belt correctly.
- Pull the safety lever back.

For Reference Only

4.4.1 Fastening the seat belt

WARNING

Danger of injury due a defective seat belt!

If there is collision or jerky machine movements personnel can be thrown against cab parts and injured.

- Check belt for signs of wear before starting up the machine.
- Replace the belt immediately if damaged.
- If the belt is dirty, clean with water.
- Belt must not be twisted.
- Belt must fit low over the hips, not over the stomach.

Closing the seat belt

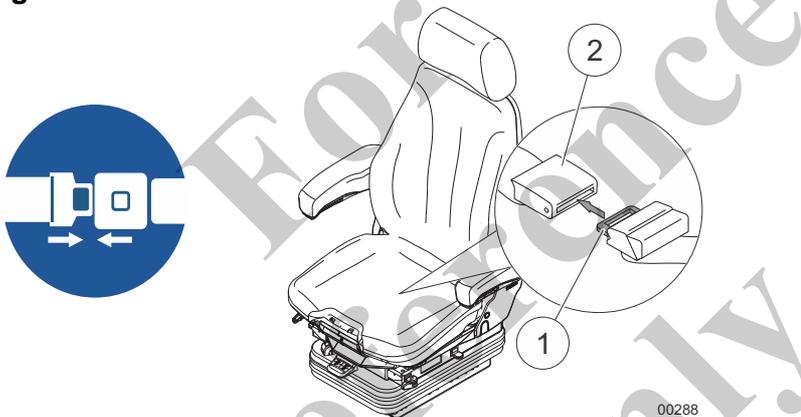
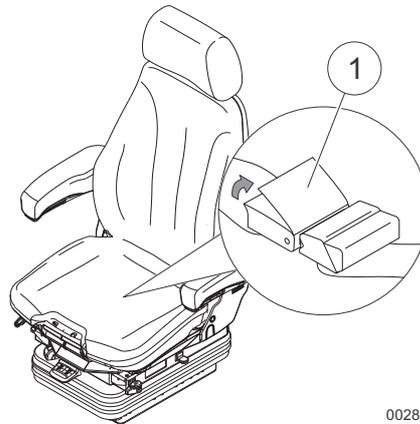


Fig. 16 Closing the seat belt

- 1 Push the latch plate (1) Fig. 16 into the belt buckle (2) Fig. 16.
 - The belt buckle clicks into place.

Opening the seat belt



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Fig. 17 Opening the seat belt

- 1 Pull the release (1) in Fig. 17 on the belt buckle (2) in Fig. 17 upward.
 - The belt buckle opens.

For Reference Only

4.4.2 Starting the engine

WARNING

Danger of poisoning due to exhaust gases!

Inhaling exhaust gases results in unconsciousness or death.

- Never leave the machine unattended with the engine running.
- Only run the engine outdoors or in well-ventilated areas.

WARNING

Danger of severe injury due to unintentional activation of the joystick or pedals!

Operating the joystick or pedals when starting the machine can result in uncontrolled machine movements. Persons be caught and severely injured by the machine.

- Make sure no one is in the danger zone.
- Pull the safety lever back before starting the machine.
- Only release the safety lever after the engine has started.

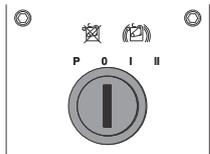


Fig. 18 Ignition lock

- 1 Turn the ignition key to position I.
 - The SENCON is switched on.



Fig. 19 SENCON loading screen



Information

The SENCON boots up after turning on the ignition. This process takes about a minute. Do not use the machine while the loading screen is present.

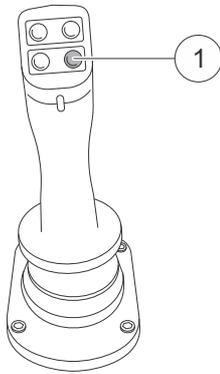


Fig. 20 Horn

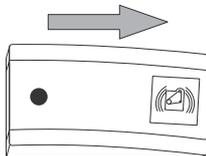
2	Select the operating mode on the SENCON.
3	Push the button 1 on the right joystick. – The horn sounds.
4	Turn the ignition key to position II .

Ignition key position

Ignition key position	Meaning
P	Enable fuel pump
0	Ignition OFF
I	Ignition ON (Ignition automatically turns off after 20 minutes)
II	Starting the engine

Engine On/Off button

The **Engine On/Off** button is used to start and stop the diesel engine. The **Engine On/Off** button is located on the bottom right control panel.



1	With the diesel engine off, press the Engine On/Off button in the direction of the arrow. – The diesel engine is started.
2	With the diesel engine on, press the Engine On/Off button in the direction of the arrow. – The diesel engine shuts off.

Automatic idle and EcoMode

Automatic idle and EcoMode are configured on the SENCON.

Symbol

Name

Description



Automatic idle

Automatic idle automatically lowers the engine speed for pauses in work. This saves fuel and protects the environment.

Automatic idle has three stages:

- Stage 1: 1440 rpm after 5 seconds of inactivity.
- Stage 2: idle speed after 13 seconds.
- Stage 3: diesel engine off after 5 minutes at Stage 2.

Settings

- On
- Off

EcoMode



EcoMode reduces maximum speed. This saves fuel and protects the environment.

Settings

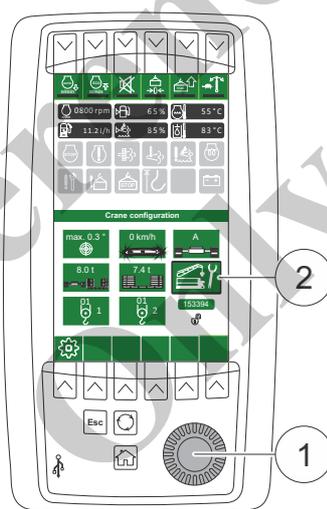
- On
- Off

For Reference Only

4.4.3 Selecting setup status

The machine operating parameters for the desired use are configured in the **Load Moment Limitation** window. The **Load Moment Limitation** window automatically appears after the ignition is turned on and the SENCON starts.

1	Switch on the battery disconnect switch.
2	Enter the cab.
3	Turn the ignition key to position I and wait until the SENCON comes on. <ul style="list-style-type: none"> – The Load Moment Limitation window appears.
4	Press the SCROLL wheel (1) in Fig. 21 on the SENCON. <ul style="list-style-type: none"> – The selected setting (2) in Fig. 21 is outlined in black.



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Fig. 21 Load Moment Limitation SENCON window

5	Roll the SCROLL wheel until the setting that you want to change is outlined.
6	Press the SCROLL wheel. <ul style="list-style-type: none"> – The setting can now be changed.
7	Roll the SCROLL wheel to change the setting.
8	Press the  button on the SENCON. <ul style="list-style-type: none"> – The configured value is saved.
9	Set additional operating parameters as needed until the setup status on the SENCON matches that of the machine.

4.4.4 Bringing the machine to operating temperature



Machine damage and danger of injury!

Operating the machine without allowing it sufficient time to warm up can damage the engine and other components. Machine functions will be adversely affected. This can result in accidents with injuries.

➤ Observe the warm-up time.

Ambient temperature	Warm-up time	Maximum engine speed
to 0 °C (32 °F)	approximately 15 min	Nominal speed -250 rpm (For nominal speed see Chapter 3)
-20 °C (-4 °F) to 0 °C (32 °F)	approximately 30 min	

Warm-up procedure

1	Allow the engine to run at low idle speed for 3 minutes after starting.
2	Then increase the engine speed incrementally up to the nominal speed of 250 rpm (no-load).
3	If a water temperature of approximately 20 °C (68 °F) has been reached, put a load on the engine by carefully actuating hydraulic functions.
4	Continue to warm-up the machine.



Information

Additional warm-up time may be required at temperatures below 0 °C (32 °F). If the hydraulic system is still slow to respond after the warm-up period, work for an additional 15 minutes at reduced speed.

The following temperature values should be displayed before operating the machine at full speed:

- Hydraulic oil: approximately 40 °C (104 °F)
- Water: approximately 35 °C (95 °F)

4.4.5 Jump start

The machine is equipped with a 24 volt starting system. Ensure that the external power source has the same voltage.

WARNING

Danger of explosion due to improper handling of the battery!
 An exploding battery causes personal injury and material damage.

- Avoid creating sparks by fire, naked light, or smoking.
- Observe the applicable directives and accident prevention regulations.

NOTICE

Damage to the electrical system!
 Using an unsuitable power source will damage the electrical system.

- Only use 24 volt power sources.

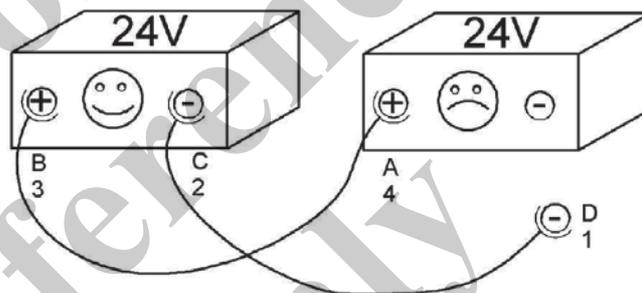
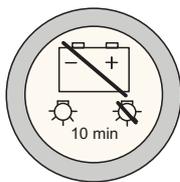
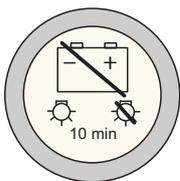


Fig. 22 Sequence for connecting an external power source



1	Press the battery disconnect switch. – The battery switch flashes for a period of 10 minutes. After 10 minutes, the battery disconnect switch lighting goes out.
2	Remove the battery cover.
3	Connect the positive terminals (+) of the power sources using appropriate jumper cables.
4	Using a jumper cable, connect the negative terminal (-) of the battery providing the jump start to the engine block or an unpainted metal part on the side of the battery receiving the jump start.
5	Press the battery disconnect switch. – The battery switch lights up. – The electrical system of the machine is connected to the battery.

6	Start the engine.
7	Removal: <ul style="list-style-type: none"> - Detach the jumper cable from the negative terminal (-). - Detach the jumper cable from the positive terminal (+).
8	Attach the battery cover.

4.5 Switching off engine

 **WARNING**

Danger of acid burns due to escaping battery acid!

Escaping battery acid burns skin, eyes or clothing.

- Avoid any contact with the skin, eyes or clothing.
- Rinse off acid splashes and spills with clean water immediately.
- If there is contact with the eyes, seek the attention of a physician.
- Observe the applicable directives and accident prevention regulations.

NOTICE

Severe damage to the electrical system due to quick-chargers!

Using a quick-charger will damage the electrical system.

- Do not, under any circumstances, use a quick-charger.

NOTICE

Increased wear on the engine and coolant system due to overheating!

If the engine is switched off without a cool-down phase, the engine components can overheat.

- Therefore, allow the drive engine to cool down before switching it off:
 - Lower engine speed to approximately 50% of the nominal speed (see Chapter 3).
 - Let machine run for an additional 5 - 10 minutes.

1	Park the machine on secure ground.
2	Lower any attached loads and the boom to the ground.
3	Reduce the diesel engine speed to 50% of nominal speed so that the diesel engine and cooling system are not damaged.
4	Let the diesel engine run for 5–10 minutes.
5	Set idle speed.

6	Turn the ignition key to position 0 and remove.
7	Pull the safety lever back.
8	Secure the machine (lights, warning triangle, etc.).

For
Reference
Only

4.6 Decommissioning the machine



Information

Check the seals every 6 months.

Proceed as follows if the machine is to be decommissioned for a prolonged period:

1	Choose a storage location that is as dry and dust-free as possible.
2	Position the machine on level ground. If a location on level ground cannot be found, secure the machine using chocks.
3	Switch off the machine as described in Chapter 4.5.
4	Check the machine for leaks (coolant, oil, etc.).
5	Clean machine. Ensure that cleaning agents do not damage the seals or enter the raceway of the rotary connection!
6	Top up operating fluids and lubricants (for levels see the maintenance manual).
7	Lubricate machine according to maintenance manual. Lubricate the rotary connection while slowly slewing the uppercarriage (top up grease supply if necessary).
8	Switch off the battery disconnect switch or disconnect the battery poles.
9	Apply preservative to bare metal parts (for example piston rods of hydraulic cylinders) (see maintenance manual).



Information

See Section 3.1 for the permissible operating temperatures.

See Section 3.5 for permissible wind speeds.

4.7 Preservation and storage

Proceed as follows if the machine will be preserved or stored for a longer period of time:

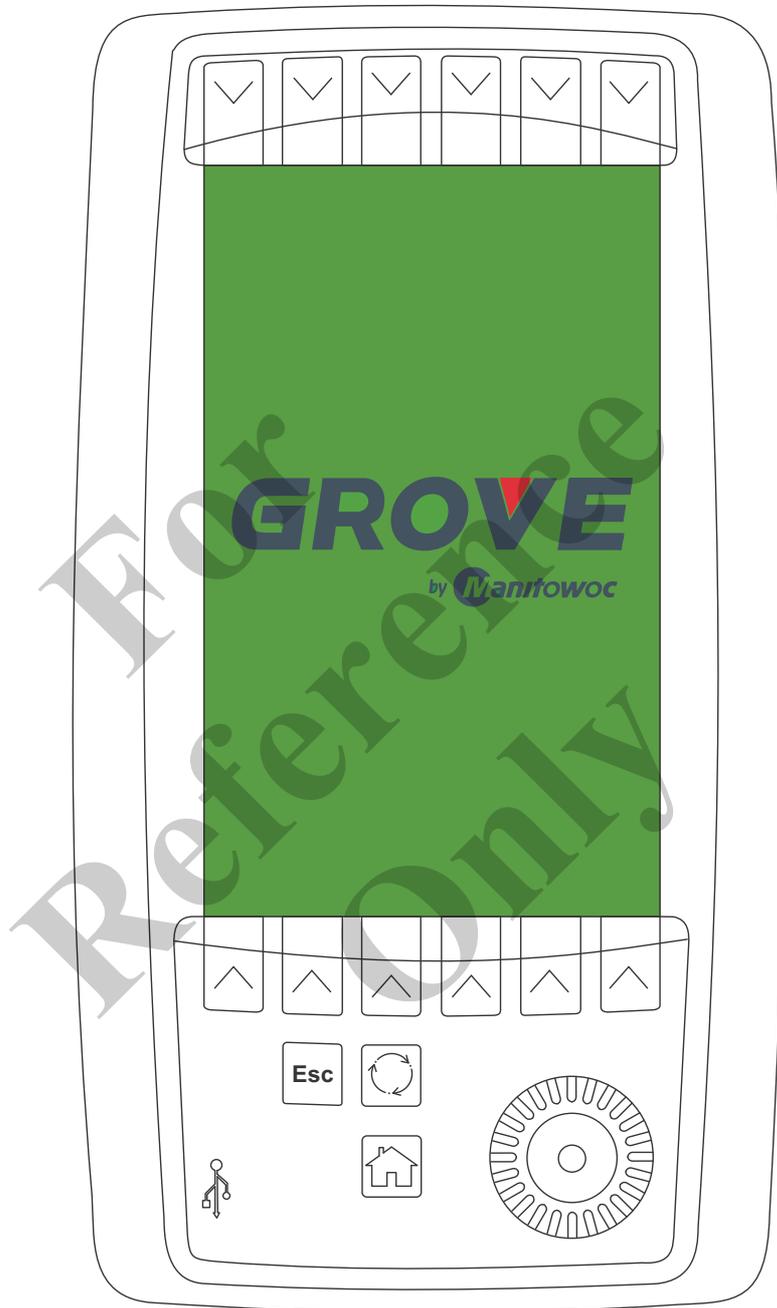
1	Select the storage location where the possibility of hazards can be excluded.
2	Set down the attachment on wooden planks to prevent freeze up.
3	Perform the maintenance for 2000 hours of operation (annual interval).
4	Clean and dry all bare surfaces thoroughly (such as piston rods).
5	Preserve all bare surfaces and bearing points with corrosion protection agent. The protective film must cover the surface completely without any bare spots.
6	Check the diesel fuel for its suitability for storing (minimum -40 °C / -40 °F).
7	Fill the fuel and hydraulic oil tanks up to the maximum fill levels.
8	Do not drain the cooling system. Check the cooling system for sufficient antifreeze protection. The antifreeze proportion must be at least 60% and must not exceed a maximum of 65%.
9	Prepare the diesel engine for storage. Also observe the instructions in the engine manufacturer's operating manual.
10	Put a warning sign on the engine and on the cab indicating the status of the machine preservation.
11	If the machine will be stored at temperatures below -40 °C (-40 °F) for a longer period of time, remove all LCD units (displays) store them in a weatherproof location.

4.8 Starting up the machine after long-term storage

Proceed as follows to recommission a preserved machine:

1	Remove the corrosion protection agent in a suitable manner, for example using a high-pressure cleaner with a suitable cleaning additive (be careful around sensitive components and electronic components!).
2	All bare surfaces and bearing points must be oiled or greased according to the service measures specified in the lubrication schedule.
3	Check oil levels for sufficient fill quantities (for example, hydraulic system, drive engine).
4	Check the fill level and proportion of the antifreeze in the cooling system.
5	Check the machine thoroughly for leaks.
6	Check the entire machine (equipment, undercarriage, etc.) for damage.
7	Reinstall the LCD displays, if necessary.
8	Check all safety devices (brakes, signal and lighting equipment, et cetera) for proper function.
9	Examine danger zones at the work site, mark and secure them sufficiently.
10	Align the machine horizontally.
11	Warm up the machine sufficiently before starting work (see <i>Section 4.4.4</i>).

5 SENCON 2.0

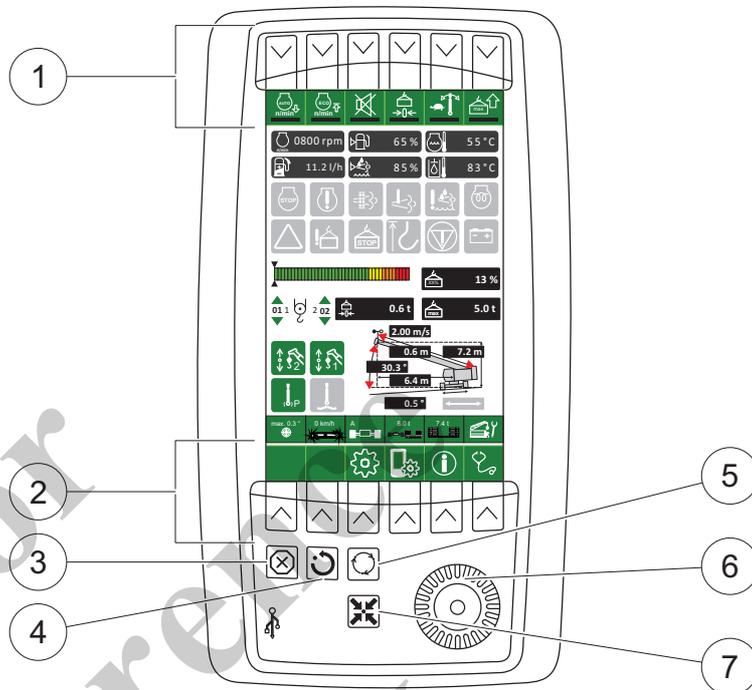


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About this chapter

This chapter describes the SENCON 2.0 diagnostic and control system. The SENCON provides up-to-date operating data on the machine and can statistically evaluate this data as needed. It can also configure various machine parameters and run error diagnostics.

5.1 Overview of controls



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Fig. 23 SENCON control elements

	Operating element	Explanation
1	Quick-select buttons and quick-select icons	Quick-select icons are activated or deactivated by the corresponding quick-select buttons.
2	Menu buttons and menu icons	Menus are opened by the corresponding menu button.
3	X button	No function used.
4	ESC button	Cancel action. Return to higher-level menu.
5	SET button	Confirm settings.
6	SCROLL wheel	Turning the SCROLL wheel selects between individual windows and menu items, and scrolls through lists.
7	HOME button	Return to start screen.

5.1.1 Quick selection icons

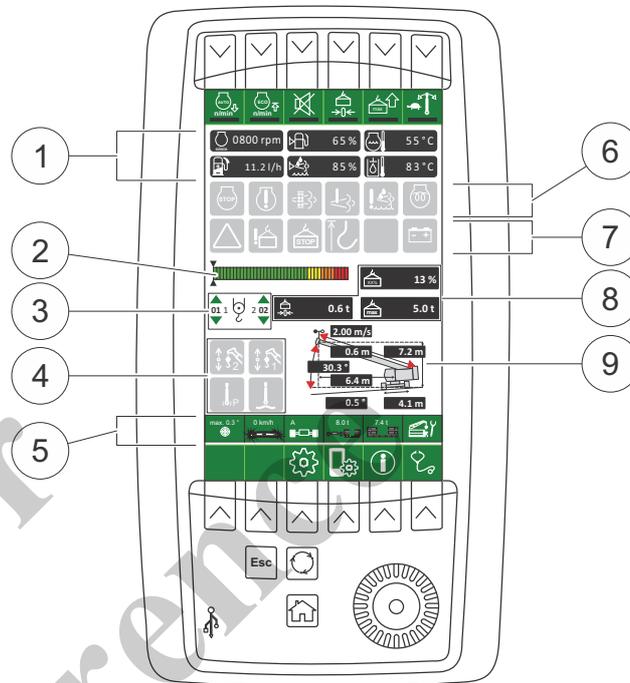
Symbol	Name	Description
	Automatic idle	<p>Automatic idle automatically lowers the engine speed for pauses in work. This saves fuel and protects the environment.</p> <p>Automatic idle has three stages:</p> <ul style="list-style-type: none"> ● Stage 1: 1440 rpm after 5 seconds of inactivity. ● Stage 2: idle speed after 13 seconds. ● Stage 3: diesel engine off after 5 minutes at Stage 2. <p>Settings</p> <p> On</p> <p> Off</p>
	EcoMode	<p>EcoMode reduces maximum speed. This saves fuel and protects the environment.</p> <p>Settings</p> <p> On</p> <p> Off</p>
	LML audible warning device on/off	<p>The LML's audible warning device is enabled when the machine is turned on and can be disabled by the operator. If an alert sounds after the machine has been started, it can be disabled after 5 seconds. Once disabled, the corresponding warning icon displays the error.</p> <p>Settings</p> <p> Audible warning device enabled.</p> <p> Audible warning device disabled.</p>
	Tare load	<p>The tare function sets the load capacity display to 0 t. This function is disabled when the boom is moved.</p> <p>Settings</p> <p> Tare function enabled.</p> <p> Tare function disabled.</p>

Symbol	Name	Description
	Uppercarriage slewing speed	The slewing speed of the uppercarriage can be reduced for more precise movement. Settings  Reduced slewing speed.  Normal slewing speed.
	Show quick selection icons	Hidden quick selection icons are displayed.

5.1.2 Menu icons

Symbol	Name	Description
	Setup	Operating parameters setting for load moment limitation for the desired operating mode.
	Device settings	Device properties setting: <ul style="list-style-type: none"> ● Device language ● Date and time ● Display brightness ● Units ● USB ● Request access
	Info	Diesel engine speed curve and machine information.
	Diagnostics	Error history and description of error. The diagnostics window contains SPN and FMI error codes. These error codes uniquely identify machine errors and are necessary for communicating with your Manitowoc Distributor.

5.2 Start screen



00204

Fig. 24 Start screen

1	Operating status
2	Load capacity scale
3	Winch parameters
4	Notification icons, joystick assignment and slew uppercarriage
5	Configured LML operating mode parameters, see Chapter 5.3
6	Diesel engine notification and warning icons
7	Overall machine and load moment limitation notification and warning icons
8	Current load capacity/maximum load capacity
9	Working diagram



Information

Notification and warning icons on the start screen indicate whether or not the operating status is within the normal range.

5.2.1 Operating status

The displays (1) in Fig. 24 on the start screen show the most commonly needed operating status values at a glance.

The operating status display can appear in different colors:

- Gray: Operating status is within normal range.
- Orange: Operating status is near the limit of normal range.
 - Take corrective action soon.
- Red: Operating status has exceeded normal range.
 - Park machine immediately.
 - Correct error immediately.
 - Only operate machine when error has been corrected.



Information

If a parameter field shows **EEEE**, an error has occurred. Errors can only be corrected by personnel authorized by Manitowoc.

If a parameter field shows **---**, the value is unavailable.

Symbol	Name	Description
	Diesel engine speed	
	Fuel level	Gray: ● Fuel level normal. Orange: ● Refuel machine at the next opportunity. Red: ● Refuel machine immediately.
	Coolant temperature	Gray: ● Coolant temperature normal. Orange: ● Reduce diesel engine load. Red: ● Lower attached loads. ● Let diesel engine go to idle.

Symbol	Name	Description
 11.2 l/h	Current fuel consumption	
 37 %	DEF level (Tier 4f engines)	Gray: <ul style="list-style-type: none"> ● DEF level normal. Orange: <ul style="list-style-type: none"> ● Refill DEF tank at the next opportunity. Red: <ul style="list-style-type: none"> ● Refill DEF tank immediately.
 65 °C	Hydraulic oil temperature	Gray: <ul style="list-style-type: none"> ● Hydraulic oil temperature normal. Orange: <ul style="list-style-type: none"> ● Lower attached loads. ● Switch off the diesel engine. ● Check combination cooler for contamination. ● Clean contaminated cooler. ● Reverse fan manually. Red: <ul style="list-style-type: none"> ● Lower attached loads. ● Switch off the diesel engine. ● Check combination cooler for contamination. ● Clean contaminated cooler.

For Reference Only

5.2.2 Telescopic boom and slew uppercarriage notification icons

Symbol	Possible statuses	Explanation
		<p>Winch 1 is operated with the left joystick. Winch 2 is operated with the right joystick. Switch position:</p>
		<p>Winch 2 is operated with the left joystick. Winch 1 is operated with the right joystick. Switch position:</p>
		<p>Soil drill function active</p>
		<p>Soil drill function inactive</p>
		<p>Slewing gear holding brake applied. The slewing gear holding brake activates once the ignition is turned on. When the slewing gear holding brake is applied, the uppercarriage cannot be slewed.</p>
		<p>Slewing gear holding brake not applied.</p>

Symbol	Possible statuses	Explanation
		Slewing gear freewheel disengaged.
		Slewing gear freewheel engaged.
		Slewing gear freewheel not available. If an uppercarriage inclination of more than 0.3° is set in the Load moment limitation window, the slewing gear freewheel cannot be engaged.

For Reference Only

5.2.3 Diesel engine notification and warning icons

Symbol	Description	Status
	Serious diesel engine error	<p>Gray:</p> <ul style="list-style-type: none"> ● Diesel engine is functioning properly. <p>Red:</p> <ul style="list-style-type: none"> ● Park machine at a safe location immediately. ● Contact your Manitowoc Distributor. ● Do not operate machine until error has been corrected.
	Diesel engine error	<p>Gray:</p> <ul style="list-style-type: none"> ● Diesel engine is functioning properly. <p>Orange:</p> <ul style="list-style-type: none"> ● Contact your Manitowoc Distributor.
	SCR catalytic converter depletion level (Tier 4f engines)	<p>Gray:</p> <ul style="list-style-type: none"> ● SCR catalytic converter automatic cleaning enabled. ● SCR catalytic converter depletion level normal. <p>Orange:</p> <ul style="list-style-type: none"> ● SCR catalytic converter depletion level high. ● Manually enable SCR catalytic converter cleaning immediately. <p>Orange strikethrough:</p> <ul style="list-style-type: none"> ● SCR catalytic converter automatic cleaning disabled. ● Enable SCR catalytic converter automatic cleaning soon. <p>Flashing:</p> <ul style="list-style-type: none"> ● Contact your Manitowoc Distributor.
	Exhaust temperature	<p>Gray:</p> <ul style="list-style-type: none"> ● Exhaust temperature normal. <p>Orange:</p> <ul style="list-style-type: none"> ● Exhaust temperature high. ● SCR catalytic converter regeneration enabled.

Symbol	Description	Status
	DEF quality (Tier 4f engines)	Gray: <ul style="list-style-type: none"> ● DEF quality normal. Orange: <ul style="list-style-type: none"> ● Drain DEF tank. ● Refill DEF.
	Preheating	Gray: <ul style="list-style-type: none"> ● Diesel engine ready. Orange: <ul style="list-style-type: none"> ● Diesel engine preheating.
	Battery	Gray: <ul style="list-style-type: none"> ● Battery charging. Red: <ul style="list-style-type: none"> ● Alternator not charging battery.

For Reference Only

5.2.4 Load moment limitation notification and warning icons

Symbol	Possible statuses	Explanation
		Gray: <ul style="list-style-type: none"> ● Load moment limitation functioning properly.
		Orange: <ul style="list-style-type: none"> ● LML error ● Check error number in the diagnostics windows. ● Contact your Manitowoc Distributor.
		Red: <ul style="list-style-type: none"> ● LML error ● Check error number in the diagnostics windows. ● Contact your Manitowoc Distributor.
		Gray: <ul style="list-style-type: none"> ● Load capacity normal.
		Orange: <ul style="list-style-type: none"> ● Load capacity at limit.
		Red: <ul style="list-style-type: none"> ● Load capacity limit exceeded.
		Red and crossed out: <ul style="list-style-type: none"> ● LML bypassed.

Symbol	Possible statuses	Explanation
		Gray: ● Lifting limit switch off.
		Red: ● Lifting limit switch on.
		Red: ● Lifting limit switch bypassed.

5.2.5 Overall machine notification and warning icons

Symbol	Possible statuses	Explanation
		Gray: ● No error.
		Orange: ● Check error number in the diagnostics windows. ● Contact your Manitowoc Distributor.
		Orange: ● Check error number in the diagnostics windows. ● Contact your Manitowoc Distributor.
		Red: ● Check error number in the diagnostics windows. ● Contact your Manitowoc Distributor.

Symbol	Possible statuses	Explanation
		<p>The emergency stop is deactivated. All machine functions are available.</p>
		<p>The emergency stop is activated. The machine is shut down.</p>

For Reference Only

5.2.6 Working diagram

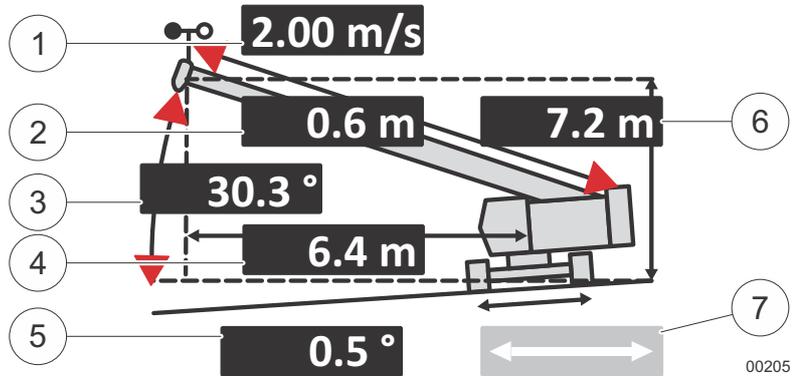


Fig. 25 Working diagram

1	Wind speed
2	Telescopic boom length
3	Telescopic boom angle
4	Working radius
5	Machine inclination
6	Telescopic boom height
7	Track width

The direction of movement of the work equipment is shown as a triangle in the working diagram. The following table shows the possible displays of the direction of movement.

Symbol	Name	Description
	Work equipment directions of movement	Gray: ● Value unavailable. Green: ● Work equipment can be moved. Red: ● Work equipment cannot be moved. ● Limit switch on. Crossed out: ● Limit switch bypassed.

Symbol	Name	Description
 	Track width monitoring	Gray: ● Track width permitted for the selected operating mode Red: ● Track width not permitted for the selected operating mode

5.2.7 Winch parameters



Fig. 26 Winch parameters

1	Direction of movement
2	Reeving number
3	Winch number

5.3 Set-up status

The load moment limitation operating parameters for the operating mode selected are configured in the **Setup status** window. The **Setup status** window automatically appears after the ignition is turned on and the SENCON has started.

Opening the setup status



1 | Press the HOME button.



2 | Press the **Setup** menu button.

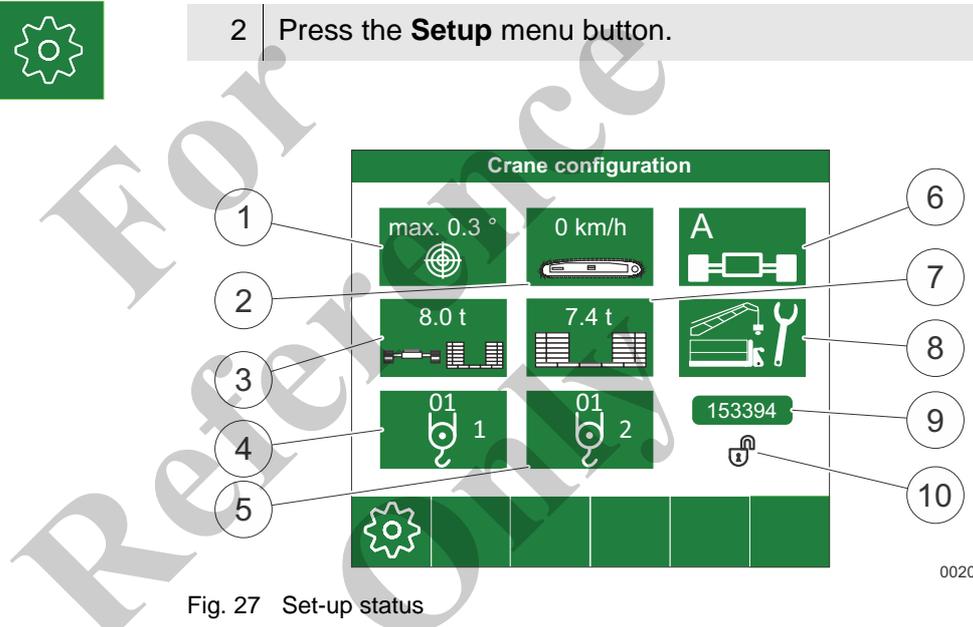


Fig. 27 Set-up status

00206

1	Machine inclination
2	Changeover, pick-and-carry/stationary work
3	Undercarriage ballast
4	Winch 1 reeving
5	Winch 2 reeving
6	Track width
7	Counterweight
8	Attachments and setup program
9	Operating mode code
10	Load change lock

**Information**

If the current load capacity is greater than a specified load, the load change lock (10) in Fig. 27 prevents the LML operating parameters from being modified. When the load change lock is active, a closed lock icon appears. When the load change lock is inactive, an open lock icon appears.

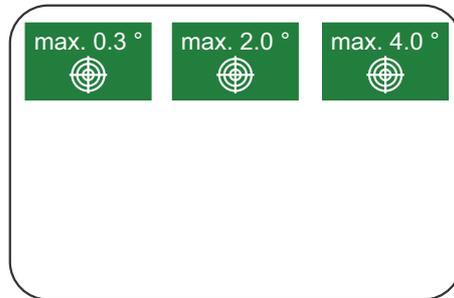
The load change lock can be reset once by turning the ignition off and back on again.

If the current load capacity returns to the permitted range or the attached load is set down, the load change lock resets.

For
Reference
Only

5.3.1 Entering uppercarriage inclination

The maximum uppercarriage inclination while in operation is entered in the **Uppercarriage inclination** window.



00207

Fig. 28 Uppercarriage inclination

- | | |
|---|---|
| 1 | Press the SCROLL wheel.
– The selected LML parameter is outlined in black. |
| 2 | Turn the SCROLL wheel until the Uppercarriage inclination LML parameter is selected. |
| 3 | Press the SCROLL wheel.
– This opens the Uppercarriage inclination settings window. |
| 4 | Turn the SCROLL wheel to set the desired value. |
| 5 | Press the SCROLL wheel. |
| 6 | Configure other LML parameters as needed. |
| 7 | Press the SET button.
– The LML parameters are saved.
The start screen appears. |



5.3.2 Entering undercarriage ballast

The weight of the attached undercarriage ballast is entered in the **Undercarriage ballast** window.

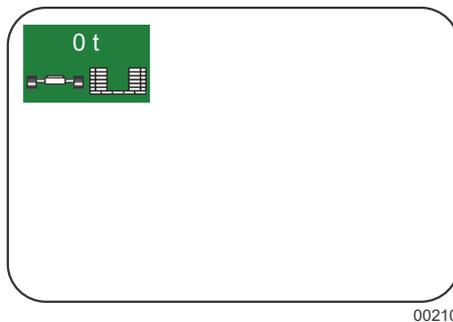
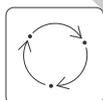


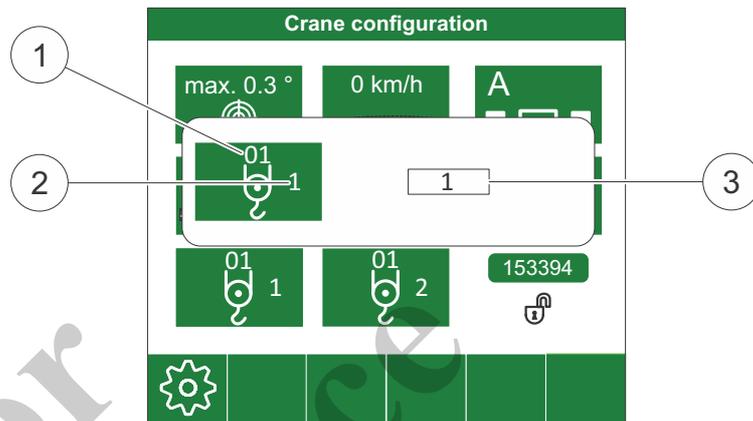
Fig. 29 Undercarriage ballast

- | | |
|---|---|
| 1 | Press the SCROLL wheel.
– The selected LML parameter is outlined in black. |
| 2 | Turn the SCROLL wheel until the Undercarriage ballast LML parameter is selected. |
| 3 | Press the SCROLL wheel.
– This opens the Undercarriage ballast settings window. |
| 4 | Turn the SCROLL wheel to set the desired value. |
| 5 | Press the SCROLL wheel. |
| 6 | Configure other LML parameters as needed. |
| 7 | Press the SET button.
– The LML parameters are saved.
The start screen appears. |



5.3.3 Entering winch reeving

The reeving number of the selected winch is entered in the **Winch reeving** window.

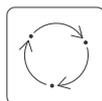


00213

Fig. 30 Winch reeving

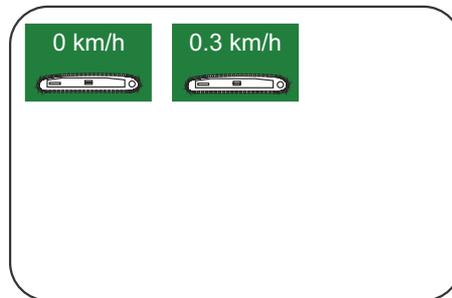
1	Configured reeving
2	Winch number
3	Field for entering winch reeving

1	Press the SCROLL wheel. – The selected LML parameter is outlined in black.
2	Turn the SCROLL wheel until the Winch 1 reeving or Winch 2 reeving LML parameter is selected.
3	Press the SCROLL wheel. – This opens the Winch reeving settings window.
4	Turn the SCROLL wheel to set the desired value.
5	Press the SCROLL wheel.
6	Configure other LML parameters as needed.
7	Press the SET button. – The LML parameters are saved. The start screen appears.



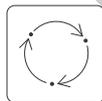
5.3.4 Setting travel speed

The maximum travel speed of the machine is set in the **Travel speed** window.



00208

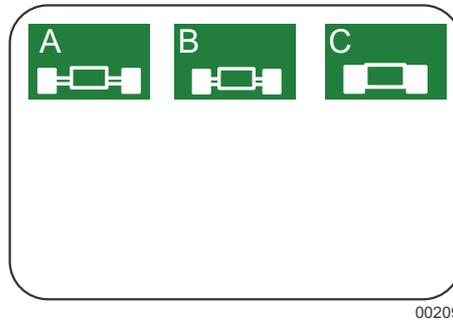
Fig. 31 Travel speed



1	Press the SCROLL wheel. – The selected LML parameter is outlined in black.
2	Turn the SCROLL wheel until the Travel speed LML parameter is selected.
3	Press the SCROLL wheel. – This opens the Travel speed settings window.
4	Turn the SCROLL wheel to set the desired value.
5	Press the SCROLL wheel.
6	Configure other LML parameters as needed.
7	Press the SET button. – The LML parameters are saved. The start screen appears.

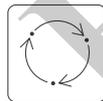
5.3.5 Entering track width

The track width of the machine is entered in the **Track width** window.



00209

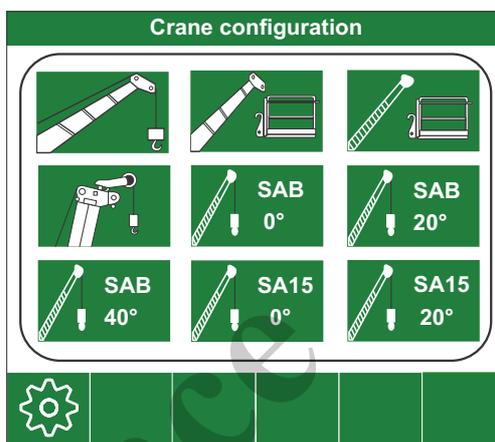
Fig. 32 Track width



1	Press the SCROLL wheel. – The selected LML parameter is outlined in black.
2	Turn the SCROLL wheel until the Track width LML parameter is selected.
3	Press the SCROLL wheel. – This opens the Track width settings window.
4	Turn the SCROLL wheel to set the desired value.
5	Press the SCROLL wheel.
6	Configure other LML parameters as needed.
7	Press the SET button. – The LML parameters are saved. The start screen appears.

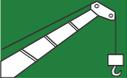
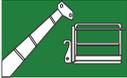
5.3.6 Entering attachments and configuring setup program

Attachments and boom extensions on the machine are entered in the **Attachments and setup program** window.



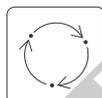
00425

Fig. 33 Attachments and setup program

Symbol	Meaning	Possible values	Explanation of values
	Telescopic boom		
	Telescopic boom with work platform		
	Auxiliary jib		
	Fly boom	SA8 0°	8 m (26 ft) fly boom at 0°
		SA8 20°	8 m (26 ft) fly boom at 20°
		SA8 40°	8 m (26 ft) fly boom at 40°
		SA15 0°	15 m (49 ft) fly boom at 0°
		SA15 20°	15 m (49 ft) fly boom at 20°

Symbol	Meaning	Possible values	Explanation of values
	Fly boom	SA15 40°	15 m (49 ft) fly boom at 40°
		SA8V6 0°	8 m (26 ft) fly boom at 0° with 6.4 m (21 ft) lattice mast section
		SA8V6 20°	8 m (26 ft) fly boom at 20° with 6.4 m (21 ft) lattice mast section
		SA8V6 40°	8 m (26 ft) fly boom at 40° with 6.4 m (21 ft) lattice mast section
		SA8V12 0°	8 m (26 ft) fly boom at 0° with 12 m (39 ft) lattice mast section
		SA8V12 20°	8 m (26 ft) fly boom at 20° with 12 m (39 ft) lattice mast section
		SA8V12 40°	8 m (26 ft) fly boom at 40° with 12 m (39 ft) lattice mast section
		SA15V6 0°	15 m (49 ft) fly boom at 0° with 6.4 m (21 ft) lattice mast section
		SA15V6 20°	15 m (49 ft) fly boom at 20° with 6.4 m (21 ft) lattice mast section
		SA15V6 40°	15 m (49 ft) fly boom at 40° with 6.4 m (21 ft) lattice mast section
		SA15V12 0°	15 m (49 ft) fly boom at 0° with 12 m (39 ft) lattice mast section
		SA15V12 20°	15 m (49 ft) fly boom at 20° with 12 m (39 ft) lattice mast section
		SA15V12 40°	15 m (49 ft) fly boom at 40° with 12 m (39 ft) lattice mast section
	Lattice mast section	HAV6	6.4 m (21 ft) lattice mast section
		HAV12	12 m (39 ft) lattice mast section
	Fly boom with work platform	SA-HAB	

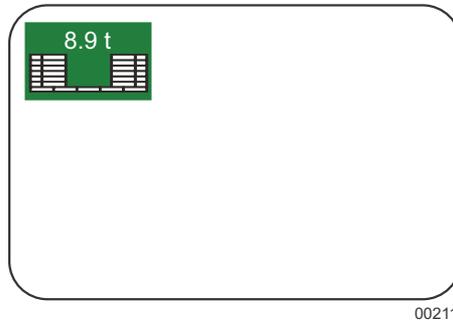
Symbol	Meaning	Possible values	Explanation of values
	Setup 1		
	Setup 2		



- 1 Press the SCROLL wheel.
 - The selected LML parameter is outlined in black.
- 2 Turn the SCROLL wheel until the **Attachments and setup program** LML parameter is selected.
- 3 Press the SCROLL wheel.
 - This opens the **Attachments and setup program** settings window.
- 4 Turn the SCROLL wheel to set the desired value.
- 5 Press the SCROLL wheel.
- 6 Configure other LML parameters as needed.
- 7 Press the SET button.
 - The LML parameters are saved.
 - The start screen appears.

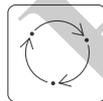
5.3.7 Entering counterweight

The attached counterweight is entered in the **Counterweight** window.



00211

Fig. 34 Counterweight



1	Press the SCROLL wheel. – The selected LML parameter is outlined in black.
2	Turn the SCROLL wheel until the Counterweight LML parameter is selected.
3	Press the SCROLL wheel. – This opens the Counterweight settings window.
4	Turn the SCROLL wheel to set the desired value.
5	Press the SCROLL wheel.
6	Configure other LML parameters as needed.
7	Press the SET button. – The LML parameters are saved. The start screen appears.

5.4 Setup

The **Setup** window provides functions required for attaching the counterweight. It also shows an electronic spirit level indicating the machine inclination.

Opening setup mode

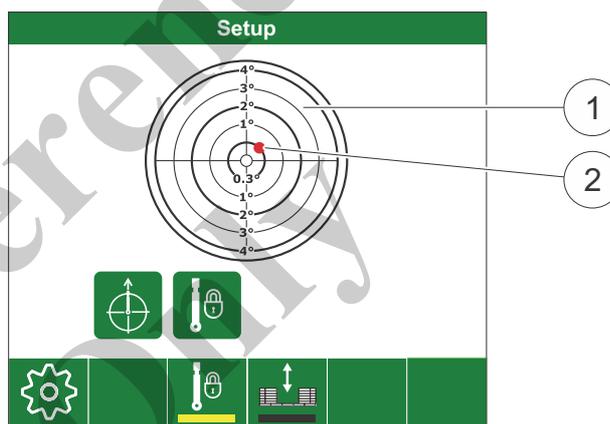


1 Press the HOME button.



2 Press the **Setup** menu button.

3 Turn the SCROLL wheel one step to the right.



00374

Fig. 35 Setup

- | | |
|---|-----------------------------------|
| 1 | Electronic spirit level |
| 2 | Indication of machine inclination |

Setup symbol

Symbol	Description	Status
	Uppercarriage in 0°-position	Green: ● The uppercarriage is in 0°-position. Gray: ● The uppercarriage is in 0°-position.
	Uppercarriage locking mechanism	Green: ● Uppercarriage is locked. Gray: ● Uppercarriage is unlocked.
	Left-hand locking bolt of counterweight locking mechanism	Green: ● Left-hand locking bolt is engaged. Gray: ● Left-hand locking bolt is disengaged.
	Right-hand locking bolt of counterweight locking mechanism	Green: ● Right-hand locking bolt is engaged. Gray: ● Right-hand locking bolt is disengaged.
	Position of the counterweight	Green: ● The counterweight is in the top position. Gray: ● The counterweight is not in the top position.

Setup menu icons

Symbol	Name	Description
	Unlock/lock the uppercarriage	Settings  Uppercarriage locked.  Uppercarriage unlocked.
	Switching the ballasting mode on/off	Settings  Ballasting mode switched on.  Ballasting mode switched off.

For Reference Only

5.5 Setting language

The language of the display text is set in window **Language settings**.

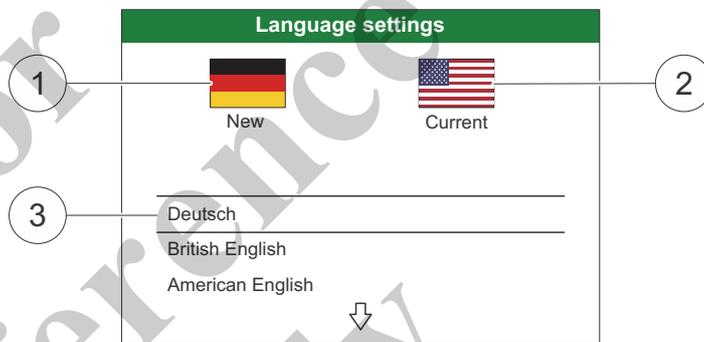
Opening language settings



1 | Press the HOME button.



2 | Press the **Device settings** menu button.

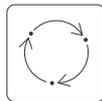


00073

Fig. 36 Language settings

1	New language selection
2	Current language
3	Available languages

Setting language



1	Press the SCROLL wheel. – Language selection is enabled.
2	Turn the SCROLL wheel to select the desired language.
3	Press the SET button.

5.6 Setting brightness

The brightness of the display and buttons is configured in the **Set brightness** window.

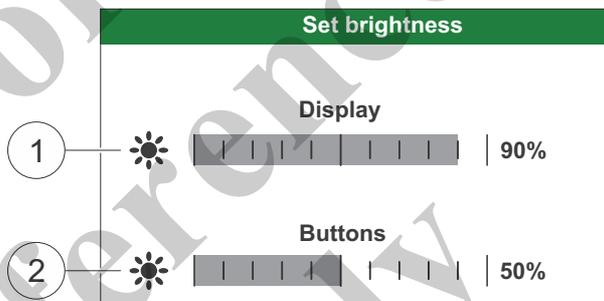
Opening brightness settings



- 1 Press the HOME button.



- 2 Press the **Device settings** menu button.
- 3 Turn the SCROLL wheel one step to the right.



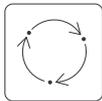
00074

Fig. 37 Set brightness

- 1 Display
- 2 Buttons

Set brightness

1	Press the SCROLL wheel. – A black selection box shows the selected brightness setting.
2	Turn the SCROLL wheel to select the desired brightness setting. ●1 Display ●2 buttons
3	Press the SCROLL wheel to set the brightness. – The selection box turns green. The brightness can be set.
4	Turn the SCROLL wheel to set the brightness.
5	Press the SET button.



For Reference Only

5.7 Setting date and time

The date and time are configured in the **Date and time** window.

Opening the date and time settings



1 Press the HOME button.



2 Press the **Device settings** menu button.

3 Turn the SCROLL wheel two steps to the right.

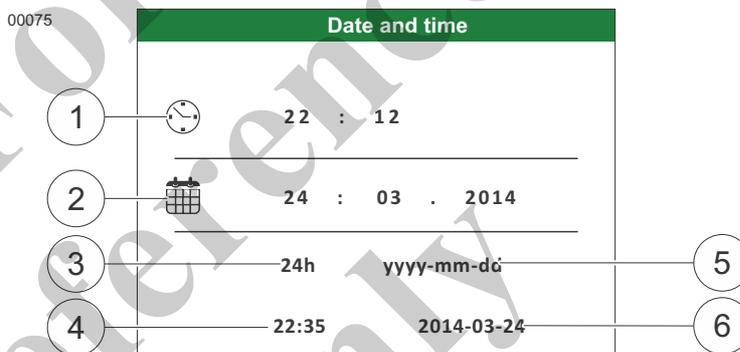
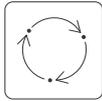


Fig. 38 Setting date and time

1	Display
2	Buttons
3	Time format 12 hrs/24 hrs
4	Set time
5	Date format
6	Set date

Setting date and time

1	Press the SCROLL wheel. – A black selection box indicates the selected field.
2	Turn the SCROLL wheel until the field you want to edit is outlined in black.
3	Press the SCROLL wheel. – The box turns green. The value can be set.
4	Turn the SCROLL wheel to set the desired value.
5	Press the SET button.

For
Reference
Only

5.8 Configuring units

The display units are set in window **System of units**.

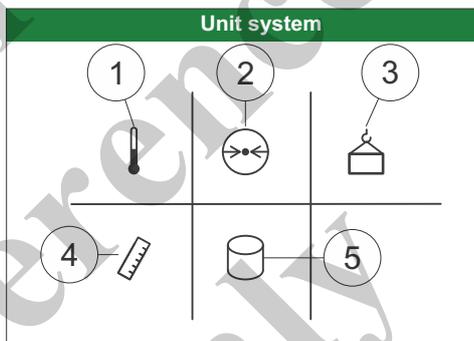
Opening the unit settings



- 1 Press the HOME button.



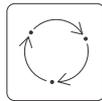
- 2 Press the **Device settings** menu button.
- 3 Turn the SCROLL wheel three steps to the right.



00076

Fig. 39 Unit system

1	Temperature units setting
2	Pressure units setting
3	Weight units setting
4	Length units setting
5	Volume units setting

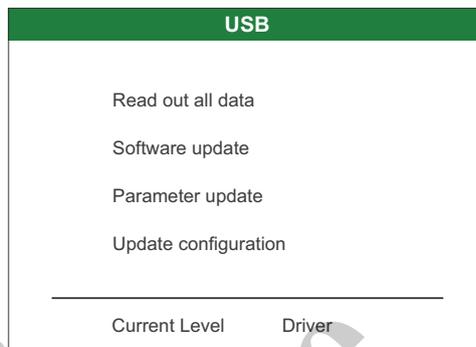
Setting the units

1	Press the SCROLL wheel. – A black selection box indicates the selected unit setting.
2	Press the SCROLL wheel. – The selection window for the unit being configured appears.
3	Turn the SCROLL wheel to select the desired value.
4	Press the SET button.

For
Reference
Only

5.9 USB

The **USB** window can only be used by personnel authorized by Manitowoc for diagnostics and configuration purposes.

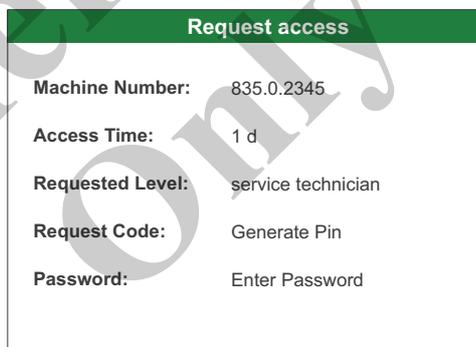


00077

Fig. 40 USB

5.10 Request access

The **Request access** window can be used for diagnostics and configuration purposes.



00078

Fig. 41 Request access

5.11 Histogram

The **Histogram** window measures the speed curve over a specific time period. The measured speed curve is displayed in a histogram.

Opening the histogram



1 | Press the HOME button.



2 | Press the **Info** menu button.

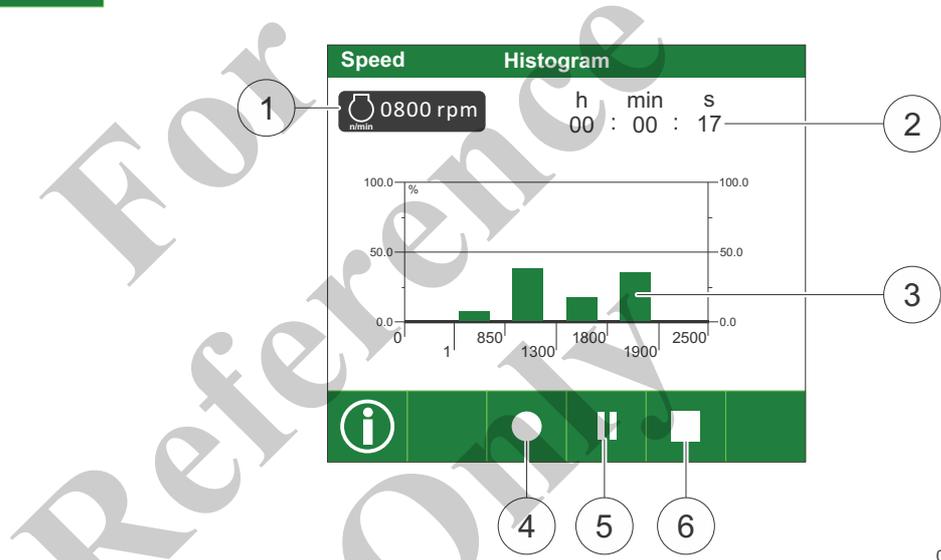


Fig. 42 Histogram

00080

1	Diesel engine speed
2	Duration of speed measurement
3	Histogram
4	Start measurement
5	Stop measurement
6	End measurement

5.12 Login information

The **Login information** window can only be used by personnel authorized by Manitowoc for diagnostics and configuration purposes.

Registration information	
Name	
company	
current level	operator
remaining time	-

00081

Fig. 43 Fig. 29: Login information

For Reference Only

5.13 General information

The **General information** window displays general information on the machine and the SENCON.

Opening General information



1 | Press the HOME button.



2 | Press the **Info** menu button.

3 | Turn the SCROLL wheel two steps to the right.

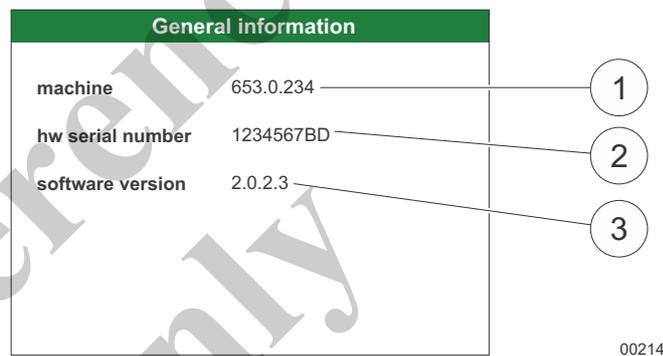


Fig. 44 General

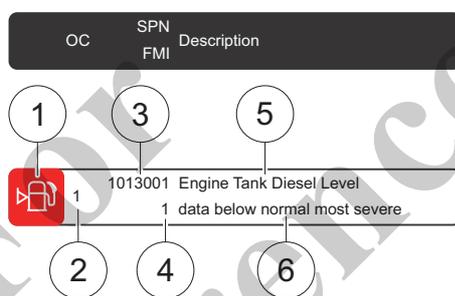
1	Machine number
2	SENCON serial number
3	Software version

5.14 Diagnostics

Windows **Active faults engine**, **Active faults machine** and **Active faults RCL** display the current machine status and any faults.

Some faults can be corrected by the operator. Troubleshooting steps can be found in the overview at the end of this chapter.

If a fault message is not shown in the overview, it must be sent to your Manitowoc Distributor. The SPN code and FMI code must be included with the error message. This information allows the service technician to diagnose the fault and take appropriate measures.



00082

Fig. 45 Example of a fault message

1	Icon, orange or red depending on severity of error
2	OC (Occurrence Count), frequency of error
3	SPN code (Suspect Parameter Number)
4	FMI code (Failure Mode Indicator)
5	Summary of SPN code
6	Summary of FMI code



Information

Arrows in the **Diagnostics** window indicate that not all errors that have occurred can be displayed.

Scroll through the list with the SCROLL wheel.



Information

The SPN code contains the sensor or actuator that triggered the message.

The FMI code is the unique error code for an SPN code.

5.14.1 Active faults engine

The **Active faults engine** window shows the faults of the diesel engine that have occurred.

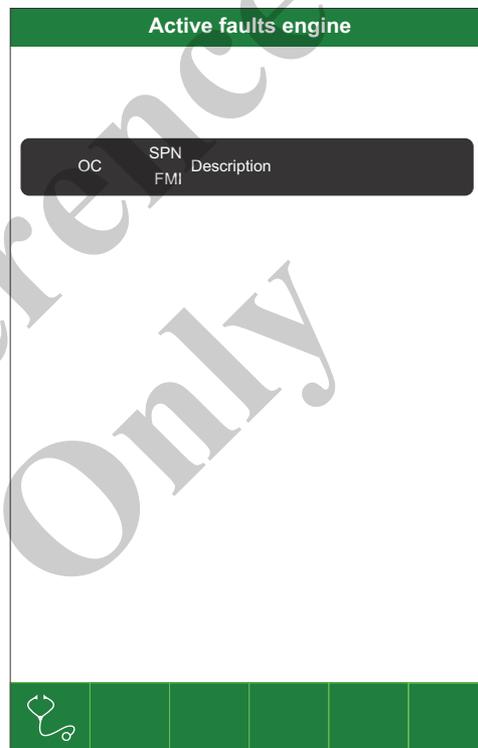
Opening Active faults engine



1 | Press the HOME button.



2 | Press the **Diagnostics** menu button.



00098

Fig. 46 Diagnostic window Active faults engine

5.14.2 Active faults machine

The **Active faults machine** window shows the faults of the overall machine that have occurred.

Opening Active faults machine

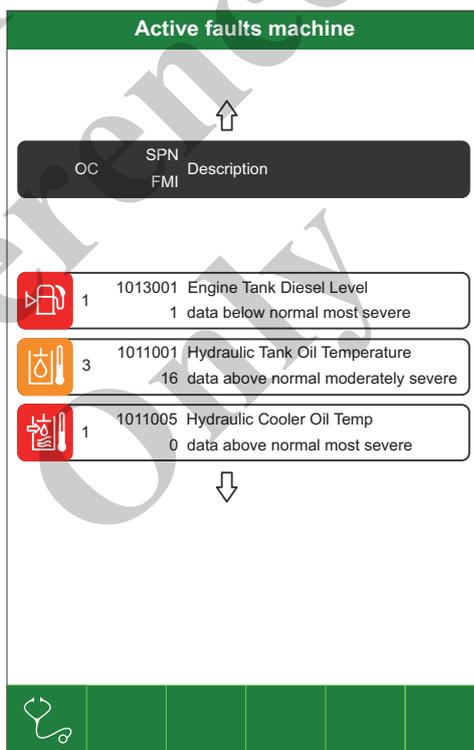


1 Press the HOME button.



2 Press the **Diagnostics** menu button.

3 Turn the SCROLL wheel one step to the right.



00099

Fig. 47 Diagnostic window Active faults engine

Overview of status messages

SENCON icon	SPN	FMI	Description	Remedy
	1011001	15 16	Hydraulic oil temperature too high	<ul style="list-style-type: none"> ● Let diesel engine go to idle. ● Check cooler for contamination and clean as needed.
	1011002	0 15 16	Hydraulic oil return filter contaminated Acknowledgment required!	<ul style="list-style-type: none"> ● Contact your Manitowoc Distributor.
	1011003	0 15 16	Hydraulic leakage oil filter contaminated Acknowledgment required!	<ul style="list-style-type: none"> ● Contact your Manitowoc Distributor.
	1011007	17 18	Hydraulic oil level too low Acknowledgment required!	<ul style="list-style-type: none"> ● Park machine in the maintenance position immediately. ● Top up hydraulic oil.
	Various codes possible	9	CAN network error	<ul style="list-style-type: none"> ● Contact your Manitowoc Distributor.

Reference Only!

Overview of engine messages

SENCON icon	SPN	FMI	Description	Remedy
	95	16	Fuel filter contaminated	<ul style="list-style-type: none"> ● Change the fuel filter.
	97	15 16	Water in fuel	<ul style="list-style-type: none"> ● Contact your Manitowoc Distributor.
	100	1 18	Diesel engine oil pressure too low Acknowledgment required!	<ul style="list-style-type: none"> ● Turn off diesel engine immediately. ● Check diesel engine oil level and add engine oil as needed.
	101	0 15 16	Crankcase pressure too high	<ul style="list-style-type: none"> ● Check crankcase breather line and clean it, if required. ● Contact your Manitowoc Distributor.
	105	0 15 16 18	Intake manifold temperature too high	<ul style="list-style-type: none"> ● Let diesel engine go to idle. ● Switch off the diesel engine. ● Let diesel engine cool down. ● Check combination cooler for soiling, check the fan function, and clean if required.
	110	0 15 16 18 31	Diesel engine coolant temperature too high	<ul style="list-style-type: none"> ● Let diesel engine go to idle. ● Switch off the diesel engine. ● Let diesel engine cool down. ● Check combination cooler for contamination and proper functioning, and clean as needed.
	111	1 17 18	Coolant level low	<ul style="list-style-type: none"> ● Switch off the diesel engine. ● Let diesel engine cool down. ● Top up coolant.
	174	0 15 16	Fuel temperature too high.	<ul style="list-style-type: none"> ● Let diesel engine go to idle. ● Check fuel level, top up fuel, if required.
	175	16	Diesel engine temperature too high.	<ul style="list-style-type: none"> ● Let diesel engine go to idle. ● Check diesel engine oil level and top up engine oil, if required.

SENCON icon	SPN	FMI	Description	Remedy
	623	31	Engine warning Acknowledgment required!	<ul style="list-style-type: none"> ● Note all engine warning messages. ● Contact your Manitowoc Distributor.
	624	31	Engine warning Acknowledgment required!	<ul style="list-style-type: none"> ● Switch off the diesel engine. ● Note all engine warning messages. ● Contact your Manitowoc Distributor.
	1761	1 17 18	DEF level is low (Tier 4f engines)	<ul style="list-style-type: none"> ● Add DEF.
	4096	31		
	3364	1 15 18	DEF quality bad (Tier 4f engines)	<ul style="list-style-type: none"> ● Check DEF quality using a refractometer. ● Drain DEF tank. ● Refill with fresh DEF.
	4094	31		
	4334	18	DEF pressure too low (Tier 4f engines)	<ul style="list-style-type: none"> ● Check the DEF level. Add DEF as needed. ● Check the DEF lines. ● Check the DEF tank filter. ● Contact your Manitowoc Distributor.
	5394	5 7	DEF feed unit not working (Tier 4f engines)	<ul style="list-style-type: none"> ● Contact your Manitowoc Distributor.
	1013001	17 18	Fuel level too low	<ul style="list-style-type: none"> ● Refuel machine.
	1014000	15	Air filter contaminated Acknowledgment required!	<ul style="list-style-type: none"> ● Contact your Manitowoc Distributor.
		31	Wait-to-start light on	<ul style="list-style-type: none"> ● Only start the motor when the message disappears.

SENCON icon	SPN	FMI	Description	Remedy
		1 17 18	Exhaust gas temperature too low Acknowledgment required!	<ul style="list-style-type: none"> ● Contact your Manitowoc Distributor.

For Reference Only

5.14.3 Active faults RCL

The **Active faults RCL** window displays the LML errors that have occurred.

Opening Active faults machine



1 | Press the HOME button.



2 | Press the **Diagnostics** menu button.

3 | Turn the SCROLL wheel two steps to the right.

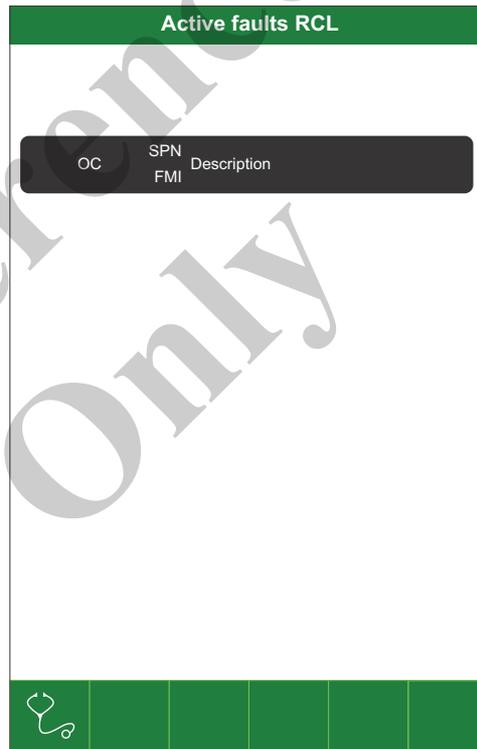


Fig. 48 Diagnostic window Active faults RCL

00215

For
Reference
Only

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6 Operation

Safety in operation

- Comply with Chapter 1 SAFETY.
Before start-up, execute checks in accordance with Section 4.2.
- Persons who work on or with the machine must be trained or instructed for this purpose.
- For all tasks, the following applies:
Only execute tasks on solid, level ground with sufficient load-bearing capacity.
- Ensure that no one is in the danger zone.
- Maintain a safe distance to overhead lines.
- Only operate the machine from the driver seat (except when using the optional Manitowoc remote control).
- Do not transport persons on the machine.
- Take environmental conditions, for example, poor visibility, wind speeds, etc. into account.
- Use the specific load lift charts for the machine.
- Observe the capacity specifications.
- Check that the safe working load of the attachment points and sling ropes is sufficient.
- Follow the banksman's signals.
- Position the boom in the direction of travel if moving over long distances. Hook in the bottom hook block and secure it.
- Before leaving the cab:
 - Park the machine on safe ground. If necessary, move the machine back from the edge of the excavation site.
 - Lower attached loads.
 - Secure the working equipment.
 - Pull the safety lever back.
 - Block the running gear.
 - Switch off the engine.

NOTICE**Machine failure due to lightning strike!**

Lightning strike can result in malfunction or total failure of the vehicle electronics.

- Before putting the machine back into operation, ensure that the operating elements and safety elements are working correctly.

NOTICE**Crane damage due to pulling jammed loads free!**

Improper pile driving tasks or pulling jammed loads free can damage the crane.

- Observe the regulations that apply for executing pile driving tasks or pulling jammed loads free (see Chapter 1.8.4)
- Check the LML for function and operating mode, based on the appropriate operating mode charts and load lift charts.
- Do not bypass the LML under any circumstances.

NOTICE**Damage to the crawler tracks and running gear components due to driving over elevations and depressions!**

When traveling over elevated or recessed obstacles such as swells or railroad tracks, chains and running gear components can be damaged.

- Do not drive over recessed or elevated obstacles under any circumstances.
- Only travel on level, smooth, paths and roads.
- Pay attention to permissible ground pressure.

6.1 Cab

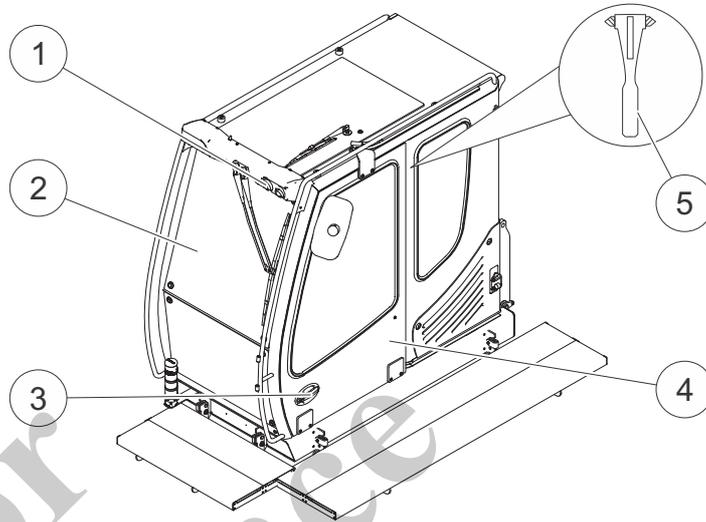


Fig. 49 Cab components

1	Work light	4	Sliding door
2	Front windshield - pop-out	5	emergency hammer
3	Door lock and handle		

The comfort cab offers you a comfortable and safe workstation. You can individually adapt certain components to your own requirements.

Emergency exit

In an emergency, you can exit via the side windows or windshield. To do this, use the emergency hammer (6) in Fig. 49 to break the glass.

Sliding door

The sliding door (5) can be held open with a catch on the side panel of the cab. You can release the locking mechanism by pulling on the release lever (5a) on the inside of the door.

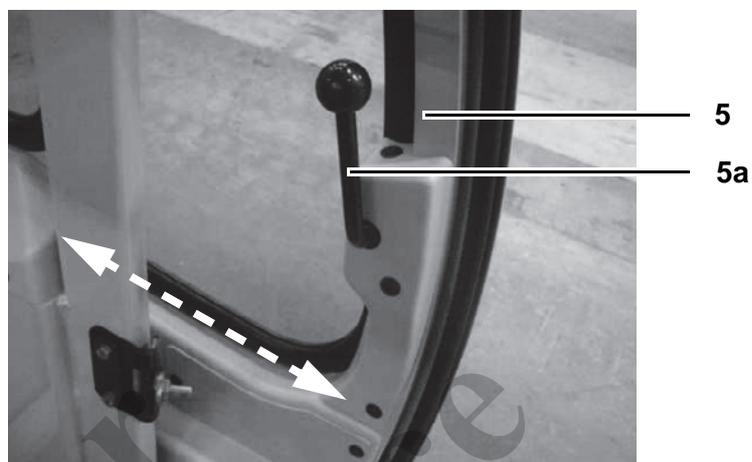


Fig. 50 Locking mechanism of the sliding door

Opening and closing the windshield

1	Press both buttons (2a) in Fig. 51.
2	Push the windshield forward to open it.
3	To close the windshield, push the buttons (2a) in Fig. 51 and pull on the handles (2b) in Fig. 51 until the windshield locking mechanism engages.



Fig. 51 Opening and closing the windshield

Turning the inside light on and off

1	The inside light (1) in Fig. 52 turns on when the cab door is opened.
2	Closing the cab door or turning the switch (2) in Fig. 52 to position 0 turns off the inside light.

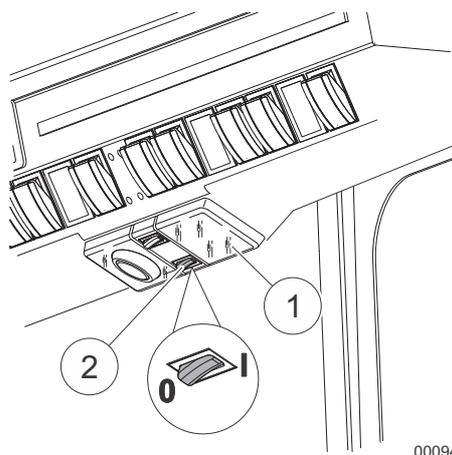
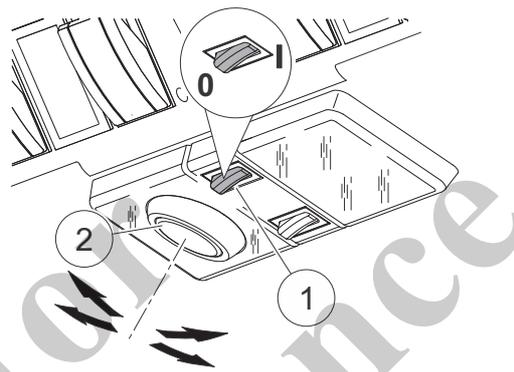


Fig. 52 inside light

00094

Turning the spotlight on and off

1	Turn the switch (1) in Fig. 53 to position I. – This turns on the spotlight (2) in Fig. 53.
2	Turn the switch (1) in Fig. 53 to position 0. – This turns the spotlight off.



00095

Fig. 53 Spotlight

Windshield washer system

The windshield wipers are controlled via the switch on the top right control panel. The washer fluid container is located behind the left front service door. Always fill the container with windshield washer fluid containing antifreeze.

Radio

The radio (9) and speakers (10) are located behind the driver seat below the cab roof.

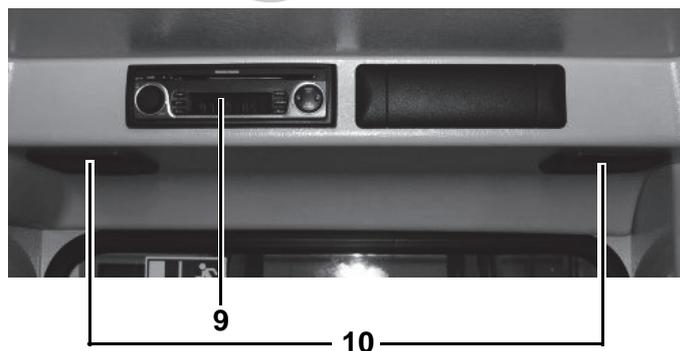


Fig. 54 Radio



Information

Further information can be found in the radio manufacturer operating instructions.

6.1.1 Adjusting the driver seat

The machine is equipped with an air-suspended driver seat that can be adjusted to the operator's individual requirements.

INFORMATION

The following description of the driver seat contains optional functions.

Safety instructions

WARNING

Risk of accident due to machine movements!

Adjusting the driver seat while operating the machine can result in loss of control and cause an accident.

- Adjust the driver seat before starting the machine.
- Do not adjust the driver seat when in drive or work mode.
- Adjustment features should lock back in place after use.

CAUTION

Damage to health due to improperly adjusted driver seat!

An improperly adjusted driver seat compromises the operator's sitting position and comfort. This can result in adverse health effects.

- Adjust the driver seat before starting up the machine or when switching operators.
- The driver seat is suitable for an operator weight of up to 150 kg.
- Always only adjust one function at a time.
- Do not use the driver seat as a climbing aid.
- Do not place any objects on the driver seat.
- Do not cover the driver seat.
- The driver seat must be adjusted so that the operator can always reach the pedals even when the road surface is poor.

Adjusting the operator weight and seat height

The operator weight must not be set so low that the seat can hit the bottom when bumps occur.

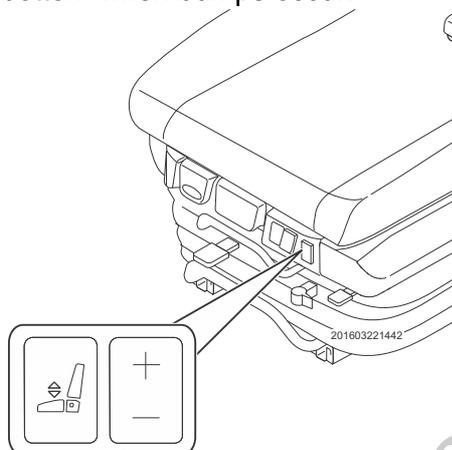


Fig. 55 Adjusting the operator weight and seat height

- 1 Turn the ignition key to the position I.
- 2 Put the full weight of your full body on the seat.
- 3 Push the switch (Fig. 55) down or up to set the desired seat height and the desired operator weight.

Adjusting the shock absorbance

The shock absorption of the driver seat can be infinitely adjusted to the conditions of the road surface or the terrain.

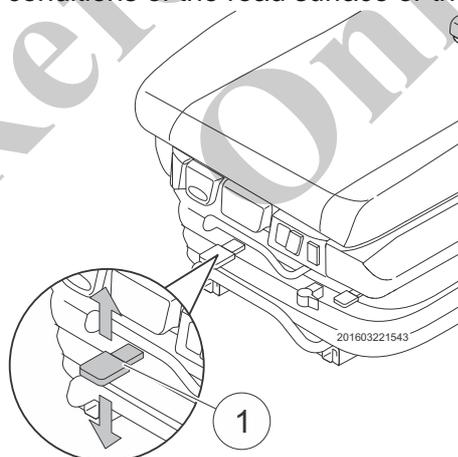


Fig. 56 Adjusting the shock absorbance

- 1 To increase the damping force, move the lever (Fig. 56/1) up.
- 2 To decrease the damping force, move the lever (Fig. 56/1) down.

Adjusting the position of the seat surface

The position of the seat surface can be adjusted lengthwise.

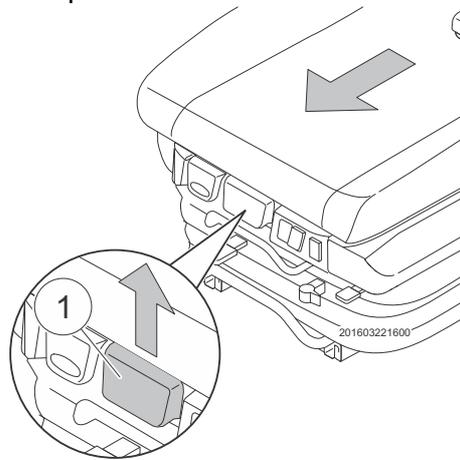


Fig. 57 Adjusting the position of the seat surface

- | | |
|---|--|
| 1 | Move the lever (Fig. 57/1) up and push the seat surface back or forwards. |
| 2 | Release the lever. <ul style="list-style-type: none"> - The seat surface must audibly engage. - After locking, it must not be possible to change the position anymore. |

Length adjustment of the driver seat

The position of the driver seat can be adjusted lengthwise.

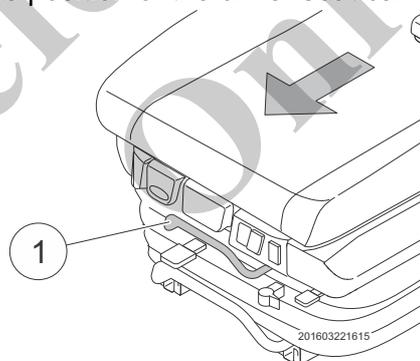


Fig. 58 Adjusting the seat position

- | | |
|---|--|
| 1 | Pull the handle (Fig. 58/1) up and push the driver seat back or forwards. |
| 2 | Release the handle. <ul style="list-style-type: none"> - The driver seat must audibly engage. - After locking, it must not be possible to change the position anymore. |

Adjusting the inclination of the seat surface

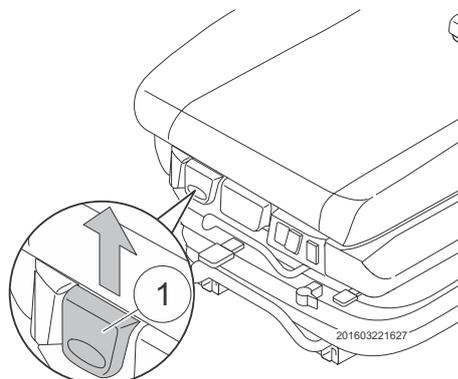


Fig. 59 Adjusting the seat inclination

- 1 Push lever (Fig. 59/1) upwards.
- 2 Adjust the desired inclination by increasing or decreasing your weight on the front or back of the seat surface.
- 3 Release the lever.
 - The seat surface must audibly engage.
 - After locking, it must not be possible to change the position anymore.

Length adjustment of the driver seat with the brackets

The position of the driver seat can be adjusted lengthwise together with the brackets.

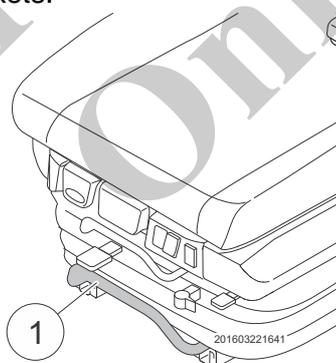


Fig. 60 Adjusting the seat position with the brackets

- 1 Pull the handle (Fig. 60/1) up and push the driver seat with the brackets back or forwards.
- 2 Release the handle.
 - The driver seat with the brackets must audibly engage.
 - After locking, it must not be possible to change the position anymore.

Adjusting the inclination of the arm rests

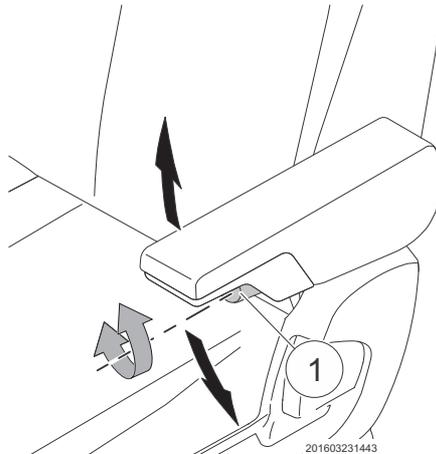


Fig. 61 Adjusting the arm rest inclination

- 1 Turn the handwheel (Fig. 61/1) outwards.
 - The arm rest is raised.
- 2 Turn the handwheel (Fig. 61/1) inwards.
 - The arm rest is lowered.

INFORMATION

The arm rests can be folded back if necessary.

Adjusting the inclination of the backrest

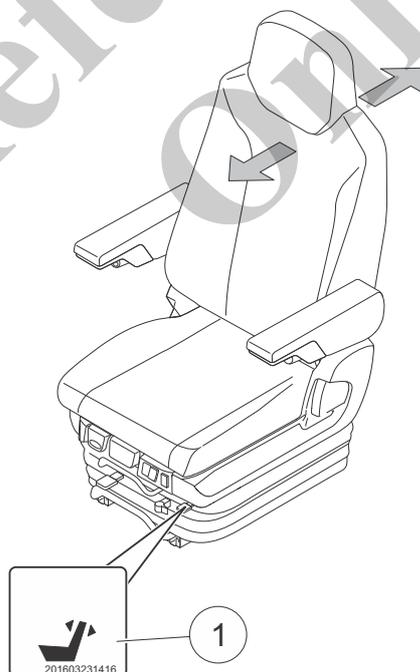


Fig. 62 Adjusting the backrest inclination

- 1 Push lever (Fig. 62/1) upwards.

- 2 Adjust the desired inclination by increasing or decreasing your weight on the backrest.
- 3 Release the lever.
 - The backrest must audibly click into place.
 - After locking, it must not be possible to change the position anymore.

Adjusting the height of the headrest

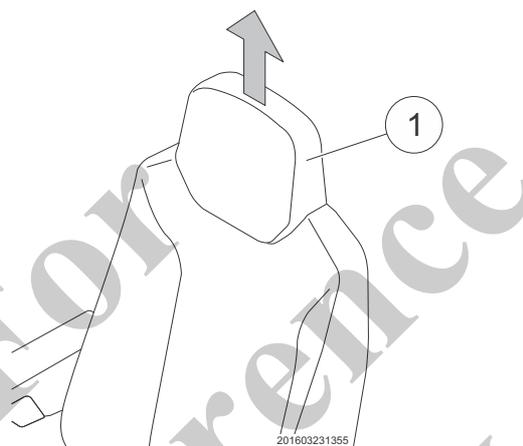


Fig. 63 Adjusting the headrest

- 1 Pull the headrest (Fig. 63/1) up or down until the desired height is reached.
 - The headrest must noticeably click into the individual positions.

INFORMATION

To remove the headrest, pull it out over the last engagement position.

Adjusting the lumbar support

The height and strength of the curvature of the lumbar support can be individually adjusted.

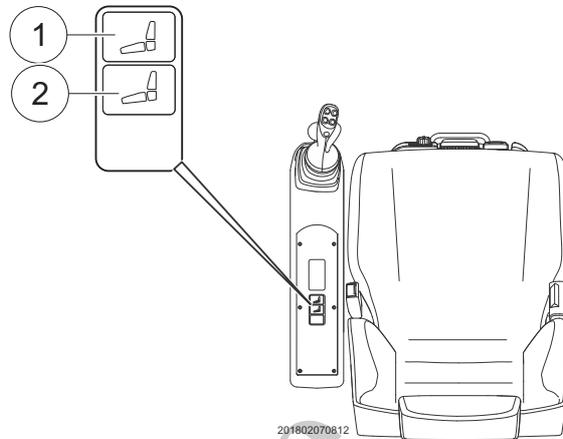


Fig. 64 Adjusting the lumbar support

Item	Description
1	Button, lumbar support, lower air chamber
2	Button, lumbar support, upper air chamber
1	Push the buttons (Fig. 64/1), (Fig. 64/2) up to increase the curvature.
2	Push the buttons (Fig. 64/1), (Fig. 64/2) down to decrease the curvature

Switching the seat heater on and off

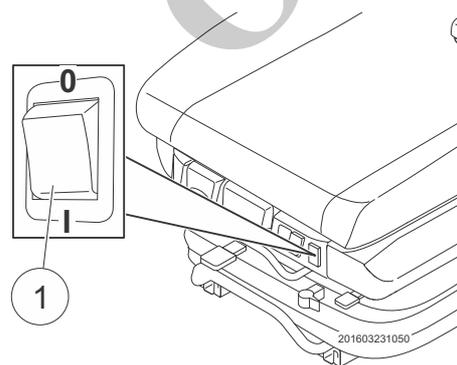


Fig. 65 Seat heater switch

1	Push the switch (Fig. 65/1) down. – The seat heater is switched on.
2	Push the switch (Fig. 65/1) up. – The seat heater is switched off.

Switching the horizontal suspension on and off

The horizontal suspension can absorb shocks in the direction of travel.

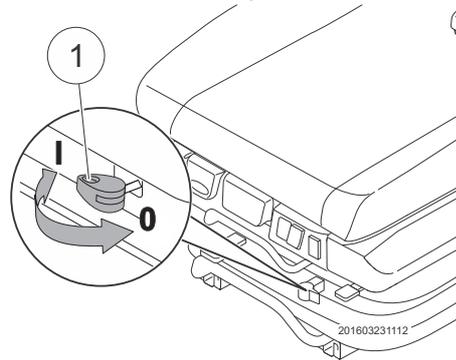


Fig. 66 Horizontal suspension

- 1 Switch the lever (Fig. 66/1) to the position **I**.
 - The horizontal suspension is switched on.

- 2 Switch the lever (Fig. 66/1) to the position **0**.
 - The horizontal suspension is switched off.
 - When the horizontal suspension is switched off, the lever must engage in the position 0. In addition, push the driver seat back until it audibly engages.
 - After locking, the horizontal suspension must not move anymore.

6.2 Uppercarriage locking mechanism

NOTICE

Damage to the uppercarriage locking mechanism if the uppercarriage is not completely unlocked!

After the uppercarriage has been unlocked in the SENCON, in some cases the locking bolt (see Fig. below) does not completely move out of the locking mechanism. If the uppercarriage is slewed when not completely unlocked, the uppercarriage locking mechanism can be damaged.

- After unlocking, check that the locking bolt is retracted.
- If the locking bolt is not completely retracted, carefully slew the uppercarriage a few degrees.

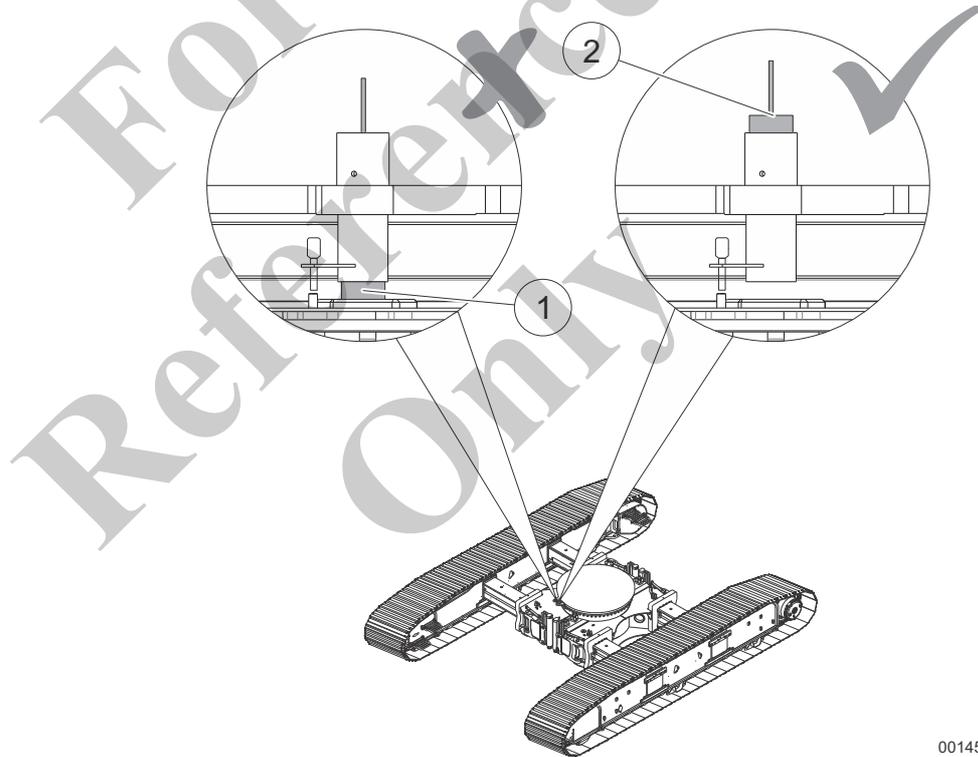


Fig. 67 Extended (2) and retracted (1) locking bolt

00145

**Unlocking the
uppcarriage**

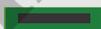


1	Start the diesel engine.
2	Wait until the SENCON has booted.
3	Select operating mode LML and confirm, See "SETUP" on page 5-98.
4	Press the HOME button on the SENCON.



5	Press the Setup menu button on the SENCON.
6	Turn the SCROLL wheel one step to the right. – Window Setup 2/2 is shown on the SENCON.



7	Push the safety lever forward.
8	Press menu button Unlock/lock uppcarriage . – If status field  is shown in a black border, the uppcarriage is unlocked.

Refer Only

6.3 Tilting the cab

WARNING

Risk of dismemberment and crushing.
Make sure no one is near the cab or the cab adjustment when moving the cab.

- Do not move the cab if persons are on, next to or under the cab.

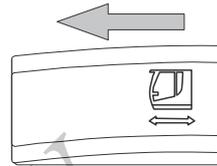
INFORMATION

Do not move the cab to the maximum elevated/extended position.

- Stop the cab approx. 10 cm before the maximum elevated/extended position. This ensures ideal damping performance and pleasant working conditions in the cab.

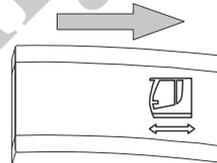
Tilting the cab

1 Press the switch left.



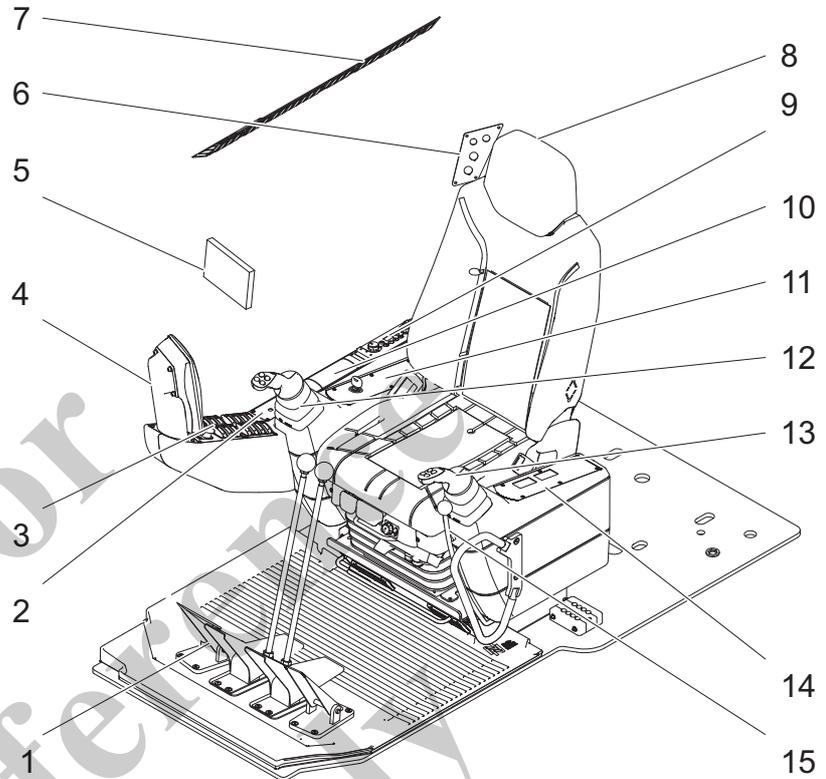
– The cab is tilted forward.

2 Press the switch right.



– The cab is tilted backward.

6.4 Operating elements in the cab



No.	Description	No.	Description
1	Pedals	9	Air conditioning system control panel
2	Right control panel	10	Radio
3	Control panel, front right	11	Right seat control panel
4	SENCON CONTROL system monitor	12	Right joystick
5	Camera system monitor	13	Left joystick
6	Outlet panel	14	Left seat control panel
7	Control panel, top right	15	Safety lever
8	Driver seat		

6.4.1 Safety lever

The safety lever (1) in Fig. 68 is a safety device. Only release the safety lever after the engine has been started.



Fig. 68 Safety lever activated (pulled back)

With safety lever activated

- all hydraulic functions are inoperable.
- the slewing gear service brake is applied.



Fig. 69 Safety lever released (pushed forward)

When the safety lever is released (see illustration)

- All hydraulic functions are available.
- All work maneuvers can be carried out.

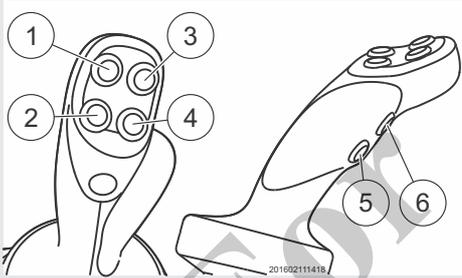
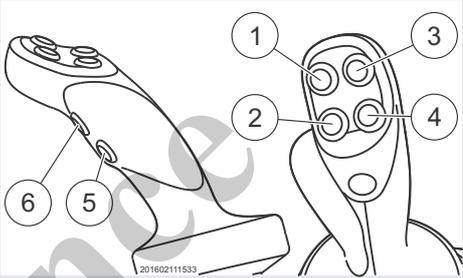
6.4.2 Assignment of the joysticks and pedals

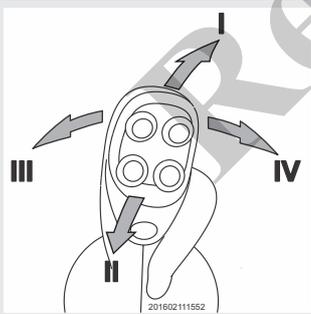
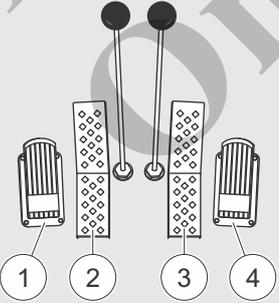
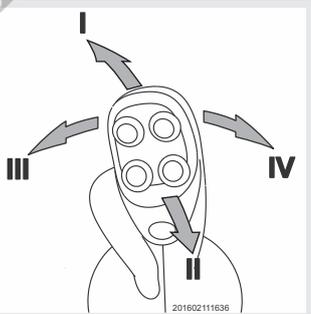
NOTICE

Machine damage due to incorrect handling of the slewing gear brake!

Using the slewing gear brake during work operation may damage the machine.

➤ Only use the slewing gear brake when the machine is at standstill.

Left joystick		Right joystick	
			
1	Slewing gear locking brake	1	Option
2	Option	2	Option
3	Slewing gear freewheeling	3	Option
4	Option	4	Horn
5	Attach fly boom	5	Option
6	Rotation speed - uppercarriage	6	Winch movement indicator on/off

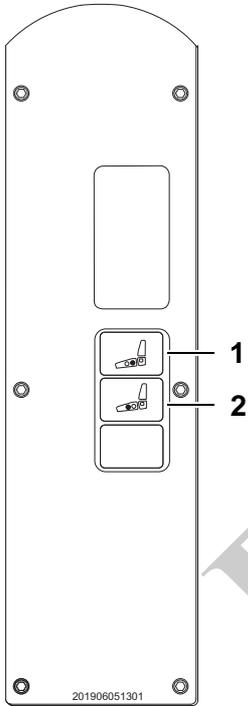
					
I	Lower winch 2	1	Slewing gear brake pedal	I	Lower winch 1
II	Raise winch 2			II	Raise winch 1
III	Slew uppercarriage left	2	Drive pedal, left crawler	III	Raise boom Telescope boom in
IV	Slew uppercarriage right	3	Drive pedal, right crawler	IV	Lower boom Telescope boom out
		4	Speed adjustment, diesel engine		

253430_en

Slewing speed - uppercarriage

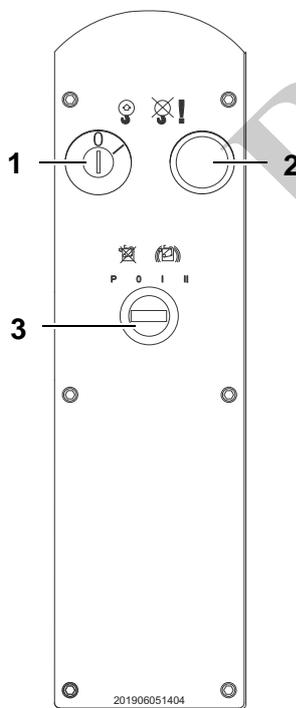
This switch is used for selecting the speed to use for work movements (slow/fast)

6.4.3 Left seat control panel



Item	Description
1	Button, lumbar support, lower air chamber
2	Button, lumbar support, upper air chamber

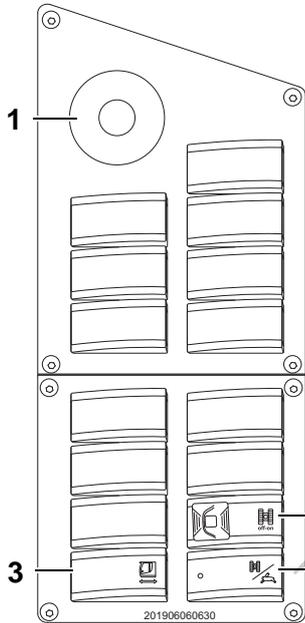
6.4.4 Right seat control panel



Item	Description
1	LML bypass key switch
2	LML bypass push-button
3	Ignition switch P = Fuel pump on 0 = Ignition off I = Ignition on II = Start engine

6.4.5 Control panel, front right

The controls perform the following function:

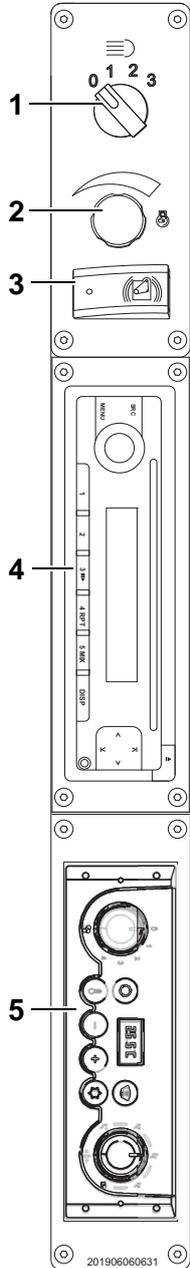


Item	Description
1	Emergency stop switch
2	Tilt cab switch – Left: The cab is tilted forward. – Right: The cab is tilted backward.
3	Tilt cab switch – Left: The cab is tilted forward. – Right: The cab is tilted backward.
4	Travel speed switch – Left: Slow travel speed – Right: Fast travel speed

For Reference Only

6.4.6 Right control panel

The controls perform the following function:



Item	Description
1	* Switch for light
2	Hand throttle
3	Engine on/off switch – Right: The engine is started or stopped by pressing a button. – Condition: Ignition is on.
4	* Radio
5	* Air conditioning system control panel * Option



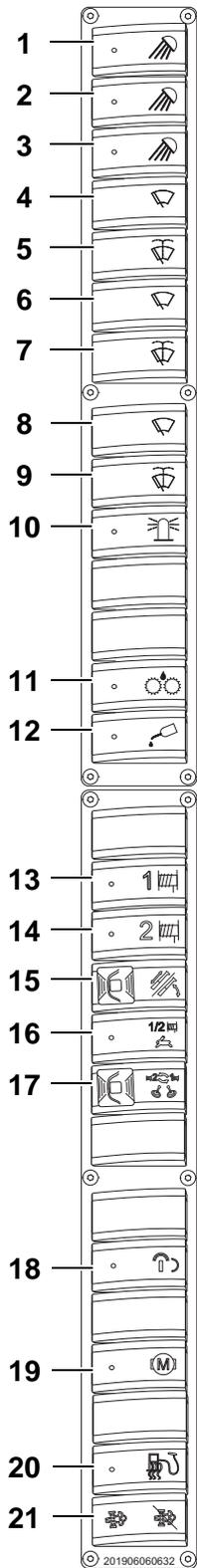
Setting the radio

See the manufacturer's instructions.

For Reference Only

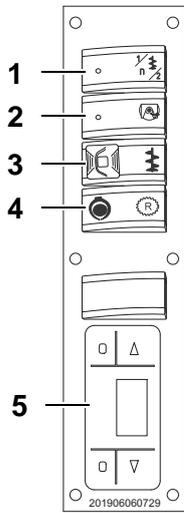
6.4.7 Control panel, top right

The controls perform the following function:



Item	Description
1	Switch for working lights on roof
2	* Switch for working lights on telescopic boom
3	Uppercarriage work light switch
4	Windshield wiper switch
5	Windshield washer button
6	* Sunroof wiper switch
7	* Sunroof washer button
8	* Bottom windshield wiper switch
9	* Bottom windshield washer button
10	* Beacon switch
11	* Slewing ring pinion lubrication button
12	* Central lubrication button
13	Winch 1 release switch
14	Winch 2 release switch
15	Switch for luff/telescope boom changeover – Unlock switch before activation
16	Switch for winch 1 and winch 2 high speed
17	Switch for winch 1 and winch 2 changeover – Unlock switch before activation
18	* Switch for remote control
19	* Switch to release hydraulic power unit
20	Diesel filter heater switch
21	* Switch for exhaust aftertreatment system regeneration – Left (momentary): Start regeneration manually – Middle: Automatic regeneration – Right (toggle): Prevent regeneration

* Option



Item	Description
1	* Switch for slow or fast drilling speed
2	* Switch to open the soil drill lock
3	* Switch to turn the soil drill on or off – Unlock switch before activation
4	* Switch to preselect pole claw or supplemental hydraulic system – Left: Pole claw – Middle: switch off – Right: Supplemental hydraulic system
5	* Auxiliary heating system * Option

For Reference Only

6.5 Slewing ring lubrication (option)

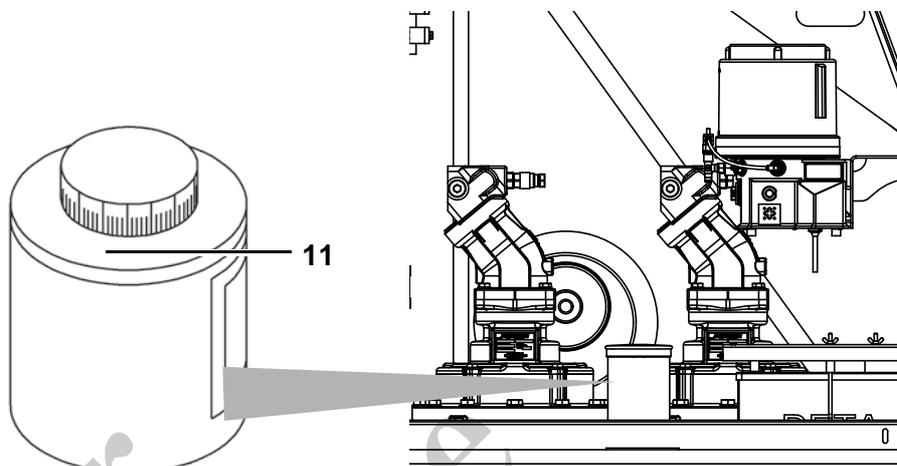


Fig. 70 Position of the lubricant reservoir



Information

Clean the lubrication point thoroughly down to the bare metal before the first application of lubricant to ensure that the lubricant creates an uninterrupted lubricant film across the surface!

1	Switch off the diesel engine.
2	Thoroughly clean the gearing.
3	Check the gearing of the slewing ring and the slewing ring pinion for wear and replace as needed.
4	Start the diesel engine.
5	Activate the slewing ring lubrication system: – Press and hold the Slewing ring lubrication button.
6	Rotate the uppercarriage 360° to the left and to the right to distribute the lubricant evenly on the gearing.
7	Check whether an uninterrupted film of lubricant is present. Repeat the lubrication process as needed.



Information

Lubricate the slewing ring every 10 operating hours or daily (depending on operating conditions)!

Check the lubricant reservoir (11) weekly and top up lubricant if necessary.

6.6 Central lubrication system (option)

The central lubrication system automatically lubricates the bearing race of the rotary connection, the pivot point on the luffing cylinder and telescopic boom on the uppercarriage. The lubrication cycle is pre-set at the factory.



Information

The preset lubricating cycle can be shortened.

Shorter lubrication intervals are required,

- in the tropics.
- in the case of high humidity.
- if there are high levels of dust and contamination.
- if the case of severe temperatures variations.
- when subject to continuous rotary movement.

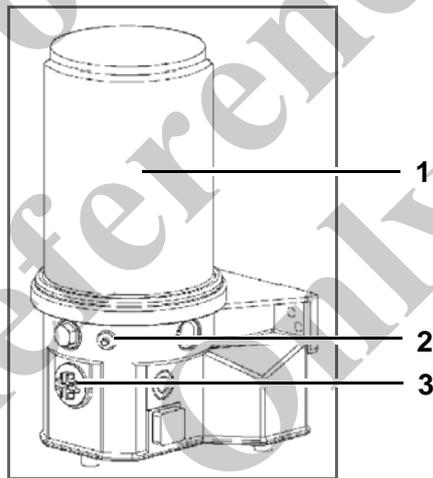
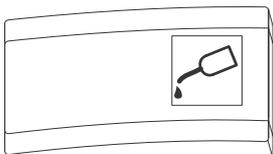


Fig. 71 Central lubrication

1	Lubricant reservoir
2	Grease nipple – Replenish grease
3	Lubrication system adjuster

Triggering the lubrication system manually



Lubrication can be triggered manually in addition to the pre-set lubrication cycle.

- | | |
|---|--|
| 1 | Activate the switch on the right-hand control panel. |
|---|--|

Information

Also observe the instructions in the operating manual provided by the manufacturer in the Appendix.

6.7 DEF/system for reducing nitrogen oxide (Tier 4f engines)

NOTICE

Risk of serious damage to parts due to crystallizing DEF.

If DEF is not immediately removed, it crystallizes and can cause serious damage.

- Immediately and thoroughly clean the parts of the machine that come into contact with DEF with water.
- Only rinse out the DEF tank with distilled water.

DEF DEF is a urea-based solution used in the exhaust aftertreatment of diesel engines to reduce nitrogen oxides. In Europe it is known as **AdBlue®**.

Nitrogen oxides Nitrogen oxides (NO_x) are the product of the reaction between oxygen and nitrogen during combustion.

DEF factory filling The Manitowoc factory filling of DEF meets the following standards:

- ISO 22241-1
- DIN 70700
- ASTM D7821

Alternative names for DEF

- AdBlue®
- Aqueous Urea Solution 32 (AUS 32)
- NO_x Reduction Agent
- Catalyst Solution
- Stableguard 32

Machine temperature range for DEF DEF can be used at a machine operating temperature range of -20 °C to +50 °C.

DEF freezes at -11 °C.



Information

Avoid the following situations:

- Contamination in the DEF circuit
- Direct sunlight

Storing DEF

DEF can be stored for three to six months under the following conditions:

- Storage temperature between -5 °C and +35 °C
- Storage in closed containers to avoid contamination
- Avoiding direct sunlight

**Information**

Check the quality of the DEF with a refractometer before starting up machines that have been in storage. Observe SENCON error messages and refill or replace the DEF as needed.

See the DEF manufacturer's MSDS for more information.

Preheating DEF

DEF is preheated at temperatures around 0 °C using the coolant circuit of the diesel engine.

DEF supply unit

The DEF supply unit transports the DEF from the tank to the exhaust aftertreatment system.

The supply unit continues to run for approx. two minutes after the engine is shut off in order to purge any DEF from the lines.

Do not press the battery disconnect switch.

**Information**

Turn the ignition back on after pressing the emergency stop button. Only press the battery disconnect switch after the ignition has been off for at least two minutes.

This ensures that the supply unit can purge the DEF lines.

Interruption of DEF supply

DEF injection can be interrupted by the DEF supply unit.

Reasons for the interruption can be:

- The DEF tank is empty.
- A component is defective.
- The filter is clogged.
- The DEF is frozen.

**Information**

If DEF injection is interrupted, the diesel engine automatically goes into idle after 30 minutes. However, this does not occur if the reason for the interruption is frozen DEF.

If the DEF level drops to 10%, a warning icon appears on the SENCON.

If the DEF level drops to 5%, the warning icon on the SENCON flashes.

If the DEF level drops to 0%, the diesel engine automatically goes into idle after 30 minutes.

6.7.1 Exhaust aftertreatment system regeneration

WARNING

Severe material damage and injury due to burning!

Exhaust becomes very hot during regeneration. Severe burns can occur by coming into contact with exhaust or the exhaust system.

- Allow the exhaust system to cool down after regeneration.
- Make sure there are no flammable materials in the vicinity of the exhaust system.
- Observe the engine manufacturer's operating manual.



Information

Exhaust temperatures over 625 °C are displayed on the SENCON using the following indicator light:



Preparations for regeneration

- Park the machine on secure ground.
- Select ground that cannot burn or melt under high exhaust temperatures. For example, do not run regeneration on grass or asphalt.
- Materials and substances that can burn, melt or explode must be at least 2 m away from the exhaust port.
- Objects must be at least 1 m away from the exhaust port.
- No gases or vapors in the vicinity that can burn, explode or help start a fire.
- Set down attached loads and lower the boom.
- Reduce engine speed to idle (800 rpm). Regeneration will not run if the engine speed is over 900 rpm.
- Pull the safety lever back.
- Secure the machine.
- Set up a secure ventilation area.
During manual regeneration, keep at least 2 m away from the exhaust port. If the machine is inside a building, set up an exhaust duct. The duct must be able to withstand an exhaust temperature of at least 850 °C.
- Keep a working fire extinguisher on hand.
- Check the surfaces of the exhaust system. Make sure nothing is on or near the exhaust system.

Running regeneration

- Turn off automatic idle on the SENCON.
Automatic idle is programmed to turn the engine off if there has been no hydraulic activity for five minutes.
- Turn off EcoMode on the SENCON.
- To start manual regeneration, press and hold the **Exhaust aftertreatment system regeneration** switch to the left.
- Once manual regeneration of the exhaust aftertreatment system has started, the following occurs:
 - The engine speed can increase.
 - The turbocharger becomes louder.
 - The **Exhaust temperature high** indicator light illuminates.



- Once the engine's ECU detects that the exhaust aftertreatment system has been regenerated, the engine automatically returns to normal idle if the engine speed had increased.
- As soon as generation is complete, all lights turn off.
- Monitor the machine and the surrounding area during regeneration. If a hazardous situation occurs, turn off the engine immediately.
- If there is no danger, turn the **Exhaust aftertreatment system regeneration** switch back to the **Automatic** position.
 - The machine is once again ready for use.

Aborting the regeneration process

To stop manual exhaust aftertreatment system regeneration before it is complete, press the Exhaust aftertreatment system regeneration switch to the right.



Information

- If manual exhaust aftertreatment system regeneration has started but the **Exhaust temperature high** indicator light has not illuminated, contact your Manitowoc Distributor.
- If high exhaust temperatures pose a risk when using the machine, exhaust aftertreatment system regeneration can be disabled.
- The exhaust aftertreatment system must be regenerated after use.
- Observe the engine manufacturer's operating manual.
- No work functions can be performed during manual regeneration.

**Information**

The exhaust aftertreatment system can only be regenerated if the load status of the exhaust aftertreatment system is sufficient for the regeneration process.

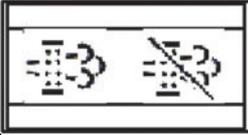
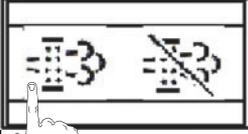
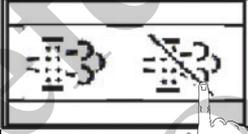
If the load status is sufficient, the following indicator light illuminates on the SENCON:

**Information**

The escalation levels pertaining to the load status of the exhaust aftertreatment system are displayed on the SENCON. See Chapter "SENCON" for more information.

For
Reference
Only

Using the switches

Switch position	
<p>0 – center</p> 	<ul style="list-style-type: none"> - Automatic exhaust aftertreatment system regeneration. - The exhaust aftertreatment system regenerates while the machine is in operation (observe the safety instructions at the beginning of this section).
<p>1 – left</p> 	<ul style="list-style-type: none"> - Start manual exhaust aftertreatment system regeneration immediately. - Press and hold the Exhaust aftertreatment system regeneration switch to the left until the light flashes orange. - Then return the button Exhaust aftertreatment system regeneration switch to the center position. - <u>Requirement:</u> The following warning icon appears on the SENCON: 
<p>1 – right</p> 	<ul style="list-style-type: none"> - Exhaust aftertreatment system regeneration is disabled. - The following notification icon appears on the SENCON: 

6.8 Using the air conditioning system control panel (option)

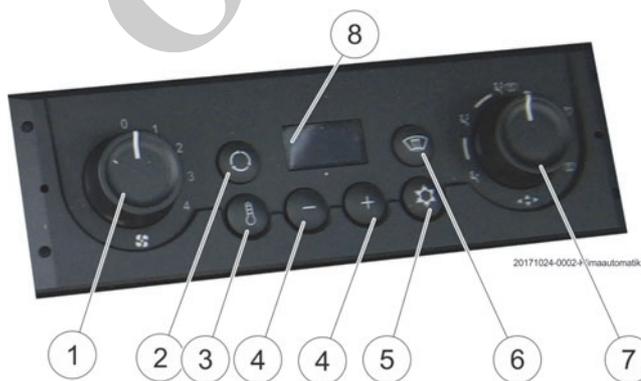
INFORMATION

The climate control system enables precise heating or cooling.

Safety instructions

- Maintenance and repair work must only be executed by trained specialist personnel.
- Do not reach into the interior of the device and do not insert any objects into the device.
- Only carry out maintenance work with the drive engine shut down and the blower disconnected.
- Danger of burns!
Allow device and components inside the device (heat exchanger, resistors) to fully cool down first.
- Danger of freezing!
Avoid touching the cooling pipes and hoses.
- Danger of poisoning!
Avoid contact with refrigerant. Coolant develops toxic gasses.
- Wear protective goggles and gloves.
- Use only R134a coolant.
- Do not add any fluorescent additives (tracer agents, sticks).

General



Item	Description
1	Blower speed selector switch
2	Recirculating air mode
3	Outside temperature display

Item	Description
4	Temperature regulator
5	Air conditioning system on/off
6	Outside air mode
7	Air diffusion selector switch
8	Temperature display (°C or °F)

INFORMATION

The automatic air conditioning system can be operated with outside air or recirculating air.

INFORMATION

To switch on the heating or air conditioning function, press the button (5).

INFORMATION

Keep the windows and cab door closed to ensure effective air conditioning.
The automatic air conditioning system regulates the temperature in relation to the outside temperature.

Recirculating air mode (2)

Faster warm-up of cab and higher maximum temperature. The air in the cab interior is recirculated, which means that no fresh air is supplied from outside. Do not leave this mode activated for longer than 15 minutes, as the air quality in the cab will deteriorate significantly. Ensure that there is a sufficient supply of outside air.

Switching on the air conditioning system (5)

1	Start the engine.
2	Switch on the blower (1) on the right control panel.
3	Open the air vents in the cab to prevent the evaporator from icing up.
4	Press the button (5) for the climate control system on the control panel.
5	Set the desired temperature using the buttons (4) on the control panel.

INFORMATION

Switch on the automatic air conditioning system regularly. This will significantly help in ensuring that the unit is ready for operation. Switch on the automatic air conditioning system once a month for at least 30 minutes at maximum blower speed, keeping the windows and doors open during the process.

Changing the temperature display °C/°F (3)

- 1 | Press the switch (3) for longer than 5 seconds.
 - The temperature display changes (°C <--> °F).

For
Reference
Only

6.9 Camera system

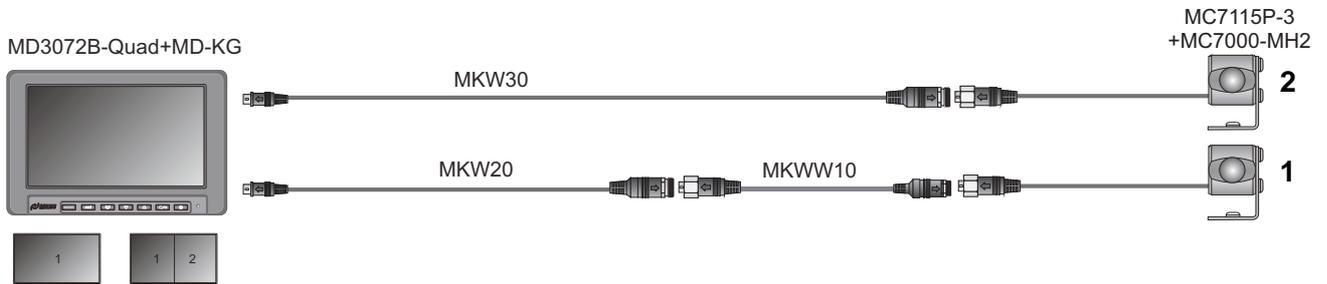


Fig. 72 Elements of the camera system

Depending on the configuration, the machine is equipped with a camera system.

- Each camera has a 115° image angle

Camera 1	For moving the machine in reverse
Camera 2	For monitoring the work area to the right of the machine
Camera 3	For monitoring the winches



Information

See the included camera system documentation for more information.

Reference Only

6.10 Load moment limitation (LML)

Safety instructions

- The load moment limitation is a safety device.
- The LML may only be bypassed in case of emergency or in the event of component failure to shut down the machine in a safe condition.
- Have the malfunction remedied as quickly as possible.

6.10.1 LML function

The LML gives the crane operator information needed to operate the crane within the operating ranges specified by the manufacturer.

Using sensors, the LML monitors crane functions and continuously provides the crane's capacity data to the crane operator. This data changes continuously as the crane moves. If the crane approaches the maximum load rating, the LML warns the crane operator with an acoustic and visual signal.

Warning device - acoustic and visual

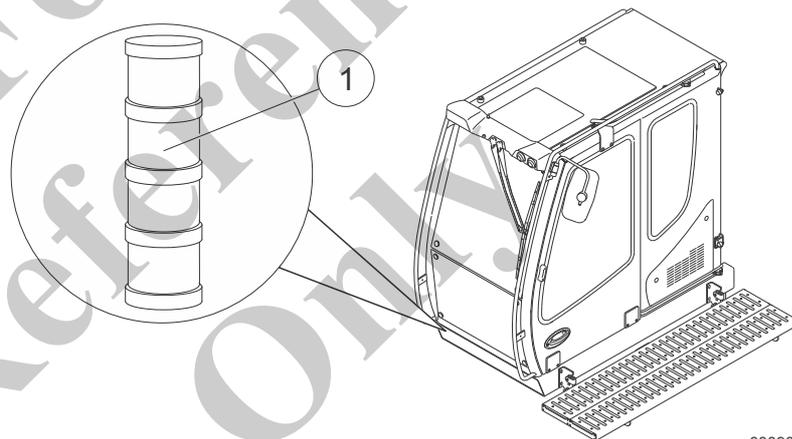


Fig. 73 LML visual warning device

1 | LML visual warning device

If the crane reaches the impermissible area of operation, any crane movements increasing the crane load moment are shut down. In order to unload the machine after the LML is tripped, the **Lower winch** and **Retract** movements can still be executed.

Once the bottom hook block has been drawn into contact with the lifting limit switch weight, the LML disables the **Winch up**, **Boom down** and **Extend** functions.

The LML is intended as an aid for the machine operator. However, the machine operator's experience, prudence and judgment are required to ensure safe operation with this device.

6.10.2 Audible and visual warning device statuses

Operating status	Load	Speed reduction to < 25%	Warning device outside cab	
			Visual	Acoustic
Normal	Load < 90%	no	Continuous green light	—
Approaching load limit	Load greater than 90% and less than 100%	no	Continuous yellow light	—
Overload	Load > 100%	No, but shutdown of the load-increasing functions*	Continuous red light	Intermittent buzzer, can be turned off after 5 s.
LML bypassed	LML inactive	yes	Flashing red light	Continuous warning signal, cannot be turned off

*Load-increasing functions are:

- Luffing
- Raising bottom hook block
- Extending the boom

For Reference Only

6.10.3 Operation

The LML is operated and adjusted via the SENCON.

6.10.4 Mode selection

The operating mode is selected automatically depending on the inputs of the user according to the current operating status.



Information

- Ensure that the correct operating mode code from the operating mode table is set (see Section 6.10.6) in the SENCON. The operating mode code must correspond to the equipment status of the machine.
- The rope reeving number (strand number) on the machine must correspond to the reeving number on the SENCON.
- The lifting capacities are programmed in accordance with ASME B30.5.
- The weight of the load handling devices must be subtracted from the permissible load ratings. Load-handling devices are:
 - Suspension gear
 - Traverses
 - Hooks
 - Bottom hook blocks
 - Hoisting ropes between bottom hook block and pulley head

6.10.5 Bypassing the load moment limitation (LML)

With the LML bypassed

- All crane functions can be executed.
- No shutdown occurs if the maximum load moment is reached.
- All limit switches are bypassed.
- All lifting limit switches are bypassed.
- No shutdown occurs when the radius limit is reached.
- No shutdown occurs in the event of faults/errors.
- A warning signal is output at the SENCON and a warning sound is output inside and outside of the cab to alert of the bypass mode. These warning signals cannot be switched off.



- 1 To bypass the LML, turn the key switch (2) in Fig. 74 while pressing the push-button (3) in Fig. 74.

The bypass is terminated by releasing the key switch (2) in Fig. 74 or the push-button (3) in Fig. 74, or by turning the ignition off then back on again.

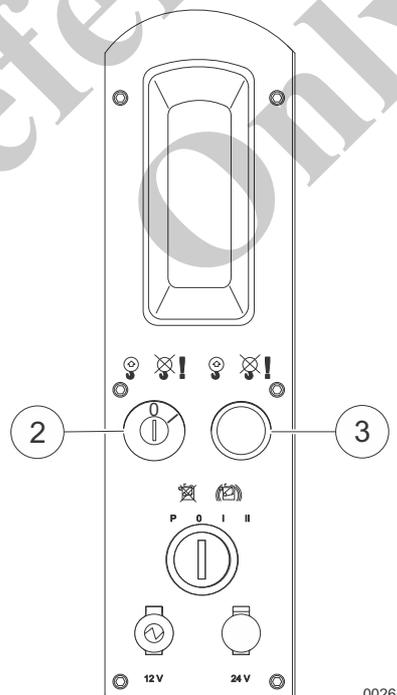


Fig. 74 LML controls

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6.10.6 LML work programs

The work programs of the LML are listed below. Specific operating modes can be disabled depending on the machine equipment.

Inclination [°]	Track span [Position]	Carbody counterweight [t]	Upper carriage counterweight [t]	Main boom / Attachment	Offset [°]	LML code
0.3	A	0.0	33.0	Boom setup		00156599
0.3	D	0.0	0.0	Boom setup		00106198
0.3	C	0.0	0.0	HA		00154101
0.3	C	0.0	0.0	HA-S		00154131
0.3	C	0.0	19.2	HA		00154401
0.3	C	0.0	19.2	HA-S		00154431
0.3	B	0.0	0.0	HA		00155101
0.3	B	0.0	0.0	HA-S		00155131
0.3	B	0.0	19.2	HA		00155401
0.3	B	0.0	19.2	HA-S		00155431
0.3	B	0.0	33.0	HA		00155501
0.3	B	0.0	33.0	HA-S		00155531
0.3	A	0.0	0.0	HA		00156101
0.3	A	0.0	0.0	HA-S		00156131
0.3	A	0.0	19.2	HA		00156401
0.3	A	0.0	19.2	HA-S		00156431
0.3	A	0.0	33.0	HA		00156501
0.3	A	0.0	33.0	HA-S		00156531
0.3	A	0.0	33.0	HAV12		00156521
0.3	A	0.0	33.0	HAV6		00156520
0.3	A	0.0	33.0	SA15	0.0	00156551
0.3	A	0.0	33.0	SA15	20.0	00156552
0.3	A	0.0	33.0	SA15	40.0	00156553
0.3	A	0.0	33.0	HAV12+SA15	0.0	00156574
0.3	A	0.0	33.0	HAV12+SA15	20.0	00156575
0.3	A	0.0	33.0	HAV12+SA15	40.0	00156576
0.3	A	0.0	33.0	HAV6+SA15	0.0	00156571
0.3	A	0.0	33.0	HAV6+SA15	20.0	00156572
0.3	A	0.0	33.0	HAV6+SA15	40.0	00156573
0.3	A	0.0	33.0	SA8	0.0	00156541
0.3	A	0.0	33.0	SA8	20.0	00156542
0.3	A	0.0	33.0	SA8	40.0	00156543
0.3	A	0.0	33.0	HAV12+SA8	0.0	00156564
0.3	A	0.0	33.0	HAV12+SA8	20.0	00156565
0.3	A	0.0	33.0	HAV12+SA8	40.0	00156566
0.3	A	0.0	33.0	HAV6+SA8	0.0	00156561
0.3	A	0.0	33.0	HAV6+SA8	20.0	00156562
0.3	A	0.0	33.0	HAV6+SA8	40.0	00156563
2.0	C	0.0	0.0	HA		00254101
2.0	C	0.0	0.0	HA-S		00254131
2.0	C	0.0	19.2	HA		00254401
2.0	C	0.0	19.2	HA-S		00254431
2.0	B	0.0	0.0	HA		00255101
2.0	B	0.0	0.0	HA-S		00255131
2.0	B	0.0	19.2	HA		00255401

Inclination [°]	Track span [Position]	Carbody counterweight [t]	Upper carriage counterweight [t]	Main boom / Attachment	Offset [°]	LML code
2.0	B	0.0	19.2	HA-S		00255431
2.0	B	0.0	33.0	HA		00255501
2.0	B	0.0	33.0	HA-S		00255531
2.0	A	0.0	0.0	HA		00256101
2.0	A	0.0	0.0	HA-S		00256131
2.0	A	0.0	19.2	HA		00256401
2.0	A	0.0	19.2	HA-S		00256431
2.0	A	0.0	33.0	HA		00256501
2.0	A	0.0	33.0	HA-S		00256531
4.0	C	0.0	0.0	HA		00354101
4.0	C	0.0	0.0	HA-S		00354131
4.0	C	0.0	19.2	HA		00354401
4.0	C	0.0	19.2	HA-S		00354431
4.0	B	0.0	0.0	HA		00355101
4.0	B	0.0	0.0	HA-S		00355131
4.0	B	0.0	19.2	HA		00355401
4.0	B	0.0	19.2	HA-S		00355431
4.0	B	0.0	33.0	HA		00355501
4.0	B	0.0	33.0	HA-S		00355531
4.0	A	0.0	0.0	HA		00356101
4.0	A	0.0	0.0	HA-S		00356131
4.0	A	0.0	19.2	HA		00356401
4.0	A	0.0	19.2	HA-S		00356431
4.0	A	0.0	33.0	HA		00356501
4.0	A	0.0	33.0	HA-S		00356531
0.3	A	0.0	33.0	HA-HAB		00156513
0.3	A	0.0	33.0	SA-HAB		00156525
0.3	A	0.0	33.0	SLS	0.0	00156535
2.0	A	0.0	33.0	SLS	0.0	00256535
4.0	A	0.0	33.0	SLS	0.0	00356535
0.3	A	0.0	19.2	SLS	0.0	00156435
2.0	A	0.0	19.2	SLS	0.0	00256435
4.0	A	0.0	19.2	SLS	0.0	00356435
0.3	B	0.0	33.0	SLS	0.0	00155535
2.0	B	0.0	33.0	SLS	0.0	00255535
4.0	B	0.0	33.0	SLS	0.0	00355535
0.3	B	0.0	19.2	SLS	0.0	00155435
2.0	B	0.0	19.2	SLS	0.0	00255435
4.0	B	0.0	19.2	SLS	0.0	00355435

HA	Main Boom
HA-S	Auxiliary Boom Nose
HA-HAB	Main Boom with Personnel Basket
SA-HAB	Boom Extension 8 m (26 ft 3 in) with Personnel Basket
SA8	8 m (26 ft 3 in) boom extension
SA15	15 m (49 ft 3 in) two piece boom extension
HAV6	Main Boom with 6.4 m (21 ft) Insert
HAV12	Main Boom with 12 m (39 ft 4 in) Insert
SA8V6	8 m (26 ft 3 in) fly boom with 6.4 m (21 ft) Insert
SA8V12	8 m (26 ft 3 in) fly boom with 12 m (39 ft 4 in) Insert
SA15V6	15 m (49 ft 3 in) two piece boom extension with 6.4 m (21 ft) Insert
SA15V12	15 m (49 ft 3 in) two piece boom extension with 12m (39 ft 4 in) Insert
SLS	Heavy duty jib
A	100% full span 5.4 m (17.7 ft)
B	50% mid span 4.2 m (13.8 ft)
C	0% retracted span 3.1 m (10 ft)
D	On frame mounted outrigger jacks

6.10.7 Components of the LML

- Pressure sensor on the luffing cylinder
- Length and angle transmitter / spring cable drum on the boom
- Lifting limit switch - boom
- Lifting limit switch - fly boom / auxiliary jib
- Cable connection
- Lowering limit switch on the winch

Pressure sensor (1) on
the luffing cylinder (2)

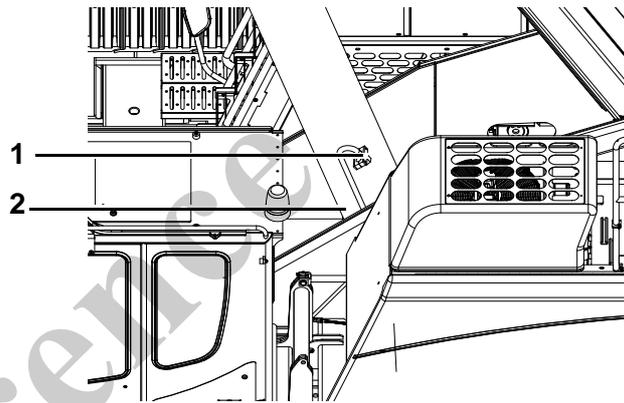


Fig. 75 Pressure sensor (1) on the luffing cylinder (2)

The pressure sensors measure the pressure on the piston head and on the rod side of the luffing cylinder.

Length and
angle transmitter /
spring cable drum (3)

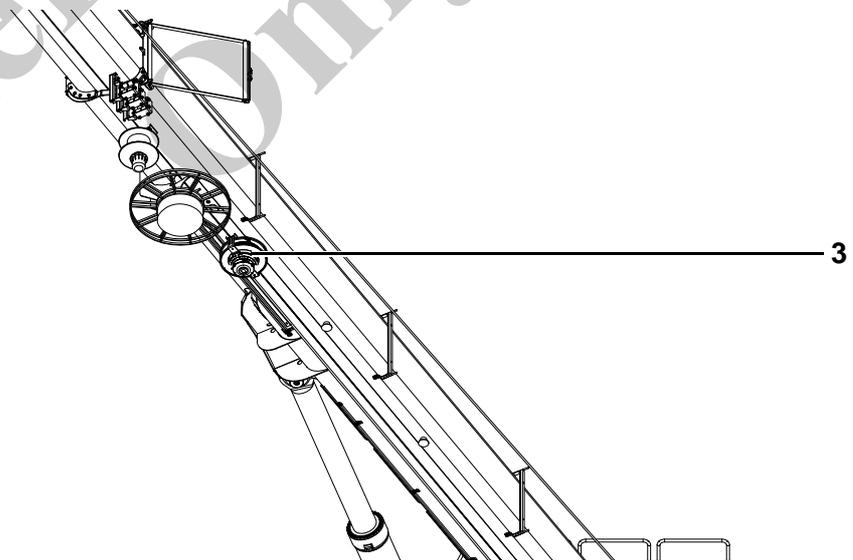


Fig. 76 Length and angle transmitter / spring cable drum (3)

The length and angle transmitter measures the boom angle relative to the horizontal as well as the length of the telescopic boom. The cable of the cable drum transmits the measurement signals from the boom

head to the LML.

Lifting limit switch (4)

NOTICE

Machine damage due to collision of the bottom hook block with the boom head!

If the chain of the lifting limit switch is shortened, this can result in a delayed response of the lifting end limit device. In this case the rope will not be stopped at the right time and the bottom hook block collides with the boom head.

➤ Do not shorten the chain of the lifting end limit device.

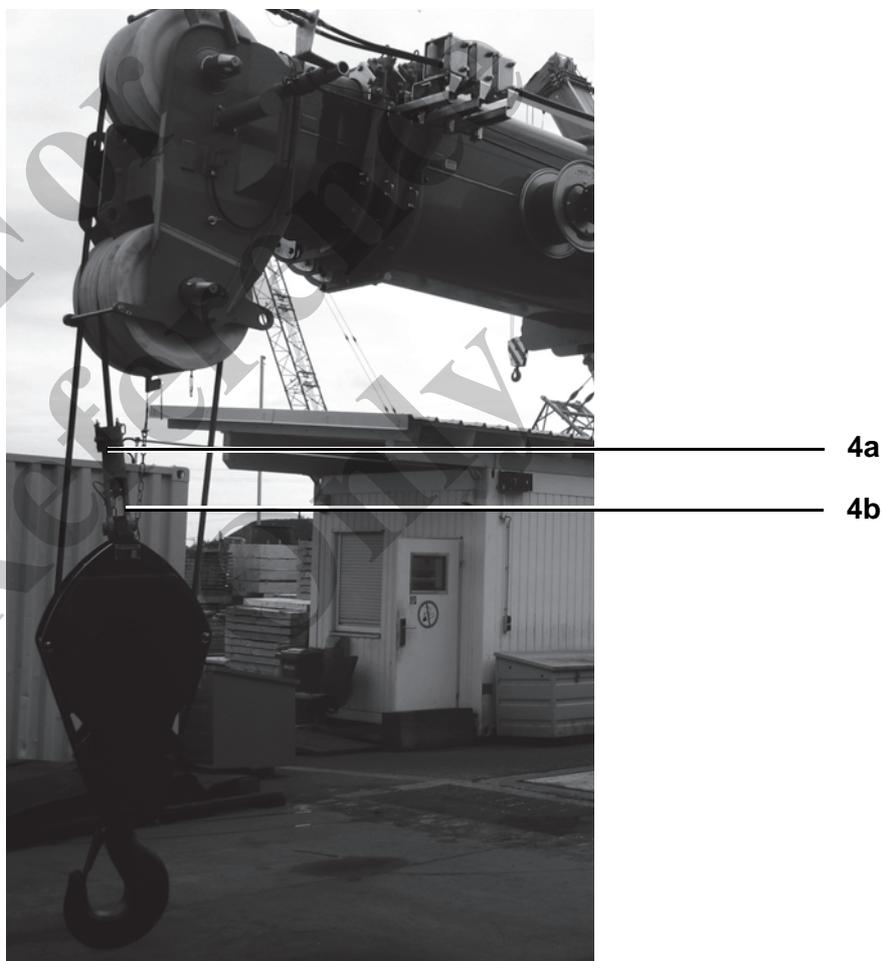


Fig. 77 Lifting end limit device (4)

The lifting end limit device prevents the bottom hook block from colliding with the boom head. This emergency limit switch should not be activated during operation.

The lifting limit switch (4a) is activated by the weight suspended on the chain (4b). The length of the chain depends on the speed of the load

hook and the response time system of the shut-down system

Check the function every time you use the crane by moving the switching weight with the bottom hook block (hoisting accessories).

**Lifting limit switch -
fly boom
(5 - option)**

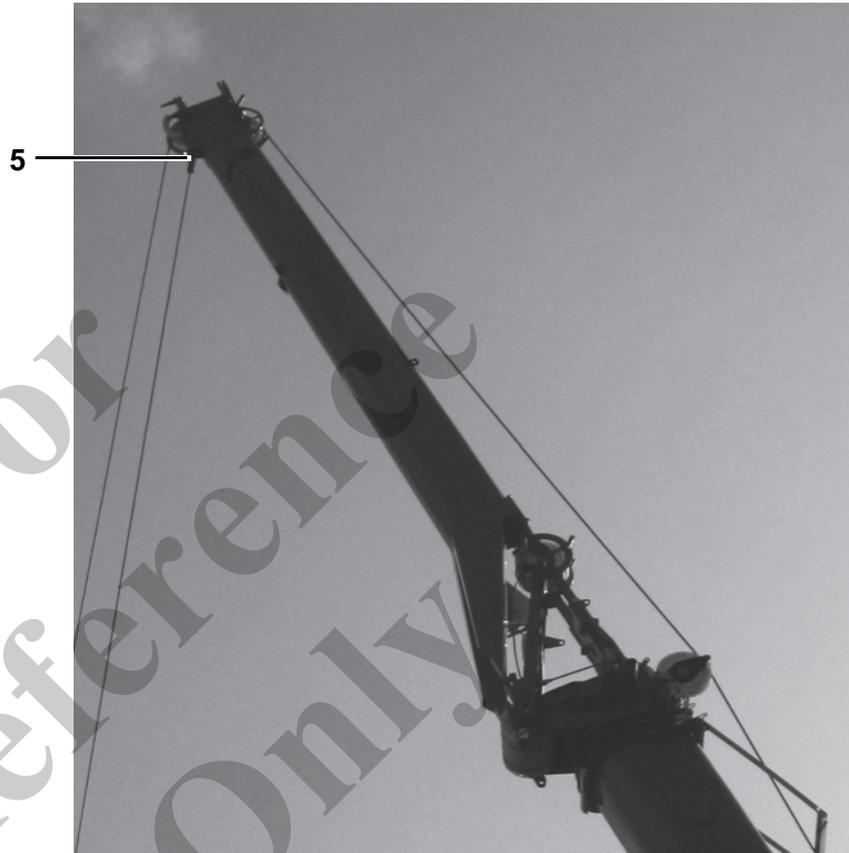


Fig. 78 Fly boom lifting limit switch

Cable connection

After mounting the fly boom, plug in the connection cable of the lifting limit switch for the fly boom on the head of the main boom (see Section 7.14).

LML

If the maximum permissible load moment is reached, the load-increasing functions "Extend telescopic boom", "Lift/lower telescopic boom", and "Lift winch" are disabled. Load-reducing movements such as "telescope boom in" and "winch down" are possible at any time.

**Lowering limit switch /
rope end limiter (E)**

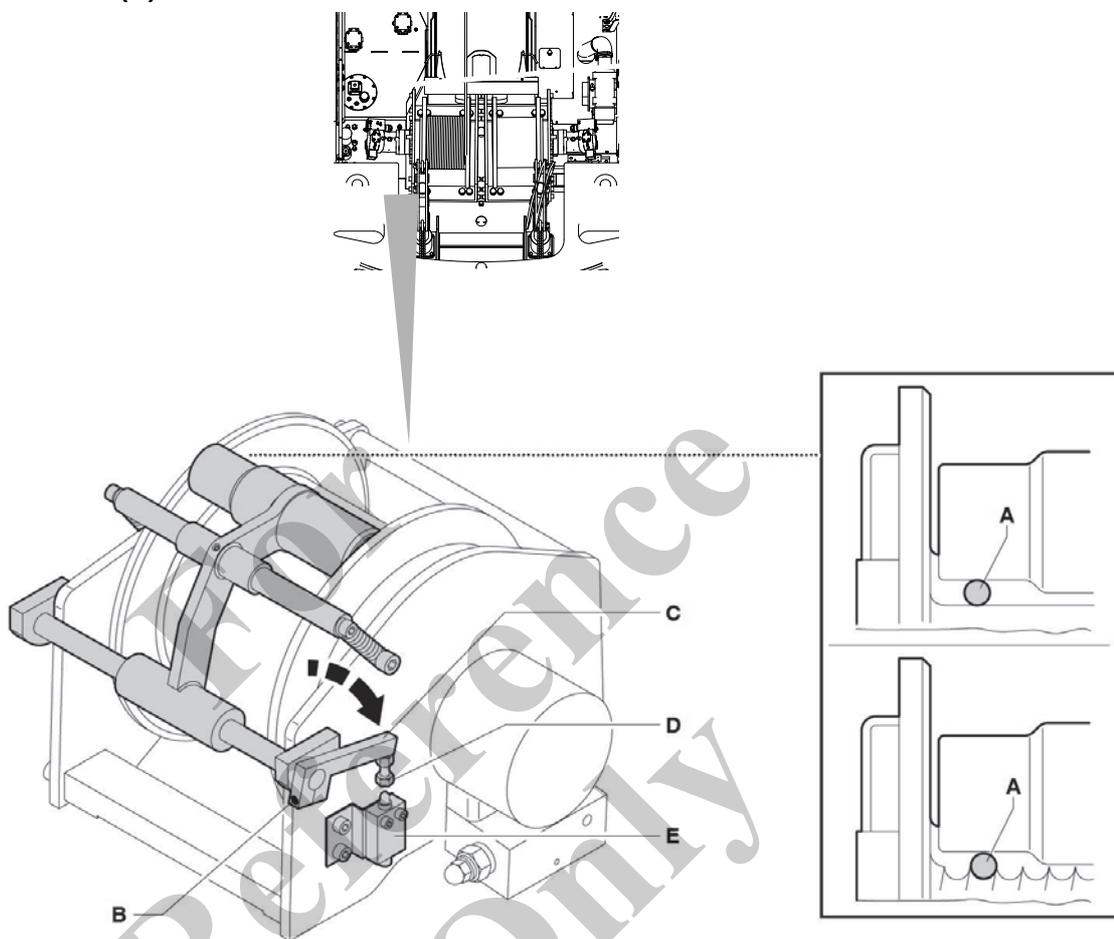


Fig. 79 Lowering limit switch on the winch

The rope end limiter (E) ensures that sufficient rope always remains wound on the winch. If the cable is retracted beyond the set minimum remaining rope length, the "lower winch" function is automatically switched off. The length of rope to be left on the drum is set when reeling in the cable.

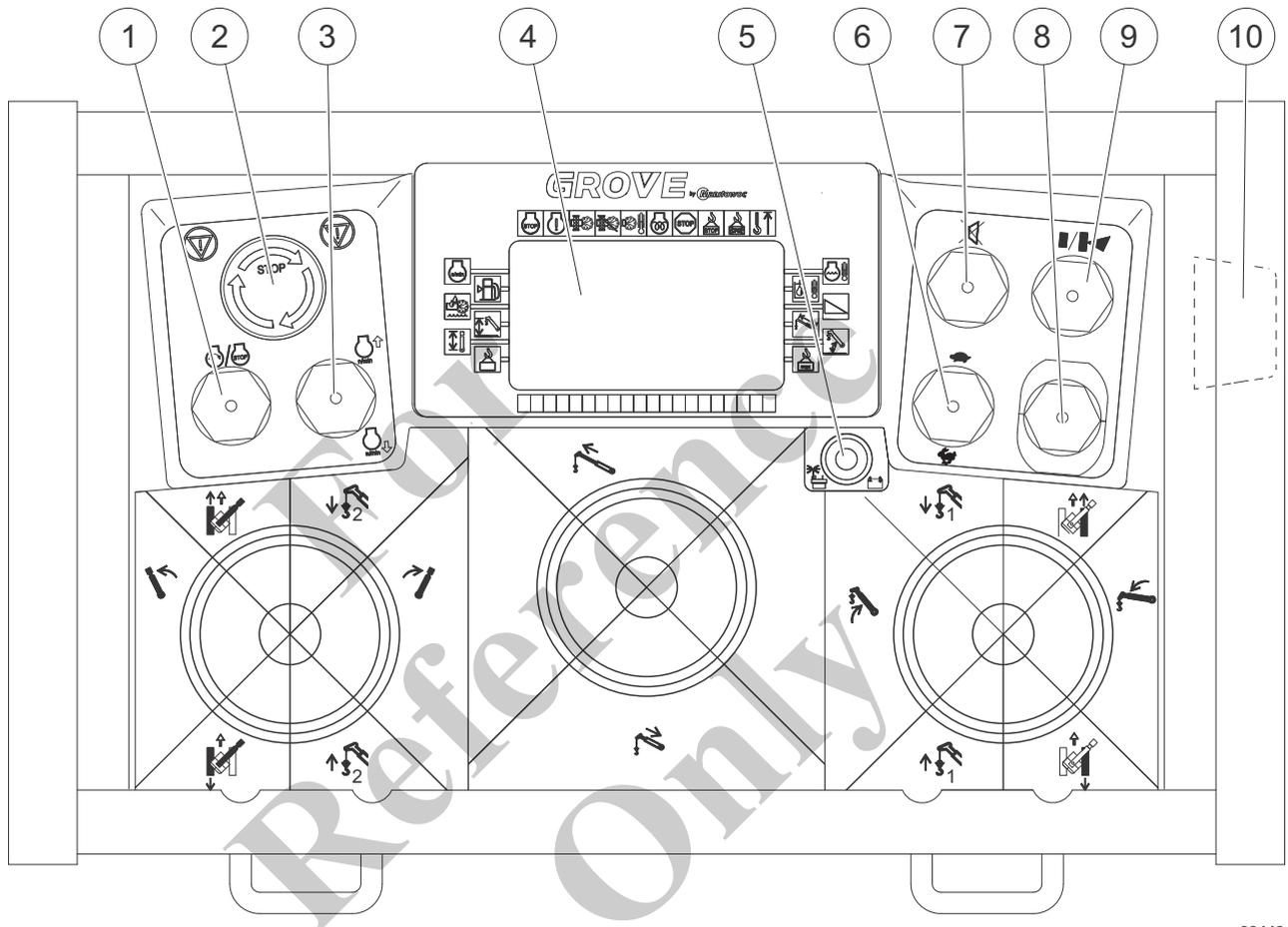
**Adjusting the rope
end limit switch**

Execute the procedure with the rope completely unreeled!

1	Insert a spacer (A) with the same diameter as the rope, under the end of the sheave.
2	Loosen the screw (B).
3	Turn the lever (C) until the screw (D) triggers the switch (E).
4	Tighten the screw (B).

6.11 Special equipment

6.11.1 Remote radio control (option)



00449

Fig. 80 Remote radio controls

1	Diesel engine on/off	6	Crane working speed, slow/fast
2	Emergency STOP	7	LML audible signals on/off
3	Increase/reduce speed	8	Crane mode/drive mode
4	Display	9	Horn/release remote radio control
5	LED operating indicator	10	Remote radio control on/off

1 Diesel engine on/off

This button turns the diesel engine on and off.

2 Emergency STOP

The machine can be immediately taken out of service with the emergency stop switch. The horn (9) has to be sounded in order to restart remote radio control after an emergency stop.

3 Increase/reduce speed

This button adjusts the speed of the diesel engine.

- Pressing the button forward increases speed.
- Pressing the button backward reduces speed.
- Holding the button down for 1 second in either direction sets the maximum speed or idle speed.

4 Display

Displays operating parameters, notification and warning messages.

5 Operating display, LED green

The LED flashes after switching on and the self-test routine is complete. The remote radio control is now ready for use.

6 Crane working speed, slow/fast

This switch preselects the working speed of the crane functions.

- Pressing the switch forward preselects the slow working speed.
- Pressing the switch backward preselects the fast working speed.

7 LML audible signals on/off

The remote radio control emits audible signals from the LML. This button turns off the audible signals.

8 Crane mode/drive mode

The machine can be driven (drive mode) or the winch reeled and unreeled (crane mode) with the left and right joysticks on the remote radio control. This switch switches between crane mode and drive mode. The switch must be pulled out before switching modes. Drive mode functions are in green. Crane mode functions are in blue.

9 Horn/remote start

Sound the horn to release the remote radio control.

Sounding the horn is necessary before starting tasks because the operator could be far away from the machine due to the remote radio control, and may possibly not be aware that other persons are in the danger zone of the machine. The horn will warn persons in the danger

zone. The button has to be pressed before the remote radio control can be activated by the switch (10) in Fig. 80.

10 Remote radio control on/off

To switch on the remote radio control. After switching on, a brief signal tone sounds and a self-test routine is started. After the self-test routine is complete, a second signal sounds, the operating display (5) flashes and the remote radio control is ready for use.



Information

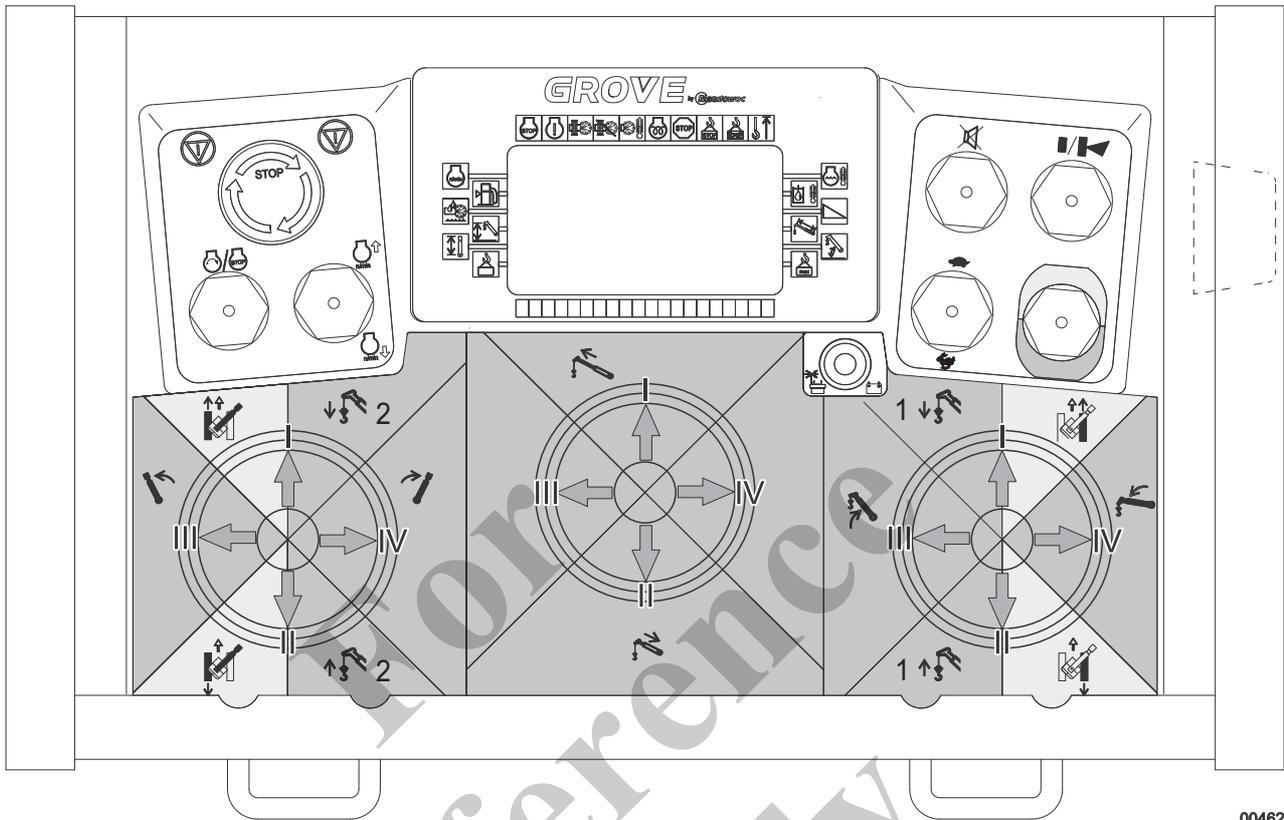
The emergency stop function can be checked on the LED operating display. If the emergency stop is engaged, the LED flashes faster.



Information

An intermittent tone indicates that the battery is low. The remote radio control deactivates after approx. 30 seconds.

For Reference Only



00462

Fig. 81 Joystick assignment of remote radio control

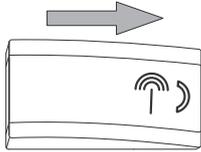
Left joystick		Center joystick		Right joystick	
I	Lower winch 2 Drive left crawler forward	I	Extend boom	I	Lower winch 1 Drive right crawler forward
II	Lift winch 2 Drive left crawler backward	II	Retract boom	II	Lift winch 1 Drive right crawler backward
III	Slew uppercarriage left	III		III	Lift boom
IV	Slew uppercarriage right	IV		IV	Lower boom



Information

The **Luff/Telescope boom** and **Winch 1/Winch 2** switches are not used with the remote radio control.

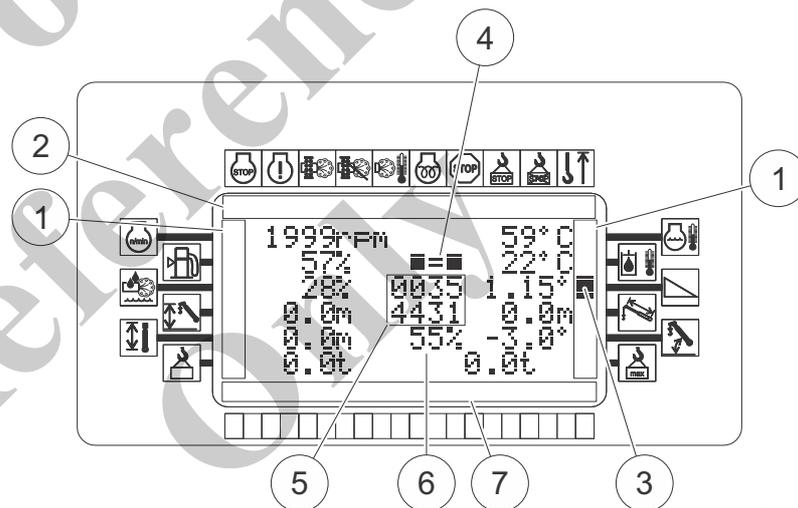
Enabling the remote radio control



1	Switch on the ignition.
2	Press the Radio remote control on/off switch on the top control panel toward the symbol.
3	Exit the cab.
4	Sound the horn on the remote radio control.
5	Start the diesel engine with the Diesel engine on/off switch on the remote radio control.
6	Perform the desired functions using the control lever.

Presentation of machine data on the remote radio control

Once the remote radio control has been started, the following display appears:



00459

Fig. 82 Displaying machine data on the remote radio control

1	Status displays
2	Notification and warning messages
3	Warning indicator
4	Track width monitoring
5	Current operating mode code
6	Actual load capacity
7	Load capacity scale

Status displays

The status displays show operating status values.

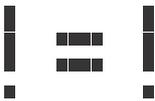
If an operating status value is outside the normal range, a warning indicator (2) in Fig. 82 appears next to it. The warning indicator appears as a rectangle.

The following statuses are possible:

Display	Description
No warning	Operating status is within normal tolerances.
	Half of the field is filled. Operating status is about to exceed normal tolerances. – Take corrective action soon.
	The entire field is filled. Operating status has exceeded normal tolerances. – Park machine immediately. – Take corrective action immediately. – Only operate machine once error has been corrected.

Track width monitoring

Track width monitoring indicates whether or not the track width is permitted for the selected operating mode.

Display	Description
	Track width permitted for the selected operating mode.
	Track width not permitted for the selected operating mode.

Operating statuses

The most frequently required operating status values are shown on the display. The icons indicating the operating statuses are shown on the right and left edges of the screen.

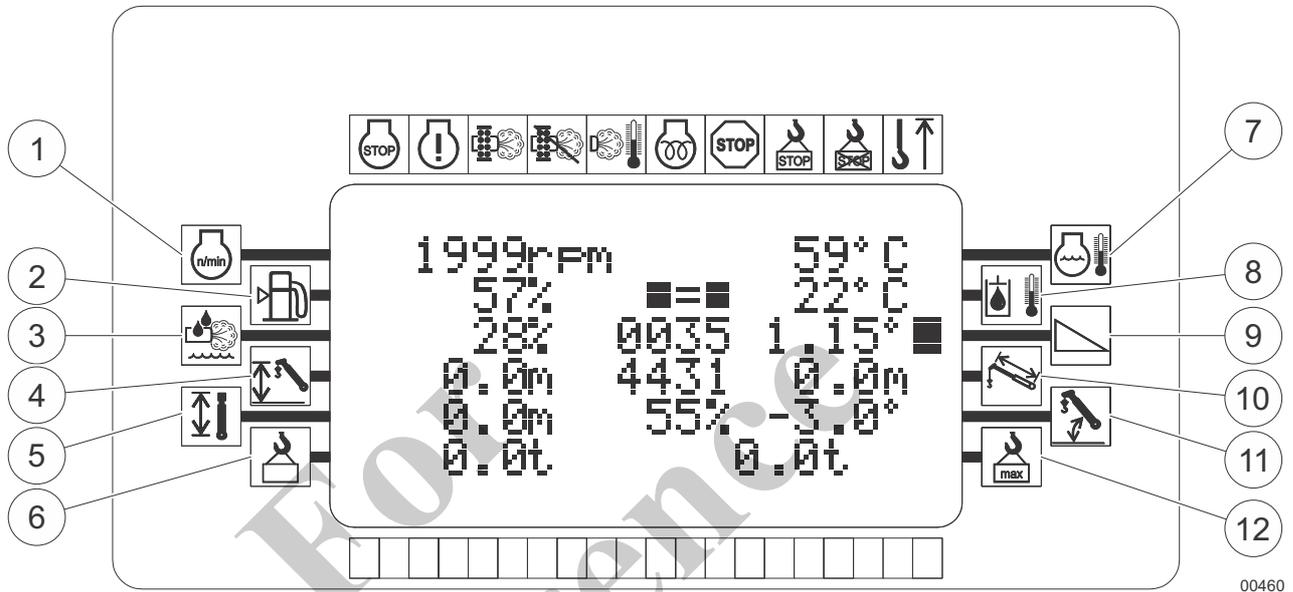


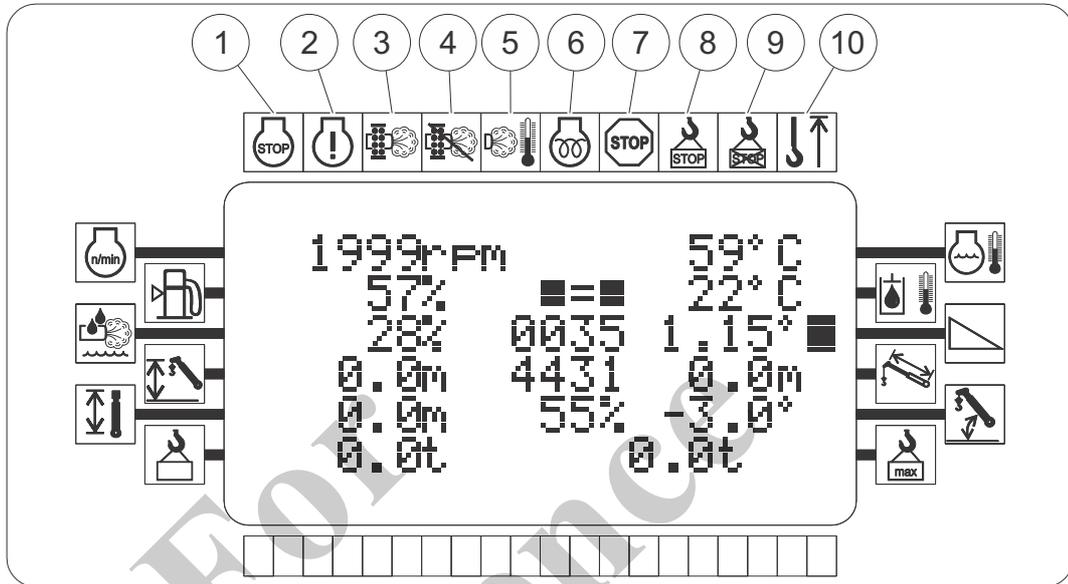
Fig. 83 Displaying operating parameters on the remote radio control

	Name	Statuses
1	Diesel engine speed	
2	Fuel level	No warning: – Fuel level normal Half of the field filled: – Refuel as soon as possible. Entire field filled: – Refuel immediately.
3	DEF [®] level (for Tier 4f engines)	No warning: – DEF level normal. Half of the field filled: – Refill DEF tank as soon as possible. Entire field filled: – Refill DEF tank immediately.
4	Telescopic boom height	
5	Working radius	

	Name	Statuses
6	Actual safe working load	
7	Coolant temperature	<p>No warning:</p> <ul style="list-style-type: none"> - Coolant temperature normal <p>Half of the field filled:</p> <ul style="list-style-type: none"> - Reduce load on diesel engine <p>Entire field filled:</p> <ul style="list-style-type: none"> - Lower attached loads. - Run diesel engine at idle speed
8	Hydraulic oil temperature	<p>No warning:</p> <ul style="list-style-type: none"> - Hydraulic oil temperature normal <p>Half of the field filled:</p> <ul style="list-style-type: none"> - Lower attached loads. - Switch off the diesel engine - Check combination cooler for soiling. - Clean soiled cooler. - Manually reverse fan. <p>Entire field filled:</p> <ul style="list-style-type: none"> - Lower attached loads. - Switch off the diesel engine - Check combination cooler for soiling. - Clean soiled cooler.
9	Machine inclination	<p>No warning:</p> <ul style="list-style-type: none"> - Machine inclination permitted for the selected operating mode. <p>Entire field filled:</p> <ul style="list-style-type: none"> - Machine inclination not permitted for the selected operating mode.
10	Telescopic boom length	
11	Telescopic boom angle	
12	Maximum safe working load	

Notification and warning messages

If machine parameters are outside of normal tolerances, a rectangular warning indicator appears under the appropriate icon.



00461

Fig. 84 Notification and warning messages on the remote radio control

1	Serious diesel engine fault	<p>No warning:</p> <ul style="list-style-type: none"> - Diesel engine functioning properly. <p>Two fields filled:</p> <ul style="list-style-type: none"> - Park machine at safe location immediately. - Contact your Manitowoc Distributor. - Only operate machine once error has been corrected.
2	Diesel engine fault	<p>No warning:</p> <ul style="list-style-type: none"> - Diesel engine functioning properly. <p>Two fields filled:</p> <ul style="list-style-type: none"> - Contact your Manitowoc Distributor.

3	Depletion level of the exhaust aftertreatment system	<p>No warning:</p> <ul style="list-style-type: none"> - Automatic exhaust aftertreatment system cleaning activated. - Depletion level of exhaust aftertreatment system normal. <p>One field filled:</p> <ul style="list-style-type: none"> - Depletion level of exhaust aftertreatment system high. - Manually activate exhaust aftertreatment system cleaning as soon as possible. <p>Two fields filled:</p> <ul style="list-style-type: none"> - Contact your Manitowoc Distributor.
4	Automatic exhaust aftertreatment system cleaning bypassed.	<p>No warning:</p> <ul style="list-style-type: none"> - Automatic exhaust aftertreatment system cleaning active. <p>Two fields filled:</p> <ul style="list-style-type: none"> - Automatic exhaust aftertreatment system cleaning bypassed. - Activate automatic exhaust aftertreatment system cleaning soon.
5	Exhaust temperature	<p>No warning:</p> <ul style="list-style-type: none"> - Exhaust temperature normal. <p>Two fields filled:</p> <ul style="list-style-type: none"> - Exhaust temperature high - Exhaust aftertreatment system regeneration active
6	Preheating	<p>No warning:</p> <ul style="list-style-type: none"> - Diesel engine ready to start. <p>Two fields filled:</p> <ul style="list-style-type: none"> - Diesel engine preheating. - Only turn on the diesel engine once the warning is no longer present.
7	Fault, overall machine	<p>No warning:</p> <ul style="list-style-type: none"> - The machine is operating normally. <p>One field filled:</p> <ul style="list-style-type: none"> - Check fault number in the diagnostics window of the SENCON. - Contact your Manitowoc Distributor. <p>Two fields filled:</p> <ul style="list-style-type: none"> - Check fault number in the diagnostics window of the SENCON. - Contact your Manitowoc Distributor.

8	Safe working load warning	No warning: – Safe working load normal One field filled: – Safe working load about to be exceeded Two fields filled: – Safe working load exceeded.
9	LML bypassed	No warning: – LML active One field filled: – LML bypassed
10	Lifting limit switch	No warning: – Lifting limit switch not tripped. One field filled: – Lifting limit switch tripped.

For Reference Only

6.11.2 Visual warning device

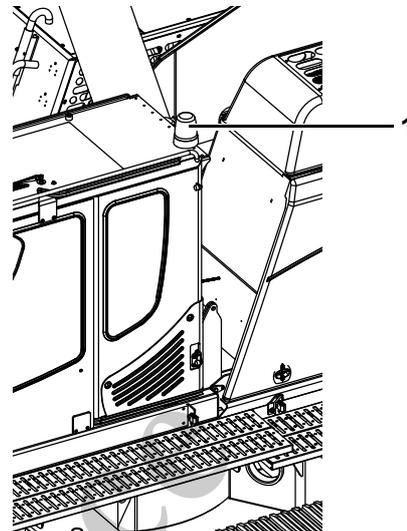


Fig. 85 Location of the beacon

1 | Beacon

For Reference Only

6.12 Work implementation

Safety instructions

- Prior to start up, perform the inspection tasks as specified in Chapter 1 SAFETY.
- Operation and work must only be carried out by trained personnel.
- Ensure that nobody other than the slinger and banksman is in the danger zone.
- Slinger and banksman must have eye contact with each other or must be able to communicate with each other.
- Maintain a safe distance to overhead lines.
- Only operate the machine from the driver seat (except when using the optional Manitowoc remote control).
- Do not use the machine to transport persons.
- Take environmental conditions, for example, poor visibility, wind speeds, etc. into account.
- Use the specific load lift chart for the machine.
- Observe the capacity specifications.
- Check that the safe working load of the attachment points and sling ropes is sufficient.
- Follow the banksman's signals.
- Position the boom in the direction of travel for movement when longer travelling longer distances, hook in and secure the bottom hook block.
- Before leaving the cab:
 - Park the machine on safe ground. If necessary, move the machine back from the edge of the excavation site.
 - Lower attached loads.
 - Secure the working equipment.
 - Pull the safety lever back.
 - Block the running gear.
 - Switch off the engine.
- Lock the cab, if necessary, safeguard it with warning lights.

6.12.1 Crane operation

During crane operation, there is always a connection between the load and the hydraulic system. Once the operating elements are released, the load remains at the current position.

Safety notice

- Only work in crane operation with the LML switched on.
- Select the operating mode corresponding to the operating status in the LML menu of the SENCON.
- Read the Section 3.5 PERMISSIBLE WIND SPEEDS

For
Reference
Only

6.12.2 Securing bottom hook block for drive mode

NOTICE

Risk of damage to the machine due to bottom hook block swinging while driving.

If the bottom hook block begins swinging while driving, machine components may be damaged.

➤ Secure the bottom hook block.

NOTICE

Risk of damage to machine due to too much tension in hoist rope.

If the hoist rope tension is too high when securing the bottom hook block, machine components may be damaged.

➤ Slowly and carefully tension the hoist rope.

Securing the bottom hook block

1	Raise the boom as high as possible.
2	Apply the slewing gear holding brake.
3	Unreel Winch 1 until the bottom hook block is hanging next to the cab.
4	Attach the included lifting tackle (1) in Fig. 86 to the lifting eyelets on the uppercarriage (2) and to the bottom hook block.
5	Slowly and carefully reel Winch 1. Slightly tension the hoist rope.
6	Move the boom to between 30° and 60°.
7	If necessary, slowly and carefully reel Winch 1 to increase tension on the hoist rope.

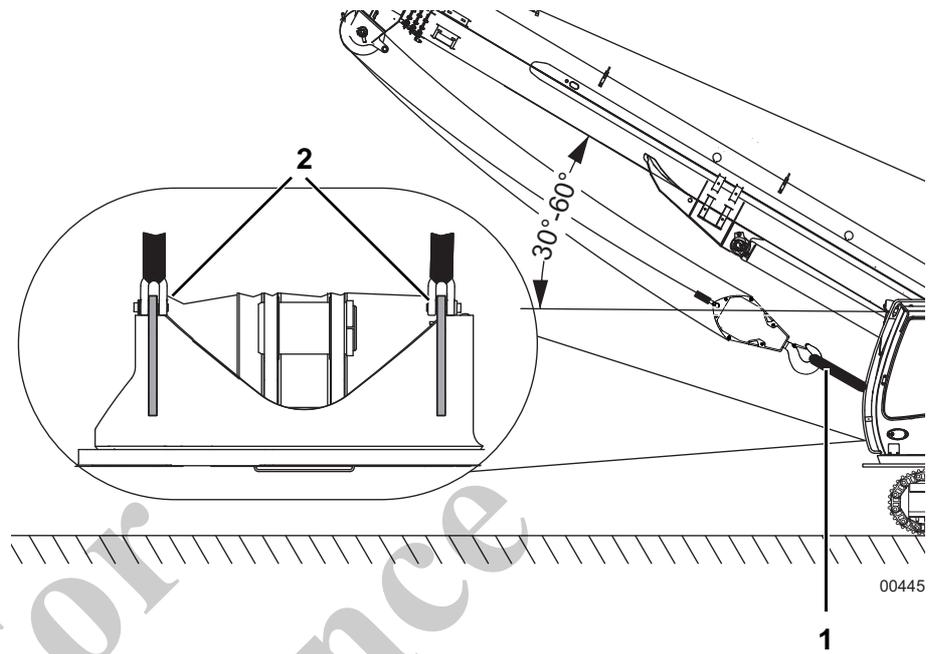
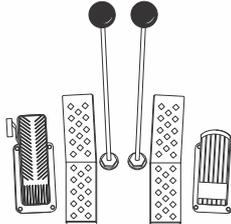
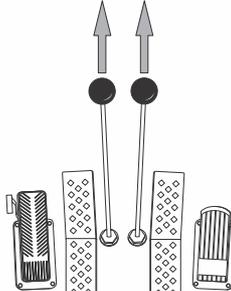
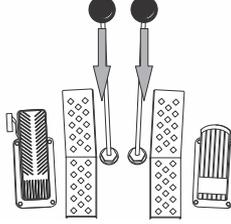
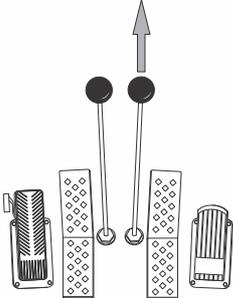
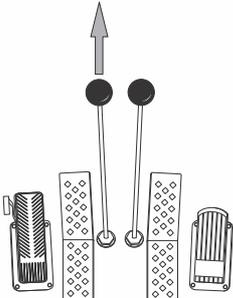
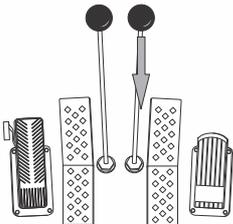
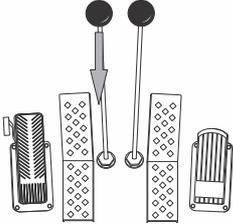


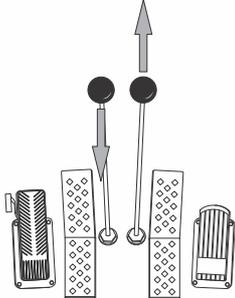
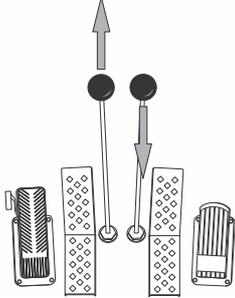
Fig. 86 Securing the bottom hook block from swinging

For Reference Only

6.12.3 Moving the machine

Machine motion	Activity	Position of hand levers
Stop the machine.	<ul style="list-style-type: none"> ● Release both hand levers. 	
Travel forward in a straight line.	<ul style="list-style-type: none"> ● Push both levers forward. 	
Travel in reverse in a straight line.	<ul style="list-style-type: none"> ● Pull both hand levers back. 	

Machine motion	Activity	Position of hand levers
Travel forward to the left.	<ul style="list-style-type: none"> ● Release the left hand lever. ● Push the right hand lever forward. 	
Travel forward to the right.	<ul style="list-style-type: none"> ● Push the left hand lever forward. ● Release the right hand lever. 	
Travel in reverse to the left.	<ul style="list-style-type: none"> ● Release the left hand lever. ● Pull the right hand lever back. 	
Travel in reverse to the right.	<ul style="list-style-type: none"> ● Pull the left hand lever back. ● Release the right hand lever. 	

Machine motion	Activity	Position of hand levers
Slew left at standstill.	<ul style="list-style-type: none"> ● Pull the left hand lever back. ● Push the right hand lever forward. 	
Slew right at standstill.	<ul style="list-style-type: none"> ● Push the left hand lever forward. ● Pull the right hand lever back. 	

For Reference Only

6.12.4 Travel with suspended load

Safety instructions

- Secure the load against swinging.
- Keep the load as close to the ground as possible.
- Pay attention to the permitted wind speeds.
- Turn the boom in the direction of travel.
- Apply the slewing gear holding brake.
- Take corners as widely as possible.
- Do not move the crane while driving.
- Drive in the lowest gear and do not exceed 0.4 m/s.

Driving on even ground

The machine may be driven at 100% permitted load capacity under the following conditions:

- At speeds of up to 0.1 m/s. At speeds exceeding 0.1 m/s, the machine may only be driven at up to 90% of the permitted load capacity. At least 1 t must be subtracted from the permitted load capacity.
- The travel route must not exceed the allowable incline of 0.3° (in the travel direction and laterally).
- The travel route must be smooth and stable, this means that movement over crests and bumps is prohibited and the occurring ground pressure must be observed.

Restrictions when traveling on a slopes and inclined ground

- If the ground is inclined, the corresponding load lift charts must be taken into account.

Incline	up to 2°	up to 4°	up to 6°	> 6°
maximum boom length	28.0 m	18.9 m	18.9 m	Moving with load is not permitted
Load capacity	100%	100%	25%	
Reeving	The same as for 100% load capacity			

6.12.5 Moving on inclines and ramps

The machine can move on inclines and ramps up to 20° (36%).

Prerequisites

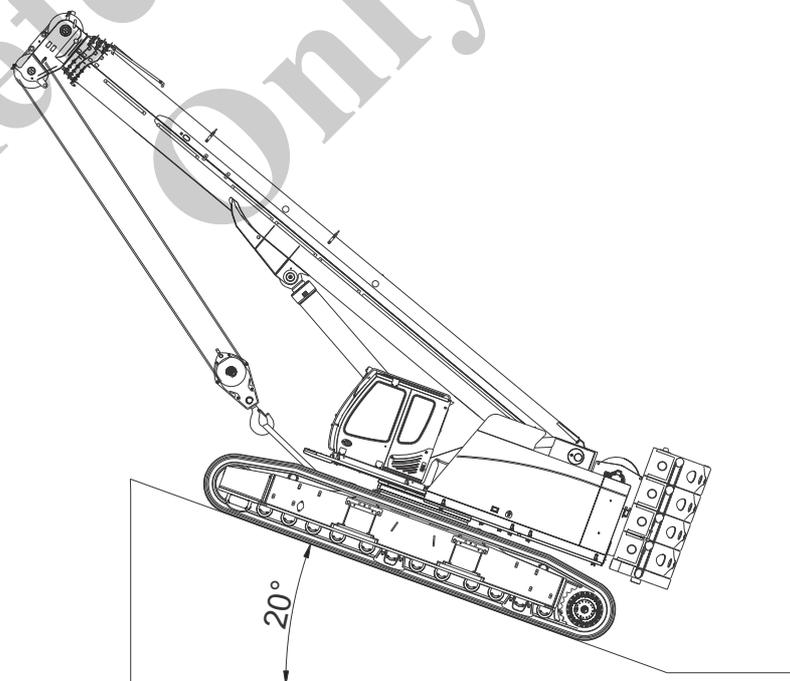
- Set boom angle to 20°.
- Place the uppercarriage in the direction of travel (sprocket back, see illustration).
- Secure the hook on the undercarriage to prevent it from swinging (see illustration).
- The machine can move on inclines with and without the counterweight attached.
- Check the counterweight for secure attachment.
- The machine can move on inclines and ramps with the undercarriage extended and retracted.

WARNING

Danger of tipping!

Severe personal injury and material damage may occur. Slewing the uppercarriage when moving on inclines and ramps may cause the machine to tip.

➤ Do not slew!



Moving on inclines

6.12.6 Slewing the uppercarriage

DANGER

Danger to life due to moving parts in the work area of the machine!

Persons in the work area of the machine will be caught and injured by moving machine parts.

- Ensure that no one is in the work area while the machine is in operation.
- Give warning signals if persons are in danger.
- Stop all work immediately if unauthorized persons are in the danger zone.

NOTICE

Risk of damage to machine when slewing and stopping the uppercarriage suddenly.

Slewing or stopping the uppercarriage suddenly places severe mechanical stress on the machine, which can result in damage.

- Stop uppercarriage slewing slowly.
- Begin uppercarriage slewing from a standstill slowly.
- Slew the uppercarriage gradually.

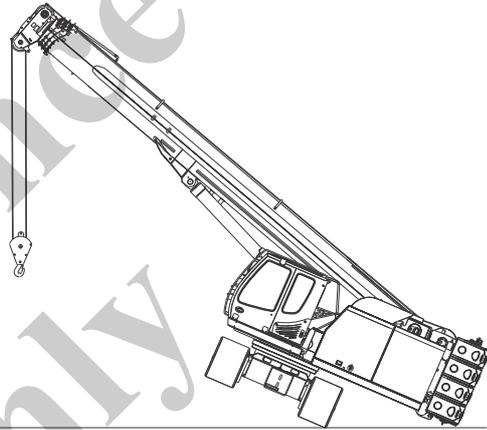
For Reference Only

WARNING**Danger to life due to the machine tipping!**

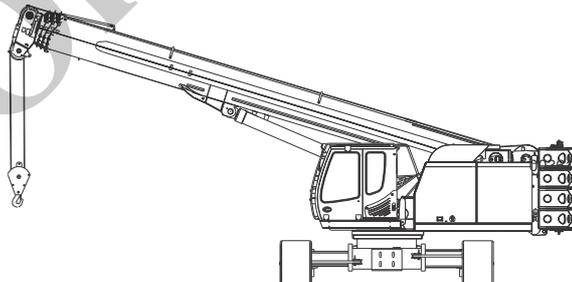
The machine may tip if slewed with the maximum counterweight attached to the uppercarriage and the undercarriage fully telescoped in. This can cause severe or fatal injury.

- Never telescope the undercarriage fully during work operation or when performing maintenance or setup work.
- Before telescoping, place the uppercarriage parallel to the undercarriage, in the direction of travel, and secure it.
- Do not slew the uppercarriage during the telescoping procedure.

Incorrect:



Correct:



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Fig. 87 Risk of tipping due to retracted undercarriage

Slewing speed



The slewing speed depends on the following parameters:

- Diesel engine speed
- Deflection of the left-hand joystick

The slewing speed of the uppercarriage can be reduced on the SENCON for more precise movement. The **Uppercarriage slewing speed** setting is located in the top quick selection bar.

Reduced slewing speed must be used when the fly boom is attached.

Settings

-  Reduced slewing speed.
-  Normal slewing speed.

Slewing gear holding brake



When the green **Slewing gear holding brake engaged** symbol is displayed on the SENCON, the slewing gear holding brake is active.

The slewing gear holding brake activates once the ignition is turned on or the safety lever is pulled. When the slewing gear holding brake is applied, the uppercarriage cannot be slewed.

Pulling the safety lever when the uppercarriage is slewing engages the slewing gear holding brake and stops the uppercarriage instantly. Only use the safety lever in an emergency to stop the uppercarriage.

Disengaging the slewing gear holding brake

- 1 Press the button (1) in Fig. 88 on the left joystick.
 - This disengages the slewing gear holding brake.

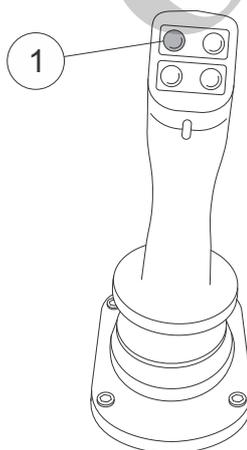


Fig. 88 Disengaging the slewing gear holding brake

Slewing gear holding brake statuses

The status of the slewing gear holding brake is shown on the SENCON. The status of the freewheel can be as follows:

Symbol	Possible statuses	Explanation
		Slewing gear holding brake applied.
		Slewing gear holding brake not applied.

Uppercarriage slewing with freewheel

Releasing the joystick to the center position when the slewing gear freewheel is engaged and the uppercarriage is slewing allows the uppercarriage to continue slewing without losing speed.

The slewing gear freewheel protects the slewing gear from excessive strain. T

When the slewing gear freewheel is engaged, the slewing gear service brake remains disengaged.

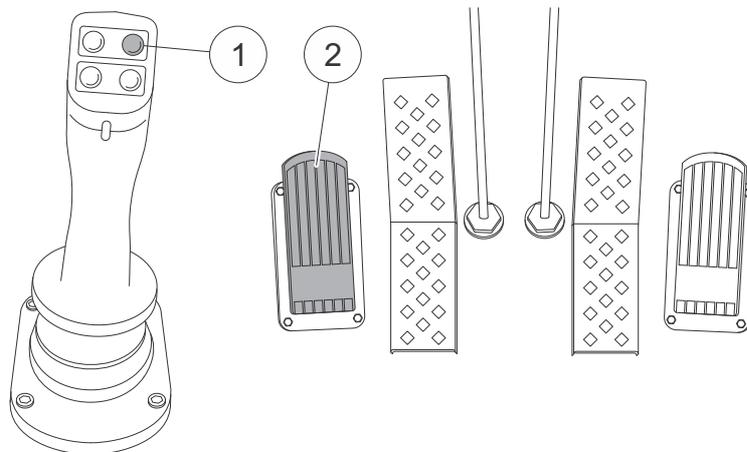
When the slewing gear freewheel is engaged, uppercarriage slewing can be stopped with the slewing brake pedal or by moving the left joystick in the opposite direction.

If an uppercarriage inclination of more than 0.3° is set in the **Load moment limitation** window, the slewing gear freewheel cannot be engaged.

The slewing gear freewheel is not suitable for work where space is limited.



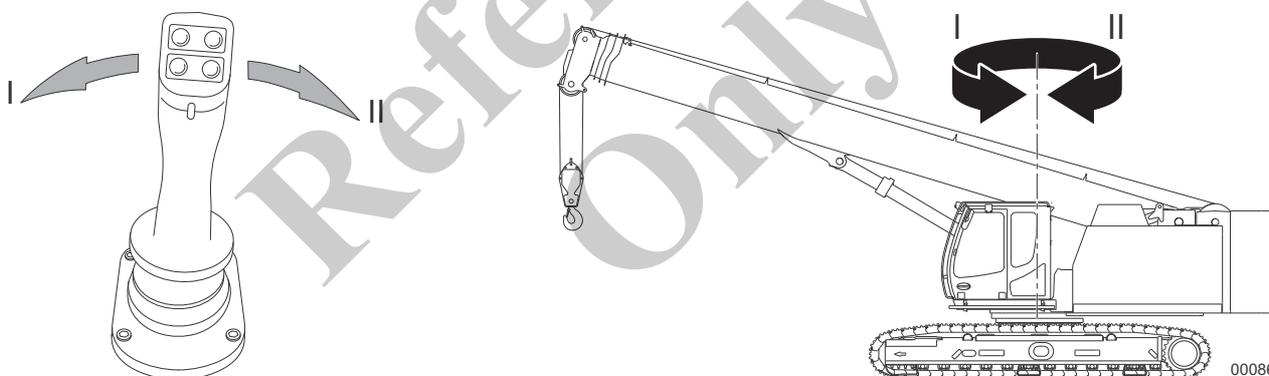
1	Start the diesel engine.
2	Disengage the slewing gear holding brake.
3	Step on the slewing gear brake pedal (2) in Fig. 89 and press the button (1) in Fig. 89 on the left joystick. <ul style="list-style-type: none"> – This engages the slewing gear freewheel. The green Slewing gear freewheel engaged symbol appears on the SENCON.



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Fig. 89 Activating slewing gear freewheeling

- | | |
|---|---|
| 4 | Push the left joystick to the left.
– The uppercarriage is slewed to the left. |
| 5 | Push the left joystick to the right.
– The uppercarriage is slewed to the right. |



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Fig. 90 Slewing the uppercarriage



- | | |
|---|--|
| 6 | To stop slewing, move the left joystick in the opposite direction or step on the slewing gear brake pedal. |
| 7 | Press the button (1) in Fig. 89.
– This disengages the slewing gear freewheel. The green Slewing gear freewheel disengaged symbol appears on the SENCON. |

Slewing gear freewheel statuses

The status of the slewing gear freewheel appears on the SENCON. The status of the freewheel can be as follows:

Symbol	Possible statuses	Explanation
		Slewing gear freewheel disengaged.
		Slewing gear freewheel engaged.
		Slewing gear freewheel not available. If an uppercarriage inclination of more than 0.3° is set in the Load moment limitation window, the slewing gear freewheel cannot be engaged.

Stopping slewing without freewheel

Slewing can be slowed down and stopped in the following ways:

- Releasing the joystick to the center position.
- Stepping on the slewing gear brake pedal.



Information

Gently moving the left joystick in the opposite direction increases braking.

Slewing gear service brake

The slewing gear service brake is applied by the foot pedal. Only activate the foot pedal if the joystick is in neutral position.

Stepping on the foot pedal deliberately stops uppercarriage slewing.

Moving the left joystick to the right or left automatically disengages the slewing gear service brake.

The slewing gear service brake is automatically applied when:

- The uppercarriage is stationary and the slewing gear freewheel is not engaged.
- The safety lever is pulled back.
- The diesel engine is off.

6.12.7 Lifting and lowering loads



Danger to life due to suspended loads!

Persons on or next to the machine will be injured due to uncontrolled load movements.

- Always lower the load when work is interrupted.
- Never leave the operator cab when a load is suspended.

Safety notice

- Use approved sling gear that is suitable for the load and the application.
- Check sling gear before each use.
- Check the cable exit protection before each use.
- Subtract the weight of the sling gear from the maximum safe working load.
- Observe the permissible wind speeds. See Section 3.5 PERMISSIBLE WIND SPEEDS
- Ensure that the LML settings are correct.
- Ensure that the rope does not have slack.
- At low temperatures under 0°C (32°F) run the hoisting gear slowly to ensure that the stiff rope coils properly.

Lifting and lowering the bottom hook block

The load on winch 1 is lifted/lowered using the right joystick.
 The load on winch 2 is lifted/lowered using the left joystick.

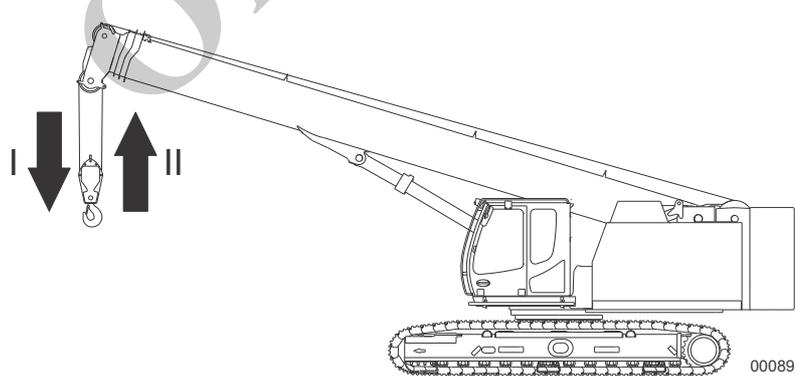
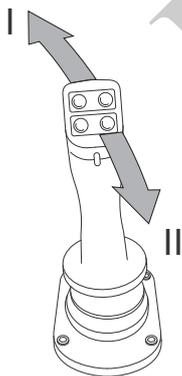


Fig. 91 Lifting and lowering the bottom hook block

1	Push the right joystick forward. – The bottom hook block will be lowered.
2	Pull the right joystick back. – The bottom hook block will be lifted.

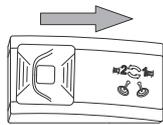
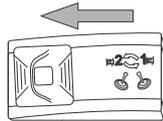


Information

The lift speed depends on the:

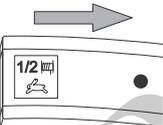
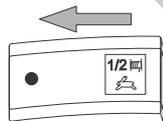
- Speed of the drive engine
- Deflection of the right joystick

Switching joystick assignment for winch control



1	Press the Winch 1/Winch 2 switch to the left. <ul style="list-style-type: none"> – Winch 2 is operated with the left joystick. – Winch 1 is operated with the right joystick.
2	Press the Winch 1/Winch 2 switch to the right. <ul style="list-style-type: none"> – Winch 1 is operated with the left joystick. – Winch 2 is operated with the right joystick.

Turning fast winch on and off



1	Press the Winch 1/Winch 2 fast switch to the left. <ul style="list-style-type: none"> – The winches are operated with reduced maximum speed.
2	Press the Winch 1/Winch 2 fast switch to the right. <ul style="list-style-type: none"> – The winches are operated at maximum speed.

Reference Only

6.12.8 Hook operation with both winches

WARNING

Danger to life!

Danger to life if the permissible safe working loads and LML programs are not observed. Severe material damage and personal injury extending to loss of life are possible.

- Only lift loads weighing less than/or equal to the permissible safe working load of the auxiliary jib or the fly boom in the appropriate working radius (auxiliary-boom safe working load 100% of the load!).
- Always select the appropriate LML program (auxiliary jib or *fly boom*)!
- When slewing parts only a load moment reduction is permitted! This means that the load's center of gravity must move towards the crane (fig. A / fig. B). Any other use is considered non-intended use and is prohibited. For examples see fig. C / fig. D.

Safety notice If the machine is operated with two winches, the fly boom can be folded to a maximum angle of 20°.

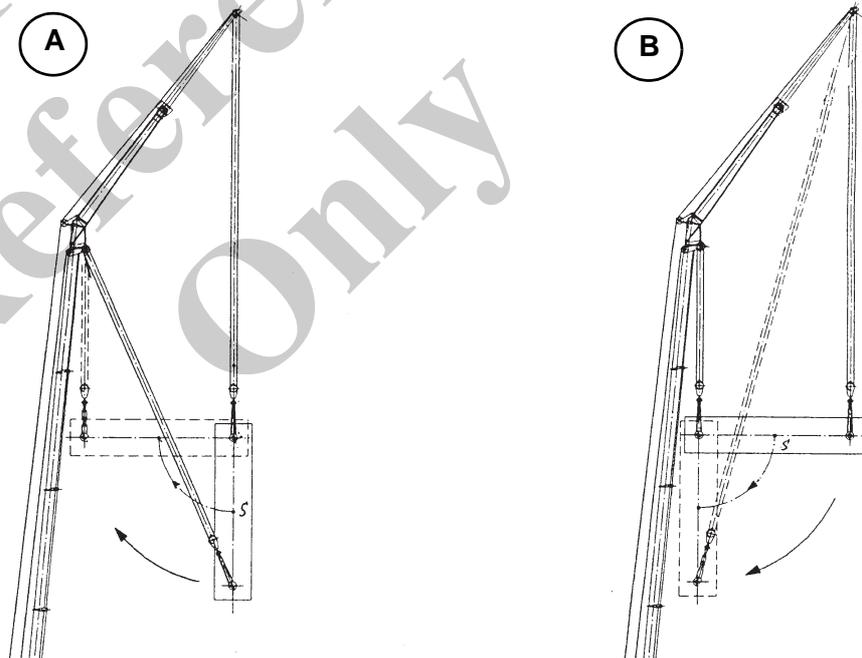


Fig. 92 Operating the hook properly with two winches

Fig. A Lift the load on the auxiliary jib or fly boom.
 The hoisting rope on the main boom remains unloaded at first but the rope must not become slack. Then lift the load via the main boom until the load is horizontal. This will lower the load moment and ensure safety. Then lower the load uniformly using the two hoisting winches.

Fig. B Lift the load horizontally using the two winches (auxiliary boom safe working load 100% of the load).
 Then slacken the lifting rope of the auxiliary jib or fly boom until the load is suspended vertically. Lower the load via the main boom and pay-out the lifting rope of the auxiliary jib or fly boom. Ensure that the rope does not have slack. Safety is ensured because the load center of gravity shifts towards the crane.

Prohibited procedures



Danger of tipping!
 Danger to Life danger when overloading the boom system! Severe material damage and personal injury extending to loss of life are possible.
 >If you proceed In accordance with fig. C / fig D, the load will slew outward and the load torque will increase. This work method can cause the machine to tip or the boom system to become overloaded and is therefore strictly prohibited!

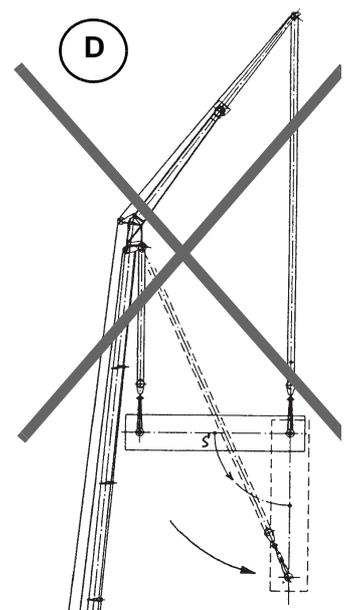
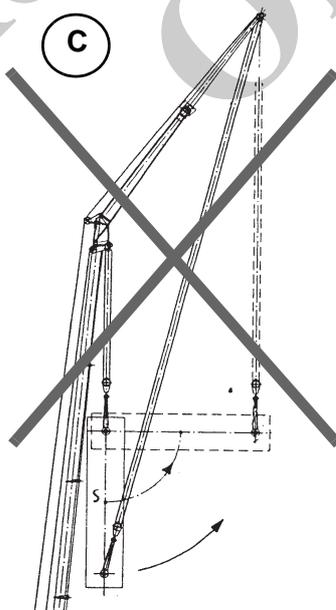


Fig. C The load is suspended on the main boom. Lift the load using the auxiliary jib or the fly boom. The load moment will increase. The machine can tip or the boom system can be overloaded.

Fig. D The load is suspended from both the main boom and the auxiliary jib. When the hoisting rope on the main boom is slackened, the load moment increases. The machine can tip or the boom system can be overloaded.

6.12.9 Adjusting the boom (luffing)

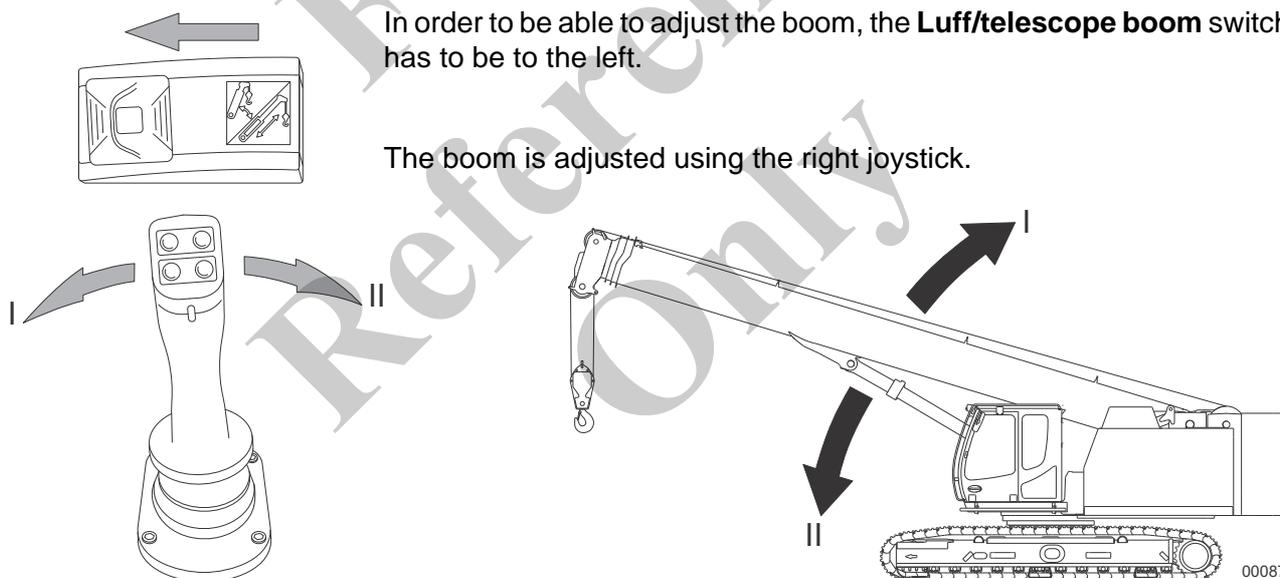


WARNING

Danger of injury and danger of machine damage due abrupt luffing of the boom!

Abrupt luffing movements can result in component failure or cause the machine to tip.

➤Execute luffing movements slowly and in a controlled manner.



In order to be able to adjust the boom, the **Luff/telescope boom** switch has to be to the left.

The boom is adjusted using the right joystick.

Fig. 93 Movement directions of the right joystick for adjusting the boom

I	Lift boom
II	Lower boom

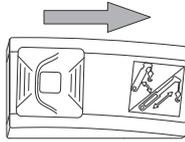
Luffing speed

The luffing speed is dependent on the:

- Speed of the drive engine
- Deflection of the right joystick.

6.12.10 Extending/retracting the boom

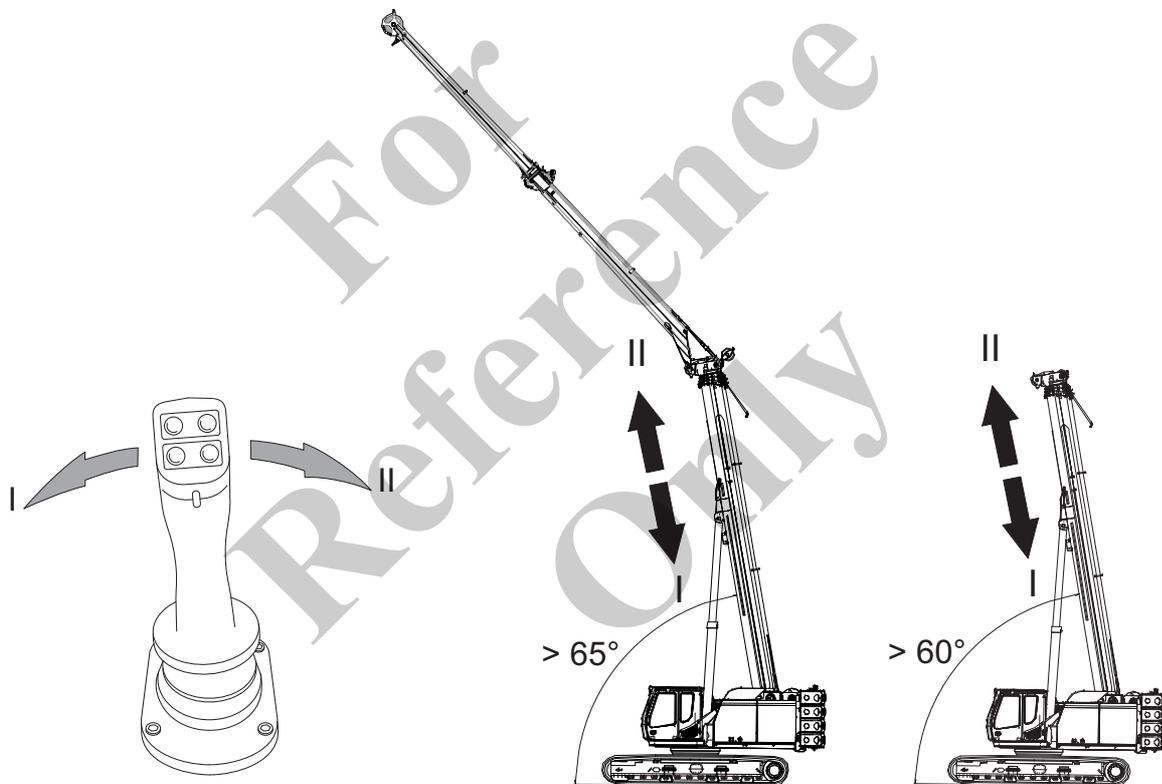
The boom is extended and retracted using the left control lever.



In order to be able to extend or retract the boom, the **Luff/telescope boom** switch has to be to the right.

Manitowoc recommends the following boom angle when extending or retracting the telescopic boom:

- > 60° when operating with the main boom, the main boom with auxiliary jib and the main boom with heavy-duty jib
- > 65° when operating with the main boom with lattice boom extensions and/or fly boom



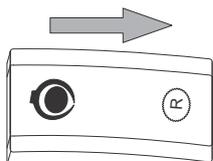
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Fig. 94 Movement directions of the lift joystick for extending and retracting the boom

I	Retract boom
II	Extend boom

6.12.11 Turning on the supplemental hydraulic system (option)

The supplemental hydraulic system is used to operate hydraulic tools such as chain saws, hydraulic runners or clamping tongs.



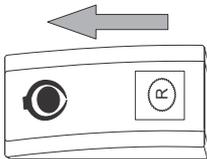
1	Attach the tool to the quick-change couplings at the boom head.
2	Press the Preselect clamping tongs/supplemental hydraulic system switch to the Supplemental hydraulic system position. – The supplemental hydraulic system is activated.
3	Exit the cab.
4	Push the safety lever forward.

Switching off the supplemental hydraulic system

Push the switch **Changeover Clamping tongs/Supplemental hydraulic system** to the center position to switch off the supplemental hydraulic system.

Reference Only

6.12.12 Operating the clamping tongs (option)



1	Telescope the undercarriage fully outward.
2	Attach the maximum counterweight.
3	Enter the cab.
4	Start the diesel engine and push the safety lever forward.
5	At the SENCON, select operating mode Maximum track width and Maximum counterweight .
6	Raise the boom higher than 25 °.
7	Press the Preselect Clamping tongs/Supplemental hydraulic system switch to the Clamping tongs position.
8	Press the button (1) in Fig. 95 on the left joystick. – The clamping tongs open.
9	Press the button (2) in on the left joystick. – The clamping tongs close.
10	Press the button (3) in Fig. 95 on the right joystick. – The clamping tongs are lowered.
11	Press the button (4) in Fig. 95 on the right joystick. – The clamping tongs are raised.

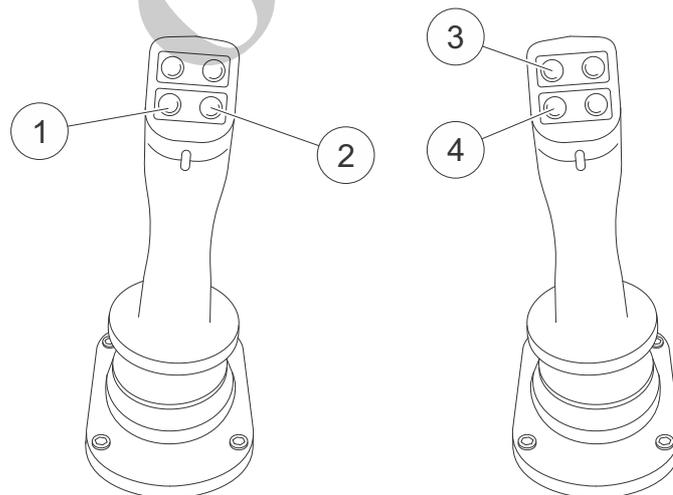


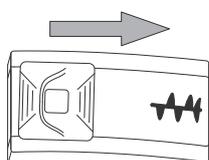
Fig. 95 Control elements for clamping tongs

Turning the clamping tongs off

To turn the clamping tongs off, press the **Preselect clamping tongs/supplemental hydraulic system** switch to the center position.

6.12.13 Operating the soil drill (option)

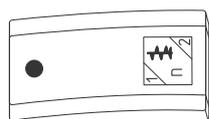
1	Telescope the undercarriage fully outward.
2	Attach the maximum counterweight.
3	Enter the cab.
4	Start the diesel engine and push the safety lever forward.
5	Select Setup operating mode on the SENCON.
6	Slew the soil drill into working position.
7	Release the switch Soil drill on and push it toward the symbol.



8	Push the left joystick forward. – The soil drill turns in drilling direction
9	Pull the left joystick back. – The soil drill turns against drilling direction.



Fig. 96 Operating the soil drill



The **Drill speed, slow/fast** switch has two switching Positions:

- Forward: Slow drill speed, high torque
- Rear: Fast drill speed, low torque

6.12.14 Refuel the machine

The machine can be refueled in two ways:

- Manually
- Using a refueling pump (option)

WARNING

Danger of health impairment and environmental damage due to escaping fuel!

Serious health impairments occur if there is contact with the body. Serious environmental damage occurs if fuel spills into the soil or bodies of water.

- Smoking or handling open flame are strictly forbidden.
- Position the machine only on a firm and level ground.
- Only top up when the engine is shut down.
- Determine the tank level prior to refueling.
- Always ensure that no fuel overflows when refueling.
- When refueling from a tanker, ensure that the maximum filling rate of 120 l/min. (32 US gpm) is not exceeded.
- Supervise the refueling process without interruption.



Information

Also observe the instructions for the fuel system in the engine manufacturer's operating manual.

Manually

1	Place attached loads on the ground and completely lower the boom.
2	Switch off the diesel engine.
3	Use the walkway on the right side of the machine to climb up to the diesel filler neck.
4	Open the cover (1) in Fig. 97 of the filler neck.
5	Clean the wide-mesh screen (2) in Fig. 97.
6	Insert a funnel into the fuel filler neck.
7	Carefully pour the fuel in through the funnel.
8	Close the cover.

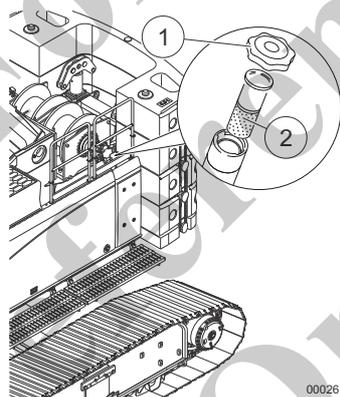


Fig. 97 Cover and wide-mesh screen of the filler neck

Using a refueling pump (option)



Information

When refueling, ensure that the maximum suction head of 3 m is not exceeded.

1	Place attached loads on the ground and completely lower the boom.
2	Switch off the diesel engine.
3	Turn the ignition key to position P .
4	Open the left service door.
5	Open cover (2) of filler strainer. This will allow air to escape from the fuel tank.

NOTICE

The fuel tank can be deformed and damaged due to overpressure when refueling! Always open the filler neck cover before refueling.

For Reference Only

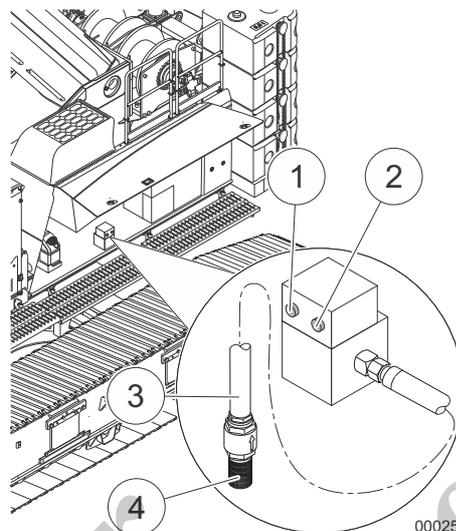


Fig. 98 Cover and wide-mesh screen of the filler neck

- | | |
|---|---|
| 6 | Remove the fueling hose (3) in Fig. 98 from the bracket. |
| 7 | Check the intake filter (4) in Fig. 98 for contamination and damage, clean or replace as needed. |
| 8 | Attach the fueling hose (3) in Fig. 98 to the suction connection on the fuel pump and insert it into external fuel tank. |
| 9 | Press the green button (1) in Fig. 98. <ul style="list-style-type: none"> – The tank is filled. The refueling pump switches off automatically when the tank is full. |

NOTICE

NOTICE! Machine damage due to a longer period of dry running! Ensure that the pump does not run dry for more than 30 s. If the pump runs dry, switch off the refueling pump at the red button (2).



Information

Pressing the red button (2) in Fig. 98 interrupts the refueling process.

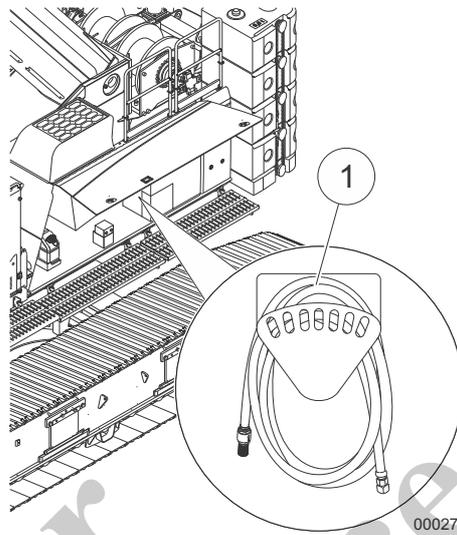


Fig. 99 Position of the fueling hose on the uppercarriage

10	Remove the fueling hose (1) in Fig. 99 and stow it securely.
11	Close the filler neck cover.
12	Close the service door.

Check the following points if the refueling pump does not start after approximately 5 seconds:

1	Is the battery charged?
2	Are all fuses in order?
3	Is the suction side free of leaks?
4	Is the maximum suction height 3 m or less?

6.12.15 Checking the DEF level and refilling (Tier 4f engines)

NOTICE

Risk of machine damage from contact with DEF.

Machine parts, especially hoses and cables, can be damaged beyond repair by DEF.

- Do not pour DEF on hoses or cables.
- Immediately remove any DEF that has been poured on these parts.
- Have damaged hoses or cables replaced before starting up the machine.

**DEF level
SENCON parameter
field**

The fill level of the DEF tank is monitored by the SENCON. The following symbol indicates the DEF level on the SENCON:



If the symbol is highlighted in orange or red, the DEF level is low. Fill up the DEF tank as soon as possible.



Information

DEF can be added at ambient temperatures down to -11 °C.

Capacity:

DEF tank | approx. 45 l/11.89 US gal

Refilling DEF

1	Park the machine on secure, even ground.
2	Raise the telescopic boom slightly so the front right service door can be completely opened.
3	Check the DEF level on the SENCON.
4	Switch off the diesel engine.
5	Exit the cab.
6	Open the left service door.

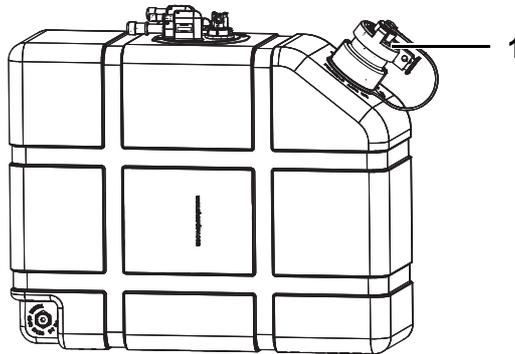


Fig. 100 DEF tank

7	Check the DEF tank for contamination. Clean as needed.
8	Carefully open the sealing cover (1) in Fig. 100 of the DEF tank.
9	Refill the DEF tank with the DEF filling unit. Supervise the refueling process without interruption.
10	Close the sealing cover.
11	Close the front right service door.

For
Reference
Only

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7 Setup tasks

Safety during setup

- Use personal protective equipment in accordance with applicable accident prevention regulations.
- When disassembling components or equipment, always use load suspension equipment with a sufficient load bearing capacity at the attachment points.
- Make sure no one is under suspended loads when performing setup tasks.
- Observe applicable accident prevention regulations when working with load suspension equipment.
- Carry out all setup tasks in sequence.
- Do not climb on equipment parts or the crane.
- Keep the necessary load suspension gear, wooden planks and tools at hand.

For Reference Only

7.1 Setup operating mode

Operating modes are configured on the SENCON.

The operating mode **Setup 1** is used for the following setup tasks:

- Setting up the traveling gear (on outrigger cylinders)

The operating mode **Setup 2** is used for the following setup and maintenance tasks:

- Reeving
- Stacking the counterweight (support bracket and ballast blocks)
- Setting up the auxiliary jib
- Setting up the heavy-duty jib
- Setting up the fly boom (SA8/SA15)
- Setting up the elevating work platform
- Setting up lattice boom extensions (HAV6/HAV12)
- Setting up lattice boom extensions in combination with fly booms (HAV6+SA8, HAV6+SA15, HAV12+SA8, HAV12+SA15)
- Lubricating the boom

To be able to use operating modes **Setup 1** and **Setup 2**, certain operating parameters have to be configured on the SENCON.

The operating parameters for **Setup 1** are configured independently from the existing machine configuration. The operating parameters for **Setup 2** are configured accordingly to the existing machine configuration.

Once the setup tasks are complete, the operating parameters have to be configured according to the machine configuration.

Selecting operating modes is described in section 5.3.6.

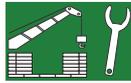
NOTICE

Risk of damage to the machine due to improper operation of the load hook when the lifting limit switch is bypassed.

If the boom angle is less than 25°, the lifting limit switch is bypassed. If the load hook is lifted too quickly while the lifting limit switch is bypassed or if the safety distance to the boom head is not maintained, the load hook can collide with the boom head. This can cause severe damage to the machine. If the **Lower hook** function is continued when the load hook has been lowered, the rope can be damaged.

- When the lifting limit switch is bypassed, lift the load hook slowly.
- Maintain a safety distance of 1 m (3.3 ft) between the load hook and the boom head.
- Once the load hook has been lowered, stop using the **Lower hook** function.

Required operating parameters for Setup 1



Uppercarriage inclination	0.3°	
Track width	D (2.9 m / 9.5 ft)	
Undercarriage ballast	0 t (0 lbs)	
Counterweight	0 t (0 lbs)	
Operating mode	Setup 1	

Required operating parameters for Setup 2

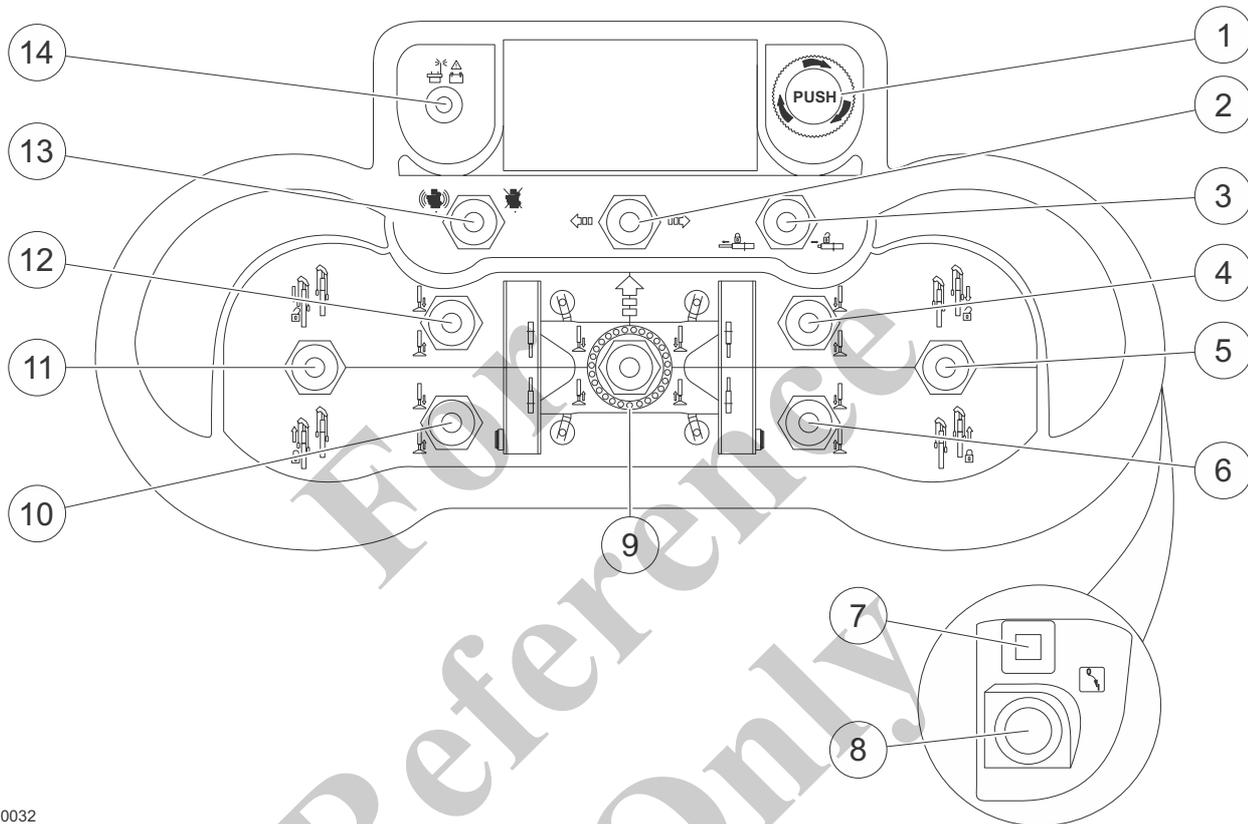


Uppercarriage inclination	0.3°	
Track width	A (5.6 m/18.4 ft)	
Undercarriage ballast	0 t (0 lbs)	
Counterweight	33.0 t (72 753 lbs)	
Operating mode	Rüsten 2	

For Reference Only

7.2 Remote radio control - setup

Overview of the control elements



00032

Fig. 101 Remote radio control - setup

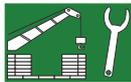
1	Emergency stop switch	8	Key switch, start engine
2	Increase/reduce track width	9	Extend/retract all outrigger cylinders
3	Lock/unlock counterweight	10	Extend/retract left rear outrigger
4	Extend/retract right front outrigger	11	Extend/retract left ballasting cylinder
5	Extend/retract right ballasting cylinder	12	Extend/retract left front outrigger
6	Extend/retract right rear outrigger	13	Starting the diesel engine
7	Horn	14	Operating display

7.3 Attaching the track wheel carriers

7.3.1 Supporting the machine with outriggers for unloading

Safety instructions

- With the included outrigger pads (550 mm in diameter), the stabilized machine produces a ground pressure of 215 psi (15.1 kg/cm²). If the ground does not have sufficient load-bearing capacity, a suitable support must be used to reduce the ground pressure.
- The ground may have a maximum inclination of 2°.



1	Transport the machine to the work site using a lowbed trailer.
2	Switch on the ignition.
3	Select the operating mode Setup 1 on the SENCON (see Chapter 7.1 SETUP OPERATING MODE).
4	Select Ballasting mode on the SENCON (see Section 5.4).
5	Exit the cab.
6	Fold in the outrigger cylinders (1) in Fig. 102 on the front and rear of the undercarriage as shown in the illustration.

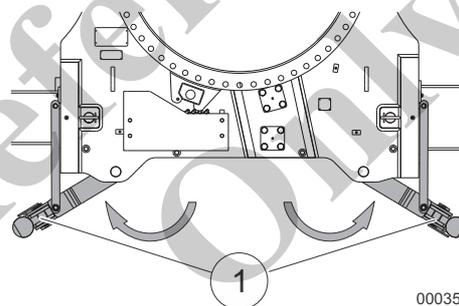


Fig. 102 Folding the outrigger cylinders

- 7 Remove the outrigger pads in Fig. 103 (1) from the middle bridge and place them under the outrigger cylinder (2) in Fig. 103.

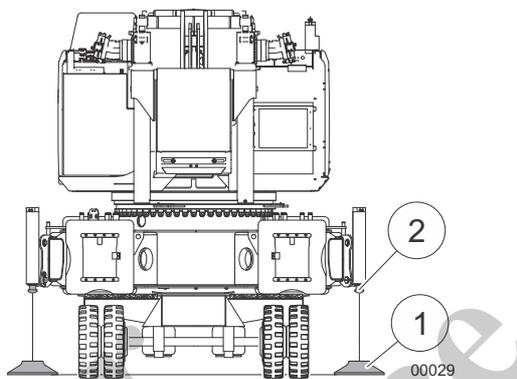


Fig. 103 Positioning the outrigger pads

- 8 Take the adapter (1) in Fig. 104 out of the tool box and place it in the outrigger pad.

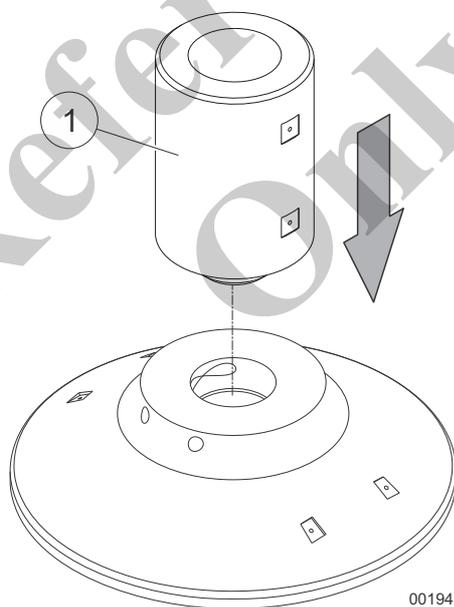
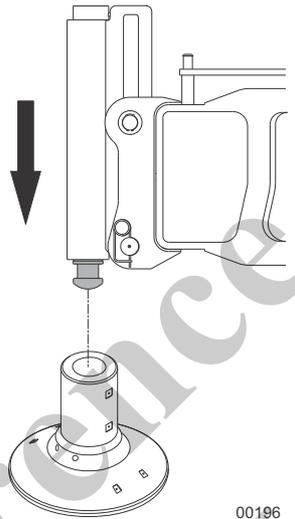


Fig. 104 Placing the adapter in the outrigger pad

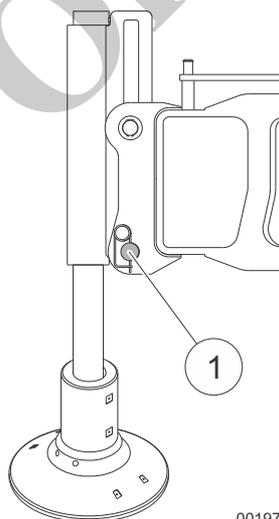
9	Sound the horn with the remote radio control.
10	Start the diesel engine using the remote radio control.
11	Lower the outrigger cylinder into the adapter using the remote radio control in Fig. 105.



00196

Fig. 105 Lowering the outrigger cylinder

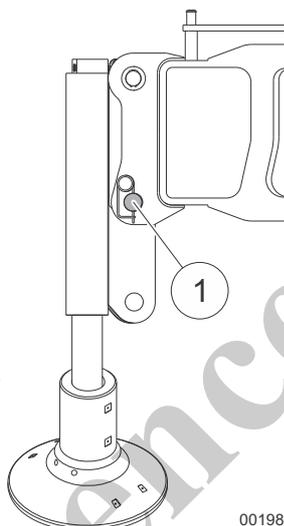
12	Remove the pin (1) in Fig. 106 from the outrigger cylinder.
----	---



00197

Fig. 106 Attaching the outrigger pad

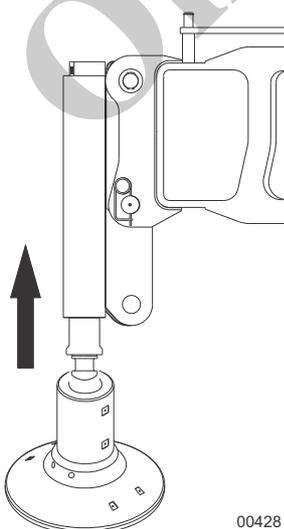
- | | |
|----|--|
| 13 | Retract the outrigger cylinder using the remote radio control until the pin (1) in Fig. 107 can be inserted into the top hole. |
| 14 | Insert and secure the pin (1) in Fig. 107 into the top hole. |



00198

Fig. 107 Securing the outrigger cylinder in working position

- | | |
|----|--|
| 15 | Retract the outrigger cylinder using the remote radio control until the adapter in Fig. 108 can be removed from the outrigger pad. |
|----|--|



00428

Fig. 108 Removing the adapter from the outrigger pad

- | | |
|----|--|
| 16 | Remove the adapter from the outrigger pad. |
|----|--|

- 17 | Extend the outrigger cylinder into the outrigger pad using the remote radio control in Fig. 109. Insert the locking bracket (1) through the outrigger pad and secure it with spring washers (2).

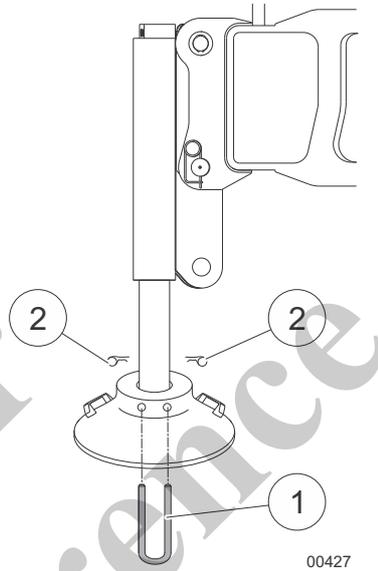


Fig. 109 Attaching the outrigger pads

- | | |
|----|---|
| 18 | Repeat these steps for the remaining outrigger cylinders. |
| 19 | Fully extend the outrigger cylinders. |
| 20 | Completely lower the lowbed of the trailer. |
| 21 | Remove the lowbed trailer from the work area. |

7.3.2 Fastening the track wheel carriers

1	Fully lower the outrigger cylinders.
2	Extend the cross members (see Section 7.7.4 INCREASING THE TRACK WIDTH).
3	Lubricate the friction surfaces on the track wheel carriers and on the cross members.
4	Move the lowbed trailer with the track wheel carriers alongside the stabilized machine. The distance A between the track wheel carrier and the center of the slewing gear cannot exceed 5,000 mm (196.9 in), see Fig. 110.



00199

Fig. 110 Distance between the machine and the transport vehicle with track wheel carriers

A | Max. 5,000 mm (196.9 in)

- 5 Attach the included edge guard (1) in Fig. 111 to the crawler track.

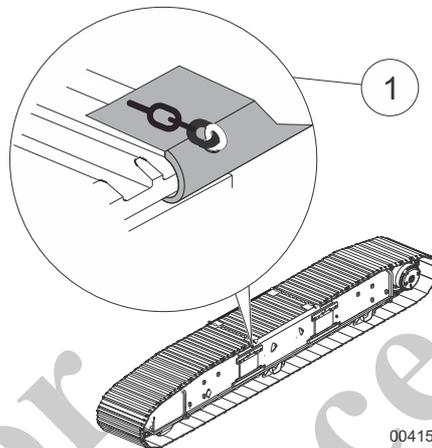


Fig. 111 Attaching the edge guard to the crawler track

- 6 Attach the included lifting tackle on the load hook to the lifting points (1) in Fig. 112 of one of the track wheel carriers.

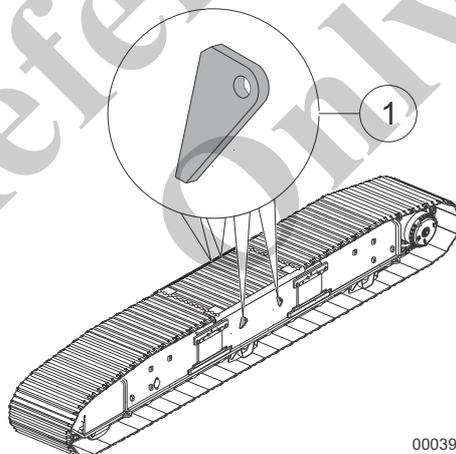


Fig. 112 Lifting points on the track wheel carrier

- 7 Place the lever of the hydraulic clamping of the terminal keys in Fig. 113 in position II.



Information

The hydraulic clamping of the terminal keys must always be activated in work mode (position I). The clamping is only deactivated for attaching and removing the track wheel carriers (position II).

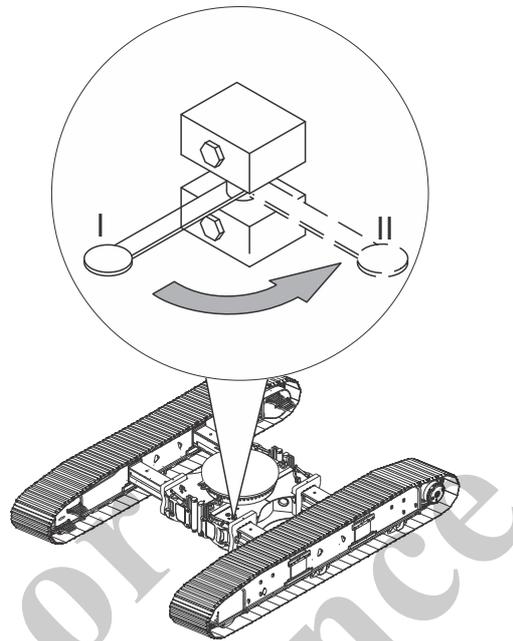


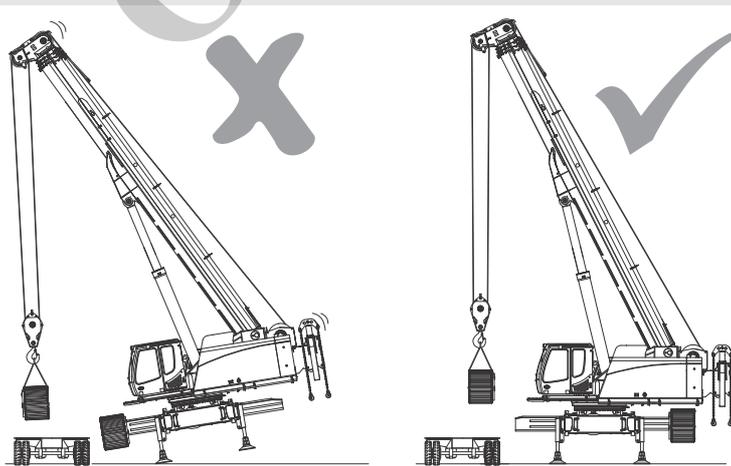
Fig. 113 Deactivating the hydraulic clamping of the terminal keys

⚠ WARNING

Risk of death due to machine tipping over.

The machine can tip over if subject to load on one side only while attaching or removing the track wheel carriers. This can cause death or serious injury.

- When one track wheel carrier is attached, lift the second track wheel carrier into position from the opposite side only.

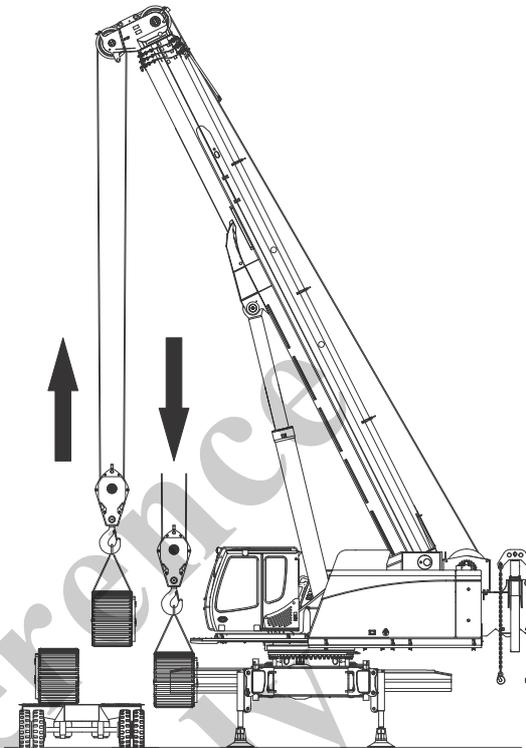


Incorrect

Correct

Fig. 114 Danger of tipping due to weight load on one side when attaching the track wheel carrier

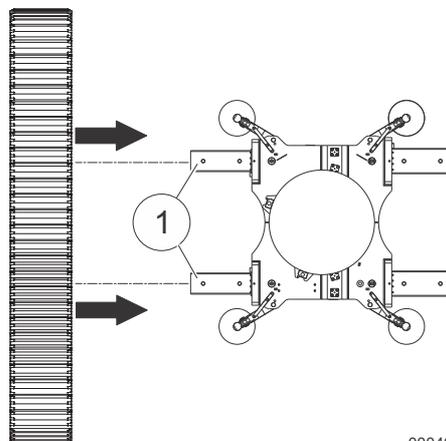
- 8 Lift the track wheel carrier in Fig. 115 toward the undercarriage.



00037

Fig. 115 Lifting the track wheel carrier toward the undercarriage

- 9 Lift or lower the outrigger cylinder to align the undercarriage to the track wheel carrier.
- 10 Slowly slide the track wheel carrier onto the cross members (1) in Fig. 116 until the cross members completely rest on the round steel rod in the track wheel carrier.



00040

Fig. 116 Aligning the track wheel carrier to the cross members

11	Insert the holder (1) in Fig. 117 at the marked position.
12	Remove the lifting tackle from the lifting points on the track wheel carrier. Remove the edge guard from the track wheel carrier.

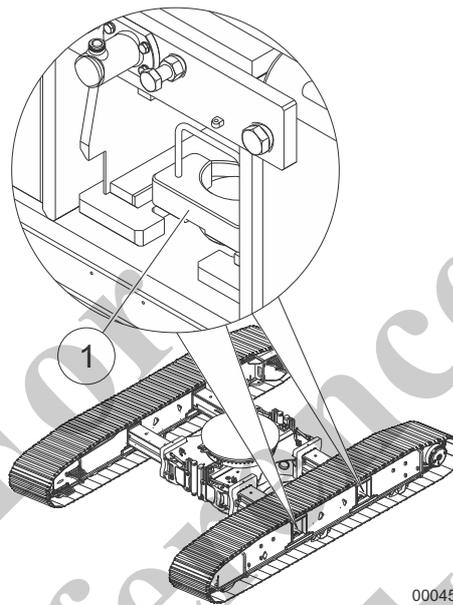


Fig. 117 Inserting and securing the retainer

13	Attach the other track wheel carrier.
14	Completely lower machine.
15	Retract the outrigger cylinders until the track wheel carriers touch the ground. Remove the pins from the outrigger cylinders.
16	Extend the outrigger cylinders.
17	Secure the outrigger arms in the upper position.
18	Extend the cross members to position A (maximum track width) and secure.
19	Completely retract the outrigger cylinders. Detach the outrigger pads from the outrigger cylinders and stow them in the transport positions on the track wheel carriers.

- 20 | Connect the travel drive hydraulics at the designated positions (1) in Fig. 118 Fig. 118 on the back of the undercarriage.

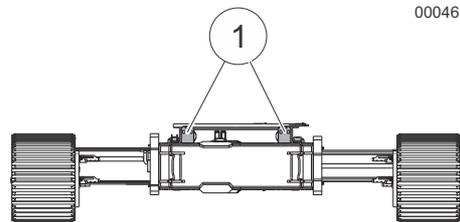


Fig. 118 Hydraulic connections on the undercarriage

- 21 | Loosen the lock nuts on the bolts (1) in Fig. 119 and twist them up to the heads.
- 22 | Close the covers on the attachment shafts of the track wheel carriers.

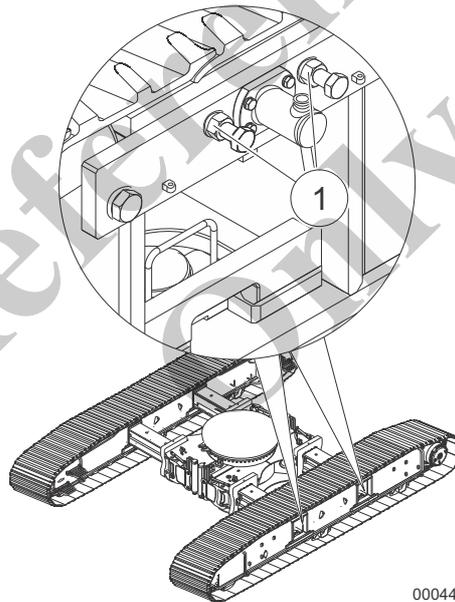


Fig. 119 Loosening the lock nuts on the keys

- 23 | Place the lever of the hydraulic clamping of the terminal keys in Fig. 120 in position I.

**Information**

The hydraulic clamping of the terminal keys must always be activated in work mode (position I). The clamping is only deactivated for attaching and removing the track wheel carriers (position II).

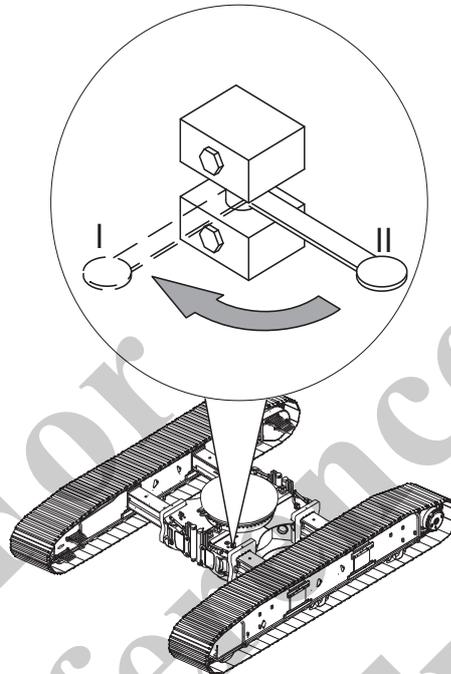
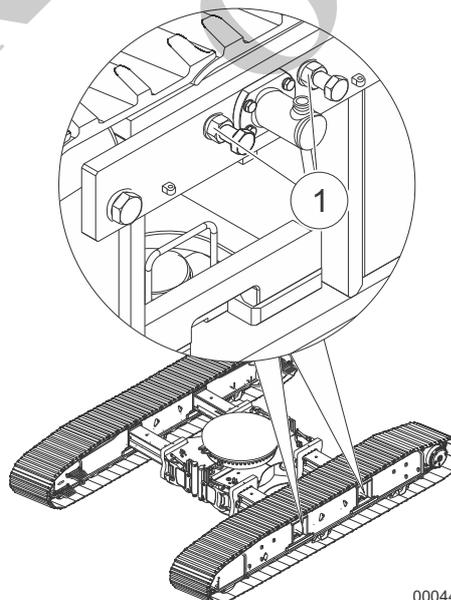


Fig. 120 Activating the hydraulic clamping of the terminal keys

**Information**

If hydraulic clamping is active, the bolts (1) in Fig. 121 always have to be loose. Loosen as needed.



00044

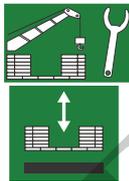
Fig. 121 Loosening bolts on terminal keys

7.4 Removing the track wheel carriers

7.4.1 Supporting the machine with outriggers for loading

Safety instructions

- With the included outrigger pads (550 mm in diameter), the stabilized machine produces a ground pressure of 215 psi (15.1 kg/cm²). If the ground does not have sufficient load-bearing capacity, a suitable support must be used to reduce the ground pressure.
- The ground may have a maximum inclination of 2°.



1	Switch on the ignition. Extend the undercarriage to maximum track width.
2	Select the operating mode Setup 1 on the SENCON (see Chapter 7.1 SETUP OPERATING MODE).
3	Select Ballasting mode on the SENCON (see Section 5.4).
4	Exit the cab.
5	Fold in the outrigger cylinders (1) in Fig. 122 on the front and rear of the undercarriage as shown in the illustration.

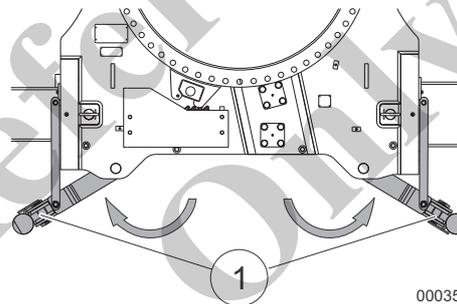


Fig. 122 Folding the outrigger cylinders

6	Sound the horn with the remote radio control.
7	Start the diesel engine using the remote radio control.

- 8 Remove the outrigger pad (1) in Fig. 123 from the track wheel carrier and place it under the outrigger cylinder (2).

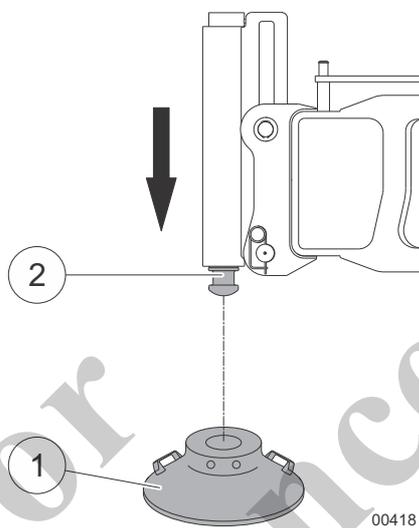


Fig. 123 Placing the outrigger pad under the outrigger cylinder

- 9 Extend the outrigger cylinder until the outrigger pad can be attached. Insert the locking bracket (1) and spring washer (2) in Fig. 124.

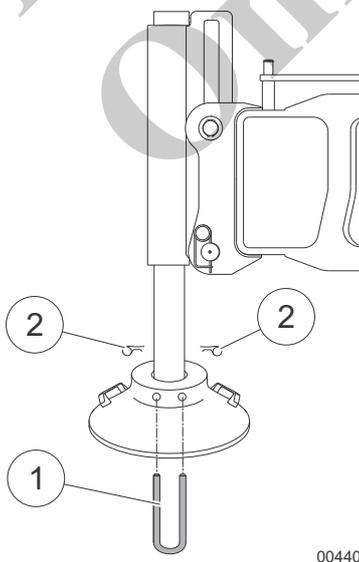


Fig. 124 Attaching the outrigger pad

10 Remove the pin (1) in Fig. 125 from the bottom hole.

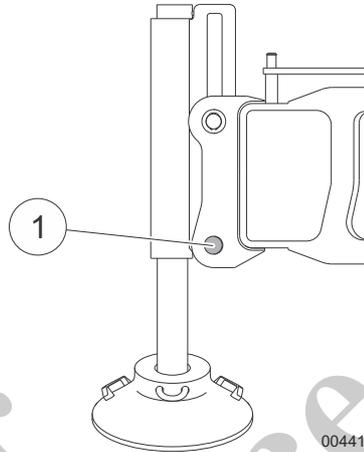


Fig. 125 Removing the pin from the bottom hole

11 Retract the outrigger cylinder until the pin (1) in Fig. 126 can be inserted into the top hole. Secure the pin in the top hole.

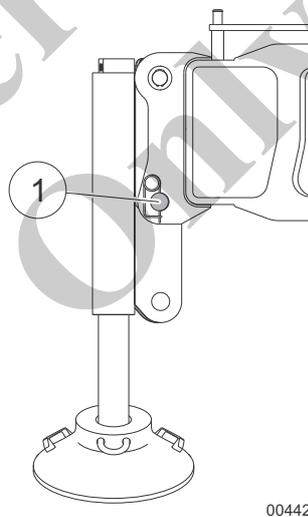


Fig. 126 Securing the pin in the top hole

12 Extend the outrigger cylinder until the track wheel carrier is no longer touching the ground.

7.4.2 Removing the track wheel carrier

- | | |
|---|--|
| 1 | Switch off the diesel engine. |
| 2 | Place the lever of the hydraulic clamping of the terminal keys in Fig. 127 in position II . |



Information

The hydraulic clamping of the terminal keys must always be activated in work mode (position **I**). The clamping is only deactivated for attaching and removing the track wheel carriers (position **II**).

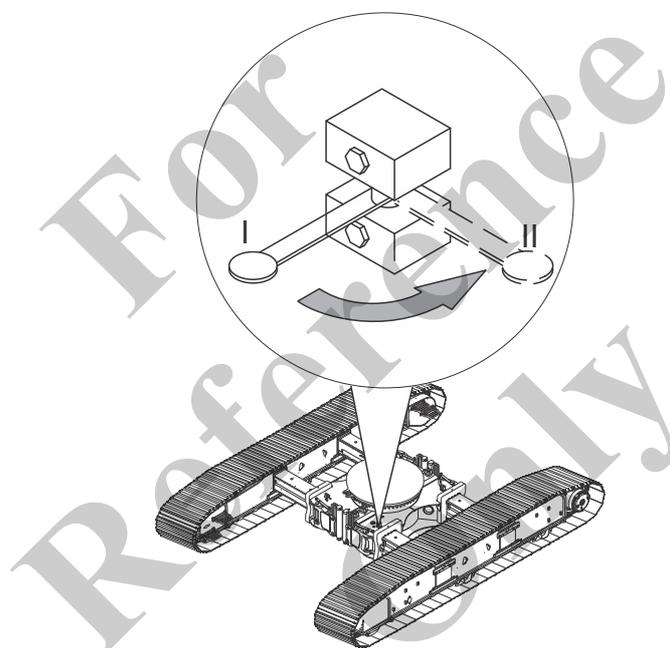
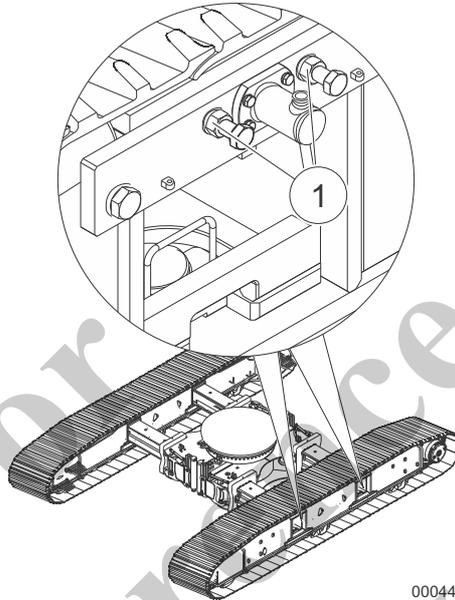


Fig. 127 Activating the hydraulic clamping of the terminal keys

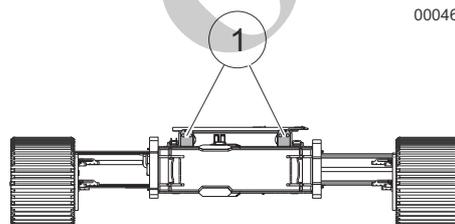
- 3 Turn the lock nuts (1) in Fig. 128 toward the track wheel carrier. Hold the wrench in place while using the bolts to remove the key. Remove the bolts gradually in alternating fashion.



00044

Fig. 128 Tightening the lock nuts on the keys

- 4 Remove the travel drive hydraulics and hydraulic key clamping from the designated positions (1) in Fig. 129 on the back of the undercarriage.



00046

Fig. 129 Hydraulic connections on the undercarriage

- 5 Attach the included edge guard (1) in Fig. 130 to the crawler tracks.

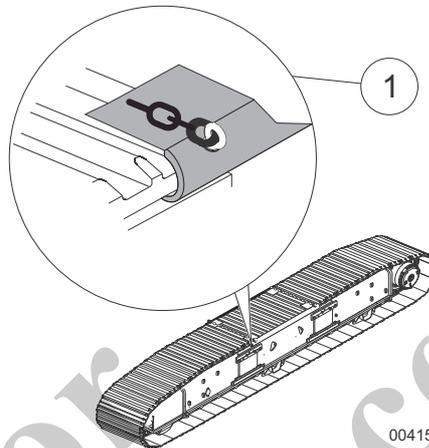


Fig. 130 Attaching the edge guard to the crawler tracks

- 6 Attach the included lifting tackle on the load hook to the lifting points (1) in Fig. 131 of one of the track wheel carriers.

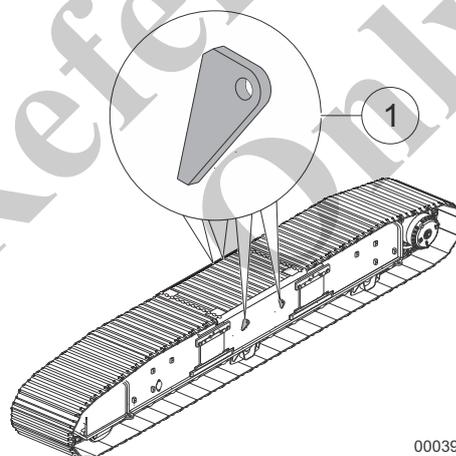


Fig. 131 Lifting points on the track wheel carrier

- 7 Remove the retainer (1) in Fig. 132 from the designated position.
 - For loosening a tightened retainer, see Section 7.4.4.

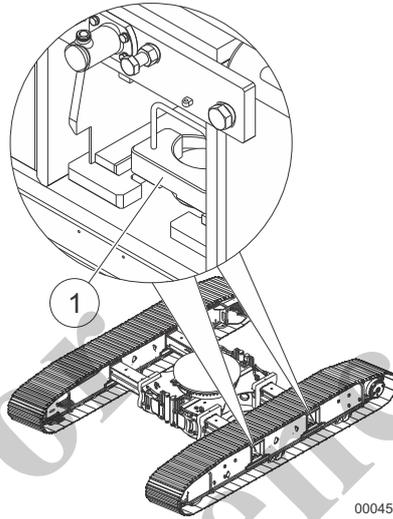
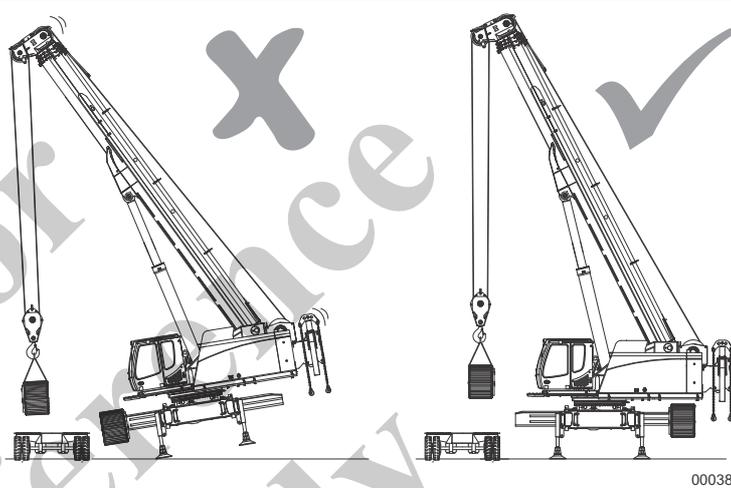


Fig. 132 Removing the retainer

⚠ WARNING**Risk of death due to machine tipping over.**

The machine can tip over if subject to load on one side only while attaching or removing the track wheel carriers. This can cause death or serious injury.

- When one track wheel carrier is removed, lift the second track wheel carrier onto the lowbed trailer from the opposite side only.

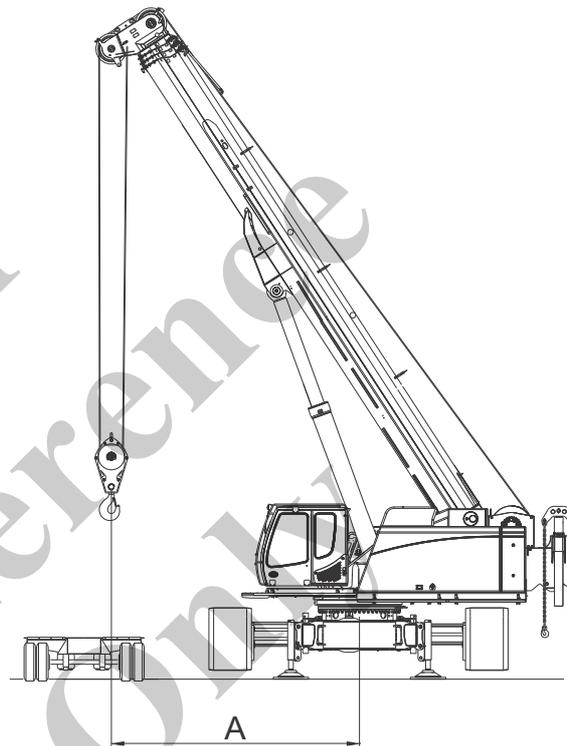


Incorrect

Correct

Fig. 133 Danger of tipping due to weight load on one side when removing the track wheel carrier

8	Remove the track wheel carriers from the cross members using the hoist winch and the luffing cylinder.
9	Move the lowbed trailer for the track wheel carriers alongside the stabilized machine. The distance A between the loading position of the track wheel carriers and the center of the slewing gear cannot exceed 5,000 mm (196.9 in), see 7.4.2.

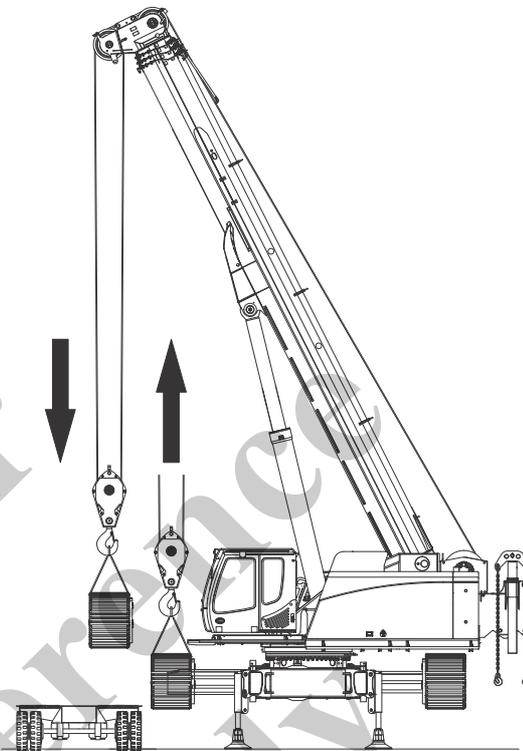


00417

Fig. 134 Distance between the machine and the loading position on the lowbed trailer

A | Max. 5,000 mm (196.9 in)

10 | Lift the track wheel carrier onto the lowbed trailer.



00416

Fig. 135 Lifting the track wheel carrier onto the lowbed trailer

11 | Repeat these steps for the other track wheel carrier.

7.4.3 Loading the machine

1	Fully extend the outrigger cylinders using the remote radio control.
2	Drive the lowbed trailer under the undercarriage.
3	Use the remote radio control to lower the machine until the undercarriage is lying on the lowbed trailer.
4	Retract the outrigger cylinders until the outrigger pads can be removed.
5	Remove the locking bracket (1) and the spring washer (2) in Fig. 136. Remove the outrigger pad.

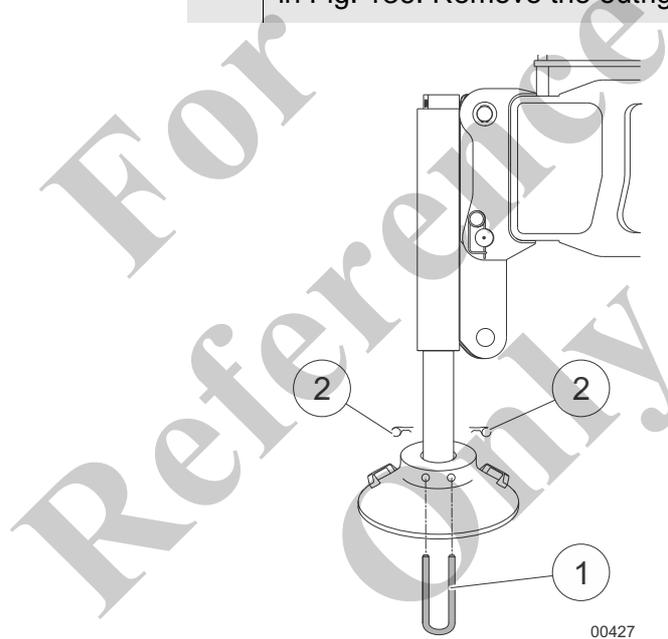


Fig. 136 Removing the outrigger pad

- 6 Take the adapter (1) in Fig. 137 out of the tool box and place it in the outrigger pad.

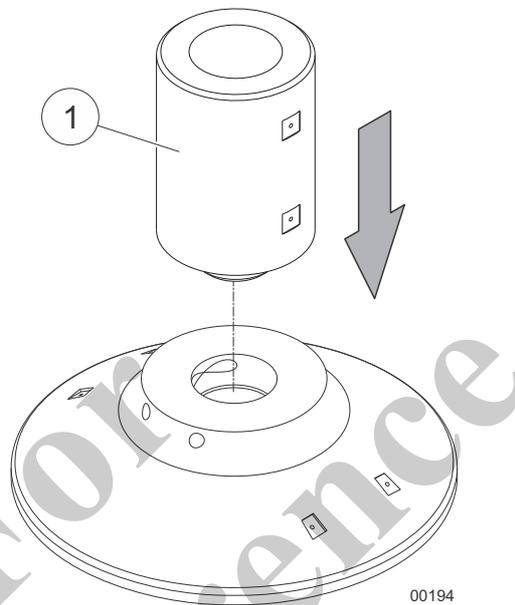


Fig. 137 Placing the adapter in the outrigger pad

- 7 Lower the outrigger cylinder into the adapter using the remote radio control in Fig. 138.

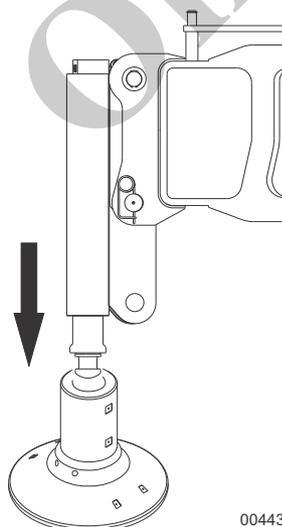


Fig. 138 Lowering the outrigger cylinder

8 Remove the pin from the outrigger cylinder.

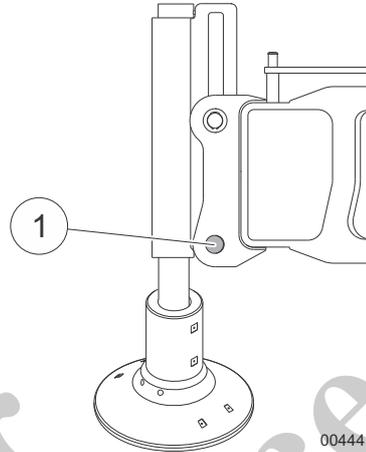


Fig. 139 Removing the pin from the outrigger cylinder

9	Retract the outrigger cylinder using the remote radio control until the pin (1) in Fig. 139 can be inserted into the bottom hole.
10	Insert the pin (1) into the bottom hole and secure.
11	Retract the outrigger cylinder until the outrigger pad and the adapter can be removed.
12	Remove the outrigger pad and the adapter. Secure the outrigger pad on the middle bridge at the designated location.
13	Repeat these steps for the remaining outrigger cylinders.
14	Fully retract the outrigger cylinders.
15	Stow the outrigger cylinders (1) in Fig. 140 on the front and rear of the undercarriage.

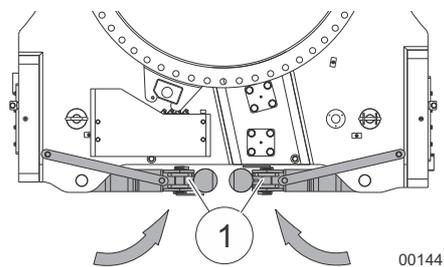


Fig. 140 Stowing the outrigger cylinders

7.4.4 Removing tightened retainers

If the key clamping retainers are tight, they can be loosened as follows.

1	Raise the outriggers on the side of the machine where the track wheel carrier is being removed.
2	Retract the cross members on the track wheel carrier being removed by approx. 20 cm.
3	Lower the outriggers until the cross members are no longer under load. Do not fully lower the track wheel carrier.
4	Extend the cross members until they are flush against the round steel rod.
5	Use a hammer and crow bar to loosen the retainers.
6	Remove the retainers.

For Reference Only

7.5 Access ladders

! WARNING

Danger of crushing due to moving machine parts!
 Persons will be caught and injured by extending track wheel carriers.

- Use a banksman for assistance.
- Ensure that no unauthorized persons are present in the danger zone during all work.
- Attach all safety bolts before using the machine in travel mode.

! WARNING

Danger of injury due to slippery surface!
 Risk of personal injury due to slipping on soiled access ladders.

- Clean the access ladders immediately of any mud, oil, lubricating grease or snow.
- Wear safety footwear.

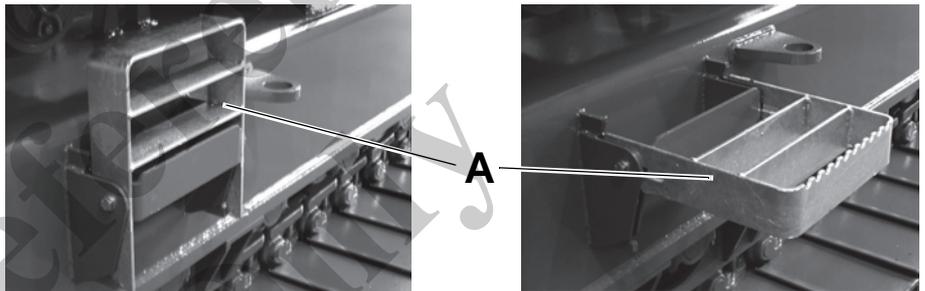


Fig. 141 Folded-in access ladder and folded-out access ladder (A)

There are access ladders (A) on both sides of the machine. These must be folded out during work operation.

Unfolding an access ladder

1	Pull the access ladder (A) in Fig. 141 upward.
2	Slowly lower the access ladder (A) in Fig. 141 until it is completely horizontal.

Folding in an access ladder

1	Lift the lowered access ladder (A) in Fig. 141 until it is resting completely against the side wall.
2	Pull the access ladder (A) in Fig. 141 upward and then let it lower.

7.6 Mounting/removing walkways

WARNING

Danger of fatal injury due to falling walkways.

Improperly fastened walkways can fall. Persons on the walkways can be severely injured.

- Check all walkways and their fastening components every time before installation.
- Use only Manitowoc spare parts.



Walkways next to the cab and on the right-hand side of the uppercarriage are mounted when the undercarriage is retracted.

Walkways on the left-hand side of the uppercarriage are mounted when the undercarriage is extended.

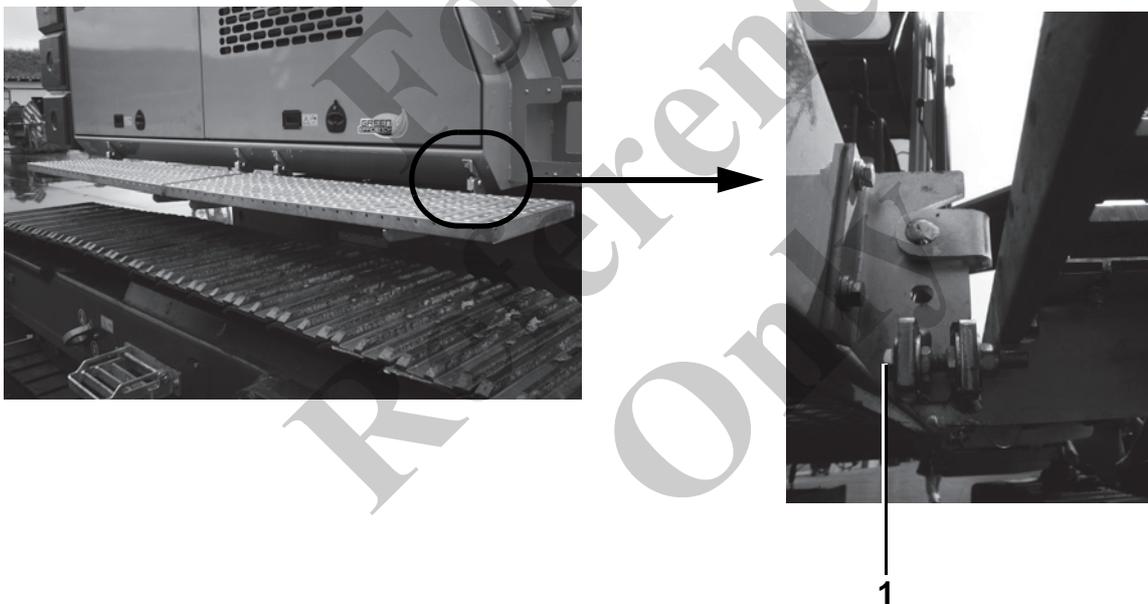


Fig. 142 Mounting walkways

1	Carefully lift the walkway onto the cab or uppercarriage using suitable equipment.
2	Screw the walkway to the frame (1) in Fig. 142. Observe the permitted tightening torque of the screws.
3	Check the walkway for secure attachment.



Information

Step grids are removed in the reverse sequence. For transport, the walkways must be removed together with the step grid holder.

7.7 Telescoping the undercarriage

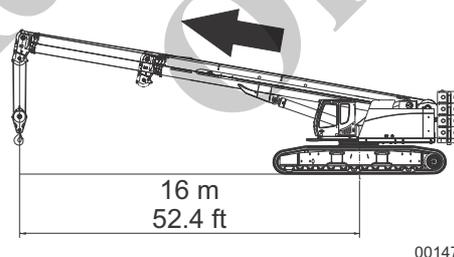
The undercarriage is telescoped in three steps:

- If no counterweight is attached to the machine, the preparatory tasks without counterweight must be performed. If a counterweight is attached to the machine, the preparatory tasks with counterweight must be performed.
- Support the machine with outriggers for telescoping.
- Increase or decrease the track width.

7.7.1 Preparatory tasks without counterweight

1	Start the diesel engine.
2	Push the safety lever forward.
3	Unlock the uppercarriage.
4	Slew the uppercarriage into the direction of travel.
5	Lift the boom to 45°. The boom angle is displayed on the SENCON.

7.7.2 Preparatory tasks with counterweight



00147

Fig. 143 Telescoping the boom with the counterweight attached

1	Start the diesel engine.
2	Push the safety lever forward.
3	Unlock the uppercarriage.
4	Slew the uppercarriage into the direction of travel.
5	Extend the boom to 52.4 ft (16 m). The boom length is displayed on the SENCON.

7.7.3 Supporting the machine with outriggers for telescoping

Safety notice

With the outrigger pads delivered (550 mm diameter), the stabilized machine with the counterweight attached produces a ground pressure of 199 psi (14 kg/cm²). If the ground does not have sufficient load-bearing capacity, a suitable support must be used to reduce the ground pressure.

NOTICE

Machine damage due to overloading of the outrigger cylinders!

If work equipment is moved while the machine is stabilized, the outrigger cylinders can be overloaded. This may cause damage to the ground and to the outrigger cylinders.

➤ Do not move work equipment while the machine is stabilized.

- | | |
|---|---|
| 1 | Select operating mode Setup on the SENCON. |
| 2 | Exit the cab. |
| 3 | Push the safety lever forward. |
| 4 | Fold out the outrigger cylinders (1) in Fig. 144 on the front and rear of the undercarriage to the position shown and lock them in place. |

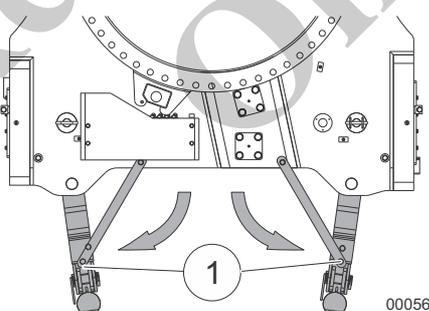


Fig. 144 Folding the outrigger cylinders

- 5 Remove the outrigger pads (2) in from the track wheel carriers and place them under the outrigger cylinders (1) in Fig. 145.

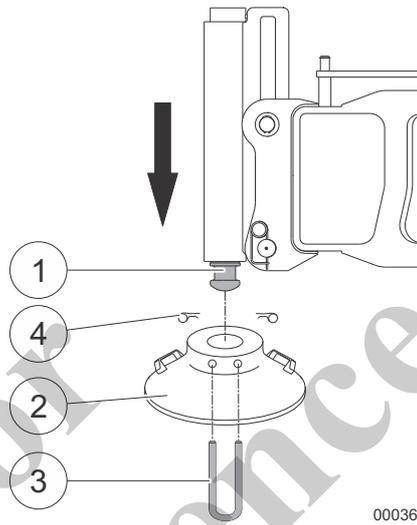


Fig. 145 Attaching the outrigger pad

- 6 Push the lever (1) in Fig. 146 on the remote radio control upward until the outrigger cylinders are extended into the outrigger pads.

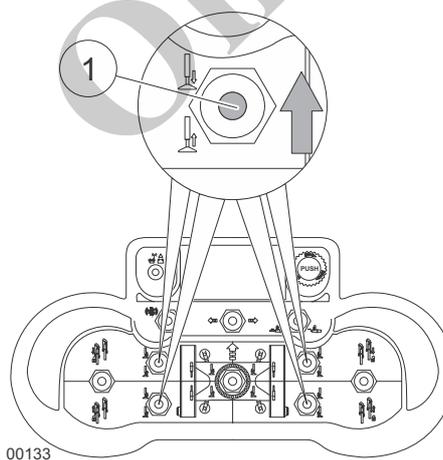


Fig. 146 Extending the outrigger cylinders using the remote radio control

- | | |
|---|---|
| 7 | Push the locking bracket (3) in Fig. 147 through the outrigger pad. |
| 8 | Secure the locking brackets with spring washers (4) in Fig. 147. |

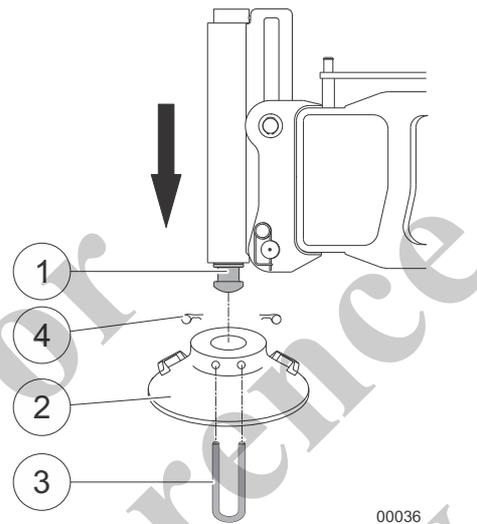


Fig. 147 Attaching the outrigger pad

- | | |
|---|--|
| 9 | Continue to extend the outrigger cylinders to relieve the chain. The chain is relieved when there is a distance of about 1 in. (30 mm) between chain and track wheels. |
|---|--|

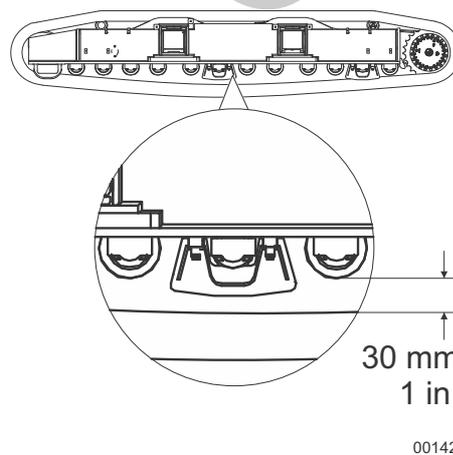


Fig. 148 Relieving the chain

7.7.4 Increasing the track width

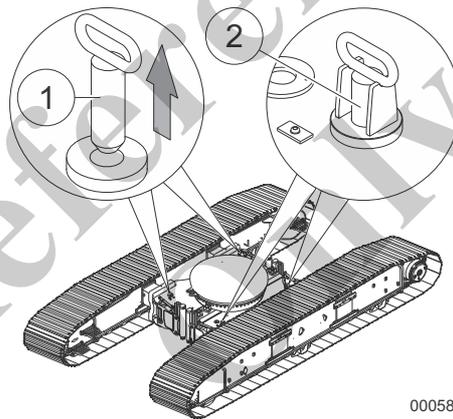
NOTICE

Damage to the machine due to improper bolt insertion!

If bolts are improperly inserted, the undercarriage and the bolts may be damaged.

➤ Never drive in bolts using a hammer or mallet.

1	Stabilize the machine.
2	Prepare a clean collection container for the bolts.
3	Completely pull out both bolts (1) in Fig. 149 on the right side of the undercarriage and place them in the collection container.
4	Bring both bolts (2) in Fig. 149 on the left side of the undercarriage into the specified position.



00058

Fig. 149 Pulling out the bolts on the right side

- 5 Push the lever (1) in Fig. 150 on the remote radio control to the right until the right track wheel carrier is completely extended.

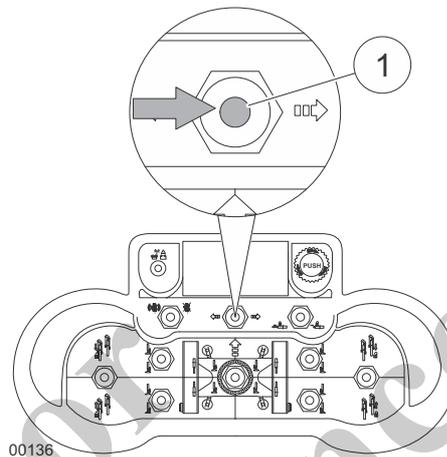


Fig. 150 Telescoping the track wheel carrier out

- 6 Insert both bolts (1) in Fig. 151 on the right side of the undercarriage.
- 7 Completely pull out both bolts (2) in Fig. 151 on the left side of the undercarriage and place them in the collection container.

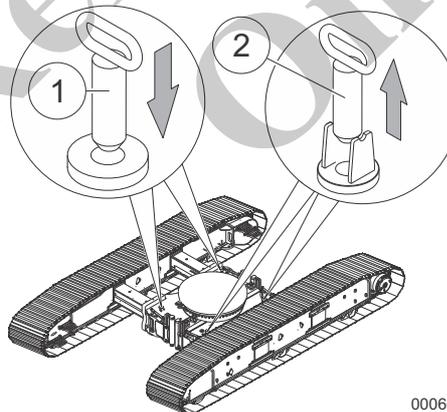
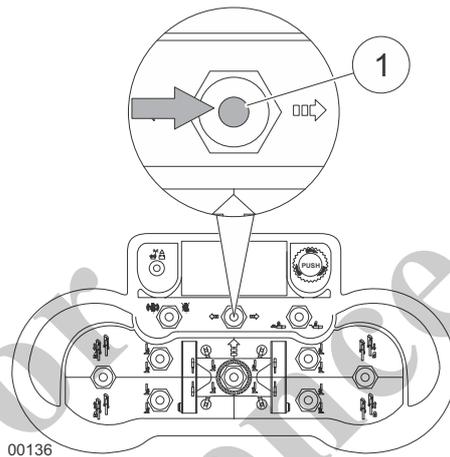


Fig. 151 Pulling out the bolts on left side

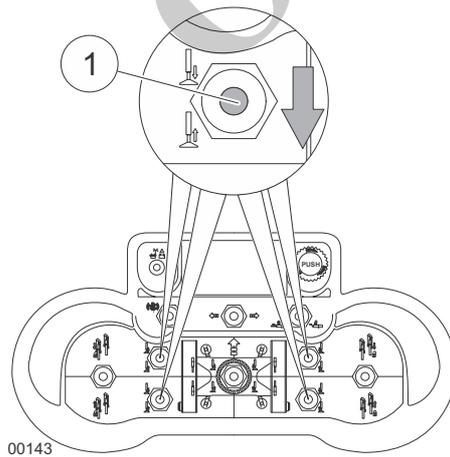
- | | |
|---|--|
| 8 | Push the lever (1) in Fig. 152 on the remote radio control to the right until the left track wheel carrier is completely extended. |
| 9 | Insert both bolts on the left side of the undercarriage. |



00136

Fig. 152 Telescoping the track wheel carrier out

- | | |
|----|--|
| 10 | Push the lever (1) in Fig. 153 on the remote radio control downward until the outrigger cylinders are retracted. |
| 11 | Remove the outrigger pads and secure them on the track wheel carriers. |



00143

Fig. 153 Retracting the outriggers

- | | |
|----|--|
| 12 | Fold in the outrigger cylinders (1) in Fig. 154 on the front and rear of the undercarriage and lock them in place. |
|----|--|

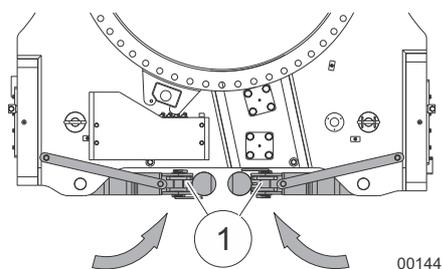


Fig. 154 Folding in the outrigger cylinders

- | | |
|----|-------------------------------|
| 13 | Enter the cab. |
| 14 | Switch off the diesel engine. |
| 15 | Pull back the safety lever. |

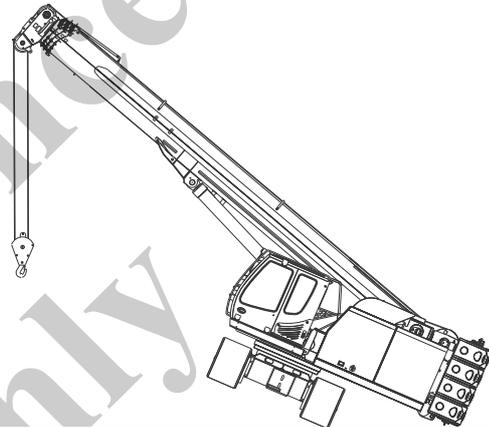
7.7.5 Decreasing the track width

WARNING**Danger to life due to the machine tipping!**

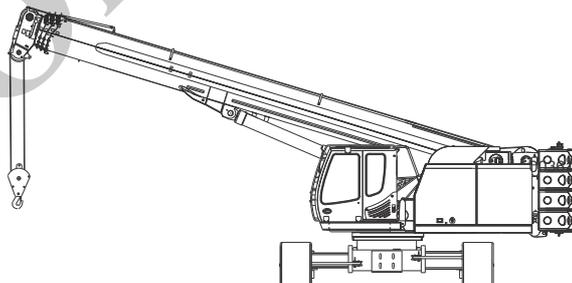
The machine may tip if slewed with the maximum counterweight attached to the uppercarriage and the undercarriage fully telescoped in. This can cause severe or fatal injury.

- Never telescope the undercarriage fully during work operation or when performing maintenance or setup work.
- Before telescoping, place the uppercarriage parallel to the undercarriage, in the direction of travel, and secure it.
- Do not slew the uppercarriage during the telescoping procedure.

Incorrect:



Correct:



00361

Fig. 155 Risk of tipping due to retracted undercarriage

NOTICE**Damage to the machine due to improper bolt insertion!**

If bolts are improperly inserted, the undercarriage and the bolts may be damaged.

➤ Never drive in bolts using a hammer or mallet.

1	Stabilize the machine.
2	Prepare a clean collection container for the bolts.
3	Completely pull out both bolts (1) in Fig. 156 on the right side of the undercarriage and place them in the collection container.
4	Bring both bolts (2) in Fig. 156 on the left side of the undercarriage into the specified position.

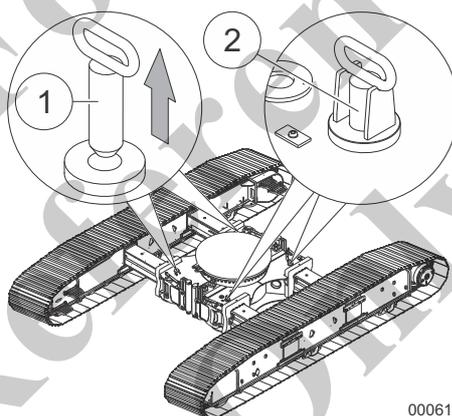
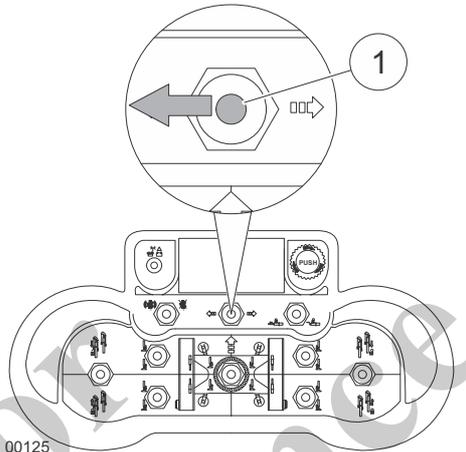


Fig. 156 Pulling out the bolts on the right side

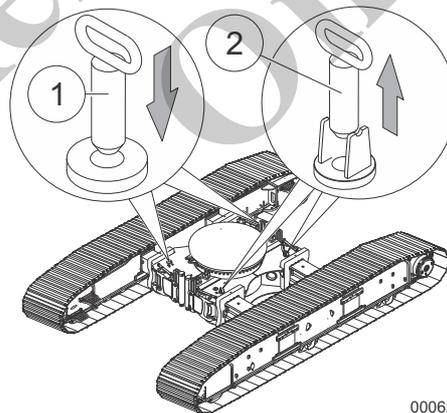
- 5 Push the lever (1) in Fig. 157 on the remote radio control to the left until the right track wheel carrier is completely retracted.



00125

Fig. 157 Telescoping the track wheel carrier in

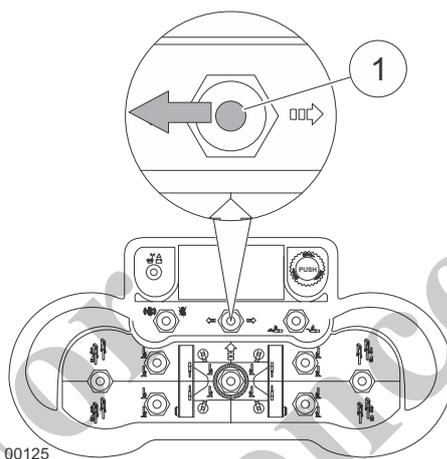
- 6 Insert both bolts (1) in Fig. 158 on the right side of the undercarriage.
- 7 Completely pull out both bolts (2) in Fig. 158 on the left side of the undercarriage and place them in the collection container.



00062

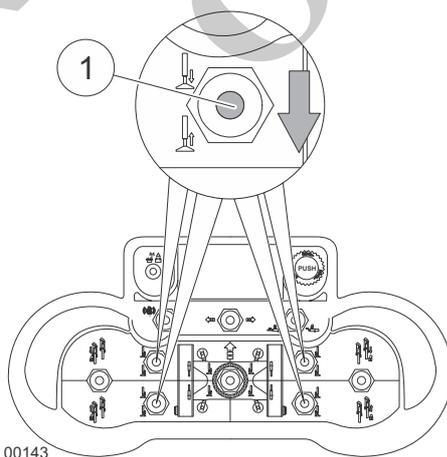
Fig. 158 Pulling out the bolts on left side

- | | |
|---|--|
| 8 | Push the lever (1) in Fig. 159 on the remote radio control to the left until the left track wheel carrier is completely retracted. |
| 9 | Insert both bolts on the left side of the undercarriage. |



00125
Fig. 159 Telescoping the track wheel carrier in

- | | |
|----|--|
| 10 | Push the lever (1) in Fig. 160 on the remote radio control downward until the outrigger cylinders are retracted. |
| 11 | Remove the outrigger pads and secure them on the track wheel carriers. |



00143
Fig. 160 Retracting the outriggers

- | | |
|----|--|
| 12 | Fold in the outrigger cylinders (1) in Fig. 161 on the front and rear of the undercarriage and lock them in place. |
|----|--|

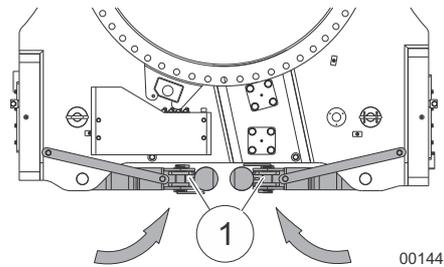


Fig. 161 Folding in the outrigger cylinders

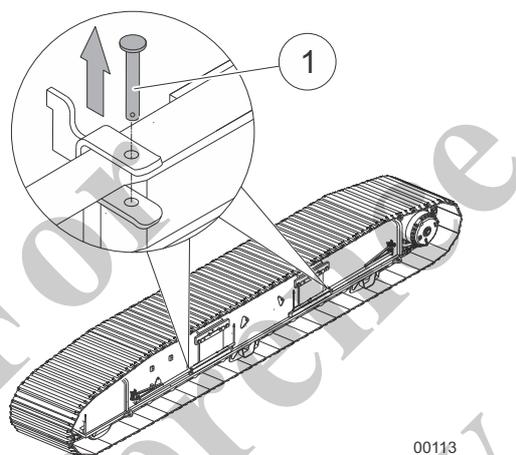
- | | |
|----|-------------------------------|
| 13 | Enter the cab. |
| 14 | Switch off the diesel engine. |
| 15 | Pull back the safety lever. |

For Reference Only

7.8 Setting up the slewing range safeguard

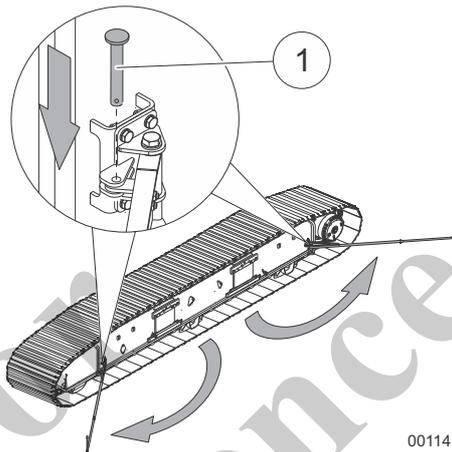
The slewing range safeguard indicates the slewing range of the uppercarriage in work operation. When in working mode, all persons must stay clear of the slewing range.

- 1 Pull the locking bolt (1) in Fig. 162 out of the slewing range safeguard.



00113
Fig. 162 Unlocking the slewing range safeguard

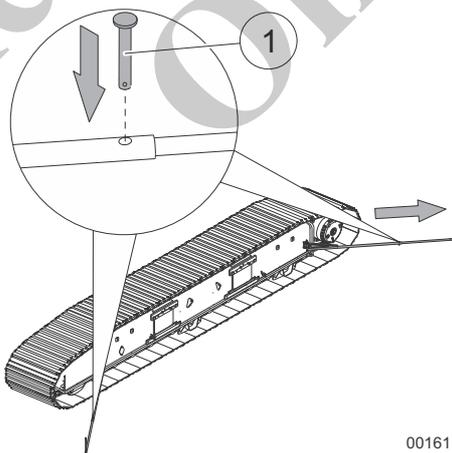
- | | |
|---|---|
| 2 | Completely fold out the slewing range safeguard. |
| 3 | Insert and secure the locking bolt (1) in Fig. 163 at the position shown. |



00114

Fig. 163 Folding out the slewing range safeguard

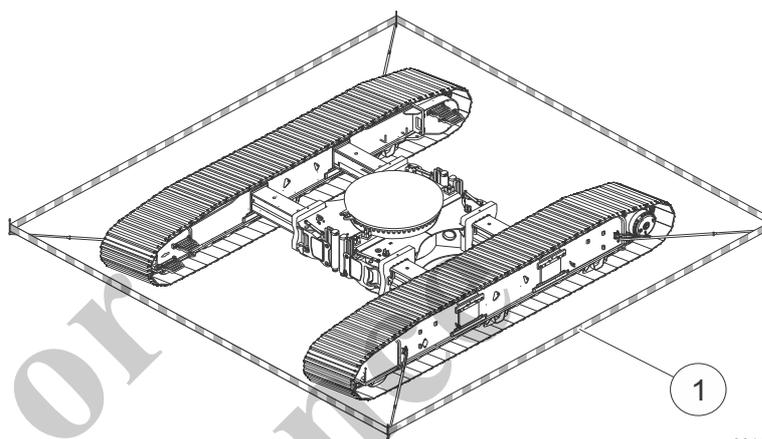
- | | |
|---|--|
| 4 | Pull out the bolt (1) in Fig. 164. Pull out the slewing range safeguard to its full length. Insert the bolt (1) in Fig. 164 at the position shown. |
|---|--|



00161

Fig. 164 Pulling out the slewing range safeguard

- | | |
|---|--|
| 5 | Unfold and pull out the slewing range safeguard on the second track wheel carrier. |
| 6 | Apply barrier tape (1) in Fig. 165. |



00115

Fig. 165 Applying barrier tape

For Reference Only

7.9 Connections for clamping tongs and supplemental hydraulic system on the boom head (option)

Safety notice

Any work involving the clamping tongs and the soil drill require the maximum counterweight to be fitted and the undercarriage to be completely telescoped out.

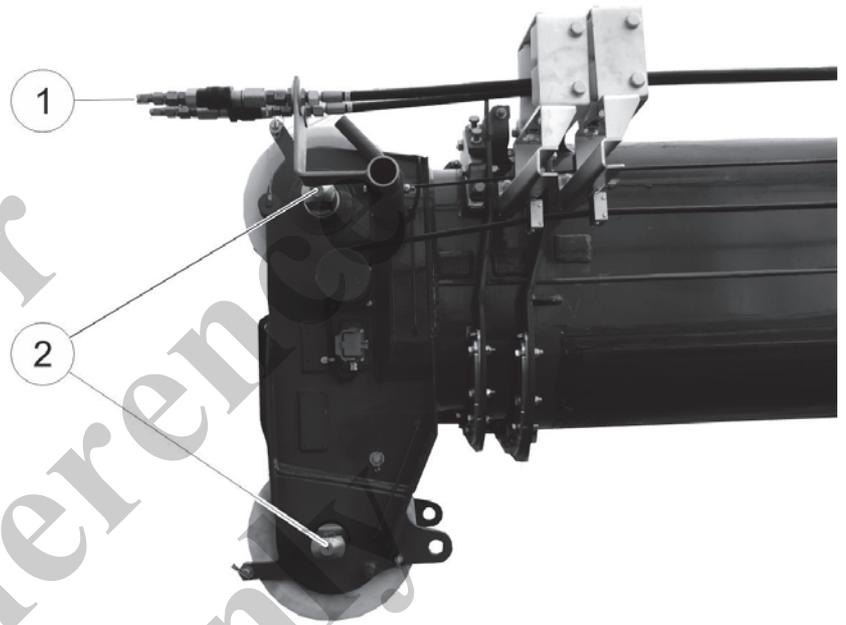


Fig. 166 Connections for the clamping tongs on the boom head

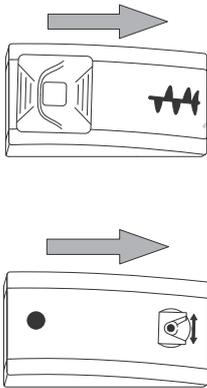
1	Hydraulic connections
2	Retaining points

7.10 Attaching clamping tongs (option)

1	Enter the cab.
2	Start the diesel engine and push the safety lever forward.
3	Select Setup operating mode on the SENCON.
4	Completely retract the telescopic boom.
5	Raise the bottom hook block. Leave a distance of 0.5 m between bottom hook block and lifting limit switch.
6	Lower the telescopic boom to 0°.
7	Lift the clamping tongs to the boom head using suitable lifting equipment and bolt them in.
8	Connect the hydraulic hoses for the clamping tongs to the quick-release couplings on the boom head.

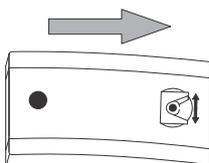
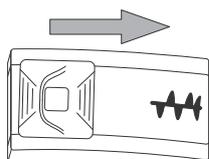
For Reference Only

7.11 Slewing the soil drill (option) into working position



1	Enter the cab.
2	Start the diesel engine and push the safety lever forward.
3	Select Setup operating mode on the SENCON.
4	Retract the boom almost completely.
5	Raise the bottom hook block. Leave a distance of 0.5 m between bottom hook block and lifting limit switch.
6	Lower the boom to approx. 45° so that the soil drill can be slewed into working position.
7	Release the Soil drill on switch and push it toward the symbol. – The soil drill is ready for operation.
8	Push and hold the Open soil drill lock switch. – The transport tab is unlocked.
9	Push the left joystick forward until the soil drill has slewed out the transport tab.
10	Release the Open soil drill lock switch.
11	Push the left joystick forward until the soil drill points downward.
12	Detach the rope and stow it away.

7.12 Slewing the soil drill into transport position (option)



1	Enter the cab.
2	Start the diesel engine and push the safety lever forward.
3	Select Setup operating mode on the SENCON.
4	Release the Soil drill on switch and push it toward the symbol.
5	Attach the rope to the soil drill and the soil drill lock.
6	Raise the boom to approx. 45° so that the soil drill can be slewed into transport position.
7	Pull the left joystick backward until the soil drill has reached the transport tab.
8	Push and hold the Open soil drill lock switch. <ul style="list-style-type: none"> – The transport tab is unlocked.
9	Pull the left joystick backward until the soil drill has gone as far as it will go. <ul style="list-style-type: none"> – When it reaches the stop, the soil drill is shut down.
10	Release the Open soil drill lock switch.
11	Push the switch Soil drill on away from the symbol.

7.13 Attaching the counterweight

The counterweight is attached in two steps:

- Set up the counterweight.
- Lift the counterweight onto the machine.

7.13.1 Setting up the counterweight

Safety instructions

- Lift the ballast blocks of the counterweight individually onto the bracket.
- Always perform the ballasting procedure with a banksman.
- Ensure that no one is in the danger zone during attachment and removal of the counterweight.
- Eye contact between the crane operator and the banksman must be maintained.
- Agree on hand signals with banksman and slinger.
- Only attach the counterweight when on firm, level ground.
- Do not stand on or under the counterweight.
- Do not change the operating mode during the ballasting procedure.
- Banksman and slinger must wear hard hats and safety footwear.
- Use the provided suspension gear and shackles to lift the ballast bracket.
- The suspension gear must not be twisted and must be of equal length on both sides.

1	Start the diesel engine.
2	Select operating mode Setup on the SENCON.
3	Telescope the undercarriage fully outward.
4	Unlock the uppercarriage.
5	Exit the cab.
6	Push the safety lever forward.
7	Move the lowbed trailer with the ballast bracket and ballast blocks to the machine. Park the lowbed trailer parallel to the machine.

- 8 Prepare wooden planks (2) in Fig. 167 as a support for the counterweight.

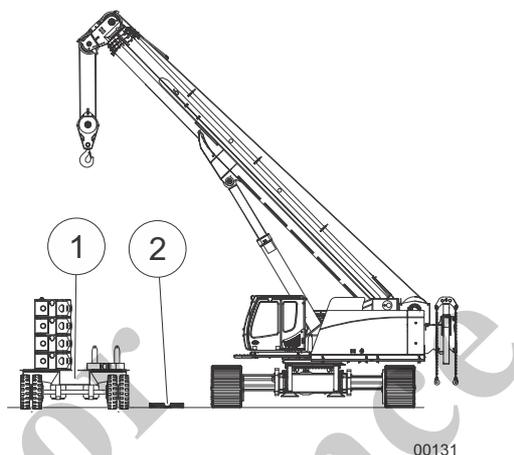


Fig. 167 Fastening the ballast bracket

- 9 Attach the ballast bracket to the load hook and to the lifting points (1) in Fig. 168 using suitable lifting equipment.

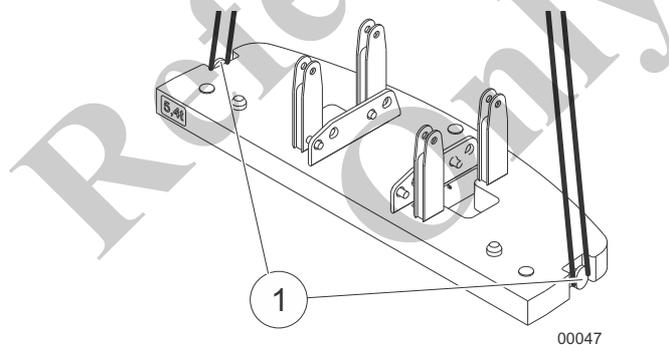
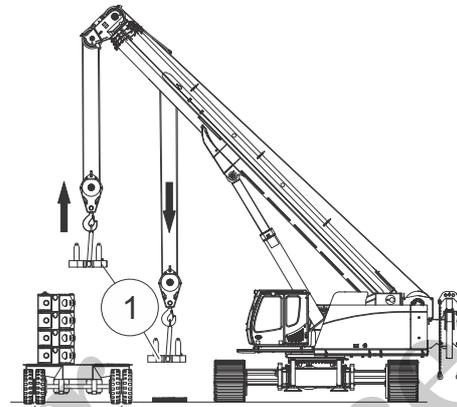


Fig. 168 Fastening the ballast bracket

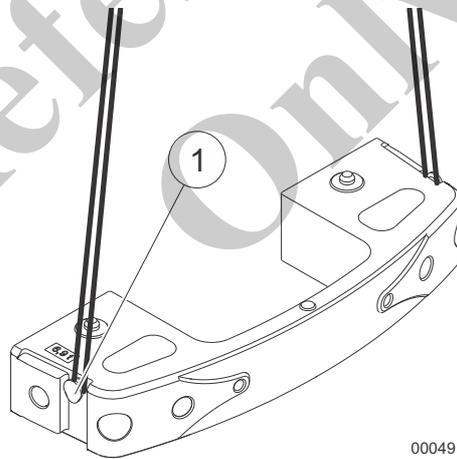
- 10 Lift the ballast bracket (1) in Fig. 169 onto the wooden planks.



00048

Fig. 169 Lifting the ballast bracket

- 11 Use the lifting equipment provided to fasten the ballast block to the load hook and to the lifting points (1) in Fig. 170.



00049

Fig. 170 Attaching the ballast blocks

- 12 Lift the ballast blocks individually onto the ballast bracket.

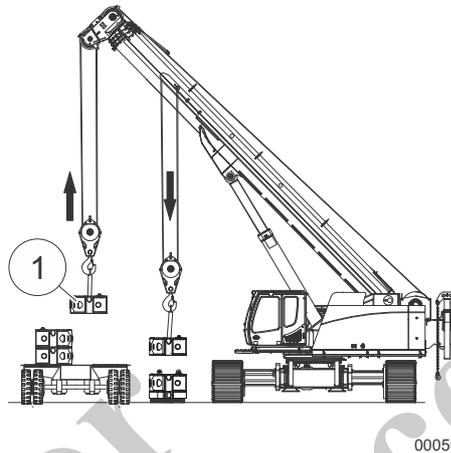
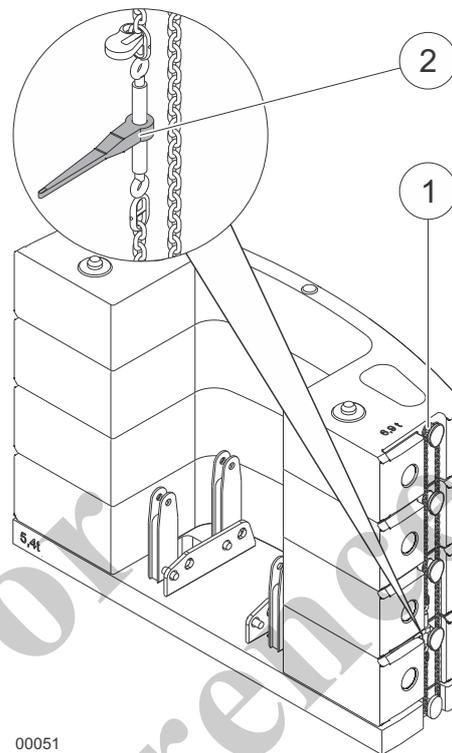


Fig. 171 Lifting the ballast blocks onto the ballast bracket

- 13 Attach a chain to the counterweight at the specified position (1) in.
- 14 Lash the counterweight using the tensioner (2) in Fig. 172. Check whether the counterweight is firmly tensioned. Tension the chain again if necessary.



00051

Fig. 172 Lashing the counterweight

15 | Lash the opposite side of the counterweight.

**Information**

To lift the counterweight onto the machine, the undercarriage must be completely telescoped out.

**Information**

The counterweight is marked by colored stripes (1) in Fig. 173. The colored stripes are a positioning aid for moving the machine to the counterweight. When reversing, the driver must observe the counterweight in the rear-view camera.

When the colored stripes are visible, the machine is in the correct position relative to the counterweight

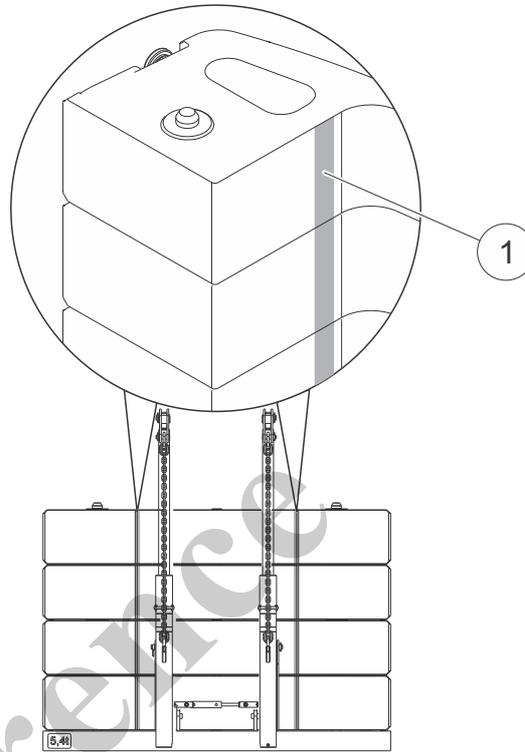
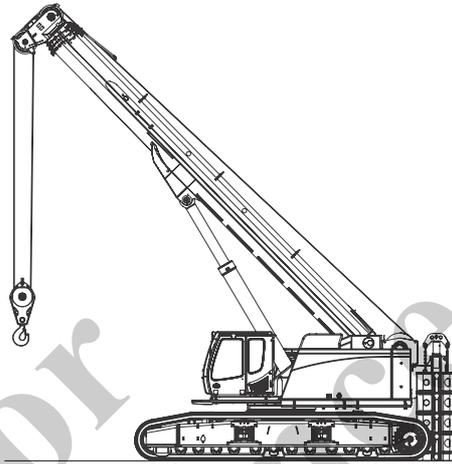


Fig. 173 Positioning aid on the counterweight

00140

For Reference Only

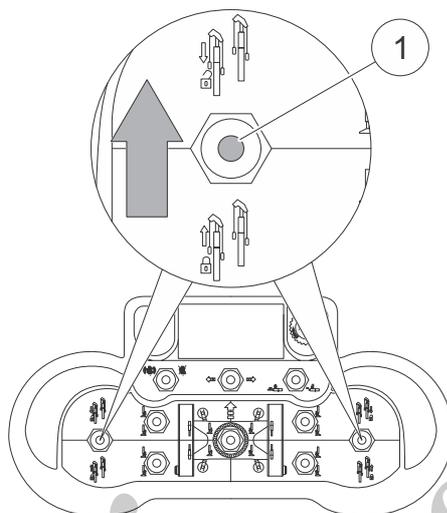
- | | |
|----|--|
| 16 | Carefully reverse the machine toward the counterweight.
Use a banksman and the rear-view camera for assistance. |
|----|--|



00052

Fig. 174 Moving the machine to the counterweight

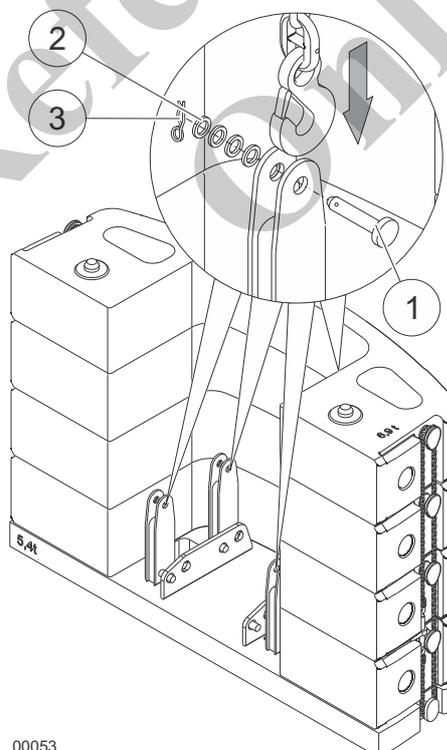
- | | |
|----|---|
| 17 | Exit the cab. |
| 18 | Push the safety lever forward and go to the rear of the machine. |
| 19 | Push both levers (1) in Fig. 175 on the remote radio control forward. <ul style="list-style-type: none">– The ballasting cylinders are retracted. |



00120

Fig. 175 Retracting the ballasting cylinders

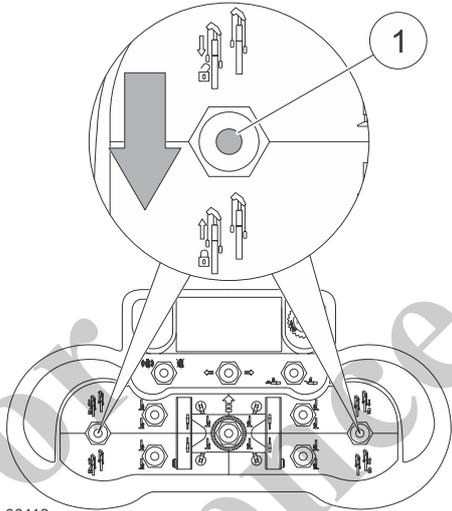
- 20 Use the bolts (1) in Fig. 176 to fasten the chains of the ballasting cylinders to the lifting points on the ballast bracket. Insert the bolts from the inside out. Secure the bolts with washers (2) in Fig. 176 and spring washers (3) in Fig. 176.



00053

Fig. 176 Attaching the counterweight to the hooks of the ballasting cylinders

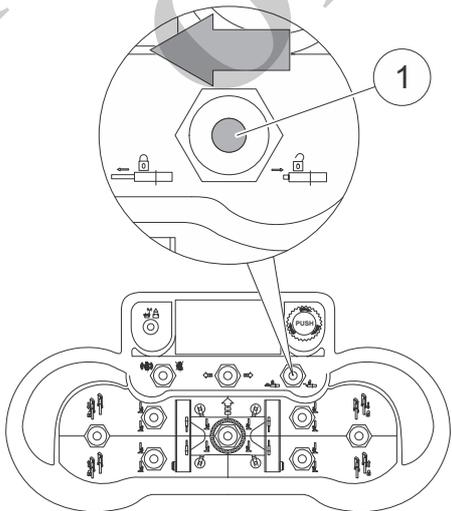
- 21 Push both levers (1) in Fig. 177 on the remote radio control back until the counterweight is lifted up as far as it will go.



00118

Fig. 177 Extending the ballasting cylinders

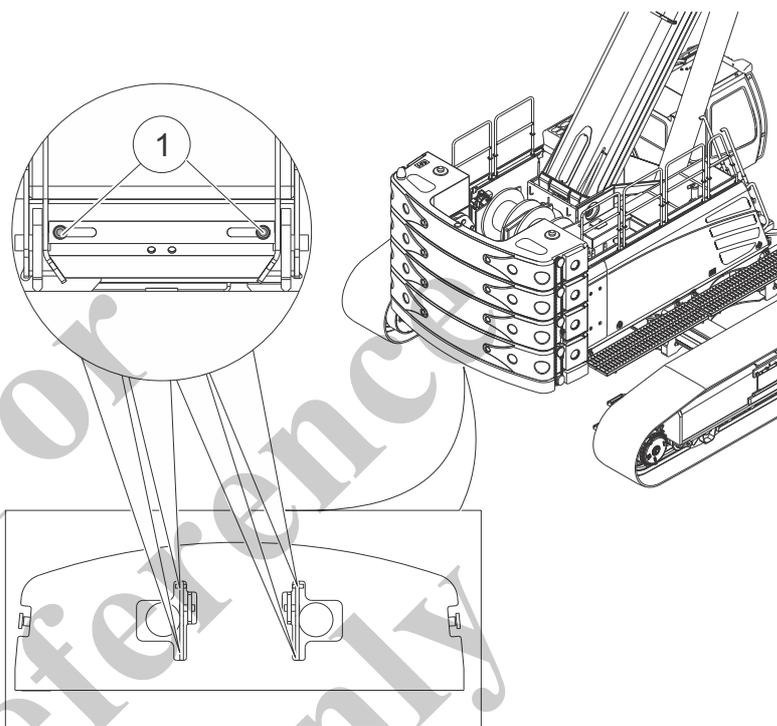
- 22 Push the lever (1) in Fig. 178 on the remote radio control to the left.
 - The counterweight is bolted to the uppercarriage.



00119

Fig. 178 Extending the ballasting cylinders

- 23 From below the counterweight, check that all bolts are correctly extended. The stops of the bolt guides (1) in Fig. 179 must be at the specified position.



00054

Fig. 179 Checking the locking bolts of the ballast bracket

24	Remove the securing bolt (2) in Fig. 180 from the position (1) in Fig. 180 on the underside of the counterweight and insert it into the locking bolt.
25	Secure the securing bolt with a spring cotter pin (3) in Fig. 180.

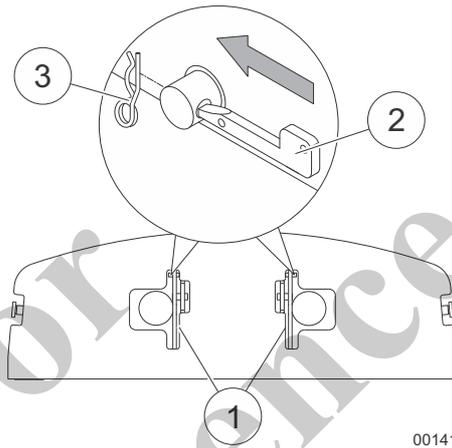


Fig. 180 Securing the counterweight

26	Retract ballasting cylinders.
27	Enter the cab.
28	Pull the safety lever towards you and switch off diesel engine.

7.14 Attaching the fly boom

CAUTION

Danger of falling!

Risk of injury due to falling from a great height.

- At heights over 1.40 m, use a ladder to install or remove the bolts.

WARNING

Danger of severe injury due to unintentional movement of the boom head!

If the switch "Dismount jib" is deactivated, sudden movement of the boom head can cause body extremities to be crushed.

- Ensure that the safety lever is always closed during the attachment procedure.

7.14.1 Attachment - deflection sheave

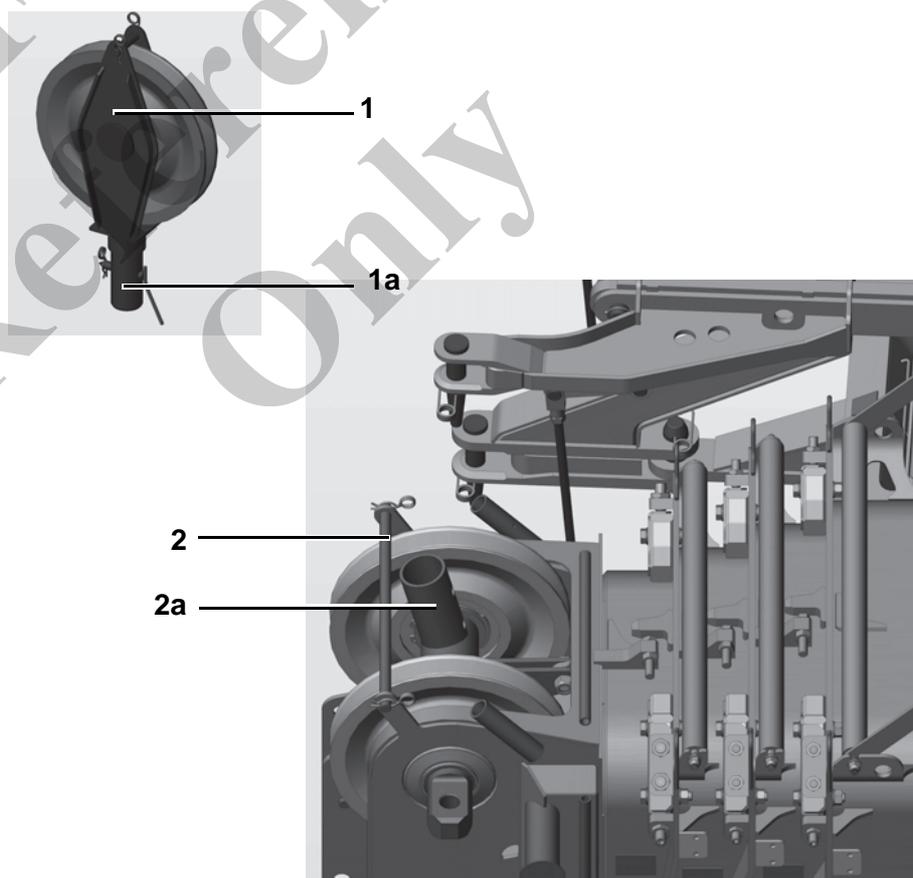
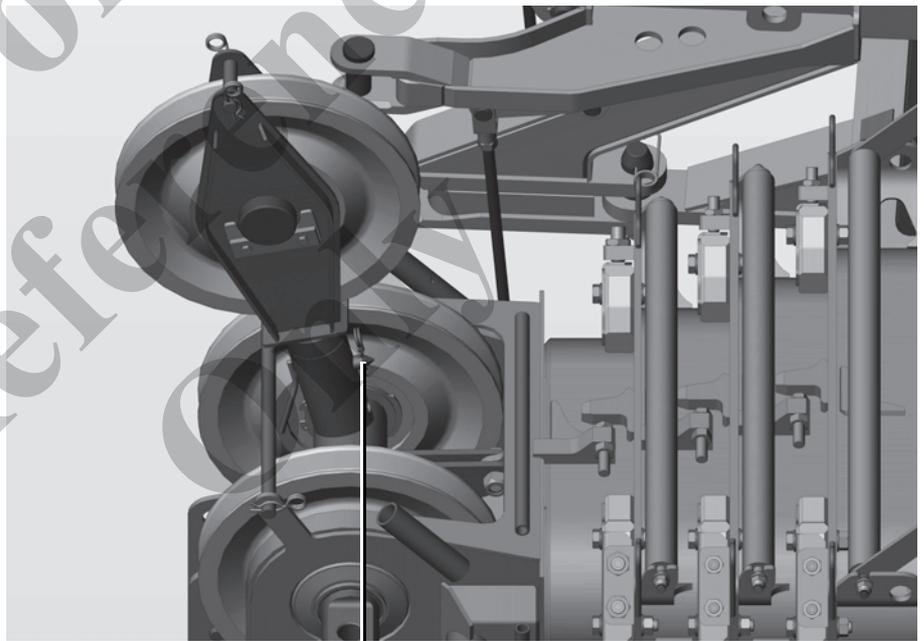


Fig. 181 Elements of the deflection sheave

1	Start the diesel engine.
2	Push the safety lever forward.
3	Completely retract the telescopic boom and put it in 0°-position.
4	Unfasten and pull out the rope guard (2) in Fig. 181 on the top sheave of the pulley head.
5	Provide a deflection sheave (1) in Fig. 181 and lift it into place using a suitable hoisting gear.
6	Use a service ladder to mount the deflection sheave.
7	Push the deflection sheave (1a) in Fig. 181 into the guide tube (2a) in Fig. 181 at the fly boom head.



3

Fig. 182 Position of the bore for securing the deflection sheave

- | | |
|---|---|
| 8 | Bolt and secure the deflection sheave at the bores (3) in Fig. 182 provided for this purpose. |
|---|---|

**Information**

Dismount the deflection sheave in the reverse sequence.

7.14.2 Attaching the fly boom

1	Attach the maximum counterweight.
2	Extend the undercarriage fully.
3	Enter the cab.
4	Start the diesel engine.
5	Select operating mode Setup 2 on the SENCON.
6	Push the safety lever forward.
7	Completely retract the telescopic boom and put it in 0°-position.
8	Place the bottom hook block on the ground.
9	Unreeve the hoist rope from the pulley head and bottom hook block and wind it into the winch.
10	Switch off the diesel engine and pull the safety lever towards you.
11	Attach the deflection sheave.
12	Attach the fly boom to an auxiliary crane using suitable hoisting gear attached to lifting points (1) in Fig. 183.

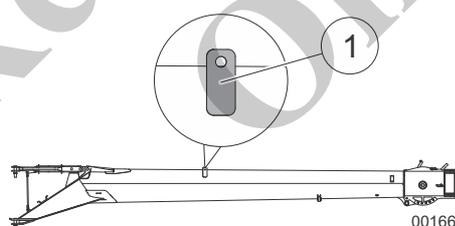


Fig. 183 Lifting points on the fly boom

- | | |
|----|---|
| 13 | Lift the fly boom to the head of the telescopic boom. |
|----|---|

- 14 | Align the fly boom to the telescopic boom head. The bores of the fly boom (2) and the telescopic boom (1) in Fig. 184 must align.

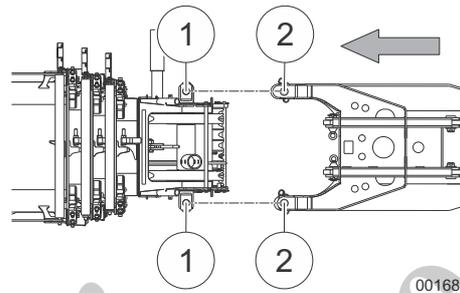


Fig. 184 Lifting the fly boom to the telescopic boom

- 15 | Bolt the fly boom to the telescopic boom at the bolting positions (1) in Fig. 185 and secure them with locking bolts.

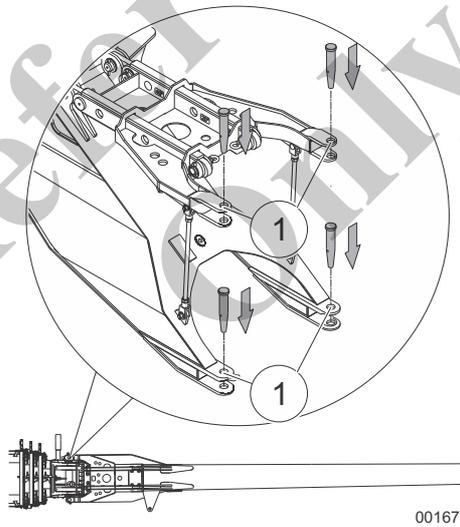


Fig. 185 Bolting the fly boom

- 16 | Detach the lifting gear from the fly boom and move the auxiliary crane out of the work area.
- 17 | Reeve the hoisting rope of winch 1 over the deflection sheave and the fly boom head.

18 Attach the bypass flag to the rope of the lifting limit switch.

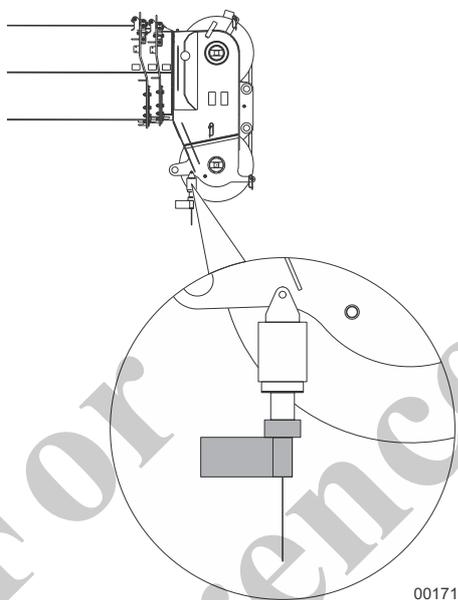


Fig. 186 Bypass flag

19 Unplug the bypass plug (1) in Fig. 187 from the left bush (2) in Fig. 187 on the telescopic boom head and plug it into the right bush (3) in Fig. 187.

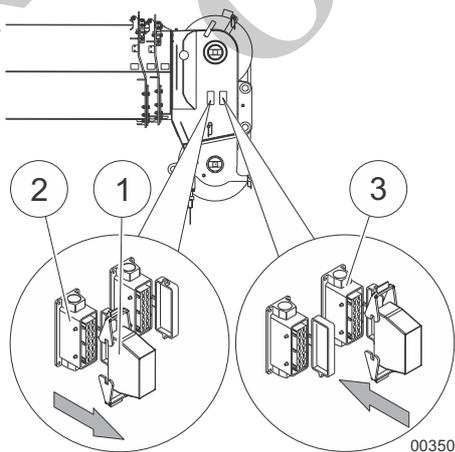


Fig. 187 Plugging the bypass plug on the telescopic boom head

20 Pull the lifting limit switch cable of the fly boom out of the bush in Fig. 188.

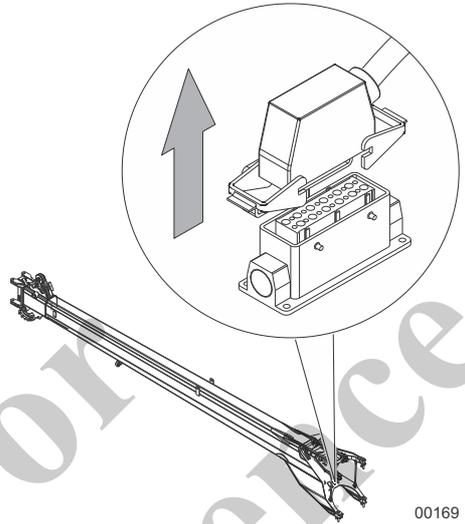


Fig. 188 Lifting limit switch cable

21 Insert the lifting limit switch cable of the fly boom into the left bush of the telescopic boom head.

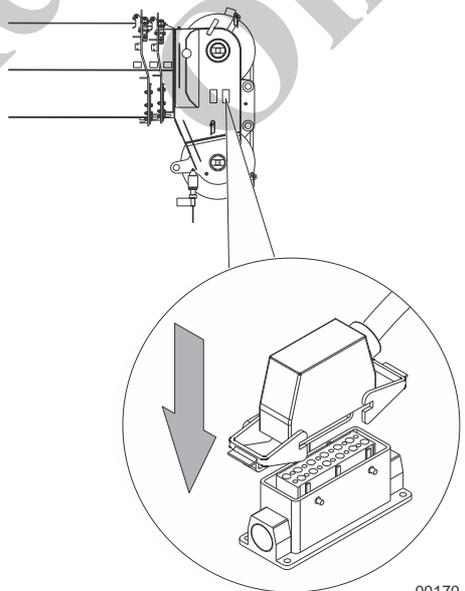


Fig. 189 Lifting limit switch cable

22	Attach the lifting limit switch weight and chain to the lifting limit switch of the fly boom.
23	Attach the bottom hook block.

7.15 Folding the fly boom into transport position

Safety notice

Strictly follow the work step sequence described below!



Information

This procedure requires a space of at least 12 m to the right of the machine.

If the fly boom is attached to the lattice boom extension, it cannot be folded into transport position.

The fly boom must be bolted to the telescopic boom in 0°-position. Fold the fly boom to the 0°-position, if required, see Section 7.15.6.

1	Enter the cab
2	Start the diesel engine.
3	Select operating mode Setup 2 on the SENCON.
4	Push the safety lever forward.
5	Place the bottom hook block on the ground and unreeve it.
6	Remove the lifting limit switch weight and chain from the lifting limit switch of the fly boom.
7	Un-reeve the hoisting cable and winch it in.
8	Completely retract the telescopic boom and put it in 0°-position.

- 9 Remove the lifting limit switch cable of the fly boom from the telescopic boom head and insert it into the storage bush (1) in Fig. 190 on the fly boom.

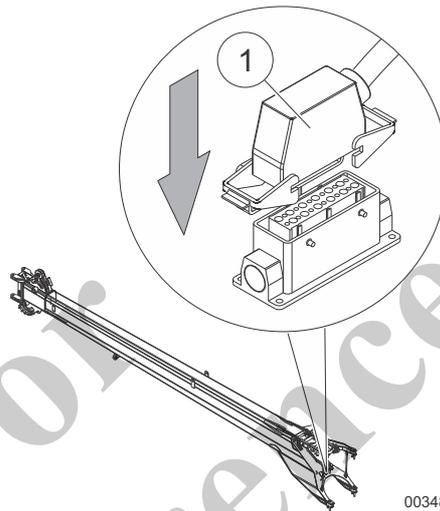


Fig. 190 Cable for lifting limit switch in park position

- 10 Remove the bypass flag of the lifting limit switch on the telescopic boom.

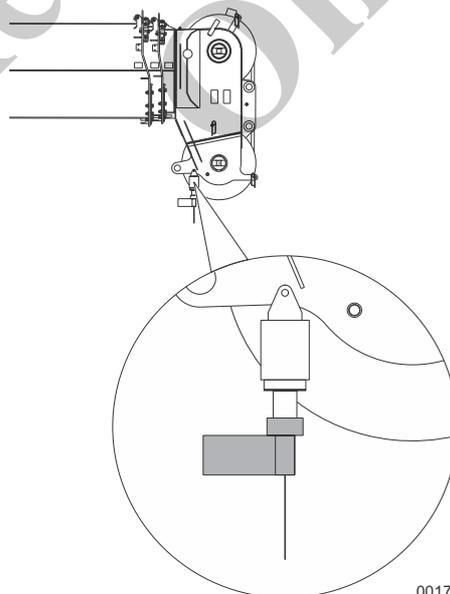


Fig. 191 Removing the bypass flag from the telescopic boom head

- 11 Remove the bypass plug (1) in Fig. 192 from the right bush (2) in Fig. 192 and plug it into the left bush (3) in Fig. 192.

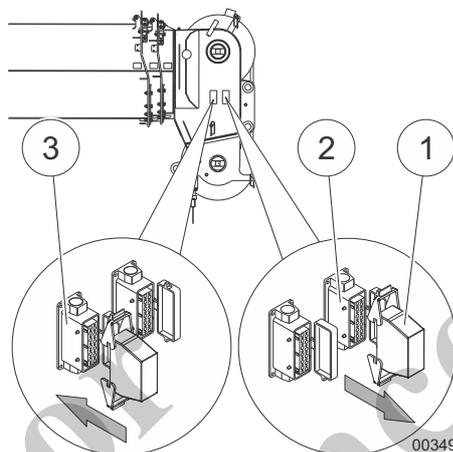


Fig. 192 Inserting the bypass plug on the telescopic boom

- 12 Release the bolt (1) in Fig. 193 on the ramp. Fold out the ramp (2) in Fig. 193.

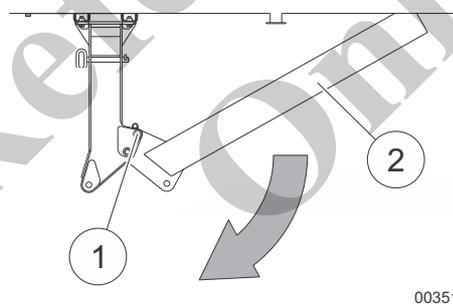


Fig. 193 Releasing and unfolding the ramp

- 13 Insert and secure the bolt (1) in Fig. 194 on the ramp and secure it with the retaining spring (2) in Fig. 194.

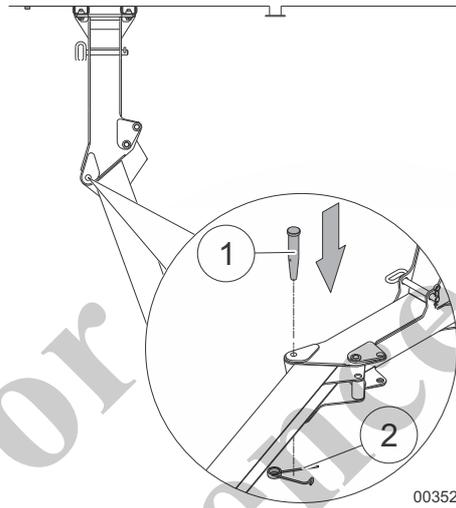


Fig. 194 Bolting the ramp

- 14 Attach a rope to the eye (1) in Fig. 195 on the fly boom.

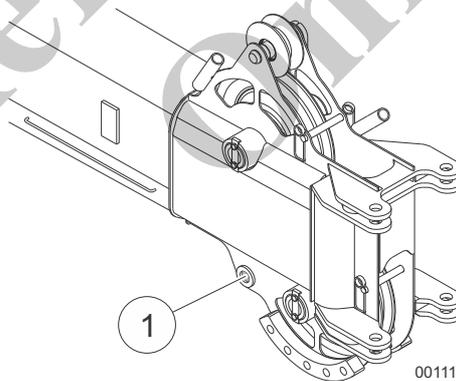


Fig. 195 Attaching a rope for pulling the fly boom around

- 15 Release and remove the bolt (1) in Fig. 196 on the ramp.

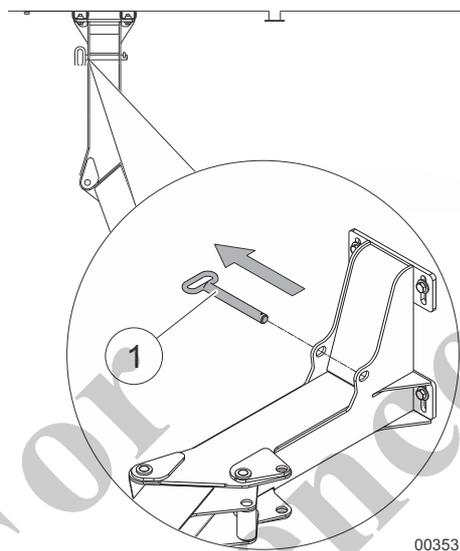


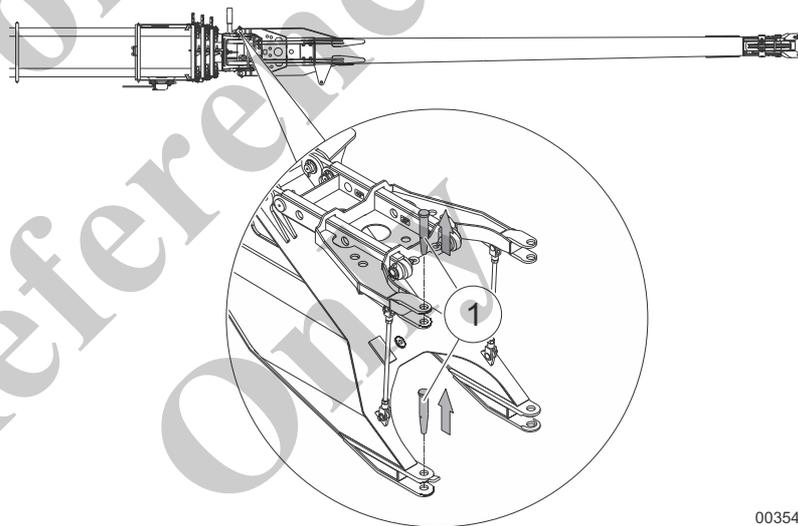
Fig. 196 Unbolting the ramp

⚠ WARNING**Danger of fatal injury due to the fly boom swinging around!**

The fly boom can swing off its support at high speed and severely injure anybody in its swing range.

- Observe the deadweight of the fly boom.
- Ensure that no one is in the danger zone. The pivot radius is at least 12 m.

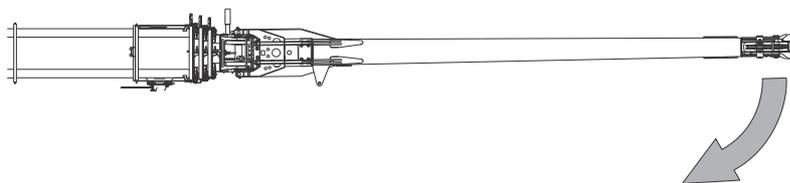
- | | |
|----|---|
| 16 | Check the boom angle. The angle of the boom must be 0°. |
| 17 | Release and drive out the bolts (1) in Fig. 197 on the left side of the boom. |



00354

Fig. 197 Unbolting the fly boom for closing

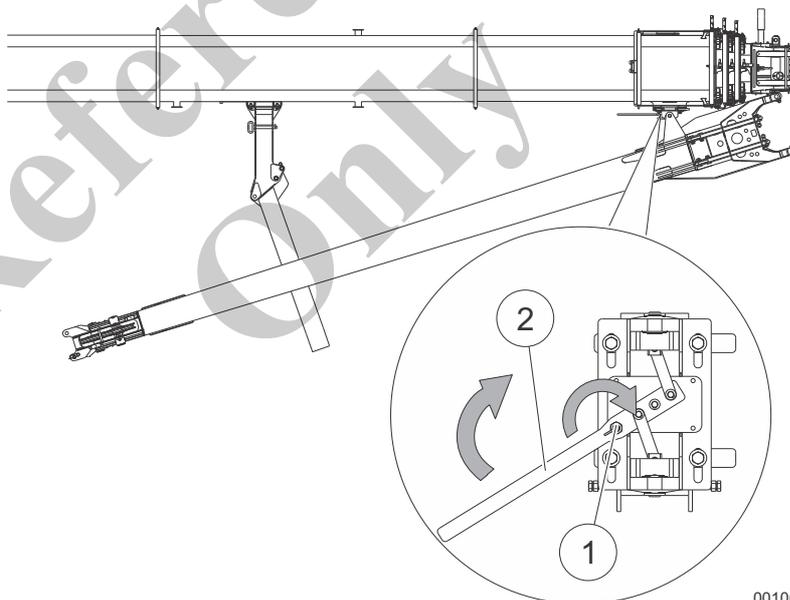
- 18 Use the rope to pull out the fly boom until the lock openings in the fly boom align with those of the telescopic boom.



00355

Fig. 198 Pulling the fly boom around

- 19 Turn the retaining lever (1) in Fig. 199 of the fly boom lock to the right.
- 20 Pull the locking lever (2) in Fig. 199 upward.
– The fly boom lock is released.



00106

Fig. 199 Releasing the fly boom lock

- 21 Pull the fly boom around until it can be bolted to the fly boom lock.

- | | |
|----|--|
| 22 | Turn the locking lever (1) in Fig. 200 downwards and turn the retaining lever (2) in Fig. 200 left.
– The fly boom is engaged with the fly boom lock. |
|----|--|

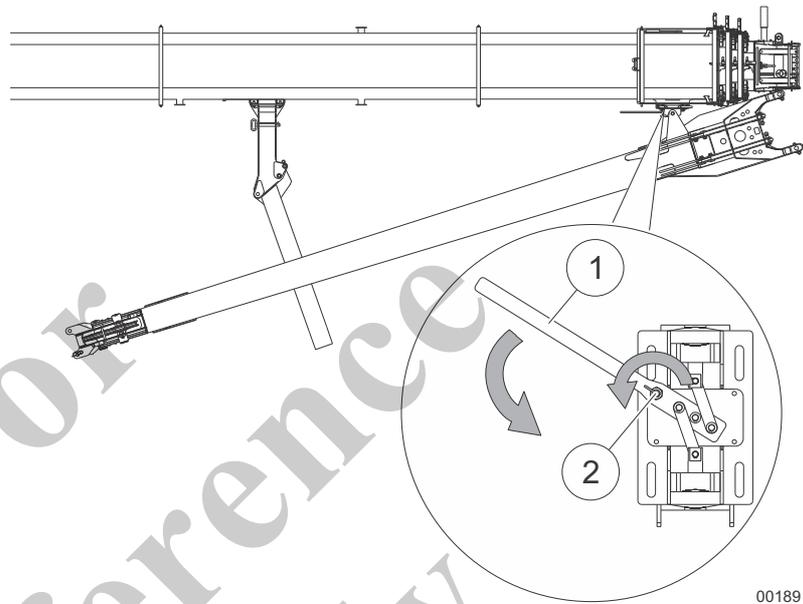


Fig. 200 Engaging the fly boom to the fly boom lock

- | | |
|----|---|
| 23 | Check that the fly boom is correctly engaged with the fly boom lock. |
| 24 | Release and drive out the bolts (1) in Fig. 201 on the right side of the boom head. |
| 25 | Insert and secure the bolts in the parking position. |

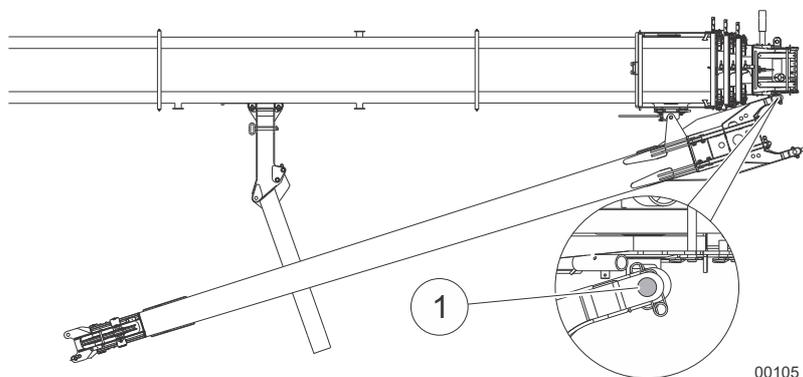
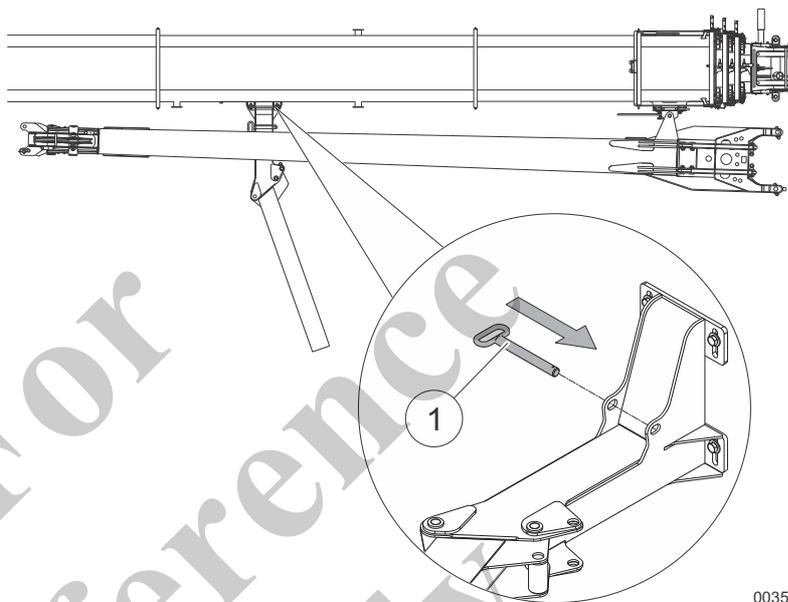


Fig. 201 Removing bolts from the boom head

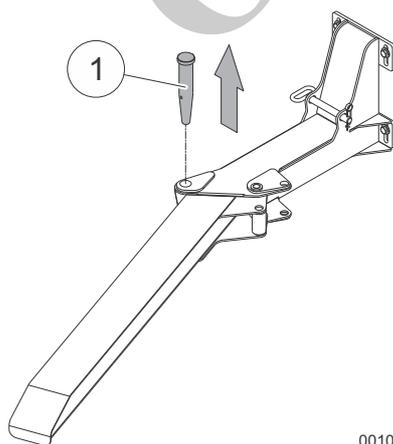
- | | |
|----|---|
| 26 | Use the rope to pull the fly boom around until the fly boom can be secured to the ramp. |
| 27 | Secure the fly boom to the ramp with the bolt (1) in Fig. 202. |



00358

Fig. 202 Securing the fly boom to the ramp

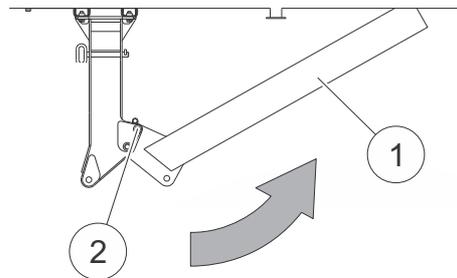
- | | |
|----|--|
| 28 | Pull out the bolt (1) in Fig. 203 at the ramp. |
|----|--|



00109

Fig. 203 Folding the ramp into transport position

29 Fold in the ramp (1) in and secure it with the bolt (2) in Fig. 204 at the position shown.



00110

Fig. 204 Folding in and bolting the ramp

- | | |
|----|---|
| 30 | Release the rope from the fly boom. |
| 31 | Reeve the hoist rope on the telescopic boom. |
| 32 | Attach and secure the lifting limit switch to the telescopic boom head. |
| 33 | Reeve the bottom hook block. |

Reference Only

7.15.1 Folding the fly boom into working position

Safety instructions

- Ensure that the fly boom is correctly bolted to the basic body and secured.
- This procedure requires a space of at least 12 m to the right of the machine.

1	Start the diesel engine.
2	Select operating mode Setup 2 on the SENCON.
3	Push the safety lever forward.
4	Move the telescopic boom to the 0°-position and retract it.
5	Place the bottom hook block on the ground.
6	Unreeve the hoist rope.
7	Completely retract the telescopic boom with the right joystick and hold the joystick in the left position. Push the button Attach jib on the left joystick. <ul style="list-style-type: none"> – The telescopic boom retracts completely. The fly boom can be folded into working position.
8	Release and remove the bolts (1) in Fig. 205 on the fly boom.

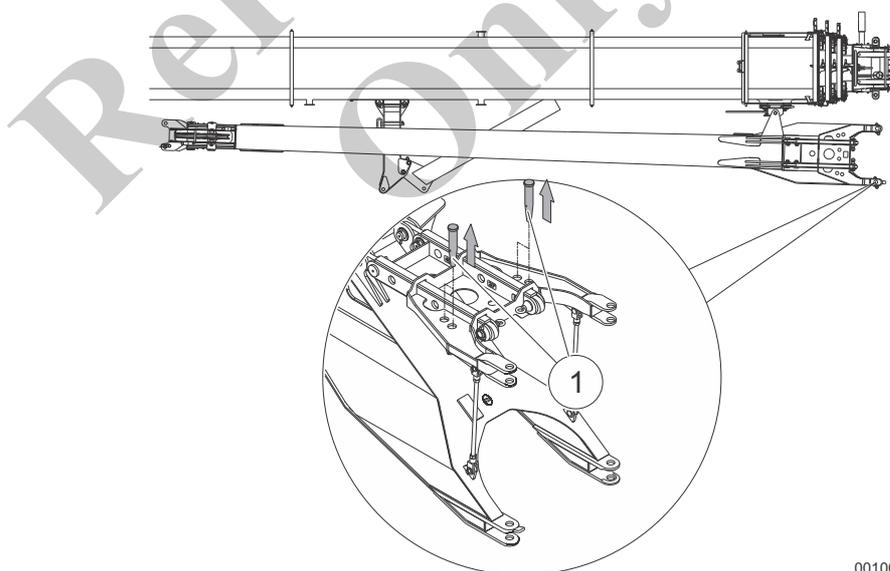


Fig. 205 Pulling out the bolt on the fly boom

9 Attach a rope to the eye (1) in Fig. 206 on the fly boom.

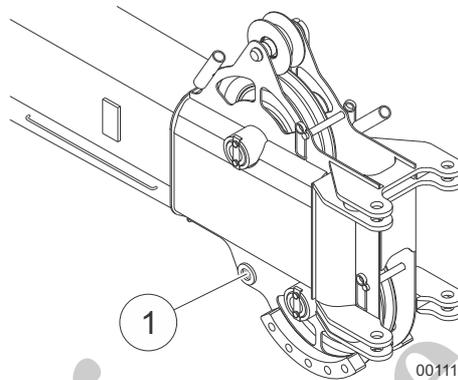


Fig. 206 Attaching a rope for pulling the fly boom around

10 Release and remove the bolt (1) in Fig. 207.

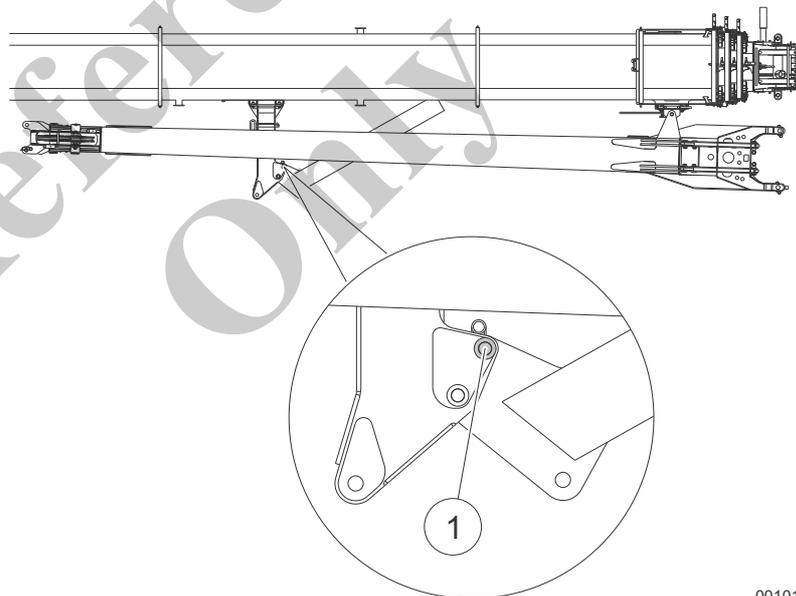
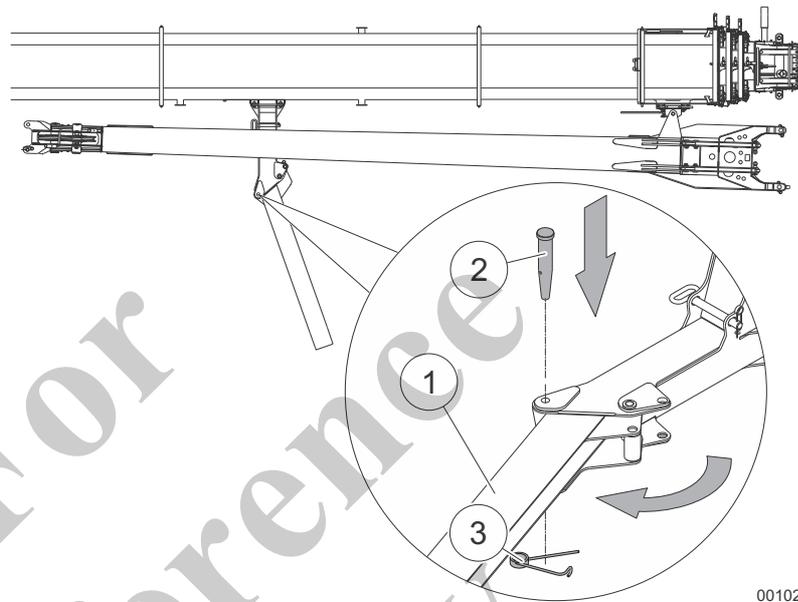


Fig. 207 Unbolting the ramp

- 11 | Fold out the ramp (1) in Fig. 208. Insert the bolt (2) in Fig. 208 at the position shown and secure it with the retaining spring (3) in Fig. 208.



00102

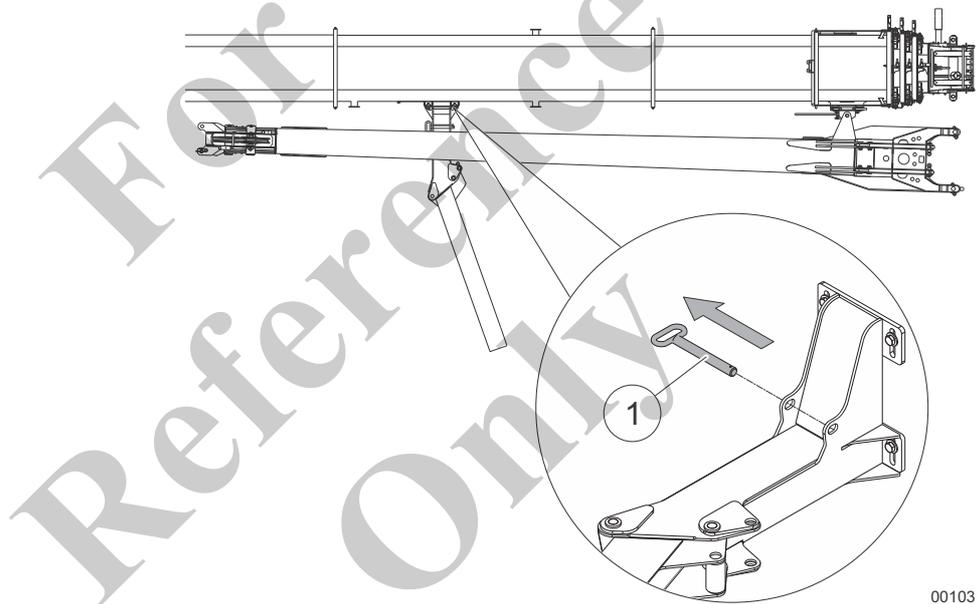
Fig. 208 Bolting the ramp in setup position

⚠ WARNING**Danger of fatal injury due to the fly boom swinging around!**

The fly boom can swing off its support at high speed and severely injure anybody in its swing range.

- Observe the deadweight of the fly boom.
- Ensure that no one is in the danger zone. The pivot radius is at least 12 m.

- 12 Unlock the bolt (1) in on the ramp and pull it out.



00103

Fig. 209 Unbolting the ramp

- 13 Use the rope to pull the fly boom (1) in Fig. 210 until the right-hand bolting openings of the fly boom align with those of the telescopic boom.

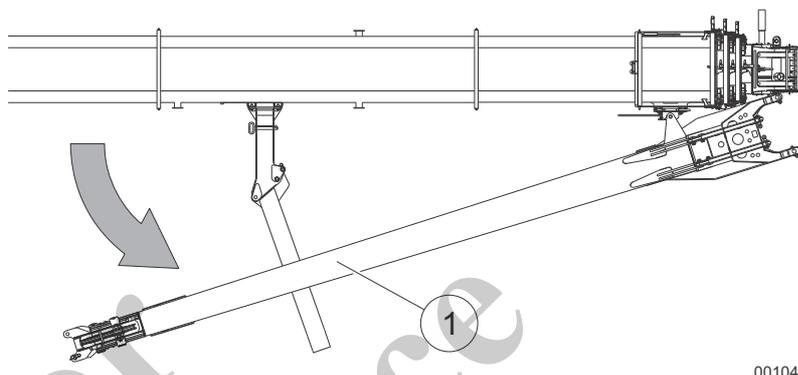


Fig. 210 Unbolting the ramp

- 14 Bolt and secure the fly boom to the telescopic boom at the bolting position (1) in Fig. 211.

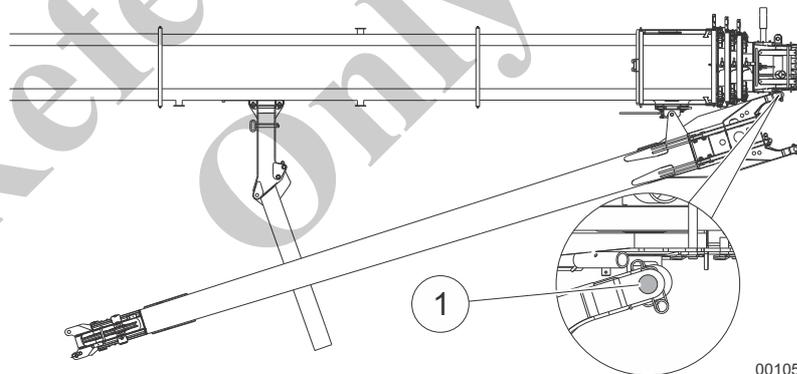


Fig. 211 Bolting the fly boom to the boom head

- 15 Turn the retaining lever (1) in Fig. 212 of the fly boom lock to the right. Pull the locking lever (2) in Fig. 212 upwards.

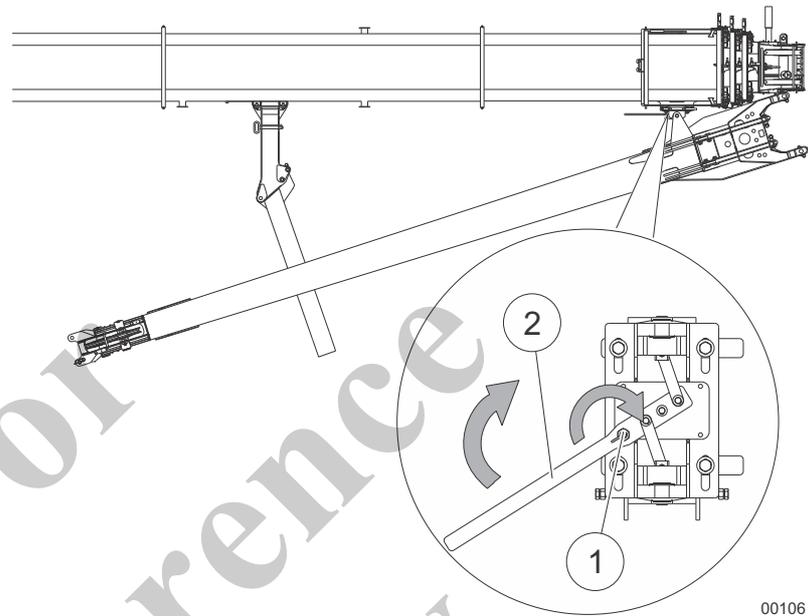


Fig. 212 Releasing the locking mechanism

- 16 Fold the fly boom into working position.

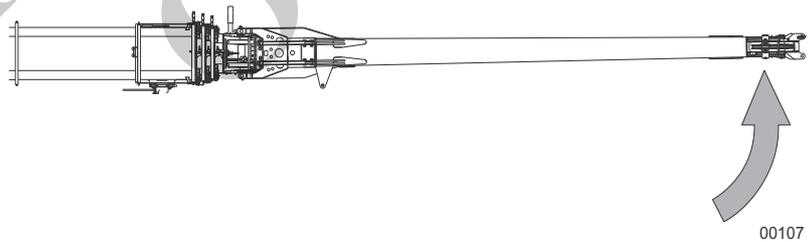
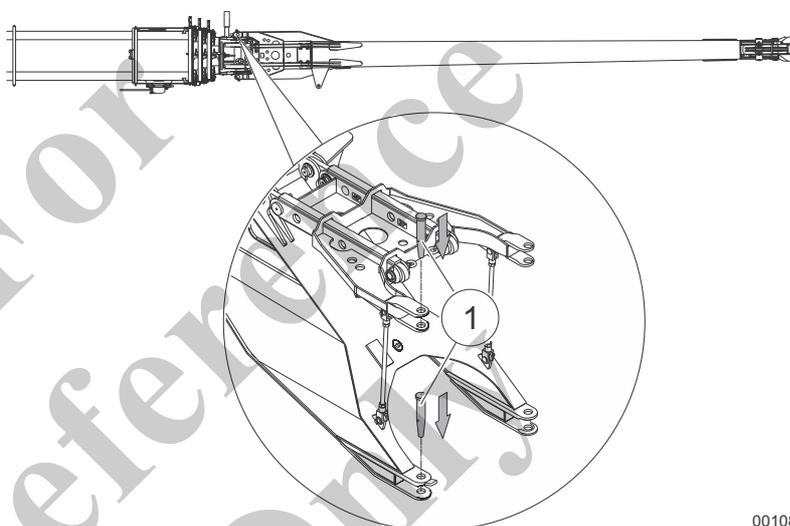


Fig. 213 Folding the fly boom into working position

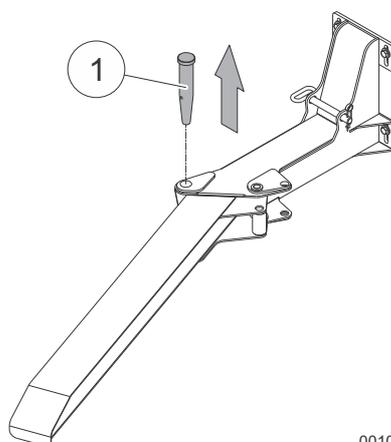
- | | |
|----|--|
| 17 | Bolt the fly boom to the main boom using the bolts (1) in Fig. 214. Start with the bottom bolt. |
| 18 | If problems occur when inserting the top bolt, proceed as follows: <ul style="list-style-type: none">– Insert the bolt as far as possible.– Slowly and carefully extend the boom to 21.6 m (70.8 ft) and lower it until the fly boom touches the ground. Make sure the bolt does not fall out of the hole.– Secure the bolt. |



00108

Fig. 214 Folding the fly boom into working position

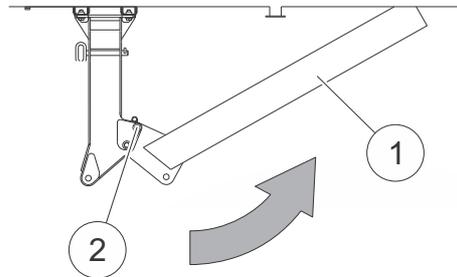
- | | |
|----|--|
| 19 | Pull out the bolt (1) in Fig. 215 at the ramp. |
|----|--|



00109

Fig. 215 Unbolting the ramp

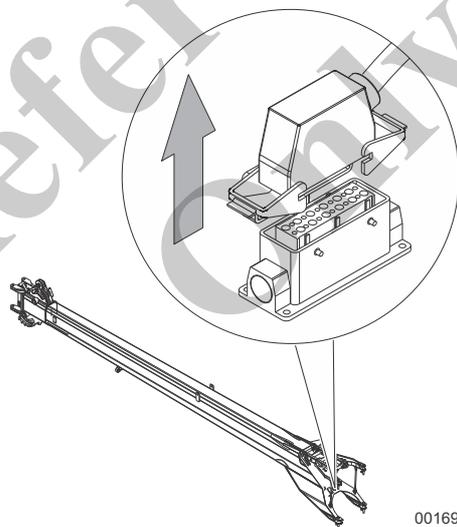
- 20 | Fold in the ramp (1) in Fig. 216 and secure it with the bolt (2) in Fig. 216 at the position specified.



00110

Fig. 216 Folding in and bolting the ramp

- 21 | Unplug the bypass plug on the telescopic boom head.
- 22 | Pull the lifting limit switch cable of the fly boom out of the socket.



00169

Fig. 217 Fly boom lifting limit switch cable

- | | |
|----|---|
| 23 | Plug the fly boom's lifting limit switch cable into the telescopic boom head. |
|----|---|

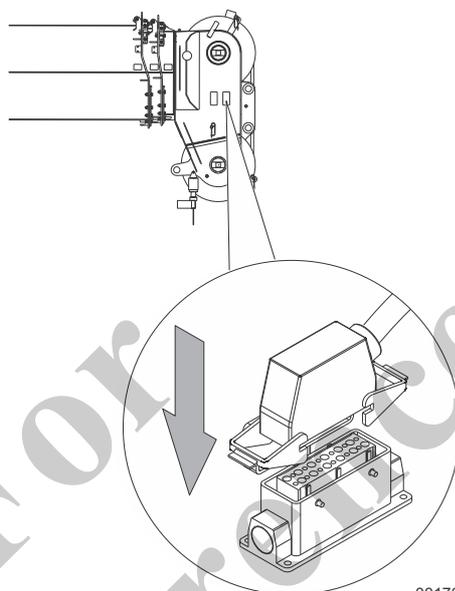


Fig. 218 Connecting the lifting limit switch cable to the telescopic boom

- | | |
|----|---|
| 24 | Attach the lifting limit switch weight and chain to the lifting limit switch of the fly boom. |
| 25 | Reeve the hoisting rope over the fly boom head. |
| 26 | Attach the bottom hook block. |

7.15.2 Folding the fly boom from 0° to 20°



Information

The fly boom can be folded when telescoped in or when telescoped out (maximum 19.3 m).

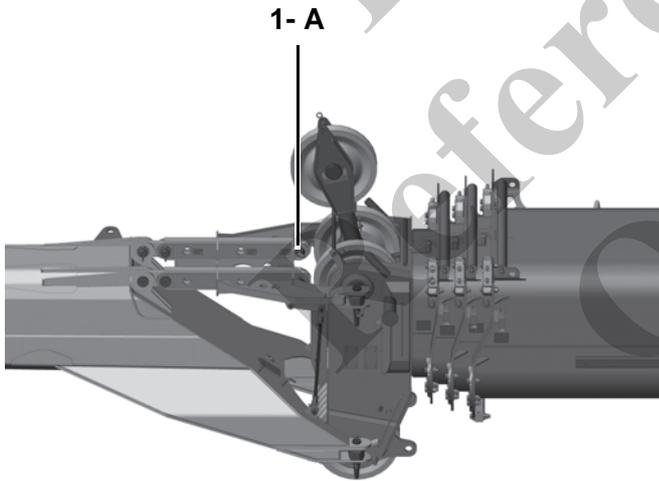
1	Start the diesel engine.
2	Select operating mode Setup 2 on the SENCON.
3	After folding out into working position, the fly boom is bolted in the 0° position.
4	Lower and telescope-out the telescopic boom until the fly boom head rests on the ground or on a suitable support.



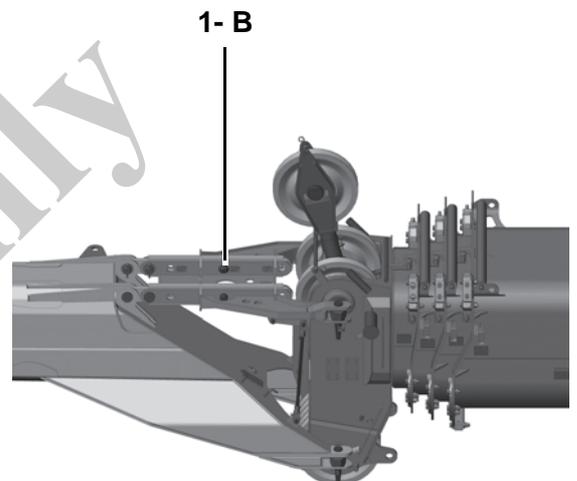
Information

When lifting the boom, the fly boom slides on the support in the direction of the machine (approximately 500 mm).

Do not push the fly boom onto the ground.



Fly boom in 0° position



Fly boom in 20° position

Fig. 219 Bolting the fly boom in 20° position

5	Unlock bolts (1) from position (A) in Fig. 219 right and left, pull them out and insert them in position (B) in Fig. 219 and secure them.
6	Carefully lift the boom, the fly boom swings downward 20°. Carefully lift the boom for operation.



Fly boom in 0° position



Fly boom in 20° position

Fig. 220 Fly boom positions 0° and 20°

7.15.3 Folding the fly boom from 0° to 40°



Information

The fly boom can be folded when telescoped in or when telescoped out.

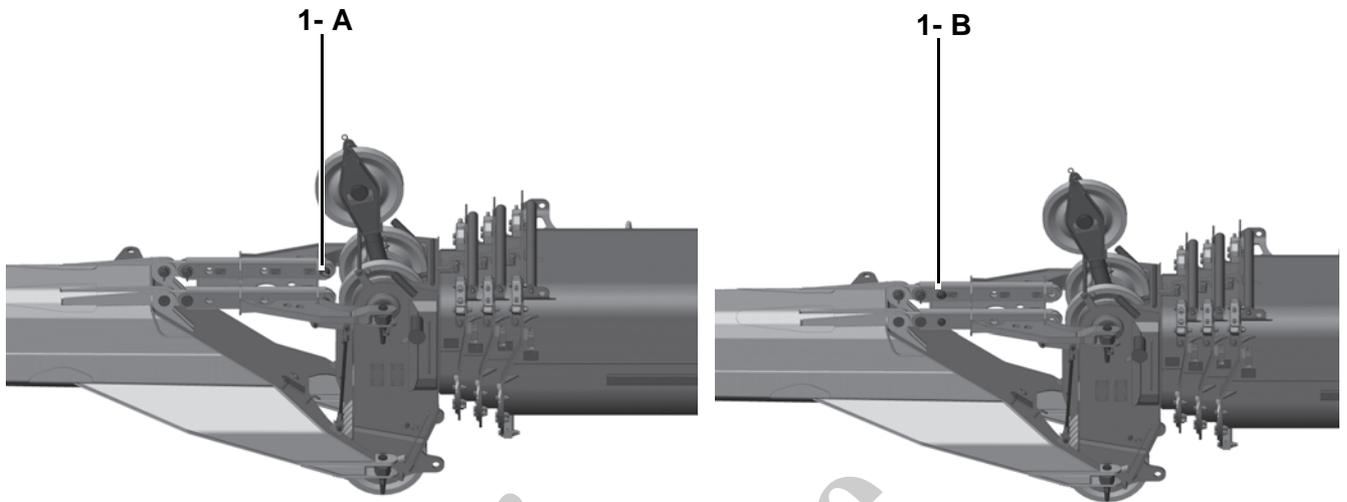
- | | |
|---|---|
| 1 | Start the diesel engine. |
| 2 | Select operating mode Setup2 on the SENCON. |
| 3 | After folding out into working position, the fly boom is bolted in the 0° position. |
| 4 | Lower and telescope-out the telescopic boom until the fly boom head rests on the ground or on a suitable support. |



Information

When lifting the boom, the fly boom slides on the support in the direction of the machine (approximately 1.5 m).

Do not push the fly boom onto the ground.



Fly boom in 0° position

Fly boom in 40° position

Fig. 221 Bolting the fly boom in 40° position

5	Unlock bolts (1) from position (A) in Fig. 221 right and left, pull them out and insert them in position (B) in Fig. 221 and secure them.
6	Carefully lift the boom, the fly boom swings downward 40°. Carefully lift the boom for operation.



Fly boom in 0° position

Fly boom in 40° position

Fig. 222 Fly boom positions 0° and 40°

7.15.4 Folding the fly boom from 20° to 40°

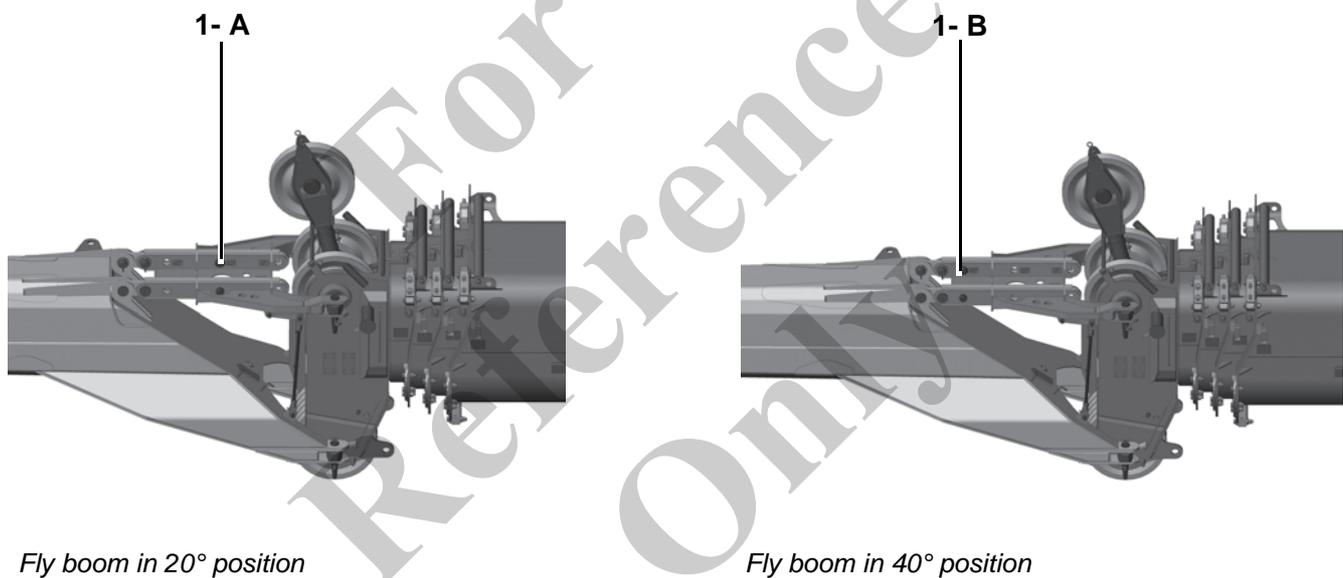
1	Start the engine in accordance with Section 4.4.2.
2	Select operating mode Setup2 on the SENCON.
3	Carefully lower the telescopic boom until the fly boom is supported on the ground or on a suitable support.



Information

When lifting the boom, the fly boom slides on the support in the direction of the machine (approximately 500 mm).

Do not push the fly boom onto the ground.



Fly boom in 20° position

Fly boom in 40° position

Fig. 223 Bolting the fly boom in the 20°-position for the 40°-position

4	Carefully lower the telescopic boom further until the fly boom is extended and the bolt (1) in Fig. 223 can be transferred from position A to B.
5	Unlock the bolts (1) in Fig. 223 position A in sequence left and right, pull them out and insert them in position B and secure them.

6	Carefully lift the telescopic boom, fly boom folds from 20° to 40°.
7	Carefully lift the telescopic boom further for operation.



Fly boom in 20° position



Fly boom in 40° position

Fig. 224 Fly boom positions 20° and 40°

For Reference Only

7.15.5 Folding the fly boom from 40° to 20°

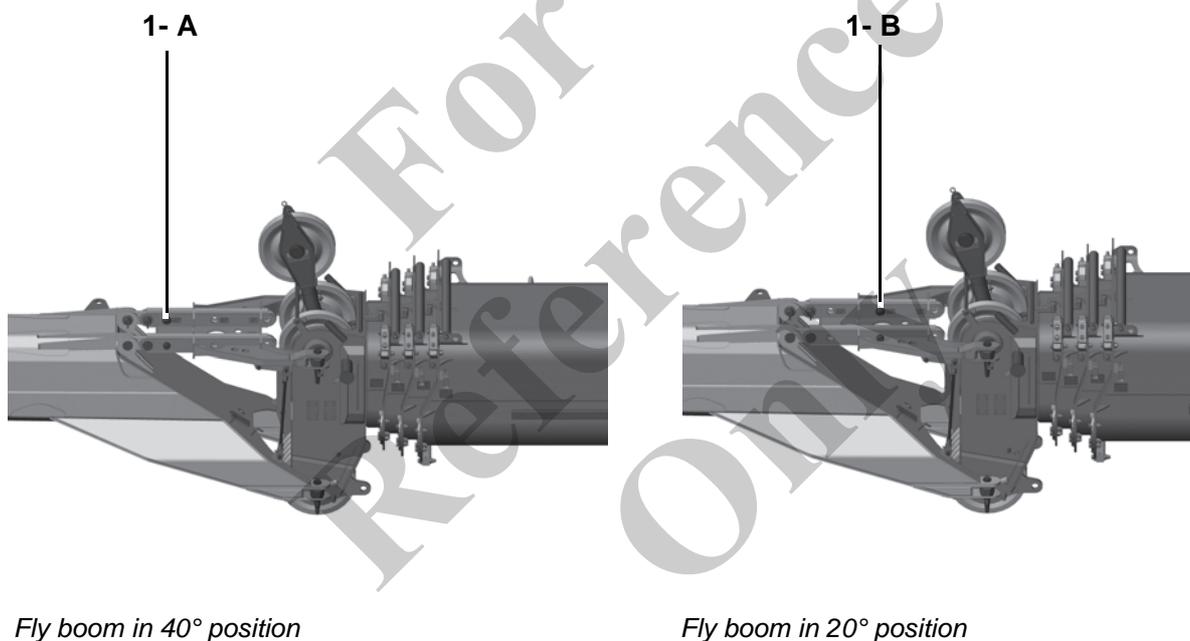
1	Start the diesel engine.
2	Select operating mode Setup 2 on the SENCON.
3	Carefully lower the telescopic boom until the fly boom rests on the ground or on a suitable support.



Information

When lifting the boom, the fly boom slides on the support in the direction of the machine (approximately 1.5 m).

Do not push the fly boom onto the ground.



Fly boom in 40° position

Fly boom in 20° position

Fig. 225 Bolting the fly boom in the 40°-position for the 20°-position

4	Carefully lower the telescopic boom further until the fly boom is extended and the bolt (1) in Fig. 225 can be transferred from position A to B.
5	Unlock the bolts (1) in Fig. 225 in position A in sequence left and right, pull them out and insert them in position B and secure them.
6	Carefully lift the telescopic boom, fly boom folds from 40° to 20°.
7	Carefully lift the telescopic boom further for operation.

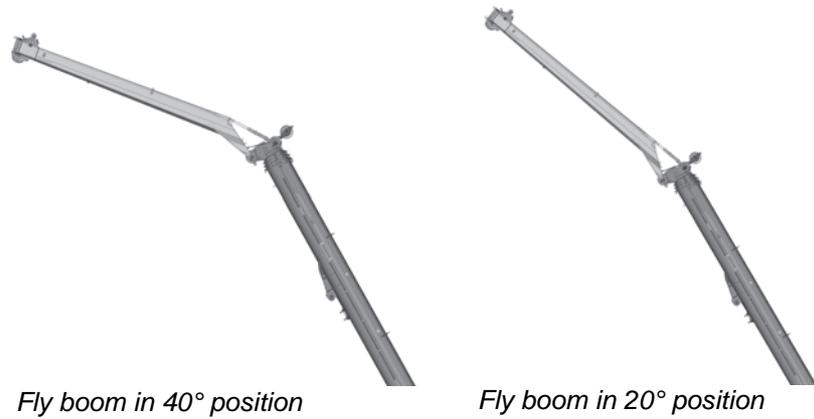


Fig. 226 Fly boom positions 40° and 20°

For
Reference
Only

7.15.6 Folding the fly boom from 20° or 40° to 0°

- | | |
|---|--|
| 1 | Start the engine in accordance with Section 4.4.2. |
| 2 | Select operating mode Setup2 on the SENCON. |
| 3 | Carefully lower the telescopic boom until the fly boom head is supported on the ground or on a suitable support. |

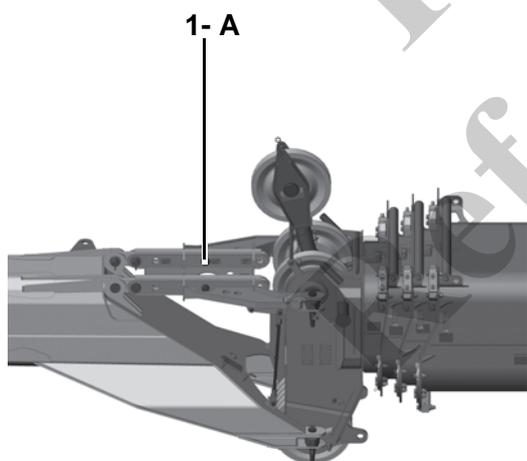


Information

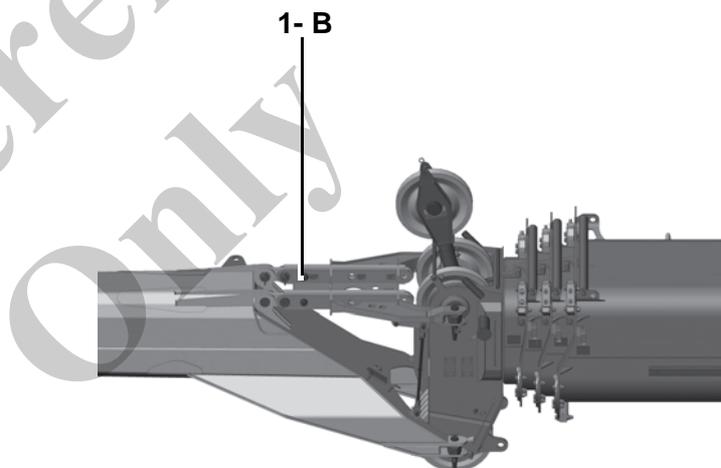
When lifting the boom, the fly boom slides on the support in the direction of the machine (approximately 1.5 m).

Do not push the fly boom onto the ground.

- | | |
|---|--|
| 4 | Carefully lower the telescopic boom further until the fly boom is extended and the bolt (1) can be inserted in position C. |
|---|--|



Fly boom in 20° position



Fly boom in 40° position

Fig. 227 Bolting the fly boom in the 20°/40°-position for the 0°-position

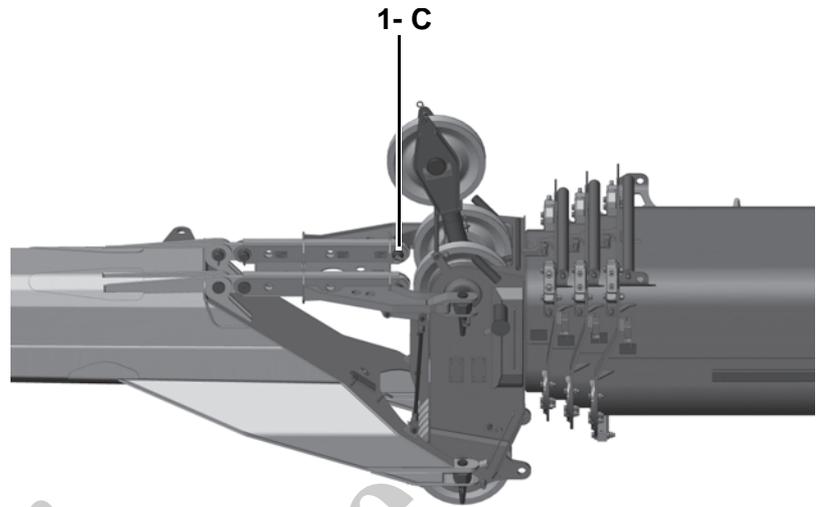


Fig. 228 Fly boom in 0° position

5	Unlock the bolt (1) in Fig. 228 from position A or B left and right, pull it out and insert it in position C and secure it.
6	Carefully lift telescopic boom for operation.



Fly boom in 0° position



Fly boom in 20° position



Fly boom in 40° position

Fig. 229 Fly boom positions 0°, 20° and 40°

7.15.7 Attaching the fly boom extension (7 m)

CAUTION

Danger of falling without fall arrest equipment!

Risk of injury when falling off the machine.

- At heights over 1.40 m, use a ladder to install or remove the bolts.
- Do not climb on the telescoping boom or the fly boom.

1	Start the diesel engine.
2	Select operating mode Setup 2 on the SENCON.
3	Completely retract the telescopic boom with the fly boom (1) in Fig. 230 attached and lower it to a boom angle of 0°.
4	Place the bottom hook block on the ground.
5	Reeve out the hoist rope from the fly boom and the bottom hook block.
6	Using suitable load suspension equipment (minimum load-bearing capacity 2000 kg), hook the fly boom extension (2) in Fig. 230 onto an auxiliary crane and move it near the fly boom (1) in Fig. 230.
7	Lift/lower the fly boom extension using the auxiliary crane until the bores of the fork elements (1a, 1b) in Fig. 230 on the fly boom head and the bores of the straps (2a, 2b) in Fig. 230 on the fly boom extension align and the bolts can be inserted.
8	Insert the bolts (3) in Fig. 230 on the right and left, top and bottom, and secure them with retaining springs.
9	Detach the suspension gear and move the auxiliary crane out of the work area.
10	Guide the hoist rope of winch 1 over the deflection sheave of the main boom and to the head of the fly boom. Guide the hoist rope further between the small (6) in Fig. 231 and large sheave on the fly boom head and further over the sheave on the end of the fly boom extension, and reeve it in between the sheave on the fly boom and bottom hook block.
11	Plug the connecting cable for (fly boom) lifting limit switch (4) in Fig. 231 into the power socket of the fly boom (5) in Fig. 231.

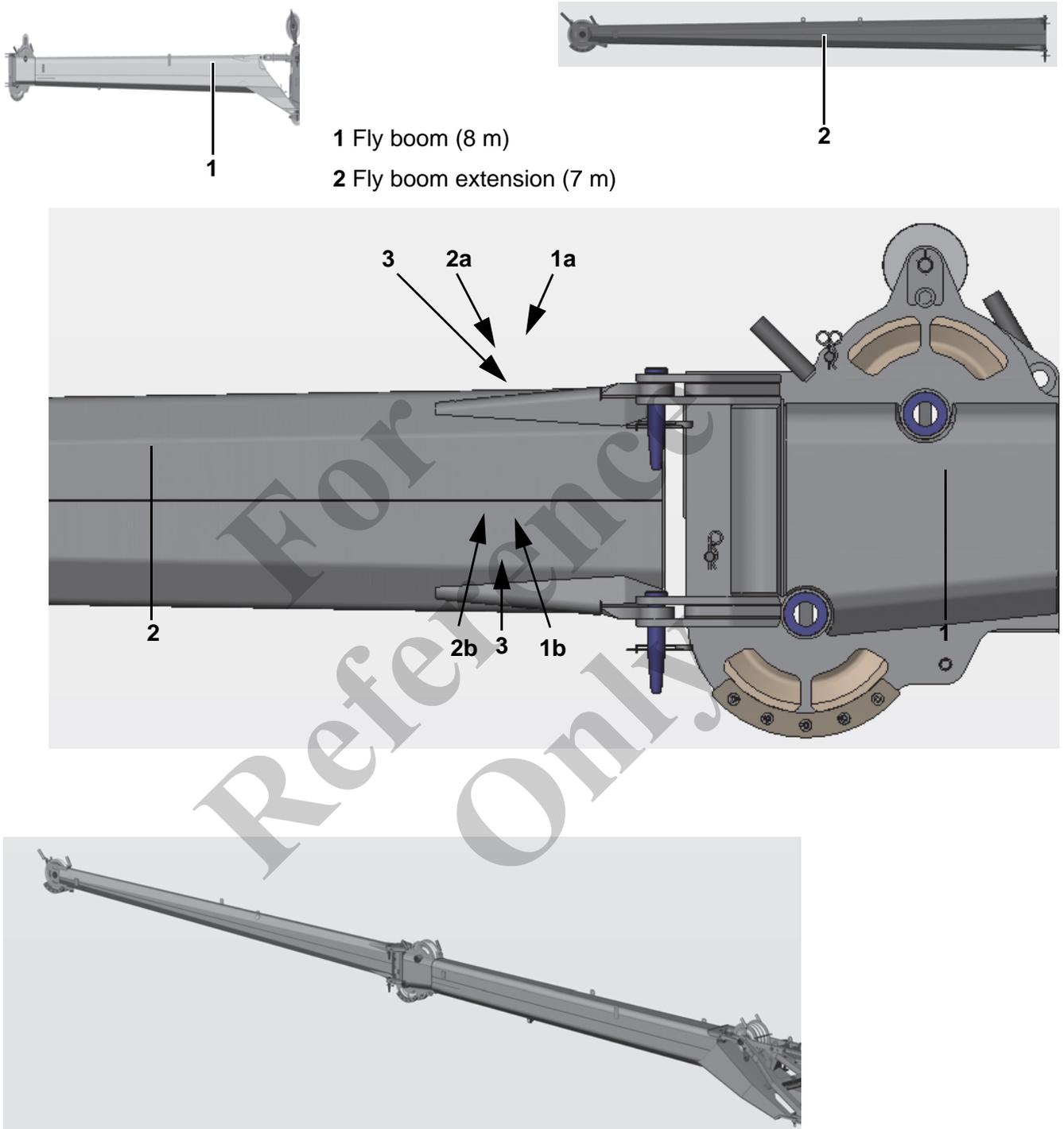


Fig. 230 Connection between fly boom extension and fly boom

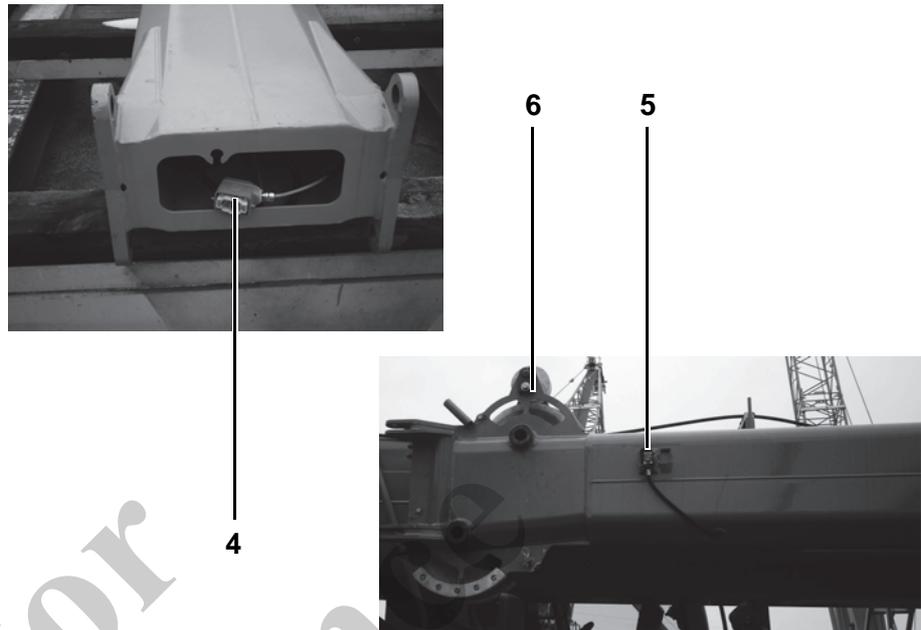


Fig. 231 Connecting the lifting limit switch to the fly boom extension

- 12 Fasten the lifting limit switch to the fly boom extension (6) in Fig. 231 and plug it into the corresponding power socket (7) in Fig. 232.

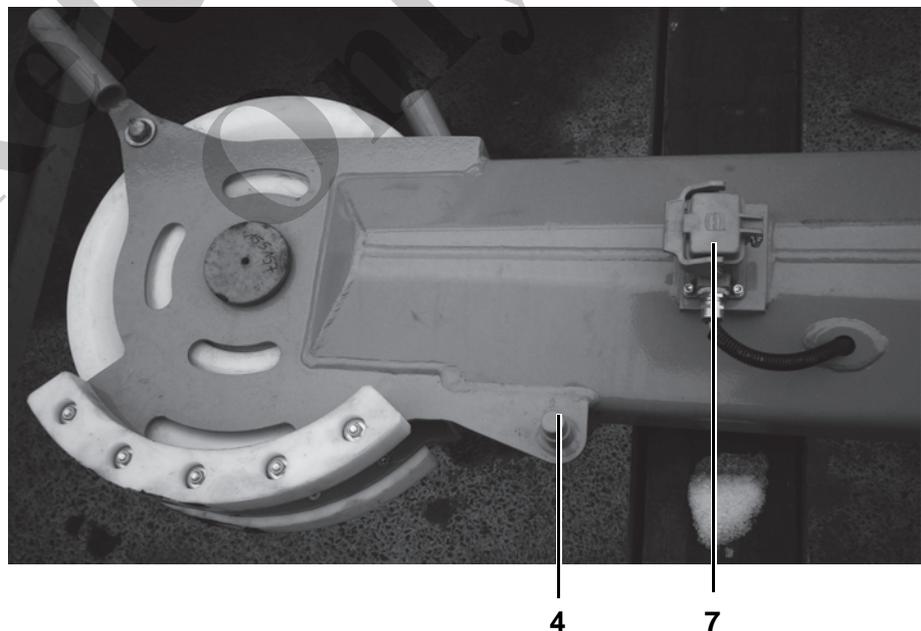


Fig. 232 Connecting the lifting limit switch to the fly boom extension

- 13 Attach the lifting limit switch weight and chain to the lifting limit switch.

7.16 Attaching the lattice boom extension

7.16.1 Attaching the lattice boom headpiece to the lattice boom section

1	Release and remove the bolts (1) in Fig. 233 from the parking positions on the lattice boom head.
2	Prepare wooden planks approx. 400 mm tall as supports for the lattice boom section.
3	Lift the lattice boom section onto the wooden planks.

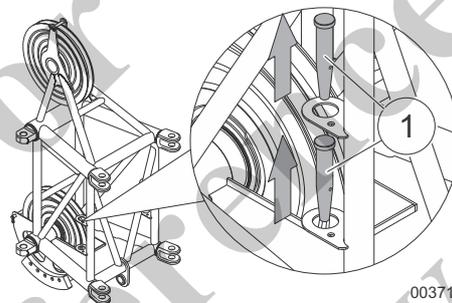


Fig. 233 Removing the bolts on the lattice boom headpiece

4	Attach the lattice boom headpiece to an auxiliary crane and lift it onto the lattice boom section.
5	Align the lattice boom headpiece with the lattice boom section. The bore holes of the lattice boom headpiece (2) in Fig. 234 must line up with those of the lattice boom section (1) in Fig. 234.

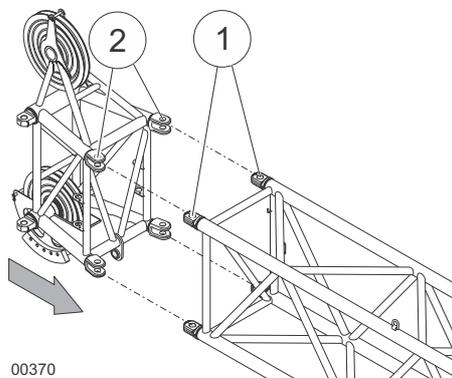


Fig. 234 Lifting the lattice boom headpiece to the lattice boom section

6	Insert the bolts in the bore holes (1) in Fig. 234 on the lattice boom section and secure them with retaining springs.
7	Remove the lifting equipment from the lattice boom headpiece and drive the auxiliary crane out of the work area.

7.16.2 Attaching the lattice boom section

The length of the crane's boom can be extended with one or two lattice boom sections. Before attaching it to the telescopic boom head, the lattice boom headpiece must be attached to the outer lattice boom section. Attaching the lattice boom sections to the telescopic boom head is the same with the lattice boom headpiece attached or not.

Preliminary work

1	Attach the lattice boom headpiece to the outer lattice boom section.
2	Extend the undercarriage fully.
3	Attach the maximum counterweight.

Attaching the lattice boom section

1	Enter the cab.
2	Start the diesel engine.
3	Select operating mode Setup 2 on the SENCON.
4	Push the safety lever forward.
5	Completely retract the telescopic boom and put it in 0°-position.
6	Place the bottom hook block on the ground.
7	Reeve out the hoist rope from the pulley head and the bottom hook block.
8	Switch off the diesel engine and pull the safety lever towards you.

- 9 Insert the deflection sheave (1) in Fig. 235 into the holder on the telescopic boom and secure it with the bolt (2) in Fig. 235.

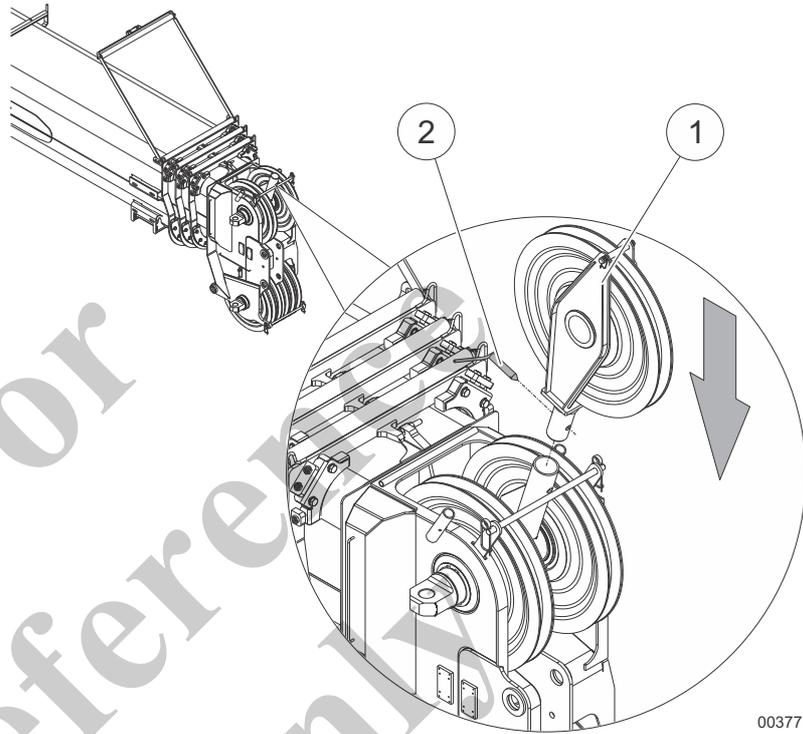


Fig. 235 Attaching the deflection sheave

- 10 Attach suitable lifting equipment to the lifting points (1) in Fig. 236 on the lattice boom section and then to an auxiliary crane.

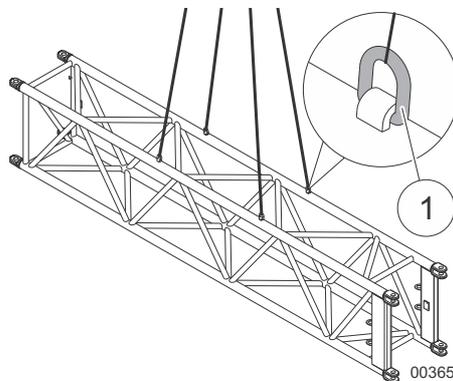


Fig. 236 Lifting points on the lattice boom section

11	Lift the lattice boom section to the boom head of the telescopic boom.
12	Align the fly boom to the telescopic boom head. The bore holes of the lattice boom section (2) in Fig. 237 must line up with those of the telescopic boom (1) in Fig. 237.

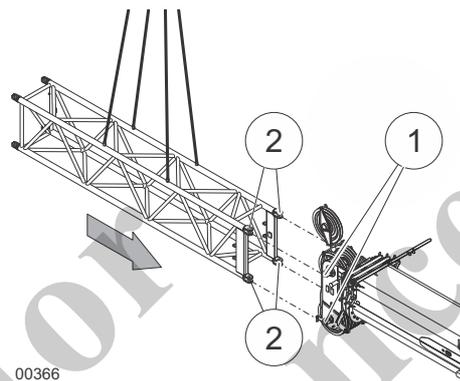


Fig. 237 Lifting the fly boom to the telescopic boom

13	Bolt the lattice boom section to the telescopic boom at the bolting positions (1) in Fig. 238 and secure with locking bolts.
----	--

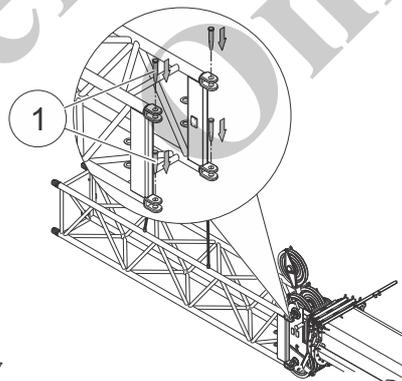
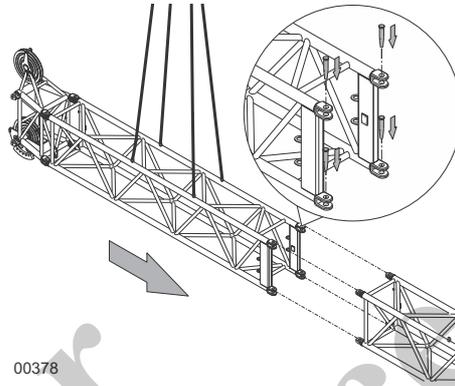


Fig. 238 Bolting the fly boom

14	Detach the lifting gear from the fly boom and move the auxiliary crane out of the work area.
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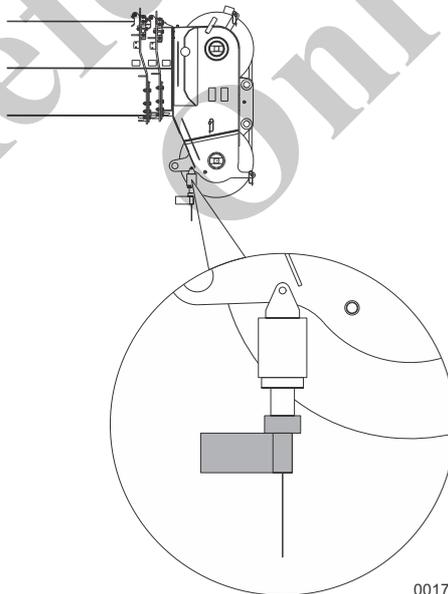
- | | |
|----|--|
| 15 | If necessary, attach the lattice boom section with the lattice boom headpiece installed. |
|----|--|



00378

Fig. 239 Attaching the lattice boom section with the lattice boom headpiece installed

- | | |
|----|--|
| 16 | Reeve the hoist rope from winch 1 over the deflection sheave on the telescopic boom and over the lattice boom headpiece. |
| 17 | Attach the bypass flag to the rope of the lifting limit switch. |



00171

Fig. 240 Bypass flag

- 18 Unplug the bypass plug (1) in Fig. 241 from the left bush (2) in Fig. 241 on the telescopic boom head and plug it into the right bush (3) in Fig. 241.

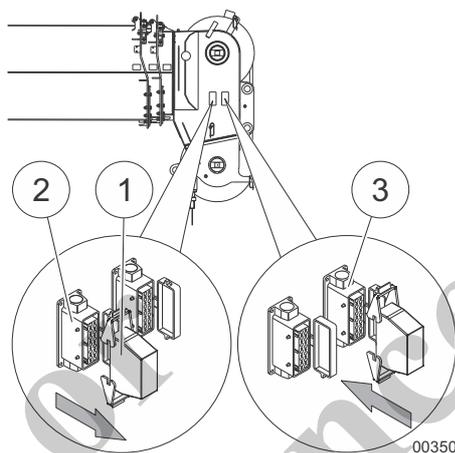


Fig. 241 Plugging the bypass plug on the telescopic boom head

- 19 Pull the lifting limit switch cable on the lattice boom section out of the socket in Fig. 242.

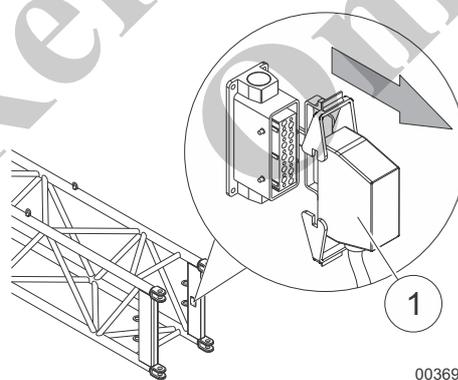


Fig. 242 Lifting limit switch cable

- | | |
|----|--|
| 20 | Insert the lifting limit switch cable on the lattice boom section into the left socket on the telescopic boom. |
|----|--|

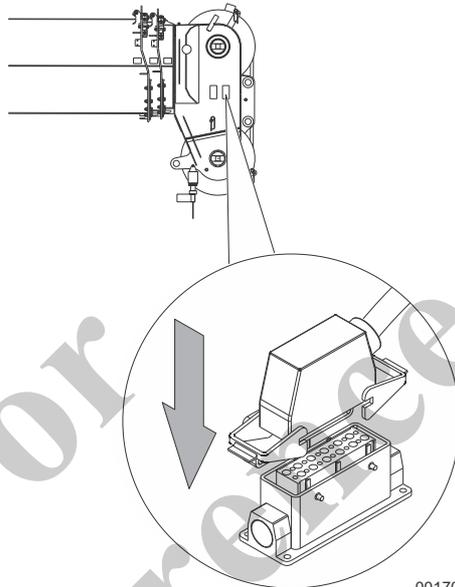


Fig. 243 Lifting limit switch cable

00170

- | | |
|----|---|
| 21 | Attach the lifting limit switch weight and chain to the lifting limit switch on the lattice boom headpiece. |
| 22 | Attach the bottom hook block. |

7.17 Attaching the auxiliary jib

1	Start the diesel engine.
2	Select operating mode Setup 2 on the SENCON.
3	Fully retract the telescopic boom and lower it to installation height.
4	Place the bottom hook block on the ground.
5	Unreeve the hoist rope.
6	Bring the auxiliary jib (1) in Fig. 244 to the boom pulley head (2) in Fig. 244 and attach it.

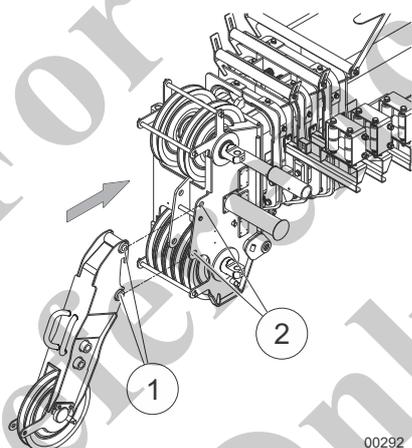


Fig. 244 Lifting the auxiliary jib to the telescopic boom

- | | |
|---|---|
| 7 | Insert the bolts (1) in Fig. 245 and secure with retaining springs. |
|---|---|

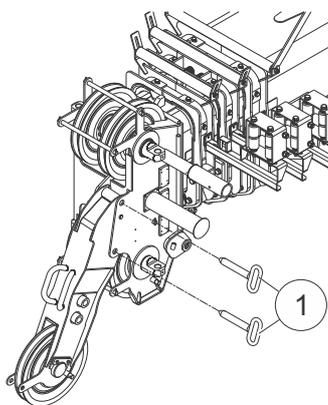


Fig. 245 Bolting the auxiliary jib to the telescopic boom

Reeving the hoist rope

- | | |
|---|---|
| 1 | Guide the hoist rope of winch 1 over the sheave of the telescopic boom and over the sheave of the auxiliary jib. |
| 2 | Unplug the bypass plug (1) in Fig. 246 from the left bush on the telescopic boom head and plug it into the right bush. |
| 3 | Attach the lifting limit switch (3) in Fig. 246 to the auxiliary jib and insert it into the left power socket on the telescopic boom (2) in Fig. 246. |

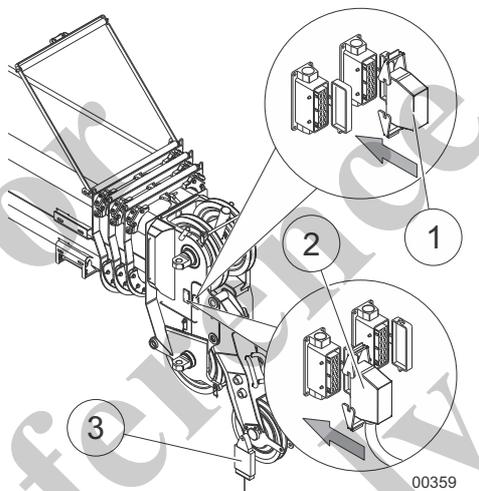


Fig. 246 Attaching the lifting limit switch of the auxiliary jib to the telescopic boom

- | | |
|---|---|
| 4 | Guide the hoist rope through the weight (2) in Fig. 247 and attach the chain (1) in Fig. 247 to the lifting limit switch on the left side as seen in direction of travel. |
|---|---|

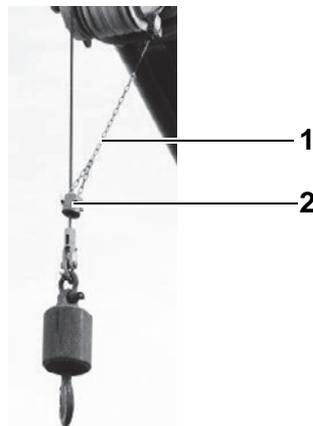


Fig. 247 Lifting limit switch weight

- 5 Insert the rope guard (1) in Fig. 248 into the auxiliary jib sheave and secure it with spring cotter pins (2) in Fig. 248.

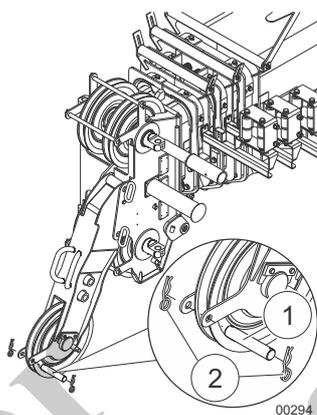


Fig. 248 Attaching the rope guard to the auxiliary jib

- 6 Attach the bottom hook block.



Information

Removal of the auxiliary jib is the reverse of installation.

7.18 Emergency control

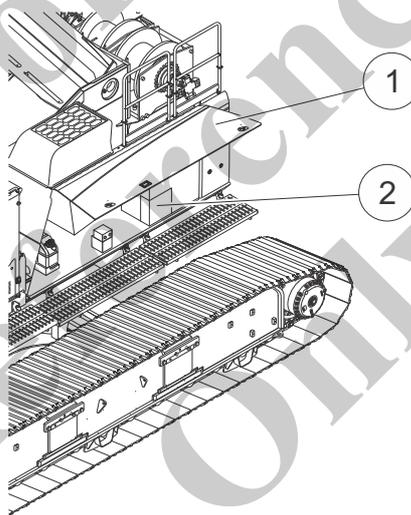


Information

Chapter Emergency control describes how the functions of the remote radio control can be activated if the remote radio control is out of order. Preparatory measures such as setting the setup program or stabilizing the machine with outriggers must still be carried out and are described elsewhere in this manual.

7.18.1 Extending outrigger cylinders

- 1 Open the left maintenance hatch (1) and open the switchgear cabinet (2) in Fig. 249.



00127

Fig. 249 Left maintenance hatch and switchgear cabinet

- 2 Press the switch (4) in Fig. 250 in the switchgear cabinet upward.
 - The emergency control is ready for operation.

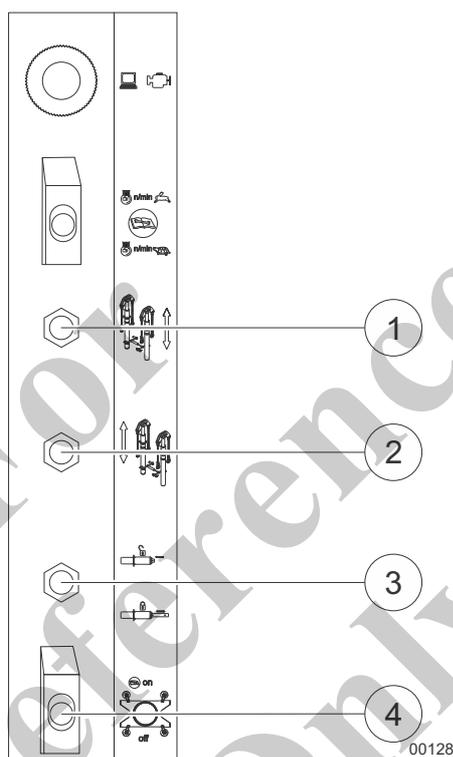
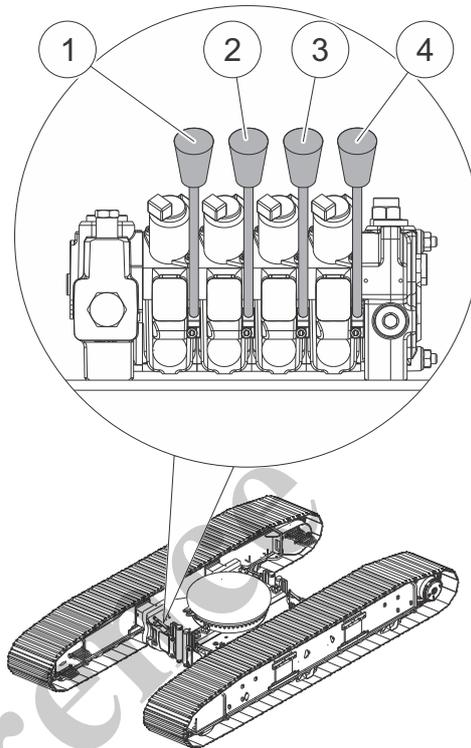


Fig. 250 Emergency control in the switchgear cabinet

- 3 Push the levers (1 to 4) in Fig. 251 downward.
 - The outrigger cylinders are extended.



00137

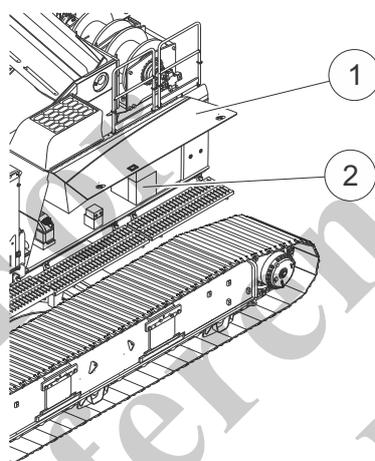
Fig. 251 Emergency control of the outriggers

1	Outrigger cylinder, right front	3	Outrigger cylinder, left rear
2	Outrigger cylinder, right rear	4	Outrigger cylinder, left front

4	Push the levers (1 to 4) in Fig. 251 upward. – The outrigger cylinders are retracted.
5	Press the switch (4) in Fig. 250 in the switchgear cabinet downward.
6	Close the switchgear cabinet and the left maintenance hatch.

7.18.2 Telescoping the undercarriage out

1	Slew the uppercarriage in the direction of travel.
2	Extend the boom to 16 m.
3	Stabilize the machine.
4	Open the left maintenance hatch (1) in Fig. 252 and open the switchgear cabinet (2) in Fig. 252.



00127

Fig. 252 Left maintenance hatch and switchgear cabinet

- 5 Push the switch (4) in Fig. 253 in the switchgear cabinet upward.
 - The emergency control is ready for operation.

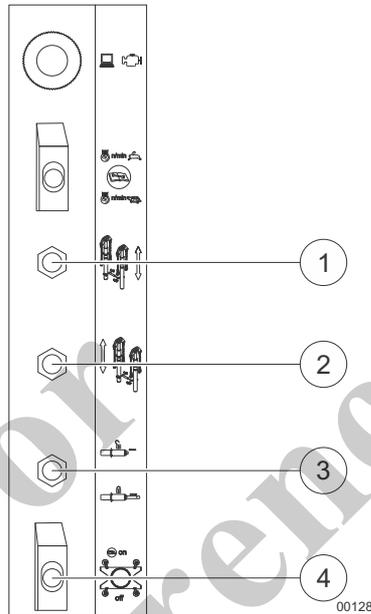
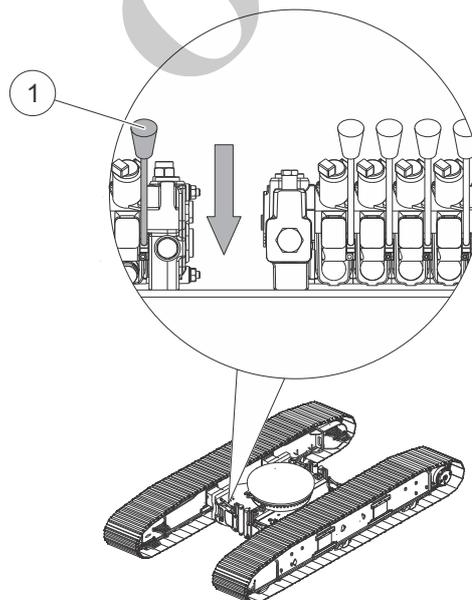


Fig. 253 Emergency control in the switchgear cabinet

- 6 Push the lever (1) in Fig. 254 downward until the undercarriage is completely extended.



00126

Fig. 254 Emergency control for telescoping the undercarriage

- 7 Press the switch (4) in Fig. 255 in the switchgear cabinet downward.

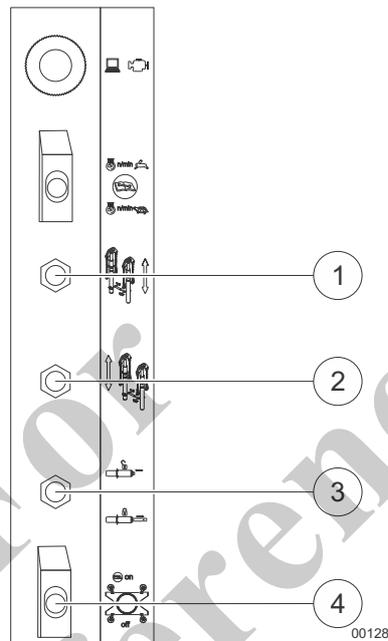
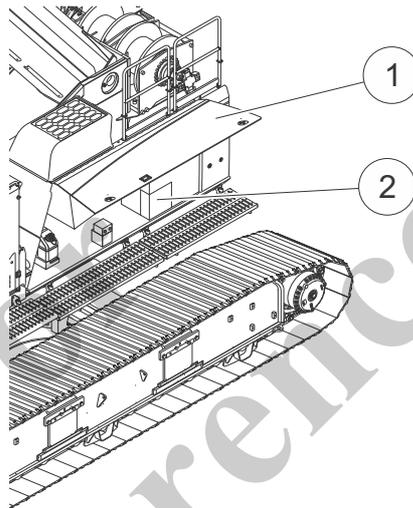


Fig. 255 Emergency control in the switchgear cabinet

7.18.3 Extending the ballasting cylinders and bolting the counterweight

- 1 | Open the left maintenance hatch (1) in Fig. 256 and open the switchgear cabinet (2) in Fig. 256.



00127

Fig. 256 Left maintenance hatch and switchgear cabinet

2	Push the switches (1) and (2) in Fig. 257 in the switchgear cabinet upward. – The ballasting cylinders are extended.
3	Press the switch (3) in Fig. 257 in the switchgear cabinet upward – The counterweight is bolted.
4	Close the switchgear cabinet and the left maintenance hatch.

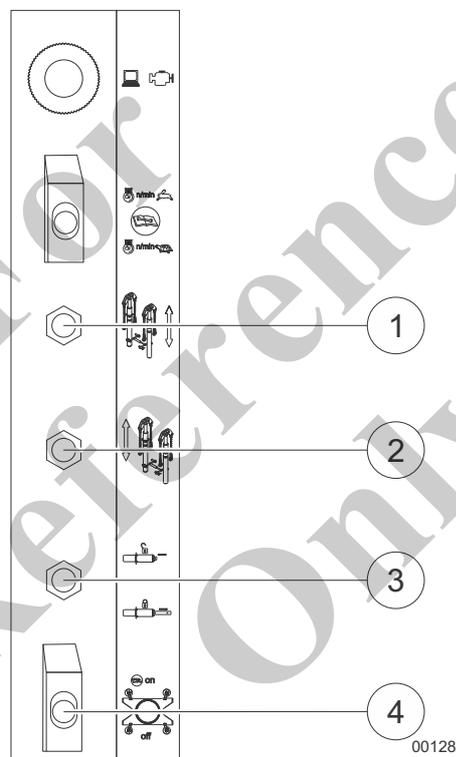


Fig. 257 Emergency control in the switchgear cabinet

8 Transport

Preliminary tasks

Transport on a lowbed trailer requires the following preliminary tasks to be performed:

- Select a suitable transport vehicle.
Note the dimensions of the machine as specified in Section 8.4.
- Clean machine.
- Bring the telescopic boom into transport position. To completely lower the boom, operate the key switch "Bypass LML".
- If necessary, dismount the fly boom or fold and secure it.
- Secure the bottom hook block against swinging.
- Lock uppercarriage and undercarriage.
 - Turn the uppercarriage parallel to the undercarriage. For ballasting, the uppercarriage must be precisely in the 0° position.
 - The uppercarriage can be locked in the precise 0° position via the corresponding SENCON menu.

Safety for transport

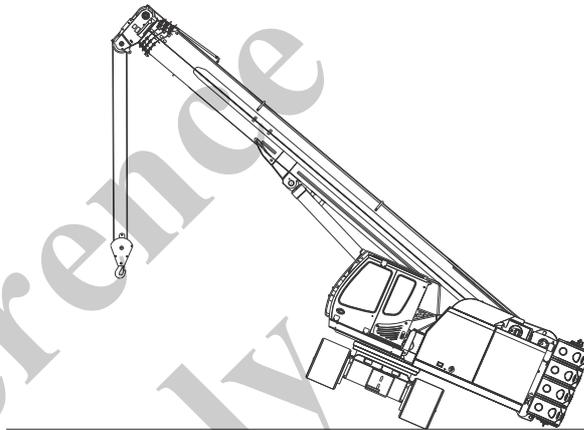
- Adjust the minimum track width of the undercarriage.
- Dismount the walkways and fold down railings.
- Only have authorized specialists execute loading and transport tasks.
- Comply with the relevant regulations for securing loads.
The respective transport company is always responsible for transport of machine and accessories.
- When loading and transporting, safeguard the machine and the working equipment against unintentional movements.
- When loading, secure all required auxiliary equipment, such as ramp sections or wooden planks against any unintentional movement.
- Clean the machine's wheels or chains of mud, snow, and ice.
- Check the conditions of the route before starting the transport.
- Only transport the machine using the designated lashing and lifting points.
- Ensure that the machine does not pose any hazards for other traffic participants.
- Wear personal protective equipment (e.g. hard hat, protective gloves, safety footwear).

WARNING**Danger to life due to the machine tipping!**

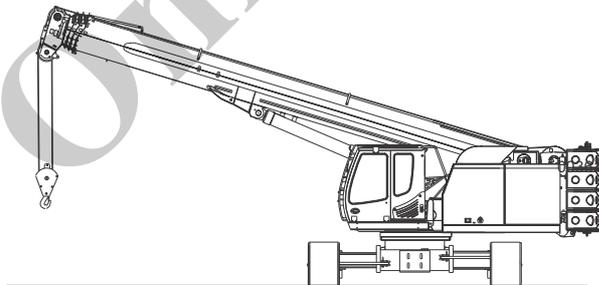
The machine may tip if slewed with the maximum counterweight attached to the uppercarriage and the undercarriage fully telescoped in. This can cause severe or fatal injury.

- Never telescope the undercarriage fully during work operation or when performing maintenance or setup work.
- Before telescoping, place the uppercarriage parallel to the undercarriage, in the direction of travel, and secure it.
- Do not slew the uppercarriage during the telescoping procedure.

Incorrect:



Correct:



00361

Fig. 258 Risk of tipping due to retracted undercarriage

8.1 Controls for unloading the machine

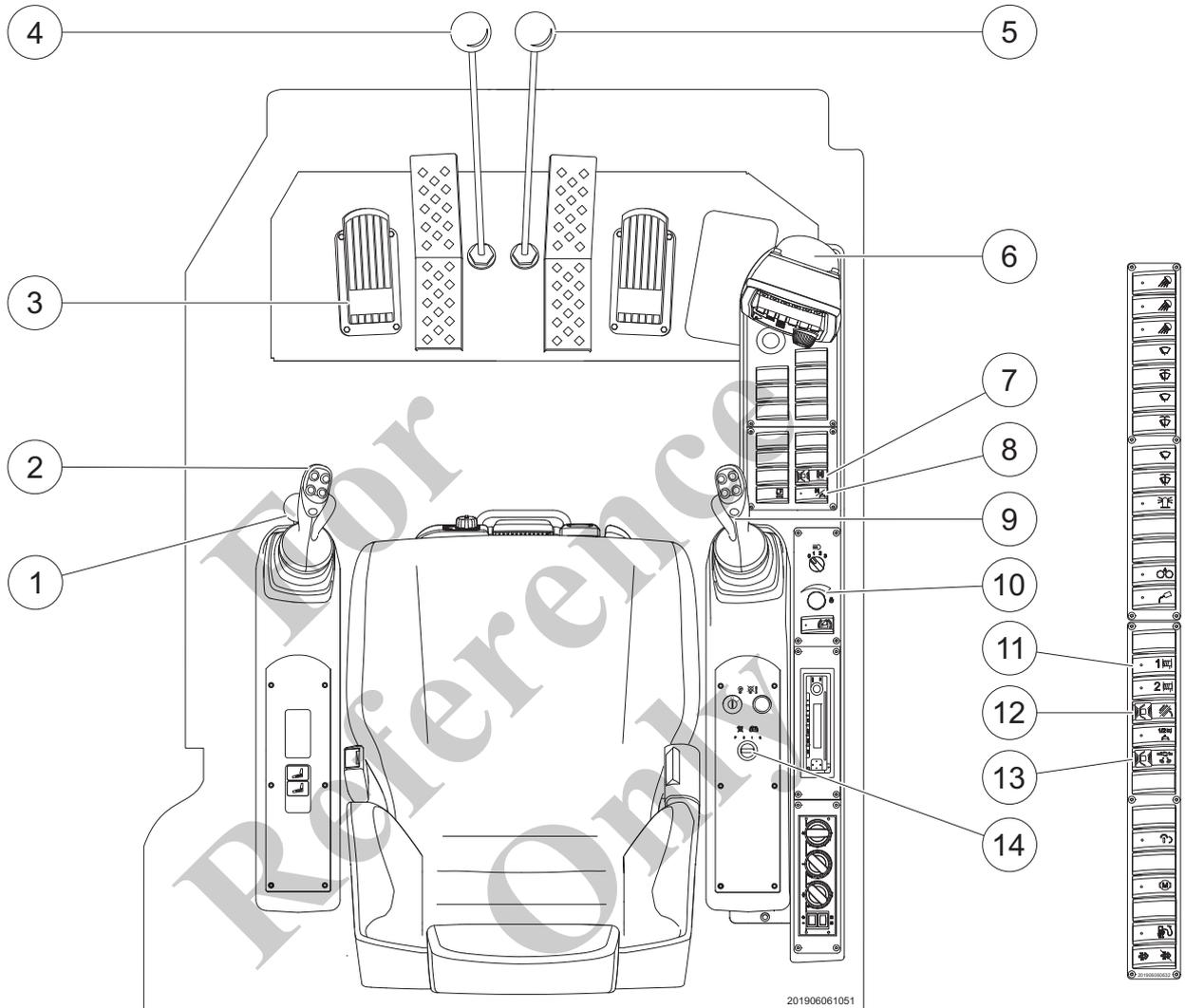
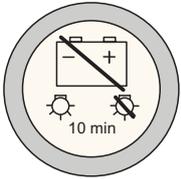


Fig. 259 Controls for unloading the machine

1	Safety lever	8	Travel slow/fast
2	Left joystick	9	Right joystick
3	Slewing gear service brake	10	Hand throttle
4	Hand lever, left crawler	11	Activate winch 1
5	Hand lever, right crawler	12	Luff/telescope boom switch
6	SENCOn	13	Changeover winch 1-2
7	Activate drive mode	14	Ignition switch

8.2 Switching on the battery disconnect switch



- 1 | Open the right service door.

- 2 | Press the battery disconnect switch.
 - The battery switch lights up.
 - The electrical system of the machine is connected to the battery.

- 3 | Close the right-hand service door.

For
Reference
Only

8.3 Unload machine

Safety instructions for loading and unloading the machine

- Make sure no unauthorized persons are in the vicinity of the machine while loading and unloading.
- Do not lift loads with the machine.
- Leave the uppercarriage of the machine locked.
- Only use the specified controls.

The machine is unloaded from the transport vehicle in two steps:

- Configuring the setup program in the SENCON.
- Driving the machine off the transport vehicle.

For
Reference
Only

8.3.1 Configuring the setup program in the SENCON

1	Completely lower the lowbed of the trailer.
2	Remove the lashings.
3	Turn on the battery disconnect switch
4	Enter the cab.
5	Turn the ignition key to position I. – The SENCON is switched on.

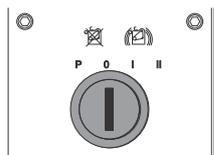


Fig. 260 Ignition lock



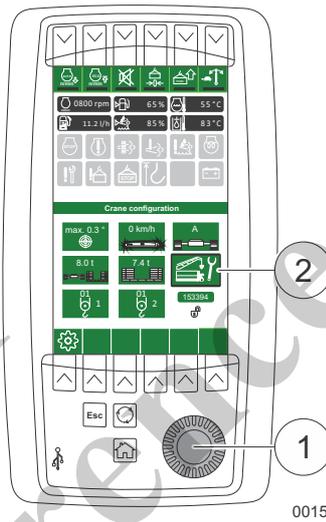
Fig. 261 SENCON loading screen



Information

The SENCON boots up after turning on the ignition. This process takes about a minute. Do not use the machine while the loading screen is present.

- | | |
|---|---|
| 6 | Roll the SCROLL wheel (1) in Fig. 262 until the setting (2) in Fig. 262 is outlined in black. |
| 7 | Press the SCROLL wheel. |



00152

Fig. 262 Selecting setup program

For Reference Only

- 8 Roll the SCROLL wheel until the setting (1) in Fig. 263 is outlined in black.



- 9 Press the  button on the SENCON.
 - The setup program is selected.

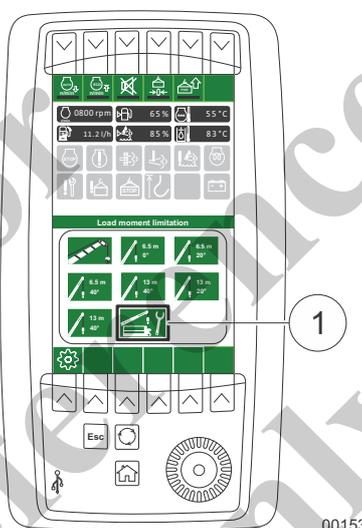
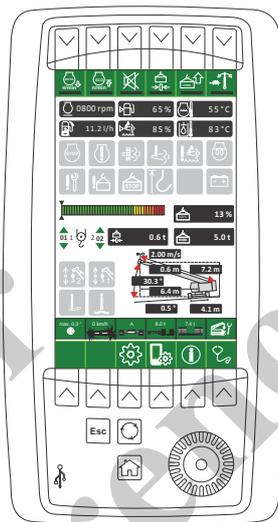


Fig. 263 Selecting attachment

00153

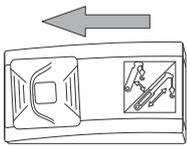
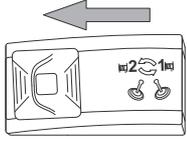
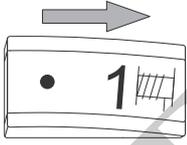
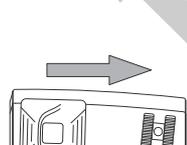
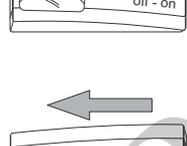
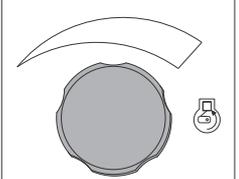
- 10 Press the  button on the SENCON.
- The setup program is configured.
 - The working diagram displays.



00154

Fig. 264 Working diagram

8.3.2 Moving the machine off the transport vehicle

	<p>1 Turn the ignition key to position II. – The diesel engine is started.</p>
	<p>2 Unlock the Luff/telescope boom switch and press it to the left.</p>
	<p>3 Press the Release winch switch to the right.</p>
	<p>4 Press the Release winch switch to the right.</p>
	<p>5 Unlock the Release travel mode switch and press it to the right.</p>
	<p>6 Press the Travel slow/fast switch to the left.</p>
	<p>7 Turn the speed governor slightly to the right.</p>

- 8 Press the button (1) in Fig. 265 on the right joystick.
 - The horn sounds.

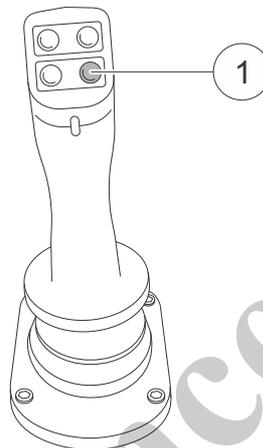


Fig. 265 Horn

- 9 Push the safety lever forward.

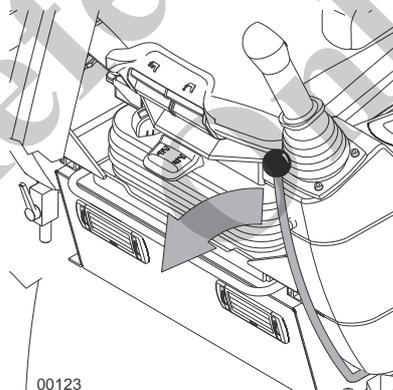


Fig. 266 Pushing the safety lever

- 10 Lift the boom into the 30° position.
 - The boom position is displayed on the SENCON.
- 11 Move the machine off of the lowbed trailer.
- 12 Lower the boom.

NOTICE!

Risk of damage to the machine due to improper operation of the load hook when the lifting limit switch is bypassed. If the load hook is lifted too quickly while the lifting limit switch is bypassed or if the safety distance to the boom head is not maintained, the load hook can strike the boom head. This can cause severe damage to the machine. If the function **Lower hook** is continued when the load hook has been lowered, the rope can be damaged.

- When the lifting limit switch is bypassed, lift the load hook slowly.
- Maintain a safety distance of 1 m between the load hook and the boom head.
- Once the load hook has been lowered, stop using use the **Lower hook** function.

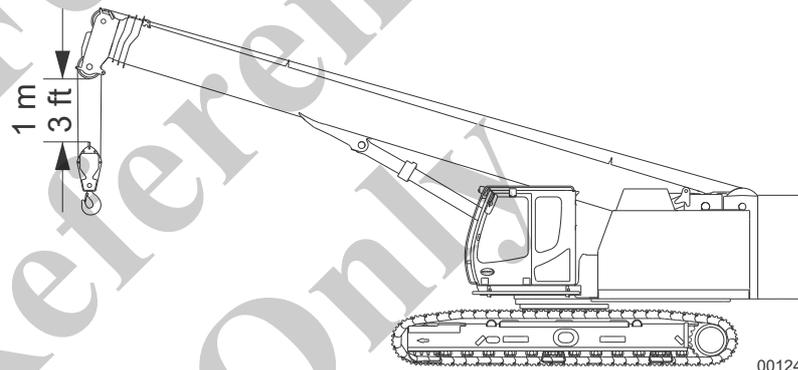
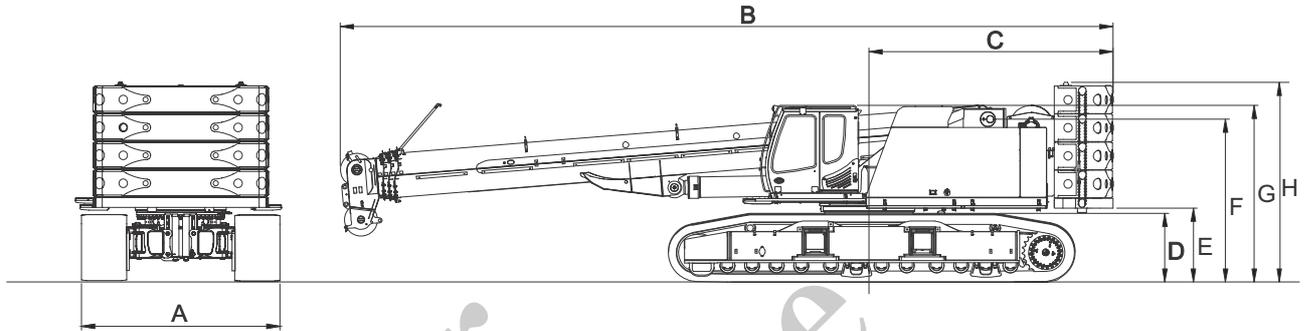


Fig. 267 Clearance between load hook and boom head

13	Park the machine at a suitable location.
14	Turn the ignition key to position 0 .
15	Pull the safety lever back.
16	Exit the cab.
17	Switch off the battery disconnect switch and lock the machine.

8.4 Transport dimensions and weights

8.4.1 Overall machine



00132

Fig. 268 Transport dimensions

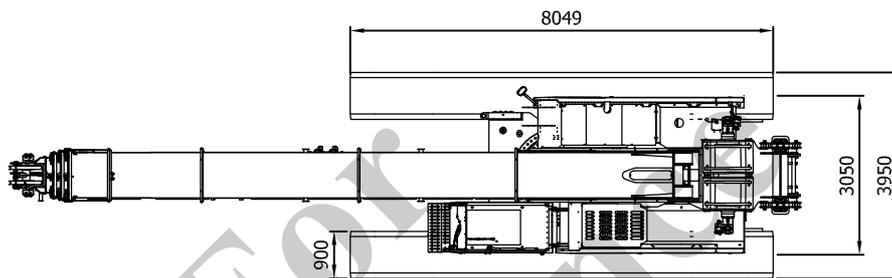
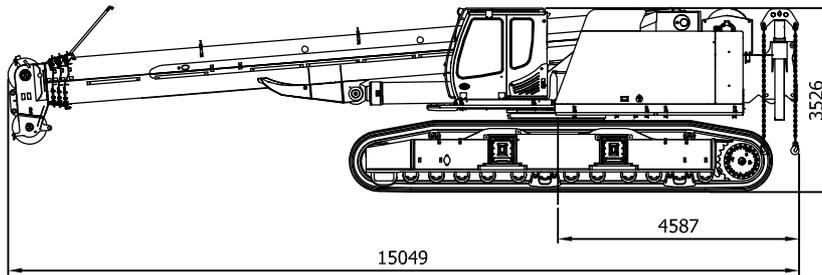
Dimensions

	Dimensions in. (mm)		Dimensions in. (mm)
A	155.5 (3 950)	E	58 (1 472)
B	602 (15 292)	F	127.9 (3 249)
C	190.2 (4 830)	G	138.8 (3 526)
D	54 (1 371)	H	156.8 (3 982)

Weights

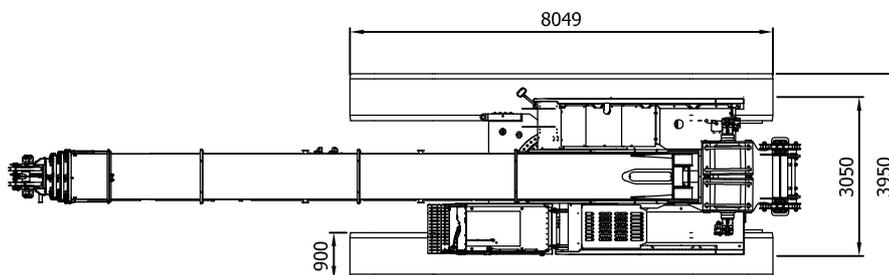
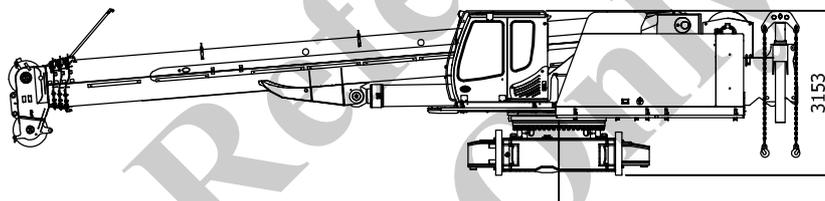
	Weight
Machine with track wheel carriers and without counterweight	79.0 t
Machine with track wheel carriers and with counterweight	112.0 t
Counterweight	33.0 t





Weight with 900 mm 3-element base plates, with folding fly boom 8 m, 2 hoisting winches, 80 t hook

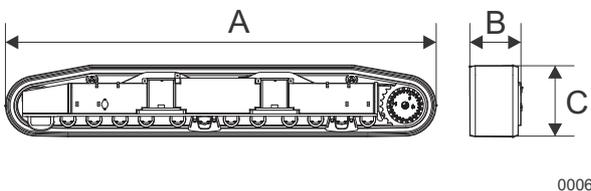
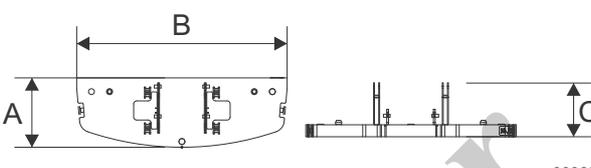
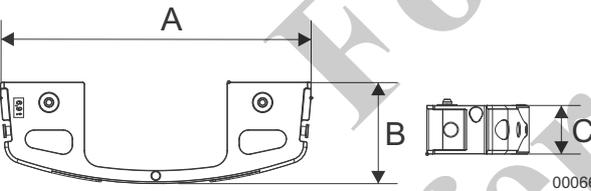
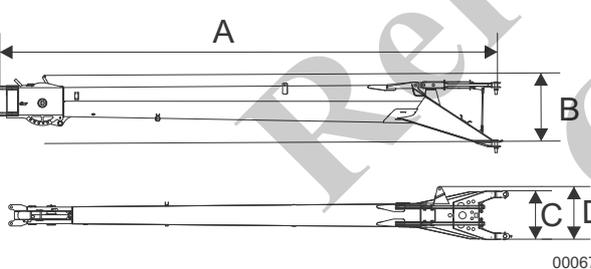
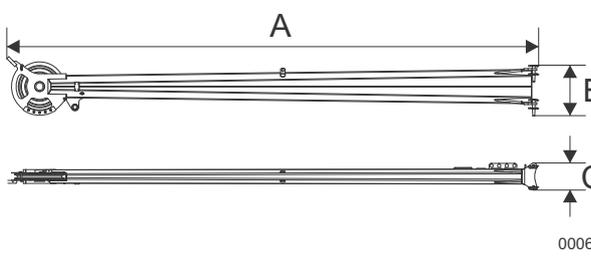
approx.
78.3 t



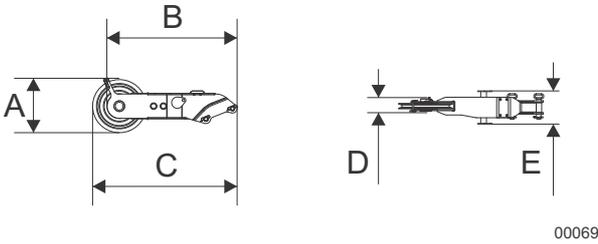
Transport weight with 900 mm 3-grouser base plates, with folding fly boom 8 m, 2 hoisting winches, 80 t hook

approx.
46.5 t

8.4.2 Attachments

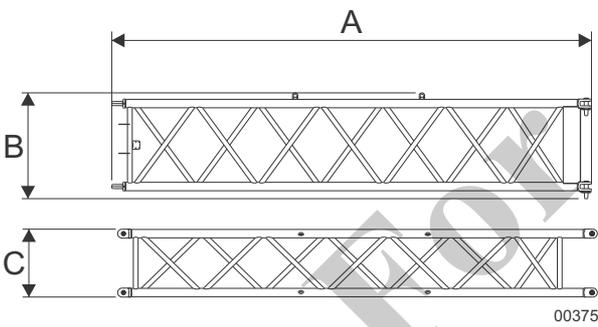
<p>2 x track wheel carrier</p>  <p>00064</p>	<table border="1"> <tbody> <tr> <td>A</td> <td>8 049 mm</td> </tr> <tr> <td>B</td> <td>969 mm</td> </tr> <tr> <td>C</td> <td>1 336 mm</td> </tr> <tr> <td>Weight</td> <td>15 800 kg</td> </tr> </tbody> </table>	A	8 049 mm	B	969 mm	C	1 336 mm	Weight	15 800 kg		
A	8 049 mm										
B	969 mm										
C	1 336 mm										
Weight	15 800 kg										
<p>1 x ballast bracket</p>  <p>00065</p>	<table border="1"> <tbody> <tr> <td>A</td> <td>1 160 mm</td> </tr> <tr> <td>B</td> <td>3 490 mm</td> </tr> <tr> <td>C</td> <td>900 mm</td> </tr> <tr> <td>Weight</td> <td>5 400 kg</td> </tr> </tbody> </table>	A	1 160 mm	B	3 490 mm	C	900 mm	Weight	5 400 kg		
A	1 160 mm										
B	3 490 mm										
C	900 mm										
Weight	5 400 kg										
<p>4 x ballast block</p>  <p>00066</p>	<table border="1"> <tbody> <tr> <td>A</td> <td>3 490 mm</td> </tr> <tr> <td>B</td> <td>1 160 mm</td> </tr> <tr> <td>C</td> <td>620 mm</td> </tr> <tr> <td>Weight</td> <td>6 980 kg</td> </tr> </tbody> </table>	A	3 490 mm	B	1 160 mm	C	620 mm	Weight	6 980 kg		
A	3 490 mm										
B	1 160 mm										
C	620 mm										
Weight	6 980 kg										
<p>Fly boom 8 m</p>  <p>00067</p>	<table border="1"> <tbody> <tr> <td>A</td> <td>8 459 mm</td> </tr> <tr> <td>B</td> <td>1 291 mm</td> </tr> <tr> <td>C</td> <td>832 mm</td> </tr> <tr> <td>D</td> <td>904 mm</td> </tr> <tr> <td>Weight</td> <td>900 kg</td> </tr> </tbody> </table>	A	8 459 mm	B	1 291 mm	C	832 mm	D	904 mm	Weight	900 kg
A	8 459 mm										
B	1 291 mm										
C	832 mm										
D	904 mm										
Weight	900 kg										
<p>Fly boom extension 7 m</p>  <p>00068</p>	<table border="1"> <tbody> <tr> <td>A</td> <td>6 995 mm</td> </tr> <tr> <td>B</td> <td>785 mm</td> </tr> <tr> <td>C</td> <td>360 mm</td> </tr> <tr> <td>Weight</td> <td>300 kg</td> </tr> </tbody> </table>	A	6 995 mm	B	785 mm	C	360 mm	Weight	300 kg		
A	6 995 mm										
B	785 mm										
C	360 mm										
Weight	300 kg										

Auxiliary jib



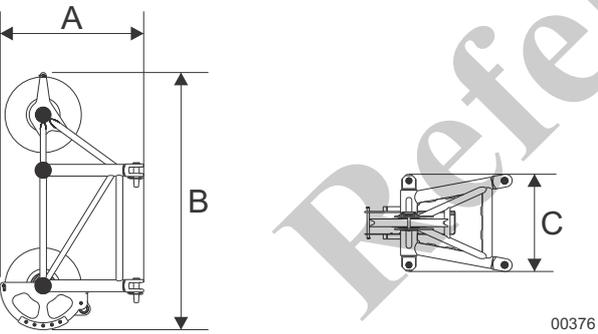
A	676 mm
B	1 601 mm
C	1 766 mm
D	219 mm
E	409 mm
Weight	160 kg

Lattice boom section



A	5 733 mm
B	1 275 mm
C	818 mm
Weight	573 kg

Lattice boom headpiece



A	1 233 mm
B	2 226 mm
C	819 mm
Weight	391 kg

8.5 Disconnecting the electrical system from the battery

If the machine will be put out of service for an extended period or for longer transport distances, the electrical system must be disconnected from the battery using the battery disconnect switch.

NOTICE

Danger - machine damage!

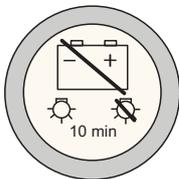
If the battery disconnect switch is switched off while the machine is still in operation, the electrical system of the machine and its controller will be damaged.

➤ Leave the battery disconnect switch switched on when the engine is running or other electrical consumers are switched on.

Prerequisites

- The engine is shut down.
- The ignition is switched off.

Procedure



1	Open the right service door.
2	Press the battery disconnect switch. – The battery switch flashes for a period of 10 minutes. After 10 minutes, the battery disconnect switch lighting goes out.
3	Close the service door.

INFORMATION

Interrupt separation process

The separation process can be interrupted. To do this, press the battery disconnect switch again while flashing.

8.6 Lifting the machine

Safety instructions

- Only attach machine on the lifting points provided for this purpose.
- Ensure that the lifting equipment has a sufficient safe working load and safe stability.
- Ensure that the sling gear has a sufficient safe working load and is undamaged.
- The following items are considered as suitable sling gear:
 - chain suspension
 - cable suspension
 - round slings/sling devices
- Pay attention to the danger zone.
- Ensure that there is nobody near, on or below the machine.
- Do not stand underneath a suspended load!

1	Select suitable lifting crane and sling gear. Pay attention to the weight and center of gravity of the machine.
2	Fasten the sling gear to the lifting points.
3	Lift up the machine carefully.

Dimensions, suspension gear, and weight distribution

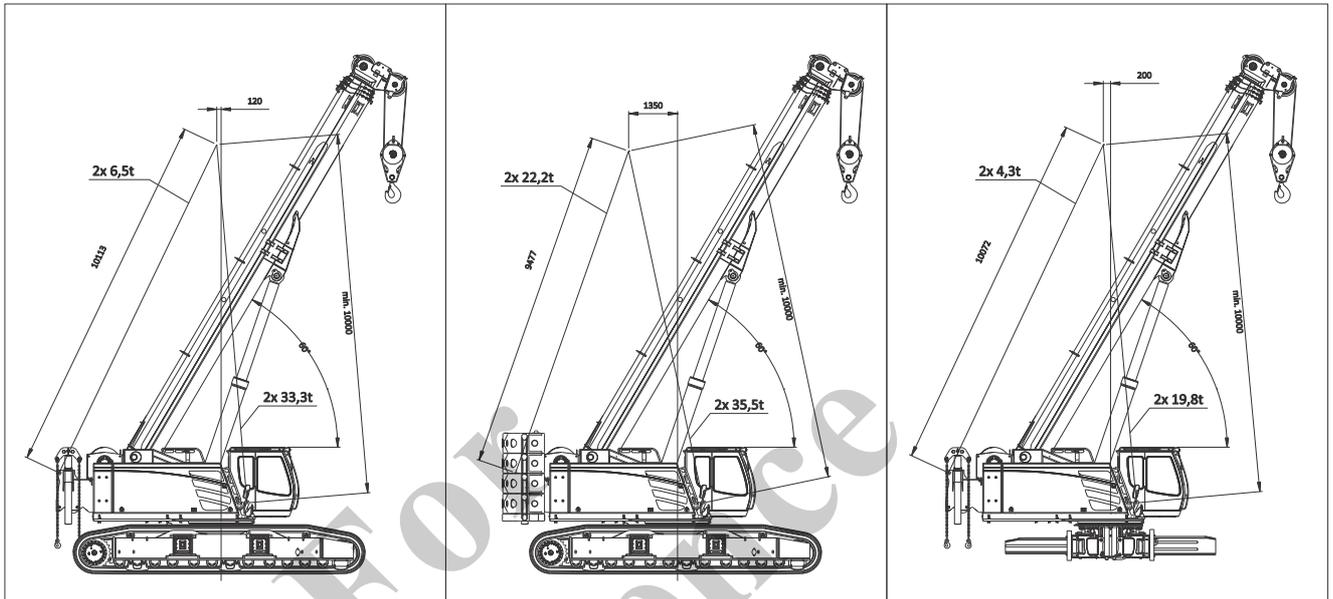


Fig. 269 Dimensions and weight distribution of the machine when lifting

Without counterweight, with 2 hoisting winches with 80 t hook
 With traveling gear (900 m, 3-elements) and 8 m fly boom
 Weight: approx. 78.3 t

With counterweight, with 2 hoisting winches with 80 t hook
 With traveling gear (900 m, 3-elements) and 8 m fly boom
 Weight: approx. 111.7 t

Without counterweight, with 2 hoisting winches with 80 t hook
 Without traveling gear, with fly boom
 Weight: approx. 47.1 t

8.7 Lashing the machine

Safety instructions

- Ensure that the sling gear has a sufficient safe working load and is undamaged.
- Ensure that the machine will not be damaged if additional securing is necessary.
- The respective transport company is always responsible for transporting the machine and accessories.
- Only attach the machine at the designated lashing points. The lashing points are marked with a green symbol.



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Reference
Only

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9 Troubleshooting

Safety when correcting faults

- Comply with Chapter 1 SAFETY.
- Personnel for maintenance, inspection and fault correction must have the appropriate qualifications for these tasks.
- For activities not described in more detail, contact the Manitowoc Distributor organization.

9.1 Diesel engine

Engine does not start

Cause	Remedy
Insufficient battery power	<ul style="list-style-type: none"> – Check fluid level of batteries. – Recharge or replace batteries. – Start machine using auxiliary battery.
Shut-off flap on hydraulic tank closed	<ul style="list-style-type: none"> – Open shut-off flap.
Fuel tank empty	<ul style="list-style-type: none"> – Refuel machine.
Emergency stop switch pressed	<ul style="list-style-type: none"> – Pull out emergency stop switch.

Engine power drops

Cause	Remedy
Suction resistance too high	<ul style="list-style-type: none"> – Replace filter element of the water separator.

Machine does not move

Cause	Remedy
Gearbox defective	<ul style="list-style-type: none"> – Have fault remedied.

Oil or fuel leaks on the diesel engine

Cause	Remedy
Hose clampings loose	<ul style="list-style-type: none"> – Fasten hose clampings.
Hoses or seals damaged	<ul style="list-style-type: none"> – Replace hoses or seals.

9.2 Hydraulic system

Oil leaks on the hydraulic system

Cause	Remedy
Hose clampings loose	– Fasten hose clampings.
Hoses or seals damaged	– Replace hoses or seals.

Hydraulic pump does not work

Cause	Remedy
Fault in pump circuit	– Have fault localized and corrected by a hydraulics specialist.

Work equipment malfunctions or does not function

Cause	Remedy
Hydraulic oil level too low	– Check hydraulic oil level. – Top up hydraulic oil, if necessary.
Leaks in the hydraulic system	– Check working cylinder, connections and hoses for leaks. – Have the fault corrected by a hydraulics specialist.
Fault in one of the working circuits	– Have the fault corrected by a hydraulics specialist.

Noises when moving a working cylinder

Cause	Remedy
Cylinder piston rod not lubricated	– Have the cylinder repaired by a hydraulics specialist.

No power or low power of the hydraulic system

Cause	Remedy
Hose clampings loose	– Fasten hose clampings.
Hoses or seals damaged	– Replace hoses or seals.
Pressure relief valve opens too soon	– Have the fault corrected by a hydraulics specialist.
Hydraulic pump worn or defective	– Have pump replaced by a hydraulics specialist.

Noises in hydraulic system

Cause	Remedy
Hydraulic pump takes in air	– Have the fault corrected by a hydraulics specialist.
Hydraulic pump delivers insufficient oil	– Check hydraulic oil level. – Top up hydraulic oil, if necessary.
Pressure relief valve chatters	– Have the fault corrected by a hydraulics specialist.

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9.3 Heating/air-conditioning system

9.3.1 Heat output

Fan does not work

Cause	Remedy
Fuse defective or loose	– Check the fuse and insert it correctly, if necessary. Replace defective fuse. If the defect recurs within a short period of time, this indicates a short-circuit or a blockage. Check the fan for blockages or other defects and rectify the fault.
Power supply interrupted	– Check lines for loose contacts or breaks.
Blower motor defective	– Replace the fan.
Defective control element	– Check control element, replace, if necessary.

Fan cannot be shut off

Cause	Remedy
Short-circuit in cable	– Rectify short-circuit, install new cable(s) if necessary.

Fan works with reduced power

Cause	Remedy
Contacts soiled	– Clean the plug contact. Proceed with caution to avoid short circuit.
Electrical lines are under-dimensioned	– Install recommended cable cross section.
Heat exchanger heavily contaminated	– Clean thoroughly and prevent damage that could cause leaks. Observe the safety instructions.
Insufficient air flow because air filter is clogged	– Clean or replace filter.

No or insufficient heat output

Cause	Remedy
Water intake temperature too low	– Wait until vehicle engine has warmed up.
Vehicle thermostat defective	– Replace thermostat.
Heat exchanger lamellas are contaminated	– Check heat exchanger, clean, if necessary.
Water lines kinked or crushed	– Rectify the fault cause or install new hoses.
Insufficient water pump pressure	– No coolant flow through heat exchanger. Install an additional or more powerful pump.
Insufficient air flow because air filter is clogged	– Clean or replace filter.
Resistor defective	– Replace resistor.
Climate control defective	– Check and replace, if necessary.

Water leaks from device

Cause	Remedy
Loose hose connection	– Check seat of the hose lines and tighten hose clips.
Water hose damaged	– Install and connect new hose.
Heat exchanger damaged	– Install an original replacement part and connect. Observe the safety instructions.

Air flaps can no longer be adjusted

Cause	Remedy
Servomotor defective	– Replace servomotor.
Foreign object is blocking flap	– Check flap, remove foreign object.
Flap deformed	– Check flap and straighten if necessary.
Flap bearing is defective	– Check flap bearing and replace if necessary.
Control system defective	– Check control system and replace if necessary.

9.3.2 Cooling capacity

Compressor does not work

Cause	Remedy
Interruption in the solenoid coil of the compressor	– Check the current flow to the clutch.
V-belt loose or torn	– Adjust the V-belt tension, replace V-belt.
V-belt pulley does not turn, even though the magnetic clutch is engaged	– Check compressor and replace if necessary.
Compressor clutch slips	– Repair clutch or replace compressor.
Control system defective	– Check control system and replace if necessary.

Evaporator flooded

Cause	Remedy
Expansion valve seizes in open position or catches	– Replace expansion valve.

Evaporator is iced up

Cause	Remedy
Thermostat sensor at the wrong position	– Reposition sensor.
Expansion valve, thermostat or collector drier is defective	– Replace expansion valve, thermostat or collector drier.

Evaporator clogged

Cause	Remedy
Cooling fins soiled	– Clean evaporator.

Loss of refrigerant

Cause	Remedy
Break in refrigerant line	– Check all lines for break due to external effects or abrasion.
Leakage in the system	– Evacuate, fill, check for leaks and repair.

Cooling capacity insufficient

Cause	Remedy
Insufficient air flow because air filter is clogged	– Clean or replace filter.
Relay defective	– Replace relay.
Fan passage obstructed	– Check air channels for obstructions. Rectify fault.
Ambient air/recirculating air flap set to ambient air at high ambient air temperature	– Set to recirculating air.
Air flow of liquefier insufficient because cooling fins are soiled	– Clean the cooling fins.
Insufficient refrigerant fill level	– Top up refrigerant (service engineer).
Moisture in the system	– Empty the air conditioning unit, replace the collector drier, evacuate and fill (service engineer).
Collector drier saturated	– Empty the air conditioning unit, replace the collector drier, evacuate and fill (service engineer).

System cools intermittently

Cause	Remedy
Line break, faulty ground connection or loose contacts in the solenoid coil of the compressor	– Check, repair or replace lines.
Blower motor defective	– Replace fan.

9.3.3 System very noisy

System very noisy

Cause	Remedy
V-belt loose or excessively worn	– Tighten or replace V-belt.
Clutch noisy	– Repair clutch.
The compressor bracket is loose or the internal components of the compressor are worn	– Repair bracket, replace compressor.
Excessive wear of fan motor	– Replace fan.
System overfilled	– Extract refrigerant until the high-pressure display shows normal value.
Insufficient refrigerant level in the system	– Check for leaks, top-up system.

For Reference Only

9.4 Slewing gear

Oil leaks on the slewing gear drive

Cause	Remedy
Loose connections	– Tighten connections.

Rotary feedthrough leaks

Cause	Remedy
Seals damaged	– Replace seals.
Lines loose	– Tighten fastening screws.

Noises in the slewing gear

Cause	Remedy
Insufficient lubrication on gear rim	– Lubricate gear rim according to lubrication plan.

9.5 Undercarriage

Oil leaks on the travel gear

Cause	Remedy
Plug is loose	– Fasten plug.
Seals damaged	– Replace seals.

9.6 Cab

Increased shaking or vibration of the cab

Cause	Remedy
Cab suspension or cab attachment damaged	<ul style="list-style-type: none"> – Check all connection elements, screws and bolts of cab suspension and fastening for damage, cracking or deformation. – Have damaged components replaced immediately by trained and instructed specialists.

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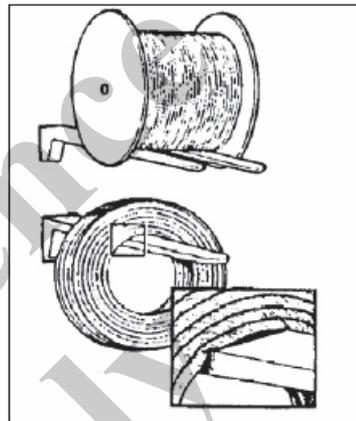
10 Appendix

10.1 Handling, Installation, and Maintenance of Steel Wire Ropes

10.1.1 Rope selection

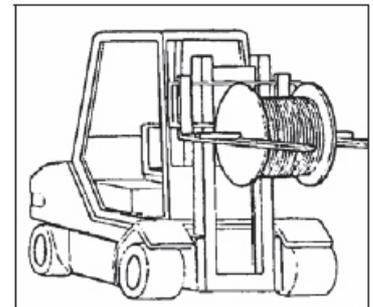
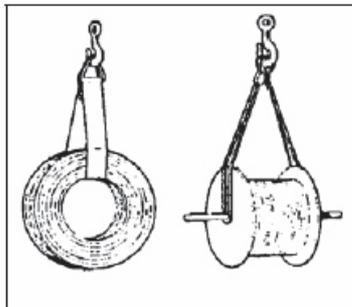
Grove cranes and excavators are already fitted with high-quality wire ropes on delivery. When ropes are ready for discarding they should be replaced by new wire ropes of the same type, with the same nominal diameter, identical wire strength and the same type and direction of lay. These details required for ordering the ropes can be found in the crane manual.

The following points should be noted when handling wire ropes:



10.1.2 How should wire ropes be unloaded?

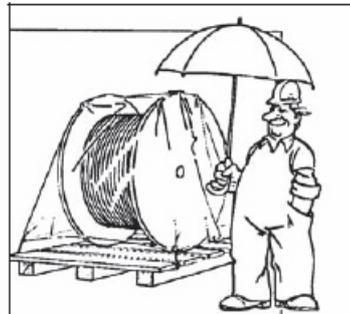
The first problems when handling wire ropes often already occur on delivery: the fork of the fork-lift truck passes under the reel or into the coil and damages the wire rope surface.



The damage may not be discovered until considerably later and possibly even blamed on the manufacturer. Wire rope supplied as coils or on reels should preferably not come into direct contact with a load hook or the fork of a fork-lift truck, but should be lifted e.g. by wide textile lifting slings.

A practical way to lift a reel is with the aid of a bar pushed through its hole. If the fork of the fork-lift truck is longer than the reel width, the reel can also be lifted at the flanges.

10.1.3 How should wire ropes be stored?



Wire ropes should be stored under cover in clean, cool and dry conditions. Contact with the ground should be avoided, e.g. by storing on pallets.

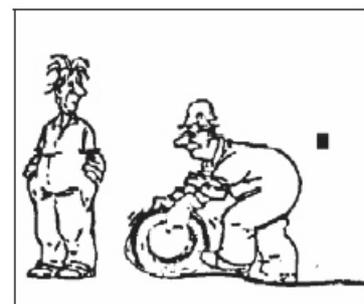
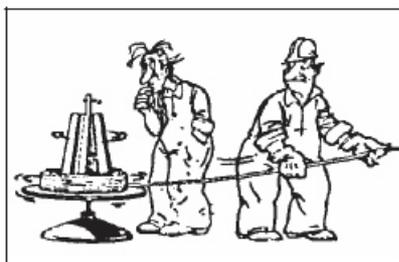
If storage outdoors is unavoidable, the ropes must be covered in such a way that they do not come into contact with water. Such a cover gives protection against rain, but condensation, which is unable to escape and possibly causes permanent damage to the wire rope, may form underneath. An intermediate layer of sacking, for example, provides a remedy in this case.

If a large number of spare ropes is stored, the following principle should apply: first in - first out. This means that the wire ropes should be used in the order of their delivery. In this way the use of individual wire ropes after many years of storage is ruled out. It goes without saying that when there is a risk of confusion (e.g. wire ropes which look identical but have different wire strengths) the various storage positions must be clearly marked. It is also essential to keep proper documentation that enables each of the stored and used wire ropes to be traced back to the supplier on the basis of the stock number, specification, order and delivery date.

10.1.4 Assembly of wire ropes

When assembling wire ropes it should generally be ensured that the ropes are unwound from the coil or reel and installed in the plant without twisting and without external damage.

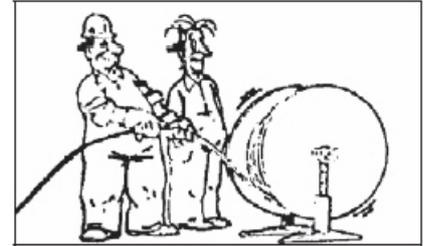
10.1.4.1 Unwinding from the coil



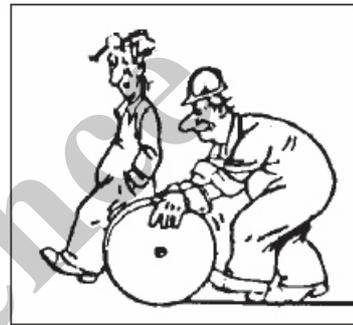
A wire rope supplied on a coil unwound by turntable or on the ground.

In the latter case the ground should be as possible, because sand adhering to the wire rope lubricant, for example, could lead to wire damage between the wire rope and pulley in the plant.

10.1.4.2 Unwinding from the reel



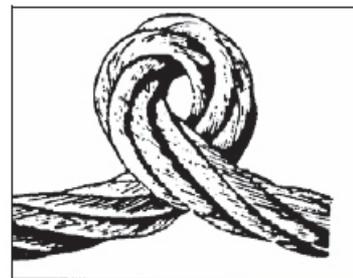
A wire rope wound on a reel is likewise preferably unwound by a turntable or a payoff stand.



Unreeing on the ground, which is repeatedly recommended in the pertinent literature, is not very satisfactory in practice because the reel unwinds an increasingly smaller amount of rope than the distance it covers, i.e. with this approach you are forced to pull the wire rope along behind you.



Under no circumstances, however, is the wire rope to be pulled sideways from the coil or reel, because torsion is introduced into the wire rope for each turn pulled off. Each twisting of the rope changes the lay lengths of strands and wire rope and thus also the length ratios of the rope elements in relation to each other and ultimately the load distributions in the rope.



A wire rope pulled sideways off the coil or reel resists the twisting and forms loops. If a rope of this type is loaded, the loops contract and produce a kink, an irreparable deformation.

Wire ropes with kink formation are no longer reliable and must be discarded.

10.1.4.3 Assembly

The most advantageous type of wire rope assembly varies from plant to plant. The type which ensures the lowest risk of rope twisting and damage to the wire rope by contact with structural parts at acceptable cost should always be selected.

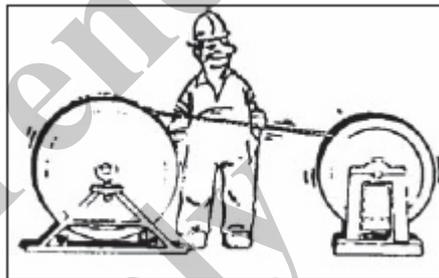
With some equipment it may be advisable first to discard the old wire rope and then assemble the new one; with other equipment, in particular larger units, it is advisable to draw in the new wire rope with the old one.

A further possibility, in particular for the initial ropes, is to use a thinner leader rope for drawing in the actual wire rope.

In all cases it should be considered whether the wire rope is to be drawn through the entire rope reeving system or first rewound directly from the coil or reel on to the rope drum and subsequently reeved by hand or with an auxiliary rope.

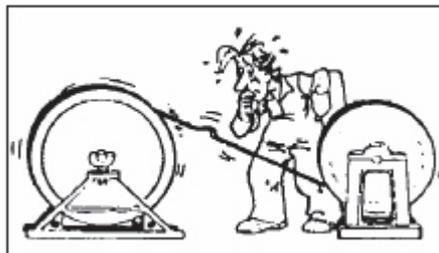
If a rope end is provided with an undetachable rope termination, the only option is to draw the free end through the entire reeving system.

10.1.4.4 Rewinding from the reel to the rope drum



Each wire rope already acquires a preferred bending direction during production, where it is drawn by take-off pulleys from the stranding cage. It is supplied to the customer already bent in this direction. When rewinding from the reel to the rope drum it should be ensured that the rope retains this preferred bending direction.

If the rope runs under the rope drum, the assembly reel should be installed in such a way that the rope running off it is likewise paid off under the reel and vice versa.



When rewinding against the preferred bending direction of the wire rope, the latter will attempt to twist between the reel and rope drum or subsequently to assume the preferred position by twisting during use. In both cases structural changes may occur in the wire.

10.1.4.5 Drawing in the new rope with the aid of the old rope or a leader rope

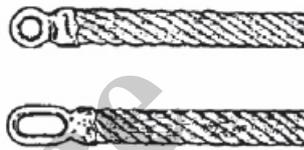
If the new wire rope is drawn in by the rope to be discarded or a leader rope, secure joining of these ropes should be ensured. Furthermore, it must be ensured that the

leader rope cannot twist. Twist-free wire rope types or three-strand fiber ropes, for example, are recommendable as leader ropes. When conventional wire ropes are used it should be ensured that they at least have the same lay direction as the wire rope to be drawn in.

If the new wire rope is drawn in with the aid of the old rope, the two rope ends are often butt-welded to each other. A joint of this type can transmit the twist built up in the rope drive from the old rope to the new one and already severely damage the latter during assembly.

This procedure is also highly problematical for other reasons: when special electrodes are used, the welded joint may well achieve satisfactory results as a straight strand in the tensile test, but because of the considerable length of the rigid joint zone there is a possibility of it breaking due to bending stresses when running over pulleys.

If this joint is used, it should be secured in addition by a rope stocking.



The joining of the wire ropes by two rings or chains welded to the ends, which are connected by stranded wires or thin ropes, is less problematical.

This joint has a satisfactory load capacity, is flexible and prevents the transmission of twist from the old rope to the new one. When two stranded wires are used it can be established on the basis of the number of twists after assembly whether the old rope had been heavily twisted on the plant.

A further possibility is joining by rope stockings. Rope stockings are meshes consisting of stranded wires, which are pushed over the rope ends and secured at the ends by adhesive tape. The rope stockings contract under load and hold the rope ends by friction.

When drawing in a Lang lay rope it should be noted that despite the tying stresses the rope stockings may turn on the rope like a nut on screw. A remedy is provided by previously wrapping strong adhesive tape around the rope sections to be held by the rope stockings.

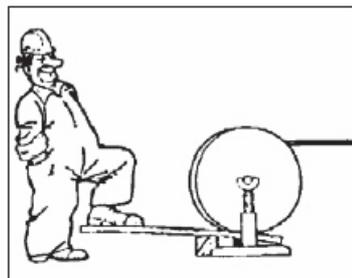
10.1.4.6 Winding on to drums under load

To ensure that the wire rope is wound properly on the drum it is highly important in the case of multi-layer winding and in particular when using the so-called Lebus winding technique that the wire ropes are brought on to the drum under pretension.

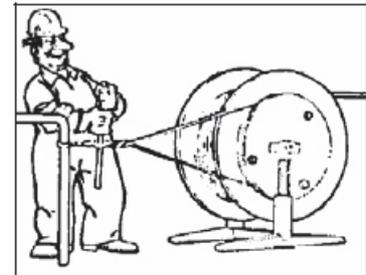
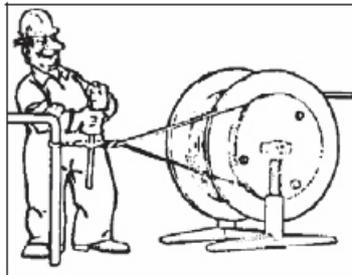
If the lower layers are too loose, the higher ones may be drawn in between lower rope sections under load. This may lead to serious rope damage.

As the rope running off may even become jammed at this point, this may suddenly lead to reversal of the winding direction when unwinding the rope and thus to sudden lifting of the descending load.

The pretension should be in the order of magnitude of about 1 to 2% of the minimum breaking force of the wire ropes.



Whereas it is often adequate to mount the wire rope normally and then unwind it and rewind it with the aid of an external load, this is not possible in other cases, e.g. in the case of a slewing tower crane, which has not yet reached its maximum climbing height. In these cases the pretension must already be supplied during assembly.



This can be done e.g. by braking the reel flange with the aid of a board or by a brake disk mounted on the reel.

The brake cords (hemp ropes with a steel core) are supplied by the wire rope manufacturer.

You should never attempt to produce the pretension by clamping forces, e.g. by clamping the wire rope between two wooden planks. The rope would be irreparably deformed by structural changes.

10.1.4.7 “Running in” the wire rope

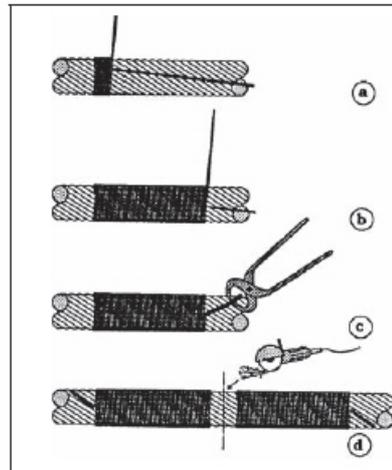
Before a wire rope takes over the actual work after its assembly, it should perform a certain number of load cycles with small partial loads. It should be “run in”, so that the rope elements settle and can adapt to the new environment. Unfortunately exactly the opposite of this recommendation is done in practice: rope assembly is often followed first by the overload test with loads above the permissible load capacity of the plant.

10.1.4.8 Cutting wire ropes to length

Wire ropes often have to be cut to length or shortened by the user himself. The ropes can be cut in various ways. Up to a diameter of about 8 mm wire rope shears can be used; mechanical or hydraulic cutters are also offered for larger rope diameters. If a suitable power source is available in the vicinity, however, it is always advisable to use a pneumatically operated or electrical angle grinder.

In all cases the wire ropes must be carefully tied next to the cutting point to prevent the ends springing open or a change in the rope and stranded wire lay lengths. This applies in particular when cutting low-twist or twist-free wire ropes, the stranded wires of which have often intentionally not been preformed by the rope manufacturer.

Iron wire must be used for tying purposes. Insulating tape cannot prevent structural changes in the wire ropes.



First mark the cutting point with chalk or insulating tape. Then lay one end of the tying wire over a length of about 4 times the rope diameter on the rope and start to wrap the wire rope and this piece of wire away from the cutting point. The rope is now wrapped tightly over a length of about 3 times the rope diameter. Then tighten the wrapped piece of wire with pincers and twist together with the second wire end.

Shorten the length of the wire ends twisted around each other to about one rope diameter with the pincers. Then lightly tap the wire ends into a recess between two outer stranded wires of the wire rope to prevent the risk of injury.

After similar preparation of the other side of the cutting point the wire rope can now be cut.

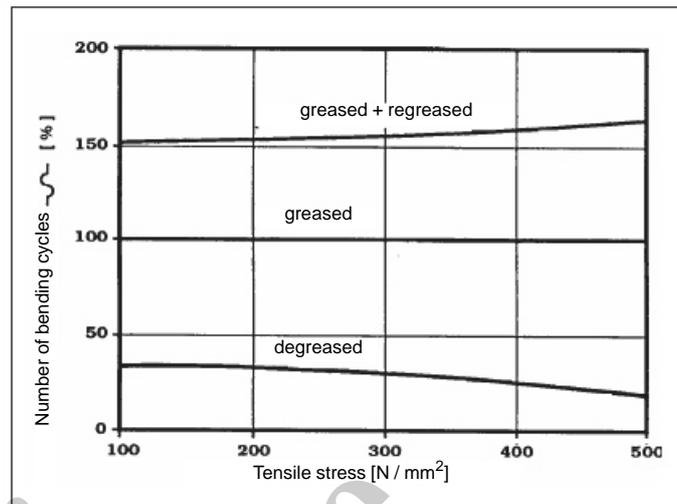
Instead of one long tying it is possible to provide each side of the cutting point with three tyings, each with a width of about one rope diameter.

10.1.5 Maintenance of wire ropes

According to DIN 15020 wire ropes must be “regularly serviced, with the work to be carried out depending on the type of hoist, its use and the type of rope”. The life of a wire rope can be significantly prolonged by regular maintenance.

10.1.5.1 Relubrication of wire ropes

During its manufacture a wire rope is intensively lubricated to provide protection against corrosion and improvement of the coefficients of friction between the rope elements and between the wire rope and pulley or drum. However, this lubrication lasts only for a limited time and should be regularly supplemented.

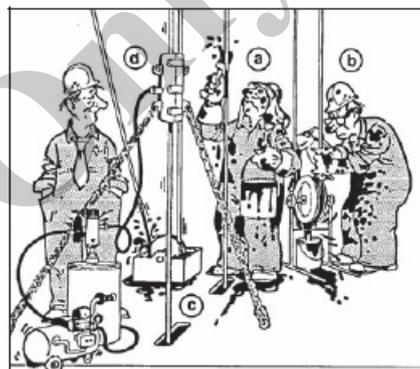


According to DIN 15020: "Wire ropes must be relubricated at regular intervals which depend on the operating conditions, in particular in the bending zone". It also states: "If relubrication of the rope must be discontinued for operating reasons, a shorter life should be anticipated and the monitoring suitably adapted." The effect of lubrication and relubrication on rope life is shown in.

When selecting the lubricant, you must ensure that it is compatible with the product of the wire rope manufacturer. Drahtseilwerk Saar will be pleased to supply information in this respect.

Lubricant recommendation

- **grease:** Aral Aralub LFZ 1
- **adhesive lubricant (spray):** Seilfett 315F L



The lubricant can be applied in various ways:

The most common methods are probably application by brush or glove.

Lubricant is also often applied in the area of a rope pulley.

Sometimes the lubricant is applied continuously as drip-feed lubrication at a cable pulley. Spray tins are often used in the case of smaller lubricant requirements.

Various plants allow the rope to run through a lubricant tank.

However, only high-pressure lubrication by a pressure sleeve ensures complete penetration of the lubricant into all cavities of the wire rope. The half shells with rubber seals are folded around the wire rope and screwed together. As the wire rope passes through, the sleeve lubricant is forced into the sleeve at pressures of around 30 bar. Whichever form of wire rope relubrication is used, the important

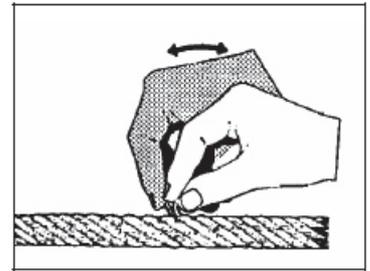
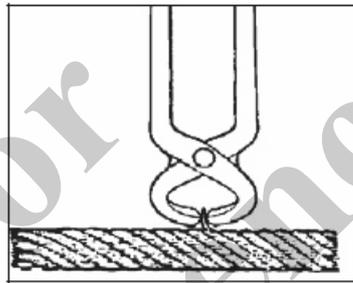
thing is that it takes place regularly from the outset and is not started only when the first damage has already been detected.

10.1.5.2 Cleaning of wire ropes

According to DIN 15020: "Extremely dirty wire ropes should be cleaned externally from time to time. "This applies in particular to wire ropes which operate in highly abrasive environments or when chemically active substances deposit during operation.

Effective cleaning is extremely troublesome, however, without the correct aids. The Canadian Rigging Manual, recommends a device with three rotating brushes followed by compressed-air for cleaning ropes. An American manufacturer offers a "spiked rope cleaner", a rotating sleeve with brushes, which is pulled over the wire rope.

10.1.5.3 Removal of broken wires



Any ends of wire breaks found during a wire rope inspection must be removed because they are likely to settle over adjacent wires and cause them to be destroyed as well when running over pulleys.

The wires should never be nipped off with pincers. The best method is to bend the wires to and fro until they break at the last point, at which they are held in the stranded wire assembly.

With a thicker wire it is advisable to move a tool to and fro over the rope and thus bend the wire until it breaks.

10.1.5.4 Shortening or relocation of wire ropes

Wire ropes often have to be discarded because short rope zones, e.g. the rope section that must climb from the first to the second layer on the drum, are extensively damaged whereas the remaining rope length is still in satisfactory condition.

In such cases the life of wire ropes can sometimes be greatly prolonged by shifting or shortening the ropes at their fixed point by a specific length that moves the most heavily stressed rope section out of the main stress zone. After this process an adjacent zone will now be exposed to the heavier stresses.

Further typical local damage occurs on the rope drum at those points where the rope runs against the adjacent turn (crossover point) and must be diverted sideways. If the damage resulting in this case is the main reason for discarding the wire rope, the rope life can possibly be increased by a multiple by repeated relocation of the rope and displacement of the stress zones.

10.1.5.5 Reversal of wire ropes

In some plants the wire ropes are exposed to completely different stresses in various zones. For example, the hauling line of a dragline excavator is subjected essentially to alternate bending stresses at the drum end; the bucket end is pulled through the ground and exposed to heavy wear.

It is common practice, particularly abroad, to reverse the wire rope after a certain running time (end-for-ending), so that the drum end usually in better condition can now be exposed to the heavy wear.

However, the success of such measures is disputed. In any case the expenditure is only worthwhile where the rope value is a multiple of the assembly costs.

10.1.6 Inspection of wire ropes

10.1.6.1 Why must a wire rope be inspected?

A wire rope is an article of daily use with a limited life. Many properties of a wire rope vary during its period of use. Its breaking force, for example, increases slightly during its initial period of use, but then deteriorates rapidly after reaching a maximum.

This decline in the breaking force is explained by an increasing loss of metal cross-section as a result of wear and corrosion, the occurrence of wire breaks and structural changes in the wire rope. The number of wire breaks usually increases continuously.

One of the aims of wire rope inspection is to monitor this natural wear, so that the rope can be discarded in good time before an unsafe operating condition is attained.

A further aim of inspection is to identify unusual rope damage, which is usually caused by external effects. On the one hand this enables the wire rope to be discarded in good time, on the other hand it can reveal weak points in the rope drive as a first step to introducing measures that can help to prevent repeated occurrence of such damage.

10.1.6.2 When must a wire rope be inspected?

15020 Part 2 recommends in point 3.4 "Monitoring" a daily visual inspection of wire ropes and rope end fastenings for any damage DIN.

The wire ropes should also be checked at regular intervals by trained technicians to ensure that they are in operationally reliable condition. According to DIN the intervals between the checks should be laid down in such a way that "damage is recognized in good time. Hence the intervals in the first few weeks after a new wire rope is mounted and after occurrence of the first wire breaks should be shorter than during the remaining life of the wire rope. After unusual loads or in the case of suspected, invisible damage the interval should be shortened accordingly (if necessary to hours). Such an inspection should also be carried out when starting up after prolonged stoppages, in the case of hoists dismantled for relocation before each start-up at a new workplace, and after each accident or case of damage which occurs in connection with the rope drive."

According to DIN 15020, rope pulleys, rope drums and compensating pulleys "should be checked as required, but at least once yearly and whenever a new wire rope is mounted".

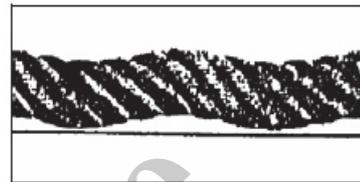
Regular inspections of the rope drive help to improve the safety of the operator in two respects: firstly the accident risk is reduced and secondly, if an accident occurs by misfortune, complete documentation of regular monitoring helps to reject a charge of negligence.

10.1.6.3 Survey of discard criteria

According to DIN 15020, a wire rope must be discarded if one or more of the following criteria are satisfied:

1. Wire breaks. A wire rope must be discarded if the permissible number of wire breaks according to DIN 15020 has been achieved or exceeded (see Section 5). If clusters of wire breaks occur, the wire rope should likewise be discarded.
2. Reduction of diameter. A wire rope must be discarded if its diameter has been reduced by structural changes on long sections by 15% or more compared to the nominal dimension.

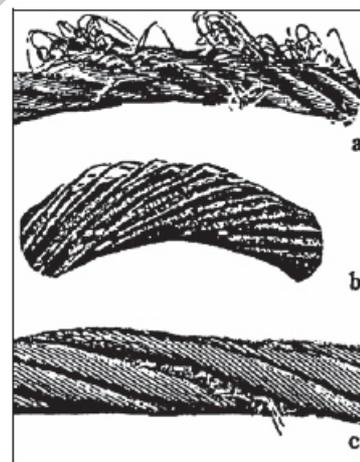
3. Corrosion. A wire rope must be discarded if its load capacity or operating strength has been unduly reduced by corrosion. In this case the wire rope must be discarded if its diameter has been reduced by 10% compared to the nominal dimension, even if no wire breaks are detected.
4. Wear. A wire rope must be discarded if its static breaking force or operating strength has been unduly reduced by metallic wear. The wire rope must be discarded in the case of a 10% reduction in diameter compared to the nominal dimension, even if no wire breaks are detected.
5. Rope deformations.



- a. Corkscrew-type deformations. A wire rope must be discarded if a corkscrew-type deformation achieves an undulation height of one third of the rope diameter.

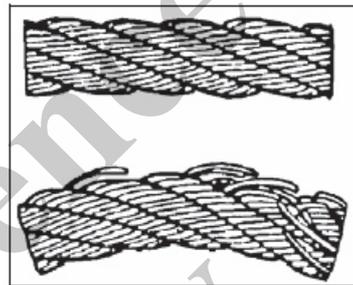


- b. Basket formations. If a basket formation occurs, a wire rope must be discarded.



- c. Loop formations. In the event of a significant change in the rope assembly as a result of loop formations of wires, a wire rope must be discarded.

- d. Wire loosening. In the event of wire loosening caused by rust or wear, a wire rope must be discarded. In the event of other causes the consequential damage is determinative for discard of the rope.
- e. Knot formations. In the case of prominent knot formation (local thickening in the rope) a wire rope must be discarded.
- f. Constrictions. Wire ropes with prominent constrictions must be discarded.
- g. Curl-type deformations. Wire ropes, which have sustained permanent deformations, because they were drawn over an edge, must be discarded.
- h. Kinks. Wire ropes with kinks (rope loops drawn together, must be discarded.
- i. Bends. Wire ropes which have been bent by external force must be discarded.



- j. Heat effect. Wire ropes, which have been exposed to excessive heat, must be discarded. Heating of rope wires to temperatures over about 300°C leads to a sharp reduction of the wire strength.

10.1.6.4 Where must a wire rope be inspected?

A visual inspection must generally be carried out on the full rope length, whereby greater attention should, of course, be paid to critical points. Critical points are as follows:

- a. The rope zones which perform the largest number of alternate bends. Increased wear and wire breaks should be anticipated in this case.
- b. The load pick-up points.
If a hoist predominantly picks up or sets down a load at a specific point, all the rope zones lying on the rope pulleys or running on to or off the drum in this position are subjected to special stresses.
- c. The rope end fastenings. The elasticity of the wire rope is reduced at the rope end fastenings; the rope geometry is “frozen” at this point.
- d. The fastening often exerts additional pressures on the wire rope and the transition zones are frequently exposed to additional stresses by rope vibrations. Moisture may often deposit in the end fastenings. Hence wire breaks and corrosion are to be anticipated here.
- e. Rope zones on compensating pulleys. Contrary to an estimation according to DIN 15020, which permits smaller diameters for compensating pulleys than for the other pulleys in the rope drive, the rope zones on compensating pulleys are sometimes exposed to very high alternate bending stresses as a result of vibrations of the load or non-uniform wind-

ing of two rope drums. Moisture may also deposit between rope and pulley and cause locally increased corrosion.

- f. Rope zones on rope drums. Load pick-up points and crossover points on rope drums are exposed to heavier wear and should therefore be inspected in particular for wear, wire breaks and structural changes. In the case of multi-layer winding the lower layers may loosen and become obstacles for the ropes running on to the drum; higher layers may also be drawn into loose lower layers. Contact points with the drum flanges and gradient zones should also be specially evaluated because they may be exposed to heavy wear.
- g. Rope pulleys. Insofar as possible, rope pulleys should be checked for easy movement. The groove base in the pulleys, the diameter of which should be about rope nominal diameter plus 6% to 8%, should be checked with a gauge.

A rope groove that is too narrow leads to a sharp drop in the rope life as a result of structural changes. A groove that is too wide causes reduction of the rope life as a result of premature rope fatigue because of the inadequate support of the wire rope.

The remaining wall thickness of pulleys should be measured; any lateral working in should be noted. Pulleys with negative impressions of the rope surface in the groove base should be changed.

- h. Rope zones, which are exposed to corrosive media or heat. The effect of chemicals or heat may clearly reduce the load capacity of wire ropes. Continuous temperatures of about 200°C are still uncritical for the wire material, but temperatures of 250°C may already lead to complete lubricant loss of the wire rope and thus to a notable deterioration of the operating conditions.

10.1.6.5 Number of wire breaks for discard

The number of wire breaks for discard is the most important discard criterion. The highest number of external or, if accessible, also inner wire breaks found on a length of 6 x rope diameter or 30 x rope diameter applies as number of wire breaks for discard.

The number of breaks for discard is shown in DIN 125020, Part 2, page 3 as a function of the number of supporting wires in the outer strands of the wire rope and the drive unit group of the rope drive. The table also distinguishes between cross-lay and Lang lay ropes.

The number of wire breaks for discard in the case of cross-lay ropes is on average twice as high as the number for Lang lay ropes.

As the number of supporting wires increases the number of wire breaks for discard also rises. In the drive unit groups 2 m, 3 m, 4 m and 5 m the number of wire breaks for discard is twice as high as in the heavily loaded groups 1 Em to 1 Am.

Specification of numbers of wire breaks for discard for a length of 6 x rope diameter (approx. one rope lay length) and for a length of 30 x rope diameter (approx. 5 rope lay lengths) takes into account the possible occurrence of locally limited damage or clusters of wire breaks. Even if the number of wire breaks for discard for a length of 30 x rope diameter is not yet achieved, the wire rope may no longer be reliable as a result of local damage. It must then be discarded because the number of wire breaks for discard for 6 x rope diameter is achieved.

10.1.6.6 How must a wire rope be inspected?

Aids

The following aids should be available for a competent inspection of the wire rope and the rope drive:

- a sliding gauge (possibly with measuring surfaces)

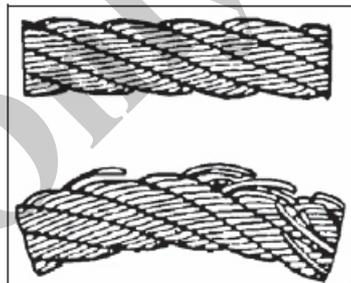
- a tape measure
- a piece of white chalk, a piece of black wax chalk
- an endless roll of paper tape
- a screwdriver
- a magnifier (possibly measuring magnifier, thread counter)
- two sets of groove gauges
- a cleaning rag
- a notepad or inspection form
- the records of the previous inspections
- a ball-point pen or the like
- a list of the discard criteria

Determination of the numbers of wire breaks

The numbers of wire breaks must be determined by an external visual inspection. The rope zone with the largest accumulation of wire breaks must first be determined preferably by checking the full length of the rope.

Sections with a length 30 x rope diameter are measured with a tape measure on the worst rope zones and marked with chalk. If clusters of wire breaks or local damage to the wire ropes occur, a length of 6 x rope diameter (approx. one rope lay length), which includes the damage, is also marked. All wire breaks on these sections are now carefully counted by visual inspection and feeling the rope on its circumference. For better visual inspection it may be necessary to clean the rope surface with a rag and remove lubricant and dirt from the recesses between the stranded wires with a scraper.

When determining the number of wire breaks the feeling of the rope is just as important as the visual inspection, because the wire break ends often do not project from the rope, particularly in well preformed ropes. In addition the narrow gap between the break ends is often clogged with lubricant and therefore barely discernible to the eye even on cleaned ropes. Anyone not getting their fingers dirty when inspecting ropes is not working thoroughly enough!



Outer wire breaks, which do not occur on the top of the stranded wires but at the contact points between adjacent strands or even on the underside are extremely difficult to recognize. In the case of thin ropes, which can be fully relieved, such wire breaks can be made visible by bending the rope.

The numbers of wire breaks determined are noted and compared with the numbers permissible according to DIN 15020. If the permissible numbers are exceeded, the wire rope must be discarded.

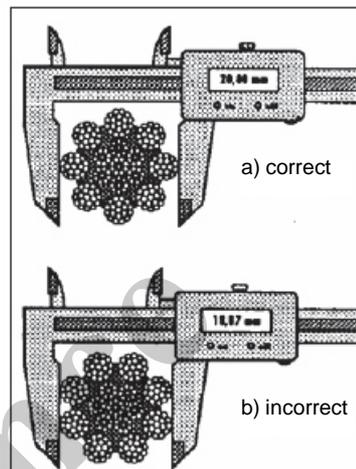
Determination of the rope diameter

The rope diameter should be measured several times on the brand-new rope. Firstly, it can be established by this measurement whether the new rope is within the tolerance of rope nominal diameter + 0 % to rope nominal diameter +5 % specified in the standards (if special winding systems are used the permissible diameter range for the wire rope may be narrower). Secondly, the mean value of the measured diameter in the brand-new condition can serve as a comparison value for all subsequent measurements.

It should be ensured by measurement of the rope diameter during further operation of the rope that abnormally rapid reductions of the rope diameter (e.g. as a result of fracture of the steel insert) are quickly detected. Furthermore, the

measurements should ensure that the rope is discarded when the maximum diameter reduction specified in the standards is achieved. With reduction of the rope diameter to 90% of its nominal value a wire rope must be discarded according to DIN 15020.

A sliding gauge is used for accurate determination of the rope diameter in various characteristic or unusual zones of the wire rope. The sliding gauge should preferably have two flat measuring surfaces; a digital display is advantageous.



The rope diameter is defined as the diameter of the enveloping circle of the outer stranded wires. Hence the measurement must cover the highest points of the outer stranded wires; measurement over the troughs would produce too small a value. Two rope diameters at right angles to each other should be measured at each measuring point to enable detection of any out-of-roundness.

The entry in the test report could read as follows:

"Rope diameter 20,4/20,5 mm".

Measurement of the rope lay length

A tape measure and chalk are required for measurement of the rope lay length. To minimize the measuring error, the measurement is made over three or more lay lengths and the measured length subsequently divided by the selected multiple.

For this purpose the top side of any strand in the range of interest is marked with chalk (top side zero) and each top side on the further rope length at the point where the same strand reappears after passing round the rope. On an eight-strand rope, for example, the eighth, sixteenth, twenty-fourth and thirty-second top sides are marked.

The distance from the first mark (top side zero) to the last one now includes exactly four rope lay lengths.

The distance is measured, the value obtained divided by four and the rope lay length in this zone obtained with a relatively small measuring error.

Like the diameter, the rope lay length should also be determined by several measurements on the brand-new rope and recorded in writing. The mean value can again serve as comparison value for all subsequent measurements. However, the rope lay length on the new rope can usually also be measured subsequently on the dead turns on the drum.

The lay length is not in itself informative for the rope operator; however, clear changes in the rope lay length are an alarm signal which indicates that something is not in order.

Another possibility of measuring the rope lay length, which also supplies a hard-copy document, is the impression of the rope surface on a long paper strip.

The impression is made as follows: the free end of the rolled-up strip is first secured on the rope by adhesive tape. The strip is then unrolled over the rope length and a piece of wax chalk moved over the paper at the same time. A clear

impression of the outer wires of the rope is thus obtained via the top sides of the strands. The paper strip is labeled for subsequent evaluation.

By laying impressions of the dead drum turns and the investigated zone over each other and viewing them against the light it can be roughly ascertained in situ whether changes have occurred.

Checking the strength of the wire rope structure

The strength of the wire rope structure is determined by inserting a screwdriver between two top strands and an attempt made to produce a gap by turning the handle without applying too much force. If the wire rope does not offer too much resistance to this turning, and it is even possible to insert the screwdriver under two adjacent strands, the rope structure is loose.

In the same way you can check whether the outer wires of the rope have worked loose in the strand assembly.

Lifting the top strands by force with the aid of a screwdriver or splicing nail, as is occasionally practiced to evaluate the condition of the rope core, is best avoided. All too often the wire rope suffers permanent damage in this case.

Checking for structural changes

The first rope damage can usually be expected to occur in the main operating range of wire ropes, i.e. in the rope zones performing the largest number of alternate bends. However, rope deformations such as corkscrews, basket formations or loop formations frequently occur outside the main operating range of the ropes, because excess strand or rope lengths are "massaged" out of the roll-over section by the pulleys. Such rope damage may also occur in front of the rope drum or end fastenings. Hence these areas should be inspected with the same care.

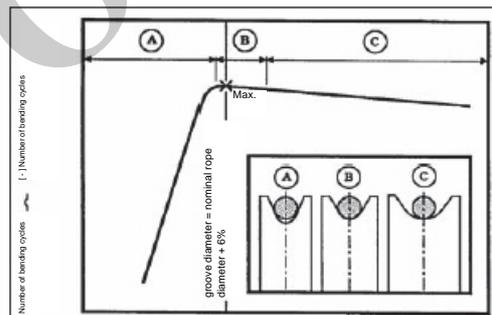
During the inspection the ropes should also be moved to enable evaluation of any rope zones that are temporarily inaccessible.

Abrasion marks on structural parts may be useful indications of an unsatisfactory rope drive and possible rope damage.

Faults in the rope assembly are the most difficult discard criteria to evaluate. The rope should be discarded even if only the slightest doubt exists with regard to its reliability.

Checking rope pulleys and rope drums

In addition to the wire rope itself, all parts of the plant with which the rope comes into contact merit attention. The following comments on the rope pulleys also apply where appropriate to the rope drums.



The pulley grooves should be smooth and have a diameter slightly larger than the effective diameter of the rope. DIN 15020 recommends a groove diameter of at least 1.05 times the rope nominal diameter. The optimum diameter in the groove base is about 1.06 to 1.08 times the rope nominal diameter.

If the groove is too narrow the wire rope is exposed to heavy compression in the radial direction. This stress soon leads to wire breaks or structural changes in the rope.

By contrast, if a groove is too wide it offers the wire rope an insufficient contact area and lateral support. The increased pressure in the groove base and the

additional stresses resulting from the greater rope deformation (ovalization of the rope) likewise lead to reduction of the rope life.

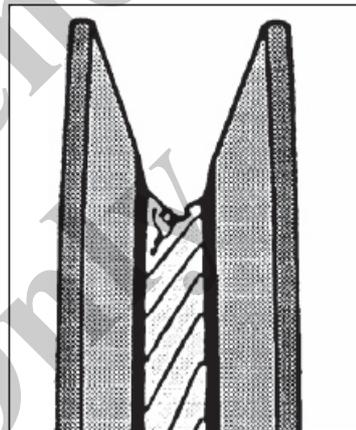
The grooves are checked by groove gauges. Although these gauges are commercially available, circular templates made on a lathe are the best method.

It is advisable to manufacture a circular groove gauge with a diameter larger by exactly the required 6% than the rope nominal diameter for the rope drive to be tested as well as gauges with slightly smaller and larger diameters for comparative measurements.

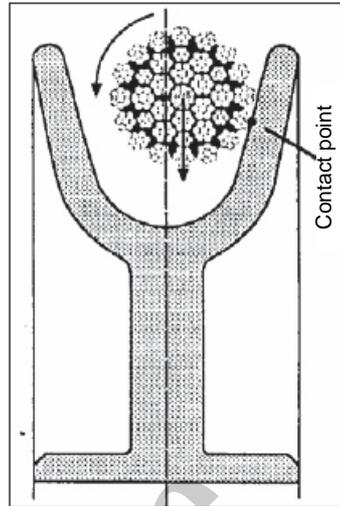
To check the groove dimension the groove gauge most suitable according to the above comments is placed in the groove and the support checked. If the template fits well over a large portion of the circumference, the groove dimension is in order. If the template rests only on the flanks, the groove is too narrow; if it rests only on a small portion of the circumference, it is too wide. In both cases the other templates are used to establish the deviation from the required value.

The confined space in many plants often makes evaluation difficult. If it is not possible to check the snug fit of the templates from the side, the templates can be pulled through the groove and the evaluation made on the basis of the sliding marks in the lubricant.

A narrow mark in the center means: the groove is larger than the template. A wide mark in the entire groove base means: the groove and template are the same size. Two narrow marks on the flanks indicate that the template is larger than the groove.



During measurement of the groove the depth of the groove base and its surface quality are also checked. Furrows and other surface changes often significantly shorten the rope life. If a negative profile of the wire rope has formed in the groove base, this profile can offer optimum support for the rope resting on the pulley, but at the latest the rope installed in the next rope change would no longer fit in this contour and would quickly be damaged. Pulleys with such furrows must likewise be changed at the same time as a rope.



The flanks of the rope pulleys should also be checked regularly. Abrasion marks pointing radially to the groove base show that the rope first contacts the flank when running over the pulley and then slides down into the groove only on further rotation of the pulley. In this case there is a risk of twisting of the rope by force, which leads to structural changes, and also the risk that the rope will jump out of the pulley. The cause of the rope running against the flanks is often an inadmissibly high deflection angle of the rope to the pulley plane. DIN 15020 rightly recommends that deflection angles of 4° for ropes, which are not twist-free, and 1.5° for twist-free ropes should not be exceeded. 4° corresponds to a deflection of about 1 m over 15 m, 1.5° to a deflection of about 1 m over 40 m.

If it is possible when the rope is not under load, the rope pulleys should be checked for easy movement of the bearings and their concentricity by turning.

10.1.7 Concluding remarks

By the special design of its equipment and selection of the initially used wire ropes, Grove has created the prerequisites for satisfactory rope life. You can make an additional contribution to the economical operation and safety of your equipment by following the above recommendations for the handling, assembly, maintenance and inspection of wire ropes.

The Grove company and the author of this publication, Dipl.-Ing. Roland Verreet, will be pleased to comment on specific questions.

Ingenieurbüro für Fördertechnik

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D-5100 Aachen

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10.2 Camera system

MD3072B	Art.-no. 401 0040 000
MD3072B-Quad	Art.-no. 401 0041 000

10.2.1 Product description

The TFT Monitor MD3072B/MD3072B-Quad shall be used to display up to 4 video images at vehicles and / or mobile machines. Using the connected camera, the driver/operator is able to monitor areas outside his direct visibility.

10.2.1.1 Important notes on the product

Make sure that the data indicated on the rating plate of the TFT display MD3072B/MD3072B-Quad correspond to this user manual. Please see the camera and control box manuals for further instructions.

10.2.1.2 Declaration of conformity

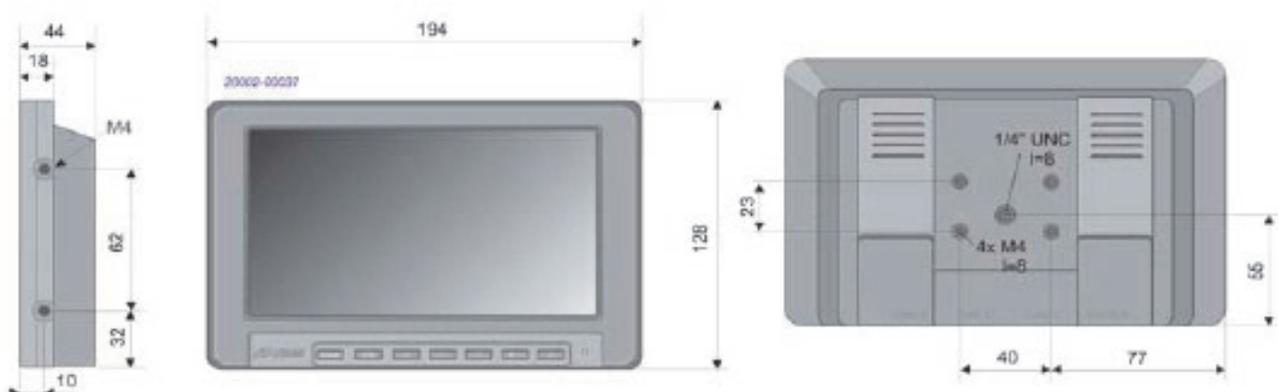
As the initial vendor within Europe, we have conducted an evaluation of conformity for

our products in accordance with EU directives and legal provisions based on the requirements of the relevant "harmonised standards".

You will find the CE marking on the product and also on the accompanying product documentation. We will be happy to provide you with a separate EC Declaration of Conformity upon re-quest. If modifications are made to the device, compliance with the requirements of conformity is no longer ensured and the warranty becomes void. In case of use outside the EU, the user is required to comply with relevant national requirements.

10.2.1.3 Technical data

Power supply	12V DC / 24V DC
Storage temperature	-35°C ... +85°C
Operating temperature	-30°C ... +80°C
Weight	600g
Display housing	Aluminium / impact resistant plastic
Protection class	IP20
Shock resistance	20g
Display dimensions (mm)	194 x 128 x 44
Mounting thread	1/4 in UNC or M4x1.5
Type of installation	Any
Access	Connector
Diagonal screen size	17,8 cm (7 in, 16:9)
Resolution in pixel	800 x 480
Backlight	300 cd/m ²
Contrast	350:1
Viewing angle	left/right 60°
Viewing angle	top 35°
Viewing angle	below 50°
Video signal	FBAS/CVBS
Video system	PAL & NTSC (automatically adapted)
Signal input	1 Vpp (30% Sync. neg.) / 75 Ohm
Lines	625 / 525
Vertical frequency	50 Hz / 60 Hz
Horizontal frequency	15625 Hz / 15750 Hz
POC	12V DC / 24V DC
SEL1 / SEL2 / SEL3 / SEL4	12V DC / 24V DC
Protection devices	Reverse voltage protection



10.2.1.4 Optional accessories

Match Code	Part Number	Description
MD-KG	406 0089 007	Progressively adjustable joint mount (406 0089 022 is required)
KG24-V50	406 0089 008	Extension 50mm for MDKG- ball joint
MD-V	406 0089 023	Anti-vibrations unit for display mount

10.2.2 Safety Instructions



WARNING

The electrical connection and commissioning of this system may only be performed by qualified personnel, in accordance with this document!

The device may only be operated if the user is fully aware of all risks and dangers that may result from the operation of the device.

Do not operate the device if damaged. Do not connect to 230 V DC supply.

10.2.2.1 Product Safety

This product is state-of-the-art and corresponds to generally acknowledged safety requirements. You may only operate the product in flawless condition, complying to this document.

10.2.2.2 Potential Dangers

Check the system for visible defects before starting operation, and keep monitoring during operation. Do not start operating, or continue operating, the system in case any defects have been detected that may affect the safety of the system. Any such defects affecting the safety must be removed before continuing to operate the system.

Dangers resulting from the use of special operating supplies and accessories which have not been approved or examined cannot be monitored. As it is also not possible to monitor the assembly, installation and operation of the device, the correct usage of the product is under the sole responsibility of the user. Observe the information provided by the machine/vehicle manufacturer when installation the system components. Observe all safety instructions provided for the machine/

vehicle. Additional dangers may arise when connecting this product to other products:

- Do not install cables in the vicinity of engines or other sources of heat.
- Protect the cables against damage by means of cable ducts or protective hoses.
- Make sure not to drill the cables.
- Cables must not be painted or get in contact with solvents.
- Loop the cable in case it is too long.

10.2.3 Operating and Display Elements



Display on / off



Menus are activated and toggled in the order:

- Brightness Brightness - 0(MIN) ... 60 (MAX)
- Contrast Contrast - 0(MIN) ... 60 (MAX)
- Color Color saturation - 0 (MIN) ... 60 (MAX)
- Standard Reset to factory settings
- Volume Volume - 0 (MIN) ... 10 (MAX)
- Language English, French, German, Spanish, Italian, Portuguese, Polish
- Mirroring..... The camera image is mirrored. Select the "Entry" menu item to return to the main menu. Select "Exit" to terminate the menu.
- Video..... PAL, NTSC, Auto
- Poc..... OFF/ON. Monitor is activated via ignition
- Timer..... OFF/ON. Activates the timer mode
- Timer Setup Selection of camera(s) to be displayed in timer mode and setting of display activation time (OFF/ON 5-30 sec.)
- Exit..... Exits the menu



Select key "Plus"



Select key "Minus"



Day / Night Selection



This key can be used to toggle to camera 1, camera 2, camera 3 and camera 4 in single camera mode.

In split screen mode you can toggle to cameras 1/2, 2/3, 3/4, 4/1, 1/3 and 2/4. In timer mode this key can be used as Play/Pause function.

In three or four camera operation mode, this button has no function.

Camera selection is only possible if no control line is busy.

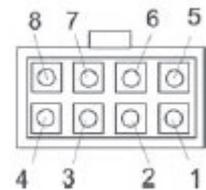


Press the Mode key to toggle to the individual display modes (single image, split screen (2), split screen (3), split screen (4) and timer mode.

10.2.4 Commissioning

1. Fasten the display mount inside the driver cabin such that the driver can easily see the TFT display. Make sure that no display instruments are hidden and that the driver's front view is not obstructed.
2. Connect the supply cable MD3072B-AK according to the following table.

Pin	Name	Function	Color
1	+12 / +24V DC	On-board supply pos. term.	Red
2	GND	On-board supply neg. term.	Black
3	POC	Control line	Yellow
4	-	-	White
5	SEL4	Selection camera 4 (MD3072B-Quad)	Red/black
6	SEL3	Selection camera 3 (MD3072B-Quad)	Red/brown
7	SEL2	Selection camera 2	Red/blue
8	SEL1	Selection camera 1	Red/green

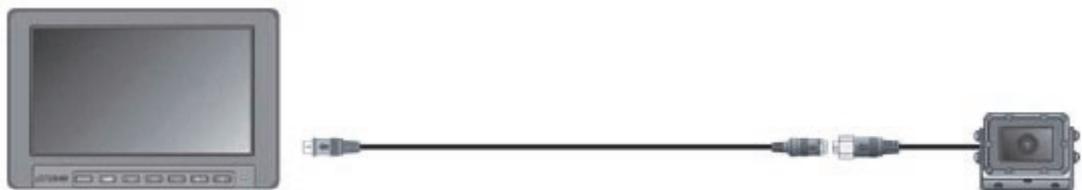


3. Attach the display to the display mount.
4. Adjust the TFT display in an angle providing convenient, optimal view to the driver.

10.2.5 Operating Modes

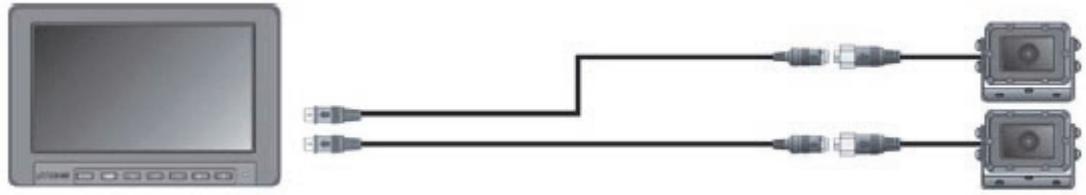
10.2.5.1 Single Camera Operation

A single camera is connected to C1 in this operating mode.



10.2.5.2 Twin Camera Operation

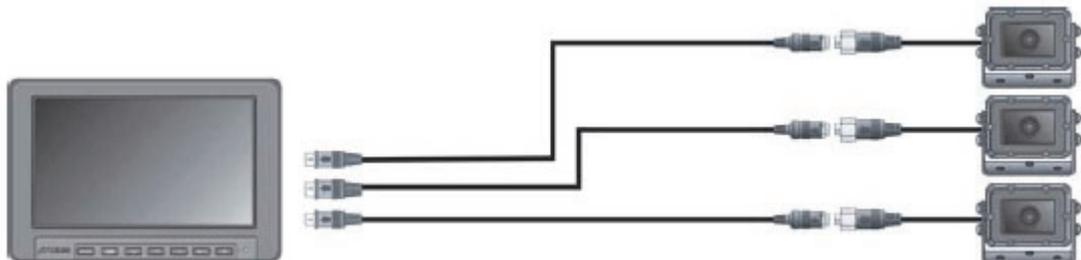
Two cameras are connected in this operating mode. Camera 1 has the highest priority, i.e. images of camera 1 will be displayed on the screen if both cameras have been selected simultaneously.



For
Reference
Only

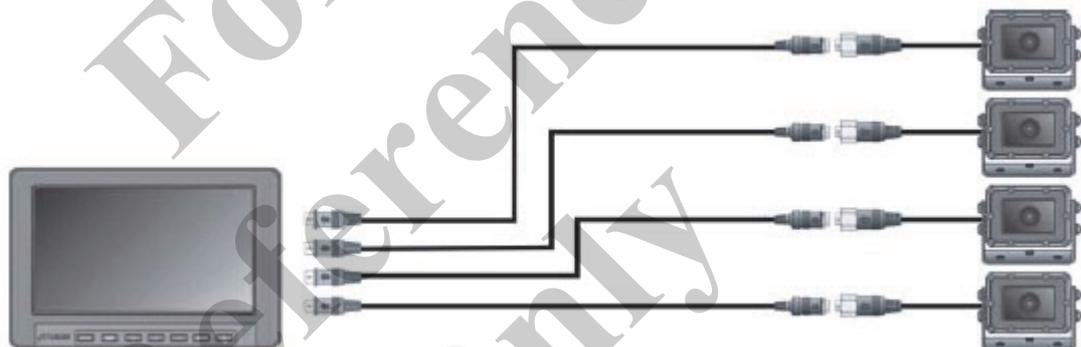
10.2.5.3 Three Camera Operation

Three cameras are connected in this operating mode. Camera 1 has the highest priority, i.e. images of camera 1 will be displayed on the screen if other cameras have been selected simultaneously. Camera 2 has a higher priority than camera 3.



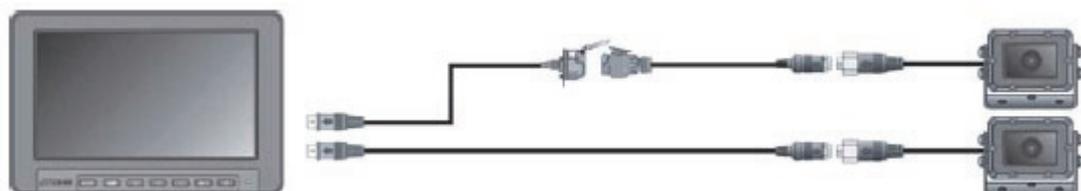
10.2.5.4 Four Camera Operation

Two or more cameras are connected in this operating mode. Camera 1 has the highest priority, i.e. images of camera 1 will be displayed on the screen if other cameras have been selected simultaneously. Camera 2 has a higher priority than camera 3 and camera 4. Camera 3 has a higher priority than camera 4.



10.2.5.5 Operation with Two or More Cameras in Trailer Mode

Two or more cameras are connected in this operating mode. Images of the trailer camera (camera 2) will automatically be displayed if the trailer camera is connected to C2 (possible only using control cable such as e.g. MK295.xx).



10.2.6 Malfunctions

If the unit does not work properly, or if you detect any malfunction, check the external wiring first (fuses, supply voltage, cabling, monitor etc.). If the problem or malfunction can definitely be related to the TFT display MD3072B/MD3072B-Quad, it should be returned to the manufacturer together with a brief description of the fault or problem.

10.2.7 Maintenance

The TFT monitor is maintenance-free. Clean the monitor cover using only a soft, slightly moistened cloth. The ventilation slots of the color display should occasionally be freed from dust using a cloth or a brush. Motec products have been designed to operate error-free and with minimum maintenance for a long time. You can extend the system life time by regularly cleaning the product and by treating it in a careful and professional manner.

Do not remove the labels which identify the product. In some cases legal provisions apply. In any case the information identifying the product with a precise designation and serial number is relevant for tracking products and in the event of claims under the warranty.

10.2.8 Service Information

MOTEC Gesellschaft für mobiltechnische Electronic mbH
- Service -
Oberweyerer Str. 21
65589 Hadamar-Steinbach GERMANY
E-mail: service@motecgmbh.de
Internet: <http://www.motecgmbh.de>
Tel.: +49 (0) 6433 91 45 88
Fax: +49 (0) 6433 91 45 77

10.2.9 Environmental Protection

Recyclable material has been used as packaging material to a large extent. Take the opportunity to protect your environment by recycling the packaging material. Unused devices can be delivered to your nearest recycling facility or returned to the manufacturer for recycling.

10.3 Radio Remote Control

10.3.1 Introduction

10.3.1.1 The operating manual

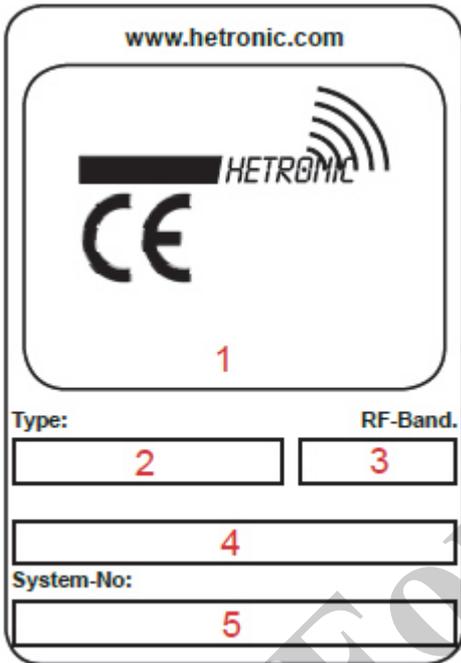
Read the manual of all system components carefully and completely before operating the system. The content will make yourself familiar with the safety instructions and the controls during standard operation and maintenance. Keep the manual in a place where the operator can access it at any time.

10.3.1.2 How to use this manual

- This manual is part of the product.
- This manual has to be retained as long as the system is operated.
- This manual has to be passed on to every future owner or user of the system.
- Please assure that each available appendix is attached to the manual.

10.3.1.3 Production and system numbers

When you contact your dealer or HETRONIC for repair work, maintenance or spare parts, please keep the system numbers of the transmitter and the receiver ready. You will find the numbers on the type label on the outside of the transmitter and receiver housing.



Type plate – Labeling and meaning

1. Approvals
2. Transmitter and receiver type
3. Frequency and RF type
4. Production number
5. System number

Explanation for item 5. system number

Each system number is made up of 11 digits. Below you will find the meaning of the particular digits from left to right:

10509178000

1.	Country indicator
05	Month of production
09	Year of production
178000	System number

For Reference Only

10.3.1.4 Copyright

All rights are reserved. Copying, reshaping, recording on electronic media and translating into other languages is only allowed with the written permission of HETRONIC Germany GmbH.

Subject to technical change without prior notice.

HETRONIC Germany GmbH reserves the right to change, improve or phase out the products anytime without public notice or obligation. HETRONIC Germany does not accept liability claims for material damage, personal injury or death, which result from the use of unlicensed spare parts or unauthorized service.

Please notice the attached drawings!

The drawings will show the specific version of your radio remote control.

10.3.2 Safety precautions

10.3.2.1 Safety of this radio remote control system

This radio remote control system is equipped with both, electronic and mechanical protection devices. Control commands from other transmitters cannot be processed, as all information from the transmitter and the receiver is encoded.

10.3.2.2 Safety information

Using a radio remote control system allows the operator for more mobility in his working area and increased precision. However, the user and the maintenance staff always have to be attentive, in order to access all these advantages. The operator always has to keep an eye on the machine running, as this is necessary to assure a proper and safe operation of the radio remote control system.

10.3.2.3 Authorized operators have to be instructed according to the industrial safety regulations!

Always check the operating instructions of your machine, to receive more important information! The operator has to assure that unauthorized persons cannot operate the transmitter. For this, he has to turn off the key switch, remove the key or the rechargeable battery and store the transmitter in a lockable location. This is the only way to prevent undesired use or misuse by unauthorized persons. The operator must have access to all operating instructions, which are necessary for the proper operation of the machine to be controlled. If the system is not used by the buyer himself, if it was lent, rented or sold, please provide this operating manual and the required safety instructions before operation.

Before operating this radio remote control, the operator has to read and completely understand all instructions of every chapter of this manual.

NOTICE

10.3.2.4 Sources of risk

The system is designed for permitting machines to be controlled by radio remote control. However, control commands are also transmitted outside your range of vision and through or around obstacles.

Therefore:

- Switch the transmitter off and pull the key from the key switch, if it is not in use.
- Remove the rechargeable battery, if your transmitter does not have a key switch.
- The protection devices may not be modified or removed.

10.3.2.5 Safety precautions in the working area

Make sure that there are no risks for the operator within the working area of the radio remote control. Ensure that there are no obstacles in the working area and that dangerous situations, affecting the operational safety, are avoided. Make sure you position yourself securely. Before each use of the radio remote control system,

ensure that nobody is within the working area or the swiveling range of your load. If a carrying strap is provided for your transmitter, this has to be used.

10.3.2.6 Protection devices

All industrial HETRONIC radio remote control systems are equipped with an emergency stop button, located on the control panel of the transmitter.

The radio remote control system is provided with protection devices, which are activated automatically in the following cases:

- Radio interference within the working area, affecting the frequency range of the HETRONIC radio remote control.
- Exceeding the range of the transmitter.

In these cases, the radio remote control will be stopped immediately and the output signals of the receiver are interrupted.

10.3.2.7 What to do in an emergency

1. Press the red stop button.
2. Turn the key switch to position "OFF".
3. Wait until the machine has stopped.
4. Proceed as instructed in the operating manual for your machine.



Unlock stop button by turning clockwise



Push-pull stop



Momentary stop

10.3.3 Protection devices

10.3.3.1 Transmitter

Key switch:

Almost all of the transmitters are equipped with a key switch. This key enables the operator to switch off the transmitter, when it is not operated. Furthermore, the key switch prevents undesired use or misuse by third parties and is a helpful device in case of maintenance work on the machine.

Self test:

After turning the key switch, the system performs a self test. 2 acoustic signals will confirm a positive test result. When the green LED is flashing the transmitter is ready for operation.

Button "start/horn" – Neutral position:

After the self test, the transmitter has to be started by pushing the start/horn button. This will activate the receiver. All control functions have to be in neutral position, in order to start the system. If one of the control functions is activated, the system cannot be started. This protective measurement ensures that machine motions cannot be activated accidentally. You cannot skip the start button by destructing it or shutting it down. If the start button is pushed during the self test, the system will not start.

Stop button:

The transmitters are equipped with a tamper-proof stop button. The stop signal is transmitted as a normally open contact and a normally closed contact at the same time. Furthermore the stop button status is monitored during the self test when the

system is started. If the stop button is activated during the startup procedure, the system will not operate. The stop button is the most important protection device of the radio remote control. It ensures that the operator can immediately stop the machine during operation.

Battery monitoring: The transmitter's electronics permanently monitors the battery state. If the battery voltage is low, an optical or acoustical signal will alert the operator for about 30 seconds. Afterwards the transmitter automatically sends out a stop signal and brings the machine into a safe state. Please note that an advanced low voltage recognition (approx. 10 minutes) is also available.

Mechanical construction: A mechanical guard on the transmitter protects the buttons and joysticks from shocks and dropping. The lightweight, fiber-reinforced PC transmitter housing meets the requirements of daily operation.

10.3.3.2 Receiver

Self test: The software runs a self test after the receiver is energized. If the self test is negative, the receiver will not start and remain in a safe state.

Emergency stop circuit: The receiver includes a specific emergency stop circuit. Due to the redundant design it functions self-monitoring.

STOP: When the receiver receives the emergency stop signal from the transmitter:

- the internal power supply to the output modules will shut down.
- a fail-safe, self-monitoring emergency stop output relay will be activated.
- the response time is 450 ms.

Power supply: The receiver has its own electronic power supply, which energizes all receiver modules.

10.3.3.3 System

System number: Each radio remote control has its own address. It ensures that only the designated transmitter can activate the corresponding receiver.

Radio interference: In case of radio interference, the system will switch into a safe mode.

Software: After the turn-on procedure, the software of the system performs a system test, where all safety devices are checked.

10.3.4 Installation

10.3.4.1 Positioning of the receiver unit

When mounting the receiver, ensure that the antenna has maximum radio reception, in order to have a radio remote control that functions properly. Metal parts of the machine to be controlled in the immediate vicinity of the receiver unit avoid a proper radio reception. If the receiver is to be installed inside a metal housing or in a shielded area, an appropriate extension and an adequate antenna have to be used in order to achieve a suitable operating range. Contact HETRONIC to get more detailed information.

Furthermore the receiver has to be mounted in a safe and easily accessible place, in order to facilitate future installation and maintenance work. Install the receiver unit with the cable connections downwards.

If the receiver is to be installed on a vehicle or on a mobile machine, you should equip the receiver with rubber buffers, which prevent the transmission of heavy vibrations from the machine to the receiver. If these rubber buffers are not standard part of your radio remote control system, you may obtain them from your HETRONIC dealer directly.

ATTENTION!

- The installation of the receiver unit on the electric system of the machine may only be performed by a qualified person, familiar with the electrical circuitry of the machine and the technical features of the radio remote control.
- Both the transmitter and the receiver have to be powered down during installation work.
- All instructions concerning the health of persons within the immediate vicinity of installation, all valid local regulations and fire regulations have to be observed strictly.
- HETRONIC will not accept liability or provide a guarantee in the event of personal injury or damage to property, resulting from improper or negligent use of the radio remote control or non-compliance with the regulations or instructions.

10.3.4.2 Installation of the output wiring

Switch the power supply of the machine off before attaching the voltage supply of the receiver.

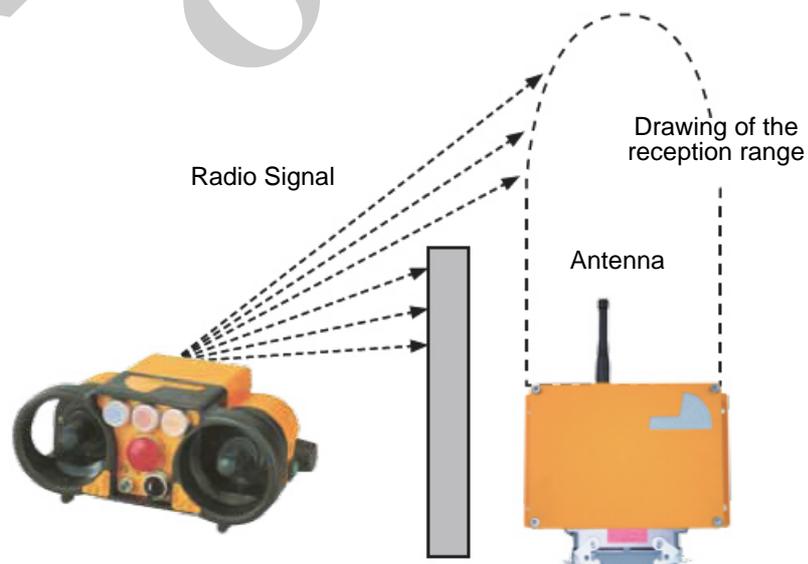
Charge a qualified technician with the wiring. Improper wiring may cause serious system damage and may void your guarantee. The output wiring has to be installed according to the connection diagram of the machine and the radio remote control. Only use contacts of good quality, to ensure a proper electric contact. You will find detailed information about the receiver wiring inside the front covering of the receiver.

The power supply and the ground wire are extremely important. They have to be connected to fail-safe electrical connections.

10.3.4.3 Correct installation of the receiver unit

(See drawings below)

When mounting the receiver unit ensure that no big metal surfaces shield the external antenna.



10.3.5 Checkup before operation

10.3.5.1 Notice for operation

Have you read and understood the operating manual, in particular section 2 "Safety precautions" and section 3 "Protection device" Please do not use the device until you have done so!

10.3.5.2 Visual checkup

ATTENTION!

Always check the transmitter for damages each time before use!

- Are all protection devices present and fully functional?
- Are there any broken parts?
- Are the rubber sleeves and the pushbutton caps in good order? (transmitter)
- Are all connectors and cables in good order? (receiver)

ATTENTION!

Never operate a radio remote control, that shows any kind of defects! All defects have to be repaired by a qualified technician before operation is started!

10.3.5.3 Before operation

- Make sure the system has been installed completely.
- Make yourself familiar with all safety precautions of the operating manual.
- Notice all safety precautions of the operating manual and check the control functions and the operation of machine and radio remote control.
- If the transmitter is not operated, turn it off and store it in a safe place, inaccessible for unauthorized persons.
- Always check that the stop function of the machine and the radio remote control work perfectly.
- If the machine does not respond correctly, immediately stop operation. Turn off the transmitter and remove the batteries. Immediately contact a qualified person.
- Remove the batteries of the transmitter and disconnect the power supply of the receiver before any maintenance work is done.
- For transistor receivers you have to install suppressor elements.
- If you are using rechargeable batteries, make sure that there is always one battery in the charger, and that the charger is always connected to a permanent power supply.
- Installation, adjustment and maintenance may only be performed by authorized technicians.
- Only use genuine Hetric spare parts.

ATTENTION!

In case of problems, turn off the machine immediately. Never operate a machine if the emergency stop does not operate properly. In case of disregarding this rule there is risk of personal injury or collateral damage. Performing work steps not complying with this operating manual may lead to the loss of your operating license and result in the expiration of your guarantee!

10.3.5.4 Functional test of the stop button for transmitters with key switch

ATTENTION!

Check the emergency stop button each time before operating the radio remote control system!

- Make sure, that the transmitter is either operated with completely charged Hetric batteries or alkaline batteries.
- Put the key into the key switch on the transmitter.

- Turn the key from position “0” to “1”. Wait until the green LED starts flashing continuously.
- Now check if the stop button is working properly. Proceed as follows:
 - (1) Push the stop button on the transmitter.
 - (2) Watch the flashing of the green LED.
 - (3) If stop button is activated = fast flashing
 - (4) If stop button is released = standard flashing
- If the stop button works properly – you may start the system.
- If the stop button does not work properly, the system has to be checked by a qualified person.
- Now your radio remote control is ready for operation. Activate any of the functions using the transmitter and check if the machine operation immediately stops if the function is released.

10.3.6 Startup procedure

10.3.6.1 Startup procedure for transmitters without key switch

1. Insert a battery or rechargeable battery
2. The transmitter will be started by activating one of the function buttons
3. The green LED has to flash
4. If the function button is released, the motion will be stopped
5. If the red LED is flashing, the battery or the rechargeable battery has to be changed (Low voltage test optionally).



10.3.6.2 Startup procedure for transmitters with key switch

1. The key switch is used to start the transmitter
2. After the startup procedure, you should hear 2 short acoustic signals (exception ERGO)
3. After this self test, the green LED on the transmitter starts flashing
4. The stop button has to be checked every day (see section 5.4.)
5. Press the green start button in order to start the system. The layout of your transmitter may differ from the pictures below. Please refer to your drawings for information about the function of the buttons.
6. Attention: Control functions which are not in neutral position prevent the startup!



Green start button and key switch



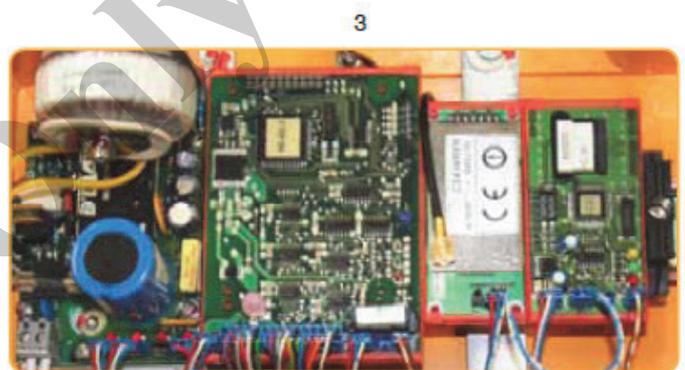
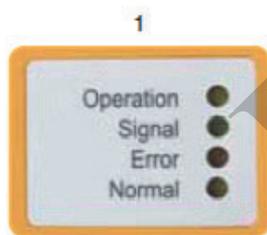
Red stop button

10.3.6.3 Receiver status display

1. Compact version with vision panel
The LED Display is on the right side of the housing.
2. Compact version without vision panel
The LEDs are only visible when receiver lid opened.
3. Modular Version
There are 3 LEDs on both the decoder and the emergency stop decoder

LED Explanation

- Yellow = Operation
- Green = Radio link
- Red = Failure
- Yellow = Normal (stop condition)



10.3.7 Operation of MFS and HL systems

10.3.7.1 MFS transmission technology (Multi Frequency Sharing)

Pocket, Hand Held and Ergo are also available as MFSHL versions. MFS technology allows the operation of several systems with the same frequency in the immediate vicinity.

Transmitter: ERGO-MFS-HL



Pocket-MFS-HL



HandHeld-MFS-HL



Receiver: RX/AC 8 and 16 MFS-HL



RX/DC 8 and 16 MFS-HL



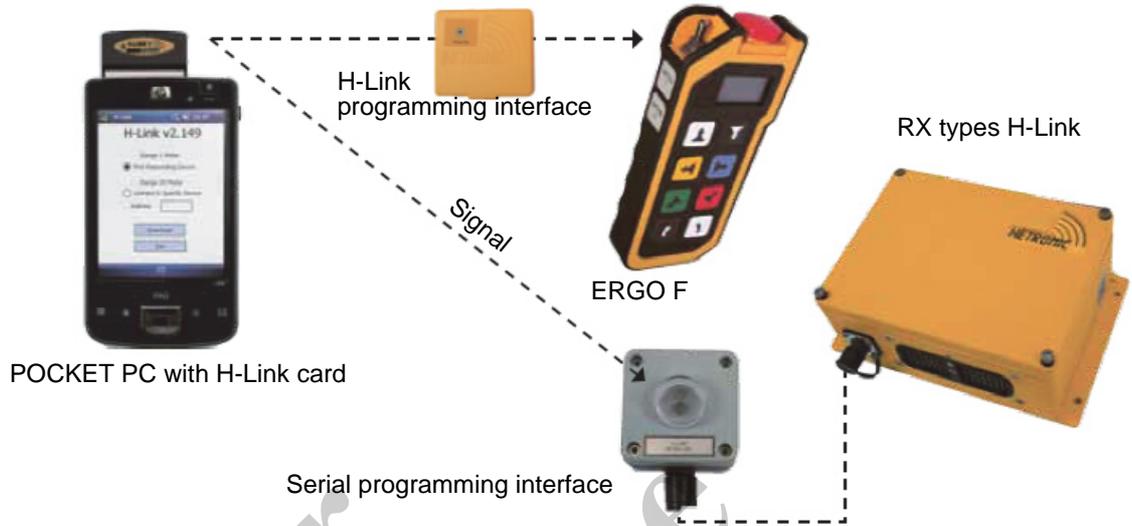
Transmitter	Red LED	Green LED
Low voltage	On	flashing
Transmitter failure	On	On
Transmitter normal	On	flashing
Emergency stop transmitter	flashing	On

Receiver	Red LED	Green LED	Buzzer
Low Failure main contact	On	Off	Off
Receiver activated	On	Off	Sounding
Receiving	On	flashing	Off

10.3.7.2 H-Link

H-Link is a technology, which enables the operator to access the configuration of a HETRONIC radio remote control system, without opening it! The wiring and assignment is replaced by a wireless data exchange between HETRONIC systems and an H-Link configurator.

Via H-Link you may set functions as system address, transmitter frequency channel, automatic shutdown, interlocking, output adjustment and many more. Refer to the Ergo F operating manual to get more information. After the initial programming by HETRONIC, you can set the frequency channel for transmitter type ERGO F without using H-Link.



10.3.8 Battery charger and rechargeable batteries

10.3.8.1 Replacing and charging rechargeable batteries

The batteries have to be fully charged before startup!

Place the charger in a clean and dry location. Connect the charger, depending on the type, to a permanent power supply. Insert the empty battery into the charger and the charging process will start automatically.

The display of the charger is described in section 8.2!

The charging time is approx. 2 – 4 hours (depending on battery type). Ready: (green) LED has to flash.

Battery chargers of HETRONIC are equipped with a charging state recognition. When the batteries are completely charged, the battery charger automatically switches over to conservation charging.

TIP!

In order to avoid down times, we recommend to always have a fully charged battery pack ready.

With **Hand Held systems**, using a charger of the type **VersaPak** (fig 1), the battery may not be charged longer than 24 hours, in order to avoid damages to the VersaPak batteries and the charger. This applies only for VersaPak batteries. Assign a specialist disposal company with the recycling and disposal!

10.3.8.2 Display and error messages of the battery charger (Picture 2 and Picture 3)



LED-Display of the battery charger

- Charging process is running: yellow LED[1] flashing
- Fast charging: yellow [1] and red [2] LED flashing, after activation of the fast charge button [2]
- Charging process completed: green LED flashing [3], conservation charging is running

Error messages of the battery charger

- No LED is flashing: rechargeable battery is damaged
- Yellow LED [1] is blinking: short circuit in the battery block

In both cases the battery may no longer be used!

ATTENTION!

Only use genuine HETRONIC batteries! Not doing so introduces the risk of explosion. Emitted chemicals and flying parts may cause irreparable damages.

WARNING

Rechargeable battery packs are to be treated as hazardous waste and have to be disposed of properly.

Defective rechargeable battery packs can also be disposed of directly through HETRONIC.

Battery charger types:

Picture 1
Versa Pak charger



Picture 2
HETRONIC charger
with battery 3,6V



Picture 3
HETRONIC charger
with battery 9,6V

10.3.9 Battery handling

10.3.9.1 Replacing alkaline batteries (Size AA – round cell)

- The battery voltage is constantly monitored by the transmitter. If the voltage is low, the red LED on the transmitter starts flashing and according to the type you will also hear an acoustic signal. Replace the batteries immediately. Proceed as follows:
- Bring the crane or the machine to a safe state as quickly as possible.
- Push the stop button on the transmitter.
- Remove the empty batteries as shown on the following pictures.
- Follow the instructions in section 6 “Startup procedure” to restart the system.

10.3.9.2 Battery replacement for type Pocket (Pict. 1 and 2)

- Open the battery compartment on the lower side of the transmitter by pulling the cover off (see picture 1).
- Remove the 3 empty batteries.
- Insert 3 new 1,5V round cells into the marked compartment. (see picture 2)
- Close the battery compartment with the cover.



Pict. 1



Pict. 2

10.3.9.3 Battery replacement for type Hand Held (Pict. 3 – 6)

- Push the lever at the end of the battery compartment, until the battery tube or the rechargeable battery releases (pict. 3 – 5).
- Remove the 2 empty batteries (pict. 6).
- Insert 2 new 1,5V round cells into the battery tube. (pict. 6).
- Insert the battery tube with the open side forwards into the battery compartment of the transmitter.
- Press the battery tube into the compartment until it fully locks into place.



Pict. 3



Pict. 4



Pict. 5



Pict. 6

10.3.9.4 HETRONIC battery compartment (Pict. 7)

- Proceed as described in section 8 "Battery charger and rechargeable batteries", to remove the battery compartment.
- Please note the polarity of the batteries +/-.



Pict. 7

ATTENTION!

Only use alkaline batteries!

Alkaline batteries may not be charged in the battery charger!

10.3.10Diagnostics

Problem	Possible Cause	Solution
The transmitter does not respond when it is switched on.	The battery is empty.	Charge the batteries or replace the alkaline batteries.
	The fuse is blown.	The fuse has to be replaced by an authorized expert.
	The key switch is broken.	The key switch has to be replaced by an authorized expert.

The batteries are fully charged but the transmitter does not respond.	The battery contacts are soiled.	Please clean the battery contacts using a cloth.
	The spring contacts of the battery compartment are broken.	The spring contacts have to be replaced by an authorized expert.
Communication failure between transmitter and receiver.	The range has been exceeded.	Move towards the receiver.
	A radio remote control with the same frequency is operated in close proximity.	The RF settings have to be adjusted by an authorized expert.
	There is an object between transmitter and receiver.	Please change the position of the transmitter or modify the antenna position by using an antenna extension.
The operation time is short.	The battery is empty.	Charge the battery and insert a fully charged battery into the transmitter.
The radio signal is good, but some of the activated functions do not work.	The connection between the machine and the receiver is broken.	Perhaps there are some cables loose. Check the receiver wiring on the respective function for loose wires.
	The output module of the receiver defective.	Check if there is a LED flashing on the receiver output module when the respective function is activated.
The system does not start after standard startup.	The stop button is engaged or broken.	Release the stop button. Activate the start/horn switch.
	A joystick is not in neutral position.	Ensure that all joysticks are in neutral position.
	The battery of the transmitter is empty.	Check the batteries and replace if necessary.
	The receiver is currentless.	The yellow LED (diagnostic display) has to flash. Check the fuses.
	The start button is broken.	Replace the start switch.

Do you have any questions?

Please contact your dealer or our HETRONIC service team. We are pleased to help you. Tel. 09452/189-0

10.3.11 Special Technical Data

10.3.11.1 System

Frequency range:400 – 470 MHz, Europe 433/434 MHz and 869 MHz

RF synthesizer:Microprocessor-controlled PLL synthesizer with 32 selectable frequencies

RF-output:<10mW standard, increased transmitting power available on demand, certified for frequency ranges subject to approval and freely assignable frequency ranges in over 40 states.

Modulation:FM – narrow bandwidth

Bandwidth:12,5kHz / 25kHz, according to the system

Range:	approx. 100 meters with standard antenna, approx. 200 meters with special antenna
Addressing:	20-bit (more than 1 million different possibilities)
Temperature range:	-25°C up to +70°C (-18°F up to 160°F)
Resistance to moisture:.....	0-97% max. (non-condensing)
Response time:	approx. 450 ms
Baud rate:	2400/4800/9600 bps
Diagnosis:	Status displays for RF communication, operating voltage displays for transmitter and receiver, low battery indication
Certificates:	CE, TÜV, ISO 9001 and many more
Control function:	Performance Level »c« according to EN ISO 13849-1:2006 (depending on the technical version)
Stop function:	Performance Level »d« according to EN ISO 13849-1:2006 (depending on the technical version)

10.3.11.2 Transmitter

Type:	Ergonomically designed housing
Housing material:	Fibrenforced polyamid with glass fibre rate, according to the transmitter type, other materials available on demand
Protection type:	IP65
Antenna:	Internal
Battery housing:	Electrically separated, with gold-plated, self-cleaning contacts
Operating time:	14 – 20 hours standard, depending on the system
Push buttons:	single or double stage
Joysticks:	All joysticks with automatic reset function, multiple-steps and proportional, deadman button optional, moisture repellent and ergonomically designed

10.3.11.3 Receiver

Housing material:	Fibrenforced polyamid with 30% glass fiber rate, according to receiver type, other materials available on demand
Connection:	Via moisture repellent connecting plug
Protection type:	IP65
Operating voltage:	12/24 VDC, 48/115/230 VAC
Current consumption:	<0,8 A, type dependant
Antenna:	external antenna, with moisture repellent connection, partly internal
Digital outputs:	Fail-safe and self-monitoring emergency stop circuit, all relay outputs 275VAC/8A
Prop. resolution:	8 Bit (256 steps per function), built-in ramp function selectable
Prop. outputs:	PWM signal with selectable dither frequency and current range, linear output voltage, setting of proportional functions via the transmitter (Quick set) or via potentiometer, multiple speed ranges selectable, all proportional functions may be set with initial and final speeds
Serial interfaces:	RS232/485, CAN-Open, Profi-Bus-DP
Protection against	

energy recovery: The protection of the proportional outputs is included in the cable by default. If the cable is made by the customer himself, he has to assure that this protection is available.

10.3.11.4 Rechargeable batteries and battery charger

Operating voltage: 10 - 30 VDC or 90-270 VAC

Charging time: approx. <4 hours

Service life: approx. 900 charges

Type: NiMH

Capacity: 1200mAh

Contacts: Gold-plated, self-cleaning contacts

10.3.11.5 Technical data sheets

Technical data sheets with further information are available on the HETRONIC web site.

10.3.11.6 General

Radio remote controls, labeled with the CE sign are approved and notified in the following countries: Germany, Austria, Switzerland, Luxembourg, Belgium, Norway, Netherlands, Denmark, Finland, France, Greece, Ireland, Italy, Portugal, Spain, Sweden, Great Britain, Iceland, Estonia.

ATTENTION!

The use of the CS434 RF module is not subject to registration or payment of a fee. Never operate the transmitter without an antenna, as this may destroy the RF module. The frequency is preset by Hetric in the factory. In case of radio link problems with your system, please contact your dealer or the HETRONIC after sales service. You will find the telephone number on the cover page of this operating manual.

10.3.12 Maintenance, Guarantee, Disposal

10.3.12.1 Maintenance

In order to always have a safe radio remote control please note the following information:

Each radio remote control has to be inspected on a regular basis, at least once a year. The maintenance staff has to ensure that power to the transmitter and the receiver is shut off during maintenance and inspection work. A preventive maintenance by the operator on a regular basis will make for an extended service life.

Installation, adjustment and service work may only be performed by qualified personnel.

Possible repairs may only be performed in service stations that are authorized or recommended by HETRONIC or directly in HETRONIC's service and spare parts department.

The use of non original spare parts or the assignment of unauthorized personnel will immediately void your guarantee.

ATTENTION!

In case of oxidized electric contacts, do not use antioxidant or similar! Please contact your HETRONIC dealer for the immediate replacement of the affected parts. The use of chemical agents will cause damage on the internal components of the radio remote control.

10.3.12.2 Guarantee and warranty

You will find the terms of guarantee in our general terms and conditions.

10.3.12.3 Disposal

Avoid the pollution of the environment! Electronic devices and their components are hazardous waste! This applies particularly to rechargeable battery packs! Charge a specialist disposal company with the recycling and disposal! Defective rechargeable battery packs may also be disposed of directly through HETRONIC!



10.3.12.4 Information about complaints report (Page 10-402)

ATTENTION!

In order to handle your complaint correctly, the fields, marked with "Kunde/customer", have to be filled in completely. Please specify the invoice or the delivery note number, so that your complaint can be handled as quickly as possible.

10.3.12.5 Qualified Persons according to the Ordinance on Industrial Safety and Health

Please note that operation, maintenance and repair work may only be performed by qualified persons according to the ordinance on industrial safety and health, with an adequate professional education, work experience and contemporary occupational activity.

10.3.13 Complaint form

For Reference Only

For
Reference
Only

Complaints report										
Customer										
Customer		Treatment No., Delivery No., Invoice No. Htr.			Date		Contact			
HETRONIC Germany										
In	Cu-No		Date		Contact					
Legend										
Reason of delivery					Customer request					
A	Wrong delivery		1		Repair		blue		Customer	
B	Order mistake		2		Replacement		white		HETRONIC Germany	
C	Part defective		3		Credit Note					
D	Rented equipment		4		Function control (only against HANDLING CHARGE of 59.50€)					
Customer										
System No.	Item No.	SAP No.	Qty.	Component/Description of failure			Reason of return delivery			Customer request
1.										
2.										
3.										
4.										
HETRONIC Germany										
Report	Date	Result1	Result2							
1				<input type="checkbox"/> Warranty <input type="checkbox"/> No warranty <input type="checkbox"/> Repair free of charge <input type="checkbox"/> Functional, return free of charge						
2										
3										
4										
Contact	Date	Signature	Date	Signature						
H-D-QS-04-08-Reklamationsbericht-06										

10.3.14 Abbreviations and definitions

10.3.14.1 Abbreviations

AK	Analog channel
DK	Digital channel
EPROM.....	Electrical programmable read-only memory
FM.....	Frequency modulation
GND	Ground
HF	High frequency
KHz	Kilohertz
LED	Light emitting diode
mAH	Milliamperere hours
mA.....	Milliamperere
msec	Millisecond
MHz.....	Megahertz
mW.....	Milliwatt
NiMH	Nickel Metal Hydride
PWM	Pulse with modulation
RF	Radio frequency
Rx.....	Receiver
SMD	Surface mounted device
TTL.....	Transistor logic
Tx.....	Transmitter
Ub	Operating power
VAC.....	Volts alternating current
VDC	Volts direct current

10.3.14.2 Definitions

Acoustic signal.....	Buzzer or other sound, warning signal
Analog signal	Proportional stepless control
Coder	Converts input signals into serial data.
Decoder	Converts serial data into output signals.
Digital signal.....	On/off function
Maintained control.....	The function is activated, if the control is in position "on". If the control is released, it goes back to position "off" and the function stops.
Momentary control	The function is activated as long as the button is pushed.
Proportional control.....	A functional control with multiple speed, stepless activation.

10.3.15 Installation and safety test declaration

This form must be completed and signed by the person responsible for the installation of the system.

HETRONIC will not accept liability for the correctness of the installation of the radio remote control system. The operator has to assure, that the radio remote control and the machine have been adapted and tested, and that all relevant safety precautions are maintained. The operator has to follow all safety precautions of this manual and other relevant instructions.

Machine dataData of the radio remote control

Machine data

Data of the radio remote control

Manufacturer

Manufacturer

Type number

Model

Serial number

Type

Production year

HETRONIC Germany GmbH

System number

I/We have carried out the installation, startup and safety checks for the radio remote control system on the above mentioned machine. In doing so, the latest standards and regulations, applicable to this type of machine, have been maintained.

Location, date

Company (address)/ stamp

Name of responsible person Signature

10.3.16EC Declaration of Conformity

We hereby declare that the components of the equipment, specified below, are suitable for the installation on machinery or other devices, designed for machinery or not, according to the following EU Directives with revisions and subsequent amendments:

Machinery Directive	2006/42/EC
Low Voltage Directive	2006/95/EC
EMC-Directive	2004/108/EC
R&TTE Directive	1999/5/EC

Signed by: HETRONIC Germany GmbH
Adalbert-Stifter-Str. 2
84085 Langquaid

Object of declaration: Radio Remote Control

Transmitter Type: EURO..., GL..., GR..., NOVA..., ERGO...,
ERGO-F..., HH..., MINI..., POCKET..., FE...

Receiver Type: RX..., RX BMS..., RX MFS..., RX 14b...

The object declaration described above is in conformity with the requirements of the following documents:

EN ISO 13849-1	2008	EN 60950-1	2006
EN 62061	2005	EN 61000-6-2	2005
EN 13557	2008	EN 61000-6-4	2007
EN 14492	2009	EN 300 220	2007
EN 60204-32	2008	EN 301 489	2002
EN 60529	1991		

* Safety Category, Performance Level and SIL Level see Cover Sheet

H. Kiss
Langquaid, 01.08.2010

10.3.17HF-Part Conformity Europe

Declaration of Conformity in accordance with the Radio and Telecommunications Terminal Equipment Act (FTEG) and Directive 1999/5/FC (R&TTE Directive)	
Manufacturer / responsible person	HETRONIC-Germany GmbH Adalbert-Stifter-Str. 2 84085 Langquaid Deutschland
Declares that the product	RF-Modul
Type (if applicable, configuration including the modules)	CS 434 TXN/RXN
Telecommunications terminal equipment	Radio equipment
Intended purpose	Transmitter/Receiver
Equipment class	2
Complies with the essential requirements of §3 and the other relevant provisions of the FTEG (Article 3 of the R&TTE Directive), when used for its intended purpose.	
Health and safety requirements pursuant to § 3 (1) 1. (Article 3(1) a)	
Harmonised Standards applied	EN 60950:2000

Declaration of Conformity in accordance with the Radio and Telecommunications Terminal Equipment Act (FTEG) and Directive 1999/5/FC (R&TTE Directive)	
Manufacturer / responsible person	HETRONIC-Germany GmbH Adalbert-Stifter-Str. 2 84085 Langquaid Deutschland
Other means of proving conformity with the essential requirements (standards/specifications used)	BMPT Decree No. 306/97
Protection requirements concerning electromagnetic compatibility § 3(1)(2), (Article 3(1)(b))	
Harmonised Standards applied	EN 301 489-1 V1.8.1 (2008-04) EN 301 489-3 V1.4.1 (2002-08)
Other means of proving conformity with the essential requirements (standards/specifications used)	
Measures for the efficient use of the radio frequency spectrum	
Air interface of the radio systems pursuant to § 3(2) (Article 3(2)»	
Harmonised standards applied	EN 300 220-1 V2.1.1 (2006-04) EN 300 220-2 V2.1.2 (2007-06)
Other means of proving conformity with the essential requirements (standards/interface specifications used)	
Address	HETRONIC-Germany GmbH Adalbert-Stifter-Str. 2 84085 Langquaid Deutschland
Phone, fax, email:	Tel. +49 (0) 9452 189 610 Fax: +49 (0) 9452 189 201



Langquaid, 01.08.2010

Place, date of issue

Signature

Declaration of Conformity in accordance with the Radio and Telecommunications Terminal Equipment Act (FTEG) and Directive 1999/5/FC (R&TTE Directive)	
Manufacturer / responsible person	HETRONIC-Germany GmbH Adalbert-Stifter-Str. 2 84085 Langquaid Deutschland
Declares that the product	RF-Modul
Type (if applicable, configuration including the modules)	CS 434 TRT/TRR
Telecommunications terminal equipment	Radio equipment
Intended purpose	Transceiver
Equipment class	2
Complies with the essential requirements of §3 and the other relevant provisions of the FTEG (Article 3 of the R&TTE Directive), when used for its intended purpose.	
Health and safety requirements pursuant to § 3 (1) 1. (Article 3(1) a)	
Harmonised Standards applied	EN 60950:2000
Other means of proving conformity with the essential requirements (standards/specifications used)	BMPT Decree No. 306/97
Protection requirements concerning electromagnetic compatibility § 3(1)(2), (Article 3(1)(b))	
Harmonised Standards applied	EN 301 489-1 V1.8.1 (2008-04) EN 301 489-3 V1.4.1 (2002-08)
Other means of proving conformity with the essential requirements (standards/specifications used)	
Measures for the efficient use of the radio frequency spectrum	
Air interface of the radio systems pursuant to § 3(2) (Article 3(2)»	
Harmonised standards applied	EN 300 220-1 V2.1.1 (2006-04) EN 300 220-2 V2.1.2 (2007-06)
Other means of proving conformity with the essential requirements (standards/interface specifications used)	

Address	HETRONIC-Germany GmbH Adalbert-Stifter-Str. 2 84085 Langquaid Deutschland
Phone, fax, email:	Tel. +49 (0) 9452 189 610 Fax: +49 (0) 9452 189 201

Langquaid, 01.08.2010

Place, date of issue



Signature

FOR
Reference
Only

Declaration of Conformity in accordance with the Radio and Telecommunications Terminal Equipment Act (FTEG) and Directive 1999/5/FC (R&TTE Directive)	
Manufacturer / responsible person	HETRONIC-Germany GmbH Adalbert-Stifter-Str. 2 84085 Langquaid Deutschland
Declares that the product	RF-Modul
Type (if applicable, configuration including the modules)	CS 869 TRT/TRR
Telecommunications terminal equipment	Radio equipment
Intended purpose	Transceiver
Equipment class	2
Complies with the essential requirements of §3 and the other relevant provisions of the FTEG (Article 3 of the R&TTE Directive), when used for its intended purpose.	
Health and safety requirements pursuant to § 3 (1) 1. (Article 3(1) a))	
Harmonised Standards applied	EN 60950:2000
Other means of proving conformity with the essential requirements (standards/specifications used)	BMPT Decree No. 306/97
Protection requirements concerning electromagnetic compatibility § 3(1)(2), (Article 3(1)(b))	
Harmonised Standards applied	EN 301 489-1 V1.8.1 (2008-04) EN 301 489-3 V1.4.1 (2002-08)
Other means of proving conformity with the essential requirements (standards/specifications used)	
Measures for the efficient use of the radio frequency spectrum	
Air interface of the radio systems pursuant to § 3(2) (Article 3(2)»	
Harmonised standards applied	EN 300 220-1 V2.1.1 (2006-04) EN 300 220-2 V2.1.2 (2007-06)
Other means of proving conformity with the essential requirements (standards/interface specifications used)	

Address	HETRONIC-Germany GmbH Adalbert-Stifter-Str. 2 84085 Langquaid Deutschland
Phone, fax, email:	Tel. +49 (0) 9452 189 610 Fax: +49 (0) 9452 189 201

Langquaid, 01.08.2010

Place, date of issue



Signature

FOR
Reference
Only

Declaration of Conformity in accordance with the Radio and Telecommunications Terminal Equipment Act (FTEG) and Directive 1999/5/FC (R&TTE Directive)	
Manufacturer / responsible person	HETRONIC-Germany GmbH Adalbert-Stifter-Str. 2 84085 Langquaid Deutschland
Declares that the product	RF-Modul
Type (if applicable, configuration including the modules)	FBTX/FBRX
Telecommunications terminal equipment	Radio equipment
Intended purpose	Transmitter/Receiver
Equipment class	2
Complies with the essential requirements of §3 and the other relevant provisions of the FTEG (Article 3 of the R&TTE Directive), when used for its intended purpose.	
Health and safety requirements pursuant to § 3 (1) 1. (Article 3(1) a)	
Harmonised Standards applied	EN 60950:2000
Other means of proving conformity with the essential requirements (standards/specifications used)	BMPT Decree No. 306/97
Protection requirements concerning electromagnetic compatibility § 3(1)(2), (Article 3(1)(b))	
Harmonised Standards applied	EN 301 489-1 V1.8.1 (2008-04) EN 301 489-3 V1.4.1 (2002-08)
Other means of proving conformity with the essential requirements (standards/specifications used)	
Measures for the efficient use of the radio frequency spectrum	
Air interface of the radio systems pursuant to § 3(2) (Article 3(2)»	
Harmonised standards applied	EN 300 220-1 V2.1.1 (2006-04) EN 300 220-2 V2.1.2 (2007-06)
Other means of proving conformity with the essential requirements (standards/interface specifications used)	

Address	HETRONIC-Germany GmbH Adalbert-Stifter-Str. 2 84085 Langquaid Deutschland
Phone, fax, email:	Tel. +49 (0) 9452 189 610 Fax: +49 (0) 9452 189 201



Langquaid, 01.08.2010

Place, date of issue

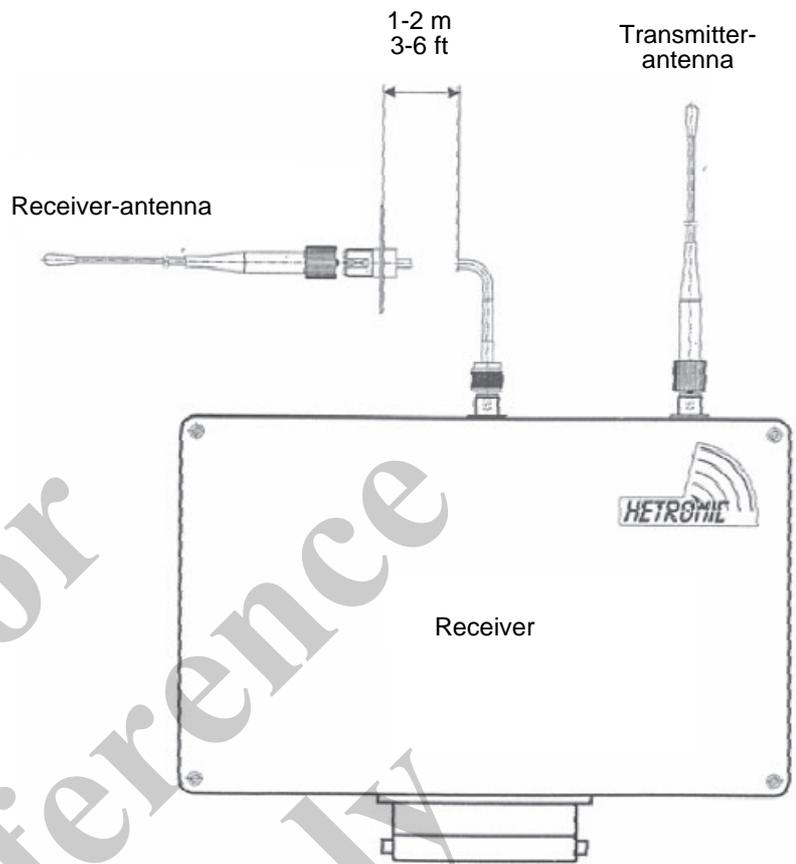
Signature

10.3.18 Mounting Antennas for Feedback-Systems

Important!

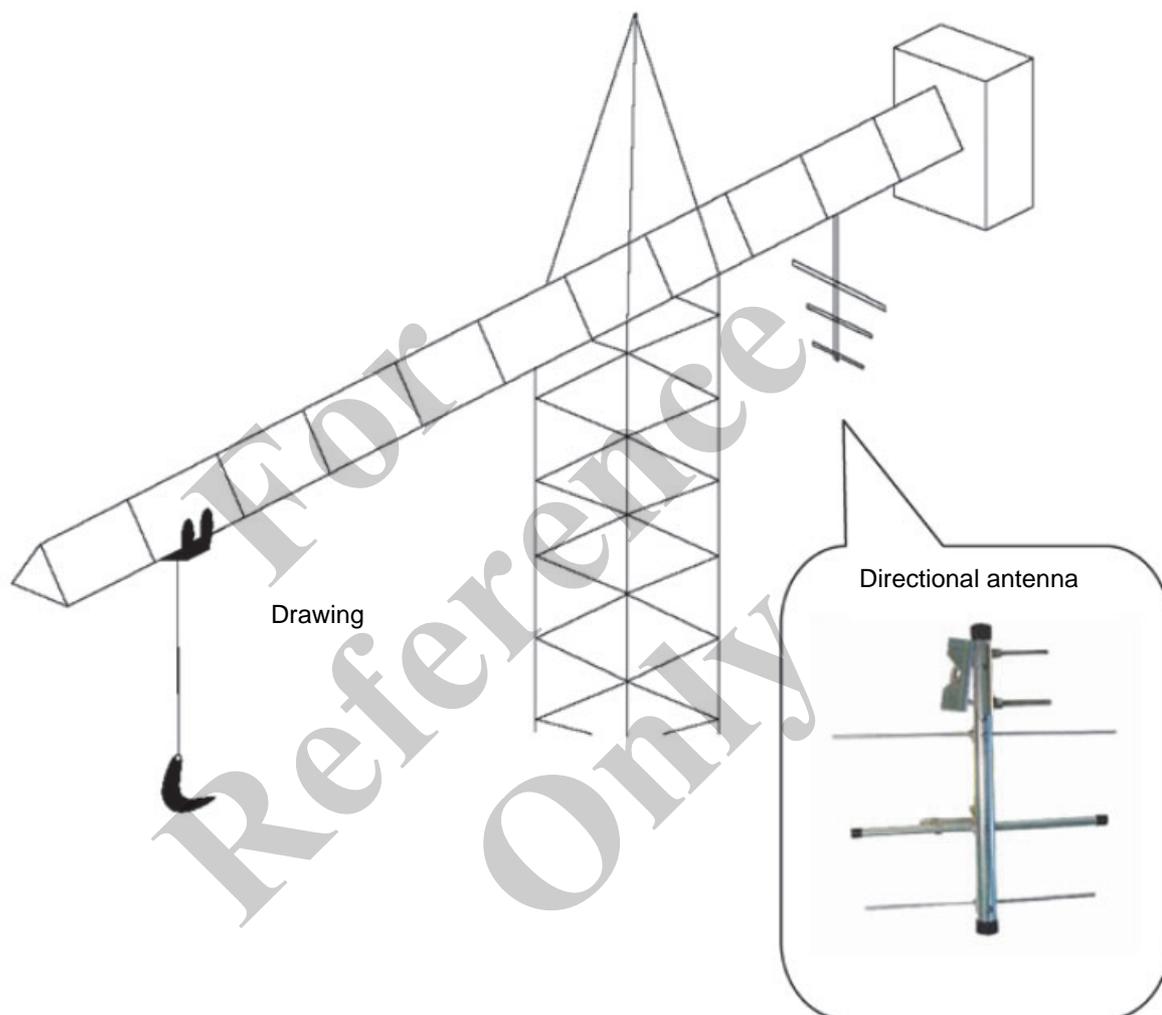
To guarantee a trouble free operation, follow the instructions given below to mount the antennas.

- Keep a minimum in distance of 3 to 6 ft between the receiver-antenna and the transmitter-antenna.
- Mount the receiver-antenna horizontal, the transmitter-antenna vertical.



10.3.19 Mounting instruction for directional antenna on top slewing cranes

The mounting of the directional antenna has to be done on the counter-boom of the crane. The mounting position should be easily accessible from all sides and not be hidden by any components. The antenna has always to be mounted pointing downwards (mounting clip on top) and the radiation elements (3 parallel pieces) have to show a 90° angle to the boom.



10.3.20 Guarantee Conditions HETRONIC Germany GmbH

Adalbert-Stifter-Straße 2, D-84085 Langquaid, Germany

As of May 2010

HETRONIC Germany GmbH (henceforth referred to as HETRONIC) as constructor allows a guarantee to the contractual item under the following conditions. The guarantee is valid from the day of delivery to the customer. The duration of the guarantee is determined by the amount of time stated in the confirmation of order.

The guarantee is only valid to the buyer mentioned in the confirmation of order. To make use of the guarantee, the buyer has to clearly prove to HETRONIC any defects immediately, but latest within 14 days after discovery of the defects or after the point of time at which the defect was noticeable to the buyer without any closer

inspection, considering normal usage. Along with the fault notice, the buyer has to deliver any proofs (photographs, drawings, fault descriptions etc.).

In case of a guarantee condition HETRONIC has the right to reimprove the same item three times because of the same fault. Only should the manufacturer fail to reimprove the item does the buyer have a right to demand a replacement delivery of an identical item. In case of a replacement delivery the manufacturer has the right to deliver the buyer a replacement part of equal kind and value.

Exempt from the guarantee are wear and tear parts. Should the buyer in any way alter or change a delivered item without the explicit agreement of the manufacturer, any claim to the guarantee expires. Should the buyer build any foreign parts into the delivered items that are not original HETRONIC replacement parts, any claims to the guarantee also expire. This is especially the case when accumulators are used that are also not original HETRONIC products.

The claim to the guarantee expires as well if the buyer treats the delivered items improperly, in case of natural wear and tear, in case of nonregard of usage, construction and maintenance instructions and in case of the use of improper and inappropriate equipment along with the delivered items. The costs and the guarantee are only covered by HETRONIC in case of later improvement and replacement delivery as stated above. Any further costs (transportation, packaging, etc.) are covered by the buyer. HETRONIC is not responsible for any further costs after the acquisition of the products by the buyer. Location of guarantee delivery is Langquaid.

These guarantee conditions are a mere translation of the german version. Should arise any differences between the two versions, the german version is valid.

German law is valid. Place of jurisdiction is Regensburg.



www.hetronic.de

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Subject to technical change without notice.

HETRONIC Germany GmbH reserves the right to change, improve or phase out the products anytime without publication or commitment. HETRONIC Germany does not accept liability claims for material damage, personal injury or death, which result from the use of unlicensed spare parts or unauthorized service.

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10.4 Cleaning the cooling system

The cooling system of a machine comprises a coolant cooler, an oil cooler and a charge-air cooler and additional coolers, depending on the design.

The cooling system ensures that the machine runs at a constant operating temperature. The cooling system has an important impact on the function and service life of the machine.

The cooler is adapted for each respective engine. The cooler must be kept fully operational in order to prevent damage to the drive system, e.g. owing to

overheating. You should therefore check the cooler regularly and clean it if necessary.

Dirt can build up on both the outside (e.g. dust) and the inside (e.g. deposits) of the cooler.

Note This section provides you with general notes on cleaning the cooler. Please also observe the specifications found in the user guide and maintenance instructions for your machine and in the operating instructions provided by the engine manufacturer.

10.4.1 Safety instructions

Warning

- Before beginning cleaning:
 - Dismantle the equipment safely
 - Switch off machine
 - Ensure that the machine cannot be restarted
 - For machines with an electric motor, also switch off the battery isolator switch
 - Allow machine to cool off.
- If the cooler is damaged, contact Grove Customer Service before starting on any repair work.
- Repair work on the cooling system should only be carried out by specialists.
- Do not touch the guard grill on the fan. Rotating fan blades may cause serious injury. Objects coming into contact with the fan blades may be catapulted into the air.
- Always wear face protection or protective glasses when working on the cooling system.

Risk of Burns

- Place a cloth over the sealing cap and open the cap slowly to allow the cooling system to cool down. Always relieve the pressure in the cooling system before starting any repair work.
- Do not use cleaning agents that may damage the cooler materials or the paint on the machine.
- Please observe the manufacturer's specifications when handling coolant or cleaning agents.

Note

Damaged cooling fins result in reduced cooling performance. Overheating in any form damages the machine, increases wear and reduces the efficiency of the machine. This results, for example, in increased diesel consumption.

The condition of the cooling fins must therefore be checked daily as part of the visual check.

If the cooler is operated in an environment in which the air contains particles of dust or oil, Grove recommends that it is checked and cleaned several times daily.

10.4.2 Coolant cooler

10.4.2.1 External cleaning

Dirt and cleaning procedure

- | | |
|----------------------------------|---------------------------------|
| Dust, insects, foliage or leaves | - Compressed air (max. 3,5 bar) |
| Oily and greasy deposits | - Steam jet |

Caution

Ensure that the cooling fins are not damaged.

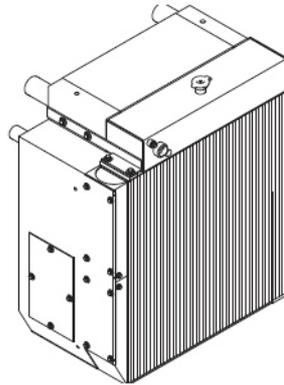


Fig. 270 Combination cooler, figure similar

Procedure

1	Direct the cleaning jet parallel to the longitudinal direction of the cooling fins. Make sure that the cooling fins are not damaged.
2	Allow the cooling system to dry before starting it up again.

10.4.2.2 Internal cleaning

It is necessary to clean the interior of the cooling system if

- The engine is constantly overheating even though the V-belt, thermostat and water pump are functioning properly.
- Green sludge (chromium hydroxide) is present on the underside of the sealing cap.
- The coolant is very cloudy.
- Lubricant incursion has occurred.

Procedure

1	Please observe the safety instructions.
2	Drain the coolant into suitable containers and dispose of it in accordance with regulations.
3	Add a mixture of standard cooling system cleaner and water.

Caution

Please note the mixing ratio and ensure that the cooling system cleaner is used properly.

4	Start the engine and allow it to run for approx. 1.5 hours.
5	Drain the mixture into suitable containers and dispose of it in accordance with regulations.
6	Flush the cooling system thoroughly with clean water; repeat this process several times.

Caution Always fill using a water-refrigerant mixture. Observe mixing ratios. Mix before filling!

7	Fill the cooling system using a water-refrigerant mixture approved by Grove.
---	--

Note Thorough cleaning is only possible if the cooler is removed. Contact Grove Customer Service before uninstalling the cooler.

10.4.3 Tips for preventive maintenance

This section provides you with a few tips on how to prevent dirt from building up in the cooling system again.

Note Please also observe the specifications found in the operating instructions of the engine manufacturer.

- Water**
- Use clean, neutral, filtered fresh water. Grove recommends distilled water.
 - Please note that only distilled water must be used on Caterpillar engines.
 - Do not use ditch water, industrial drain water, salt water, sea water or rain water.
 - Use the same antifreeze. Observe mixing ratios. Mix before filling!
 - Ensure that the water has the following characteristics:

pH value	7 - 8
Chloride content	max. 100 ppm
Sulphate content	max. 100 ppm
Water hardness	3-12 °dGH

10.4.4 Coolant

- Note** Only use antifreeze approved by Grove.
Adapt the mixing ratio of the antifreeze to the operating temperature of the machine.
- Grove recommends changing the coolant every 2000 operating hours or max. 24 months. Whichever occurs first.

Note To change the coolant, follow the guidelines in the engine manufacturer's operating instructions.

10.4.5 Charge-air cooler

10.4.5.1 External cleaning

Dirt and cleaning procedure

Dust, insects, foliage or leaves	- Compressed air (max. 3,5 bar)
Oily and greasy deposits	- Steam jet

Caution Ensure that the cooling fins are not damaged.

10.4.6 Oil cooler

10.4.6.1 External cleaning

Dirt and cleaning procedure

Dust, insects, foliage or leaves - Compressed air (max. 3,5 bar)
Oily and greasy deposits - Steam jet

Caution

Ensure that the cooling fins are not damaged.

10.4.6.2 Internal cleaning

If dirt is present, rinse out oil channels using a suitable cleaning material intended for this operation. Rinse for as long as required depending on the amount of dirt present. Blow out rinse-aid residue using compressed air once rinsing is complete.

10.5 Residual Useful Life of Winches

10.5.1 General steps required to ensure safe periods of operation

Under the German accident prevention regulations covering winches, lifting and pulling equipment (VBG 8), the owner of the crane is obliged to perform a crane inspection at least once a year (see also ISO 9927-1).

Among other checks, the inspection requires the spent share of the theoretical length of useful life of the winches to be determined. Where necessary, the owner of the crane must commission an expert person to do this.

ATTENTION:

This is a legally binding requirement within the scope of application of the accident prevention regulations of the German statutory accident insurance. Outside the scope of application, the crane manufacturer recommends to also follow the procedure specified below.

10.5.2 Periodic inspection of cranes

10.5.3 Steps required to monitor the winches

10.5.3.1 Theoretical length of useful life

When calculating and dimensioning the winches of your crane, the design engineers have assumed particular operating conditions and a theoretical total running time, from which results a theoretical length of useful life.

In accordance with DIN-Fachbericht 1, ISO 4301/1, or FEM 9.511, respectively, the winches of your crane have been classified as follows:

Driving gear group:	M.....
Duty cycle:	Q..... (L.....)
Factor of duty cycle:	km =

From this results a **theoretical length of useful life D**.

Note For the data applicable in the individual case refer to the table "Monitoring of the Winches" in the crane inspection and test log book.

ATTENTION: The "theoretical length of useful life" must not be treated as equivalent to the real (effective) length of useful life of a winch!

In case the crane is used in a manner which differs from that provided for, the owner has to perform the calculations himself!

The effective length of useful life of a winch is subject in addition to a great number of external influences, such as:

1. Instances of overloading due to misuse of the crane
2. Inadequate maintenance: Failure to perform oil change in due time
3. Incorrect operation: Extreme acceleration or deceleration of the load
Load is allowed to drop into the ropes
4. Improper maintenance: Use of the wrong oil
Incorrect filling level
Contamination during oil change
5. Fitting errors made during repair and maintenance
6. Failure to attend to leakages
7. Improperly adjusted safety features
8. Hidden damage ensuing from accidents
9. Extreme ambient conditions: Low or high temperatures
Aggressive atmosphere
Dust and dirt

10.5.3.2 Spent share of the theoretical length of useful life

The owner of the crane is obliged to perform a crane inspection at least once a year (ISO 9927-1 and VBG 8).

Among other checks, the inspection requires the spent share of the theoretical length of useful life to be determined. Where necessary, the owner of the crane must commission an expert person to do this.

Determination of the spent share of the theoretical length of useful life requires the effective operating conditions (duty cycle) and the service hours of the hoist mechanisms to be established for any inspection interval. The owner is responsible for the documentation in the crane inspection and test log book.

Establishing the operating conditions (duty cycle)

The duty cycle of the crane falls into one of several categories; see also DIN-Fachbericht 1, ISO 4301/1, or FEM 9.511, respectively.

On the basis of the knowledge of the effective operating conditions, one of the duty cycles specified below must be selected and be entered in the crane inspection and test log book for the inspection interval concerned.

Note To be normally assumed for carrier-mounted cranes in erection service is the duty cycle L1 (Q1) with the duty cycle factor of km = 0,125

Duty Cycle Class	Definition	Breakdown of Running Time	Factor of duty cycle	Graphical Representation
light Q 1 L 1	Driving gears or parts thereof which are subject to maximum stress in exceptional cases only, but which are regularly subject to very low stress only	10% of running time with maximum load (dead load+1/1 working load) 40% of running time with dead load+1/3 working load 50% of running time with dead load only	km=0,125	
medium Q 2 L 2	Driving gears or parts thereof which are subject to maximum stress rather frequently, which are regularly subject to low stress however	1/6 of running time with maximum load (dead load+1/1 working load) 1/6 of running time with dead load+2/3 working load 1/6 of running time with dead load+1/3 working load 50% of running time with dead load only	km=0,25	
heavy Q 3 L 3	Driving gears or parts thereof which are frequently subject to maximum stress and regularly subject to medium stress	50% of running time with maximum load (dead load+1/1 working load) 50% of running time with dead load only	km=0,5	
very heavy Q 4 L 4	Driving gears or parts thereof which are regularly subject to stress adjacent to the maximum stress	90% of running time with maximum load (dead load+1/1 working load) 10% of running time with dead load only	km=1	

Establishing the effective service hours T_i

The effective service hours established as outlined below must be entered in the crane inspection and test log book for the inspection interval concerned.

There are the following four distinct cases:

Service hour meter available on each winch

When your crane has been equipped with a service hour meter on each winch, the number of effective service hours T_i for any inspection interval can be read directly.

Service hour meter available for the entire crane drive system

The share of winch hours in the total number of service hours of the upper structure is to be estimated.

Note In the case of carrier-mounted cranes in erection service, it can normally be assumed for hoisting winches that the share of the winches in the service hours is 20% referred to the overall service hours of the upper structure.

Service hour meter available jointly for the travel and crane drive systems

The share of winch hours in the total number of service hours of the crane is to be estimated.

Note In the case of carrier-mounted cranes in erection service, the share of upper structure operation can normally be assumed to be 60%, referred to the total number of service hours of the crane. If the hoisting winch is assumed to have a share of 20%, referred to the upper structure service hours (see "SERVICE HOUR METER AVAILABLE FOR THE ENTIRE CRANE DRIVE SYSTEM" on page -424), the resulting share, referred to the total number of service hours of the crane, is 12%.

No service hour meter available

In this case, the effective number of service hours of the winch must be estimated and documented by the owner.

Note The percentages shown are guiding values normally applicable to main hoisting winches. In the case of auxiliary hoisting winches or boom hoist winches, the shares in the total number of service hours may be significantly smaller and must therefore be estimated by the owner.

Determining the spent share of the theoretical length of useful life

For an inspection interval i (not to exceed 1 year, according to ISO 9927-1 or VBG 8), the spent share S_i of the theoretical length of useful life is calculated by the equation:

$$S_i = \frac{km_i}{km_i} \cdot i \cdot T$$

where:

km = Factor of duty cycle taken as a basis in the design calculation of the winch. For this factor refer to the Operating Manual.

km_i = Factor of duty cycle in the inspection interval i , according to "ESTABLISHING THE OPERATING CONDITIONS (DUTY CYCLE)" on page -422

T_i = Effective service hours in the inspection interval i , according to "ESTABLISHING THE EFFECTIVE SERVICE HOURS T_i " on page -424

After each inspection interval, the spent share is deducted from the residual theoretical length of useful life D_i (refer to example below).

Whenever a theoretical length of useful life is left which is expected to be inadequate for the subsequent period of operation, a general overhaul of the winch must be carried out.

When the theoretical length of useful life D has been attained (see "THEORETICAL LENGTH OF USEFUL LIFE" on page -422), continued operation of the winch is not allowed until after a general overhaul.

A general overhaul must be carried out not later than 10 years after commissioning of the crane at any rate.

The owner has to arrange for the general overhaul which must then be performed by the manufacturer, or else by any persons duly authorized by the manufacturer, and must be documented in the inspection and test log book.

On completion of the general overhaul, a new theoretical length of useful life D will be specified by the manufacturer, or by any persons duly authorized by the manufacturer.

At any rate, the maximum period of time to the next general overhaul will not exceed 10 years.

10.5.3.3 Example

A carrier-mounted crane fitted with a separate service hour meter for travel drive and crane drive has been classified as follows by the manufacturer, according to the Operating Manual:

Driving gear group: M3
 Duty cycle: light L₁, km = 0,125
 Theoretical length of useful life: D = 3200 h

The spent share S of the theoretical length of useful life is calculated over the individual inspection intervals as follows:

Inspection No. 1 (first year)

In the past year, the crane has been used for erection work:

Duty cycle: L₁, that is, km₁ = 0,125.

The reading taken on the upper structure service hour meter is 800 h, of which period the winch has been in operation for about 20%, that is, T₁ = 160 h.

So at the first inspection the spent share S of the theoretical length of useful life is:

$$S_1 = \frac{0,125}{0,125} \times 160 \text{ h} = 160 \text{ h}$$

Residual theoretical length of useful life:

$$D_1 = 3200 \text{ h} - 160 \text{ h} = 3040 \text{ h}$$

The above values are entered in the table in the crane inspection and test log book (see "ANNEX" on page -426).

Inspection No. 2 (second year)

The crane has been used for unloading work in the harbour:

Duty cycle: L₃, that is, km₂ = 0.5

The reading taken on the upper structure service hour meter is 2000 h, that is, during the period concerned: 2000 h – 800 h = 1200 h (800 h were used in the first year of operation).

Of this the winch has been in operation for about 40%, that is, T₂ = 480 h.

So the spent share S₂ of the theoretical length of useful life in the second inspection interval is:

$$S_2 = \frac{0,5}{0,125} \times 480 \text{ h} = 1920 \text{ h}$$

Residual theoretical length of useful life:

$$D_2 = 3040 \text{ h} - 1920 \text{ h} = 1120 \text{ h}$$

Inspection No. 3 (third year)

The crane has been used for erection work and occasionally for unloading work in the harbour: Duty cycle: L_2 , that is, $km_3 = 0,25$

The reading taken on the upper structure service hour meter is 3000 h, that is, during the period concerned: $3000 \text{ h} - 2000 \text{ h} = 1000 \text{ h}$ (2000 h were used in the first two years of operation).

Of this the winch has been in operation for about 30%, that is, $T_3 = 300 \text{ h}$.

So the spent share S_3 of the theoretical length of useful life in the third inspection interval is:

$$S_3 = \frac{0,25}{0,125} \times 300 \text{ h} = 600 \text{ h}$$

Residual theoretical length of useful life:

$$D_3 = 1120 \text{ h} - 600 \text{ h} = 520 \text{ h}$$

The entries to be made in the table in the crane inspection and test log book are as follows: see Table 1.

10.5.3.4 Annex

An example is shown in Table 1.

The residual theoretical length of useful life is to be documented by means of the enclosed Table 2.

For
Reference
Only

Table 1: Determine the Residual Theoretical Length of Useful Life on Winch No. 1 (Main Hoist Winch) EXAMPLE

Crane model: S 613
 Factory number: 613.0. ...
 Initial commissioning: 12345
 Winch serial number - refer to identification plate: 0815
 Last general overhaul performed on:
 Winch design data (refer to Operating Manual):
 Power unit group: M3
 Duty cycle: Q1 (L1)
 Duty cycle factor km: 0,125
 Theoretical length of useful life D: 3200 h

Si = length of useful life spent since the last inspection
 Di = Residual theoretical length of useful life
 Di-I = Residual theoretical length of useful life after the preceding inspection
 km = Duty cycle factor taken as a basis in the design calculation of the winch
 For this factor refer to the Operating Manual
 kmi = Duty cycle factor in the inspection interval. i. See "ESTABLISHING THE OPERATING CONDITIONS (DUTY CYCLE)" on page 10-422.
 Ti = Effective service hours in the inspection interval. i. See "ESTABLISHING THE EFFECTIVE SERVICE HOURS Ti" on page 10-424.

Inspection No.	Date of initial commissioning Date of inspection	Operating conditions in the period since the last inspection (duty cycle)	Factor of the duty cycle km	Service hours of the crane as a whole [h]	Service hours of the upper structure [h]	Service hours of the upper structure in the period since the last inspection [h]	Service hours of the winch [h]	Service hours of the winch in the period since the last inspection Ti [h]	Spent share of the theoretical length of the useful life D $\frac{kmi}{Si} \times Ti$ [h]	Residual theoretical length of useful life $Di = D - I - Si$ [h]	Name of inspector	Signature	Notes
0	20.11.94	-	-	0	0	0	-	0	0	3200			
1	15.11.95	L1	0,125	800	800	800	160 (20% of 800)	160	160	3040	Müller		
2	17.11.96	L3	0,5	2000	1200	1200	480 (40% of 1200)	1920	1920	1120	Huber		
3	23.11.97	L2	0,25	3000	1000	1000	300 (30% of 1000)	600	600	520	Meier		

ATTENTION: A general overhaul must be performed at least every 10 years.
 General overhaul performed on:

h/gr/tb/hotiz1/doku/NDWInde

For
Reference
Only

Table 2: Determine the Residual Theoretical Length of Useful Life on Winch No.

Crane model:.....
 Factory number:.....
 Initial commissioning:
 Winch serial number - refer to identification plate:.....
 Last general overhaul performed on:.....
 Winch design data (refer to Operating Manual):.....
 Power unit group: M.....
 Duty cycle: Q..... (L.....)
 Duty cycle factor km:.....
 Theoretical length of useful life D:.....

Si = Share of the theoretical length of useful life spent since the last inspection
 Di = Residual theoretical length of useful life
 Di-I = Residual theoretical length of useful life after the preceding inspection
 km = Duty cycle factor taken as a basis in the design calculation of the winch
 For this factor refer to the Operating Manual
 kmi = Duty cycle factor in the inspection interval i. See "ESTABLISHING THE OPERATING CONDITIONS (DUTY CYCLE)" on page 10-422.
 Ti = Effective service hours in the inspection interval i. See "ESTABLISHING THE EFFECTIVE SERVICE HOURS Ti" on page 10-424.

Inspection No.	Date of initial commissioning Date of inspection	Operating conditions in the period since the last inspection (duty cycle)	Factor of the duty cycle km	Service hours of the crane as a whole [h]	Service hours of the upper structure [h]	Service hours of the upper structure since the last inspection [h]	Service hours of the winch [h]	Service hours of the winch since the last inspection Ti [h]	Spent share of the theoretical length of the useful life D $Si = \dots \times Ti$ [h]	Residual theoretical length of useful life $Di = Di-I - Si$ [h]	Name of inspector	Signature	Notes
i													

ATTENTION: A general overhaul must be performed at least every 10 years.
 General overhaul performed on:

h/g/tb/notiz1/doku/NDW/inde

10.6 Installing Large Roller Bearings, Slewing Gears, and Flange Connections

Current when going to press

Ongoing development ensures the advanced technology and the high level of quality in our machines. This may result in deviations between these Instructions and your machine. Errors can also not be ruled out. Please understand that no legal claims can be derived from the specifications, illustrations and descriptions within these instructions.

10.6.1 General

This supplementary information applies to the installation of large roller bearings and flange connections (FV). This concerns e.g.:

- Flange connection between the upper structure and the slewing gear
- Flange connection between the upper structure and the slewing ring
- Flange connection between the slewing ring and the lower assembly
- Flange connection between the slewing ring and intermediate ring and the lower assembly
- Flange connection between the slewing ring and the pylon and intermediate ring and the lower assembly
- Flange connection between the pylon and pylon

DANGER

- Make sure that there is no-one within the hazardous area before starting the installation!
- Pay attention to dimensions and weight according to the operating instructions.
- Observe general safety information for the installation according to the operating instructions

10.6.2 Preparatory measures

In order to guarantee a secure connection between the individual components, several important preparations are required:

- The flange surfaces on the slewing ring are to be kept free of corrosion.
- Make absolutely sure that all surfaces including holes, e.g. the lower assembly flange are free of grease. If there is grease in the holes, there is a danger of pushing the grease into the threads in the slewing ring with the bolts. This additional grease in the threads can greatly decrease the required friction under certain circumstances. The bolt can be damaged without your recognizing it or it could even break eventually.
- No additional oil or grease is to be used for bolted connections e.g. "lower assembly flange-slewing ring, pylon-slewing ring". The bolts and pins are to be installed as delivered.

10.6.3 Assembly

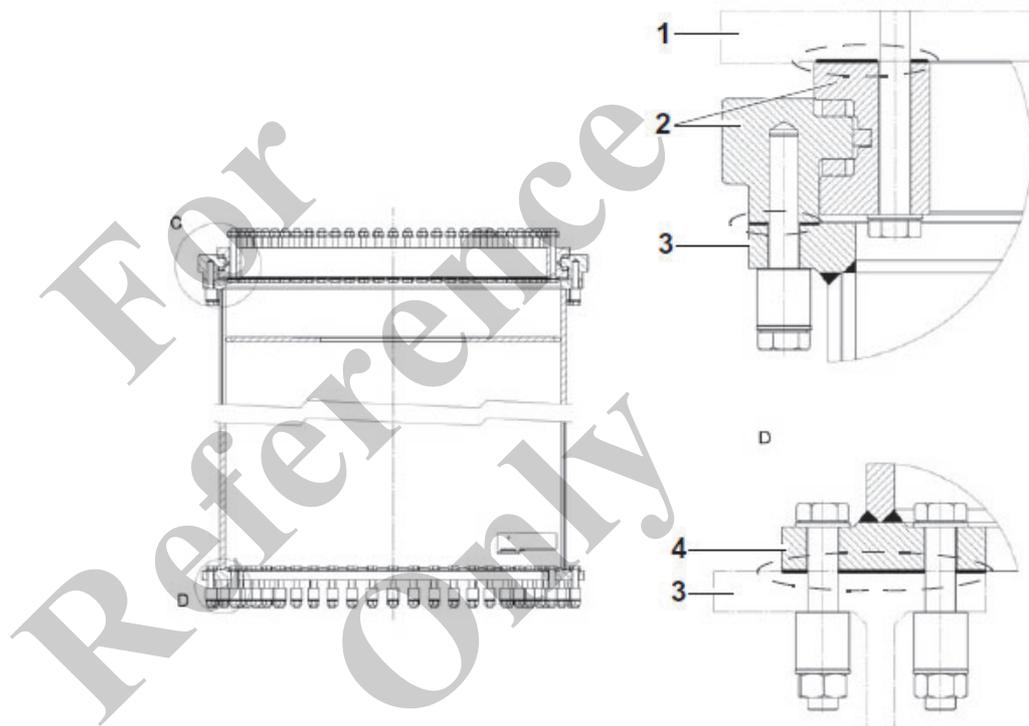
There are a few important points to observe for the installation:

- Clean all contact surfaces of the flange connections of any oil and grease.
- Galvanized or coated surfaces must be treated beforehand with AKTIVATOR T 747 because a thread lock compound (such as Gluetec or Loctite) must only be applied on activated surfaces.
- Apply the thread lock compound with a brush on a surface.
- Centering elements must not come into contact with the thread lock compound, because later dismantling involves difficulties
 - coat centering elements with wax or grease!

- Tighten fastening screws according to the torque specifications in a cross pattern. The thread lock compound starts to set after approx. 2 hours. Full strength is achieved after 12 - 24 hours.
 - 1) Upper structure
 - 2) Slewing ring
 - 3) Pylon or lower assembly
 - 4) Pylon



Flange connection with Loctite



10.6.4 Tightening torques for bolts

Note For certain fixing bolts on the undercarriage, values differing from those listed in this table may apply. Please observe notes in the respective sections.

Strength class 8.8

Coarse thread		Fine thread	
Bolt	Tightening torque M_A (Nm)	Bolt	Tightening torque M_A (Nm)
M4	2,7	M8x1	24
M5	5,4	M10x1	50
M6	9,3	M10x1.25	47
M8	23	M12x1.25	84
M10	45	M12x1.5	81

M12	77	M14x1.5	135
M14	125	M16x1.5	205
M16	190	M18x1.5	305
M18	275	M20x1.5	430
M20	385	M22x1.5	580
M22	530	M24x2	720
M24	660	M27x2	1050
M27	980	M30x2	1450
M30	1350		
M33	1850		
M36	2350		

Strength class 10.9

Coarse thread		Fine thread	
Bolt	Tightening torque M_A (Nm)	Bolt	Tightening torque M_A (Nm)
M4	4,0	M8x1	36
M5	7,9	M10x1	73
M6	14	M10x1.25	69
M8	33	M12x1.25	125
M10	66	M12x1.5	120
M12	115	M14x1.5	195
M14	180	M16x1.5	300
M16	280	M18x1.5	435
M18	390	M20x1.5	610
M20	550	M22x1.5	830
M22	750	M24x2	1050
M24	950	M27x2	1500
M27	1400	M30x2	2100
M30	1900		
M33	2600		
M36	3300		

Strength class 12.9

Coarse thread		Fine thread	
Bolt	Tightening torque M_A (Nm)	Bolt	Tightening torque M_A (Nm)
M4	4,7	M8x1	42
M5	9,2	M10x1	86
M6	16	M10x1.25	81
M8	39	M12x1.25	145
M10	77	M12x1.5	140
M12	135	M14x1.5	230

M14	210	M16x1.5	350
M16	330	M18x1.5	510
M18	450	M20x1.5	710
M20	640	M22x1.5	960
M22	880	M24x2	1200
M24	1100	M27x2	1750
M27	1650	M30x2	2450
M30	2200		
M33	3000		
M36	3900		

10.7 PFEIFER Pouch Socket System

10.7.1 Preamble

The instruction manual has to be read and understood carefully before using the PFEIFER Pouch Socket System. The instruction manual must be adhered to while using the PFEIFER Pouch Socket System.

The safety of the PFEIFER Pouch Socket System is only guaranteed if the pouch socket will be used, installed and maintained as described in this instruction manual. In addition, all safety instructions of the machine manufacturer and the operating company has to be considered.

10.7.2 Signs and symbols



WARNING

Indicates a serious risk of injury and death.



CAUTION

Indicates danger of injury and the risk of property damage.



General information



Wear a helmet



Wear safety shoes



Wear protective gloves

10.7.3 Application area and intended use



The PFEIFER Pouch Socket System is a removal end connection for hoist and luffing ropes and the appropriate designed connection to a crane.



CAUTION

Any other use of the PFEIFER Pouch Socket System than those described hereunder is prohibited!

10.7.4 General information

The **pouch sockets type 22 A** of the PFEIFER Pouch Socket System consist of following parts (see Fig. 1): Pouch socket, bolt with safety clip pin A and safety pin with arresting cable and safety clip pin B.

1. Safety clip pin A
2. Safety clip pin B
3. Safety pin
4. Swaged sleeve alternatively resin socket with rope
5. Bolt
6. Arresting cable
7. Pouch socket



Fig. 1

PFEIFER swaged steel sleeves type 11A (Fig. 2) and 12A (Fig. 3) and PFEIFER resin sockets Type 1 A and 14A are used for rope end terminations.



Fig. 2

PFEIFER swaged sleeve Type 11A-(Fig2)

PFEIFER resin socket Type 13 A

Tested according to EN1 411

Field of application: High performance rotation resistant ropes

Characteristic: Without rotary locking device at the tail



Fig. 4

Reeving eye for mounting of a reeving-rope on the end termination.



Never exceed the working load limit of the reeving eye.



PFEIFER swaged sleeve rotary locked Type 12A
PFEIFER resin socket rotary locked Type 14A
Tested according to EN1 411
Field of application: Non rotation resistant and rotation resistant ropes
Characteristics: Rotary locking device (nose) at the tail



Rotary locking device (nose) at the tail of the end termination to secure the nonrotation resistant and rotation resistant ropes against twisting.

Fig. 3

Fig. 5



CAUTION

Twisting of the rope can substantially reduce its breaking force and result in rope failure.

10.7.5 Installation and Assembling



Before assembling, the pouch socket, the bolts and the end terminations has to be proofed for visible damages e.g. cracks, corrosion, deformations etc.



CAUTION

Parts with shown cracks, deformations or other damages must not be installed or used.



The PFEIFER Pouch Socket System particularly the pouch socket itself and the corresponding end terminations have to match to the rope diameter. The nominal sizes on the used components have to match one another.



CAUTION

The usage of parts other than the original components and parts of the PFEIFER Pouch Socket System is forbidden. The usage of modified parts is also forbidden.

- Fit the pouch socket by using the bolt at the fixed-point of the crane.

- Secure the bolt with the corresponding safety clip pin A (Fig. 6). The safety bracket must lock in the intended slot (Fig. 7).
- For usage take the permanent end termination of the rope (swaged steel sleeve or resin socket) in the pouch socket and secure it with the safety pin (Fig. 8). The safety pin has to be fitted in front of the end termination and must not be inserted in the reeving eye (Fig. 9).
- Secure the safety pin with the corresponding safety clip pin B (Fig. 8). The safety bracket must lock in the intended slot (Fig. 7).



After appropriate assembly of the PFEIFER Pouch Socket System, the bolt, the safety pin and the safety clip pins have to be checked for tight fit and the function of the safety pin must be tested (Fig. 10).





10.7.6 Important security informations



Accidental releasing of the load or releasing the load as a result of failure of the PFEIFER Pouch Socket System poses direct or indirect danger to the health and safety of persons within the danger zone.

**WARNING**

Non rotation resistant ropes and rotation resistant ropes must not be used with a rotating fixed-point (e.g. swivel hydraulic cylinder etc.). Noncompliance will result in considerable rope damage rope break and releasing of the load.



By using a swaged steel sleeve for rope end termination (Type 11A and 12A) the minimum breaking load of the rope will be reduced to 90%.



Never use in conditions below -40°C or exceeding $+80^{\circ}\text{C}$.



While working with the PFEIFER Pouch Socket System special protective measures must be taken. Wear a helmet.



While working with the PFEIFER Pouch Socket System special protective measures must be taken. Wear safety shoes.



While working with the PFEIFER Pouch Socket System special protective measures must be taken. Wear protective gloves.

10.7.7 Operation**CAUTION**

Falling loads shock loads or to exceed the working load limit are forbidden and will result in the exclusion of warranty and product liability.

**CAUTION**

The PFEIFER Pouch Socket System has to be checked for damages. Damaged parts and components have to be replaced and may not be used.



During the operation pay attention to the correct fit of the bolt the safety pin the safety clip pins and the end terminations (swaged sleeve and resin socket) in the pouch socket.



During the operation avoid side-loading of the pouch socket and oblique pull.

10.7.8 Accessories and spare parts

Auxiliary reeving device to pull the rope into the reeving system consists of two connecting links and one swivel (Fig. 11).



Do not exceed the working load limit of the reeving eye of the end termination. The auxiliary reeving device is not designed for lifting of loads.



To pull the rope into the reeving system use a rotation resistant auxiliary reeving rope.



Spare Parts

Repairs of components of the whole PFEIFER Pouch Socket System may only be carried out by trained and approved technicians and by the company PFEIFER Seil- und Hebetchnik GmbH authorized service personnel.

Nominal Size NG	Part Number	Working Load Limit
16, 19, 22, 26, 29, 32, 36	233596	10 kN
40, 44, 48	233597	20 kN
52	233598	30 kN



1. Swivel
2. Connecting link

NG	Bolt	Safety Clip Pin A	Safety Pin	Safety Clip Pin B
16	214275	112121	228505	212842
19	214556	112112	228514	212842
22	214561	112112	228551	212842
26	214204	112123	228556	212842
29	213240	112123	228589	212842
32	212770	112123	558590	212842
36	214042	230723	228591	212842
40	230835	230723	230887	112121
44	230836	230723	230888	112121
48	230836	230723	230888	112121
48	230837	230723	230889	112121
52	230838	230723	230890	112121



10.7.9 Maintenance and Repair



The whole pouch socket has to be checked for visible damages in periodic intervals and after unexpected incidents (falling loads shock loads etc.) but at least one time after 12 months.



CAUTION

Parts with cracks heavy corrosion deformations and other damages may not be used and loaded.



This instruction manual does not deal with discard criteria of wire ropes. You will find information about discard criteria in the available issue of the standard ISO 4309.



Repairs of components of the whole PFEIFER Pouch Socket System may only be carried out by trained and approved technicians and by the company PFEIFER Seil- und Hebetchnik GmbH authorized service personnel.

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10.7.10 Lifting Capacity Table



CAUTION

Falling Loads, shock loads or exceeding the working load limit is forbidden and will result in the exclusion of warranty and product liability.

NG	Order Number	Working Load Limit	Weight
16	03 22A 016	85 kN	2,8 kg
19	03 22A 019	120 kN	4,7 kg
22	03 22A 022	160 kN	7,0 kg
26	03 22A 026	220 kN	10,8 kg
29	03 22A 029	275 kN	15,6 kg
32	03 22A 032	335 kN	21,8 kg
36	03 22A 036	425 kN	29,7 kg
40	03 22A 040	500 kN	42,3 kg
44	03 22A 044	610 kN	55,9 kg
48	03 22A 048	730 kN	71,4 kg
52	03 22A 052	850 kN	90,1 kg

10.8 Operating Fluids and Lubricants

List of operating fluids and lubricants

For
Reference
Only

For
Reference
Only

Introductory remarks

Introductory remarks

This list contains the operating fluids and lubricants used and recommended by Grove for the **United States of America and Canada.**

Hazardous substances

Operating fluids and lubricants for machines are in many cases hazardous substances, therefore certain guidelines must be observed in the handling, storage, transport, labeling and disposal of the substances. These guidelines are based on the legal and technical regulations for hazardous substances, which apply in the respective country and are found in the safety information sheets from the operating fluid and lubricant manufacturer. The user of the operating fluids and lubricants list is therefore obliged to inform himself about the nationally applicable laws and regulations. The Grove assumes no liability for improper or illegal use of their approved operating fluids and lubricants.

The factory filling of each Grovemachine is marked with a sticker at the corresponding filling points.



Fig. 1: Sticker hydraulic oil

- ▲ If, for one application, several supplies, e.g. Cryogenic, high temperature or rapidly biodegradable operating fluid are specified, the fuel of the factory filling for the standard temperature range is marked by a black triangle.

The ambient temperature that can be expected at the work site is an important criterion for selection of an operating fluid or lubricant. Consequently, in this list the temperature ranges are assigned to the respective operating fluid or lubricant.

For the low-temperature range and the high-temperature range, various equipment and packages are available, which in addition to the special operating fluids and lubricants contain further measures and modified components.

For operating temperature ranges outside the temperature ranges specified in this list of operating fluids and lubricants, please contact a Groveservice partner.

The machine's operating conditions are another important factor. This implies the amount of dust in the machine's environment and the number of tool changes. These factors significantly affect the service life of the operating fluids and lubricants.

Introductory remarks

When topping up operating fluids and lubricants, only use products of the same brand and type to ensure that technical performance parameters are not impaired. Do not mix operating fluids and lubricants with the same specifications or of the same type from different manufacturers. Do not mix operating fluids and lubricants from the same manufacturer with different specifications or of different types. Through such mixing, significant component damage and malfunction can occur. When changing the operating fluid or lubricant to another grade, type or manufacturer, please contact a Groveservice partner.



WARNING!

Health risks from operating fluids and lubricants.

Care must be taken when handling operating fluids and lubricants, skin, eye contact, ingestion or inhalation can result in serious damage to health.

- Observe the safety information sheet of the operating fluid and lubricant manufacturer.
- Wear protective goggles, protective clothing and protective gloves.
- Avoid contact with eyes and skin.
- Do not inhale operating fluid or lubricant fumes.
- Do not swallow operating fluids or lubricants.

First aid measures:

- **General**
 - Take off contaminated clothing, wash it or dispose of it in an environmentally sound manner.
- **Skin contact**
 - Rinse the operating fluid and lubricant off with water and wash affected skin areas with soap.
 - If skin irritation persists, consult a doctor.
- **Eye contact**
 - immediately rinse the eye with clean water.
 - if irritation persists consult an ophthalmologist.
- **Inhalation**
 - provide fresh air supply.
 - If respiratory arrest occurs , perform artificial respiration.
 - consult a doctor if breathing problems persist.
- **Ingested**
 - Consult a doctor.

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For
Reference
Only

Hydraulic systems

Hydraulic oils for material handlers > Hydraulic oils with extended change interval

1 Hydraulic systems

1.1 Hydraulic oils for material handlers

1.1.1 Hydraulic oils with extended change interval

Using the following hydraulic oils can extend change intervals depending on the results of regularly conducted hydraulic oil analyses (Shell LubeAnalyst).

To extend the change interval, the machine must be equipped with SENNEBOGEN HydroClean.

Shell Tellus S4 VX 32 (for A-Series to D-Series)

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157284 Shell: 001D7769	DIN 51524-3 HVLP (ISO VG 32)	-30 to +30 °C -22 to +86 °F	 The sticker features the SENNEBOGEN logo, a Shell logo, and the text 'Shell Tellus S4 VX 32 (SE 157284 / 001D7769)'. It also includes a small icon of a drop and a thermometer.	Avia Syntofluid PEB 30

Shell Tellus S4 VX 32 (for E-Series)

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157284 Shell: 001D7769	DIN 51524-3 HVLP (ISO VG 32)	-30 to +40 °C -22 to +104 °F	 The sticker features the SENNEBOGEN logo, a Shell logo, and the text 'Shell Tellus S4 VX 32 (SE 157284 / 001D7769)'. It also includes a small icon of a drop and a thermometer.	Avia Syntofluid PEB 30

Shell Tellus S2 VA 46

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179233 Shell: 001D7756	DIN 51524 -3 HVLP -D ISO VG 46	-20 to +50 °C -4 to +122 °F	 The sticker features the SENNEBOGEN logo, a Shell logo, and the text 'Shell Tellus S2 VA 46 (SE 179233 / Shell 001D7756)'. It also includes a small icon of a drop and a thermometer.	

Hydraulic systems

Hydraulic oils for material handlers > Hydraulic oils with extended change interval

Panolin HLP Synth 46

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 149198	<ul style="list-style-type: none"> ■ ISO 15380 HEES saturated ■ OECD 301B 	-15 to +50 °C +5 to +122 °F		Avia Syntofluid PEB 50

Avia Syntofluid PEB 30 (for A-Series to D-Series)

- Rapidly biodegradable
- Low temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 149199	<ul style="list-style-type: none"> ■ ISO 15380 HEPR ■ DIN 51524-3 HVLP-D ■ CEC-L-33-A-93 	-30 to +30 °C -22 to +86 °F		

Avia Syntofluid PEB 30 (for E-Series)

- Rapidly biodegradable
- Low temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 149199	<ul style="list-style-type: none"> ■ ISO 15380 HEPR ■ DIN 51524-3 HVLP-D ■ CEC-L-33-A-93 	-30 to +40 °C -22 to +104 °F		

Avia Syntofluid PEB 50

- Rapidly biodegradable
- Low temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 149200	<ul style="list-style-type: none"> ■ ISO 15380 HEPR ■ DIN 51524-3 HVLP-D ■ CEC-L-33-A-93 	-25 to +50 °C -13 to +122 °F		

Hydraulic systems

Hydraulic oils for duty cycle cranes with free-fall winches > Hydraulic oils with extended change interval

1.1.2 Hydraulic oils without an extended change interval

The hydraulic oils cited below can be used if there is no hydraulic oil with an extended change interval available.

When using these hydraulic oils the change interval of 2000 operating hours must be complied with.

Shell Tellus S2 MX 46

Order number	Specification	Temperature range	Sticker	Alternative
SE: 217002 Shell: 001F8439	<ul style="list-style-type: none"> DIN 51524-2 HLP/HLPD ISO VG 46 	-10 to +40 °C +14 to +104 °F		<ul style="list-style-type: none"> Agip OSO-D46 Shell Tellus S2 M 46

Shell Tellus S2 MX 68

Order number	Specification	Temperature range	Sticker	Alternative
SE: 217001 Shell: 001F8440	<ul style="list-style-type: none"> DIN 51524-2 HLP/HLPD ISO VG 68 	-5 to +50 °C +23 to +122 °F		<ul style="list-style-type: none"> Agip OSO-D68 Shell Tellus S2 M 68

1.2 Hydraulic oils for duty cycle cranes with free-fall winches

1.2.1 Hydraulic oils with extended change interval

Using the following hydraulic oils can extend change intervals depending on the results of regularly conducted hydraulic oil analyses (Shell LubeAnalyst).

To extend the change interval, the machine must be equipped with SENNEBOGEN HydroClean.

Shell Spirax S3 TLV

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179231 Shell: 001D8244	Oil-specific suitability test	-20 to +40 °C -4 to +104 °F		

Hydraulic systems

Hydraulic oils for crawler cranes, telescopic cranes, harbor cranes, duty cycle cranes without free-fall winches > Hydraulic oils with extended change interval

Shell Spirax S4 TXM

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179232 Shell: 001D8246	Oil-specific suitability test	-10 to +50 °C +14 to +122 °F		<ul style="list-style-type: none"> OMV Austromatic HGN ¹⁾ Castrol Agri Trans Plus 80W ¹⁾
¹⁾ When using these hydraulic oils, the change interval of 2000 operating hours must be complied with.				

Panolin Biofluid SBH 68

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 204129	<ul style="list-style-type: none"> ISO 15380 HEES saturated Oil-specific suitability test OECD 301B 	-15 to +50 °C +5 to +122 °F		

Panolin Biofluid SBH 46

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 204129	<ul style="list-style-type: none"> ISO 15380 HEES saturated Oil-specific suitability test OECD 301B 	-20 to +40 °C -4 to +104 °F		

1.3 Hydraulic oils for crawler cranes, telescopic cranes, harbor cranes, duty cycle cranes without free-fall winches

1.3.1 Hydraulic oils with extended change interval

Using the following hydraulic oils can extend change intervals depending on the results of regularly conducted hydraulic oil analyses (Shell LubeAnalyst).

To extend the change interval, the machine must be equipped with SENNEBOGEN HydroClean.

Hydraulic systems

Hydraulic oils for crawler cranes, telescopic cranes, harbor cranes, duty cycle cranes without free-fall winches > Hydraulic oils with extended change interval

Shell Tellus S4 VX 32 (for A-Series to D-Series)

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157284 Shell: 001D7769	DIN 51524-3 HVLP (ISO VG 32)	-30 to +30 °C -22 to +86 °F	 The sticker features the SENNEBOGEN logo, the Shell logo, and the product name 'Shell Tellus S4 VX 32' with the reference numbers '(SE 157284 / 001D7769)' and 'SE 180752'.	Avia Syntofluid PEB 30

Shell Tellus S4 VX 32 (for E-Series)

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157284 Shell: 001D7769	DIN 51524-3 HVLP (ISO VG 32)	-30 to +40 °C -22 to +104 °F	 The sticker features the SENNEBOGEN logo, the Shell logo, and the product name 'Shell Tellus S4 VX 32' with the reference numbers '(SE 157284 / 001D7769)' and 'SE 180752'.	Avia Syntofluid PEB 30

Shell Tellus S2 VA 46

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179233 Shell: 001D7756	DIN 51524 -3 HVLP -D ISO VG 46	-20 to +50 °C -4 to +122 °F	 The sticker features the SENNEBOGEN logo, the Shell logo, and the product name 'Shell Tellus S2 VA 46' with the reference numbers '(SE 179233 / Shell 001D7756)' and 'SE 180743'.	

Panolin HLP Synth 46

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 149198	<ul style="list-style-type: none"> ■ ISO 15380 HEES saturated ■ OECD 301B 	-15 to +50 °C +5 to +122 °F	 The sticker features the SENNEBOGEN logo, the Panolin logo, and the product name 'Panolin HLP Synth 46' with the reference number '(SE 149198)' and 'SE 180752'.	Avia Syntofluid PEB 50

Hydraulic systems

Hydraulic oils for crawler cranes, telescopic cranes, harbor cranes, duty cycle cranes without free-fall winches > Hydraulic oils without an extended change interval

Avia Syntofluid PEB 30 (for A-Series to D-Series)

- Rapidly biodegradable
- Low temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 149199	<ul style="list-style-type: none"> ■ ISO 15380 HEPR ■ DIN 51524-3 HVLP-D ■ CEC-L-33-A-93 	-30 to +35 °C -22 to +95 °F		

Avia Syntofluid PEB 30 (for E-Series)

- Rapidly biodegradable
- Low temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 149199	<ul style="list-style-type: none"> ■ ISO 15380 HEPR ■ DIN 51524-3 HVLP-D ■ CEC-L-33-A-93 	-30 to +40 °C -22 to +104 °F		

Avia Syntofluid PEB 50

- Rapidly biodegradable
- Low temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 149200	<ul style="list-style-type: none"> ■ ISO 15380 HEPR ■ DIN 51524-3 HVLP-D ■ CEC-L-33-A-93 	-25 to +50 °C -13 to +122 °F		

1.3.2 Hydraulic oils without an extended change interval

The hydraulic oils cited below can be used if there is no hydraulic oil with an extended change interval available.

When using these hydraulic oils the change interval of 2000 operating hours must be complied with.

Hydraulic systems

Hydraulic oils for Multihandler 305, 310 > Hydraulic oils without an extended change interval

Shell Tellus S2 MX 46

Order number	Specification	Temperature range	Sticker	Alternative
SE: 217002 Shell: 001F8439	<ul style="list-style-type: none"> ■ DIN 51524-2 HLP/ HLPD ■ ISO VG 46 	-10 to +40 °C +14 to +104 °F		<ul style="list-style-type: none"> ■ Agip OSO-D46 ■ Shell Tellus S2 M 46

Shell Tellus S2 MX 68

Order number	Specification	Temperature range	Sticker	Alternative
SE: 217001 Shell: 001F8440	<ul style="list-style-type: none"> ■ DIN 51524-2 HLP/ HLPD ■ ISO VG 68 	-5 to +50 °C +23 to +122 °F		<ul style="list-style-type: none"> ■ Agip OSO-D68 ■ Shell Tellus S2 M 68

1.4 Hydraulic oils for Multihandler 305, 310

1.4.1 Hydraulic oils without an extended change interval

The hydraulic oils cited below can be used if there is no hydraulic oil with an extended change interval available.

When using these hydraulic oils the change interval of 2000 operating hours must be complied with.

Shell Tellus S4 VX 32

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157284 Shell: 001D7769	DIN 51524-3 HVLP (ISO VG 32)	-30 to +30 °C -22 to +86 °F		

Shell Tellus S2 VA 46

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179233 Shell: 001D7756	DIN 51524 -3 HVLP -D ISO VG 46	-20 to +40 °C -4 to +104 °F		Agrip Precis HVLP-D

Hydraulic systems

Hydraulic oils for telehandlers > Hydraulic oils with extended change interval

Panolin HLP Synth 46

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 149198	<ul style="list-style-type: none"> ■ ISO 15380 HEES saturated ■ OECD 301B 	-15 to +40 °C +5 to +104 °F		Avia Syntofluid PEB 30

1.5 Hydraulic oils for telehandlers

1.5.1 Hydraulic oils with extended change interval

Using the following hydraulic oils can extend change intervals depending on the results of regularly conducted hydraulic oil analyses (Shell LubeAnalyst).

To extend the change interval, the machine must be equipped with SENNEBOGEN HydroClean.

Shell Tellus S4 VX 32

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157284 Shell: 001D7769	DIN 51524-3 HVLP (ISO VG 32)	-30 to +30 °C -22 to +86 °F		Avia Syntofluid PEB 30

Shell Tellus S2 VA 46

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179233 Shell: 001D7756	DIN 51524 -3 HVLP -D ISO VG 46	-20 to +50 °C -4 to +122 °F		

Hydraulic systems

Hydraulic oils for Powerpacks

Panolin HLP Synth 46

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 149198	<ul style="list-style-type: none"> ■ ISO 15380 HEES saturated ■ OECD 301B 	-15 to +50 °C +5 to +122 °F		Avia Syntofluid PEB 50

1.5.2 Hydraulic oils without an extended change interval

The hydraulic oils cited below can be used if there is no hydraulic oil with an extended change interval available.

When using these hydraulic oils the change interval of 2000 operating hours must be complied with.

Shell Tellus S2 MX 46

Order number	Specification	Temperature range	Sticker	Alternative
SE: 217002 Shell: 001F8439	<ul style="list-style-type: none"> ■ DIN 51524-2 HLP/HLPD ■ ISO VG 46 	-10 to +40 °C +14 to +104 °F		<ul style="list-style-type: none"> ■ Agip OSO-D46 ■ Shell Tellus S2 M 46

Shell Tellus S2 MX 68

Order number	Specification	Temperature range	Sticker	Alternative
SE: 217001 Shell: 001F8440	<ul style="list-style-type: none"> ■ DIN 51524-2 HLP/HLPD ■ ISO VG 68 	-5 to +50 °C +23 to +122 °F		<ul style="list-style-type: none"> ■ Agip OSO-D68 ■ Shell Tellus S2 M 68

1.6 Hydraulic oils for Powerpacks

Fill Powerpacks with the same hydraulic oil that is used in the machine's hydraulic system.

Diesel engines

Engine oil > Caterpillar

2 Diesel engines

2.1 Engine oil

2.1.1 Caterpillar

2.1.1.1 Emissions Stage US EPA Tier 2 / EU Tier II and US EPA Tier 3 / EU Tier IIIa

Shell Rimula Ultra 5W-30¹⁾

Order number	Specification	Temperature range	Sticker	Alternative
SE: 215956 Shell: 001F4540	<ul style="list-style-type: none"> ■ API CJ-4 ■ CAT ECF-3 	-30 to +30 °C -22 to +86 °F		<ul style="list-style-type: none"> ■ OMV Supertruck 5W-30

¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.

Shell Rimula R5 E 10W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181934 Shell: 001C4591	<ul style="list-style-type: none"> ■ API CI-4 	-20 to +50 °C -4 to +122 °F		

Shell Rotella T5 10W-30¹⁾

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179999 Shell: 001D5436	<ul style="list-style-type: none"> ■ API CK-4 ■ CAT ECF-3 	-20 to +50 °C -4 to +122 °F		

¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.

Shell Rimula R4 X 15W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181933 Shell: 001E7746	<ul style="list-style-type: none"> ■ API CI-4 ■ CAT ECF-2 	-10 to +50 °C +14 to +122 °F		

Diesel engines

Engine oil > Caterpillar

Panolin Ecomot 5W-30¹⁾ Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214838	<ul style="list-style-type: none"> ■ API CJ-4 ■ CAT ECF-3 ■ OECD 302C 	-30 to +50 °C -22 to +122 °F		
<p>¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.</p>				

2.1.1.2 Emissions Stage US EPA Tier 4 interim / EU Tier IIIb

Shell Rimula Ultra 5W-30¹⁾

Order number	Specification	Temperature range	Sticker	Alternative
SE: 215956 Shell: 001F4540	<ul style="list-style-type: none"> ■ API CJ-4 ■ CAT ECF-3 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ Shell Rotella T6 5W-40 ■ Motorex Nexus FE 5W-30 ■ Eni i-Sigma top MS 5W-30
<p>¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.</p>				

Shell Rotella T5 10W-30 Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179999 Shell: 001D5436	<ul style="list-style-type: none"> ■ API CK-4 ■ CAT ECF-3 	-20 to +50 °C -4 to +122 °F		

Shell Rotella T3 15W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 187162 Shell: 001D5433	<ul style="list-style-type: none"> ■ API CJ-4 ■ CAT ECF-3 	-10 to +50 °C +14 to +122 °F		

Diesel engines

Engine oil > Cummins

Panolin Ecomot 5W-30 Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214838	<ul style="list-style-type: none"> ■ API CJ-4 ■ CAT ECF-3 ■ OECD 302C 	-30 to +50 °C -22 to +122 °F		

2.1.2 Cummins

2.1.2.1 Emissions Stage US EPA Tier 2 / EU Tier II and US EPA Tier 3 / EU Tier IIIa

Shell Rimula Ultra 5W-30¹⁾

Order number	Specification	Temperature range	Sticker	Alternative
SE: 215956 Shell: 001F4540	<ul style="list-style-type: none"> ■ API CJ-4 ■ Cummins CES 20081 	-30 to +30 °C -22 to +86 °F		<ul style="list-style-type: none"> ■ OMV Supertruck 5W-30

¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.

Shell Rimula R5 E 10W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181934 Shell: 001C4591	<ul style="list-style-type: none"> ■ API CI-4 ■ Cummins CES 20078 	-20 to +50 °C -4 to +122 °F		

Shell Rotella T5 10W-30¹⁾

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179999 Shell: 001D5436	<ul style="list-style-type: none"> ■ API CJ-4 ■ API CK-4 ■ Cummins CES 20086 	-20 to +50 °C -4 to +122 °F		

¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.

Diesel engines

Engine oil > Cummins

Shell Rimula R4 X 15W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181933 Shell: 001E7746	<ul style="list-style-type: none"> ■ API CI-4 ■ Cummins CES 20078 	-10 to +50 °C +14 to +122 °F		

Panolin Ecomot 5W-30¹⁾

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214838	<ul style="list-style-type: none"> ■ API CJ-4 ■ OECD 302C ■ Performance level Cummins CES 20081 	-30 to +50 °C -22 to +122 °F		
<p>¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.</p>				

2.1.2.2 Emissions Stage US EPA Tier 4 interim / EU Tier IIIb

Shell Rimula Ultra 5W-30

Order number	Specification	Temperature range	Sticker	Alternative
SE: 215956 Shell: 001F4540	<ul style="list-style-type: none"> ■ API CJ-4 ■ Cummins CES 20081 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ Shell Rotella T6 5W-40 ■ Motorex Nexus FE 5W-30

Shell Rotella T5 10W-30

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179999 Shell: 001D5436	<ul style="list-style-type: none"> ■ API CK-4 ■ Cummins CES 20086 	-20 to +50 °C -4 to +122 °F		

Shell Rotella T3 15W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 187162 Shell: 001D5433	<ul style="list-style-type: none"> ■ API CK-4 ■ Cummins CES 20086 	-10 to +50 °C +14 to +122 °F		

Diesel engines

Engine oil > Cummins

Panolin Ecomot 5W-30 Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214838	<ul style="list-style-type: none"> ■ API CJ-4 ■ OECD 302C ■ Performance level Cummins CES 20081 	-30 to +50 °C -22 to +122 °F		

2.1.2.3 Emissions Stage US EPA Tier 4 final / EU Tier V

Shell Rimula Ultra 5W-30

Order number	Specification	Temperature range	Sticker	Alternative
SE: 215956 Shell: 001F4540	<ul style="list-style-type: none"> ■ API CJ-4 ■ Cummins CES 20081 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ Shell Rotella T6 5W-40

Shell Rotella T5 10W-30 Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179999 Shell: 001D5436	<ul style="list-style-type: none"> ■ API CK-4 ■ Cummins CES 20086 	-20 to +50 °C -4 to +122 °F		

Shell Rotella T3 15W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 187162 Shell: 001D5433	<ul style="list-style-type: none"> ■ API CK-4 ■ Cummins CES 20086 	-10 to +50 °C +14 to +122 °F		

Panolin Ecomot 5W-30 Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214838	<ul style="list-style-type: none"> ■ API CJ-4 ■ OECD 302C ■ Performance level Cummins CES 20081 	-30 to +50 °C -22 to +122 °F		

Diesel engines

Engine oil > Cummins

2.1.2.4 Emissions Stage US EPA Tier 4 final / EU Tier IV with extended oil change interval

Shell Rimula Ultra 5W-30

Order number	Specification	Temperature range	Sticker	Alternative
SE: 215956 Shell: 001F4540	<ul style="list-style-type: none"> ■ API CJ-4 ■ Cummins CES 20081 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ Shell Rotella T6 5W-40 ■ Motorex Nexus FE 5W-30

Shell Rotella T3 15W-40¹⁾

Order number	Specification	Temperature range	Sticker	Alternative
SE: 187162 Shell: 001D5433	<ul style="list-style-type: none"> ■ API CK-4 ■ Cummins CES 20086 	-10 to +50 °C +14 to +122 °F		

¹⁾ Observe the instructions in the operating manual.

Shell Rotella T5 10W-30¹⁾

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179999 Shell: 001D5436	<ul style="list-style-type: none"> ■ API CK-4 ■ Cummins CES 20086 	-20 to +50 °C -4 to +122 °F		

¹⁾ Observe the instructions in the operating manual.

Panolin Ecomot 5W-30

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214838	<ul style="list-style-type: none"> ■ API CJ-4 ■ OECD 302C ■ Performance level Cummins CES 20081 	-30 to +50 °C -22 to +122 °F		

2.1.2.5 Emissions Stage US EPA Tier 4 final / EU Tier V with extended oil change interval

Shell Rimula Ultra 5W-30

Order number	Specification	Temperature range	Sticker	Alternative
SE: 215956 Shell: 001F4540	<ul style="list-style-type: none"> ■ API CJ-4 ■ Cummins CES 20081 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ Shell Rotella T6 5W-40

Diesel engines

Engine oil > FPT

Shell Rotella T3 15W-40¹⁾

Order number	Specification	Temperature range	Sticker	Alternative
SE: 187162 Shell: 001D5433	<ul style="list-style-type: none"> ■ API CK-4 ■ Cummins CES 20086 	-10 to +50 °C +14 to +122 °F		

¹⁾ Observe the instructions in the operating manual.

Shell Rotella T5 10W-30¹⁾

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179999 Shell: 001D5436	<ul style="list-style-type: none"> ■ API CK-4 ■ Cummins CES 20086 	-20 to +50 °C -4 to +122 °F		

¹⁾ Observe the instructions in the operating manual.

Panolin Ecomot 5W-30

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214838	<ul style="list-style-type: none"> ■ API CJ-4 ■ OECD 302C ■ Performance level Cummins CES 20081 	-30 to +50 °C -22 to +122 °F		

2.1.3 FPT

2.1.3.1 Emissions Stage US EPA Tier 3 / EU Tier IIIa

Shell Rimula Ultra 5W-30¹⁾

Order number	Specification	Temperature range	Sticker	Alternative
SE: 215956 Shell: 001F4540	<ul style="list-style-type: none"> ■ API CJ-4 	-30 to +30 °C -22 to +86 °F		<ul style="list-style-type: none"> ■ OMV Supertruck 5W-30

¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.

Diesel engines

Engine oil > FPT

Shell Rimula R5 E 10W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181934 Shell: 001C4591	<ul style="list-style-type: none"> API CI-4 	-20 to +50 °C -4 to +122 °F		

Shell Rotella T5 10W-30¹⁾

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179999 Shell: 001D5436	<ul style="list-style-type: none"> API CK-4 	-20 to +50 °C -4 to +122 °F		

¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.

Shell Rimula R4 X 15W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181933 Shell: 001E7746	<ul style="list-style-type: none"> API CI-4 	-10 to +50 °C +14 to +122 °F		

Panolin Ecomot 5W-30¹⁾

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214838	<ul style="list-style-type: none"> API CJ-4 OECD 302C 	-30 to +50 °C -22 to +122 °F		

¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.

Diesel engines

Engine oil > Deutz

2.1.3.2 Emissions Stage US EPA Tier 4 final / EU Tier IV / EU Tier V

Shell Rimula Ultra 5W-30

Order number	Specification	Temperature range	Sticker	Alternative
SE: 215956 Shell: 001F4540	<ul style="list-style-type: none"> ■ API CJ-4 ■ ACEA E9 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ Shell Rotella T6 5W-40 ■ Motorex Nexus FE 5W-30

Shell Rotella T5 10W-30

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179999 Shell: 001D5436	<ul style="list-style-type: none"> ■ API CJ-4 ■ API CK-4 ■ ACEA E9 	-20 to +50 °C -4 to +122 °F		

Shell Rotella T3 15W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 187162 Shell: 001D5433	<ul style="list-style-type: none"> ■ API CJ-4 ■ ACEA E9 	-10 to +50 °C +14 to +122 °F		

Panolin Ecomot 5W-30

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214838	<ul style="list-style-type: none"> ■ API CJ-4 ■ OECD 302C 	-30 to +50 °C -22 to +122 °F		

2.1.4 Deutz

2.1.4.1 Emissions Stage US EPA Tier 2 / EU Tier II and US EPA Tier 3 / EU Tier IIIa

Shell Rimula R6 ME 5W-30

Order number	Specification	Temperature range	Sticker	Alternative
SE: 182085 Shell: 001C4595	<ul style="list-style-type: none"> ■ Deutz DQC IV-10 	-30 to +30 °C -22 to +86 °F		OMV Supertruck SAE 5W-30

Diesel engines

Engine oil > Deutz

Shell Rimula R6 MS 10W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181936 Shell: 001E7457	<ul style="list-style-type: none"> ■ Deutz DQC IV-10 ■ ACEA E7 	-20 to +50 °C -4 to +122 °F		OMV Supertruck SAE 10W-40

Shell Rotella T5 10W-30¹⁾

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179999 Shell: 001D5436	<ul style="list-style-type: none"> ■ API CK-4 ■ Deutz DQC III-10 LA 	-20 to +50 °C -4 to +122 °F		

¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.

Shell Rimula R4 X 15W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181933 Shell: 001E7746	<ul style="list-style-type: none"> ■ API CI-4 ■ Deutz DQC III-10 	-10 to +50 °C +14 to +122 °F		

2.1.4.2 Emissions Stage US EPA Tier 4 interim / EU Tier IIIb

Shell Rimula R6 LME 5W-30

Order number	Specification	Temperature range	Sticker	Alternative
SE: 182086 Shell: 001C4597	<ul style="list-style-type: none"> ■ ACEA E7 ■ Deutz DQC IV-10 LA 	-30 to +30 °C -22 to +86 °F		Motorex Nexus FE 5W-30 Eni i-Sigma top MS 5W-30

Shell Rotella T5 10W-30

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179999 Shell: 001D5436	<ul style="list-style-type: none"> ■ API CK-4 ■ Deutz DQC III-10 LA 	-20 to +50 °C -4 to +122 °F		

Diesel engines

Engine oil > Scania

Shell Rimula R6 MS 10W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181936 Shell: 001E7457	<ul style="list-style-type: none"> ■ Deutz DQC IV-10 ■ ACEA E7 	-20 to +50 °C -4 to +122 °F		OMV Supertruck SAE 10W-40

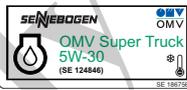
Shell Rotella T3 15W-40

Order number	Specification	Temperature range	Sticker	Alternative
SE: 187162 Shell: 001D5433	<ul style="list-style-type: none"> ■ API CJ-4 ■ Deutz DQC III-10 LA 	-10 to +50 °C +14 to +122 °F		

2.1.5 Scania

2.1.5.1 Emissions Stage US EPA Tier 3 / EU Tier IIIa

OMV Super Truck SAE 5W-30

Order number	Specification	Temperature range	Sticker	Alternative
SE: 124846	<ul style="list-style-type: none"> ■ API CI-4 ■ ACEA E7 ■ Scania LDF 	-30 to +30 °C -22 to +86 °F		

Shell Rimula R6 MS 10W-40

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181936 Shell: 001E7457	<ul style="list-style-type: none"> ■ ACEA E7 ■ Scania LDF-3 	-20 to +50 °C -4 to +122 °F		OMV Supertruck SAE 10W-40

2.1.5.2 Emissions Stage US EPA Tier 4 interim / EU Tier IIIb

Shell Rimula R6 LME 5W-30

Order number	Specification	Temperature range	Sticker	Alternative
SE: 182086 Shell: 001C4597	<ul style="list-style-type: none"> ■ ACEA E7 ■ Scania LA 	-30 to +30 °C -22 to +86 °F		

Diesel engines

Engine oil > Diesel emergency generator

Shell Rimula R6 MS 10W-40 Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181936 Shell: 001E7457	<ul style="list-style-type: none"> ■ ACEA E7 ■ Scania LDF-3 	-20 to +50 °C -4 to +122 °F		OMV Supertruck SAE 10W-40

2.1.5.3 Emissions Stage US EPA Tier 4 final / EU Tier V

Shell Rimula Ultra 5W-30

Order number	Specification	Temperature range	Sticker	Alternative
SE: 215956 Shell: 001F4540	<ul style="list-style-type: none"> ■ API CJ-4 ■ ACEA E9 ■ Scania LDF-4 	-30 to +50 °C -22 to +122 °F		

Shell Rotella T5 10W-30 Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179999 Shell: 001D5436	<ul style="list-style-type: none"> ■ API CK-4 ■ Scania LDF-4 	-20 to +50 °C -4 to +122 °F		

2.1.6 Diesel emergency generator

All diesel engine oils in this list are compatible.

↳ Chapter 2.1 "Engine oil" on page 17



Observe the respective temperature range when using engine oil.

Diesel engines

Coolant > Cummins

2.2 Coolant

2.2.1 Caterpillar

CAT ELC

Order number	Specification	Temperature range	Sticker	Alternative
SE: 175268	CAT ELC	Mixing ratio for coolant concentrate/water <ul style="list-style-type: none"> ■ 50/50: Up to -37 °C (-34 °F) ■ 60/40: Up to -52 °C (-61 °F) 		
Use a coolant with a mixing ratio of at least 50/50 all year round. Do not exceed a mixing ratio of 60/40.				

2.2.2 Cummins

Cummins ES Compleat

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181966	Cummins CES 14603	Mixing ratio Coolant concentrate/water <ul style="list-style-type: none"> ■ 50/50: Up to -37 °C (-34 °F) ■ 60/40: Up to -52 °C (-61 °F) 		Cummins CES 14603
Use a coolant with a mixing ratio of at least 50/50 all year round. Do not exceed a mixing ratio of 60/40.				

Senprotect

Order number	Specification	Temperature range	Sticker	Alternative
SE: 187301	Cummins CES 14603	Mixing ratio Coolant concentrate/water <ul style="list-style-type: none"> ■ 50/50: Up to -37 °C (-34 °F) ■ 60/40: Up to -52 °C (-61 °F) 	--	Cummins CES 14603
Use a coolant with a mixing ratio of at least 50/50 all year round. Do not exceed a mixing ratio of 60/40.				

Diesel engines

Coolant > Scania

2.2.3 FPT

Cummins ES Compleat

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181966	Cummins CES 14603	Mixing ratio Coolant concentrate/water <ul style="list-style-type: none"> ■ 50/50: Up to -37 °C (-34 °F) ■ 60/40: Up to -52 °C (-61 °F) 		Cummins CES 14603
Use a coolant with a mixing ratio of at least 50/50 all year round. Do not exceed a mixing ratio of 60/40.				

Senprotect

Order number	Specification	Temperature range	Sticker	Alternative
SE: 187301	Cummins CES 14603	Mixing ratio Coolant concentrate/water <ul style="list-style-type: none"> ■ 50/50: Up to -37 °C (-34 °F) ■ 60/40: Up to -52 °C (-61 °F) 	--	Cummins CES 14603
Use a coolant with a mixing ratio of at least 50/50 all year round. Do not exceed a mixing ratio of 60/40.				

2.2.4 Scania

Scania (Ready Mix)

Order number	Specification	Temperature range	Sticker	Alternative
SE: 182087	Scania	Mixing ratio for coolant concentrate/water <ul style="list-style-type: none"> ■ 50/50: Up to -37 °C (-34 °F) ■ 60/40: Up to -52 °C (-61 °F) 		
Use a coolant with a mixing ratio of at least 50/50 all year round. Do not exceed a mixing ratio of 60/40.				

Diesel engines

Fuels > Emissions Stage US EPA Tier 4 final / EU Tier IV / EU Tier V

2.3 Fuels

2.3.1 Emissions Stage US EPA Tier 2 / EU Tier II and US EPA Tier 3 / EU Tier IIIa

Diesel fuel with high sulfur content

Order number	Specification	Temperature range	Sulfur content
-	<ul style="list-style-type: none"> ■ Diesel fuel DIN EN 590 ■ ASTM D975 LSD 1D, 2D 	-	≤ 500 mg/kg
Comply with the instructions concerning fuel in the operating manuals provided by the manufacturers of the diesel engines.			

2.3.2 Emissions Stage US EPA Tier 4 interim / EU Tier IIIb

Diesel fuel with low sulfur content

Order number	Specification	Temperature range	Sulfur content
-	<ul style="list-style-type: none"> ■ Diesel fuel DIN EN 590 ■ ASTM D975 ULSD 1D, 2D 	-	≤ 15 mg/kg
Comply with the instructions concerning fuel in the operating manuals provided by the manufacturers of the diesel engines.			

2.3.3 Emissions Stage US EPA Tier 4 final / EU Tier IV / EU Tier V

Diesel fuel with low sulfur content

Order number	Specification	Temperature range	Sulfur content
-	<ul style="list-style-type: none"> ■ Diesel fuel DIN EN 590 ■ ASTM D975 ULSD 1D, 2D 	-	≤ 15 mg/kg
Comply with the instructions concerning fuel in the operating manuals provided by the manufacturers of the diesel engines.			

Diesel engines

DEF, diesel exhaust fluid for US EPA Tier 4 final / EU Tier IV diesel engines

2.4 Diesel flow improvers

Fuchs Maintain Winterfit

Order number	Specification	Temperature range	Mixing ratio			Alternative
SE: 180464	<ul style="list-style-type: none"> ■ MB 137.1 ■ BMW BG 13 	-31 to -10 °C -23.8 to +14 °F	Summer			
			1:1000	-10 °C	14 °F	
			2:1000	-18 °C	0 °F	
			3:1000	-23 °C	-10 °F	
			4:1000	-25 °C	-13 °F	
			Winter			
			1:1000	-25 °C	-13 °F	
			2:1000	-28 °C	-18 °F	
			3:1000	-31 °C	-24 °F	

AUTOL TP 10

Order number	Specification	Temperature range	Sticker	Alternative
SE: 182173	<ul style="list-style-type: none"> ■ MB 137.1 ■ BMW BG 13 		—	

2.5 DEF, diesel exhaust fluid for US EPA Tier 4 final / EU Tier IV diesel engines

DEF

Order number	Specification	Temperature range	Sticker	Alternative
SE: 149060	<ul style="list-style-type: none"> ■ ISO 22241 ■ DIN 70070 ■ AUS 32 	-10 to +30 °C -14 to +86 °F		

Electric motors

Coolant - heating circuit

3 Electric motors

3.1 Lubrication

Shell Gadus S2 V100 3

Order number	Specification	Temperature range	Sticker	Alternative
SE: 182536 Shell: 001D8464	<ul style="list-style-type: none"> ■ DIN 51825 K3K-30 ■ NLGI 3 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ Esso UNIREX N3

3.2 Coolant - heating circuit

Cummins ES Compleat

Order number	Specification	Temperature range	Sticker	Alternative
SE: 181966	Cummins CES 14603	Mixing ratio Coolant concentration/water <ul style="list-style-type: none"> ■ 50/50: Up to -37 °C (-34 °F) ■ 60/40: Up to -52 °C (-61 °F) 		Cummins CES 14603
Use a coolant with a mixing ratio of at least 50/50 all year round. Do not exceed a mixing ratio of 60/40.				

Senprotect

Order number	Specification	Temperature range	Sticker	Alternative
SE: 187301	Cummins CES 14603	Mixing ratio Coolant concentration/water <ul style="list-style-type: none"> ■ 50/50: Up to -37 °C (-34 °F) ■ 60/40: Up to -52 °C (-61 °F) 	--	Cummins CES 14603
Use a coolant with a mixing ratio of at least 50/50 all year round. Do not exceed a mixing ratio of 60/40.				

Gearbox

Slewing gear box > Lubricating grease - roller bearings

4 Gearbox

4.1 Slewing gear box

4.1.1 Gear oil

Shell Omala S4 GXV 220

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179227 Shell: 001F8458	<ul style="list-style-type: none"> ■ CLP HC (PAO) 220 ■ DIN 51517 T3 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ OMV gear oil SHG 220 ■ Castrol Alphasyn EP 220

Panolin EP Gear Synth 220

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214837	<ul style="list-style-type: none"> ■ CLP ■ DIN 51517 ■ OECD 301B 	-30 to +50 °C -22 to +122 °F	-	

4.1.2 Lubricating grease - roller bearings

Fuchs Stabyl LT 50

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157280	<ul style="list-style-type: none"> ■ DIN 51502 - KPHC2N-50 ■ NLGI 2 	-30 to +50 °C -22 to +122 °F		Avia Grease PE Polar

Shell Gadus S2 V220 2

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179226 Shell: 001D8451	<ul style="list-style-type: none"> ■ DIN 51502 - KP2K-20 ■ NLGI 2 	-20 to +50 °C -4 to +122 °F		<ul style="list-style-type: none"> ■ OMV Signum CX 2 ■ AUTOL TOP 2000 ■ Castrol Olit 2 EP

Gearbox

Winch gear > Gear oil

Panolin Biogrease EP2 Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214840	<ul style="list-style-type: none"> ■ DIN 51502 KPE2K-30 ■ NLGI 2 ■ OECD 301B 	-25 to +50 °C -13 to +122 °F		<ul style="list-style-type: none"> ■ Avia Syntogrease 2 ■ BP Biogrease EP 2 ■ OMV Signum BD 2

4.2 Pump distributor gearbox

4.2.1 Gear oil

Shell Omala S4 GXV 220

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179227 Shell: 001F8458	<ul style="list-style-type: none"> ■ CLP HC (PAO) 220 ■ DIN 51517 T3 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ OMV gear oil SHG 220 ■ Castrol Alphasyn EP 220

Panolin EP Gear Synth 220 Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214837	<ul style="list-style-type: none"> ■ CLP ■ DIN 51517 ■ OECD 301B 	-30 to +50 °C -22 to +122 °F	-	

4.3 Winch gear

4.3.1 Gear oil

Shell Omala S4 GXV 220

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179227 Shell: 001F8458	<ul style="list-style-type: none"> ■ CLP HC (PAO) 220 ■ DIN 51517 T3 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ OMV gear oil SHG 220 ■ Castrol Alphasyn EP 220

Gearbox

Winch gear > Refilling

Panolin EP Gear Synth 220 Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214837	<ul style="list-style-type: none"> ■ CLP ■ DIN 51517 ■ OECD 301B 	-30 to +50 °C -22 to +122 °F	-	

4.3.2 Refilling

Fuchs Stabyl LT 50

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157280	<ul style="list-style-type: none"> ■ DIN 51502 - KPHC2N-50 ■ NLGI 2 	-30 to +50 °C -22 to +122 °F		Avia Grease PE Polar

Shell Gadus S2 V220 2 Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179226 Shell: 001D8451	<ul style="list-style-type: none"> ■ DIN 51502 - KP2K-20 ■ NLGI 2 	-20 to +50 °C -4 to +122 °F		<ul style="list-style-type: none"> ■ OMV Signum CX 2 ■ AUTOL TOP 2000 ■ Castrol Olit 2 EP

Panolin Biogrease EP2 Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214840	<ul style="list-style-type: none"> ■ DIN 51502 KPE2K-30 ■ NLGI 2 ■ OECD 301B 	-25 to +50 °C -13 to +122 °F		<ul style="list-style-type: none"> ■ Avia Syntogrease 2 ■ BP Biogrease EP 2 ■ OMV Signum BD 2

Gearbox

Powershift transmission > Refilling

4.4 Powershift transmission

4.4.1 Gear oil

Fill power shift transmission with diesel engine oil.

☞ Chapter 2.1 "Engine oil" on page 17

They do not apply to axle distribution gearboxes 817E, MP17.

4.4.2 Refilling

Fuchs Stabyl LT 50

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157280	<ul style="list-style-type: none"> ■ DIN 51502 - KPHC2N-50 ■ NLGI 2 	-30 to +50 °C -22 to +122 °F		Avia Grease PE Polar

Shell Gadus S2 V220 2

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179226 Shell: 001D8451	<ul style="list-style-type: none"> ■ DIN 51502 - KP2K-20 ■ NLGI 2 	-20 to +50 °C -4 to +122 °F		<ul style="list-style-type: none"> ■ OMV Signum CX 2 ■ AUTOL TOP 2000 ■ Castrol Oilit 2 EP

Panolin Biogrease EP2

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214840	<ul style="list-style-type: none"> ■ DIN 51502 KPE2K-30 ■ NLGI 2 ■ OECD 301B 	-25 to +50 °C -13 to +122 °F		<ul style="list-style-type: none"> ■ Avia Syntogrease 2 ■ BP Biogrease EP 2 ■ OMV Signum BD 2

Gearbox

Axles > Wheel hub transmission

4.5 Travel gear Multihandler 305, 310

4.5.1 Gear oil

Shell Spirax S3 ALS 80W-90

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179230 Shell: 001D8843	<ul style="list-style-type: none"> ■ API GL5 LS ■ ZF-TE ML-05 C¹⁾ 	-30 to +40 °C -22 to +104 °F		<ul style="list-style-type: none"> ■ Eni ROTRA MP/S 85W-90 ■ Castrol Axle Z Limited Slip 85W-90 ■ OMV gear oil LS SAE 85W-90

¹⁾ In addition, the gear oils of the lubricant classes F, G, H of the ZF-TE ML-05 can be used.

4.6 Telehandler travel gears

4.6.1 Gear oil

Shell Spirax S3 ALS 80W-90

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179230 Shell: 001D8843	<ul style="list-style-type: none"> ■ API GL5 LS ■ ZF-TE ML-05 C¹⁾ 	-30 to +40 °C -22 to +104 °F		<ul style="list-style-type: none"> ■ Eni ROTRA MP/S 85W-90 ■ Castrol Axle Z Limited Slip 85W-90 ■ OMV gear oil LS SAE 85W-90

¹⁾ In addition, the gear oils of the lubricant classes F, G, H of the ZF-TE ML-05 can be used.

4.7 Axles

4.7.1 Wheel hub transmission

4.7.1.1 Gear oil

Shell Spirax S3 ALS 80W-90

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179230 Shell: 001D8843	<ul style="list-style-type: none"> ■ API GL5 LS ■ ZF-TE ML-05 C¹⁾ 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ Eni ROTRA MP/S 85W-90 ■ Castrol Axle Z Limited Slip 85W-90 ■ OMV gear oil LS SAE 85W-90

¹⁾ In addition, the gear oils of the lubricant classes F, G, H of the ZF-TE ML-05 can be used.

Gearbox

Axle distribution gearbox 817E, MP17 > Gear oil

4.7.2 Axle differential transmission

4.7.2.1 Gear oil

Shell Spirax S3 ALS 80W-90

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179230 Shell: 001D8843	<ul style="list-style-type: none"> ■ API GL5 LS ■ ZF-TE ML-05 C¹⁾ 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ Eni ROTRA MP/S 85W-90 ■ Castrol Axle Z Limited Slip 85W-90 ■ OMV gear oil LS SAE 85W-90
<p>¹⁾ In addition, the gear oils of the lubricant classes F, G, H of the ZF-TE ML-05 can be used.</p>				

4.7.3 Countershaft transmission

4.7.3.1 Gear oil

Shell Spirax S3 ALS 80W-90

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179230 Shell: 001D8843	<ul style="list-style-type: none"> ■ API GL5 LS ■ ZF-TE ML-05 C¹⁾ 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ Eni ROTRA MP/S 85W-90 ■ Castrol Axle Z Limited Slip 85W-90 ■ OMV gear oil LS SAE 85W-90
<p>¹⁾ In addition, the gear oils of the lubricant classes F, G, H of the ZF-TE ML-05 can be used.</p>				

4.7.3.2 Hydraulic oil - parking brake

Fill parking brake with the same hydraulic oil that is used in the machine's hydraulic system.

↳ Chapter 1 "Hydraulic systems" on page 8

4.8 Axle distribution gearbox 817E, MP17

4.8.1 Gear oil

Shell Spirax S3 ALS 80W-90

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179230 Shell: 001D8843	<ul style="list-style-type: none"> ■ API GL5 LS ■ ZF-TE ML-05 C¹⁾ 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ Eni ROTRA MP/S 85W-90 ■ Castrol Axle Z Limited Slip 85W-90 ■ OMV gear oil LS SAE 85W-90
<p>¹⁾ In addition, the gear oils of the lubricant classes F, G, H of the ZF-TE ML-05 can be used.</p>				

Gearbox

Rail drive > Gear oil

4.9 Crawler travel drive

4.9.1 Gear oil

Shell Omala S4 GXV 220

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179227 Shell: 001F8458	<ul style="list-style-type: none"> ■ CLP HC (PAO) 220 ■ DIN 51517 T3 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ OMV gear oil SHG 220 ■ Castrol Alphasyn EP 220

Panolin EP Gear Synth 220

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214837	<ul style="list-style-type: none"> ■ CLP ■ DIN 51517 ■ OECD 301B 	-30 to +50 °C -22 to +122 °F	-	

4.10 Rail drive

4.10.1 Gear oil

Shell Omala S4 GXV 220

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179227 Shell: 001F8458	<ul style="list-style-type: none"> ■ CLP HC (PAO) 220 ■ DIN 51517 T3 	-30 to +50 °C -22 to +122 °F		<ul style="list-style-type: none"> ■ OMV gear oil SHG 220 ■ Castrol Alphasyn EP 220

Panolin EP Gear Synth 220

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214837	<ul style="list-style-type: none"> ■ CLP ■ DIN 51517 ■ OECD 301B 	-30 to +50 °C -22 to +122 °F	-	

Lubricating grease

Slewing ring, roller bearings

5 Lubricating grease

5.1 Central lubrication system

Fuchs Stabyl LT 50

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157280	<ul style="list-style-type: none"> ■ DIN 51502 - KPHC2N-50 ■ NLGI 2 	-30 to +50 °C -22 to +122 °F		Avia Grease PE Polar

Shell Gadus S2 V220 2

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179226 Shell: 001D8451	<ul style="list-style-type: none"> ■ DIN 51502 - KP2K-20 ■ NLGI 2 	-20 to +50 °C -4 to +122 °F		<ul style="list-style-type: none"> ■ OMV Signum CX 2 ■ AUTOL TOP 2000 ■ Castrol Oliit 2 EP

Panolin Biogrease EP2

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214840	<ul style="list-style-type: none"> ■ DIN 51502 KPE2K-30 ■ NLGI 2 ■ OECD 301B 	-25 to +50 °C -13 to +122 °F		<ul style="list-style-type: none"> ■ Avia Syntogrease 2 ■ BP Biogrease EP 2 ■ OMV Signum BD 2

5.2 Slewing ring, roller bearings

Fuchs Stabyl LT 50

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157280	<ul style="list-style-type: none"> ■ DIN 51502 - KPHC2N-50 ■ NLGI 2 	-30 to +50 °C -22 to +122 °F		Avia Grease PE Polar

Lubricating grease

Slewing ring, inner gearing

Shell Gadus S2 V220 2 Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179226 Shell: 001D8451	<ul style="list-style-type: none"> ■ DIN 51502 - KP2K-20 ■ NLGI 2 	-20 to +50 °C -4 to +122 °F		<ul style="list-style-type: none"> ■ OMV Signum CX 2 ■ AUTOL TOP 2000 ■ Castrol Olit 2 EP

Panolin Biogrease EP2 Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214840	<ul style="list-style-type: none"> ■ DIN 51502 KPE2K-30 ■ NLGI 2 ■ OECD 301B 	-25 to +50 °C -13 to +122 °F		<ul style="list-style-type: none"> ■ Avia Syntogrease 2 ■ BP Biogrease EP 2 ■ OMV Signum BD 2

5.3 Slewing ring, inner gearing

Fuchs Stabyl LT 50

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157280	<ul style="list-style-type: none"> ■ DIN 51502 - KPHC2N-50 ■ NLGI 2 	-30 to +50 °C -22 to +122 °F		Avia Grease PE Polar

Shell Gadus S2 V220 2 Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179226 Shell: 001D8451	<ul style="list-style-type: none"> ■ DIN 51502 - KP2K-20 ■ NLGI 2 	-20 to +50 °C -4 to +122 °F		<ul style="list-style-type: none"> ■ OMV Signum CX 2 ■ AUTOL TOP 2000 ■ Castrol Olit 2 EP

Lubricating grease

Manual lubricating points

Panolin Biogrease EP2

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214840	<ul style="list-style-type: none"> DIN 51502 KPE2K-30 NLGI 2 OECD 301B 	-25 to +50 °C -13 to +122 °F		<ul style="list-style-type: none"> Avia Syntgrease 2 BP Biogrease EP 2 OMV Signum BD 2

5.4 Slewing ring, outer gearing

Fuchs Ceplattyn KG 10 HMF - LT

Order number	Specification	Temperature range	Sticker	Alternative
SE: 156982	<ul style="list-style-type: none"> DIN 51502 - OGPF00N-50 NLGI 00 	-30 to +50 °C -22 to +122 °F		

Shell Gadus S2 OG 80

Order number	Specification	Temperature range	Sticker	Alternative
SE: 184872 Shell: 001D8496	<ul style="list-style-type: none"> DIN 51502-OGPF0S-30 NLGI 0 	-20 to +50 °C -4 to +122 °F		OKS 490

5.5 Manual lubricating points

Fuchs Stabyl LT 50

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157280	<ul style="list-style-type: none"> DIN 51502 - KPHC2N-50 NLGI 2 	-30 to +50 °C -22 to +122 °F		Avia Grease PE Polar

Lubricating grease

Undercarriage telescoping

Shell Gadus S2 V220 2

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179226 Shell: 001D8451	<ul style="list-style-type: none"> ■ DIN 51502 - KP2K-20 ■ NLGI 2 	-20 to +50 °C -4 to +122 °F		<ul style="list-style-type: none"> ■ OMV Signum CX 2 ■ AUTOL TOP 2000 ■ Castrol Olit 2 EP

Panolin Biogrease EP2

Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214840	<ul style="list-style-type: none"> ■ DIN 51502 KPE2K-30 ■ NLGI 2 ■ OECD 301B 	-25 to +50 °C -13 to +122 °F		<ul style="list-style-type: none"> ■ Avia Syntogrease 2 ■ BP Biogrease EP 2 ■ OMV Signum BD 2

5.6 Undercarriage telescoping

Fuchs Stabyl LT 50

Order number	Specification	Temperature range	Sticker	Alternative
SE: 157280	<ul style="list-style-type: none"> ■ DIN 51502 - KPHC2N-50 ■ NLGI 2 	-30 to +50 °C -22 to +122 °F		Avia Grease PE Polar

Shell Gadus S2 V220 2

Factory filling - standard temperature range

Order number	Specification	Temperature range	Sticker	Alternative
SE: 179226 Shell: 001D8451	<ul style="list-style-type: none"> ■ DIN 51502 - KP2K-20 ■ NLGI 2 	-20 to +50 °C -4 to +122 °F		<ul style="list-style-type: none"> ■ OMV Signum CX 2 ■ AUTOL TOP 2000 ■ Castrol Olit 2 EP

Lubricating grease

Telescopic boom > Multihandler 305, 310

Panolin Biogrease EP2 Rapidly biodegradable

Order number	Specification	Temperature range	Sticker	Alternative
SE: 214840	<ul style="list-style-type: none"> ■ DIN 51502 KPE2K-30 ■ NLGI 2 ■ OECD 301B 	-25 to +50 °C -13 to +122 °F		<ul style="list-style-type: none"> ■ Avia Syntogrease 2 ■ BP Biogrease EP 2 ■ OMV Signum BD 2

5.7 Telescopic boom

5.7.1 Telescopic crane

Berulub TCG 1 V¹⁾

Order number	Specification	Temperature range	Sticker	Alternative
SE: 197206	<ul style="list-style-type: none"> ■ NLGI 1 ■ PTFE ■ Oil-specific suitability test 	-30 to +50 °C -22 to +122 °F		

¹⁾Sprayable version (with diluent) from Berulub TCG 1

5.7.2 Multihandler 305, 310

Berulub TCG 1 V¹⁾

Order number	Specification	Temperature range	Sticker	Alternative
SE: 197206	<ul style="list-style-type: none"> ■ NLGI 1 ■ PTFE ■ Oil-specific suitability test 	-30 to +50 °C -22 to +122 °F		

¹⁾Sprayable version (with diluent) from Berulub TCG 1

Lubricating grease

Wire ropes

5.7.3 Telehandler

Berulub TCG 1 V¹⁾

Order number	Specification	Temperature range	Sticker	Alternative
SE: 197206	<ul style="list-style-type: none"> ■ NLGI 1 ■ PTFE ■ Oil-specific suitability test 	-30 to +50 °C -22 to +122 °F		
¹⁾ Sprayable version (with diluent) from Berulub TCG 1				

5.8 Wire ropes

Pfeifer RL-S

Order number	Specification	Temperature range	Sticker	Alternative
SE: 185735	Rope spray	-30 to +50 °C -22 to +122 °F	-	Rope grease F 315 L (adhering lubricating spray in the spray can)

Pfeifer RL-B

Order number	Specification	Temperature range	Sticker	Alternative
SE: 185736	Rope oil	-30 to +50 °C -22 to +122 °F	-	

Air conditioning systems and switchgear cabinet air conditioning

Switchgear cabinet air conditioning > Antifreeze

6 Air conditioning systems and switchgear cabinet air conditioning

6.1 Air conditioning systems

6.1.1 Refrigerant

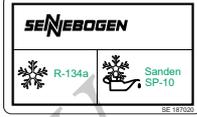
KLEA 134a

Order number	Specification	Temperature range	Sticker	Alternative
SE: 185737	R134a	-30 to +50 °C -22 to +122 °F	–	

6.1.2 Refrigerant oil

6.1.2.1 Sanden compressor

Sanden SP-10

Order number	Specification	Temperature range	Sticker	Alternative
SE: 185732		-30 to +50 °C -22 to +122 °F		Sanden SP-15

6.1.2.2 Bitzer compressor

Bitzer BSE32

Order number	Specification	Temperature range	Sticker	Alternative
SE: 193700		-30 to +50 °C -22 to +122 °F	–	

6.2 Switchgear cabinet air conditioning

6.2.1 Antifreeze

Tyfocor L

Order number	Specification	Temperature range	Sticker	Alternative
SE: 185731		-30 to +50 °C -22 to +122 °C	–	

Windshield washer systems

Antifreeze

7 Windshield washer systems**7.1 Antifreeze**

Windshield washer system anti-freeze

Order number	Specification	Temperature range	Sticker	Alternative
SE: 185734	Fresh water with a proportion of at least 50% antifreeze	-30 to +50 °C -22 to +122 °F	–	

For
Reference
Only

Starter batteries

Battery terminal spray

8 Starter batteries**8.1 Battery terminal grease**

Battery terminal grease

Order number	Specification	Temperature range	Sticker	Alternative
SE: 071706			–	

8.2 Battery terminal spray

Battery terminal spray

Order number	Specification	Temperature range	Sticker	Alternative
SE: 113732			–	

For Reference Only

10.9 Personnel Basket

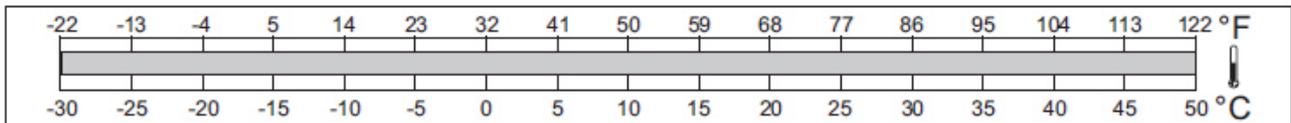


Fig. 271 Temperature ranges

10.9.1 Safety

The following safety rules apply specifically to basket operation and are to be used in conjunction with and supplemental to the safety information in the Safety and Operation sections in the front of the Operator Manual.

10.9.1.1 General safety requirements

1. Verify that there are no less hazardous alternatives to performing the work, or providing access to the area.
2. Lift controls and basket shall be tested and inspected each day prior to use to determine the system is in safe working condition.
3. Only authorized persons shall operate the crane and personnel platform.
4. Belting off to an adjacent pole, structure, or equipment while working from a personnel lift shall not be permitted.
5. Occupants shall always stand firmly on the floor of the basket, and shall not sit or climb on the edge of the basket or use planks, ladders, or other devices for a work position.
6. A body harness shall be worn and a lanyard attached to the designated tie-off anchor at all times when working from a personnel platform, unless special work requirements dictate otherwise.
7. Boom and basket load limits specified shall not be exceeded.
8. The crane shall not be moved when the boom is elevated, or the platform is occupied.
9. Climbers shall not be worn while performing work from a personnel platform.
10. Do not operate near power line or other electrical hazards. This device is not insulated. Remain a minimum of 6 ms (20 ft) away from any electrical component. Consult minimum clearance table or Electrocution Hazard decal for additional clearance information (Figure 10-1). Hoisting personnel within 20 ft of a power line that is up to 350kV, and hoisting personnel within 50 ft of a power line that is over 350kV, is prohibited (Figure 10-1). You must use a signal person on the ground to guide the operator.
11. No modifications or additions which affect the mechanical, hydraulic, or electrical integrity or the safe operation of the crane or personnel platform shall be made without the written approval of the manufacturer or an equivalent entity. See 29CFR1926.1412(a) and 29CFR1926.1434

12. Do not use the load line to lift or handle loads while personnel are in the basket. Load block must be removed from load line.
13. Safety harness and lanyards shall be used only for employee safeguarding. Any safety harness or lanyard actually subjected to an in-service loading shall be immediately removed from service and discarded or destroyed.
14. A personnel lift plan containing at least the information shown in "Personnel Platform Lift Planning and Authorization Form" shall be prepared.
15. Do not allow personnel lifts in winds in excess of 32 km/hr (20 mph) at the raised platform height, or during electric storms, snow, ice, sleet, or other adverse weather conditions that could affect the safety of personnel. Terminate personnel lifting operations if hazardous conditions develop during the lift.
16. Conduct a Pre-lift briefing attended by the equipment operator, platform occupants and ground crew.
17. Appropriately brief any individuals that are changed during a series of personnel lifts.
18. The contents of the Pre-Lift briefings shall cover, as a minimum:
 - a. The proper use of all equipment involved.
 - b. Assignment and responsibilities of each person involved in the lift operation.
 - c. The procedures to be followed.
 - d. Guidance on general and specific safety precautions.
 - e. Special signals for the operation.
 - f. Unique considerations of the lift.
 - g. Work to be accomplished during lift.
 - h. If applicable, the responsibilities and assignments of a signal person when lifting personnel near electrical power lines.
19. Allow personnel platforms to be only used for personnel, their tools, and sufficient material to do their work. Make sure the weight of the personnel and tools do not overload the personnel platform. Never use personnel platforms to transport bulk materials.
20. Have a qualified person evaluate the safety issues of the operational environment and verify the platform and hoisting equipment are suitable for use.
21. Determine if special work circumstances require further precautions.
22. Precautions such as but not limited to the following shall be taken:
 - a. When welding is to be accomplished from the personnel platform, suitable electrode holders shall be provided to protect them from contact with any conducting components of the platform.
 - b. When personnel lifts are conducted over water, personal flotation devices shall be provided and required to be worn. Personal fall protection devices with quick release features shall be provided, and required to be

- worn. The fall protection device shall be appropriately attached while personnel are lifted over land and detached while personnel are lifted over water.
- c. A boat with appropriate rescue personnel shall be available at all times during a personnel lift over water.
 - d. Appropriate personnel protective equipment shall be provided and required to be used around toxic, flammable or hazardous substances or fumes.
23. Review any concentrated loading of the platform to preclude the over stressing of any component or the impairing of the platform stability.

10.9.1.2 Equipment operator

Equipment Operator shall:

1. Comply with any applicable qualification criteria. As a minimum the qualification requirements shall include, but not be limited to:
 - a. Qualification to operate the specific type hoisting equipment used in the personnel lift.
 - b. Successfully meeting the physical qualification criteria as established in the applicable hoisting equipment ASME B30 volume. Additionally, the operator shall have been tested for substance abuse. Testing shall be in accordance with applicable government regulations and the policies of the employer.
 - c. Successfully meeting the training and qualification criteria established in the applicable hoisting equipment ASME B30.5 volume for telescoping cranes.
2. Be qualified to operate the platform controls of a platform with controls.
3. Not engage in a personnel lift when physically or mentally unfit. The operator has the right to refuse any personnel lift under the following circumstances:
 - a. The operator does not feel physically or mentally fit to perform the operation.
 - b. The operator has been working for more than ten hours prior to the start of the lift or the lift will not be completed before the operator has been working for twelve hours.
 - c. The operator did not have at least eight hours off immediately prior to the work shift containing the personnel lift operation.
4. Not engage in any practice that will divert their attention while actually engaged in operating the hoisting equipment.
5. Only respond to signals from the Personnel Lift Supervisor or a designated signal person. The operator shall obey a stop signal at any time, no matter who gives it.
6. Consult with the Personnel Lift Supervisor before commencing or continuing the lift whenever the operator has any doubt as to the safety of the lift.
7. When involved with a boom mounted platform without controls, remain at the hoisting equipment controls whenever personnel are in the platform.

8. When involved with a boom mounted platform with boom motion controls and a means of lowering, retracting and rotating in the event the primary power source becomes inoperative, be free not to remain at the hoisting equipment controls.
9. Consult the Safety and Operation sections in the Operator Manual for specific instruction on the equipment operation.
10. Inspect the hoist equipment setup area before the personnel lift and report his observations to the Personnel Lift Supervisor. The operator shall inspect the area for potential hazards such as, but not limited to:
 - a. Excessive load or radius.
 - b. Overhead obstructions and electrical transmission lines.
 - c. Hazardous locations.
 - d. Inadequate surface and support to withstand all forces imposed.
 - e. Wind, weather and other unstable conditions.
 - f. Any potentially hazardous conditions.
11. Inspect the hoist equipment immediately prior to starting a personnel lift operation. The criteria for a frequent inspection as specified in the appropriate hoisting equipment ASME B30 volume shall be used.
12. Operate hoisting equipment with tracks at full extension and pinned and crane equipped with full counterweight configuration. Handling of personnel is not permitted with mid span or zero span positions.
13. Verify that the hoisting equipment is set up and maintained within one percent of grade level ($\pm 0.30^\circ$).
14. For hoisting equipment with a boom attached platform, verify that the platform is attached as specified in the basket installation section.
15. Not allow the total weight of the lifted load including rigging, platform, personnel, tools and material to exceed 50 percent of the hoisting equipment's rated load, under the planned conditions of operation. (Except during testing as outlined in Inspection Section.)
16. Not allow the platform's rating or the hoisting equipment's reduced rated load, to be exceeded when loads are transferred to the hoisted platform.
17. Perform a trial lift prior to lifting personnel with the platform on each shift and after any change of set up location, hoist equipment configuration or operator. These lifts shall be used to ascertain that hoist equipment set up and configuration is correct, load capacities are adequate, that no hazardous interferences exist, and to further demonstrate the operator's operational competence.
18. Verify that during the trial lift, the platform is loaded to at least the weight expected during the actual lift.
19. Not knowingly allow the platform load to exceed the platform rating. (Except during testing as outlined in inspection section).
20. Not travel the hoisting equipment with personnel in the personnel platform.

21. Perform all movements of the platform under the direction of a designated signal person and in a slow, controlled manner to minimize sudden movements of the platform.
22. Remain at the hoisting equipment controls at all times when the platform is occupied.
23. Set all brakes and locks on the hoisting equipment after positioning of the personnel platform and before personnel perform any work.
24. Not move platforms over, under or in the vicinity of power lines unless the requirements of the minimum clearance shown in the required clearance table and on the Electrocution Hazard decal are met (Figure 1-1).
25. Not lift any other loads, on any other load lines, while conducting a personnel lift. See "General safety requirements" on page -493 (Step 12). When the hoisting equipment has a boom attached platform without controls it shall not be used for other lifting service.
26. Not disable, or allow to be disabled, any hoist equipment safety device during a personnel lift.
27. Not operate a platform with motion controls without the platform operation manual available in the platform.
28. Avoid the simultaneous operation of more than one of the hoisting equipment motion controls, unless such practice increases the safety of the lift operation.

10.9.1.3 Ground crew

Ground Crew shall:

1. Visually inspect the personnel lifting platform, and its associated rigging, for hazardous conditions, prior to and during any operation.
2. Assist in the entrance and exit of personnel occupants at ground level.
3. Verify the personnel platform is securely attached to the hoisting equipment and in a manner specified by the platform manufacturer and that all attachments and the platform are secure.
4. Verify that boom attached personnel platforms are only attached using the pins and fittings specified by the hoist equipment manufacturer or a qualified person.
5. Keep people from passing under the raised personnel platform.
6. Not use a suspension system for lifting personnel that has been used for lifting loads other than the personnel platform.
7. Maintain continuous and positive communication between the personnel platform occupants and the operator, if signal persons are part of the ground crew.
8. Not engage in any practice or have any other duties that will reduce the safety of the personnel lift operation.
9. Observe the weight test and report any deformation or hazardous conditions to the Personnel Lift Supervisor.

10. Verify the platform is evenly loaded, material secured, and the total platform weight does not exceed the platform rating or the reduced hoisting equipment lift capacity.
11. Not allow an occupied platform over, under or in the vicinity of power lines unless the requirements minimum clearance distances are met as shown in the required clearance table and on the Electrocution Hazard decal (Figure 1-1).

10.9.1.4 Platform occupants

**Personnel Platform
Occupants shall:**

1. Maintain a stable and even loading on the platform.
2. Keep all parts of their body inside the platform during raising, lowering and positioning, except when performing duties as a designated signal person.
3. Not interfere with the platform operator or the designated signal person in the platform except to give an emergency stop signal.
4. Keep their personnel fall protection device lanyard fastened to the provided anchorage points at all times, while occupying the platform, unless special circumstance work requirements dictate otherwise.
5. Be familiar with the hand signals posted in the platform. All occupants shall know the emergency stop signal.
6. Conduct their work in a manner to help maintain the platform stability, and the safety of the personnel lift operation.
7. Remain in continuous sight or in communication with the operator, and in sight and communication of a signal person.
8. Use personal protective equipment such as hard hats, safety glasses, hearing protection and gloves in conditions where a hazard of injury exists.
9. Wear personal fall protection devices with lanyards attached to a specific anchorage point(s), unless Special Circumstance Work requirements dictate otherwise.
10. Limit their number commensurate with the work being performed, the platform design and hoisting equipment limitations.
11. Evenly distributing and securing materials and equipment while the platform is lifted.
12. Not stand, sit on, or work from the top rail, intermediate rail, toe board or use any other device to enhance their vertical height working capability
13. Not pull the platform out of plumb with the hoisting equipment.
14. Not enter or exit a suspended platform while it is raised unless the platform has an installed gate and the platform is physically secured to the structure to which they are entering or exiting and to which they have attached their safety harness lanyard.
15. Not enter or exit a platform that does not have an installed gate, while it is suspended or raised.

16. Keep entrance gate closed and pinned in the horizontal position, except when entering or exiting the platform.

10.9.1.5 Communications

1. A communication system shall be used that effectively addresses the unique lift constraints, environmental issues and communication security necessary for a safe operation.
2. All communications shall be discernible to the operator. No response to a signal shall be made unless the signal is clearly understood.
3. If communications between operator and platform occupants are disrupted, all operations shall be stopped until communication is re-established.
4. Communication systems to be used during the lift shall be verified as functioning and effective prior to commencing each lift.
5. Hand signals to the operator shall be in accordance with the hoisting equipment ASME B30 Volume, unless voice communication (telephone, radio, or equivalent) is utilized.
 - a. A pictorial representation of the hand signals shall be posted conspicuously at the following locations:
 - As required by the hoisting equipment ASME B30 volume.
 - Inside the personnel platform.
 - At any platform motion control locations.
 - b. Some operations may require additions to, or modifications of, standard hand signals.
 - Any special signals shall be agreed upon and understood by the signal persons and the hoisting equipment operator.
 - Special signals shall not conflict with the hoisting equipment standard signals.
6. Radios or other electronic means of communications, if used, should operate on a secure channel.
7. Audible and visual alert devices should be provided in the platform for use in an emergency (i.e. air horns or strobe lights).

10.9.1.6 Lifting personnel near power lines



FIGURE 10-1

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Required Clearance for Lifting Personnel Near High Voltage Power Lines	
Kilovolts (kV)	Minimum Radial Distance ft (m)
to 50	10 (3)
over 50 to 200	15 (4,6)
over 200 to 350	20 (6,1)
over 350 to 500	25 (7,6)
over 500 to 750	35 (10,7)
over 750 to 1000	45 (13,7)

Lifting personnel where the crane equipment or platform can become electrified from electric power lines is an extremely hazardous practice. It is advisable to perform the lift so there is no possibility of any of the crane equipment, load line or personnel platform becoming a conductive path. This hoisting equipment shall not be used to lift personnel under, beside, or over electric power lines if any combination of boom, personnel platform, load line and machine component will enter the prohibited zone as specified in the required clearance table or the Electrocution Hazard decal (Figure 10-1). Lifting personnel near electric power lines is not allowed unless there is no less hazardous way to do the job. However, under no circumstance are the required clearance distances be to violated.

Situations to consider when lifting personnel near electric power lines are:

- a. Power lines are de-energized and grounded to ground and between phases. (This is the preferred condition.)

- b. Power lines are energized with the hoisting equipment outside the prohibited zone but there is a potential for the hoisting equipment or platform being energized.
- c. Power lines are energized with the hoisting equipment inside the prohibited zone and there is a possibility that the hoisting equipment or platform can become energized. **(Lifting personnel in this condition is prohibited)**
- d. Hoisting equipment is in transit with the boom lowered and no personnel in the platform.

Condition A

This is the preferred condition under which a personnel lift can be performed. The hazard of injury or death due to electrocution has been removed. The following steps shall be taken when lifting personnel in a Condition A situation:

1. The power company or owner of the power lines shall de-energize the lines.
2. The power lines shall be visibly grounded to ground and between the phases to avoid the possibility of electrical feedback.
3. A qualified representative of the owner of the power lines or a designated representative of the electric utility shall be on the site to verify that step (1) and (2) of this section have been completed and that the power lines are not energized.
4. Durable signs shall be installed at the operator station, and on the outside of the crane, warning that electrocution or serious bodily injury may occur unless the minimum clearance shown in the required clearance table and on the Electrocution Hazard decal is maintained between the hoisting equipment and platform and power lines. These signs shall be posted at the hoist equipment operating station, on the outside of the hoist equipment, and inside the personnel platform.
5. If proximity warning devices, insulated links or boom cages are used, by choice or legal mandate, they shall not be a substitute for any of the requirements of this section. If these devices are used, the hoist equipment operator, ground crew and platform occupants shall be instructed by management on the limitations of the devices, operating condition requirements of the devices and the devices' testing requirements prescribed by the device manufacturer.

Condition B

The following steps shall be taken when lifting personnel in a Condition B situation:

1. A meeting, on the job site, between the job site management and either a qualified representative of the owner of the power lines or the electric utility shall take place. Procedures to safely complete the lift shall be established.
2. The clearance specified in the Required Clearance Table or in the Electrocution Hazard decal (Figure 10-1) shall be maintained between the hoisting equipment, load line and personnel platform at all times. Hoisting personnel within 20 ft of a power line that is up to 350kV, and hoisting personnel within 50 ft of a power line that is over 350kV, is prohibited (Figure 10-1).

3. Power line movement, horizontal and vertical, due to wind shall be added to the distances specified. A qualified representative of the power line owner or a designated representative of the electric utility shall be consulted for the movement distances.
4. The required clearances to the power lines shall be continuously monitored by a dedicated and qualified signal person in constant communication with the hoist equipment operator.
5. Personnel platform movement restraint, when required, shall be done through electrically non-conductive tag lines.
6. No person outside the personnel platform shall be permitted to touch the hoist equipment, load line or platform unless the signal person identified in (Step 4) above indicates it is safe.
7. Operation of the boom or the personnel platform over power lines shall not be permitted.
8. Power line visibility enhancing devices, such as ribbons or balls, should be attached to the power lines to aid in the location of the prohibited zone established in (Step 2) and (Step 3) above.
9. Durable signs shall be posted warning that electrocution or serious bodily injury may occur unless the minimum clearance is maintained between the hoisting equipment and platform and power lines. These signs shall be posted at the hoist equipment operating station, on the outside of the hoist equipment, and inside the personnel platform.
10. If proximity warning devices, insulated links or boom cages are used, by choice or legal mandate, they shall not be substituted for any of the requirements of this section. If these devices are used, the hoist equipment operator, ground crew and platform occupants shall be instructed by management on the limitations of the devices, operating condition requirements of the devices and the devices testing requirements prescribed by the device manufacturer.

Condition C Lifting personnel under this condition is prohibited.

Condition D The following steps shall be taken when transiting to a personnel lifting location in a Condition D situation:

1. While in transit and with no occupants in the platform, the clearance to power lines shall be as specified in 29CFR1926.1411 and ASME B30.23 volume applicable to the hoisting equipment.
2. When planning the transit of the hoisting equipment the effect of transit speed and transit surface on the hoisting equipment movement shall be considered.

10.9.2 Inspection and testing

The following instructions are for Inspection and Weight Testing of the Yoke Basket Assemblies.

The purpose of inspecting and testing the basket platform is to comply with ASME B30.23.

 **DANGER**

Falling hazard. Do not operate the basket without the proper pins in place. Inspect the pins each time the basket is used.

10.9.2.1 Inspection**Initial Inspection**

Prior to initial use and at each new job site, the basket platform and all attachment points shall be inspected by a qualified person for damage or excessive wear, and inspected using the "Personnel Lift Platform Pre-Lift Inspection" form on page - 504.

Regular Inspection

Frequent Inspection - The platform, suspension system, attachment points, and any platform motion controls shall be inspected at least once each day, before use and by a designated person. The inspection is to identify conditions that could create hazardous operating conditions. Inspect for damage or excessive wear, and inspect using the "Personnel Lift Platform Pre-Lift Inspection" form on page - 504.

Periodic Inspection - At least once every 12 months inspect, the basket platform. Basket platforms that have been out of service for 12 or more consecutive months shall be inspected prior to use.

For Reference Only

PERSONNEL LIFT PLATFORM PRE-LIFT INSPECTING		
Inspector	Date	Platform ID
	10.10 Satisfactory	10.11 Unsatisfactory
1. Markings		
Platform decals and placards (all information legible)		
Suspension system decals and placards		
2. Structure		
Load supporting welds/bolts		
Load supporting members		
Barrier from toe board to intermediate rail		
Hand Rail		
Fall protection device anchor points		
Gate locking mechanisms		
Platform flooring		
Suspension attachment points		
3. Attachment mechanisms		
Pins/Ears/Bolt-ups/Eyes (circle)		
Basket mounting bracket		
Basket pivot bearings		
4. Special purpose items		
Hand brake operation		
Safety harness and lanyards		
Floor cleanliness		
5. General comments:		

<i>Name</i>	<i>Signature</i>	<i>Date</i>

PERSONNEL PLATFORM LIFT PLANNING AND AUTHORIZATION FORM		
1. Location _____	Date _____	
2. Purpose of Lift _____ _____ _____		
3. Hoisting Equipment Mfg. _____	Model# _____	Serial # _____
4. Expected radius _____	(max) _____	(at work location) _____
5. (A) Rated load at radius _____	(B) Maximum lift load (50% of 5A) _____	
6. Platform ID _____		
7. Platform Weight _____		
8. (A) Number of platform occupants _____	(B) Approximate weight with equipment. _____	
9. Total Lift Weight _____		
10. Personnel Lift Supervisor _____		
11. What are the alternatives to this personnel lift? _____ _____ _____ _____		
12. Why are they not being used? _____ _____ _____		
13. Prelift briefing held _____	AM/PM _____	
Attendees _____		
14. Anticipated hazards (wind, weather visibility, power lines) _____		
15. Lift accomplished date _____	Time _____	
16. Remarks _____ _____ _____ _____		
<i>Name</i>	<i>Signature</i>	<i>Date</i>

10.11.0.1 Lift Testing

All equipment used in lifting of personnel should be tested and inspected to protect against failure during lifting operations. Trial Lift and Proof Lift are the two test lifts that must be used for the Yoke Basket Platforms. Perform these test lifts using the following information and criteria.

Contact Crane Care with any questions concerning Basket Test Failure, Inspection, Trial or Proof Lift, Basket Repairs or any other questions concerning this procedure.

Proof Lift

At each new job site, prior to hoisting people in the basket platform, the basket and rigging shall be proof tested to 125% of the basket platform's rating.

- The test load shall be evenly distributed.
- The weight used for the Proof Lift is identified in the *Basket Type and Test Weights* table in parentheses ().
- The platform shall be lifted and held in a raised position for not less than five minutes.
- After the Proof Lift test is completed, a qualified person shall inspect the platform and fill out the *Personnel Lift Platform Pre-Lift Inspection* form on page -504. Any damage revealed by the inspection shall be corrected and another test conducted before using the basket.

The most recent record of the test shall be maintained at the job site.

- The Proof Lift test is considered successful if during inspection the Basket Platform (and basket connection points) show no signs of damage or excessive wear and all inspection categories on the *Personnel Lift Platform Pre-Lift Inspection* form (on page -504) are checked as Satisfactory. Any *Unsatisfactory* checks or damage to the basket platform qualifies as a failed Proof Lift.
- If the basket platform fails the *proof* test inspection and structural repairs or modification are necessary; a Proof Lift Retest to 150% of the platforms rated capacity must be made after the repairs are completed.
- Retest by following Performing The Lift Test steps. Step 3 will be a 150% Proof Test only.
- **Never** use a basket that fails the Proof Lift.

Trial Lift

Perform a trial lift prior to lifting personnel on each shift the basket is used and after any change of setup location, hoist equipment configuration or operator.

This lift shall be used to ascertain that hoisting equipment setup and configuration is correct, load capacities are adequate and no hazardous interferences exist (electric wiring) and to further demonstrate the operator's competence.

- The weight used for the Trial Lift is identified in the *Basket Type and Test Weights* table in parentheses ().

Performing The Lift Test

Use the Basket Parts List, Figure 10-2, Figure 10-3 and the *Basket Type and Test Weights* table to determine which basket type and weight combinations to use for each different test lift.

1. Install two bracket assemblies (1, Figure 10-2, Figure 10-3).
2. Install two web sling shackles and two slings to the basket, Figure 10-2.

3. Determine the Basket Type and the amount of weight for each lift using the *Basket Type and Test Weights* table.
4. Position the weight on the floor and lower the basket assembly onto the weight. Connect the weight to the basket with the two slings (Figure 10-2, Figure 10-3).
5. Raise the basket into the air.
 For a Proof Lift, a minimum of 5 minutes.
 For a Trial Lift, be sure the basket clears any hazards or interference/objects.
6. Lower the basket and perform the after test inspection.
 If the Proof Lift was performed fill out the *Personnel Platform Lift Planning and Authorization Form*. If the lift is successful remove brackets, weights, shackles and slings.

10.11.0.2 Basket Type and Test Weights

Basket Type	Jib Trial Lift (Item No. (lb.) **	Jib Proof Lift (125%) (Item No. (lb.) **	Boom Trial Lift (Item No. (lb.) **	Boom Proof Lift (125%) (Item No. (lb.) **
Yoke (2 person)	4 (500 lb)	4,5 (625 lb)	4,5,6 (1200 lb)	4,5,6,7 (1500 lb)

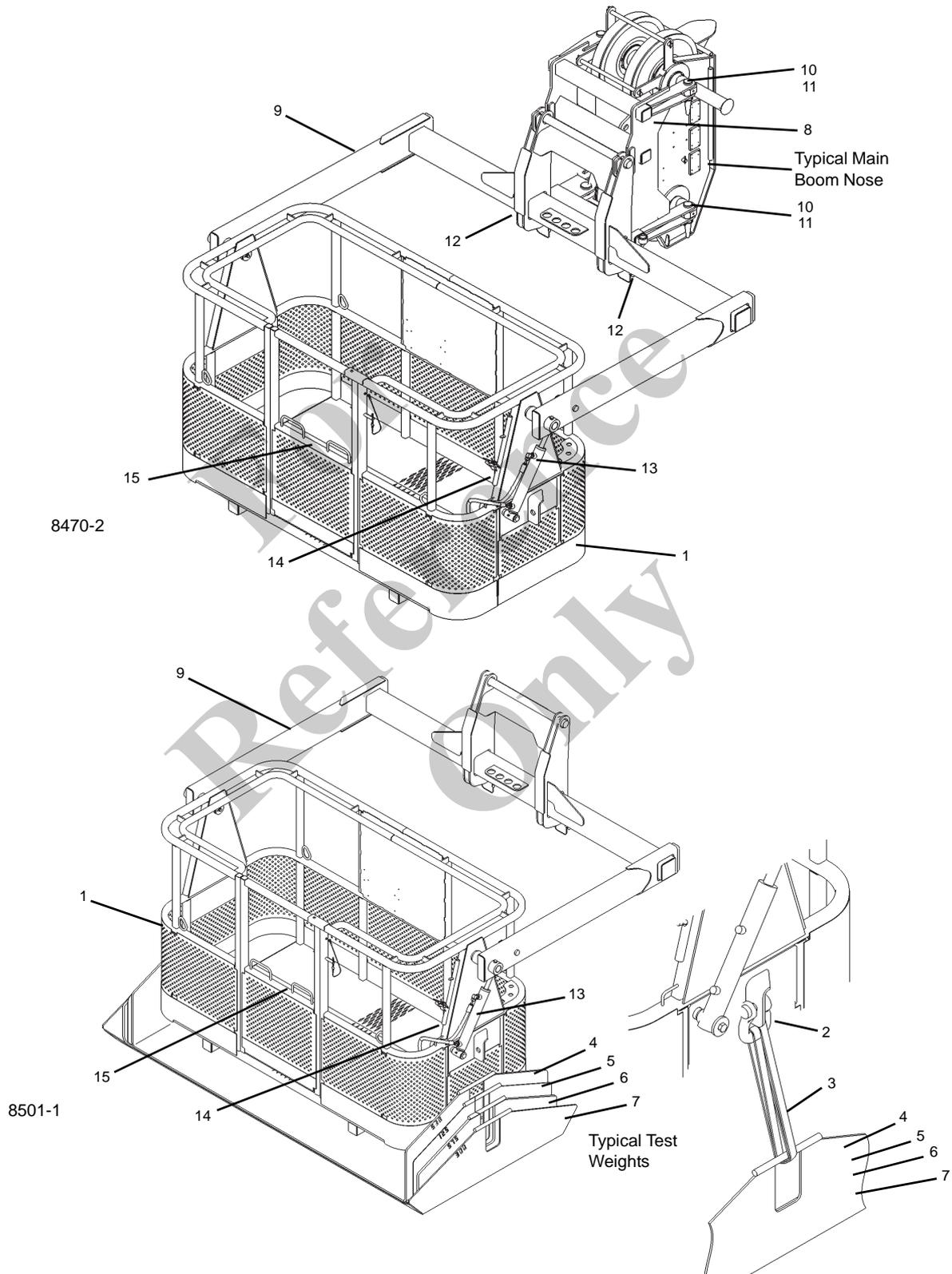
** Item No. = Basket Assembly Parts List Item Number

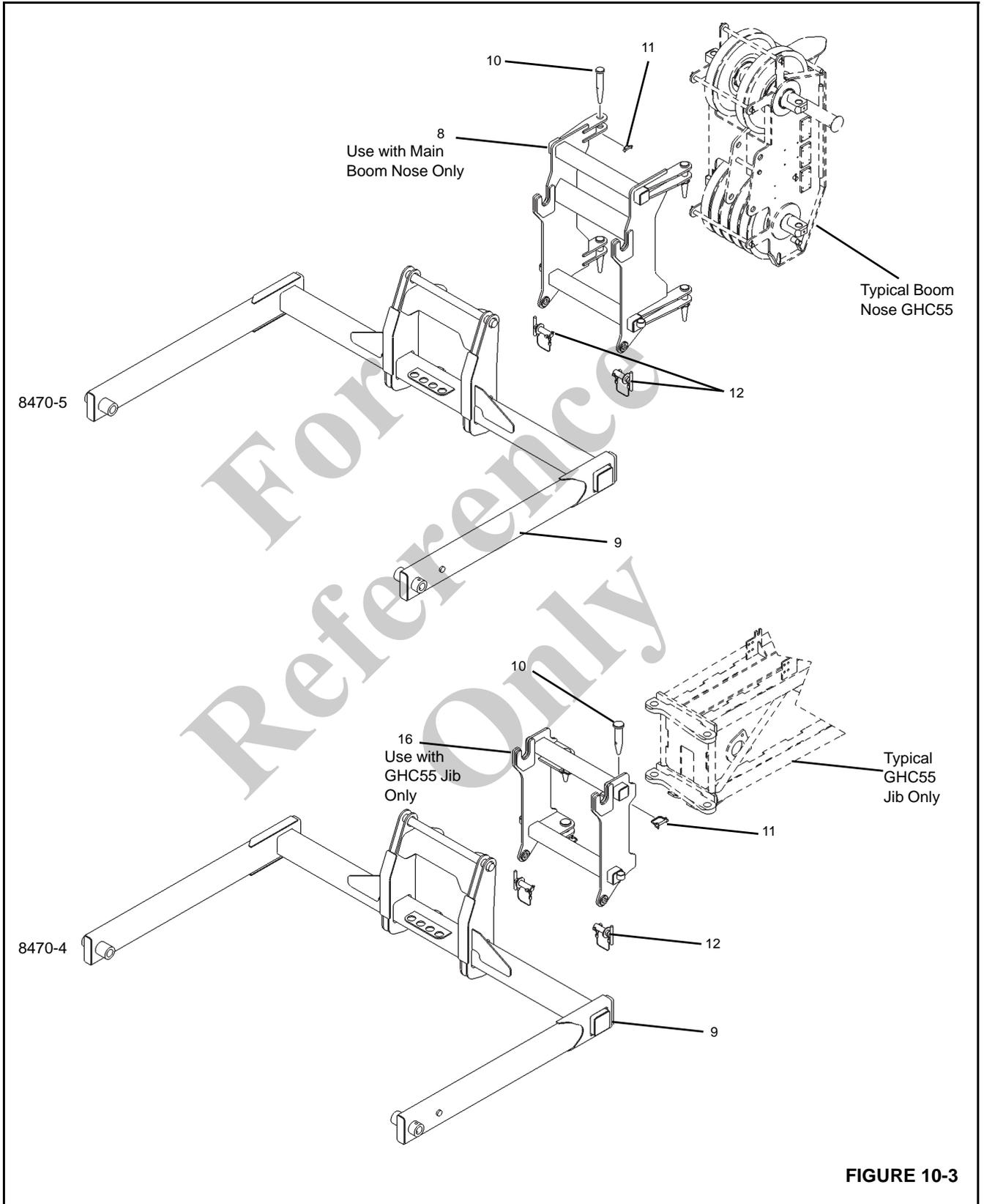
** lb = The total pounds of all weights and the Bracket Assy (if used).

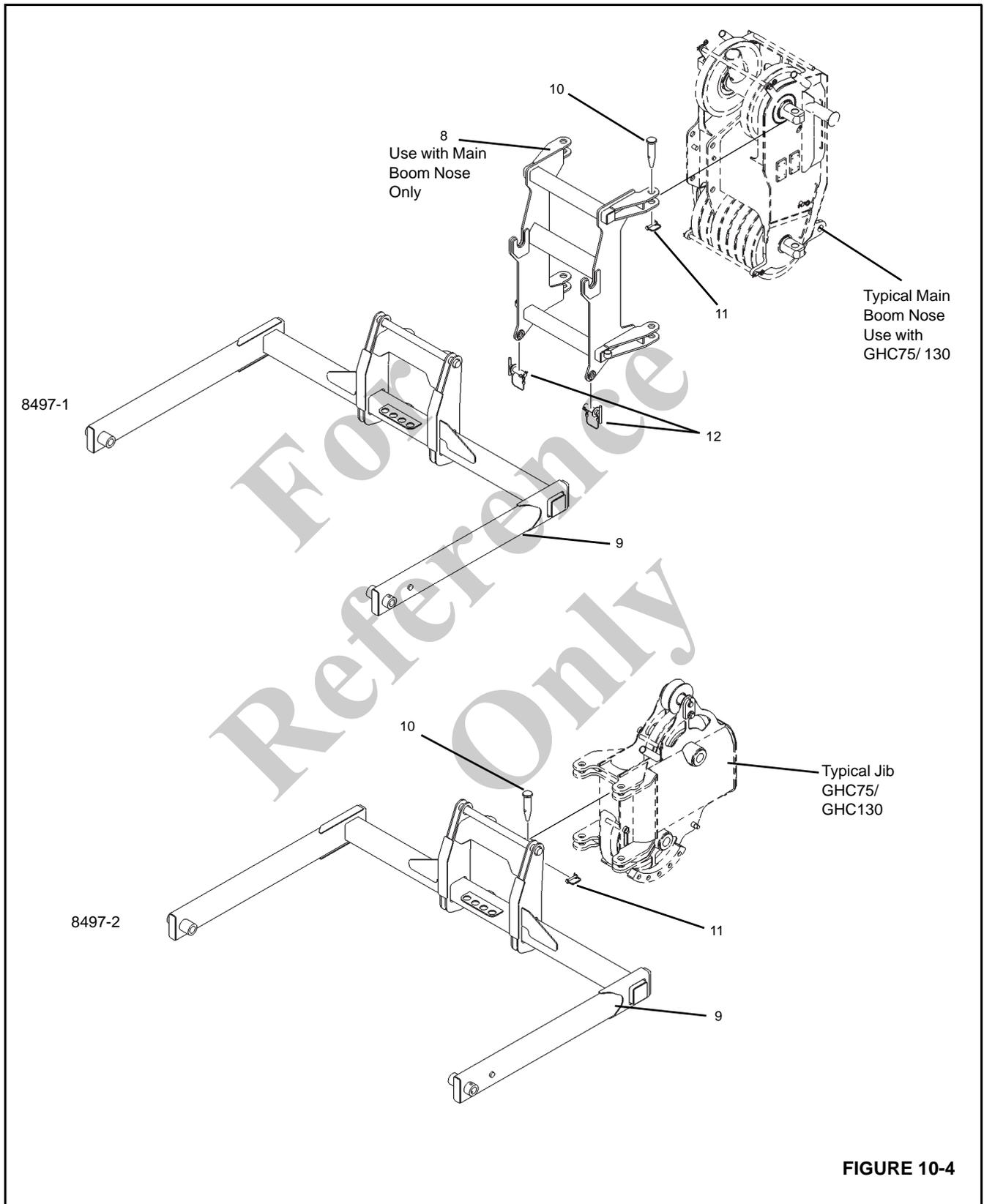
BSAY Yoke Basket Assembly Parts List (Figure 10-2)

Item No.	Description	Qty
1	Basket Assembly, 2 Person	1
2	Web Sling Shackle	2
3	Sling	2
4	500 lb Weight Assy	1
5	125 lb Weight Assy	1
6	575 lb Weight Assy	1
7	300 lb Weight Assy	1
8	Adapter-Yoke (Main Boom Use Only)	1
9	Yoke	1
10	Pin	4
11	Lock Pin	4
12	Pin	2
13	Lift Cylinder	1
14	Leveling Valve - Pump	1
15	Gate	1
16	Adapter-Yoke (GHC55 Jib Only)	1

BSAY-2 YOKE BASKET TEST WEIGHT ASSEMBLIES - TWO PERSON







10.11.0.3 Yoke Basket

The basket can be attached to either the tip of the boom or the tip of the jib for the purpose of lifting personnel and their work equipment to elevated working heights.

 **DANGER**

Boom tip attachment can contact jib in stowed position when boom is fully retracted causing damage to boom. Boom attachments must be removed for retracted boom lifting operations.

The maximum capacity of the basket is 1200 pounds when attached to the tip of the boom and 500 pounds when attached to the tip of the jib. The maximum occupancy rating in all cases is two people.

NOTE: Refer to the crane Rated Capacity Charts. Verify capacity chart matches crane model and boom length.

 **DANGER**

Overloading basket or crane will result in death or serious injury.

Where no capacity ratings are shown on the rated charts, for example: at below 0° boom angle, operation is allowable with the boom fully retracted. All work with a personnel basket must be done on firm level ground ($\pm 0.30^\circ$), with the tracks fully extended and pinned, and crane equipped with full counterweight configuration.

The basket is equipped with a manually applied brake to keep basket from swinging when the basket is being loaded or after the desired work position is reached. The brake is intended to be disengaged when the basket is raised to the work position so that the basket hangs freely within 10 degrees of level until the work position is reached.

10.11.0.4 Safety harnesses

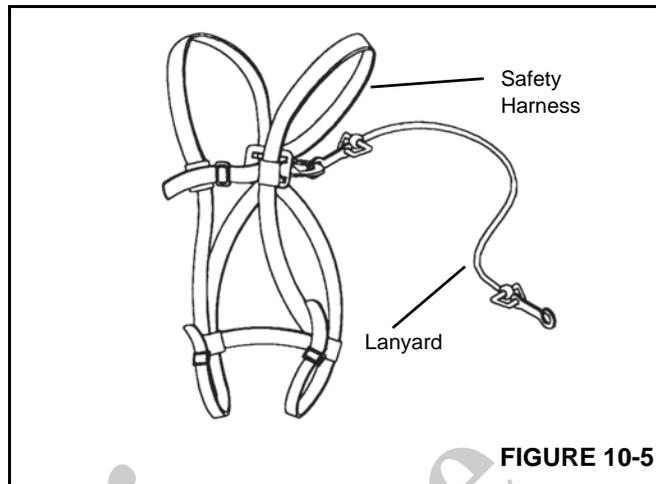
Safety harnesses are provided for basket occupants and should be secured to the harness attachment links located near the basket corners See (Figure 1-5).

 **DANGER**

Falling hazard!

Working at elevated heights without using proper fall protection can result in severe injury or death. Always use proper fall protection as required by local, state or federal regulations.

A gate is located at the front center of the basket. The gate is to be used for ease of entrance and exit to the basket and must be latched in the closed position when the basket is occupied.

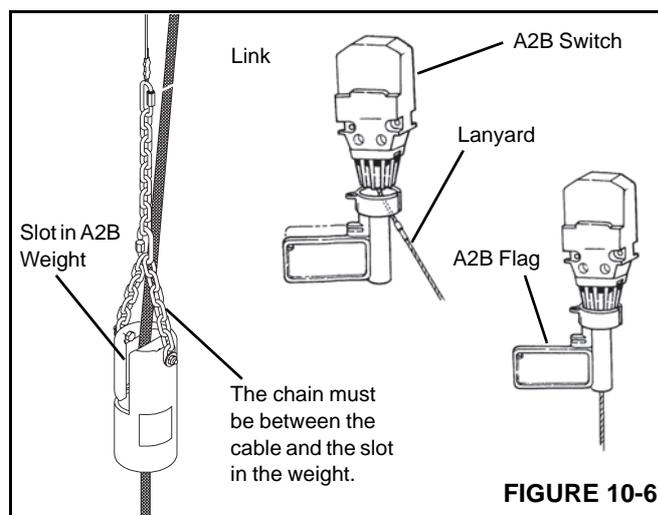


10.11.1 Basket Installation

The baskets use the quick attaching system to attach the basket to the tip of the boom or jib. See (Figure 1-2) and (Figure 1-3) and (Figure 1-4) for yoke basket attachment.

To install the attaching hardware do the following:

1. Remove the anti-two-block (A2B) weight and override the A2B system with the A2B flag (Figure 1-6).
 - a. Loosen the link on the lanyard and remove the A2B weight and chain.
 - b. With the lanyard in the slot of the A2B flag, push the flag up on the bottom of the switch.
 - c. Pull the lanyard down into the catch in the flag so that the switch is in the open position.



2. Remove the hook block from the load line and stow the wedge socket and the pin and clip.

10.11.1.1 Basket Yoke to Main Boom Installation

1. For a main boom attachment, remove the jib deployment pin from the shafts on the boom.
2. Position the adapter (8) to the tip of the main boom nose using attaching hardware (10) and (11) see (Figure 1-3) and (Figure 1-4).
3. Position the yoke (9) to the adapter (8) using attaching pin (12) see (Figure 1-3) and (Figure 1-4).

10.11.1.2 Basket Yoke to Jib Boom Installation

1. Remove adapter (8) from the boom nose to allow for jib deployment. Stow away adapter for future use.
2. Properly deploy the jib to the main boom nose (Refer to Crane Operator Manual).
3. On Model GHC55 only, position the adapter (16) to the tip of the jib using attaching hardware (10) and (11). See (Figure 1-2) and (Figure 1-3).
4. Position the yoke (9) to the adapter (16) using attaching pins (10, 11 and 12) see (Figure 1-3).
5. On Model GHC75 and GHC130, position the yoke (9) directly to the jib using attaching pins (10 and 11) see (Figure 1-4).

NOTE: Step 4 is not required on Model GHC75 or GHC130 since the yoke (9) attaches directly to the jib.

10.11.1.3 Yoke Basket Adjustment

To install the yoke basket follow Basket Installation. The following instructions are additional installation instructions that apply only to the yoke basket.

1. If the basket yoke is raised higher than required during installation; it can be lowered by *SLOWLY* pulling up on the float selector (1, Figure 10-9). Use caution when lowering the yoke in this manner. Pulling the float selector (1) out to fast and to far will lower the yoke at a very fast rate.
2. If the basket yoke needs to be raised; return the float selector to the down position and use the hand pump to raise the yoke to the desired position.

NOTE: See "Yoke Basket Operation" on page -515 to attach the yoke basket to the main boom or jib.

10.11.1.4 Before Making the Lift

- Set the tracks at the full extended position and with the full counterweight configuration.

NOTE: Refer to the crane Rated Capacity Charts. All work with a personnel basket must be done on firm level ground ($\pm 0.30^\circ$), with the tracks fully extended and pinned, and crane equipped with full counterweight configuration.

- Program the RCL as specified in the RCL Operator Manual which is located in the document case.
- Check all controls for proper operation. If any abnormal operations are detected, the condition must be corrected before continuing.
- Check the work area for electric power lines. If power lines are present. See "LIFTING PERSONNEL NEAR POWER LINES" on page 10-500.

Hoist Cable

The hoist cable must be disconnected from the hook block and properly secured to the stowing point when using the basket assemblies.

If your crane has the hoist mounted to the turret (as shown in Figure 10-7) - DO NOT connect the hoist cable to any place on the boom.

CAUTION

DO NOT connect the hoist cable to any place on the boom. When the hoist is mounted to the turret; connecting the hoist cable to the boom while operating the basket assembly will cause extensive damage to the machine.

Hoist Cable Tie Down - Turret Mounted Hoist

1. Remove the hook block (4) from the wedge socket (3, Figure 1-7) and feed the cable back through the boom nose until the wedge socket (3) has cleared the boom nose. Note that a typical single reeved hook block (4) is shown in Figure 1-7, your machine may appear to be reeved differently.
2. Slowly re-wind the hoist cable until the wedge socket (3) is within several feet of the stowing point.
3. Slowly rewind the hoist cable (2) until any remaining slack is removed and the cable is snug.

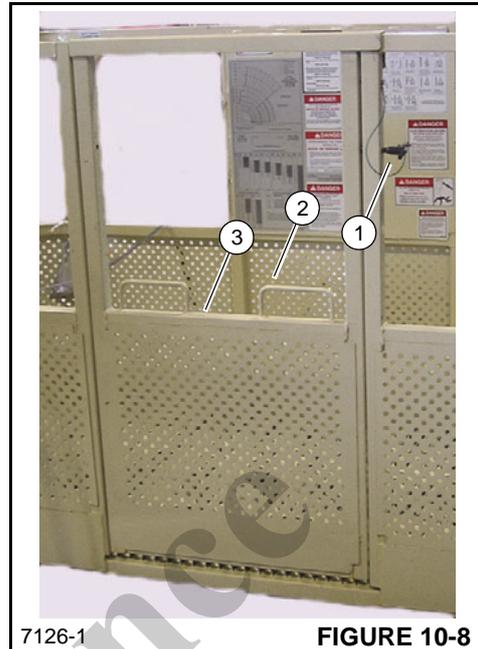


10.11.1.5 Yoke Basket Operation

The following operating instructions are for the two man yoke basket option. These instructions will explain how to raise the yoke basket assembly to the level necessary to attach the basket adapter to the boom nose.

Perform the Installation instructions beginning on page -512 before starting these operating instructions.

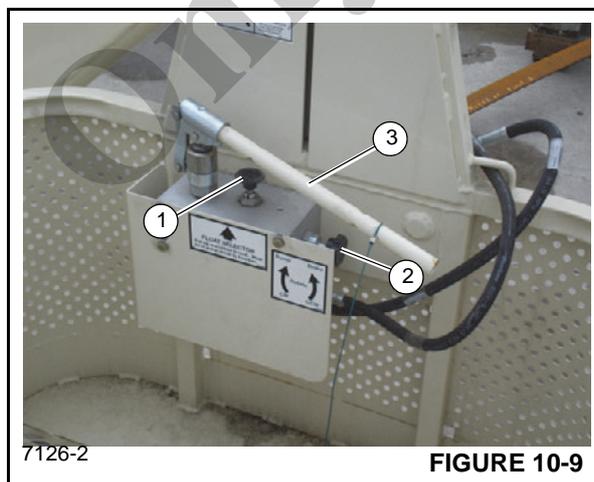
1. To enter the basket, remove the gate locking pin (1, Figure 10-8), pull up on the grab handle (2) and swing the gate (3) open.



7126-1

FIGURE 10-8

2. Connect the safety harness. Close the basket gate (3, Figure 10-8) by lifting up on the gate grab handle (2) and move the gate to the closed position, reinstall the safety pin (1).
3. Make sure the float selector (1, Figure 10-9) is turned to the up position and the brake selector (2) is in the CW (clockwise) position. This allows the basket to swing freely as the basket is raised to the work location.



7126-2

FIGURE 10-9

4. After the basket platform is raised to the working position; rotate the brake selector (2) to the CCW (counterclockwise) position to lock the brake.

This locks the yoke assembly into position and prevents free-swing when the basket platform is attached to the boom nose.

CAUTION

Rotate the brake selector (2, Figure 10-9) to the CCW (counterclockwise) brake position **immediately** after raising the yoke assembly to the proper height (step 4

above). The brake selector must be in the lock position before continuing or using the basket during normal operation.

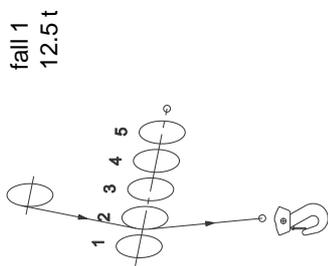
NOTE: The Yoke Basket hand pump (3, Figure 10-9) should not be used when the crane is operating. The hand pump is to be used *only* when installing the yoke to the crane.

For
Reference
Only

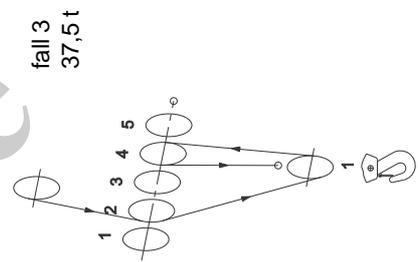
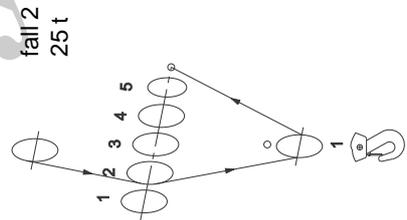
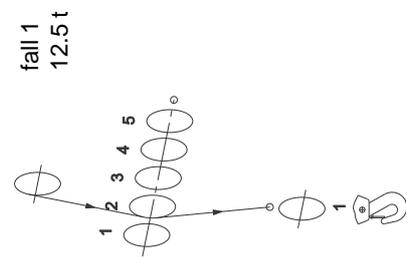
10.12 Reeving diagram

Reeving options at pulley head GHC130

Hook block
 maximum lifting capacity: 15 t
 rope diameter: 26 mm



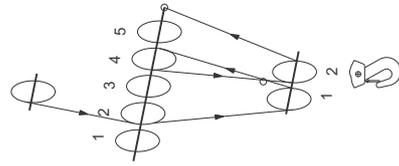
1-pulley hook block
 maximum lifting capacity: 40 t
 rope diameter: 26 mm



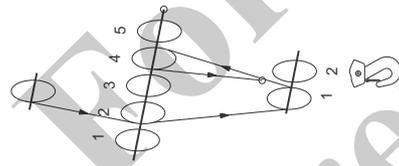
For Reference Only!

Reeving options at pulley head GHC130

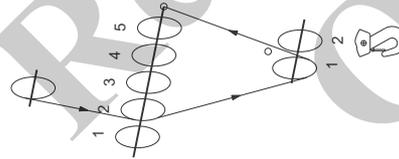
2-pulley hook block
maximum lifting capacity: 60 t
rope diameter: 26 mm



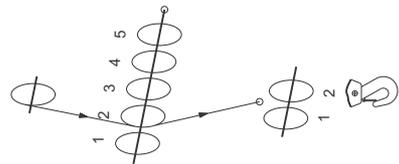
fall 3
37,5 t



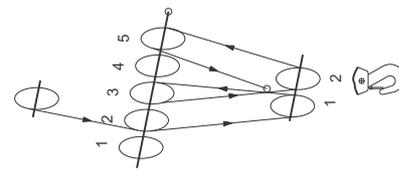
fall 2
25 t



fall 1
12.5 t



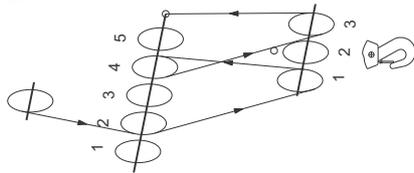
fall 4
60 t



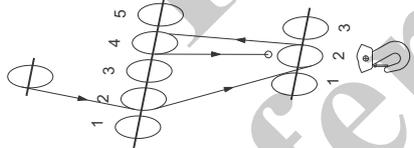
Reeving options at pulley head GHC130

3-pulley hook block
 maximum lifting capacity: 80 t
 rope diameter: 26 mm

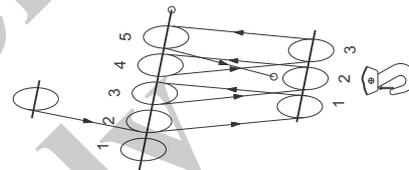
fall 4
60 t



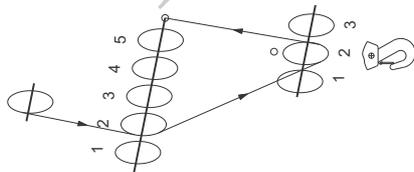
fall 3
37,5 t



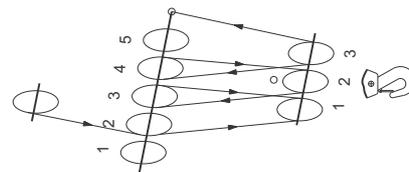
fall 6
80 t



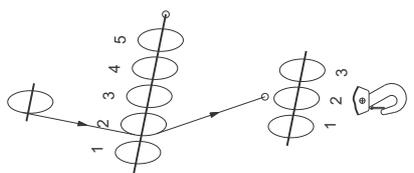
fall 2
25 t



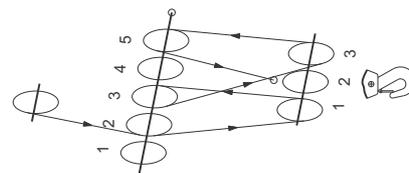
fall 6
75 t



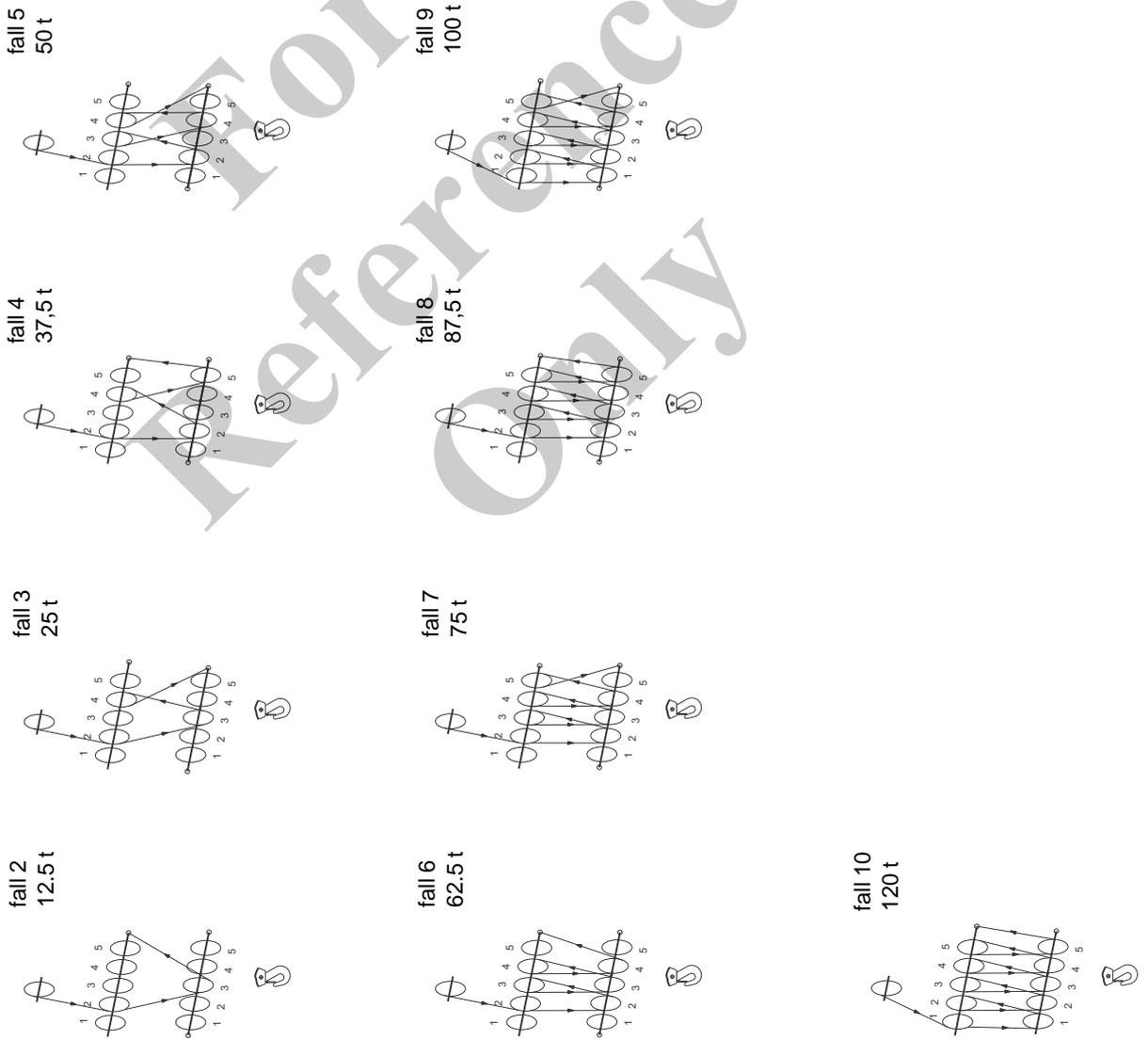
fall 1
12.5 t



fall 5
62.5 t



5-pulley hook block
 maximum lifting capacity: 15 t
 rope diameter: 26 mm



10.13 Warnings and information signs

ANSI signage for GHC130

GHC130



GHC130 en
ANSI signage

Printed copies are not subject to change.

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Reference
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GHC130_OW 245637 / UW 247147, 1, en_US

© 2019

2

GHC130

18.07.2019

Foreword**Foreword****Information on this decal scheme**

This decal scheme contains an overview of safety-relevant signage and is part of the operating manual.

It refers to the state of the machine upon delivery. It must be reviewed and modified as needed if changes are made to the machine's equipment.

Layout

This decal scheme is divided into sections on the cab, the upper-carriage and the undercarriage. The overview graphics show the application areas on the machine. These areas are numbered. The locations of adhesive signage are numbered consecutively on the overview graphic.

Optional decals

This decal scheme includes the maximum number of warning and safety signage. Optional decals are indicated as such. Further information on optional versions can be found in the operating manual.

Parts

The operator must check spare parts for the necessary warning and safety signage and apply them as needed.

If the machine leaves the original country of destination for a job, the operator must make sure the warning and safety signage meets the regulations of the new country and modify, add, or change the signage accordingly.

**DANGER!**

Failure to observe warning and safety signage can result in death or serious injury.

- Follow all warning and safety signage.
- Stay clear of the danger zone.

Foreword

For
Reference
Only

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ANSI signage for the Maxcab 2 cab

Overview diagrams for cab

1 ANSI signage for the Maxcab 2 cab

1.1 Overview diagrams for cab

Maxcab 2 cab

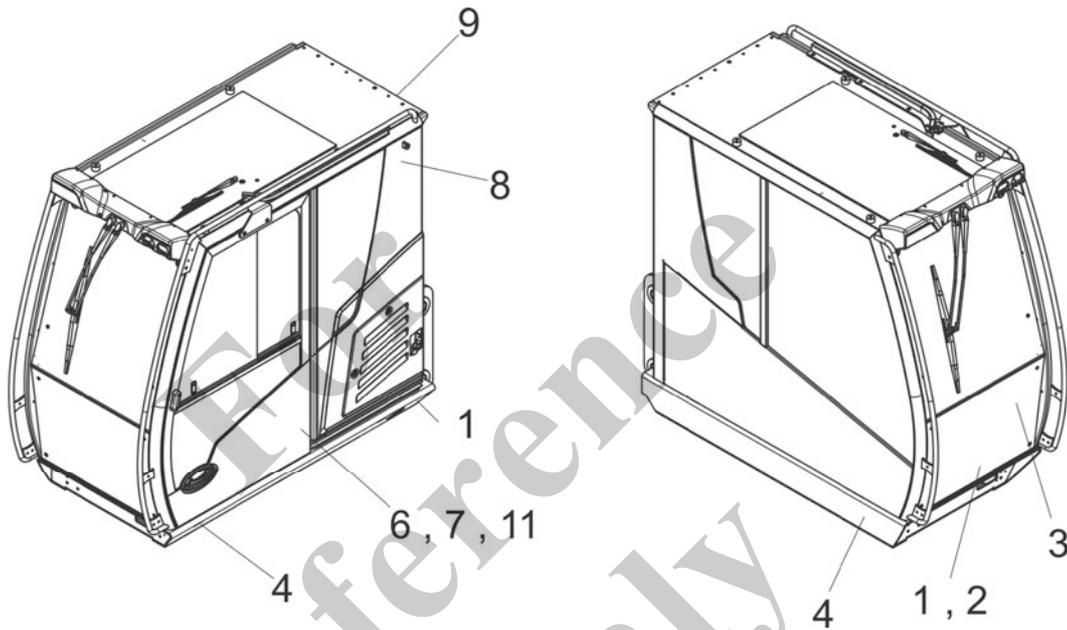


Fig. 1: External signage for the Maxcab 2 cab

ANSI signage for the Maxcab 2 cab

Overview diagrams for cab

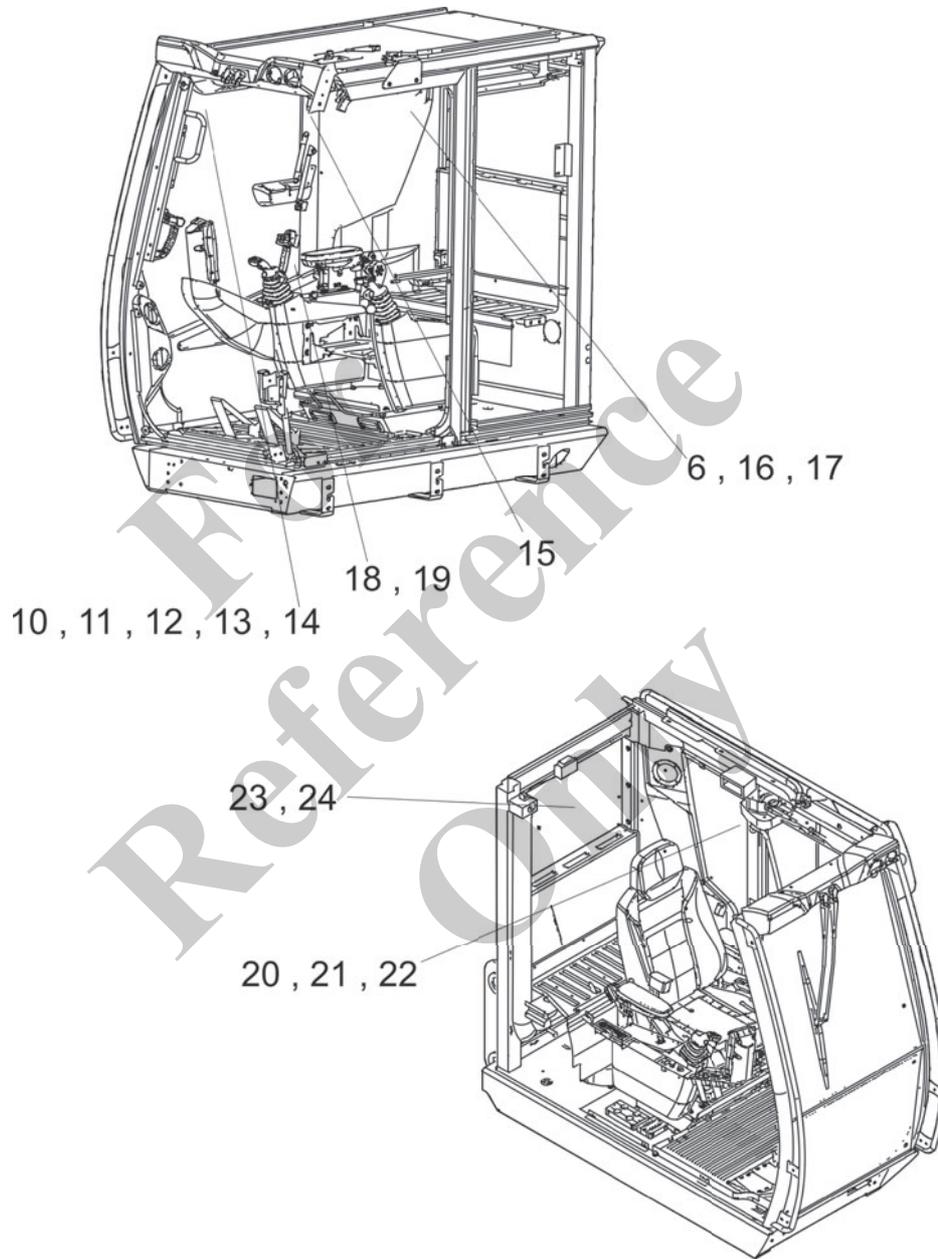


Fig. 2: Internal signage for the Maxcab 2 cab

ANSI signage for the Maxcab 2 cab

Warning and safety signs for the cab

- | | | | |
|----|---|----|---|
| 1 | Warning against collapse | 13 | Danger of tipping |
| 2 | Warning of falling load | 14 | Emergency exit |
| 3 | Warning of lowering cab | 15 | Warning against falling out of cab |
| 4 | Warning of rotating machine | 16 | Drilling and welding prohibited |
| 5 | -- | 17 | Read the operating manual! |
| 6 | Operation by authorized personnel only | 18 | Danger caused by improper use of the machine |
| 7 | Warning of electric shock | 19 | Crane Star |
| 8 | Fire extinguisher storage location | 20 | You must understand the language in which the operating manual is written |
| 9 | 24 V power socket | 21 | Never leave the machine unattended |
| 10 | Pay attention to the load lift charts and follow the operating instructions | 22 | Sound power level |
| 11 | Suspended load | 23 | Load capacity sticker |
| 12 | Crane falling backward | 24 | Machine control sticker |

1.2 Warning and safety signs for the cab

Warning against collapse

Shown	Meaning	SEBO no.
	Danger of falling due to exceeding the maximum load of the walkway per segment. <ul style="list-style-type: none"> Do not exceed the maximum load of the walkway. 	187962

Warning of falling load

Shown	Meaning	SEBO no.
	Falling load can cause serious injury or death to persons. <ul style="list-style-type: none"> Ensure that no one is under a suspended load. 	187957

Warning of lowering cab

Shown	Meaning	SEBO no.
	Lowering cab can result in crushing. Do not stay in the danger zone.	187973

ANSI signage for the Maxcab 2 cab

Warning and safety signs for the cab

Warning of rotating machine

Shown	Meaning	SEBO no.
	<p>A rotating machine can cause death or serious injury.</p> <ul style="list-style-type: none"> Do not stay in the danger zone. 	187233

187983

Operation by authorized personnel only

Shown	Meaning	SEBO no.
	<p>Operation by authorized personnel only.</p>	239651

Warning of electric shock

Shown	Meaning	SEBO no.
	<p>Electrical current from overhead lines can cause serious or fatal injuries. Maintain the safety distance.</p>	239627

Fire extinguisher storage location

Shown	Meaning	SEBO no.
	<p>Fire extinguisher storage location</p>	187974

ANSI signage for the Maxcab 2 cab

Warning and safety signs for the cab

24 V power socket

Shown	Meaning	SEBO no.
 <p>A blue rectangular sign with the text "24 V" in large white letters. Below the text, in smaller white letters, is "SE 186587".</p>	24 V socket label	186587

Pay attention to the load lift charts and follow the operating instructions

Shown	Meaning	SEBO no.
 <p>A sign with a green header "SAFETY INSTRUCTIONS". The text below reads: "Ignoring load lift charts and operating instructions can cause injury due to maloperation. Be sure to read and understand load lift charts and operating instructions before operating the machine. Do not solely rely on the electronic equipment provided on this machine."</p>	Failure to observe load lift charts and operating instructions can result in death or serious injury.	239647

Suspended load

Shown	Meaning	SEBO no.
 <p>A sign with a red prohibition symbol (a person standing under a load) and a yellow header "WARNING". The text below reads: "Suspended loads can cause serious injury or death by falling on persons standing underneath. Never lift loads directly over persons."</p>	Suspended loads can cause death or serious injury to personnel below. Never swing suspended loads over personnel.	187953

Crane falling backward

Shown	Meaning	SEBO no.
 <p>A sign with a red header "DANGER". The text below reads: "Machine turning over backward can cause serious injury or death. Properly extend tracks before moving the boom from its stowed position. Properly install all pins and floats."</p>	Crane falling backward can result in death or serious injury. Only operate crane when properly assembled.	239643

Danger of tipping

Shown	Meaning	SEBO no.
 <p>A sign with a red header "DANGER" and an illustration of a crane tipping. The text below reads: "Tipping machine can cause serious injury or death. Observe load and machine capacities. Place machine on firm and level surface. Stay clear of hazardous areas."</p>	Tipping crane can result in death or serious injury. Observe specified safe working loads. Always position crane on level ground. Keep away from danger zones.	239631

ANSI signage for the Maxcab 2 cab

Warning and safety signs for the cab

Emergency exit

Shown	Meaning	SEBO no.
	Emergency exit label	187970

Warning against falling out of cab

Shown	Meaning	SEBO no.
	Warning against falling out of cab. Wear seat belt.	187971

Drilling and welding prohibited

Shown	Meaning	SEBO no.
	Drilling and welding prohibited.	187949

Read the operating manual!

Shown	Meaning	SEBO no.
	Warning of serious injury or death from failing to observe operating manual. Keep operating manual inside the machine.	187975

Danger caused by improper use of the machine

Shown	Meaning	SEBO no.
	Improper use of the machine can cause death or serious injury. For proper use only as described in the manual.	239635

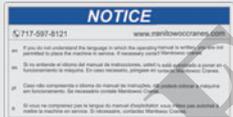
ANSI signage for the Maxcab 2 cab

Warning and safety signs for the cab

Crane Star

Shown	Meaning	SEBO no.
 <p>This crane is equipped with a CraneSTAR telematics device. If you do not opt out, Manitowoc and its affiliates and distributors could remotely monitor and log certain data concerning the crane. Visit www.cranestar.net and review your owner's manual for full terms and conditions of operation and use of the CraneSTAR system or to opt-out from any remote data monitoring by Manitowoc and its affiliates or distributors.</p>	Crane Star	187877

You must understand the language in which the operating manual is written

Shown	Meaning	SEBO no.
 <p>NOTICE If you do not understand the language in which the operating manual is written, you are not allowed to start the machine.</p>	If you do not understand the language of the operating manual, you are not allowed to start the machine.	187963

Never leave the machine unattended

Shown	Meaning	SEBO no.
 <p>WARNING Leaving the machine unattended with the engine running can cause serious injury or death. Never leave the machine unattended, while the engine is running.</p>	Never leave the machine unattended with the engine running.	187979

Sound power level

Shown	Meaning	SEBO no.
	Sound power level of the machine	

Load capacity sticker

Shown	Meaning	SEBO no.
	Load capacity sticker for the machine	

Machine control sticker

Shown	Meaning	SEBO no.
	Machine control sticker for the machine	

ANSI signage for uppercarriage

Overview diagrams for uppercarriage

2 ANSI signage for uppercarriage

2.1 Overview diagrams for uppercarriage

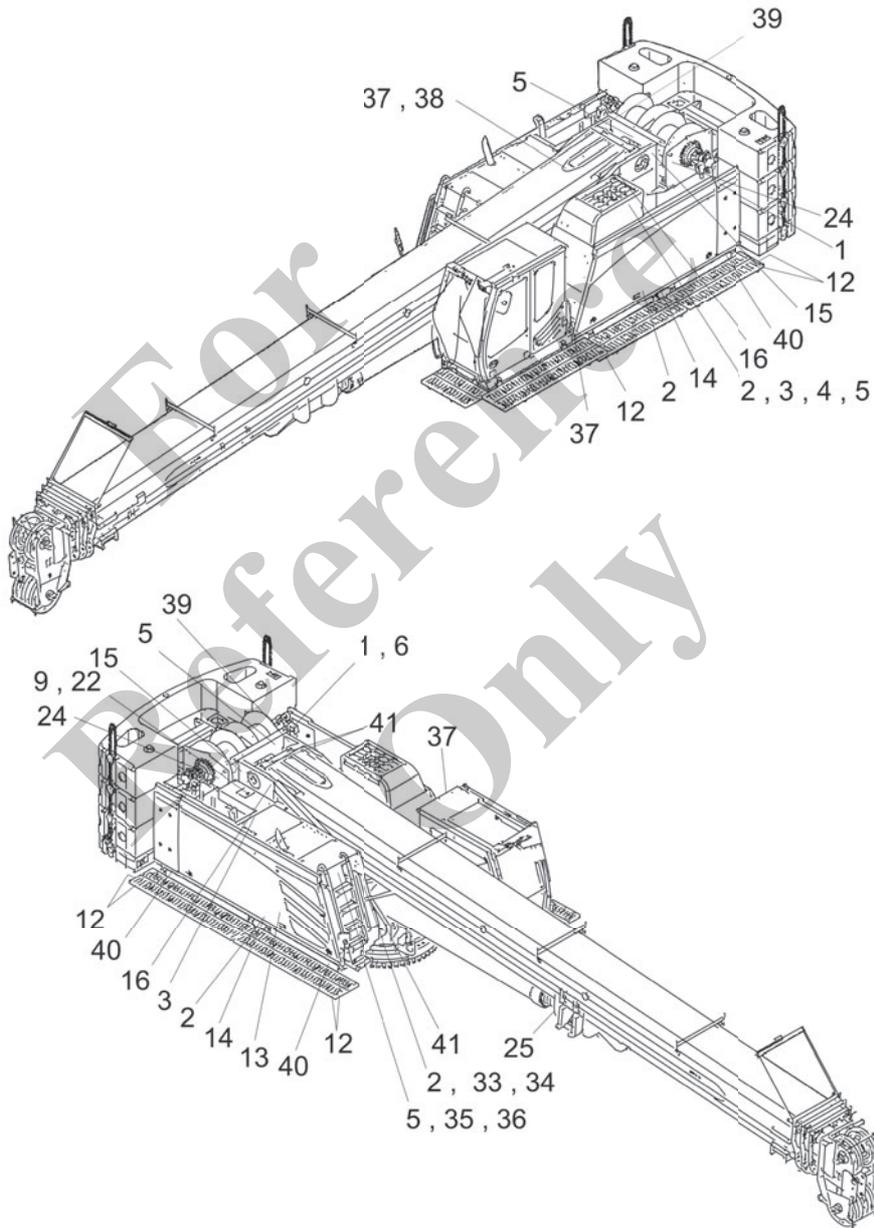


Fig. 3: Exterior uppercarriage

ANSI signage for uppercarriage

Overview diagrams for uppercarriage

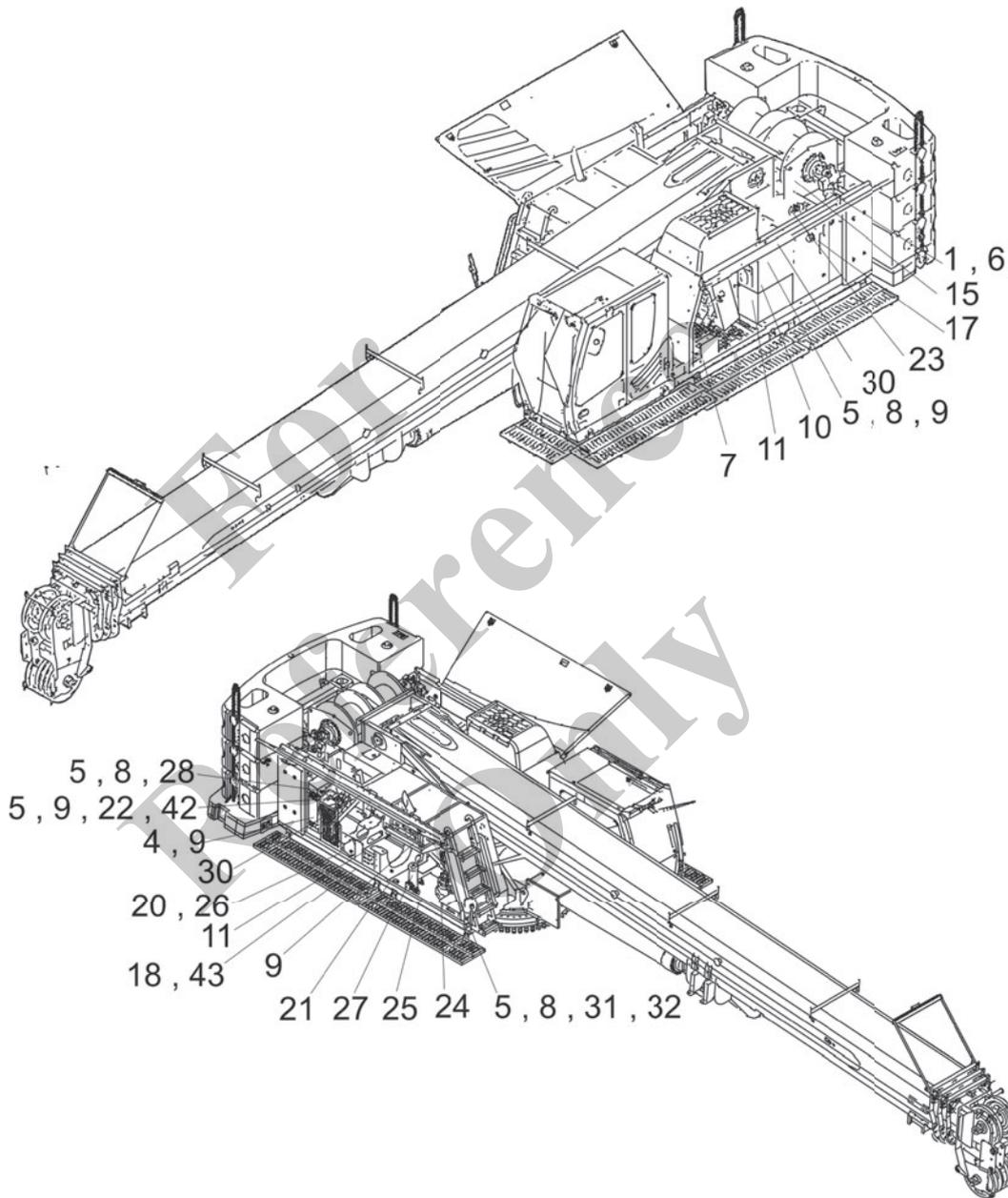


Fig. 4: Interior uppercarriage

- | | |
|--------------------------------|----------------------------------|
| 1 Smoking prohibited! | 3 Keep off! |
| 2 Read the maintenance manual! | 4 Warning of rotating fan blades |

ANSI signage for uppercarriage

Warning and safety signs for the uppercarriage

- | | |
|--|---|
| 5 Read the operating manual! | 25 Lubricating grease |
| 6 Note diesel fuel | 26 Engine oil |
| 7 DEF fuel | 27 HydroClean label |
| 8 Warning of escaping fluid | 28 Warning of rotating belt drive |
| 9 Danger of burn injuries | 29 Notice about 3 minutes for the battery disconnect switch |
| 10 Warning - high voltage | 30 High-pressure cleaning forbidden |
| 11 24 V power socket label | 31 Warning of corrosive battery acid |
| 12 Warning sign hatching | 32 Warning of danger of explosion! |
| 13 Hand signals | 33 Warning of falling load |
| 14 Warning against collapse | 34 Keep away from danger zones |
| 15 Danger of being pulled in by rope drive | 35 Do not climb |
| 16 Danger of crushing on boom | 36 Danger of uppercarriage falling |
| 17 Notice on maximum hydraulic oil tank fill level | 37 Keep off |
| 18 40 A ignition fuse label | 38 Chains on uppercarriage |
| 19 -- | 39 Winch rope not attached correctly |
| 20 Note engine oil | 40 Warning of rotating machine |
| 21 Sampling point label | 41 Lifting point label |
| 22 Warning of overflow or boil-over of fluids | 42 Coolant |
| 23 Hydraulic oil | 43 Battery disconnect switch label |
| 24 Transmission oil | |

2.2 Warning and safety signs for the uppercarriage

Smoking prohibited!

Shown	Meaning	SEBO no.
	<p>Diesel fuel is easily ignited. Severe injury and death can result in the case of fire.</p> <ul style="list-style-type: none"> Smoking or open fire in the vicinity of the machine is prohibited. 	187984

Read the maintenance manual!

Shown	Meaning	SEBO no.
	<p>Warning of serious injury or death from failing to observe maintenance manual.</p> <p>Wear protective equipment!</p>	187976

ANSI signage for uppercarriage

Warning and safety signs for the uppercarriage

Keep off!

Shown	Meaning	SEBO no.
<p>A yellow triangular warning sign with a black border. Inside the triangle is a black silhouette of a person falling backwards. To the right of the triangle is a white rectangular box with a red border containing the text: 'WARNING Fall hazard. Stay off!'.</p>	<p>Warning against falling. Stay clear of the danger zone!</p>	187985

Warning of rotating fan blades

Shown	Meaning	SEBO no.
<p>A yellow triangular warning sign with a black border. Inside the triangle is a black silhouette of a hand being struck by a rotating fan blade. To the right of the triangle is a white rectangular box with a red border containing the text: 'WARNING Rotating fan blades can cause serious injury. Keep hands clear. Turn off engine and remove key before doing any maintenance on this machine.'</p>	<p>Rotating fan blades can cause severe injury.</p> <ul style="list-style-type: none"> ■ Do not reach into the fan blades. ■ Maintain a safety distance. 	187941

Read the operating manual!

Shown	Meaning	SEBO no.
<p>A blue square warning sign with a white border. Inside the square is a white silhouette of a person reading a book. To the right of the square is a white rectangular box with a red border containing the text: 'WARNING Failure to read and understand operator manual and all safety signs could result in death or serious injury. Manual must remain with the machine.'</p>	<p>Warning of serious injury or death from failing to observe operating manual. Keep operating manual inside the machine.</p>	187975

Note diesel fuel

Shown	Meaning	SEBO no.
<p>A white rectangular information sign with a black border. At the top, it says 'ULTRA LOW SULFUR FUEL ONLY'. Below this, there are two icons: a fuel nozzle and an open book. Under the fuel nozzle icon, it says 'S ≤ 15 mg/kg'. At the bottom right, it says 'SE 182976'.</p>	<p>Sulfur-free diesel fuel or diesel fuel with less than 15 mg/kg sulfur content only.</p>	186976

DEF fuel

Shown	Meaning	SEBO no.
<p>A white rectangular information sign with a black border. At the top, it says 'AdBlue® DEF'. Below this, there is a blue silhouette of a person pouring liquid from a container. At the bottom, it says '(ISO22241 / DIN70700 / AUS32)'. At the bottom right, it says 'SE 187996'.</p>	<p>DEF fuel</p>	187996

ANSI signage for uppercarriage

Warning and safety signs for the uppercarriage

Warning of escaping fluid

Shown	Meaning	SEBO no.
	<p>Corrosive fluids can cause serious injury.</p> <ul style="list-style-type: none"> Wear protective gloves and eye protection. 	187981

Danger of burn injuries

Shown	Meaning	SEBO no.
	<p>There is a risk of burns from hot surfaces.</p> <ul style="list-style-type: none"> Do not touch hot surfaces. Maintain a safety distance. 	187978

Warning - high voltage

Shown	Meaning	SEBO no.
	<p>Electrical voltages can result in death or serious injury.</p> <ul style="list-style-type: none"> Do not touch live parts. 	187980

24 V power socket label

Shown	Meaning	SEBO no.
	<p>24 V power socket label</p>	186587

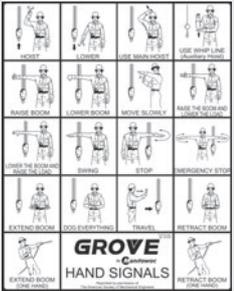
Warning sign hatching

Shown	Meaning	SEBO no.
	<p>Danger area label</p> <ul style="list-style-type: none"> Pay special attention to danger areas. Maintain a safety distance. 	187969

ANSI signage for uppercarriage

Warning and safety signs for the uppercarriage

Hand signals

Shown	Meaning	SEBO no.
	Hand signals for communication between crane operator and guide.	187239

Warning against collapse

Shown	Meaning	SEBO no.
	Danger of falling due to exceeding the maximum load of the walkway per segment. <ul style="list-style-type: none"> Do not exceed the maximum load of the walkway. 	187962

Danger of being pulled in by rope drive

Shown	Meaning	SEBO no.
	Warning of dismemberment due to winch rope winding in. <ul style="list-style-type: none"> Stay away from the winch rope when it is winding in. 	187943

Danger of crushing on boom

Shown	Meaning	SEBO no.
	Warning of crushing or dismemberment due to moving boom. <ul style="list-style-type: none"> Stay out of the danger zone. 	187945

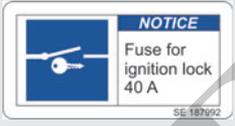
ANSI signage for uppercarriage

Warning and safety signs for the uppercarriage

Notice on maximum hydraulic oil tank fill level

Shown	Meaning	SEBO no.
	Maximum oil level on sight glass: ■ The oil level must not exceed the upper marking.	186976

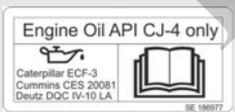
40 A ignition fuse label

Shown	Meaning	SEBO no.
	40 A ignition fuse label	187992

Battery disconnect switch label

Shown	Meaning	SEBO no.
	Disconnect the power supply here: ■ Activate the battery disconnect switch.	194773

Note engine oil

Shown	Meaning	SEBO no.
	Only use engine oils as per specification ACEA E9-08 or API CJ-4.	186977

Sampling point label

Shown	Meaning	SEBO no.
	Hydraulic oil sampling point label	186594

ANSI signage for uppercarriage

Warning and safety signs for the uppercarriage

Warning of overflow or boil-over of fluids

Shown	Meaning	SEBO no.
	Fluids can cause serious injury or scalding when overflowing or during boil-over. <ul style="list-style-type: none"> ■ Maintain a safety distance. 	187960

Hydraulic oil

Shown	Meaning	SEBO no.
	Shell Tellus S2 VA 46 hydraulic oil	187999

Transmission oil

Shown	Meaning	SEBO no.
	Shell Omala S4 GX 220 gear oil	187939

Lubricating grease

Shown	Meaning	SEBO no.
	Shell Gadus S2 V220 2 lubricating grease	187995

Engine oil

Shown	Meaning	SEBO no.
	Shell Rimula R5 LE 10W-30 engine oil	187997

ANSI signage for uppercarriage

Warning and safety signs for the uppercarriage

HydroClean label

Shown	Meaning	SEBO no.
	HydroClean label	187994

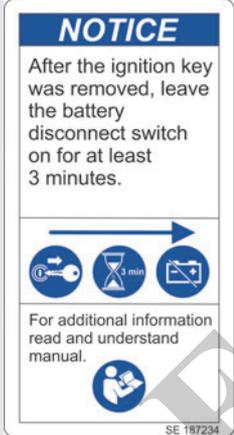
Warning of rotating belt drive

Shown	Meaning	SEBO no.
	The rotating belt drive can cause serious injury. <ul style="list-style-type: none"> ■ Do not reach into the belt drive. ■ Maintain a safety distance. 	187982

ANSI signage for uppercarriage

Warning and safety signs for the uppercarriage

Notice about 3 minutes for the battery disconnect switch

Shown	Meaning	SEBO no.
	<p>Leave the battery disconnect switch on for at least three minutes after switching off the engine.</p>	187234

High-pressure cleaning forbidden

Shown	Meaning	SEBO no.
	<p>The use of a high-pressure cleaner in the engine compartment can cause engine damage.</p> <ul style="list-style-type: none"> The use of a high-pressure cleaner in the engine compartment is prohibited. 	187977

Warning of corrosive battery acid

Shown	Meaning	SEBO no.
	<p>Corrosive battery acid and lead can cause serious injury.</p> <ul style="list-style-type: none"> Maintain a safety distance. 	187988

Warning of danger of explosion!

Shown	Meaning	SEBO no.
	<p>Improper handling of the battery may cause an explosion.</p> <ul style="list-style-type: none"> No smoking or open flame. Ensure good ventilation when charging the battery externally. 	187989

ANSI signage for uppercarriage

Warning and safety signs for the uppercarriage

Warning of falling load

Shown	Meaning	SEBO no.
	Falling load can cause serious injury or death to persons. <ul style="list-style-type: none"> Ensure that no one is under a suspended load. 	187957

Keep away from danger zones

Shown	Meaning	SEBO no.
	Warning of serious injuries in the danger zone while the machine is in operating mode. <ul style="list-style-type: none"> Do not stay in the danger zone. 	187956

Do not climb

Shown	Meaning	SEBO no.
	Warning of serious injury due to unauthorized use of the access ladder. <ul style="list-style-type: none"> Unauthorized access prohibited! 	187958

Danger of uppercarriage falling

Shown	Meaning	SEBO no.
	Warning against danger of falling on the uppercarriage. <ul style="list-style-type: none"> Wear safety harness and safety shoes! 	187946

Keep off

Shown	Meaning	SEBO no.
	Warning against falling. <ul style="list-style-type: none"> Keep off. 	187987

ANSI signage for uppercarriage

Warning and safety signs for the uppercarriage

Chains on uppercarriage

Shown	Meaning	SEBO no.
	Warning - danger of falling ■ Use fall arrest safety harness.	187986

Winch rope not attached correctly

Shown	Meaning	SEBO no.
	The winch rope can cause serious injury if it is not attached correctly. Use the recommended cable wedges to attach the winch rope to the cable drum.	187961

Warning of rotating machine

Shown	Meaning	SEBO no.
	A rotating machine can cause death or serious injury. ■ Do not stay in the danger zone.	187233

Lifting point label

Shown	Meaning	SEBO no.
	Secure attachment ■ Lift the machine only at the marked points and with suitable slings.	186792

Coolant

Shown	Meaning	SEBO no.
	Cummins ES Compleat coolant	187998

ANSI signage for uppercarriage

Warning and safety signs for the uppercarriage

Battery disconnect switch label

Shown	Meaning	SEBO no.
	<p>Battery disconnect switch label</p>	<p>225045</p>

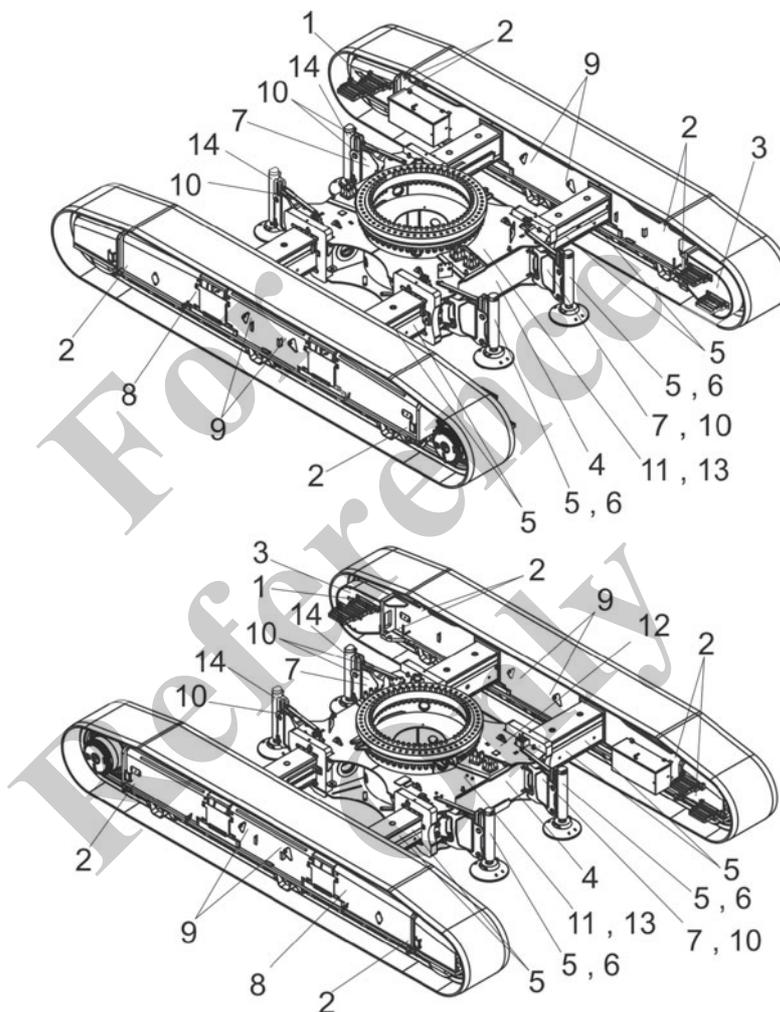
For Reference Only

ANSI signage for T119/540 undercarriage

Overview diagrams for undercarriage

3 ANSI signage for T119/540 undercarriage

3.1 Overview diagrams for undercarriage



- | | | | |
|---|---|----|---|
| 1 | Direction light | 8 | Warning of pressurized sealing caps |
| 2 | Lashing point label | 9 | Lifting point label |
| 3 | Transmission oil | 10 | Warning sign hatching |
| 4 | Danger of crushing on track wheel carrier | 11 | Lubricating grease |
| 5 | 50% and 100% arrow | 12 | Information on clamping the undercarriage |
| 6 | Danger of crushing feet | 13 | Stabilizing cylinder positions |
| 7 | Danger of crushing hands | 14 | Stabilizing cylinders label |

ANSI signage for T119/540 undercarriage

Warning and safety signs on undercarriage

3.2 Warning and safety signs on undercarriage

Direction light

Shown	Meaning	SEBO no.
	Direction arrow <ul style="list-style-type: none"> The arrow points toward the front end of the machine. 	139054

Lashing point label

Shown	Meaning	SEBO no.
	Label of the point where the machine can be lashed	186793

Transmission oil

Shown	Meaning	SEBO no.
	Transmission oil	-

Danger of crushing on track wheel carrier

Shown	Meaning	SEBO no.
	Single telescopic track wheel carriers can cause serious crushing. <ul style="list-style-type: none"> Do not stay in the danger zone. 	187942

ANSI signage for T119/540 undercarriage

Warning and safety signs on undercarriage

50% and 100% arrow

Shown	Meaning	SEBO no.
	Signifies 50% or 100% mark with undercarriage retracted	187964

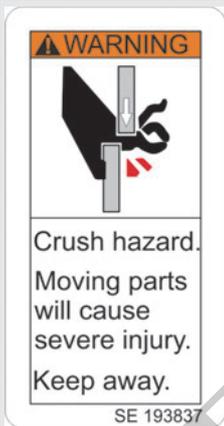
Danger of crushing feet

Shown	Meaning	SEBO no.
	Warning: extendable outrigger <ul style="list-style-type: none"> ■ Maintain a safety distance. 	187940

ANSI signage for T119/540 undercarriage

Warning and safety signs on undercarriage

Danger of crushing hands

Shown	Meaning	SEBO no.
	Warning against danger of crushing hands <ul style="list-style-type: none"> ■ Maintain a safety distance. 	193837

Warning of pressurized sealing caps

Shown	Meaning	SEBO no.
	Pressurized sealing caps can cause serious injury. <ul style="list-style-type: none"> ■ Maintain a safety distance. ■ Wear safety glasses and protective gloves. 	187944

Lifting point label

Shown	Meaning	SEBO no.
	Secure attachment <ul style="list-style-type: none"> ■ Lift the machine only at the marked points and with suitable slings. 	186792

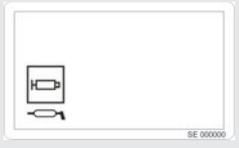
Warning sign hatching

Shown	Meaning	SEBO no.
	Danger area label <ul style="list-style-type: none"> ■ Pay special attention to danger areas. ■ Maintain a safety distance. 	187969

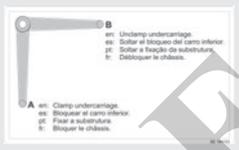
ANSI signage for T119/540 undercarriage

Warning and safety signs on undercarriage

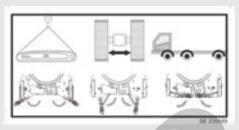
Lubricating grease

Shown	Meaning	SEBO no.
	Lubricating grease	-

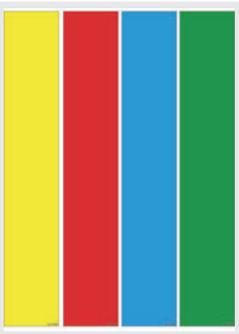
Information on clamping the undercarriage

Shown	Meaning	SEBO no.
	Ball valve selector lever position for clamping the undercarriage	194103

Stabilizing cylinder positions

Shown	Meaning	SEBO no.
	Stabilizing cylinder positions <ul style="list-style-type: none"> ■ Folded out: Track wheel carrier setup ■ Middle position: Change track width ■ Folded in: Transport 	235589

Stabilizing cylinders label

Shown	Meaning	SEBO no.
	To provide assistance, the outrigger cylinders are labeled in the same colors as on the remote control.	247088

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