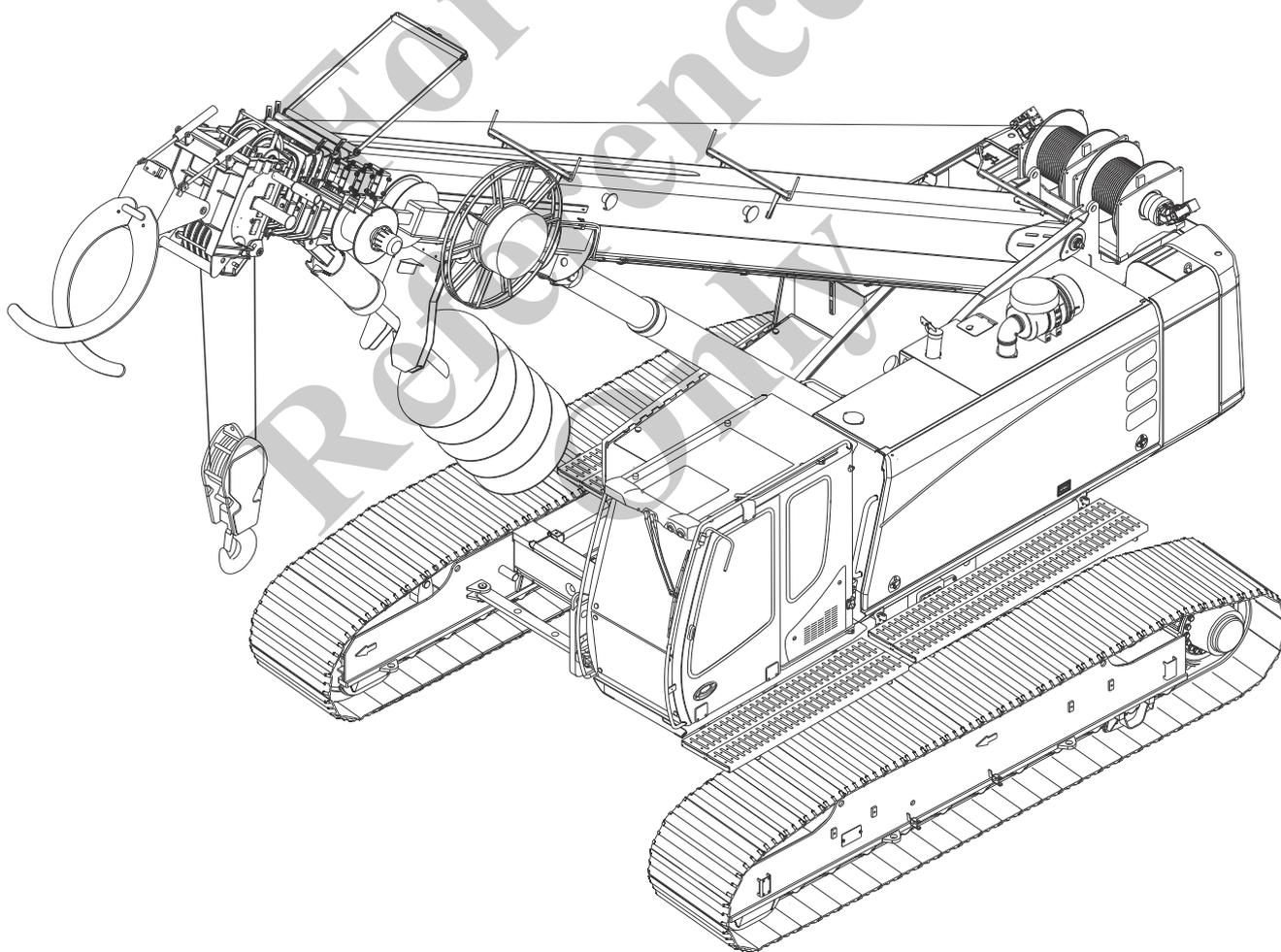


Operating and Maintenance Manual

GHC 55



**Read this manual completely
before using for the first time!**



00083

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 1.7 REQUIREMENTS ON PERSONNEL 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 11 chapters:

- 1: Safety
Here you will find general safety instructions that must always be complied with.
- 2: Overview
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 2.0:
This chapter describes the SENCON 2.0 diagnostic and control system.
- 6: Operation
This chapter contains information on control elements and work operation.

- 7: Setup tasks
Chapter 6 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 7.
- 9: Maintenance:
Chapter 8 presents procedures for ensuring the functionality of the machine.
- 10: Troubleshooting
This chapter contains information on determining the causes of faults and how to correct them.
- 11: Appendix
Here you will find an index of key words and additional information, e.g. about the warranty and supplemental documentation, e.g. for the driving engine.

For
Reference
Only

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For
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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 is used to alert you to potential injury hazards. Observe all safety information that follow this symbol to avoid possible injury or death.

Signal word

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



DANGER indicates a hazardous situation that, if not avoided, will result in serious injury or death.



WARNING indicates a hazardous situation that, if not avoided, could result in serious injury or death.



CAUTION indicates a hazardous situation that, if not avoided, could result in minor to moderate injury.



NOTE indicates important information not pertaining to a hazard.

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.

NOTE

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 must 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.

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 Grove 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 $a < 45^\circ$.
 - For ground fill (or hilly), the safe distance (A) must be two times the excavation depth (B), slope angle $a < 30^\circ$.

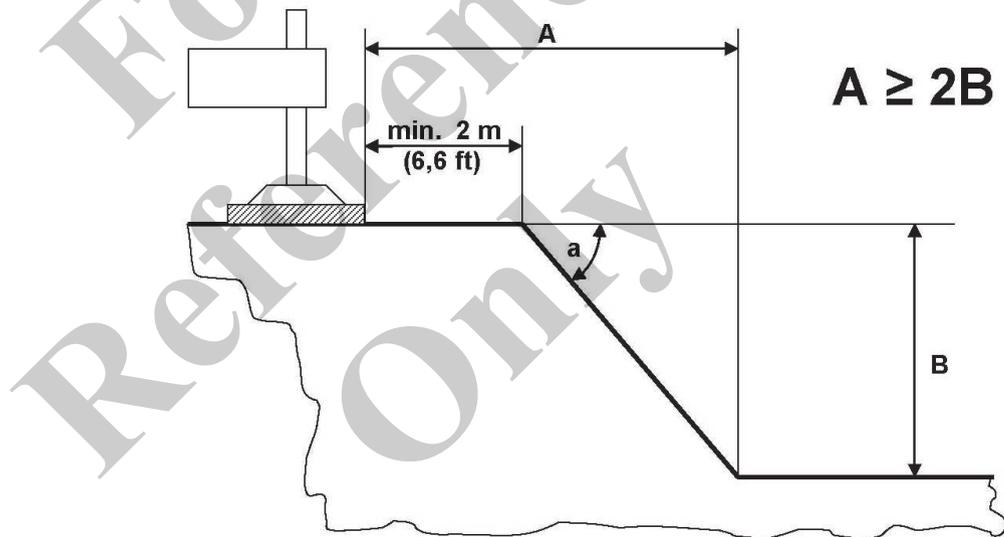


Fig. 1 Determination of the distance from embankments and excavations

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 (see Section 3 TECHNICAL DATA)
- Using other than original Grove 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.

Original spare parts and Grove accessories ensure the safety of personnel. Parts and equipment from other manufacturers are not tested by Grove 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, Grove 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 <i>Excerpt from OSHA regulations (USA)</i>	<p>Operating personnel are those persons authorized by the owner to operate the product.</p> <p>Machine operators must have the following qualifications:</p> <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 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

 **WARNING****Danger to life when the work area set in a working area limitation is exceeded!**

If machine motions are executed quickly when an optional work area limitation is used, the set work area can be exceeded. This can cause severe or fatal injury. The machine and fixed installations can also be damaged.

- Keep an additional safety distance from persons, machines and fixed installations near the set work area.
- Execute machine movements carefully and slowly.

 **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, Grove 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 V 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 V 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

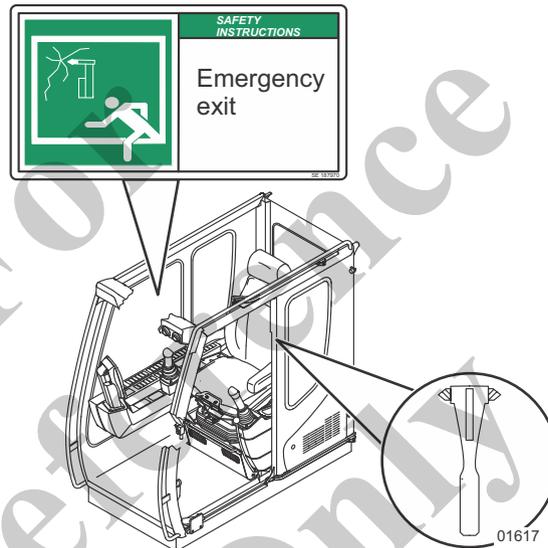


Fig. 2 Position of the emergency hammer next to the operator door



Information

In the event of an emergency exit, use the emergency hammer (1) to break the right 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 Grove 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 used with the proper operating modes and load lift charts. Do not bypass the load moment limiter when performing ramming tasks or pulling sheet pile walls.

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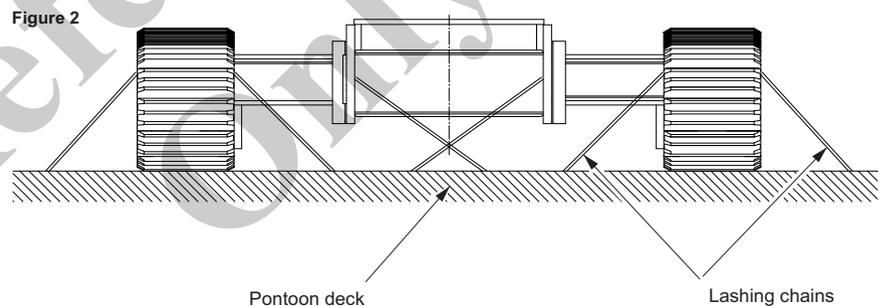
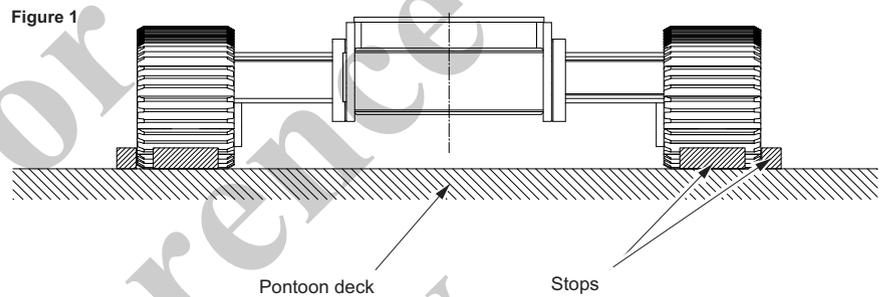
1.8.5 Deployment on a pontoon

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 Grove 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 GROVE 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 GROVE Cranecare ahead of time.

1.8.6 Start-up

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

- Comply with Chapter 1 SAFETY.
Before start-up, carry out checks in accordance with 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

- Comply with Chapter 1 SAFETY.
Before start-up, carry out checks in accordance with 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 Grove.

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 immanent.
- Observe the relevant accident prevention regulations for working with load suspension equipment.
- When removing components or dismounting 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 (in accordance with Chapter 9.9.2) before starting maintenance tasks.
- Only trained Grove 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 original Grove 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 GROVE 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 Grove

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 specialist inspection is always to be performed in the 13th year of operation and annually 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.

<p>Dangers of non-compliance with the safety instructions</p>	<ul style="list-style-type: none"> ● 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 Grove. <p>Non-compliance with the safety instructions is dangerous and can be hazardous to persons as well as to the environment and the machine.</p> <p>Non-compliance with the safety instructions invalidates all claims for damages.</p>
<p>Fire extinguisher and first-aid kit</p>	<p>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 Grove.</p>
<p>Warranty conditions</p>	<p>The warranty conditions of Grove are summarized in the warranty manual.</p>

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 Grove (see Spare parts catalog).



Fig. 3 Organization of the rating plate

1	Machine type
2	Machine number
3	Manufacturing date
4	Model year

1.14 Warning and information signs



Information

The overviews and descriptions of the warning and information signs on the machine are located in the appendix of the manual.



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2 Overview

2.1 Overall machine

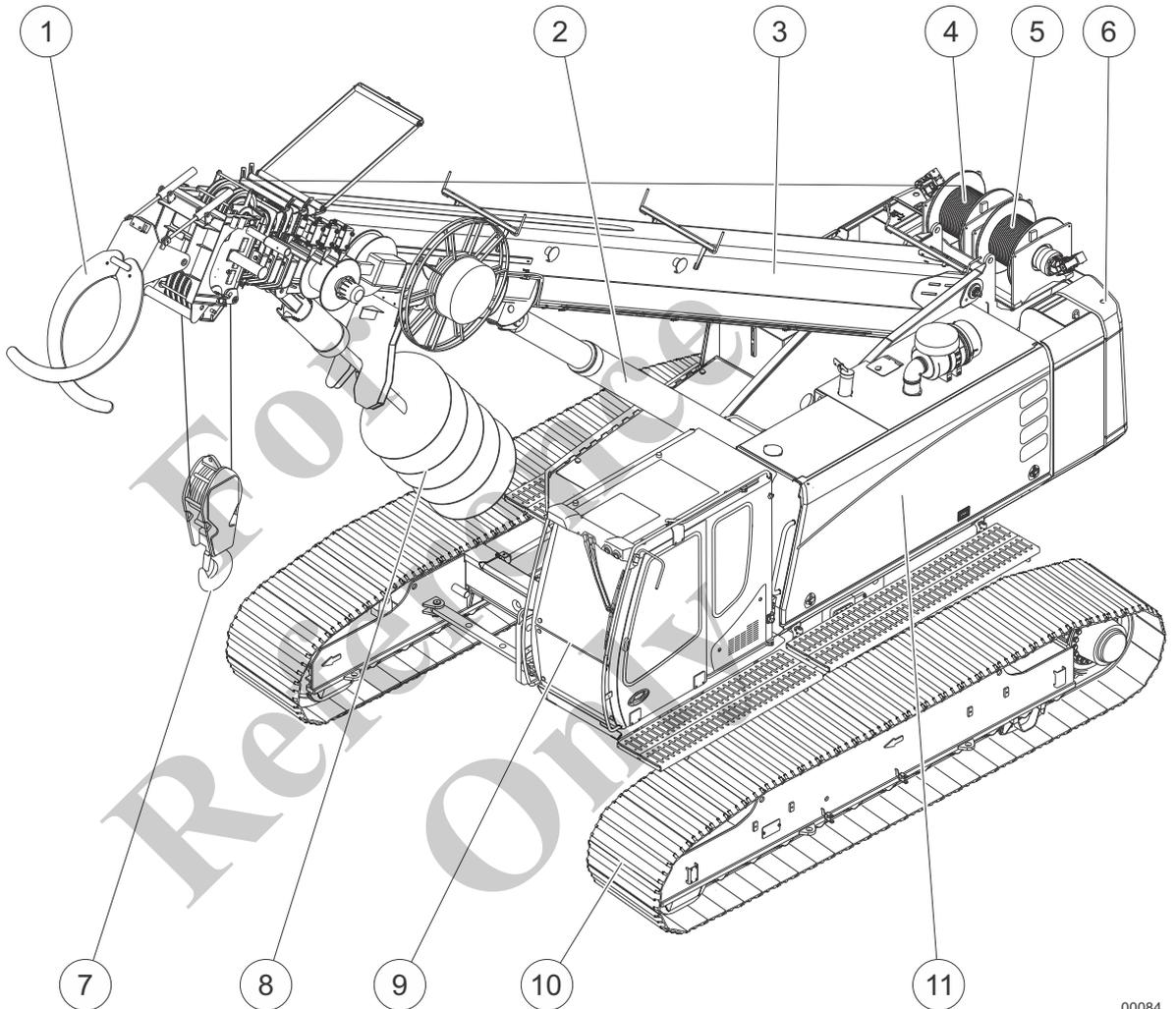


Fig. 4 Components of the machine

00084

1	Clamping tongs	6	Bottom hook block
2	Luffing cylinder	7	Soil drill
3	Telescopic boom	8	Cab
4	Winches	9	Undercarriage
5	Counterweight	10	Uppercarriage

2.2 Undercarriage

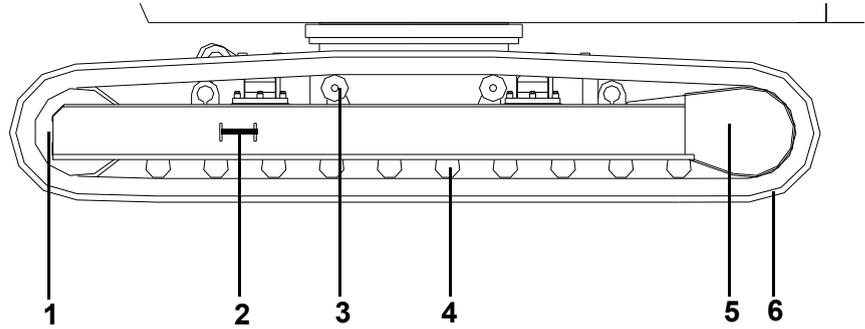


Fig. 5 Components of the undercarriage

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

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2.3 Cab

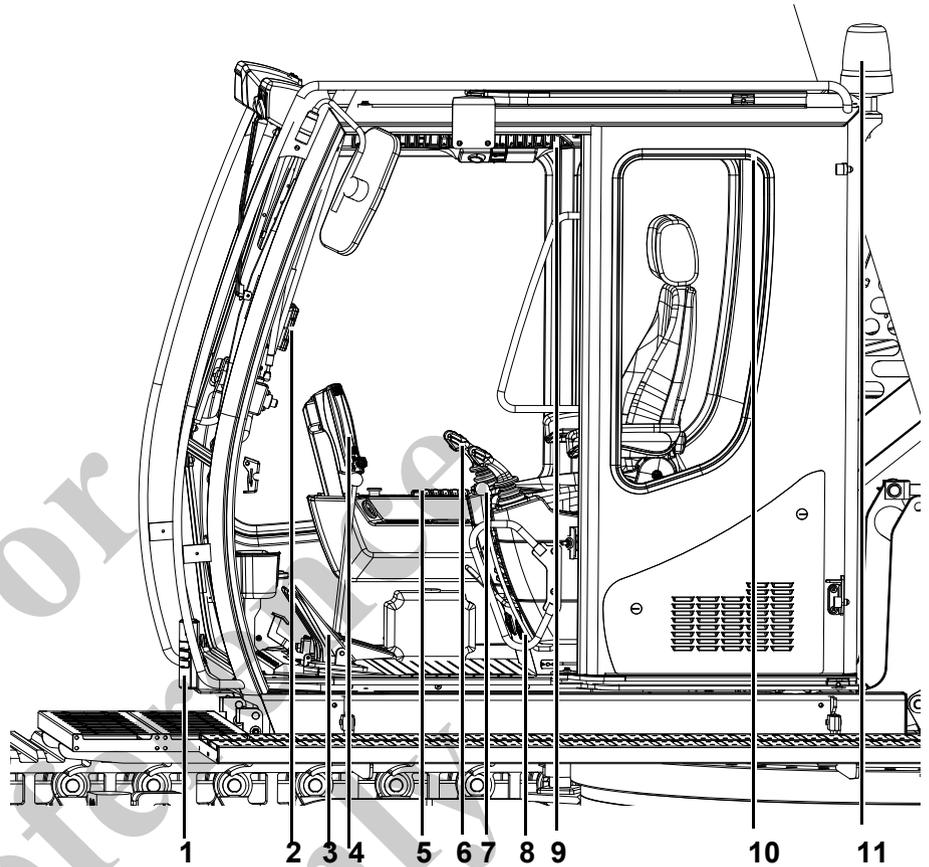
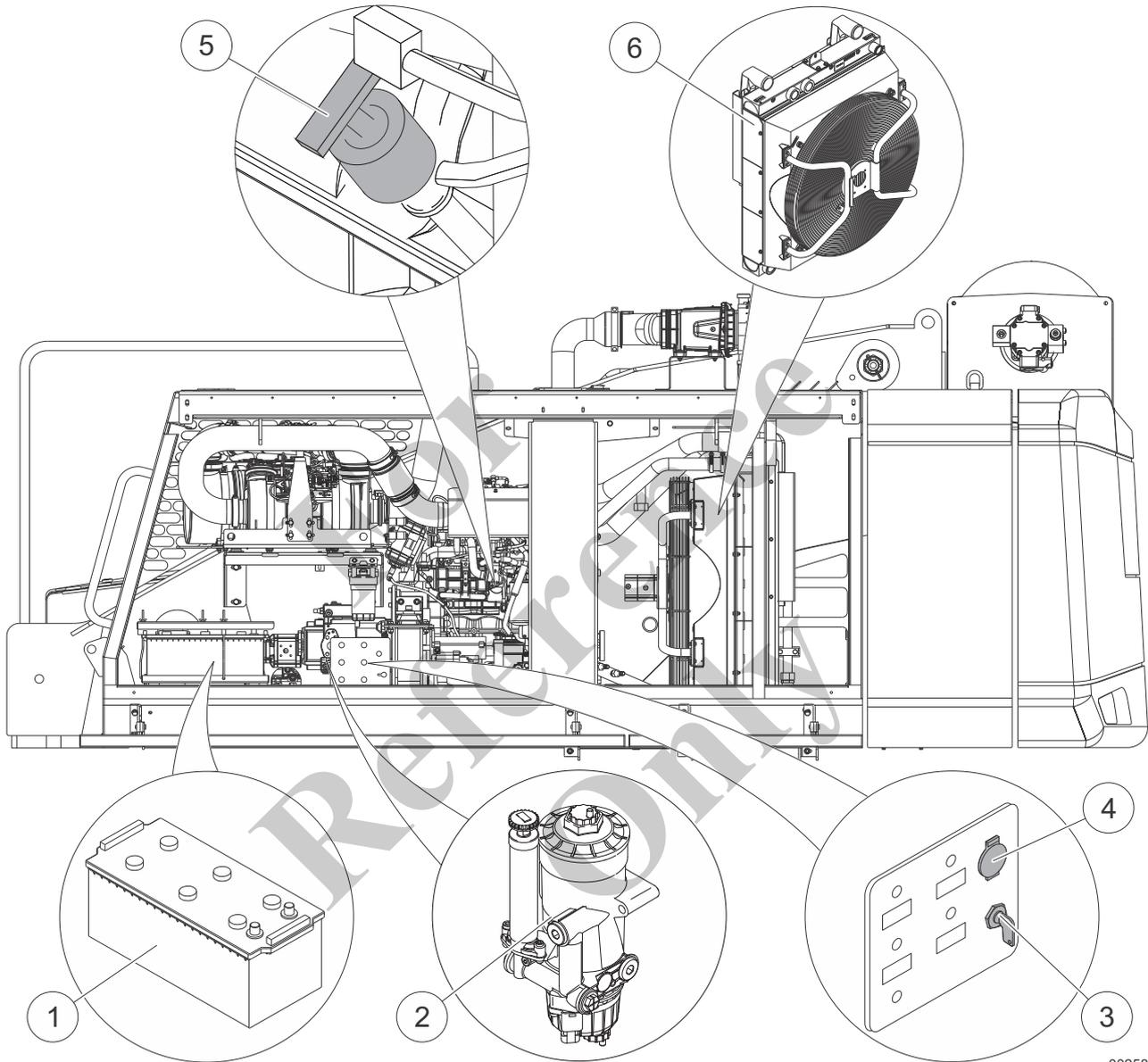


Fig. 6 Components of the cab

1	Visual and acoustic warning system LML	7	Safety lever
2	Camera display	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		

2.4 Uppercarriage



00258

Fig. 7 Service access door, left

1	Battery	4	24 V power socket
2	Fuel prefilter with water separator	5	Dipstick
3	Battery disconnect switch	6	Combination cooler

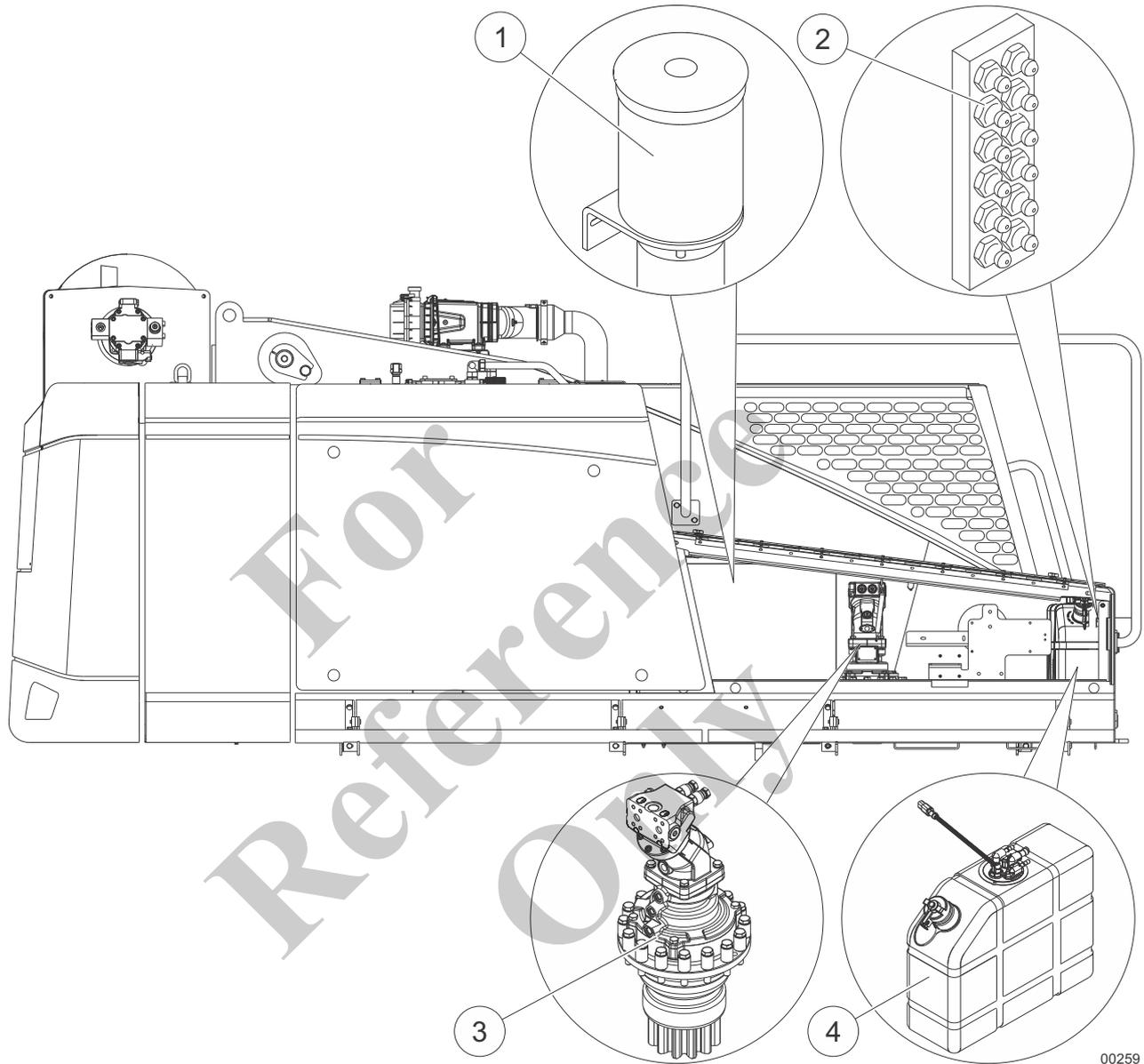


Fig. 8 Service access door, left

00259

1	Slewing ring lubrication
2	Lubricating strip
3	Slewing gear
4	DEF tank (Tier 4f engines)

2.5 Winch

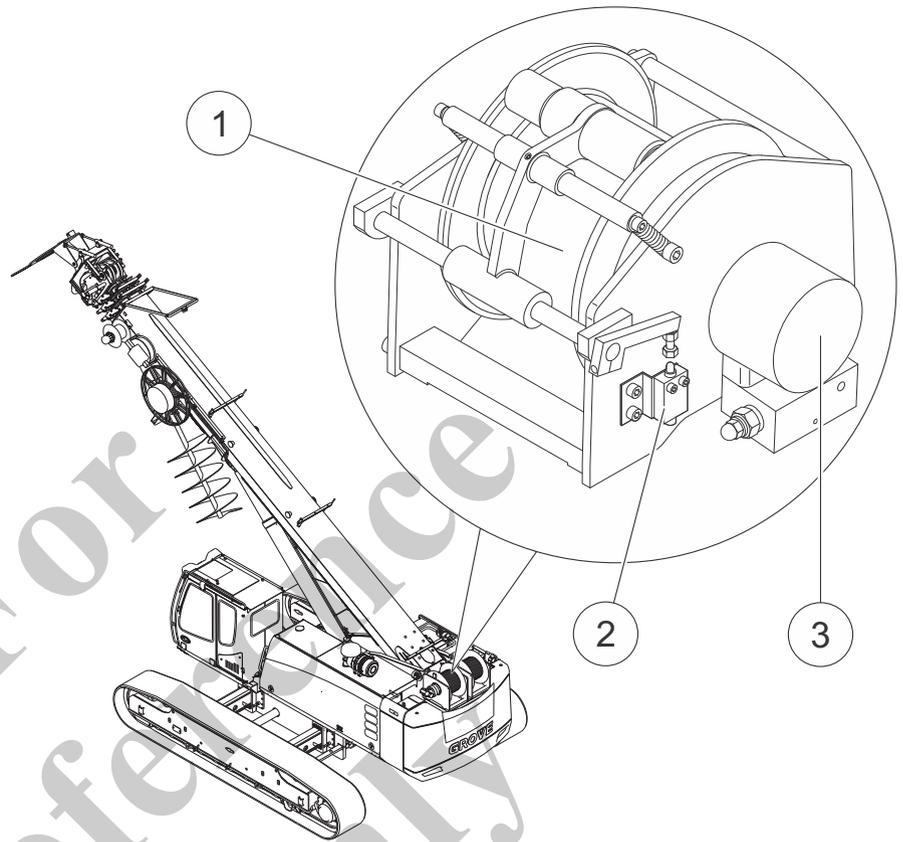


Fig. 9 Winch layout

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

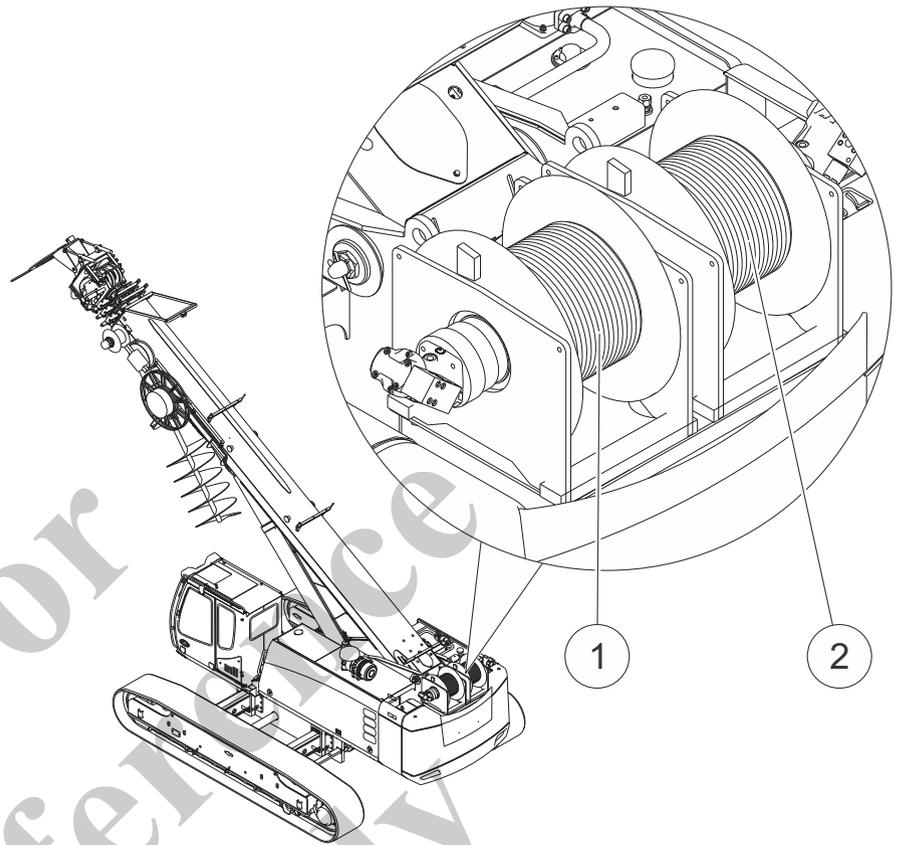


Fig. 10 Winch positions

1	Winch 1
2	Winch 2

Allocation of attachments to winches

Winch 1: Main boom, auxiliary jib, fly boom

Winch 2: Main boom

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3 Technical data

The technical data of the basic machine is listed in Section 3.1. Section 3.6 specifies the load ratings of the machine.



Note

Shipping dimensions and weights for the basic machine are provided in Section 8.5 TRANSPORT DIMENSIONS AND WEIGHTS. Specific information about attachment systems can be found in the manuals for those items.

3.1 Basic machine

Drive engine



Tier IIIa:

Cummins QSB 4.5 diesel engine

Power (in accordance with ISO9349)	119 kW (160 hp) at 2,500 rpm
---------------------------------------	---------------------------------

Displacement	4.5 l
--------------	-------

Cylinders	4
-----------	---



Tier 4f:

Cummins QSB 4.5 diesel engine

Power (in accordance with ISO9349)	129 kW (175 hp) at 2,200 rpm
---------------------------------------	---------------------------------

Displacement	4.5 l
--------------	-------

Cylinders	4
-----------	---

The speed limitation sticker of the diesel engine must be undamaged and free from soiling.



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. For further information on the drive engine refer to the manual provided by the engine manufacturer.

Modifications to delivered device

Any modifications of the delivered device on

- Engine,
- Engine cooling system including ventilation ducts,
- Air filter system,
- Exhaust aftertreatment system,
- Exhaust system

will result in the invalidation of the certification for the diesel engine exhaust emissions and invalidation of the operating certificate for the machine, and also the invalidation of any claims made against Grove.

Electrical system 24 V



Information

Make sure that the available output of the alternator is not exceeded when adding other power consumers (for example headlights).

Hydraulic system Max. operating pressure 330 bar (4 786 psi)

Slewing gear Slewing speed | 0 - 2.0 rpm

Travel speed Max. 0–2.5 kph (0–1.55 mph)

Ambient temperature - 20 °C - + 40 °C (-4 °F - +104 °F)



Information

Special temperature packages are available for operating the machine at ambient temperatures outside the specified temperature range (optional).

Please contact GROVE cranecare if you have any other questions.

3.2 Permissible ground pressure



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

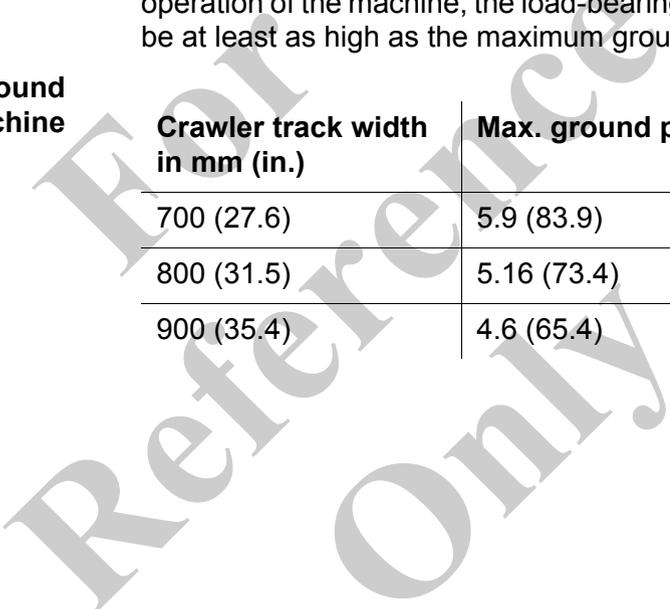
If the machine's ground pressure exceeds the load-bearing capacity of the ground at the operation site, then the ground may give in, causing the machine to fall over. This can cause severe injury.

➤ 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

Crawler track width in mm (in.)	Max. ground pressure in kg/cm² (psi)
700 (27.6)	5.9 (83.9)
800 (31.5)	5.16 (73.4)
900 (35.4)	4.6 (65.4)



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 Grove 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. 11 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 emission standards. This however requires the use of an engine oil with special properties matched to this requirement.

Engine oil filled at the Grove 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 Grove 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 ACEA 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

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

Wind speed can be measured with the optional anemometer. The necessary safety measures (for example, setting down the boom) must be undertaken before the preset limit values are reached.

	Boom length	Wind in operation	Wind not in operation
Main boom	9.4–30.4 m (30.8–99.7 ft)	14.0 m/s (45.9 ft/s)	20.0 m/s (65.6 ft/s)
Main boom with jib	9.4–43.4 m (30.8–142.4 ft)	14.0 m/s (45.9 ft/s)	20.0 m/s (65.6 ft/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"

4	Set down the attached load.
5	Telescope in the boom.
6	Completely lower the boom.
7	Switch off the machine.

3.6 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 tensile force: 50 kN

Hoisting rope diameter: 16 mm (0.63 in)

Capacity	Hook weight in kg (lbs)
5 t	80 (176)
15 t – 1 sheave	190 (419)
35 t – 3 sheaves	270 (595)
60 t – 6 sheaves	850 (1 874)

For Reference Only

3.7 Dimensions of the basic machine

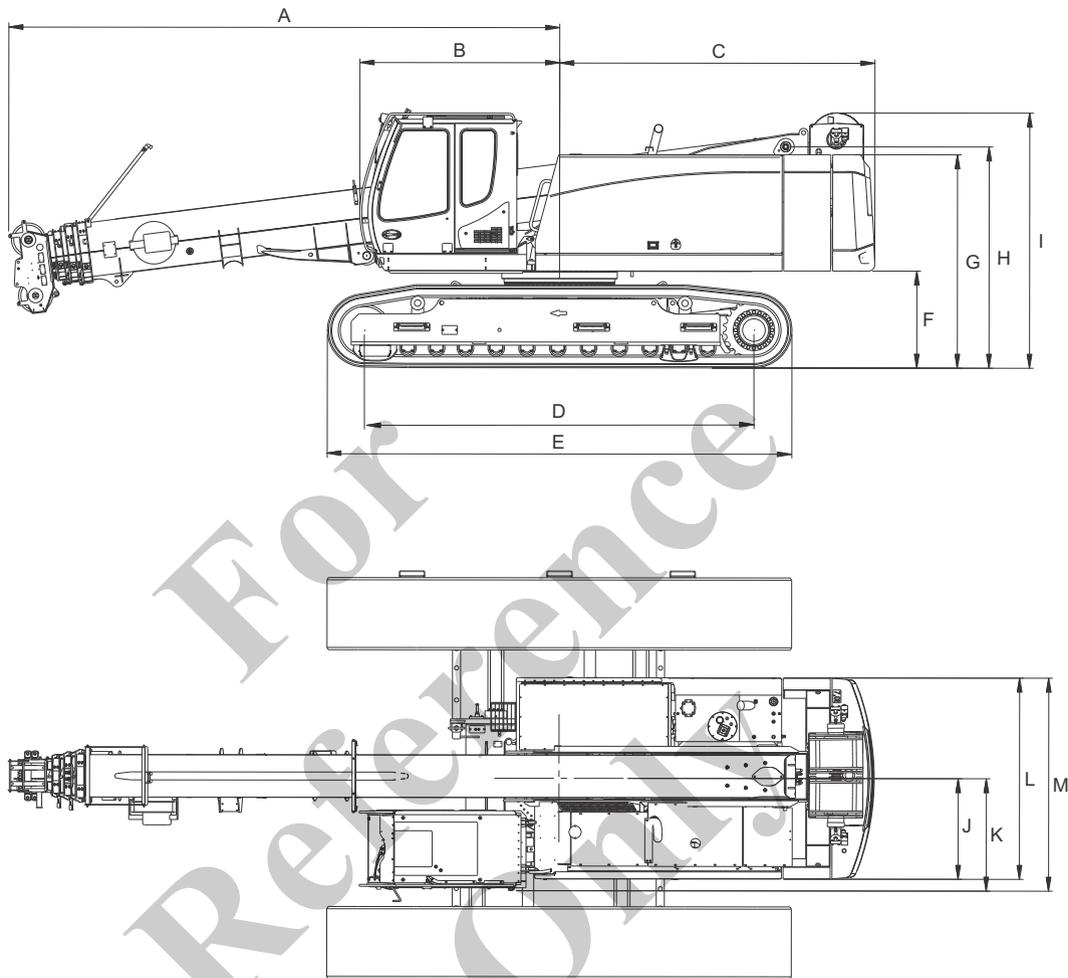
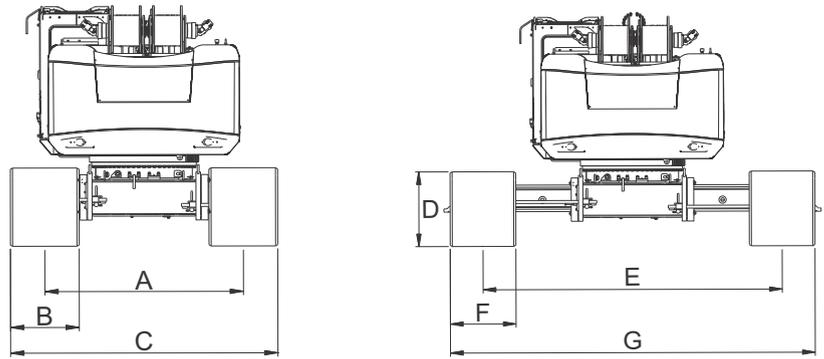


Fig. 12 Dimensions of the basic machine – 1

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	Dimensions in mm (inches)		Dimensions in mm (inches)
A	6 799 (267.7)	H	2 757 (108.5)
W	2 466 (97.1)	I	3 179 (125.2)
C	3 891 (153.2)	J	1 254 (49.4)
D	4 808 (189.3)	P	1 401 (55.2)
E	5 734 (225.7)	L	2 508 (98.7)
F	1 209 (47.6)	M	2 655 (104.5)
G	2 660 (104.7)		



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Fig. 13 Dimensions of the basic machine – 2

	Dimensions in mm (inches)		Dimensions in mm (inches)
A	2 600 (102.4)	E	4 100 (161.4)
W	900 (35.4)	F	900 (35.4)
C	3 500 (137.8)	G	5 000 (196.9)
D	1 034 (40.7)		

For Reference Only

3.8 Working diagram - main boom

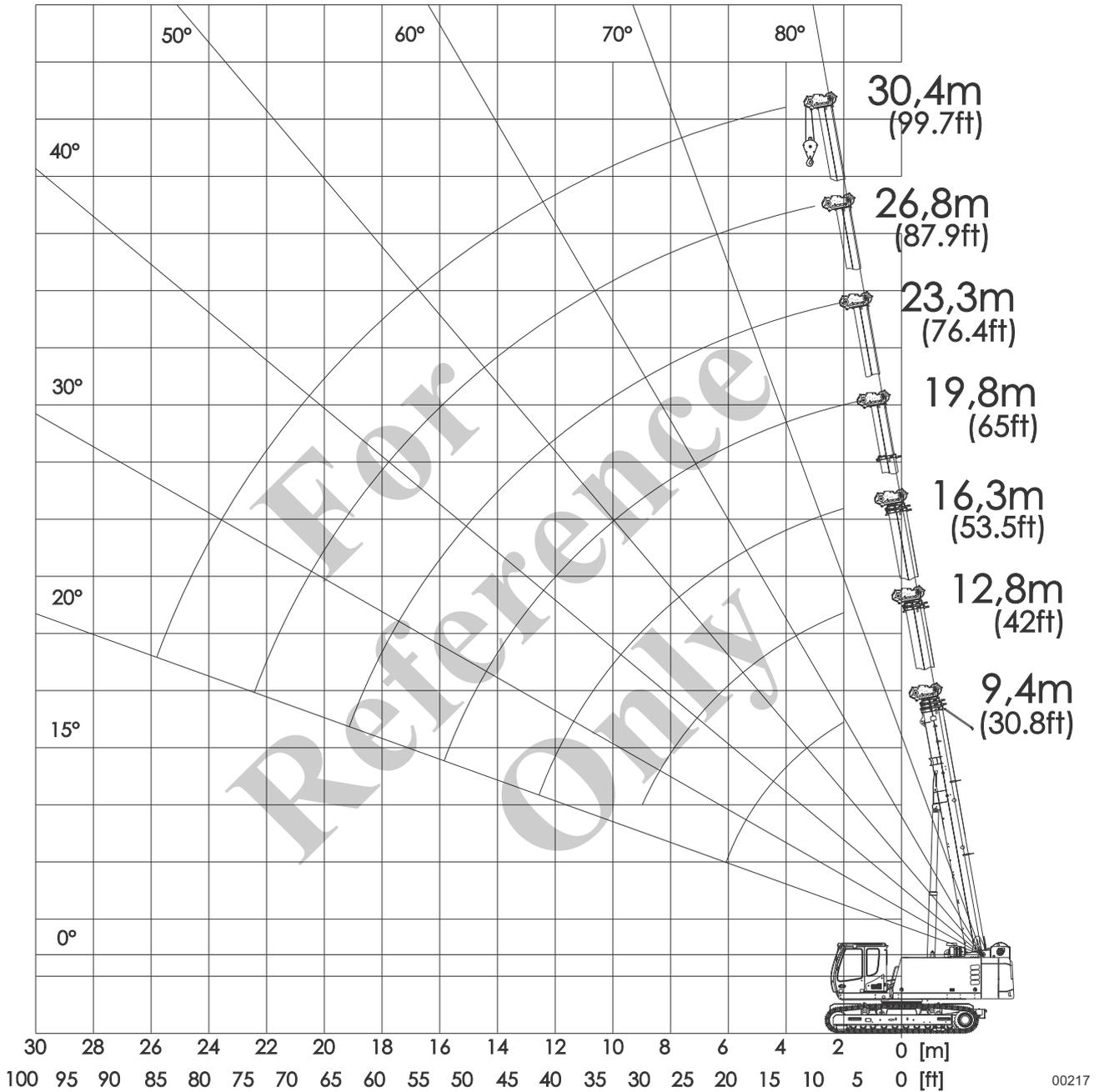


Fig. 14 Work range of the machine depending on boom length and the boom angle

3.9 Weights

	Weight in kg (lbs)
Machine with counterweight	45 300 (99 869)
Fly boom 6.5 m	600 (1 323)
Fly boom 13 m	850 (1 874)

3.10 Working loads

Information



The load ratings

- apply for
 - when the machine is standing on a flat and stable surface ($\pm 0.3^\circ$)
 - maximum undercarriage track width.
- taking the following standards into account:
 - EN 13000
- are indicated in pounds (lbs) and are applicable for 360 degrees.

Deduct the weight of the hoisting accessories (hooks, suspension gear, hoisting rope) from the safe working loads.

Hoisting rope weights per linear meter

Diameter	Weight
Ø 14 mm	1.0 kg/m
Ø 16 mm	1.3 kg/m
Ø 18 mm	1.6 kg/m
Ø 20 mm	2.0 kg/m
Ø 22 mm	2.4 kg/m
Ø 26 mm	3.4 kg/m
Ø 28 mm	4.0 kg/m
Ø 34 mm	5.9 kg/m
Ø 36 mm	6.6 kg/m

Adverse conditions

Limit or reduce load ratings to compensate for adverse conditions. Adverse conditions include

- Soft or uneven ground
- Steep slopes

- Wind
- Lateral loads
- Oscillating loads
- Jerking or sudden stopping of the load
- Inexperience of operating personnel
- Driving with load.

Permissible rope winch

Per strand in crane operation:

At rope diameter 16 mm | 5,000 kg / 11,000 lbs

Load capacity reduced with fly boom (6.5 m) attached to basic body

Boom length in m (ft)	Load capacity reduction in kg (lbs)
9.4 (30.8)	420 (926)
12.8 (42)	310 (683)
16.3 (53.5)	240 (529)
19.8 (65)	200 (441)
23.3 (76.4)	170 (375)
26.8 (88)	150 (331)
30.4 (99.7)	130 (287)

Load capacity reduced with fly boom (13 m) attached to basic body

Boom length in m (ft)	Load capacity reduction in kg (lbs)
9.4 (30.8)	580 (1279)
12.8 (42)	420 (926)
16.3 (53.5)	330 (728)
19.8 (65)	270 (595)
23.3 (76.4)	230 (507)
26.8 (88)	200 (441)
30.4 (99.7)	180 (397)

3.11 Conversion factors

Pressure

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

Flow

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	1609 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

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Reference
Only

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4 Start-up

Safety at 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 1 SAFETY before starting up the machine.

4.1 Initial start-up

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

If the machine was shut down for a prolonged period (> 6 months), contact GROVE 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 1.
- 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 left service access door (1) in Fig. 15.
2	Turn the battery disconnect switch (2) in Fig. 15 to position I.
3	Close the service door.

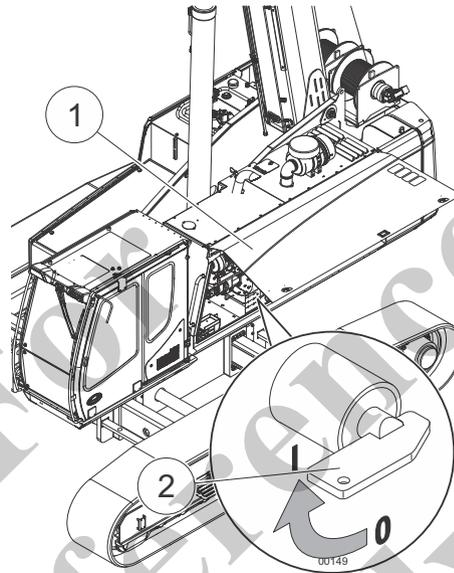


Fig. 15 Switching on the battery disconnect switch

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

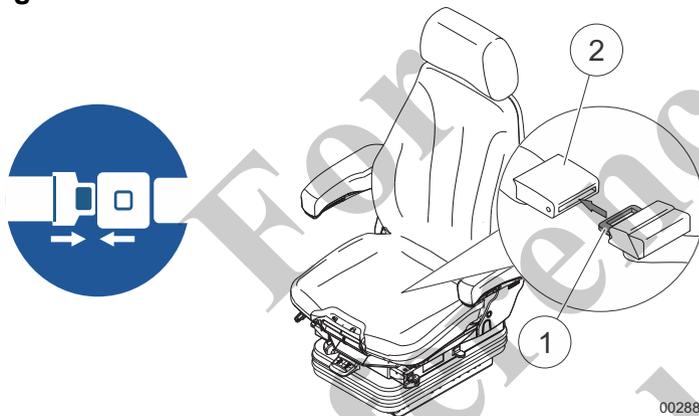


Fig. 16 Closing the seat belt

- 1 Insert the metal tang (1) in Fig. 16 into the belt buckle (2) in Fig. 16.
 - The belt buckle clicks into place.

Opening the seat belt



00289

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.

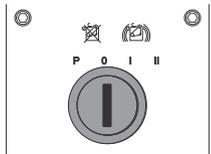


Fig. 18 Ignition lock

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

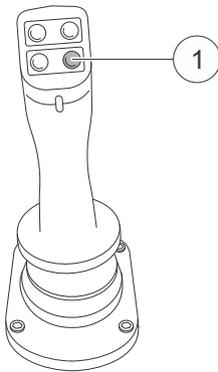


Fig. 19 SENCON loading screen



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.



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

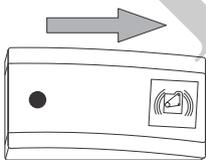
Fig. 20 Horn

Ignition key position

Ignition key position	Meaning
P	Enable fuel pump
0	Ignition OFF
I	Ignition ON
II	Start 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.

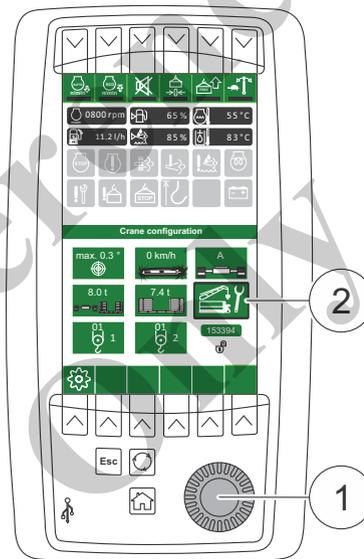
Symbol	Name	Description
	<p>Automatic idle</p>	<p>Automatic idle automatically lowers the engine speed for pauses in work. This saves fuel and protects the environment.</p> <p>Automatic idle has three stages:</p> <ul style="list-style-type: none"> ● Stage 1: 1,440 rpm after 5 seconds of inactivity. ● 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>
	<p>EcoMode</p>	<p>EcoMode reduces maximum speed. This saves fuel and protects the environment.</p> <p>Settings</p> <p> On</p> <p> Off</p>

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. – The Load Moment Limitation window appears.
4	Press the SCROLL wheel (1) on the SENCON. – The selected setting (2) 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. – The setting can now be changed.
7	Roll the SCROLL wheel to change the setting.
8	Press the  button on the SENCON. – 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



WARNING

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.

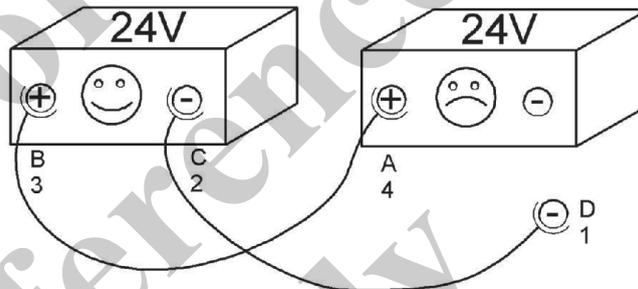
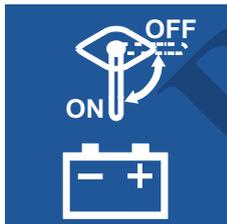


Fig. 22 Sequence for connecting an external power source



1	Activate the battery disconnect switch.
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	Activate the battery disconnect switch.
6	Start the engine in accordance with Section 4.4.2.
7	Removal: – Detach jumper cable from negative terminal (-). – Detach jumper cable from 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 over-heating!
 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.).

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>).

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5 SENCON 2.0

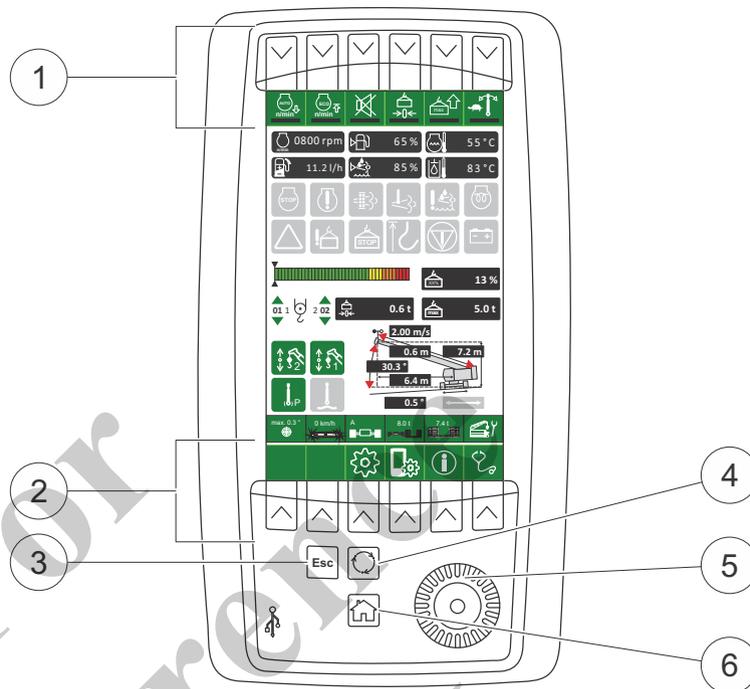


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About this chapter

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 selection buttons and quick selection icons	Quick selection icons are enabled or disabled by the corresponding quick selection button.
2	Menu buttons and menu icons	Menus are opened by the corresponding menu button.
3	ESC button	<ul style="list-style-type: none"> ● Cancel an action. ● Return to the previous menu.
4	SET button	<ul style="list-style-type: none"> ● Save settings.
5	SCROLL wheel	Turning the SCROLL wheel selects individual windows and menu entries, and navigates through lists.
6	HOME button	Return to the start screen.

5.1.1 Quick selection icons

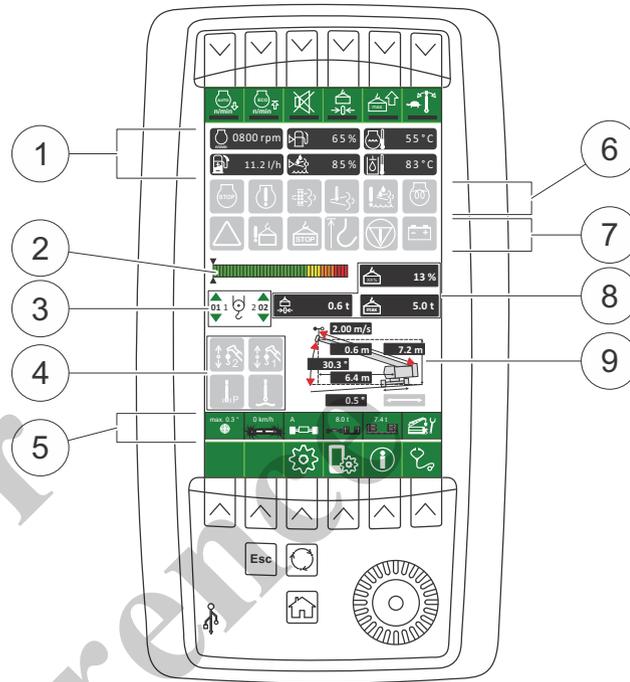
Symbol	Name	Description
	Automatic idle	<p>Automatic idle automatically lowers the engine speed for pauses in work. This saves fuel and protects the environment.</p> <p>Automatic idle has three stages:</p> <ul style="list-style-type: none"> ● Stage 1: 1,440 rpm after 5 seconds of inactivity. ● Stage 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
	LML parameters	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 Grove Service Partner.

5.2 Start screen



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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:

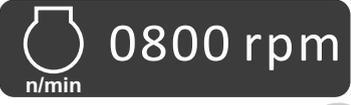
- Gray: Operating status is within normal range.
- Orange: Operating status is near the limit of normal range.
 - Take corrective action soon.
- Red: Operating status has exceeded normal range.
 - Park machine immediately.
 - Correct error immediately.
 - Only operate machine when error has been corrected.



Information

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

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

Symbol	Name	Description
	Diesel engine speed	
	Fuel level	Gray: <ul style="list-style-type: none"> ● Fuel level normal. Orange: <ul style="list-style-type: none"> ● Refuel machine at the next opportunity. Red: <ul style="list-style-type: none"> ● Refuel machine immediately.
	Coolant temperature	Gray: <ul style="list-style-type: none"> ● Coolant temperature normal. Orange: <ul style="list-style-type: none"> ● Reduce diesel engine load. Red: <ul style="list-style-type: none"> ● Lower attached loads. ● Let diesel engine go to idle.

Symbol	Name	Description
	Current fuel consumption	
	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.
	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.

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>
		Soil drill function active
		Soil drill function inactive
		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.
		Slewing gear holding brake not applied.

Symbol	Possible statuses	Explanation
		Slewing gear freewheel disengaged.
		Slewing gear freewheel engaged.
		<p>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.</p>

For Reference Only

5.2.3 Diesel engine notification and warning icons

Symbol	Description	Status
	Serious diesel engine error	Gray: <ul style="list-style-type: none"> ● Diesel engine is functioning properly. Red: <ul style="list-style-type: none"> ● Park machine at a safe location immediately. ● Contact your Grove Service Partner. ● Do not operate machine until error has been corrected.
	Diesel engine error	Gray: <ul style="list-style-type: none"> ● Diesel engine is functioning properly. Orange: <ul style="list-style-type: none"> ● Contact your Grove Service Partner.
	SCR catalytic converter depletion level (Tier 4f engines)	Gray: <ul style="list-style-type: none"> ● SCR catalytic converter automatic cleaning enabled. ● SCR catalytic converter depletion level normal. Orange: <ul style="list-style-type: none"> ● SCR catalytic converter depletion level high. ● Manually enable SCR catalytic converter cleaning immediately. Orange strikethrough: <ul style="list-style-type: none"> ● SCR catalytic converter automatic cleaning disabled. ● Enable SCR catalytic converter automatic cleaning soon. Flashing: <ul style="list-style-type: none"> ● Contact your Grove Service Partner.
	Exhaust temperature	Gray: <ul style="list-style-type: none"> ● Exhaust temperature normal. Orange: <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 Grove Service Partner.
		Red: <ul style="list-style-type: none"> ● LML error ● Check error number in the diagnostics windows. ● Contact your Grove Service Partner.
		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: <ul style="list-style-type: none"> ● Lifting limit switch off.
		Red: <ul style="list-style-type: none"> ● Lifting limit switch on.
		Red: <ul style="list-style-type: none"> ● Lifting limit switch bypassed.

5.2.5 Overall machine notification and warning icons

Symbol	Possible statuses	Explanation
		Gray: <ul style="list-style-type: none"> ● No error.
		Orange: <ul style="list-style-type: none"> ● Check error number in the diagnostics windows. ● Contact your Grove Service Partner.
		Orange: <ul style="list-style-type: none"> ● Check error number in the diagnostics windows. ● Contact your Grove Service Partner.
		Red: <ul style="list-style-type: none"> ● Check error number in the diagnostics windows. ● Contact your Grove Service Partner.

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

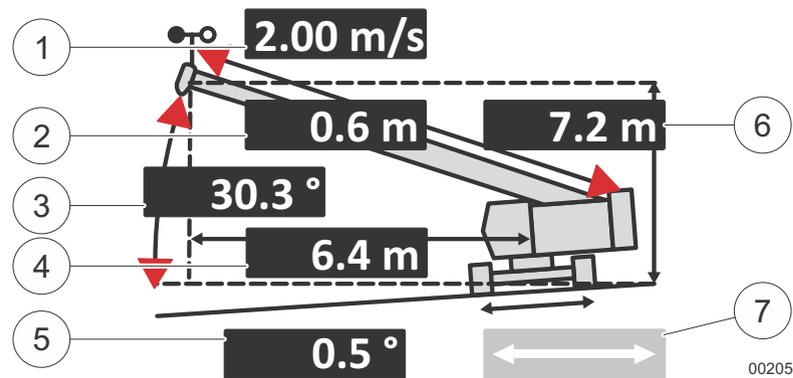
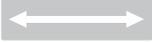


Fig. 25 Working diagram

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: <ul style="list-style-type: none"> ● Value unavailable. Green: <ul style="list-style-type: none"> ● Work equipment can be moved. Red: <ul style="list-style-type: none"> ● Work equipment cannot be moved. ● Limit switch on. Crossed out: <ul style="list-style-type: none"> ● Limit switch bypassed.

Symbol	Name	Description
 	Track width monitoring	Gray: <ul style="list-style-type: none"> Track width permitted for the selected operating mode Red: <ul style="list-style-type: none"> Track width not permitted for the selected operating mode

5.2.7 Winch parameters

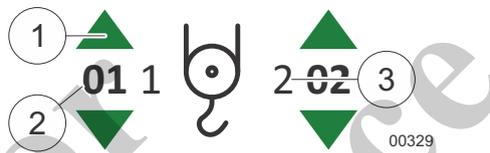


Fig. 26 Winch parameters

1	Direction of movement
2	Reeving number
3	Winch number

5.3 Load moment limitation

The load moment limitation operating parameters for the desired operating mode 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.

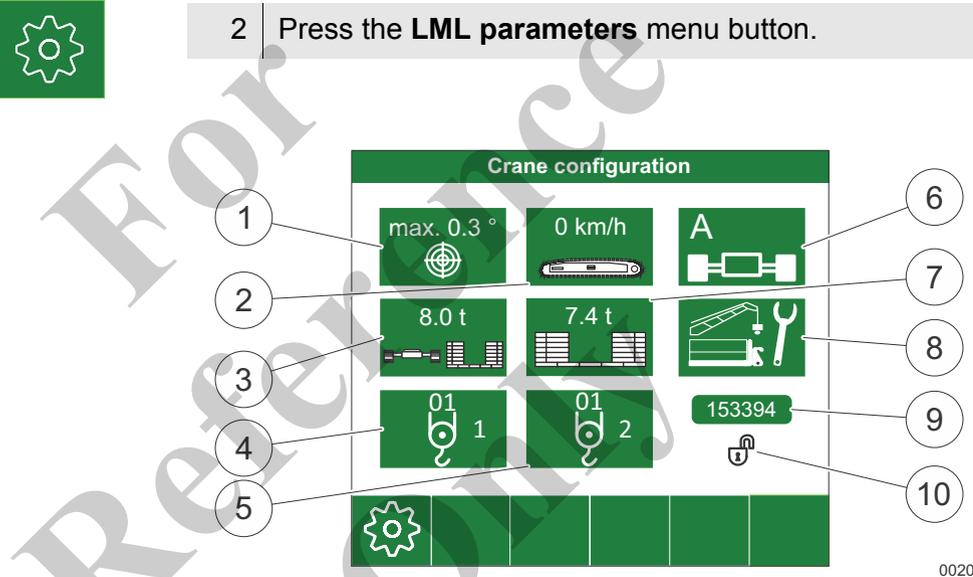
Opening LML settings



1 | Press the HOME button.



2 | Press the **LML parameters** menu button.



00206

Fig. 27 Crane configuration

1	Machine inclination
2	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.

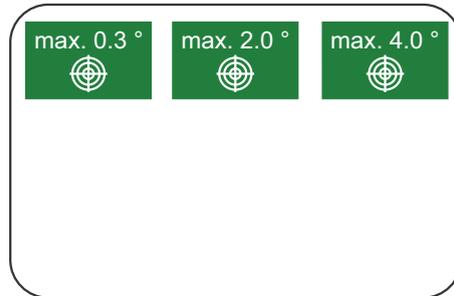
The load change lock can be reset once by turning the ignition off and back on again.

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

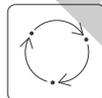
5.3.1 Entering uppercarriage inclination

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.

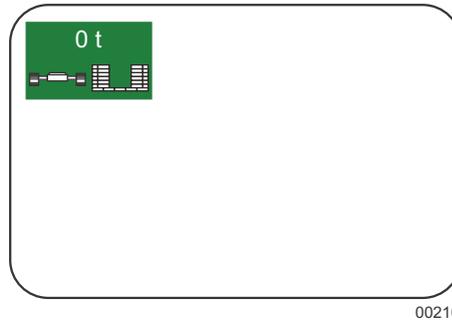


Fig. 29 Undercarriage ballast

	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.

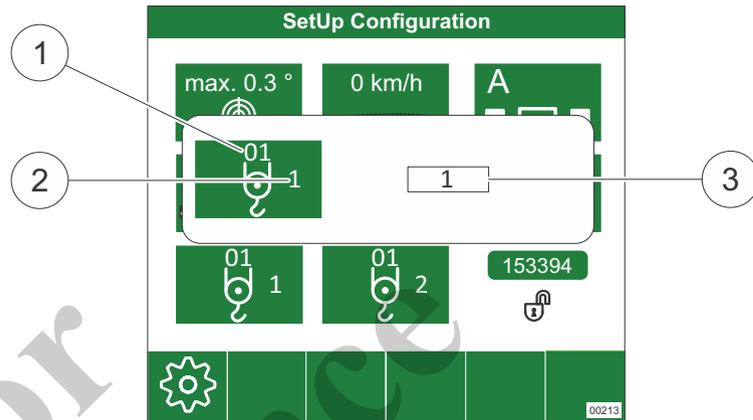
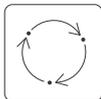


Fig. 30 Winch reeving

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

Reference Only

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.

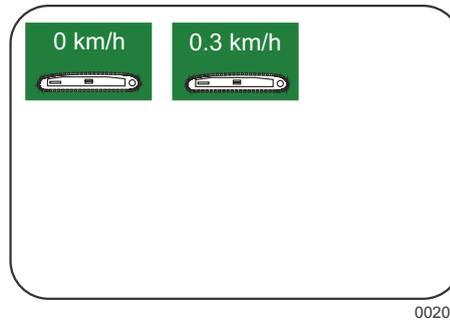
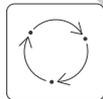


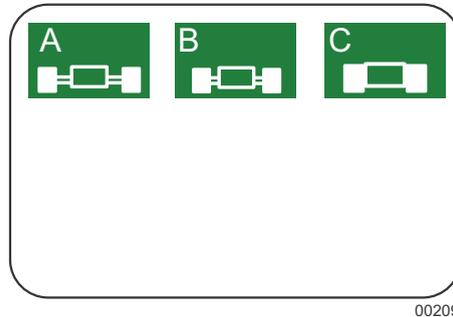
Fig. 31 Travel speed

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.



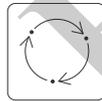
5.3.5 Entering track width

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.

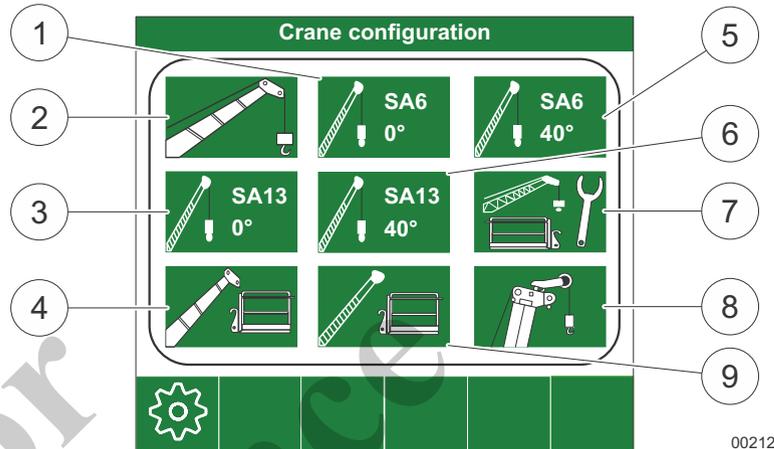
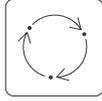


Fig. 33 Attachments and setup program

1	6.5 m (21.3 ft) fly boom
2	Main boom
3	13 m (42.7 ft) fly boom
4	Main boom with elevating work platform
5	6.5 m (21.3 ft) fly boom at 40°
6	13 m (42.7 ft) fly boom at 40°
7	Setup program
8	Auxiliary jib
9	Fly boom with elevating work platform

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.

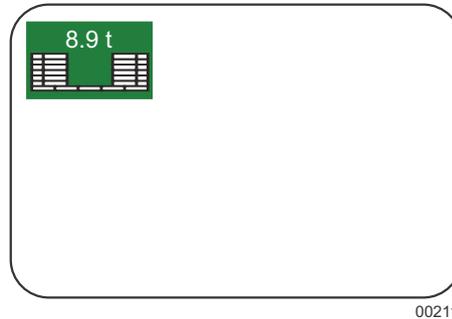


5	Press the SCROLL wheel.
6	Configure other LML parameters as needed.
7	Press the SET button. <ul style="list-style-type: none">– The LML parameters are saved. The start screen appears.

For
Reference
Only

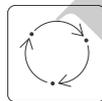
5.3.7 Entering counterweight

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 Setting language

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

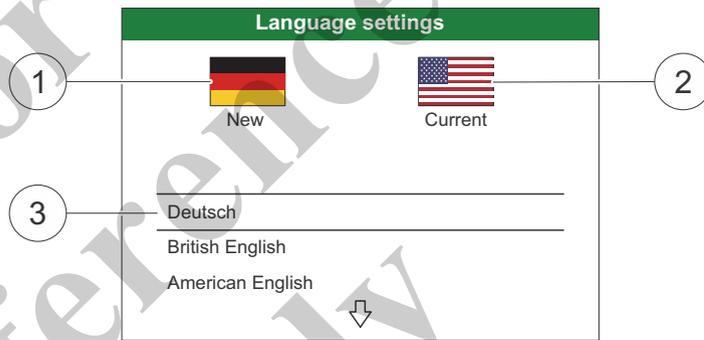
Opening language settings



1 | Press the HOME button.



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

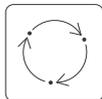


00073

Fig. 35 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.

5.5 Setting brightness

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

Opening brightness settings

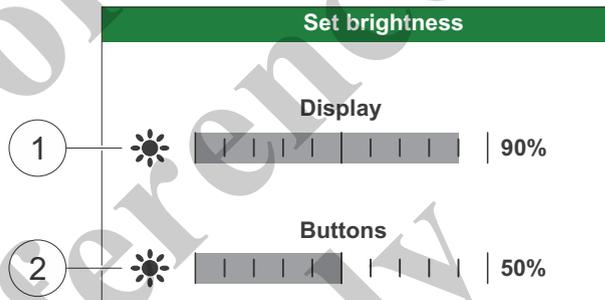


1 | Press the HOME button.



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

3 | Turn the SCROLL wheel one step to the right.



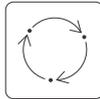
00074

Fig. 36 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

5.6 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.

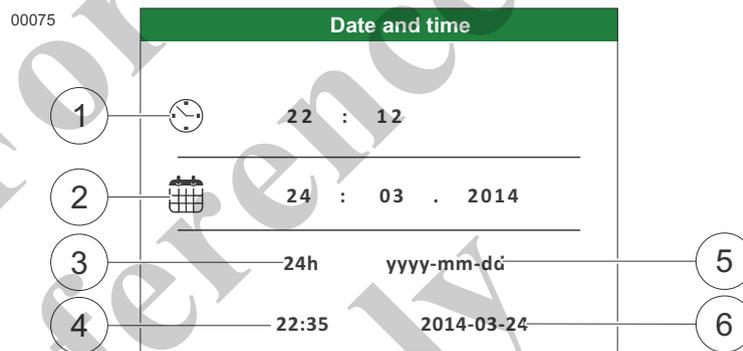
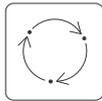


Fig. 37 Setting date and time

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

5.7 Configuring units

The displayed units of measurement are configured in the **System of units** window.

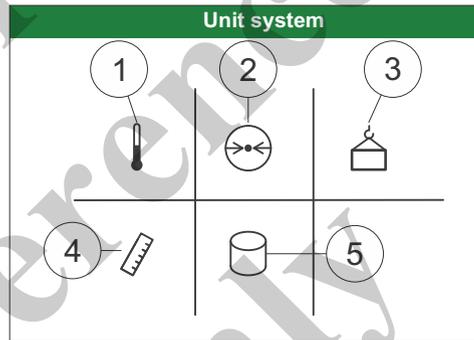
Opening the unit settings



- 1 Press the HOME button.



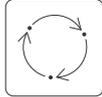
- 2 Press the **Device settings** menu button.
- 3 Turn the SCROLL wheel three steps to the right.



00076

Fig. 38 Unit system

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

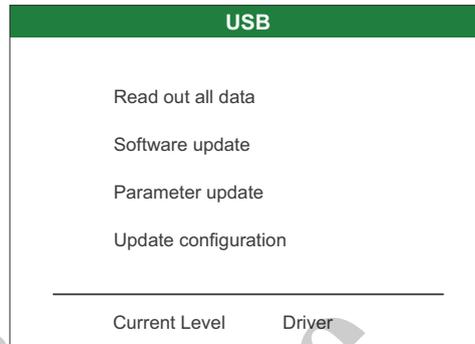
**Configuring units
of measurement**

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

5.8 USB

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

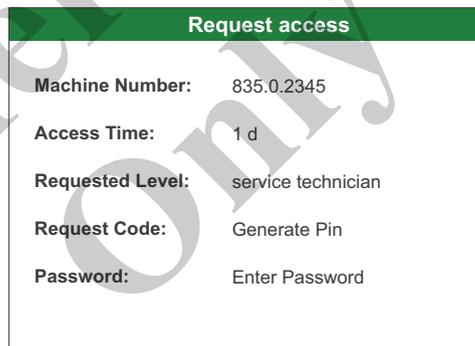


00077

Fig. 39 USB

5.9 Request access

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



00078

Fig. 40 Request access

5.10 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.

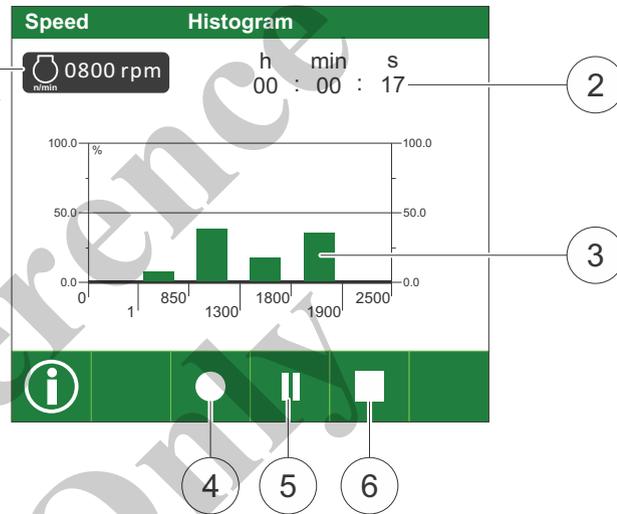


Fig. 41 Histogram

00080

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

5.11 Login information

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

Registration information	
Name	
company	
current level	operator
remaining time	-

00081

Fig. 42 Fig. 29: Login information

For Reference Only

5.12 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.

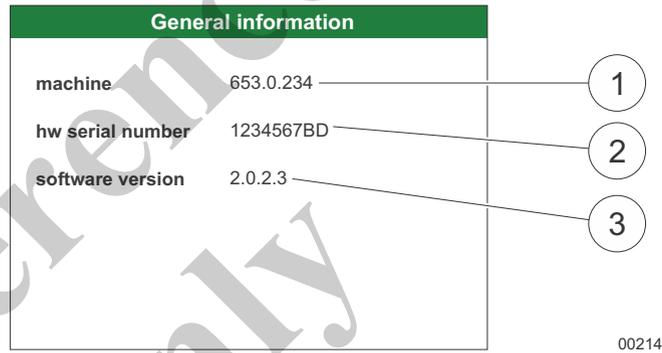


Fig. 43 General

1	Machine number [machine]
2	SENCON serial number [hw serial number]
3	Software version [software version]

5.13 Diagnostics

The **Active faults engine**, **Active faults machine** and **Active faults RCL** diagnostic windows display the current machine status and errors.

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

If an error message is not in the overview, it must be sent to your Grove Service Partner. The SPN code and FMI code must be included with the error message. This information allows the service technician to diagnose the error and take appropriate measures.

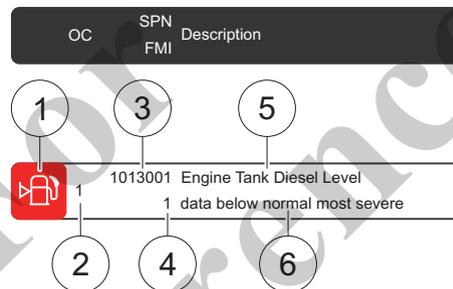


Fig. 44 Sample error message

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



Note

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

Scroll through the list with the SCROLL wheel.



Note

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

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

5.13.1 Active faults engine

The **Active faults engine** window displays the diesel engine errors that have occurred.

Opening Active faults engine



1 | Press the HOME button.



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

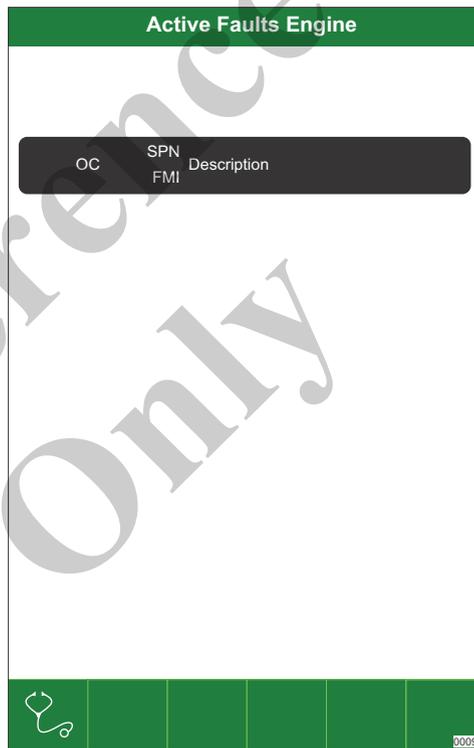


Fig. 45 Active faults engine diagnostics

5.13.2 Active faults machine

The **Active faults machine** window displays the overall machine errors 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.

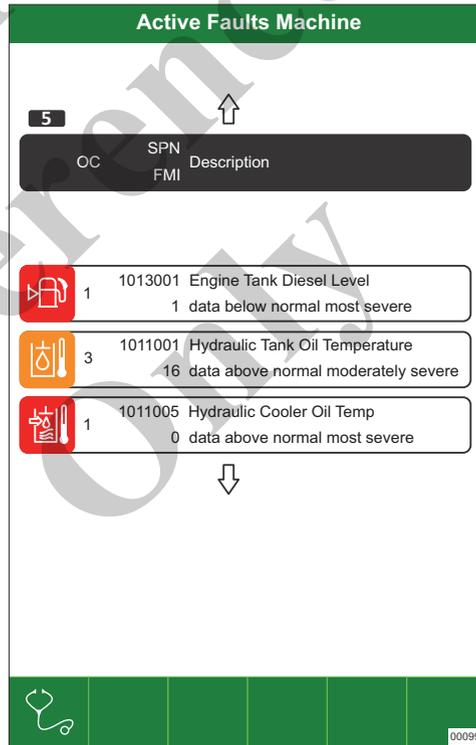


Fig. 46 Active faults machine diagnostics

Overview of status messages

SENCON icon	SPN	FMI	Description	Remedy
	<ul style="list-style-type: none"> ● 1011001 	<ul style="list-style-type: none"> ● 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.
	<ul style="list-style-type: none"> ● 1011002 	<ul style="list-style-type: none"> ● 0 ● 15 ● 16 	Hydraulic oil return filter contaminated Acknowledgment required!	<ul style="list-style-type: none"> ● Contact your Grove Service Partner.
	<ul style="list-style-type: none"> ● 1011003 	<ul style="list-style-type: none"> ● 0 ● 15 ● 16 	Hydraulic leakage oil filter contaminated Acknowledgment required!	<ul style="list-style-type: none"> ● Contact your Grove Service Partner.
	<ul style="list-style-type: none"> ● 1011007 	<ul style="list-style-type: none"> ● 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.
	<ul style="list-style-type: none"> ● Various codes possible 	<ul style="list-style-type: none"> ● 9 	CAN network error	<ul style="list-style-type: none"> ● Contact your Grove Service Partner.

Overview of engine messages

SENCON icon	SPN	FMI	Description	Remedy
	<ul style="list-style-type: none"> ● 95 	<ul style="list-style-type: none"> ● 16 	Fuel filter contaminated	<ul style="list-style-type: none"> ● Change the fuel filter
	<ul style="list-style-type: none"> ● 97 	<ul style="list-style-type: none"> ● 15 ● 16 	Water in fuel	<ul style="list-style-type: none"> ● Contact your Grove Service Partner.
	<ul style="list-style-type: none"> ● 100 	<ul style="list-style-type: none"> ● 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.
	<ul style="list-style-type: none"> ● 101 	<ul style="list-style-type: none"> ● 0 ● 15 ● 16 	Crankcase pressure too high	<ul style="list-style-type: none"> ● Check crankcase breather line. Clean as needed. ● Contact your Grove Service Partner.

SENCON icon	SPN	FMI	Description	Remedy
	<ul style="list-style-type: none"> ● 105 	<ul style="list-style-type: none"> ● 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 contamination and proper functioning, and clean as needed.
	110	<ul style="list-style-type: none"> ● 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.
	<ul style="list-style-type: none"> ● 111 	<ul style="list-style-type: none"> ● 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	<ul style="list-style-type: none"> ● 0 ● 15 ● 16 	Fuel temperature too high.	<ul style="list-style-type: none"> ● Let diesel engine go to idle. ● Check fuel level. Refuel as needed.
	<ul style="list-style-type: none"> ● 175 	<ul style="list-style-type: none"> ● 16 	Diesel engine temperature too high.	<ul style="list-style-type: none"> ● Let diesel engine go to idle. ● Check oil level. Add oil as needed.
	<ul style="list-style-type: none"> ● 623 	<ul style="list-style-type: none"> ● 31 	Engine warning Acknowledgment required!	<ul style="list-style-type: none"> ● Note all engine warning messages. ● Contact your Grove Service Partner.
	<ul style="list-style-type: none"> ● 624 	<ul style="list-style-type: none"> ● 31 	Engine warning Acknowledgment required!	<ul style="list-style-type: none"> ● Switch off the diesel engine. ● Note all engine warning messages. ● Contact your Grove Service Partner.

SENCON icon	SPN	FMI	Description	Remedy
	● 1761	● 1 ● 17 ● 18	DEF level low (Tier 4f engines)	● Add DEF.
	● 4096	● 31		
	● 3364	● 1 ● 15 ● 18	DEF quality bad (Tier 4f engines)	● Check DEF quality with refractometer. ● Drain DEF tank. ● Refill with fresh DEF.
	● 4094	● 31		
	● 4334	● 18	DEF pressure too low (Tier 4f engines)	● Check DEF level. Add DEF as needed. ● Check DEF lines. ● Check DEF tank filter. ● Contact your Grove Service Partner.
	● 5394	● 5 ● 7	DEF feed unit not working (Tier 4f engines)	● Contact your Grove Service Partner.
	● 1013001	● 17 ● 18	Fuel level too low	● Refuel machine.
	● 1014000	● 15	Air filter contaminated Acknowledgment required!	● Contact your Grove Service Partner.
		● 31	Wait-to-start light on	● Only start the motor when the message disappears.
		● 1 ● 17 ● 18	Exhaust gas temperature too low Acknowledgment required!	● Contact your Grove Service Partner.

5.13.3 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.

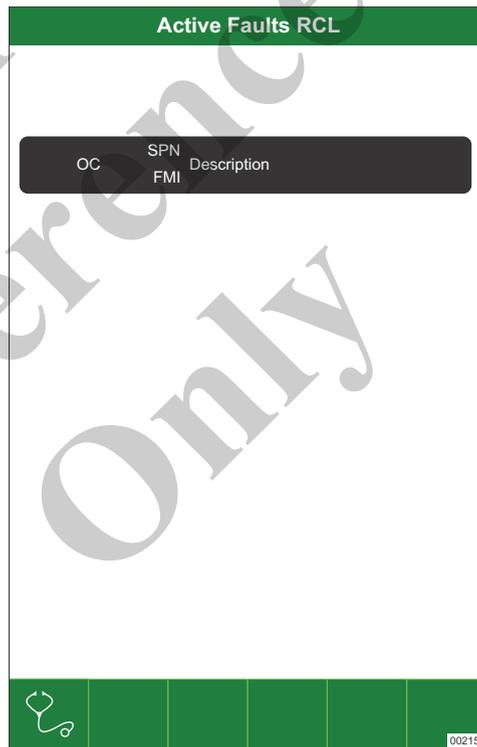


Fig. 47 Active faults RCL diagnostics

6 Operation

6.1 Safety instructions

- 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.
- Work only if the work area is level and solid enough.
- Ensure that no one is in the danger zone.
- Maintain safety clearance to overhead power lines.
- Only operate the machine from the operators seat (except for with the optional Grove remote control).
- Do not transport persons on the machine.
- Take environmental conditions, for example, poor visibility, wind speeds, et cetera, into account.
- Use the load lift charts for the machine.
- Comply with capacity specifications.
- Check whether attachment points and attachment ropes have an adequate safe working load.
- Comply with banksman's signals.
- For long drives, position the boom in the direction of travel, and hook in and secure the bottom hook block to the undercarriage.
- Before leaving the cab:
 - Park machine on a firm substrate. If necessary, set back from excavation edge
 - Lower attached loads
 - Secure equipment
 - Pull safety lever back
 - Block running gear
 - Switching off engine

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

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

- Make sure the controls and safety features are working properly before starting the machine back up.

NOTICE**Risk of damage to the machine when freeing jammed loads.**

Improper pile driving or improperly pulling jammed loads free can damage the machine.

- Observe the regulations for pile driving or pulling jammed loads free (see Chapter 1.8.4)
- Check the functionality and operating mode of the LML using 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.

6.2 Cab

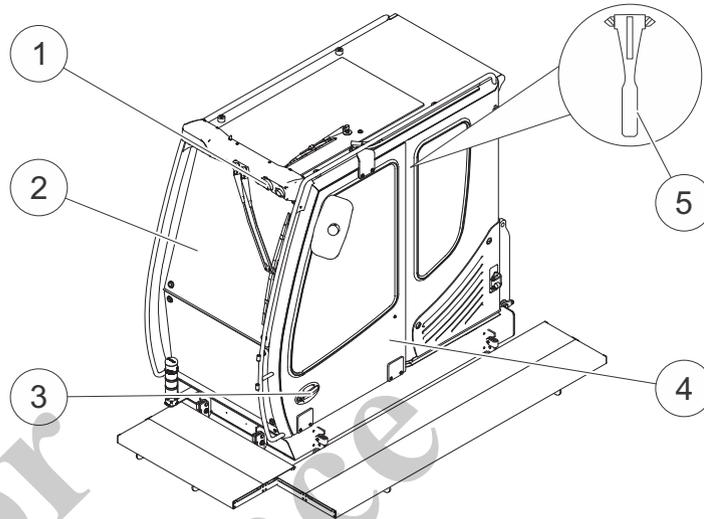


Fig. 48 Cab components

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 to break the glass Fig. 48.

Sliding door

The sliding door (5) in Fig. 49 can be held open with a catch on the side panel of the cab. Pulling on the release lever (5a) in Fig. 49 on the inside of the door releases the locking mechanism.

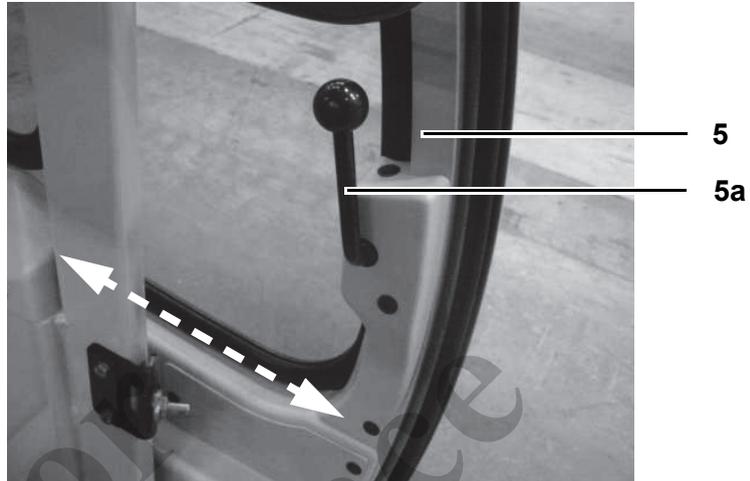


Fig. 49 Locking mechanism of the cab door

For Reference Only

Opening and closing the windshield

1	Press both buttons (2a) in Fig. 50.
2	Push the windshield forward to open it.
3	To close the windshield, push the buttons (2a) in Fig. 50 and pull on the handles (2b) in Fig. 50 until the windshield locking mechanism engages.

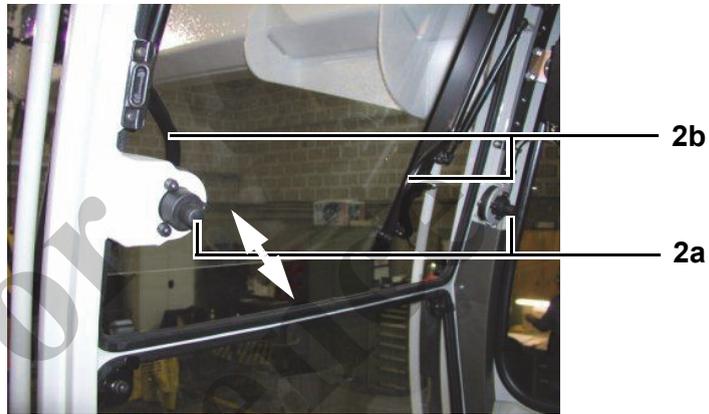


Fig. 50 Opening and closing the windshield

Turning the inside light on and off

1	The inside light (1) in Fig. 51 turns on when the cab door is opened.
2	Closing the cab door or turning the switch (2) in Fig. 51 to position 0 turns off the inside light.

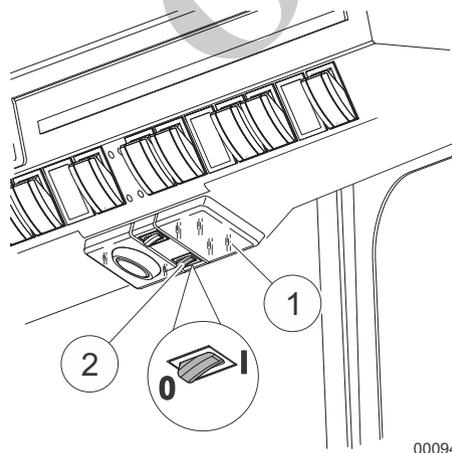


Fig. 51 inside light

00094

Turning the spotlight on and off

1	Turn the switch (1) in Fig. 52 to position I. – This turns on the spotlight (2) in Fig. 52.
2	Turn the switch (1) in Fig. 52 to position 0. – This turns the spotlight off.



00095

Fig. 52 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) in Fig. 53 and speakers (10) in Fig. 53 are located behind the driver seat below the cab roof.

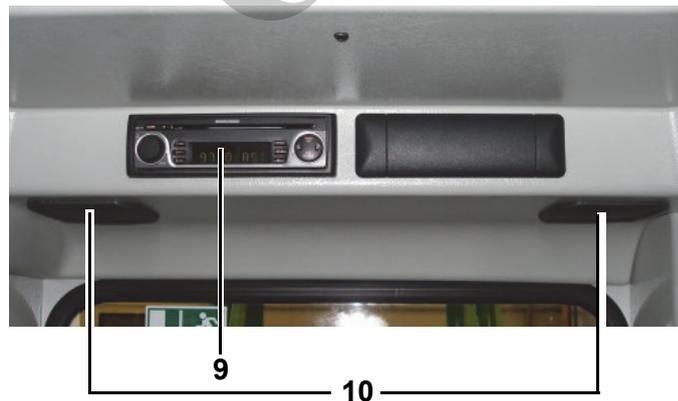


Fig. 53 Radio

**Note**

Refer to the radio manufacturer's operating manual for more information.

6.2.1 Driver seat**WARNING****Danger of accident due to incorrect use of the driver seat!**

Risk of personal injury as a consequence of malfunctions of the driver seat.

- Before starting up the machine, ensure that all adjustments of the driver seat are properly locked in place.
- Only adjust the driver seat when the machine is at a standstill.
- Do not store any objects in the pivot range of the driver seat.
- Each time the machine is serviced, perform a function check of the driver seat.

CAUTION**Back injuries due to incorrectly set operator weight on the driver seat!**

The wrong seat settings can result in permanent back damage.

- Adjust the driver seat to the operator weight prior to each start-up.

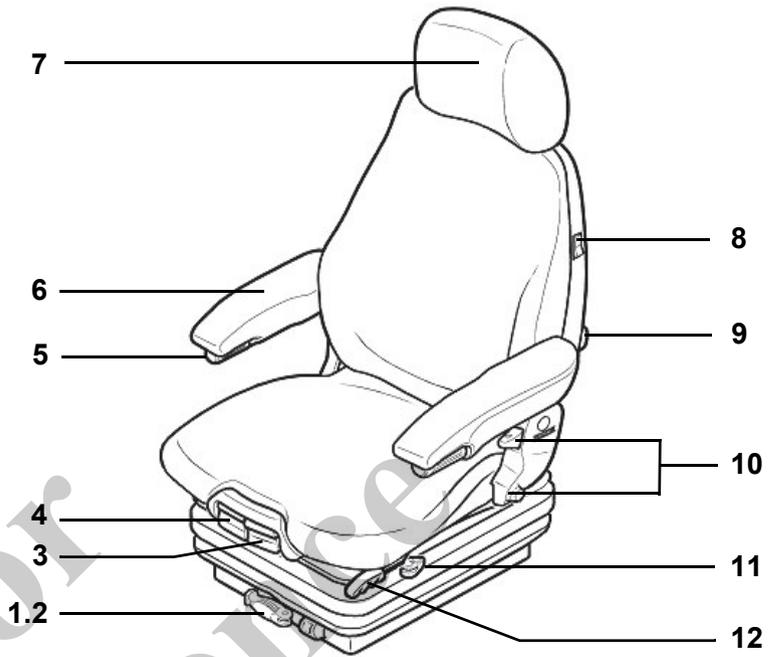


Fig. 54 Driver seat

1	Weight adjustment
2	Height adjustment
3	Seat tilt adjuster (option)
4	Seat depth adjuster (option)
5	Armrest tilt adjuster (option)
6	Arm rests (option)
7	Headrest/seatback extension
8	Seat heater
9	Lumbar support
10	Backrest adjustment
11	Horizontal suspension (option)
12	Length adjustment

6.2.2 Tilting the cab

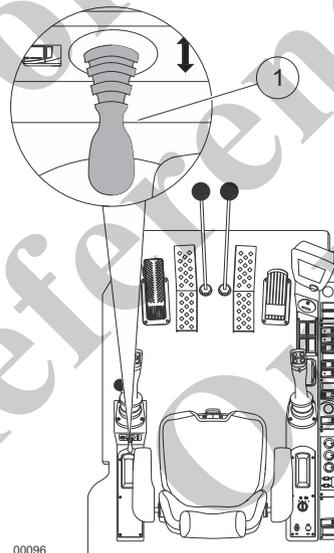
WARNING

Risk of death from shearing and crushing when tilting the cab.

Persons can be crushed between the cab and the undercarriage.

➤ Make sure no one is underneath, behind or on top of the cab when tilting it.

1	Start the diesel engine.
2	Increase engine speed using the speed adjuster on the right-hand control panel.
3	To increase tilt, move lever (1) in Fig. 55 upward.
4	To decrease tilt, move lever (1) in Fig. 55 downward.



00096
Fig. 55 Setting cab tilt



Information

The cab stops in its current position as soon as the switch is released; maximum angle to the rear is 15°.

6.3 Operating elements in the cab

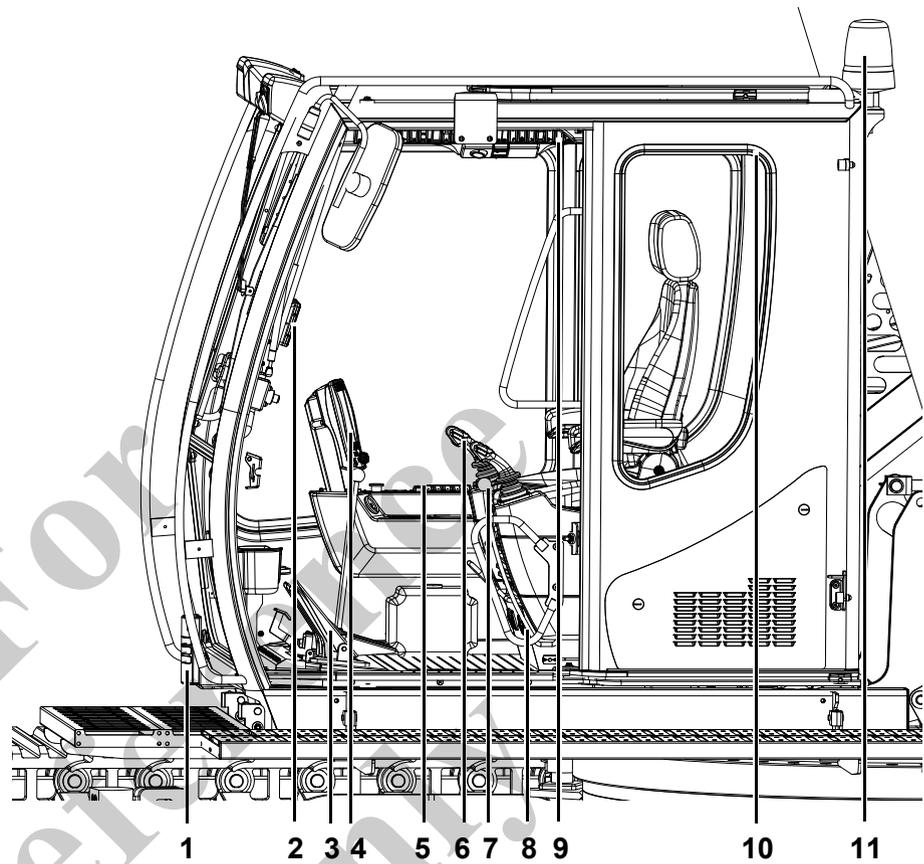


Fig. 56 Components of the cab

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

6.3.1 Emergency stop switch

The emergency stop switch (1) in Fig. 57 is located on the bottom right control panel and immediately shuts down the machine when pressed.

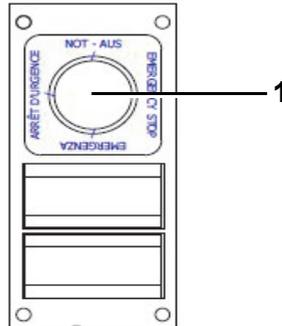


Fig. 57 Emergency stop switch

Positions:

Pulled = machine On

Pushed = machine Off

6.3.2 Safety lever

The safety lever (1) in Fig. 58 is a safety device. Only release the safety lever after the engine has been started.



Fig. 58 Safety lever activated (pulled back)

With safety lever activated

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

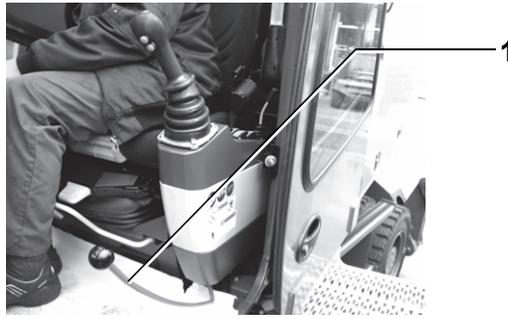


Fig. 59 Safety lever released (pushed forward)

When the safety lever is released (see illustration)

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

For
Reference
Only

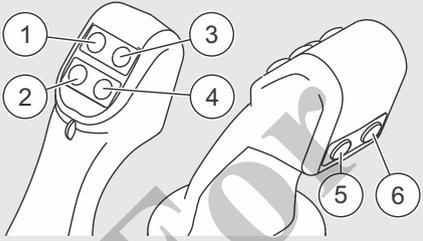
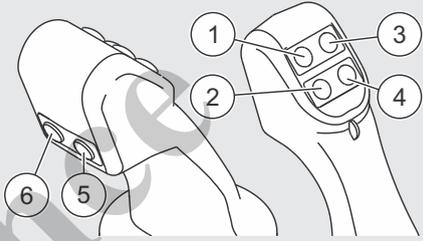
6.3.3 Assignment of the joysticks and pedals

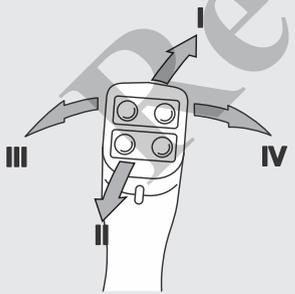
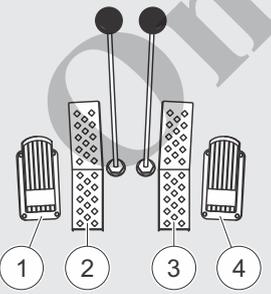
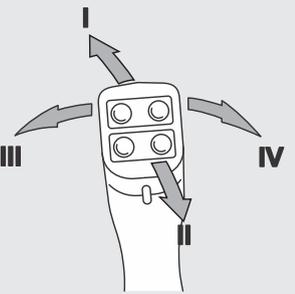
NOTE

Risk of damage to the machine due to improper handling of the slewing gear holding brake.

Using the slewing gear holding brake during work can damage the machine.

➤ Only apply the slewing gear holding brake when the machine is stationary.

Left joystick		Right joystick	
			
1	Slewing gear locking brake	1	Lower pole claw
2	Open pole claw	2	Raise pole claw
3	Slewing gear freewheeling	3	Option
4	Close pole claw	4	Horn
5	Option	5	Option
6	Rotation speed - uppercarriage	6	Winch movement indicator on/off

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

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Rotation speed - uppercarriage

This changeover switch is used to select the speed of work movements (slow / fast).

6.3.4 Storage compartment, right of the driver seat

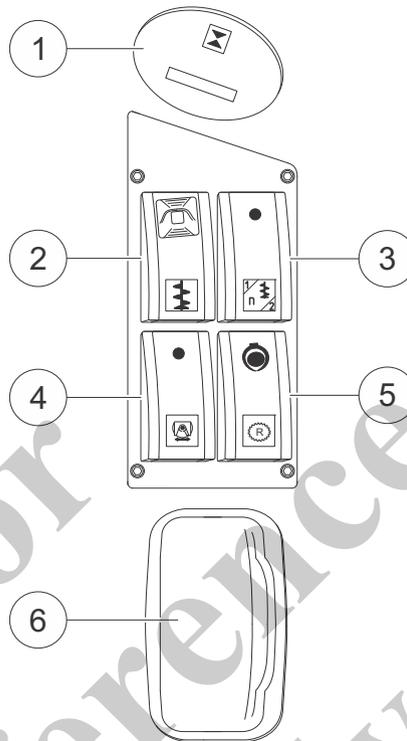


Fig. 60 Right storage compartment

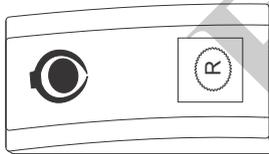
1	Hour meter
2	Soil drill on/off (option)
3	Drill speed, slow/fast (option)
4	Open soil drill lock (option)
5	Preselect clamping tons/supplemental hydraulic system (option)
6	Ashtray

⚠ DANGER**Danger to life from preselected supplemental hydraulic system!**

Danger to life from preselected supplemental hydraulic system!
The clamping tongs will fully close when the Preselect clamping tongs/supplemental hydraulic system switch is set to the Supplemental hydraulic system position. Persons near the clamping tongs may become crushed.

Objects inside the clamping tongs may be cut apart and fall down. This can cause serious injury or death. The machine may become severely damaged.

- Make sure no one is in the danger zone of the machine while it is in operation.
- Before switching on the supplemental hydraulics, ensure that there are no objects inside the clamping tongs or ensure that the clamping tongs have been removed or disconnected.

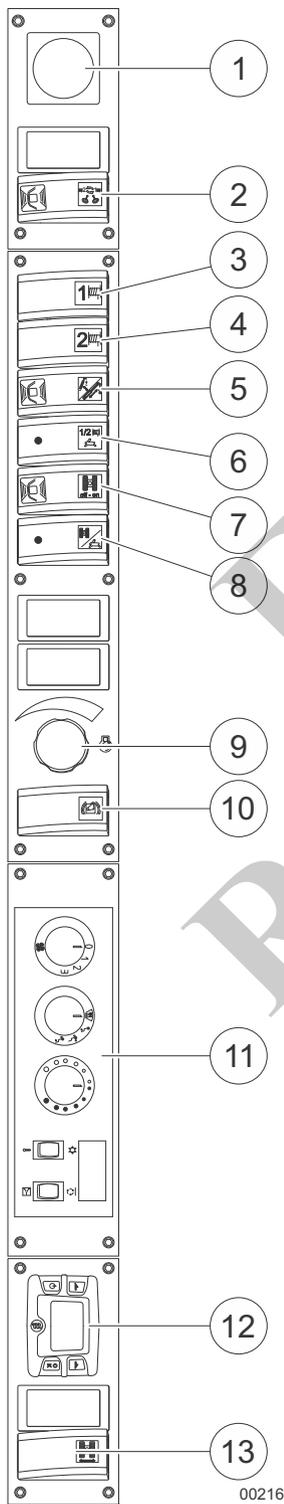


The **Preselect clamping tons/supplemental hydraulic system** switch has three switching positions:

- Forward: clamping tons
- Middle: switch off
- Rear: supplemental hydraulic system

Reference Only

6.3.5 Control panels, right



1	Emergency stop
2*	Winch 1/Winch 2
3	Release - winch 1
4	Release - winch 2
5*	Luff/telescope boom switch
6	Rapid motion winch 1/2
7*	Release travel mode
8	Travel slow/fast
9	Speed governor
10	Start/stop engine
11	Automatic climate control
12	Auxiliary heating system timer (option)
13	Release undercarriage telescoping

* At activation, unlock switch

Reference Only

Fig. 61 Control panel, right

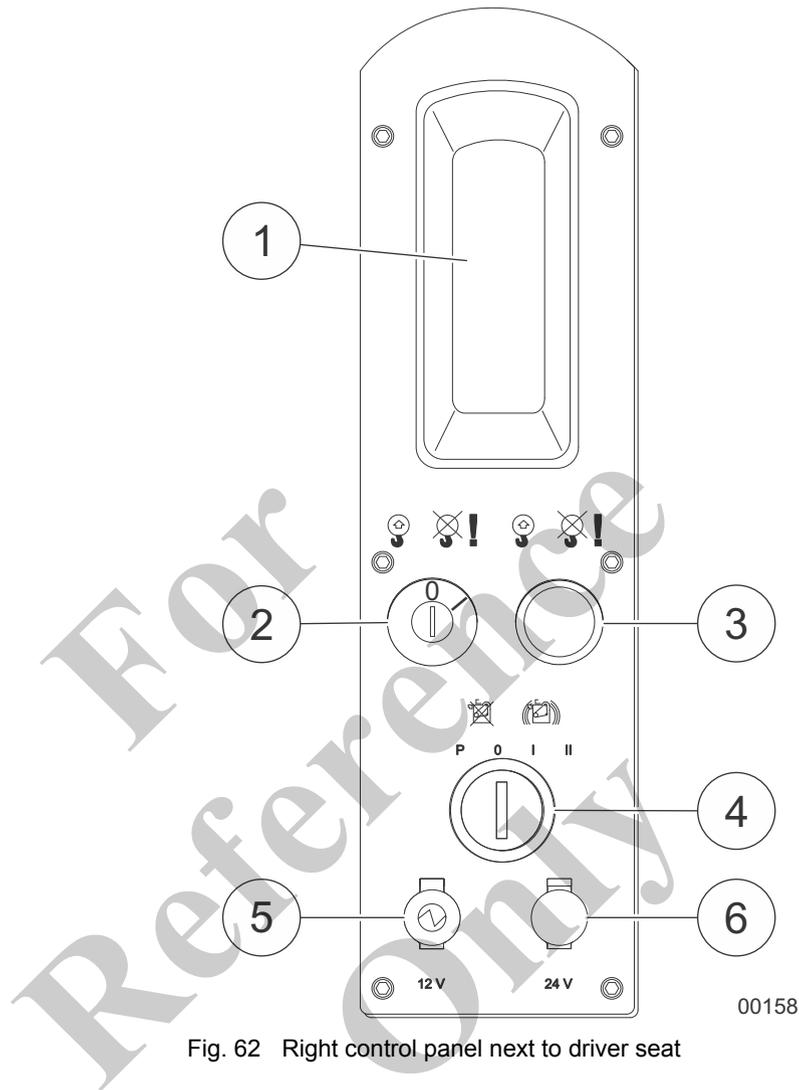


Fig. 62 Right control panel next to driver seat

1	Storage compartment
2	LML bypass key switch
3	LML bypass push-button
4	Ignition lock - start engine P = Enable the fuel pump 0 = Ignition OFF I = Ignition ON (Ignition switch-off after 20 minutes!) II = Start engine
5	Power socket 12 V
6	Power socket 24 V

6.3.6 Control panel, top right

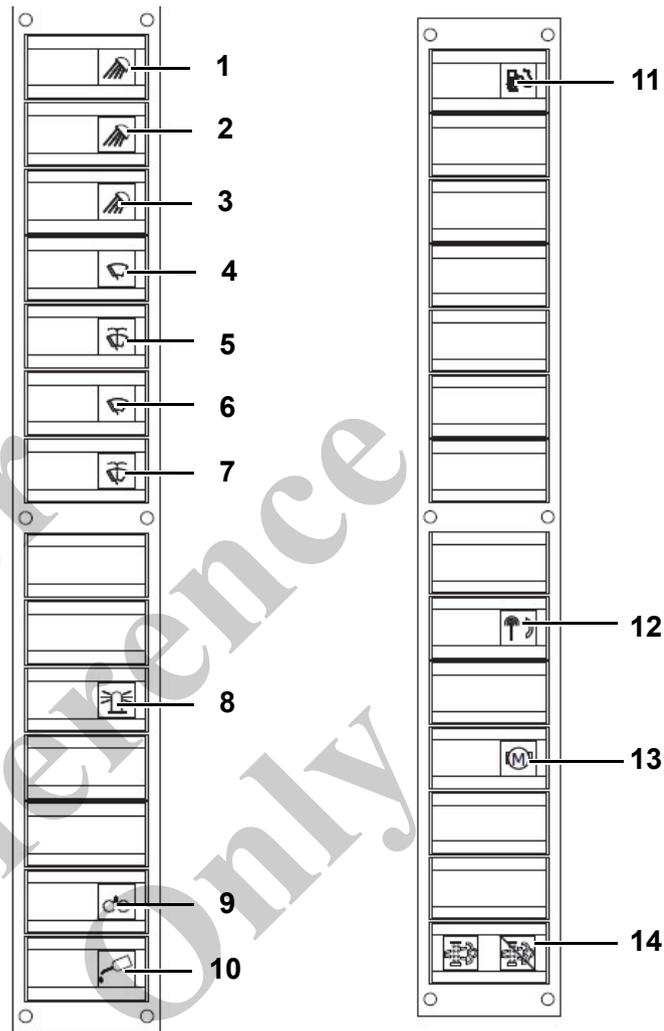


Fig. 63 Top control panel

1	Roof work light	8	Beacon
2	Boom headlight	9	Slewing ring lubrication (option)
3	Uppercarriage headlights	10	Central lubrication system (option)
4	Windshield wiper - windshield	11	Diesel filter heating on/off (option)
5	Windshield washer system	12	Radio operation on/off (option)
6	Windshield wiper - glass roof panel	13	Release hydraulic power unit (option)
7	Glass roof panel washer system	14	Start/stop SCR filter cleaning (Tier 4f engines)

6.4 Slewing ring lubrication (option)

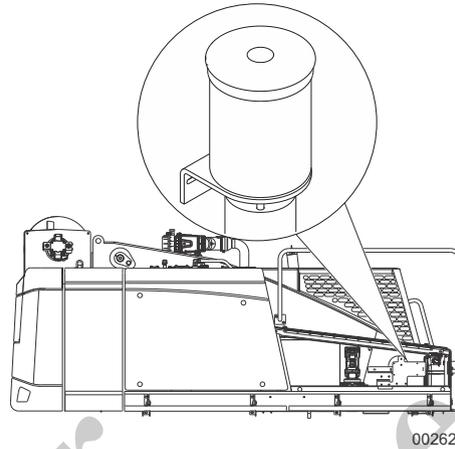


Fig. 64 Position of lubricant reservoir for slewing ring lubrication system



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. Push the push button every 1-2 seconds during the process.
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 every week and refill lubricant as needed.

6.5 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.

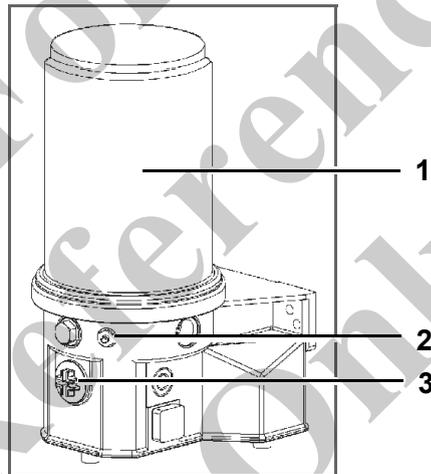
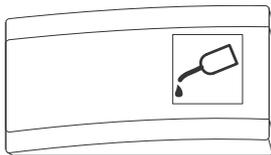


Fig. 65 Central lubrication

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.

6.5.1 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 Grove factory filling of DEF meets the following standards: <ul style="list-style-type: none"> ● ISO 22241-1 ● DIN 70700 ● ASTM D7821
Alternative names for DEF	<ul style="list-style-type: none"> ● AdBlue® ● Aqueous Urea Solution 32 (AUS 32) ● NO_x Reduction Agent ● Catalyst Solution ● Stabeguard 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: <ul style="list-style-type: none"> ● Contamination in the DEF circuit ● Direct sunlight
Storing DEF	DEF can be stored for 3 to 6 months under the following conditions: <ul style="list-style-type: none"> ● 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.

6.5.2 Exhaust aftertreatment system regeneration (Tier 4f engines)

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.

- 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.

Running regeneration

- 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 Grove Service Partner.
- 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:

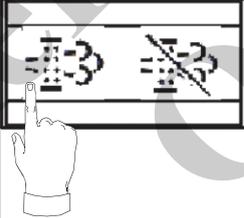
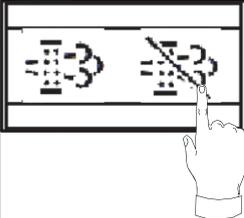


Information

The escalation levels pertaining to the load status of the exhaust aftertreatment system are displayed on the SENCON.

See Chapter "SENCON" for more information.

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: 

6.5.3 Control panel - automatic air conditioning

The machine is equipped with air conditioning automation that enables exact heating or cooling.

Safety instructions

- Maintenance and repair tasks must only be executed by trained specialists.
- Do not reach into the interior of the device and do not insert any objects into the device.
- Only execute maintenance tasks with the drive engine shut down and the fan disconnected.
- Allow device and components inside the device (heat exchanger, resistors) to fully cool down first.
- Do not touch any cooling pipes or hoses.
- Avoid contact with the refrigerant.
- Wear protective goggles and gloves.
- Use only R134a refrigerant.
- Do not fill any fluorescent additives (tracer-agents, sticks) into the system.



Fig. 66 Elements of the automatic air conditioning control panel

1	Rotary selector switch - fan speeds
2	Rotary selector switch - air distribution
3	Temperature controller
4	Combination button - outside temperature display, air conditioning on/off
5	Changeover switch - ambient air / air recirculating
6	Temperature indicator (°C or °F)



Information

The air conditioning can be operated with ambient air or in air recirculation mode.

**Information**

Press the A/C button (4) in Fig. 66 two times to switch on the heating/air conditioning.

**Information**

Keep windows and cab door closed to ensure effective air conditioning.

The air conditioner regulates the temperature depending on the ambient temperature.

Outside air mode

When windows are fogged up, to dehumidify the cab.

**Recirculating air mode**

Faster warm-up of cab and higher limit temperature.

The air in the cab interior is re-circulated, this means that very little fresh air is drawn in from outside. Do not operate the system in this mode for more than 15 minutes as the air quality in the cab will deteriorate significantly. Ensure that there is a sufficient supply of outside air.



Reference Only

Switching on the air conditioning system



1	Start the diesel engine.
2	Turn on the blower (1) in Fig. 66 on the right control panel.
3	Open the air nozzles in the cab to prevent the evaporator from icing up.
4	Press the automatic air conditioning button (4) in Fig. 66 on the control panel <ul style="list-style-type: none"> – Press 1x briefly: The current status is displayed (heating or cooling) <p>or</p> <ul style="list-style-type: none"> – Press 2x: the operating mode changes
5	Set the desired temperature using the temperature controller (3) in Fig. 66 on the right control panel.



Information

Switch on the automatic air conditioning regularly. This greatly contributes to the unit being ready for operation.

Switch on the automatic air conditioning once a month for at least 30 minutes at maximum fan speed, keeping windows and doors open during the process.

Changing the temperature display °C/°F



1	Press the combination switch (4) in Fig. 66 for more than 5 s.
2	Temperature display changes (°C <--> °F).

6.5.4 Camera system

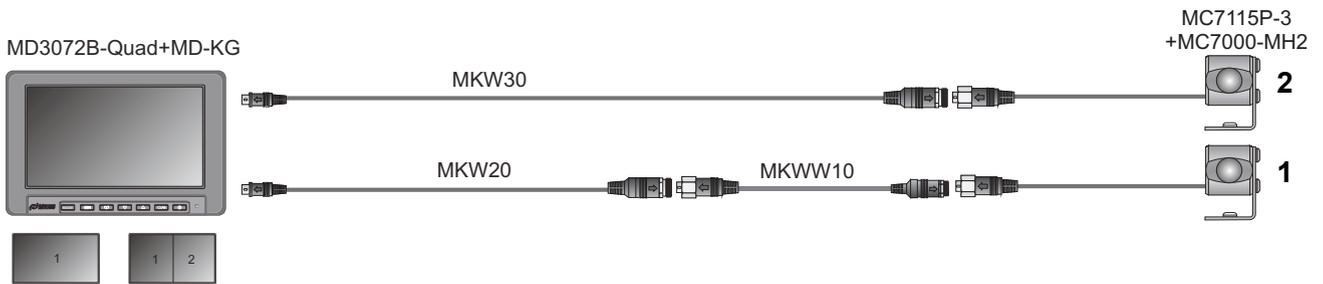


Fig. 67 Elements of the camera system

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.

6.6 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.

6.6.1 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

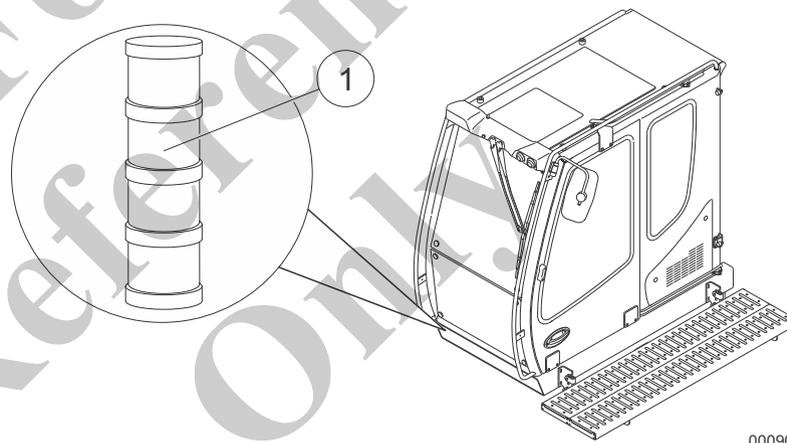


Fig. 68 LML visual warning device

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.

6.6.2 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: <ul style="list-style-type: none"> – Luffing – Raising bottom hook block – Extending the boom 				

6.6.3 Operation

The LML is operated and adjusted via the SENCON.

6.6.4 Mode selection

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



Information

- Make sure the operating parameters configured on the SENCON match the setup 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

6.6.5 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. 69 while pressing the push-button (3) in Fig. 69.

The bypass is terminated by releasing the key switch (2) in Fig. 69 or the push-button (3) in Fig. 69, or by turning the ignition off then back on again.

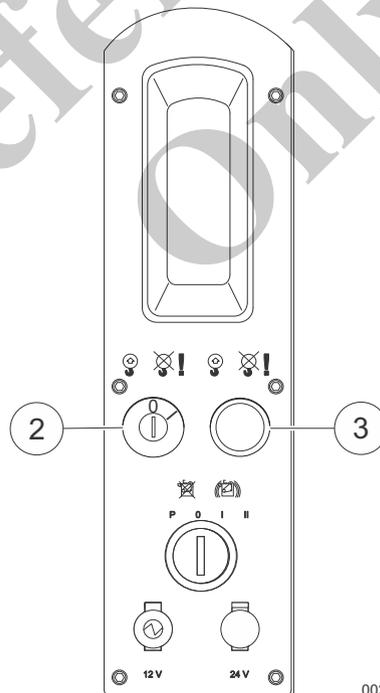


Fig. 69 LML controls

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6.6.6 Operating modes table

Specific operating modes can be disabled depending on the machine equipment.

Inclination [°]	Track span [Position]	Carbody counter-weight [t]	Upper carriage counter-weight [t]	Main boom / Attachment	Offset [°]	LML code
0.3	A	0	8.9	Setting-up		00153394
0.3	A	0	8.9	HA		00153301
2.0	A	0	8.9	HA		00253301
4.0	A	0	8.9	HA		00353301
0.3	B	0	8.9	HA		00159301
2.0	B	0	8.9	HA		00259301
4.0	B	0	8.9	HA		00359301
0.3	C	0	8.9	HA		00158301
2.0	C	0	8.9	HA		00258301
4.0	C	0	8.9	HA		00358301
0.3	A	0	8.9	SA6	0.0	00153344
0.3	A	0	8.9	SA6	40.0	00153346
0.3	A	0	8.9	SA13	0.0	00153354
0.3	A	0	8.9	SA13	40.0	00153356
0.3	A	0	8.9	HA-HAB		00153313
0.3	A	0	8.9	SA-HAB		00153325
0.3	A	0	8.9	HA-S		00153331
2.0	A	0	8.9	HA-S		00253331
4.0	A	0	8.9	HA-S		00353331
0.3	B	0	8.9	HA-S		00159331
2.0	B	0	8.9	HA-S		00259331
4.0	B	0	8.9	HA-S		00359331
0.3	C	0	8.9	HA-S		00158331
2.0	C	0	8.9	HA-S		00258331
4.0	C	0	8.9	HA-S		00358331

HA	Main boom
HA-S	Auxiliary boom nose
HA-HAB	Main Boom with personnel basket
SA-HAB	Boom extension 6.5 m (21 ft 4 in) personnel basket
SA6	6.5 m (21 ft 4 in) boom extension
SA13	13 m (42 ft 8 in) bi-fold boom extension
A	100% full span 4.1 m (13.5 ft)
B	50% mid span 3.3 m (10.8.ft)
C	0% retracted span 2.6 m (8.5 ft)

For
Reference
Only

6.6.7 Safety components

- Pressure sensors on the luffing cylinder (LML)
- Angle transmitter/spring cable drum on the boom (LML)
- Lifting limit switch – boom
- Lifting limit switch – fly boom
- Lowering limit switch on the winch

Pressure sensors on the luffing cylinder

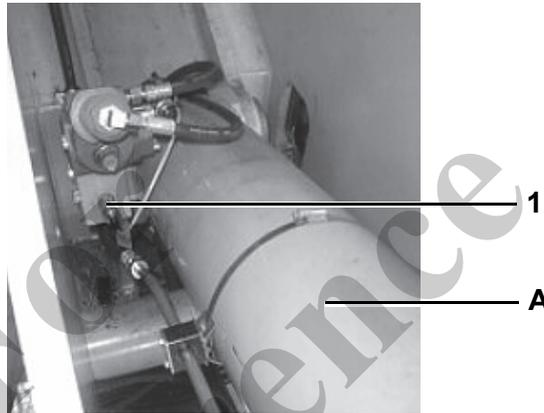


Fig. 70 Pressure sensors on the luffing cylinder

The pressure sensors (1) in Fig. 70 measure the pressure on the piston head and on the rod side of the luffing cylinder (A) in Fig. 70.

Angle transmitter/spring cable drum

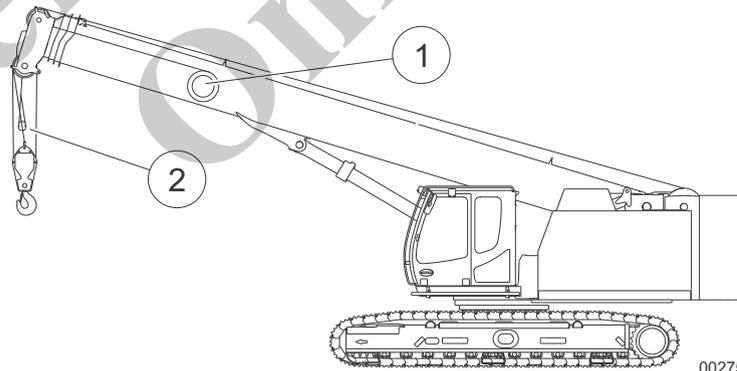


Fig. 71 Length and angle transmitter/spring cable drum

1	Length and angle transmitter
2	Lifting limit switch

The length and angle transmitter (1) in Fig. 71 measures both the angle above the horizontal and the length of the telescopic boom. The cable of the cable drum transmits the measurement signals from the boom head to the LML.

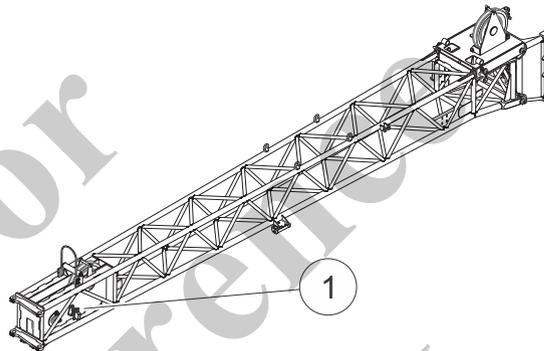
Lifting limit switch

NOTICE**Risk of damage to machine due to bottom hook block colliding with boom head.**

If the lifting limit switch chain is shortened, it can cause a delayed response in the lifting limit switch. 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 lifting limit switch chain.

Lifting limit switch – fly boom (option)



00285

Fig. 72 Location of the lifting limit switch on the fly boom

The lifting limit switch (1) in Fig. 72 prevents the bottom hook block from colliding with the boom head. Do not activate this emergency limit switch while the machine is in operation.

The lifting limit switch is actuated by the weight suspended on the chain. The length of the chain depends on the speed of the load hook and the system shut-down response time.

Make sure the switch is functioning every time you use the crane by moving the switching weight with the bottom hook block (load handling device).

Inserting the lifting limit switch cable

After mounting the fly boom, insert the connection cable of the fly boom lifting limit switch into the main boom head.

LML

When the maximum permitted load moment is reached, the load-increasing functions "Extend telescopic boom", "Raise/lower telescopic boom" and "Raise winch" are disabled. Load-reducing movements such as "Retract telescopic boom" and "Lower winch" are possible at any time.

NOTICE**Risk of damage to machine due to bottom hook block colliding with boom head.**

If the chain of the lifting limit switch is shortened, this can result a delayed reaction of the lifting limit switch. 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 limit switch under any circumstances.

Cable connection

After mounting the fly boom, plug the connection cable of the lifting limit switch for the fly boom onto the head of the main boom.

For
Reference
Only

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

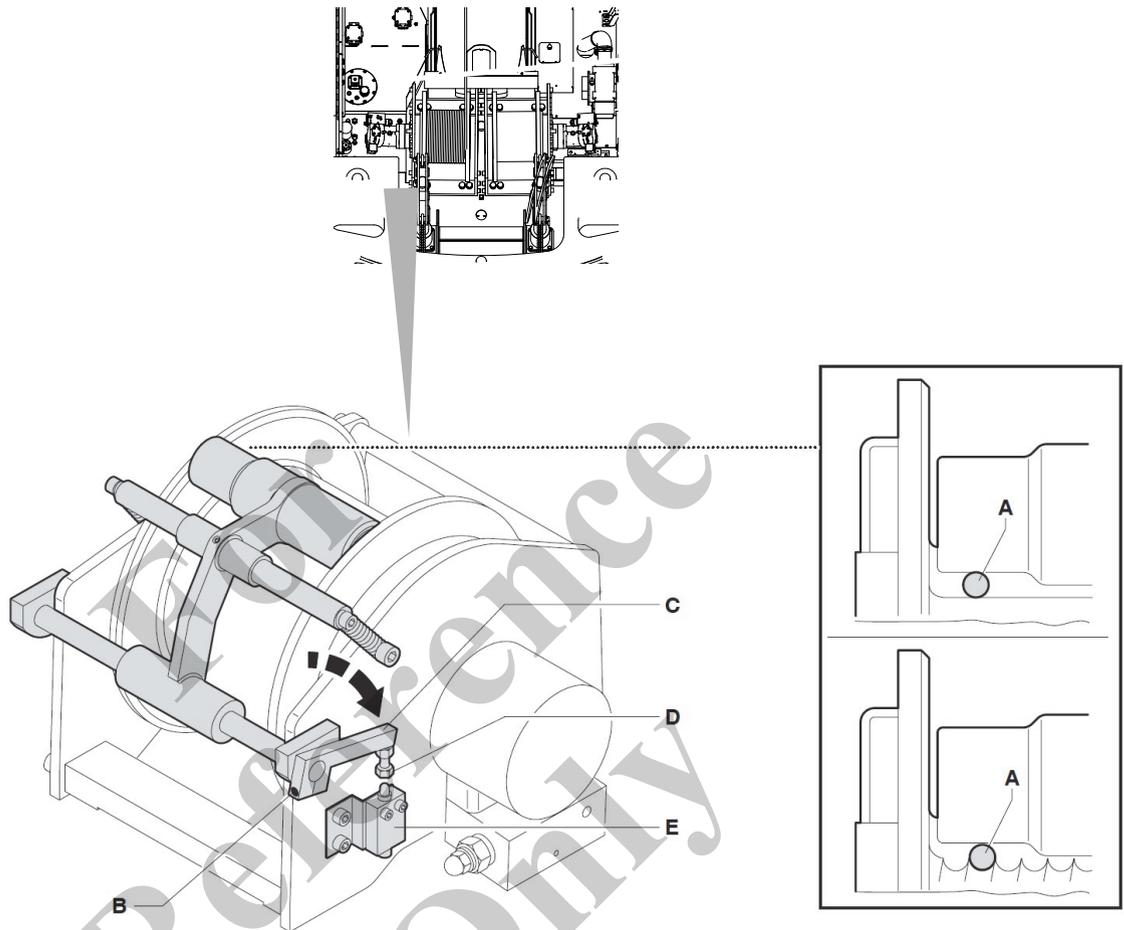


Fig. 73 Lowering limit switch on the winch

The rope end limiter ensures that sufficient rope always remains wound on the winch. If the cable is retracted beyond the set minimum rope remaining length, the "winch up" function is automatically switched off. The length of the rope left on the drum is set when retracting the rope.

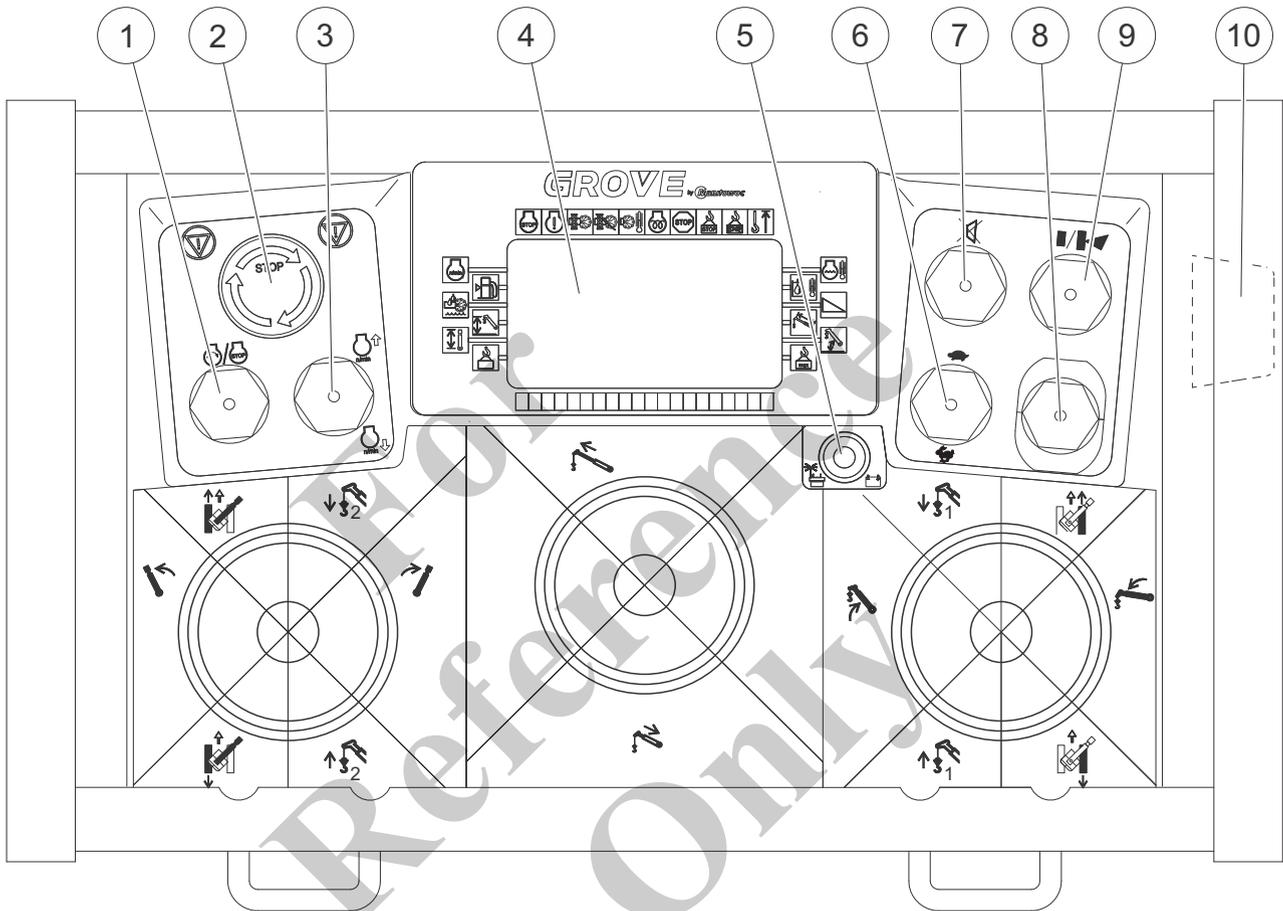
**Adjusting the rope
end limit switch**

Complete the following procedure with the rope completely unreeled

1	Insert a spacer (A) in Fig. 73 with the same diameter as the rope under the end of the sheave.
2	Loosen the screw (B) in Fig. 73.
3	Turn the lever (C) in Fig. 73 until the screw (D) in Fig. 73 triggers the switch (E) in Fig. 73.
4	Tighten the screw (B) in Fig. 73.

6.7 Special equipment

6.7.1 Remote radio control (option)



00449

Fig. 74 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. 74.

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.



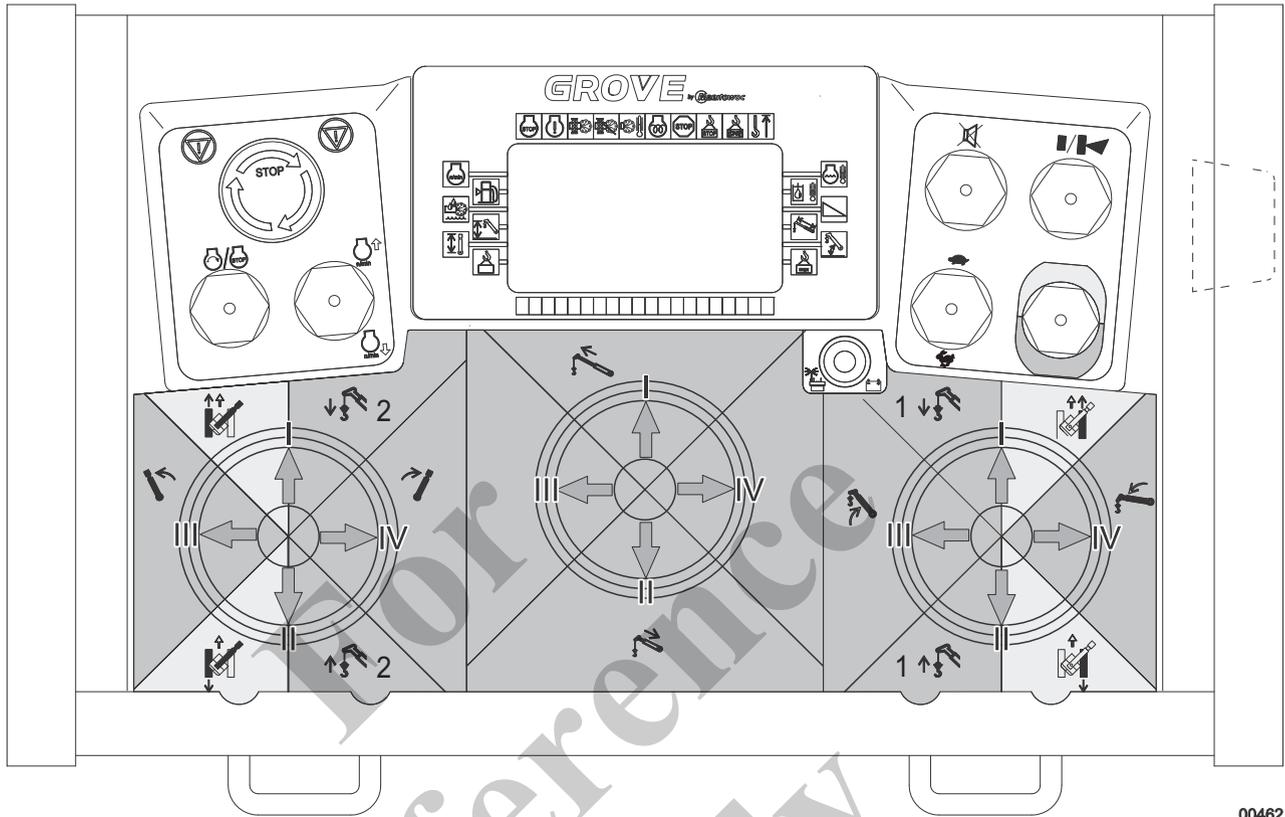
Information

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.



00462

Fig. 75 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

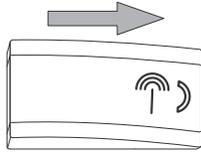
The **Luff/Telescope boom** and **Winch 1/Winch 2** switches are not used with the remote radio control.



Information

The radio remote control of traveling drive is disabled when the lifting working platform is attached.

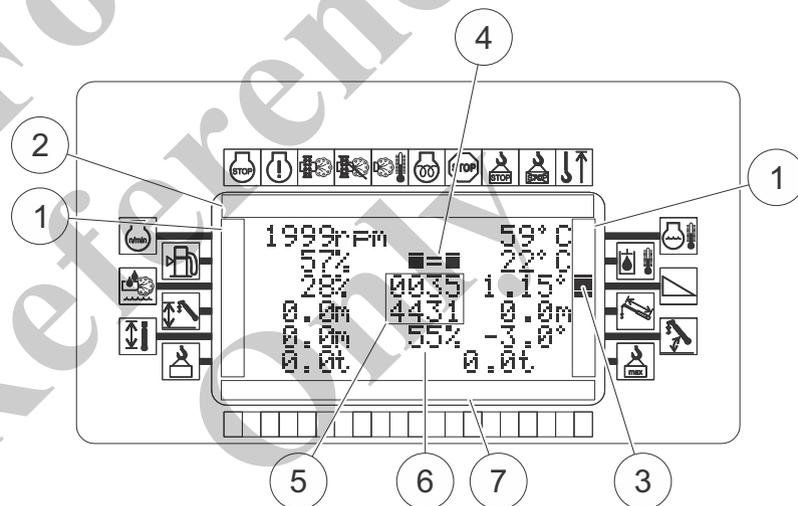
Enabling the remote radio control



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. 76 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. 76 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.

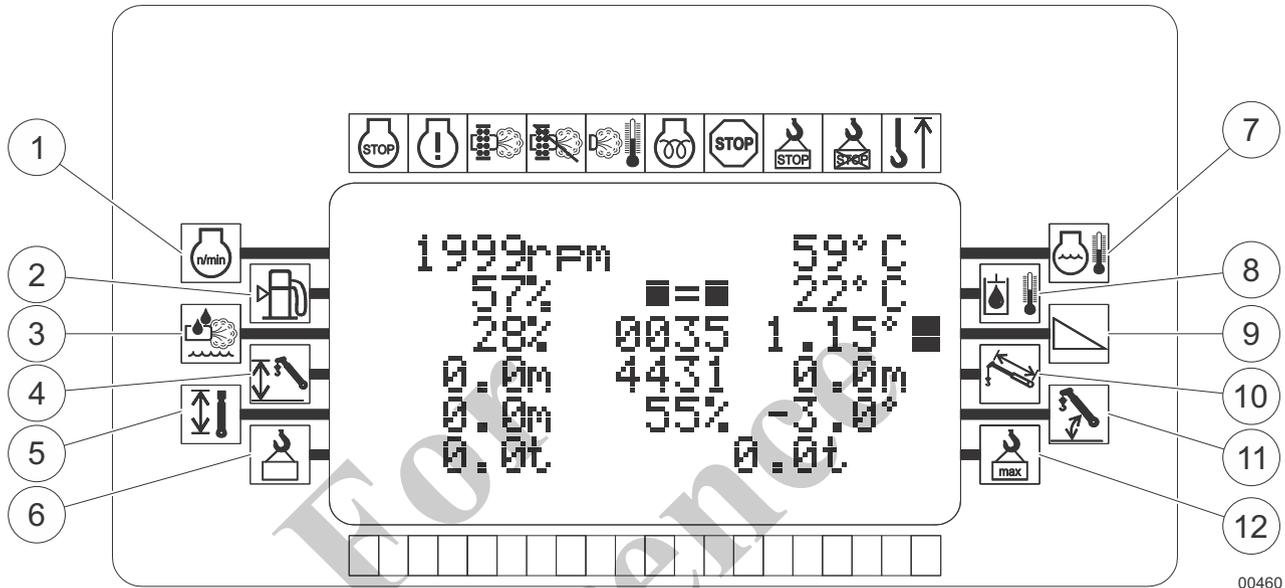


Fig. 77 Displaying operating parameters on the remote radio control

	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	

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 Grove Service Partner.
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 Grove Service Partner. <p>Two fields filled:</p> <ul style="list-style-type: none"> - Check fault number in the diagnostics window of the SENCON. - Contact your Grove Service Partner.

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

6.7.2 Diesel filter heater (option)

The machine is equipped with a heatable diesel filter.



Information

Once the fuel temperature drops below 5 °C, Grove recommends activating the diesel filter heater. The SENCON displays the current fuel temperature.

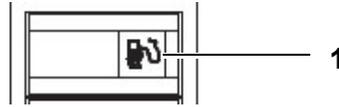


Fig. 79 Turning on the diesel filter heater

- | | |
|---|---|
| 1 | Start the diesel engine. |
| 2 | Press the switch (1) in Fig. 79 to activate the diesel filter heater. <ul style="list-style-type: none">- The indicator light in the switch lights up until the fuel reaches operating temperature. |

For Reference Only

6.7.3 Beacon

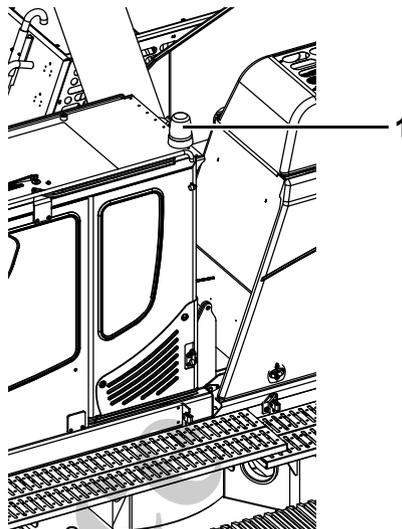


Fig. 80 Location of the beacon

1 | Beacon

For Reference Only

6.8 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 Grove 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.

6.8.1 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 in the momentary position (lifting/lowering friction-locked, see Section 6.8.7).

Safety notice

- Only work in crane operation with the LML switched on.
- Select the appropriate operating mode for the operating status in the LML menu of the SENCON, Section 5.3.
- Read the Section 3.5 PERMISSIBLE WIND SPEEDS

For
Reference
Only

6.8.2 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. 81 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.

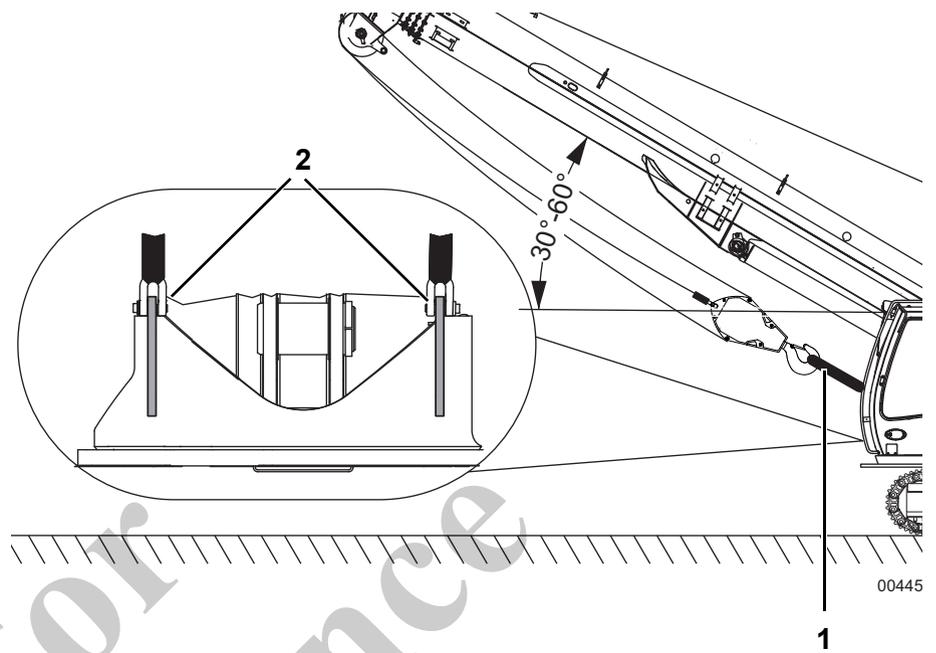
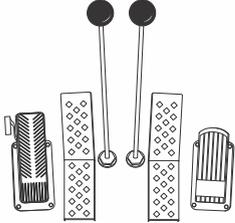
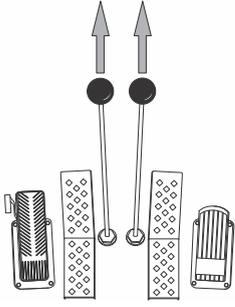
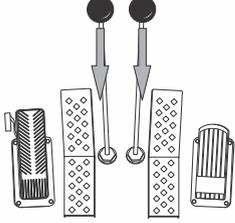
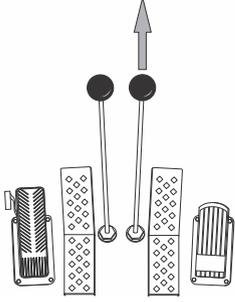
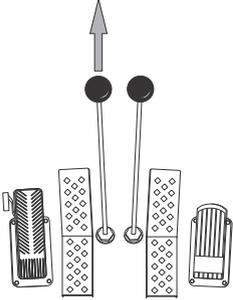
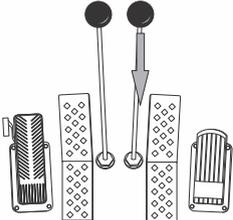
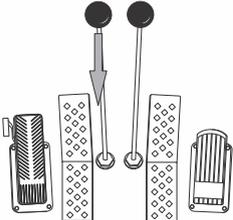
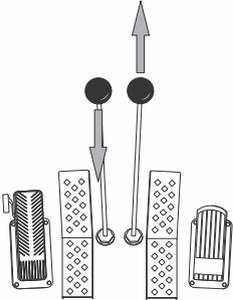


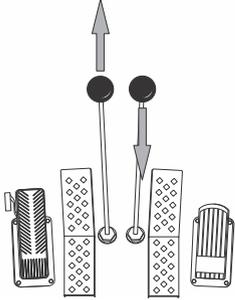
Fig. 81 Securing the bottom hook block from swinging

For Reference Only

6.8.3 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. 	
Travel forward to the left.	<ul style="list-style-type: none"> ● Release the left hand lever. ● Push the right hand lever forward. 	

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

Machine motion	Activity	Position of hand levers
Slew right at standstill.	<ul style="list-style-type: none"> ● Push the left hand lever forward. ● Pull the right hand lever back. 	 <p>The diagram shows two hand levers on a control panel. The left lever is pushed forward, indicated by a downward-pointing arrow. The right lever is pulled back, indicated by an upward-pointing arrow. The control panel also includes a gear selector on the left and a stop button on the right.</p>

For Reference Only

6.8.4 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 driving on slopes and other inclines

Incline	up to 2°	up to 4°	up to 6°	> 6°
maximum boom length	23.3 m	16.3 m	16.3 m	Moving with load is not permitted
Value of the reduced load capacity	100%	100%	25%	
Reeving	Same as at 100% load capacity			

6.8.5 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!

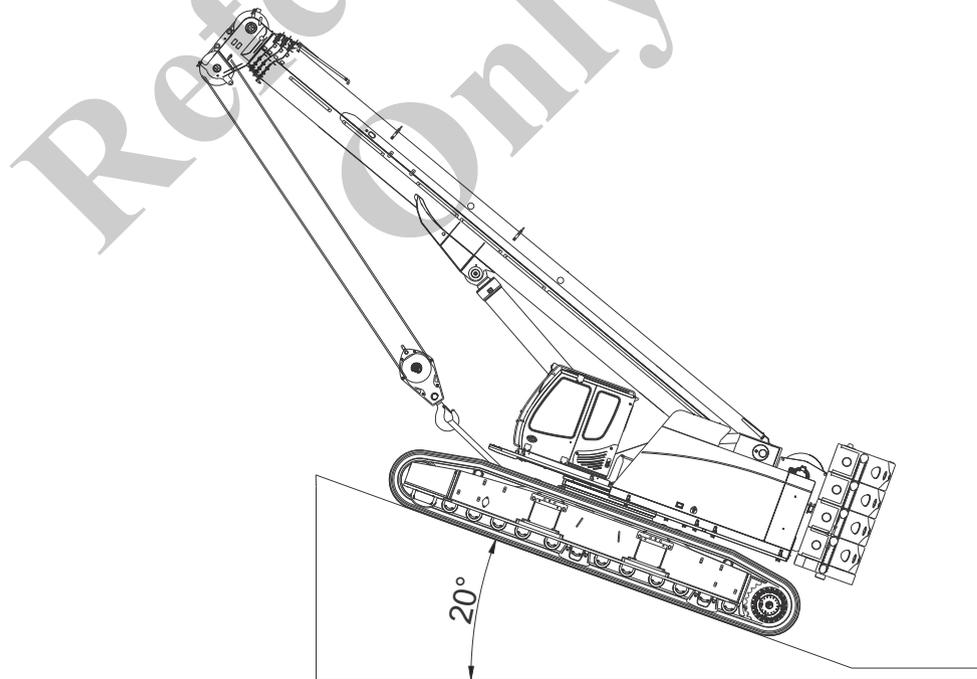


Fig. 82 Moving on inclines

6.8.6 Slewing the uppercarriage



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.



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.

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. 83 on the left joystick.
 - This disengages the slewing gear holding brake.

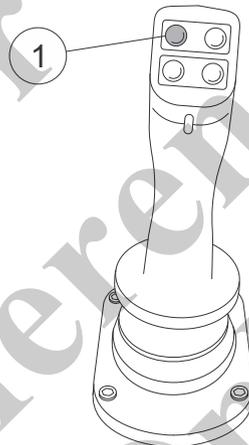


Fig. 83 Disengaging the slewing gear holding brake

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, such as can occur with swinging loads. Diese tritt beispielsweise beim Pendeln von Lasten auf.

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

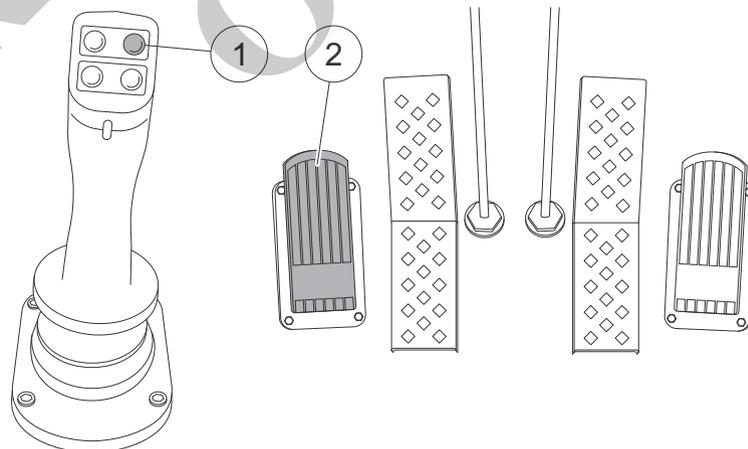
When the slewing gear freewheel is engaged, uppercarriage slewing can be stopped with the slewing brake pedal or by moving the left joystick in the opposite direction.

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. 84 and press the button (1) in Fig. 84 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.



00357

Fig. 84 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.

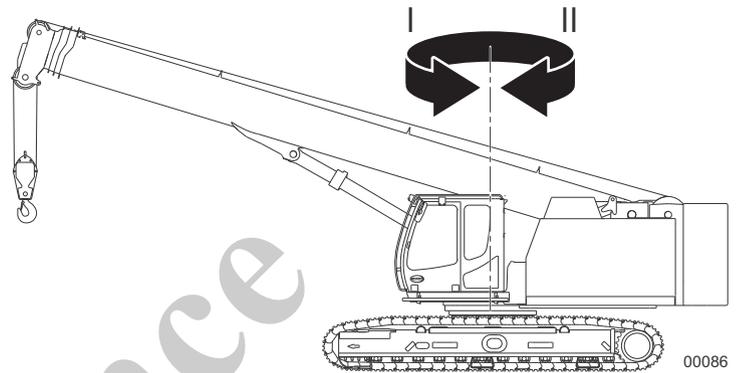
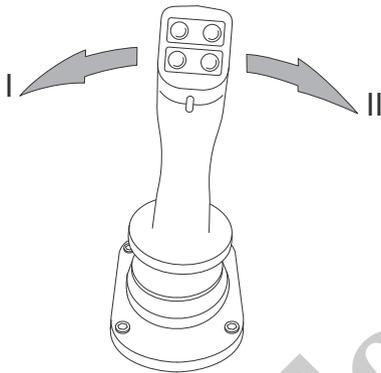


Fig. 85 Slewing the uppercarriage

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. 84. – 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.

For Reference Only

**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.

**Note**

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.

For Reference Only

6.8.7 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° (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.

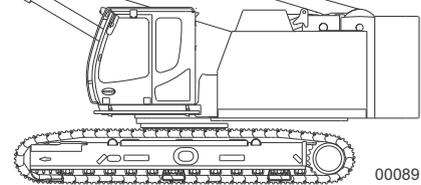
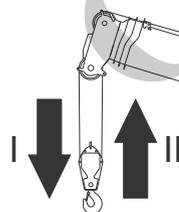
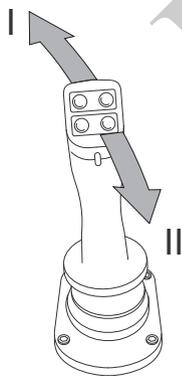


Fig. 86 Lifting and lowering the bottom hook block

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.

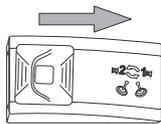
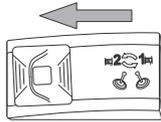


Information

The lift speed depends on the:

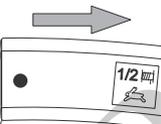
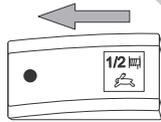
- Speed of the drive engine
- Deflection of the right joystick

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.

6.8.8 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.

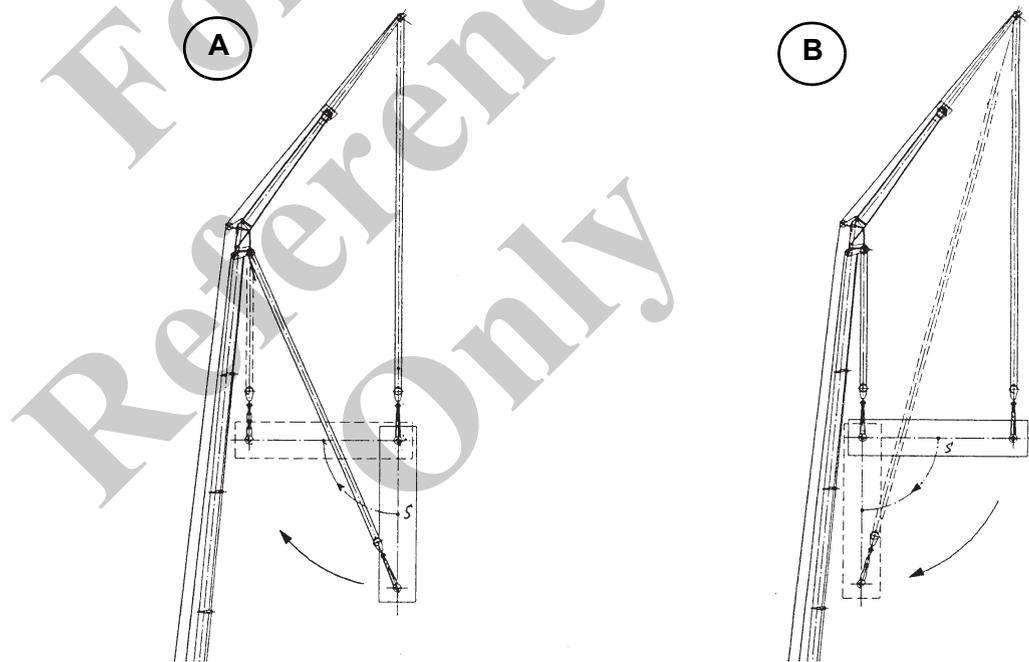


Fig. 87 Operating the hook properly with two winches

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 operating methods



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!

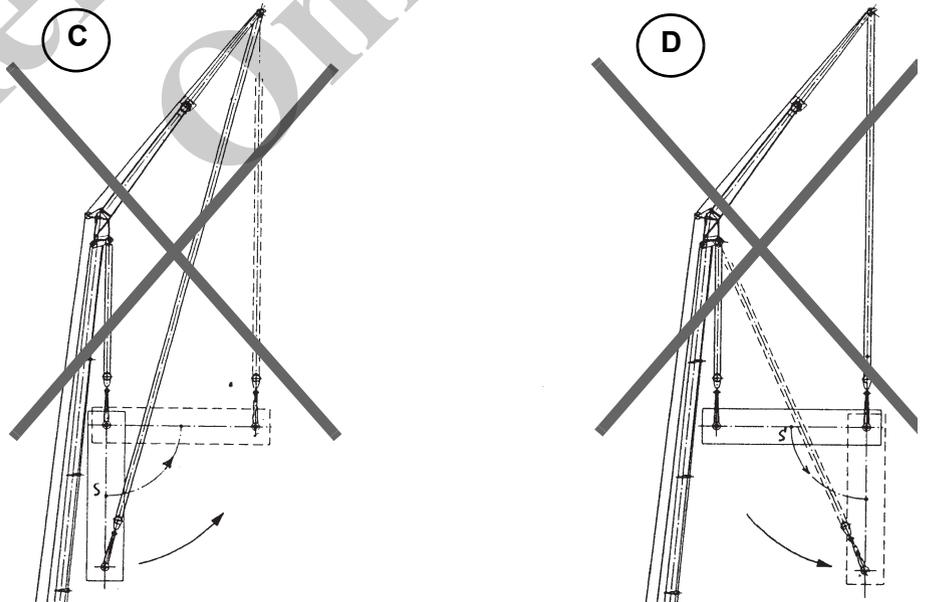


Fig. 88 Operating the hook improperly with two winches

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.

6.8.9 Adjusting the boom (luffing)

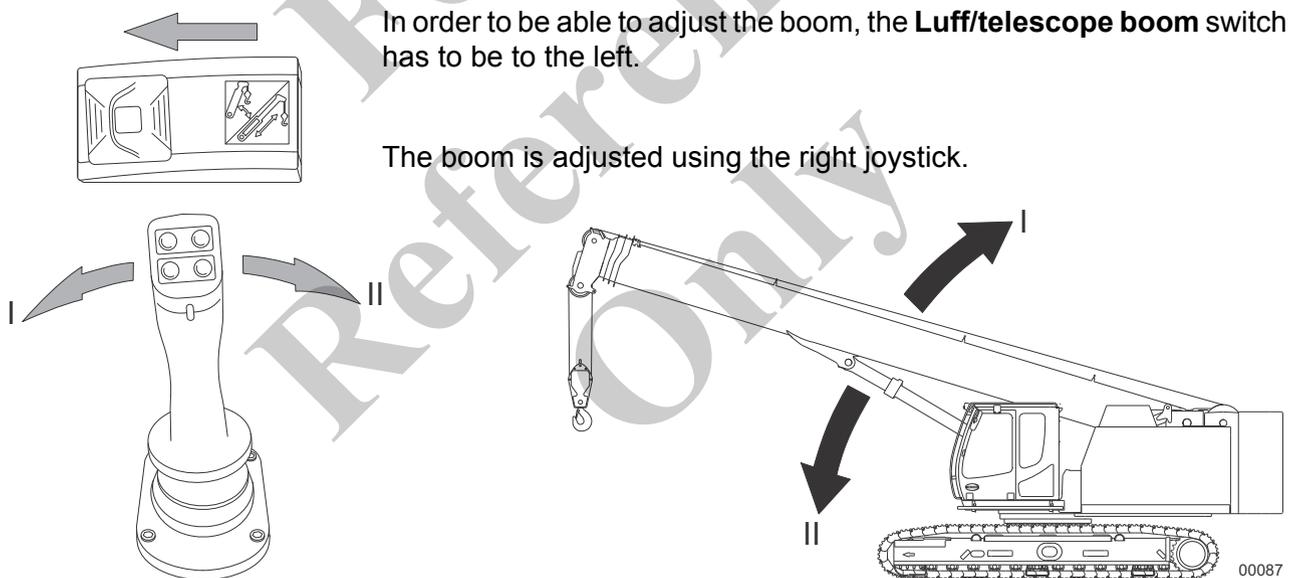


WARNING

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. 89 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.

6.8.10 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.

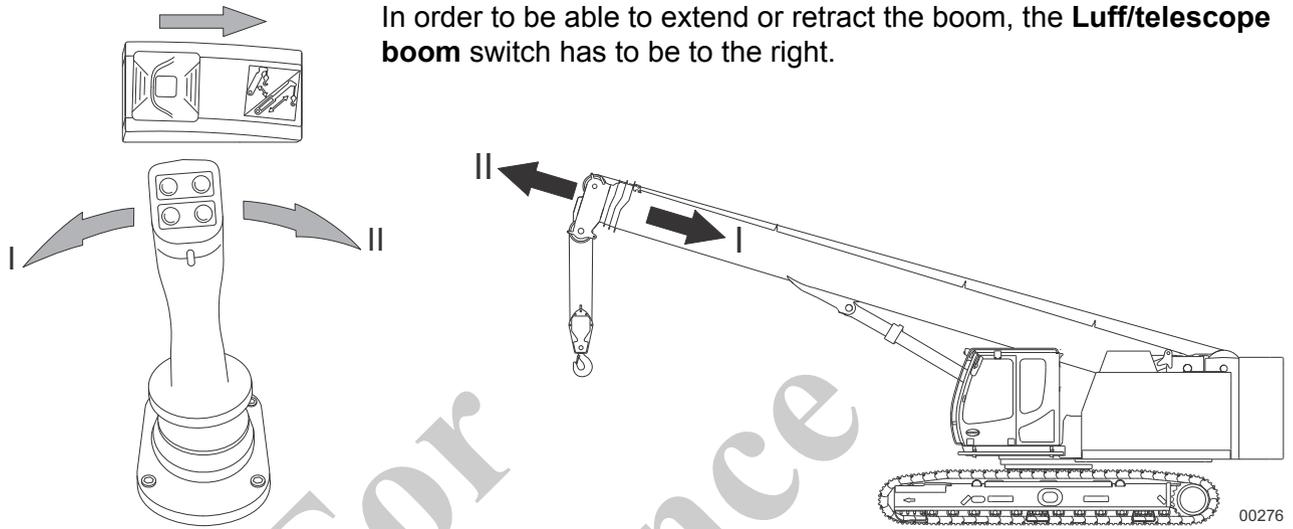


Fig. 90 Movement directions of the lift joystick for extending and retracting the boom

I	Retract boom
II	Extend boom

For Reference Only

6.8.11 Turning on the supplemental hydraulic system (option)



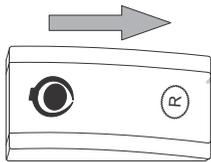
Danger to life from preselected supplemental hydraulic system!

Danger to life from preselected supplemental hydraulic system! The clamping tongs will fully close when the Preselect clamping tongs/supplemental hydraulic system switch is set to the Supplemental hydraulic system position. Persons near the clamping tongs may become crushed.

Objects inside the clamping tongs may be cut apart and fall down. This can cause serious injury or death. The machine may become severely damaged.

- Make sure no one is in the danger zone of the machine while it is in operation.
- Before switching on the supplemental hydraulics, ensure that there are no objects inside the clamping tongs or ensure that the clamping tongs have been removed or disconnected.

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. <ul style="list-style-type: none"> – 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.

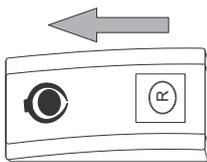
6.8.12 Operating the clamping tongs (option)



Danger to life from preselected supplemental hydraulic system!

Danger to life from preselected supplemental hydraulic system! The clamping tongs will fully close when the Preselect clamping tongs/supplemental hydraulic system switch is set to the Supplemental hydraulic system position. Persons near the clamping tongs may become crushed. Objects inside the clamping tongs may be cut apart and fall down. This can cause serious injury or death. The machine may become severely damaged.

- Make sure no one is in the danger zone of the machine while it is in operation.
- Before switching on the supplemental hydraulics, ensure that there are no objects inside the clamping tongs or ensure that the clamping tongs have been removed or disconnected.



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. 91 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. 91 on the right joystick. – The clamping tongs are lowered.
11	Press the button (4) in Fig. 91 on the right joystick. – The clamping tongs are raised.

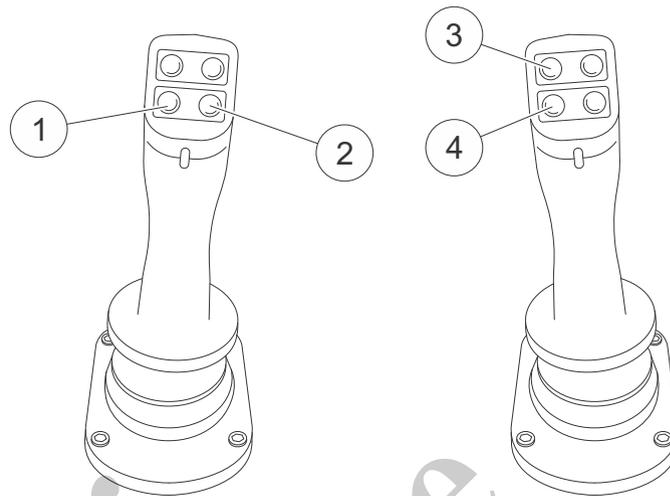


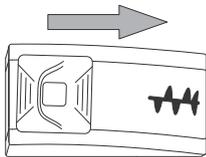
Fig. 91 Control elements for clamping tongs

Turning the clamping tongs off

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

For Reference Only

6.8.13 Operating the soil drill (option)

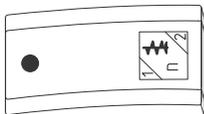


1	Telescope the undercarriage fully outward.
2	Attach the maximum counterweight.
3	Enter the cab.
4	Start the diesel engine and push the safety lever forward.
5	Select Setup operating mode on the SENCON.
6	Slew the soil drill into working position.
7	Release the switch Soil drill on and push it toward 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. 92 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

6.8.14 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.
- Park the machine on a firm, level substrate.
- Only refuel when the engine is shutdown.
- Determine the tank fill level before filling.
- Always ensure that no fuel does not overflow when refueling.
- When refueling from a tanker, ensure that the maximum filling speed of 120 l/min. (32 US gpm) is not exceeded.
- Constantly supervise the refueling process.

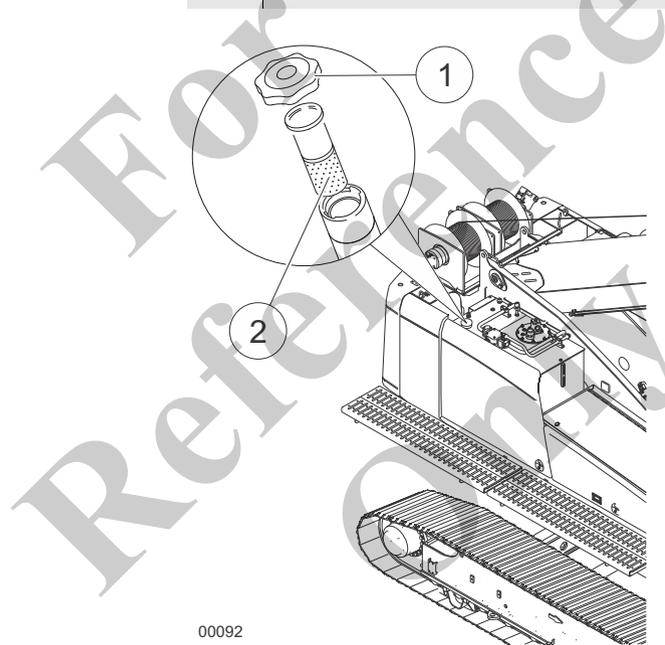


Information

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

Manually

1	Lower attached loads to the ground.
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. 93 of the fuel filler neck.
5	Clean the wide-mesh screen (2) in Fig. 93.
6	Insert a funnel into the fuel filler neck.
7	Carefully pour the fuel in through the funnel.
8	Close the cover (1) in Fig. 93.



00092

Fig. 93 Diesel filler neck and wide-mesh screen

Using a refueling pump
(option)



Information

Ensure that the maximum suction lift of 3 m is not exceeded.

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 necessary, switch off the fuel pump with the red button (3).

1	Lower attached loads and the boom to the ground.
2	Switch off the diesel engine.
3	Turn the ignition key to position P.
4	Open the right service door.
5	Open the diesel filler neck cover.

NOTICE

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

6	Remove the fueling hose (1) in Fig. 94 from the bracket.
---	--

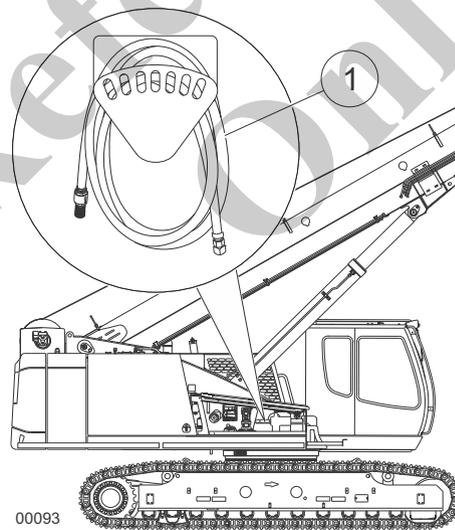


Fig. 94 Location of the fueling hose

7	Check the intake filter (4) in Fig. 95 for contamination and damage. Replace the intake filter if necessary.
8	Attach the fueling hose (3) in Fig. 95 to the intake port on the fuel pump and insert it into external fuel tank.
9	Turn on the fuel pump by pressing the green button (1) in Fig. 95. – The tank is filled automatically. The fuel pump automatically turns off once the tank is full.
10	The red button (2) in Fig. 95 turns off the fuel pump if necessary.

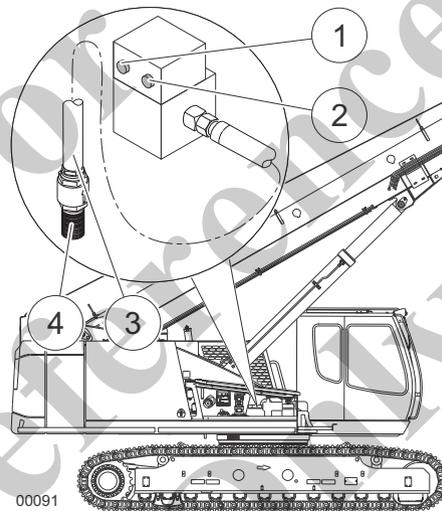


Fig. 95 Activating the fuel pump

11	Remove the fueling hose and stow it securely.
12	Close the filler neck cover.
13	Close the service door.

Check the following points if the fuel pump does not start up 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?

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

NOTE

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.



Note

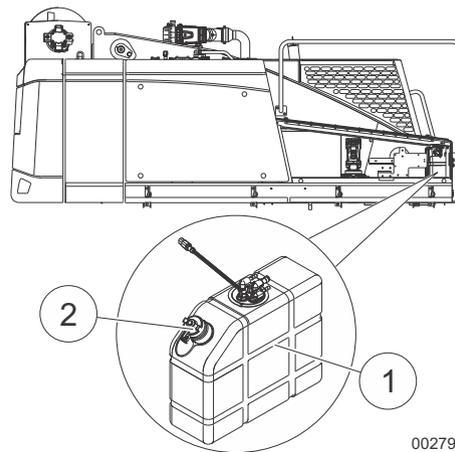
DEF can be added at ambient temperatures down to -11 °C.

Capacity:

DEF tank | approx. 30 l/7.93 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 front right service door.



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Fig. 96 Location of the DEF tank in the machine

7	Check the DEF tank (1) in Fig. 96 for contamination and clean as needed.
8	Carefully open the sealing cover (2) in Fig. 96 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 (2) in Fig. 96.
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 Walkways

7.1.1 Mounting/Removing

The walkways at the cab entrance, in front of the cab and on the right side of the uppercarriage must be installed before starting any work with the machine. Installing a walkway is described below.

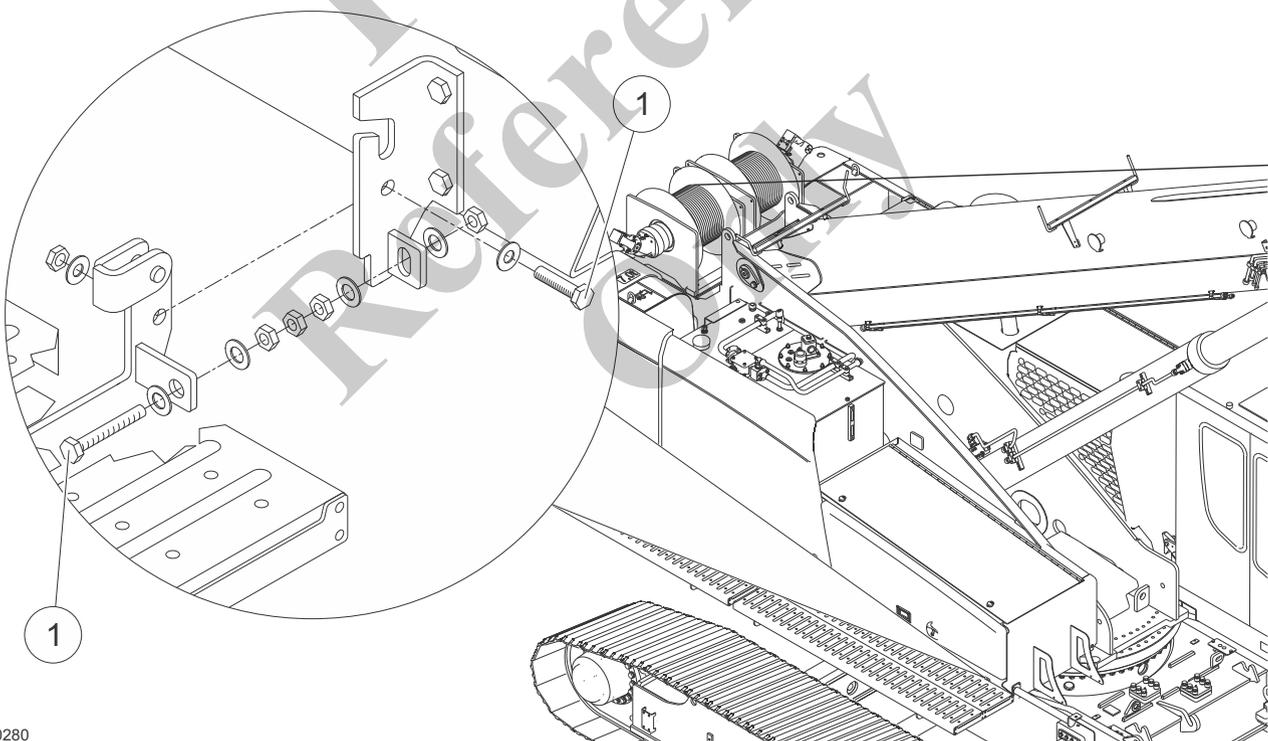
Install walkways with the undercarriage retracted.

WARNING

Danger of fatal injury due to falling walkways.

Installing the walkway incorrectly or using defective screws can cause the walkway to collapse and result in injury.

- Check all walkways and their fastening components before every installation.
- Use only Grove spare parts.
- Only install the walkways with unused screws.



00280

Fig. 97 Installing walkway

- 1 Carefully lift the walkway up to the cab or uppercarriage using suitable lifting equipment.

2	Insert the walkway in the bracket.
3	Screw the walkway to the frame (1) in Fig. 97. Observe the specified tightening torque of the screws.
4	Make sure the walkway is fastened securely.

**Information**

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

For
Reference
Only

7.1.2 Stowing

The machine is equipped with stowable walkways on the cab and uppercarriage.

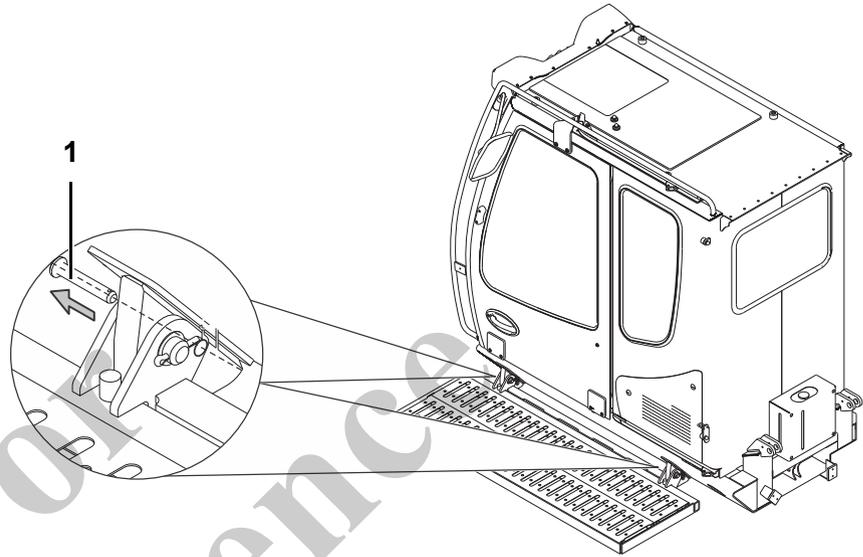


Fig. 98 Stowing walkways – removing pins

- 1 Unlock and remove the rear pins (1) in Fig. 98.

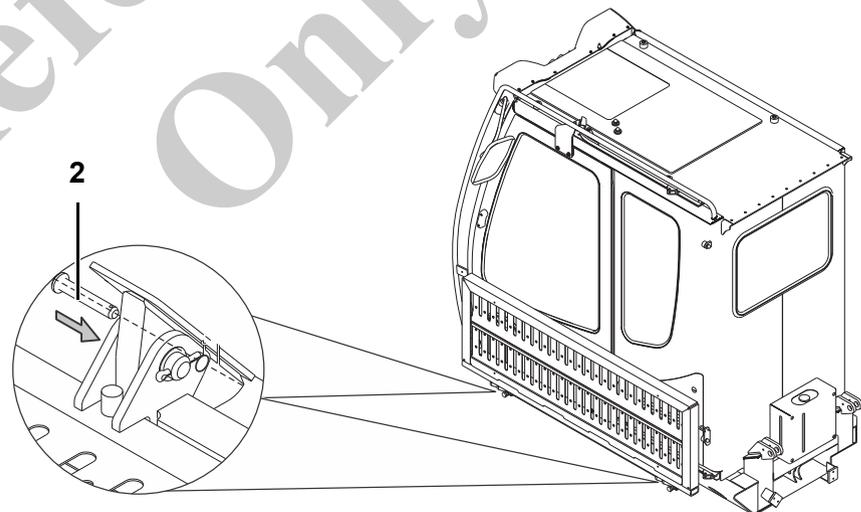


Fig. 99 Stowing walkways

- 2 Stow the walkway.
- 3 Insert and secure the rear pins (2) in Fig. 99.
 - The walkway is now secured.

7.2 Setup operating mode

Operating modes are configured on the SENCON.

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

- Reeving
- Setting up the auxiliary jib
- Setting up the fly boom (SA8/SA15)
- Setting up the elevating work platform

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

The operating parameters for setup are configured independently from 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 Chapter 5.3.6 ENTERING ATTACHMENTS AND CONFIGURING SETUP PROGRAM

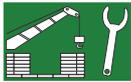
NOTICE

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	A (3.8 m/12.5 ft)	
Undercarriage ballast	0 t (0 lbs)	
Counterweight	8.9 t (19 621 lbs)	
Operating mode	Setup 1	

For Reference Only

7.3 Changing the track width

General information

You can change the track width of the machine.

- Always extend the running gear to the maximum track width and secure it during maintenance and servicing.
- Reduce the track width of the running gear in order to transport the machine on a flatbed trailer.

Safety instructions

Comply with the safety instructions before starting to telescope the running gear.

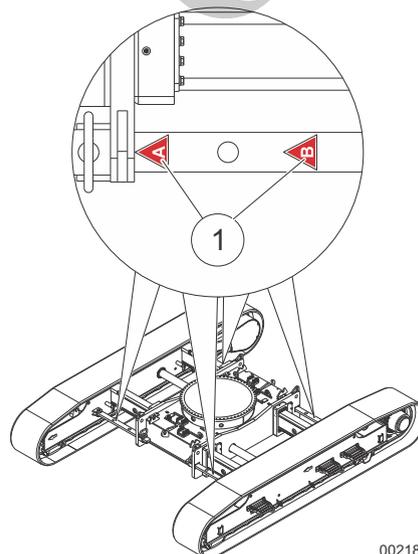
- Before telescoping, position the uppercarriage parallel to the undercarriage and apply the slewing gear brake to prevent twisting.
- Do not rotate the uppercarriage during the telescoping procedure.

7.3.1 Track width markings

The undercarriage has arrows (1) at the positions shown in Fig. 100. The arrows show the set track width.

When the tip of each arrow is aligned with the middle bridge, the following track widths are set:

Arrow	Track width
A	13.5 ft (4.1 m)
B	10.8 ft (3.3 m)
Undercarriage fully retracted	8.5 ft (2.6 m)



00218

Fig. 100 Track width marking with fully extended undercarriage

7.3.2 Extending the running gear

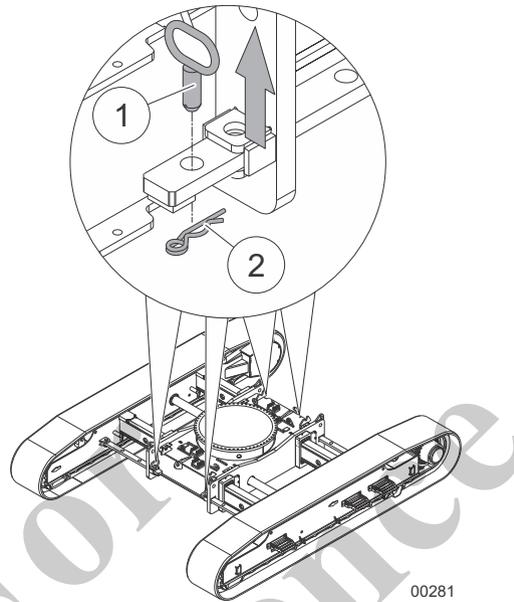
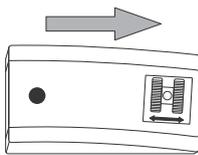


Fig. 101 Unbolting the undercarriage for telescoping

- | | |
|---|---|
| 1 | Remove the spring cotter pins (2) in Fig. 101 and the bolts (1) in Fig. 101 on the locking rods at the positions shown. |
| 2 | Enter the cab. |
| 3 | Push the safety lever forward. |
| 4 | Start the diesel engine. |
| 5 | Press the Release undercarriage telescoping switch to the right and hold it until the running gear has reached the desired track width and can be bolted in place. |



**Information**

Drive the machine a short distance forward and backward to facilitate the telescoping process.

6	Switch off the diesel engine.
7	Pull the safety lever back.
8	Exit the cab.

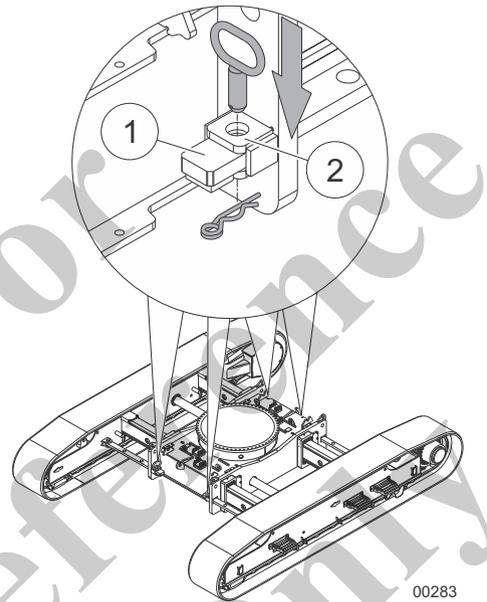
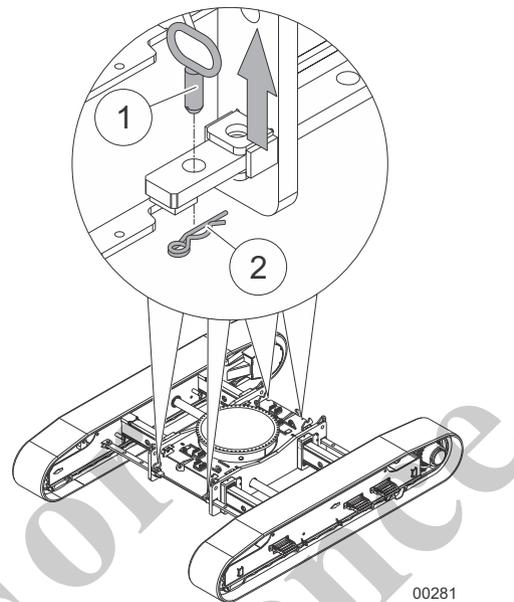


Fig. 102 Bolting the undercarriage

9	Bolt the locking rods (1) in Fig. 102 with the straps (2) in Fig. 102.
10	Secure the bolts with the retaining springs.

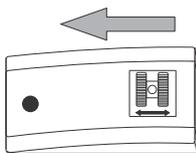
7.3.3 Retracting the running gear



00281

Fig. 103 Unbolting the undercarriage for telescoping

- | | |
|---|---|
| 1 | Remove the spring cotter pins (2) in Fig. 103 and the bolts (1) in Fig. 103 on the locking rods at the positions shown. |
| 2 | Enter the cab. |
| 3 | Push the safety lever forward. |
| 4 | Start the diesel engine. |
| 5 | Press the Release undercarriage telescoping switch to the left and hold it until the running gear retracts. |





Information

Drive the machine a short distance forward and backward to facilitate the telescoping process.

6	Switch off the diesel engine.
7	Pull the safety lever back.
8	Exit the cab.

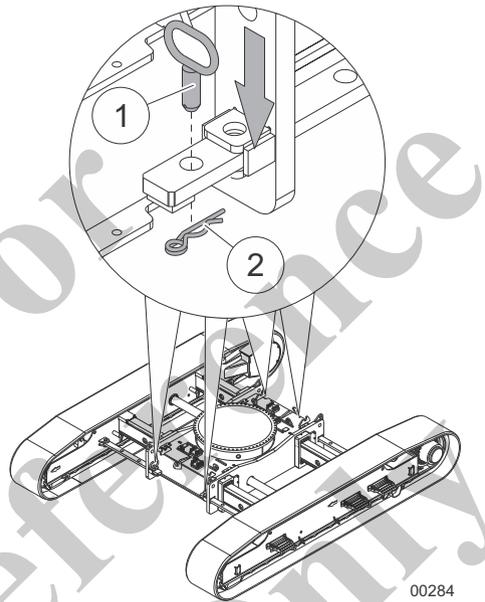


Fig. 104 Bolting the retracted undercarriage

9	Insert the bolts (1) in Fig. 104 at the positions shown.
10	Secure the bolts with the retaining springs (2) in Fig. 104.

7.4 Access ladders

WARNING

Danger of crushing due to moving machine parts!

Persons will 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.

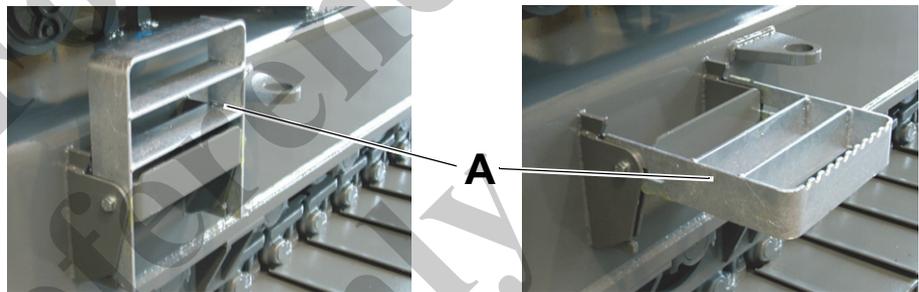


Fig. 105 Folded-in access ladder and folded-out access ladder (A)

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. 105 upward. |
| 2 | Slowly lower the access ladder A in Fig. 105 until it is completely horizontal. |

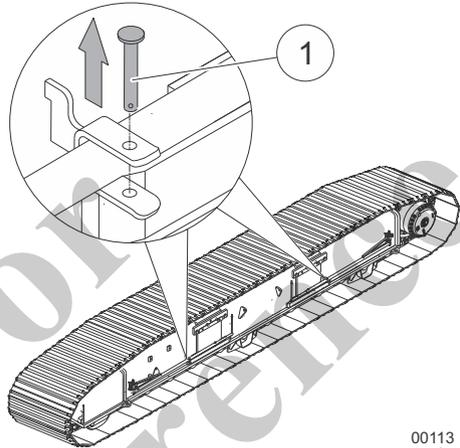
Folding in an access ladder

- | | |
|---|--|
| 1 | Lift the lowered access ladder A in Fig. 105 until it is resting completely against the side wall. |
| 2 | Pull the access ladder A in Fig. 105 upward and then let it lower. |

7.5 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.

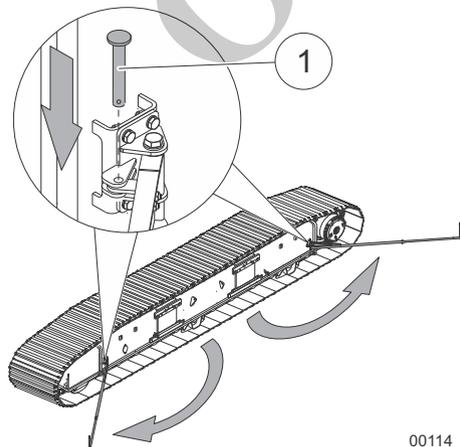
- 1 Pull the locking bolt (1) in Fig. 106 out of the slewing range safeguard.



00113

Fig. 106 Unlocking the slewing range safeguard

- 2 Completely fold out the slewing range safeguard.
- 3 Insert and secure the locking bolt (1) in Fig. 107 at the position shown.



00114

Fig. 107 Folding out the slewing range safeguard

- 4 Pull out the bolt (1) in Fig. 108. Pull out the slewing range safeguard to its full length. Insert the bolt (1) in Fig. 108 at the position shown.

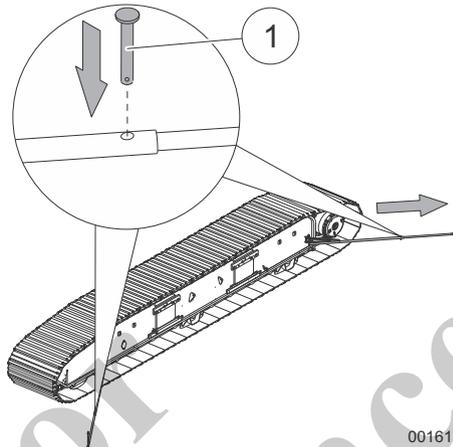


Fig. 108 Pulling out the slewing range safeguard

- 5 Unfold and pull out the slewing range safeguard on the second track wheel carrier.
- 6 Apply barrier tape (1) in Fig. 109.

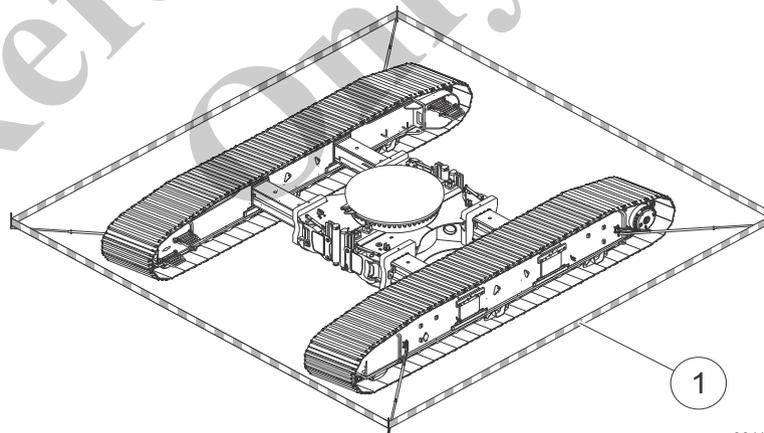


Fig. 109 Applying barrier tape

7.6 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.

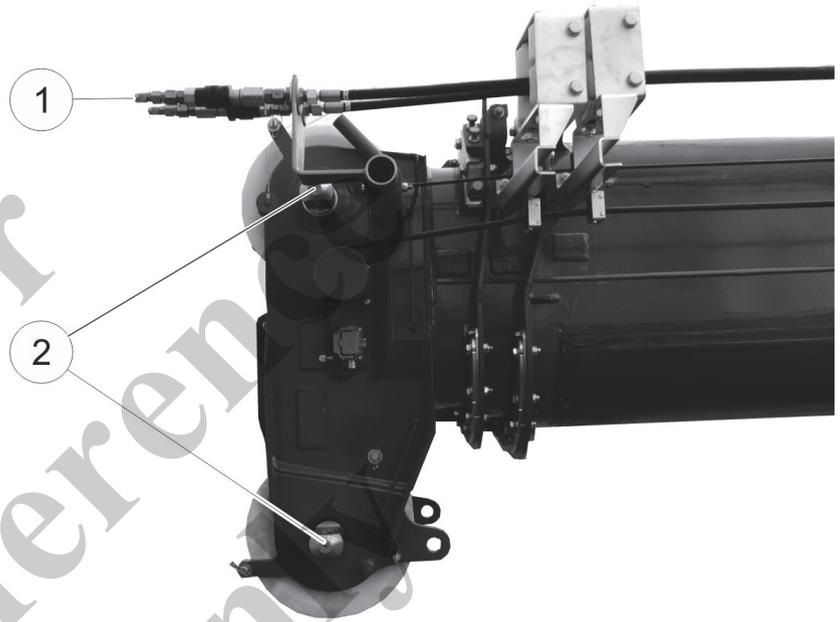


Fig. 110 Connections for the clamping tongs on the boom head

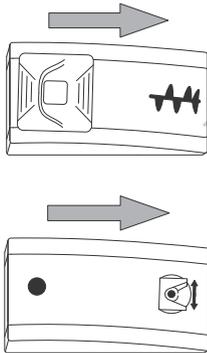
1	Hydraulic connections
2	Retaining points

7.7 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.

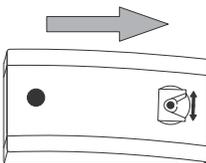
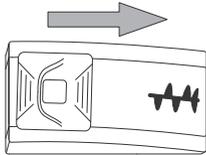
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7.8 Slewing the soil drill (option) into working position



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.

7.9 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.

7.10 Attaching the fly boom (6.5 m)

WARNING

Risk of falling.

Climbing on the boom can result in a fall causing serious injury or death.

- Use a ladder with a minimum height of 1.40 m to insert/remove the bolts.
- Do not climb onto the boom.

1	Enter the cab.
2	Start the diesel engine.
3	Extend the undercarriage fully.
4	Select Setup operating mode on the SENCON.
5	Push the safety lever forward.
6	Place the bottom hook block on the ground.
7	Unreeve the hoist rope from the pulley head and bottom hook block and wind it into the winch.
8	Lower the telescopic boom to 0° and retract it.
9	Switch off the diesel engine and pull the safety lever towards you.
10	Attach the fly boom to an auxiliary crane with suitable lifting gear.
11	Lift the fly boom to the head of the telescopic boom.

- 12 Align the fly boom to the telescopic boom head. The bores of the fly boom (2) in Fig. 111 and the telescopic boom (1) in Fig. 111 must be aligned.

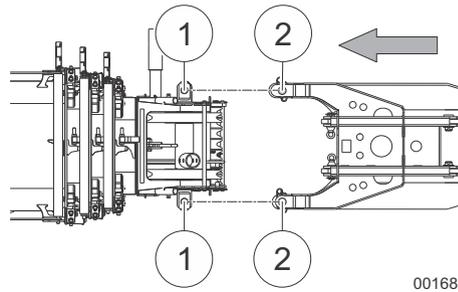


Fig. 111 Lifting the fly boom to the telescopic boom

- 13 Remove the bolts (1) in Fig. 112 from the retainers (2) in Fig. 112.
- 14 Bolt the fly boom to the telescopic boom at the bolting positions (1) in Fig. 112.

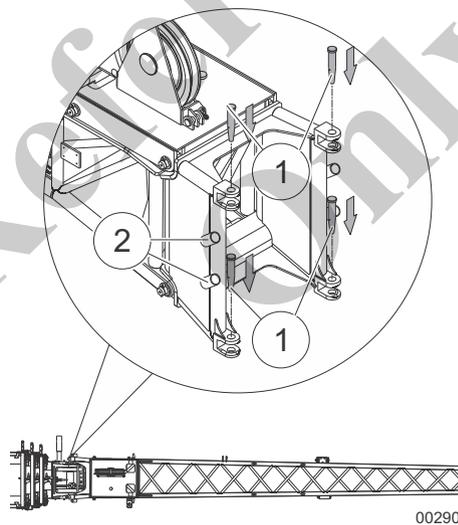
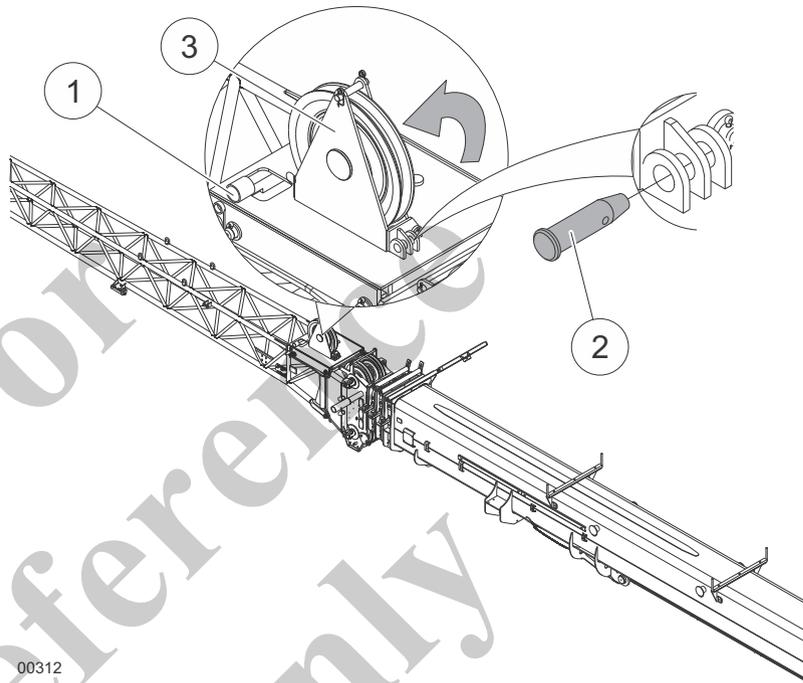


Fig. 112 Bolting the fly boom

- 15 Secure the bolts (1) in Fig. 112 with retaining springs.
- 16 Detach the lifting gear from the fly boom and move the auxiliary crane out of the work area.

17	Remove the bolt (2) in Fig. 113 from the retainer (1) in Fig. 113.
18	Fold up the deflection sheave (3) in Fig. 113.
19	Bolt down and secure the deflection sheave with the bolt (2) in Fig. 113.



00312
Fig. 113 Folding up the deflection sheave

- | | |
|----|---|
| 20 | Run the hoist rope over the deflection sheave and the head pulley sheave on the fly boom. |
| 21 | Remove the bypass plug (1) in Fig. 114 from the lower socket (2) in Fig. 114 and insert it into the upper socket (3) in Fig. 114. |

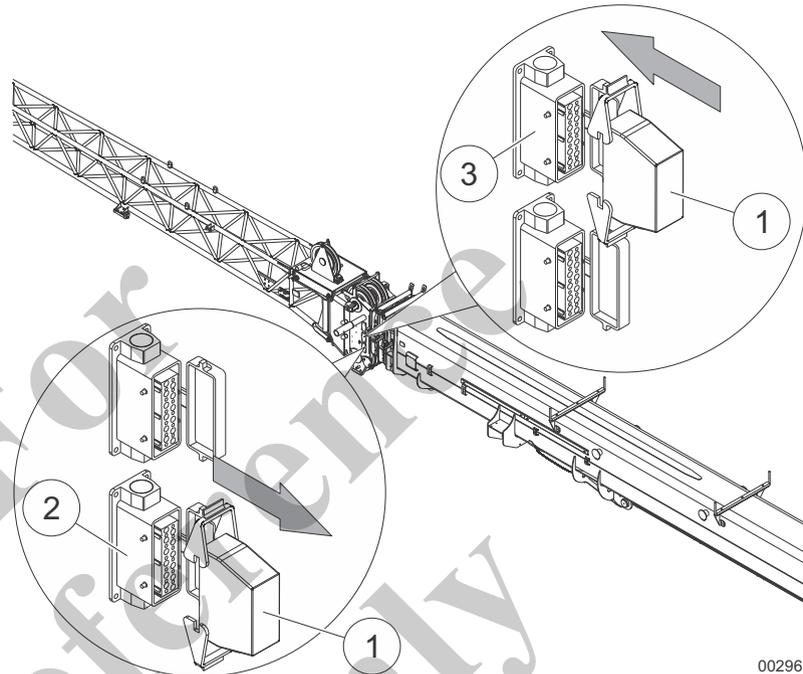


Fig. 114 Inserting the bypass plug on the telescopic boom

00296

- 22 Attach the bypass flag of the lifting limit switch to the telescopic boom head.

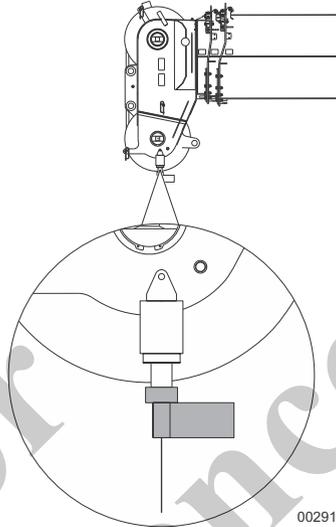


Fig. 115 Attaching the bypass flag to the telescopic boom

- 23 Remove the lifting limit switch cable of the fly boom (1) in Fig. 116 from the socket.

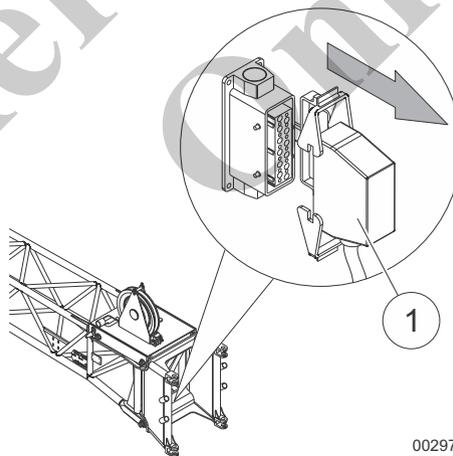
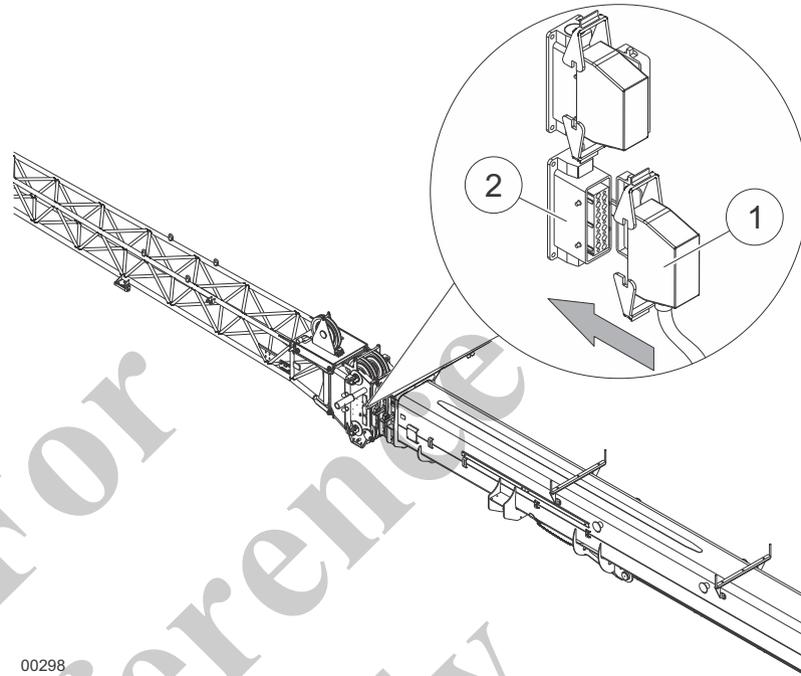


Fig. 116 Fly boom lifting limit switch cable

- 24 Insert the lifting limit switch cable of the fly boom (1) in Fig. 117 into the lower socket (2) in Fig. 117 on the telescopic boom.



00298

Fig. 117 Inserting the fly boom lifting limit switch cable into the telescopic boom

- 25 Attach the lifting limit switch weight and chain to the lifting limit switch of the fly boom.
- 26 Reeve the bottom hook block. See Section 11.16 REEVING DIAGRAM.

7.11 Folding the fly boom (6.5 m) into working position

Safety instructions

- Ensure that the fly boom is correctly bolted to the basic body and secured.
- This procedure requires at least 10 m of space on the right side of the machine.

1	Enter the cab.
2	Start the diesel engine.
3	Select Setup operating mode on the SENCON.
4	Push the safety lever forward.
5	Place the bottom hook block on the ground.
6	Unreeve the hoist rope.
7	Lower the telescopic boom to 0° and retract it.
8	Attach a rope (1) in Fig. 118 to the fly boom.

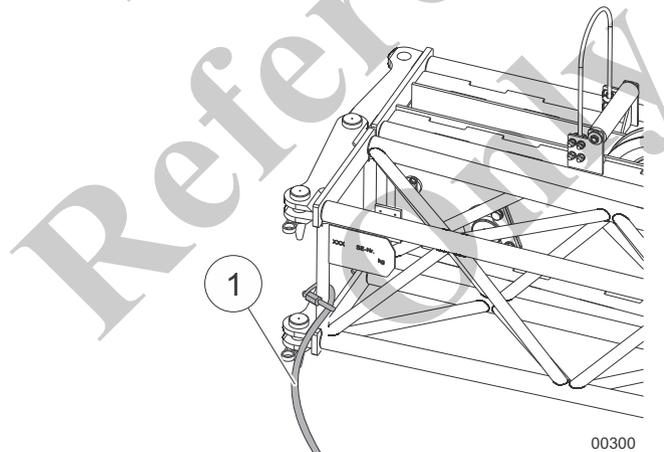
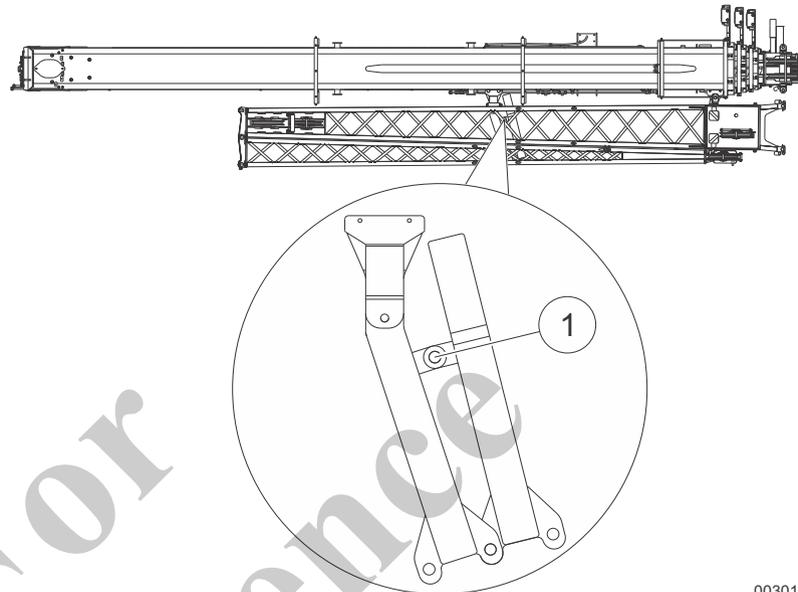


Fig. 118 Attaching a rope for pulling the fly boom around

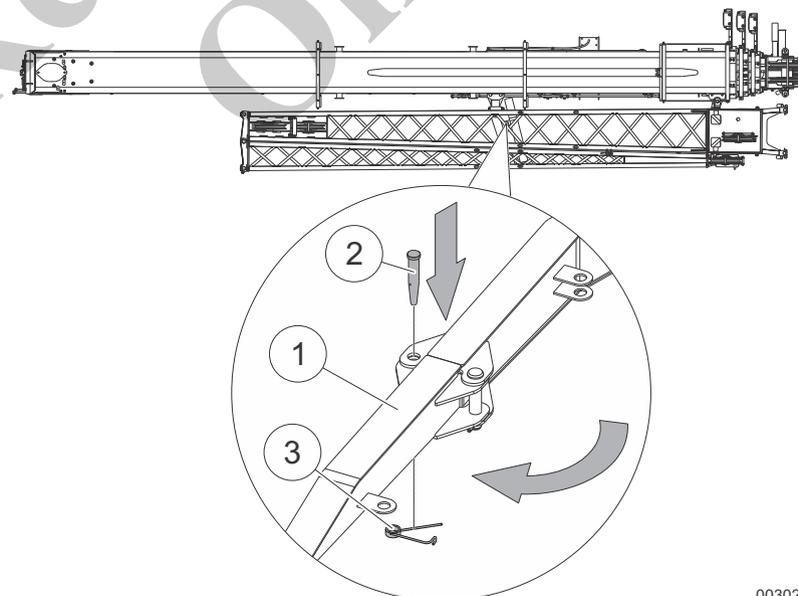
9 Release and remove the bolt (1) in Fig. 119 on the ramp.



00301

Fig. 119 Unbolting the ramp

10 Fold out the ramp (1) in Fig. 120. Insert the bolt (2) in Fig. 120 at the position shown and secure it with the retaining spring (3) in Fig. 120.



00302

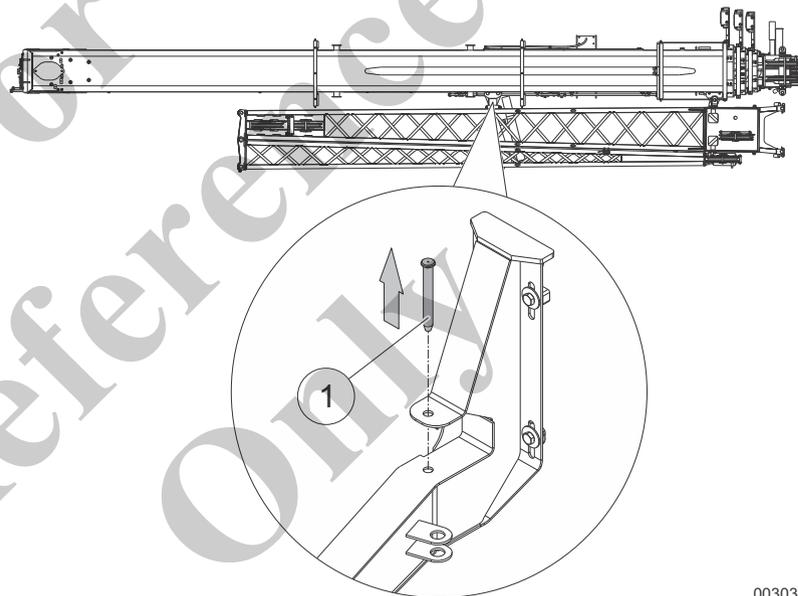
Fig. 120 Bolting the ramp in setup position

⚠ 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 10 m.

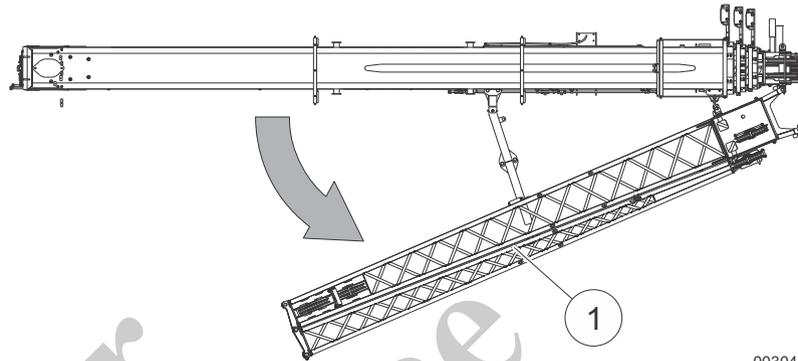
- | | |
|----|--|
| 11 | Check the boom angle. The angle of the boom must be 0°. |
| 12 | Release and remove the bolt (1) in Fig. 121 on the ramp. |



00303

Fig. 121 Unbolting the ramp

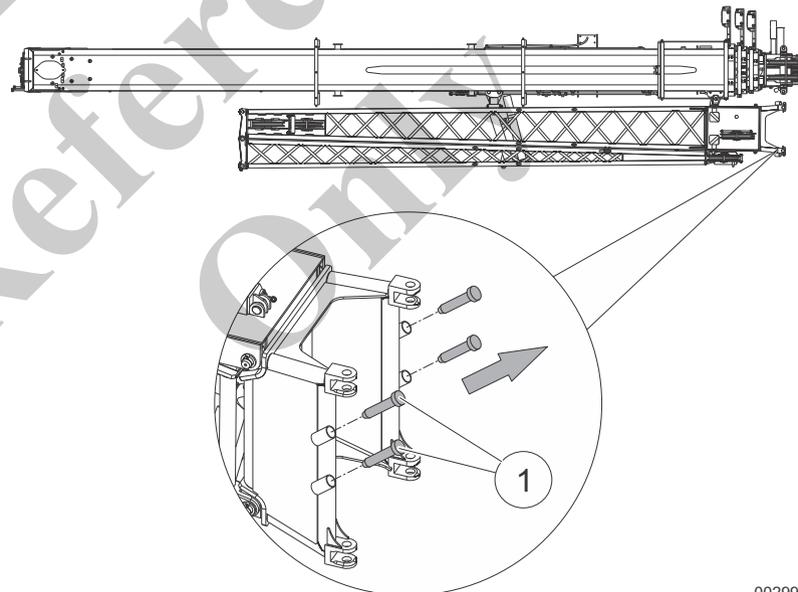
- 13 Use the rope to move the fly boom (1) in Fig. 122 around until the bolt openings on the right of the fly boom align with those of the telescopic boom.



00304

Fig. 122 Pulling the fly boom around

- 14 Release and remove the bolts (1) in Fig. 123 on the fly boom.



00299

Fig. 123 Pulling out the bolt on the fly boom

- 15 Bolt the fly boom to the telescopic boom at the bolting positions (1) in Fig. 124 and secure with retaining springs (2) in Fig. 124.

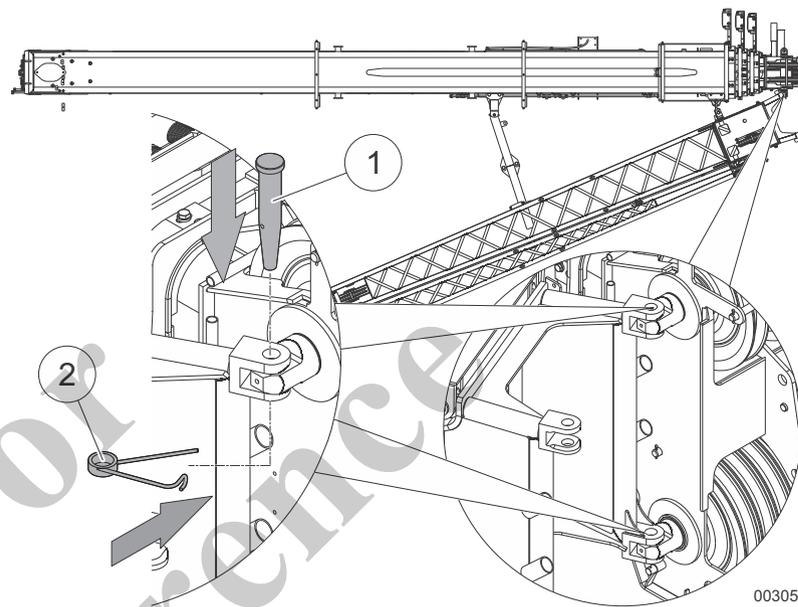


Fig. 124 Bolting the fly boom to the boom head

- 16 Release and remove the vertical bolt (1) in Fig. 125 on the basic body.

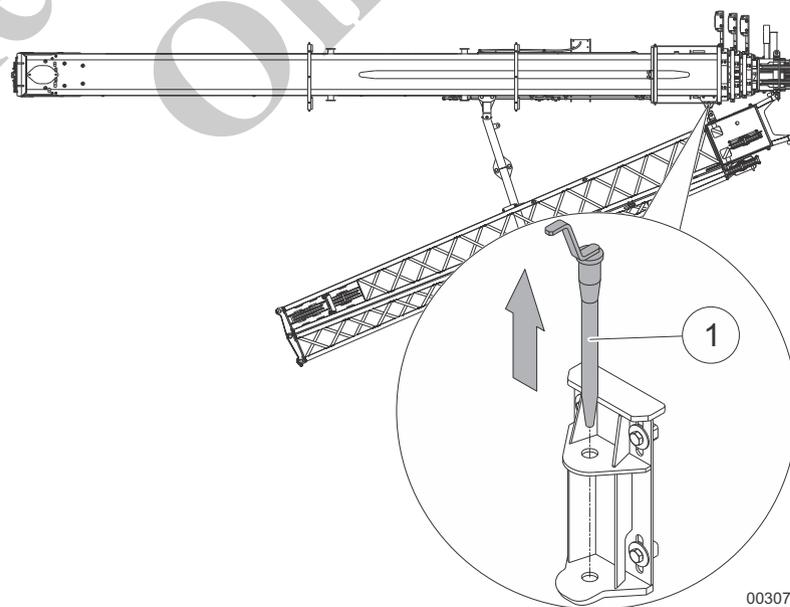


Fig. 125 Releasing the fly boom lock

- 17 Use the rope to pull the fly boom into working position.

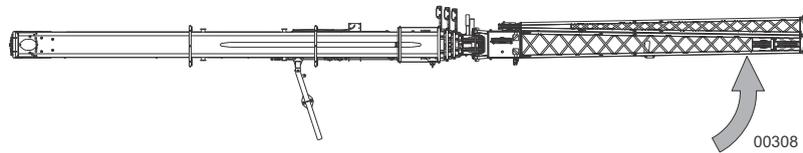


Fig. 126 Pulling the fly boom into working position

- 18 Bolt and secure the fly boom to the main boom (1) in Fig. 127.

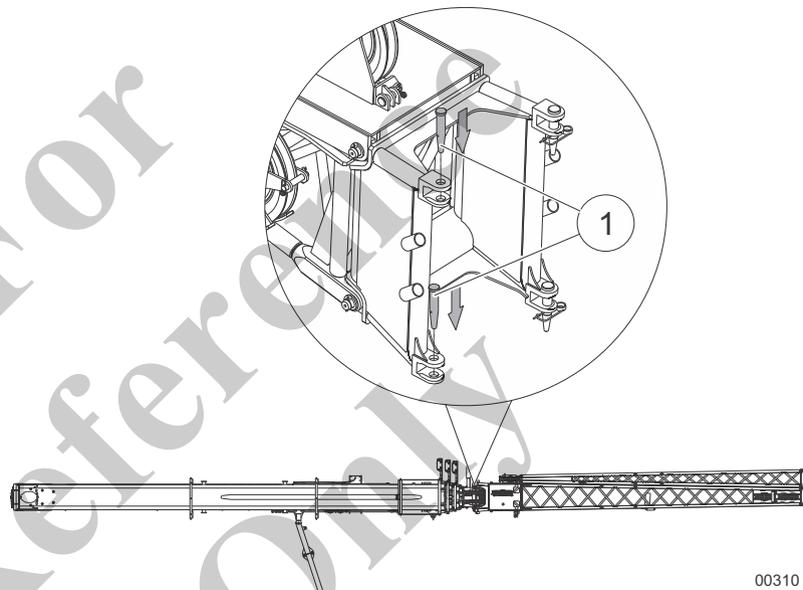


Fig. 127 Folding the fly boom into working position

- 19 Insert and secure the vertical bolt (1) in Fig. 125 into the fly boom lock on the basic body.

- 20 Release and remove the bolt (1) in Fig. 128 on the ramp.

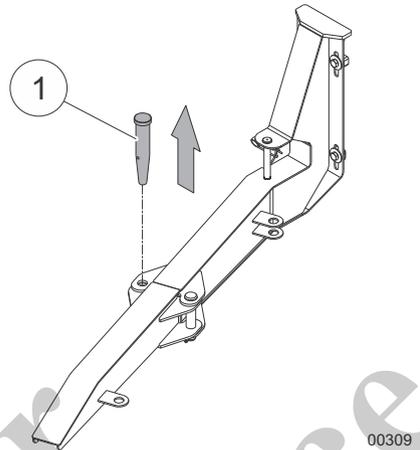


Fig. 128 Unbolting the ramp

- 21 Fold in the ramp (1) in Fig. 129 and secure it with the bolt (2) in Fig. 129 at the position shown.

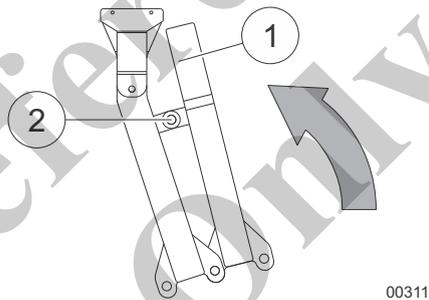


Fig. 129 Folding in and bolting the ramp

22	Remove the bolt (2) in Fig. 130 from the retainer (1) in Fig. 130.
23	Fold up the deflection sheave (3) in Fig. 130.
24	Bolt down and secure the deflection sheave with the bolt (2) in Fig. 130.

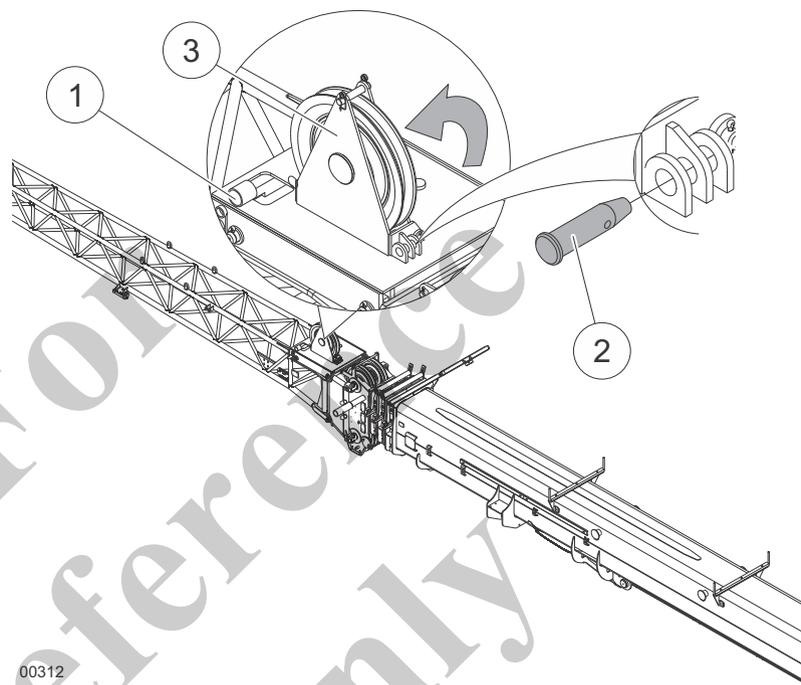


Fig. 130 Folding up the deflection sheave

- 25 Remove the bypass plug (1) in Fig. 131 from the lower socket (2) in Fig. 131 and insert it into the upper socket (3) in Fig. 131.

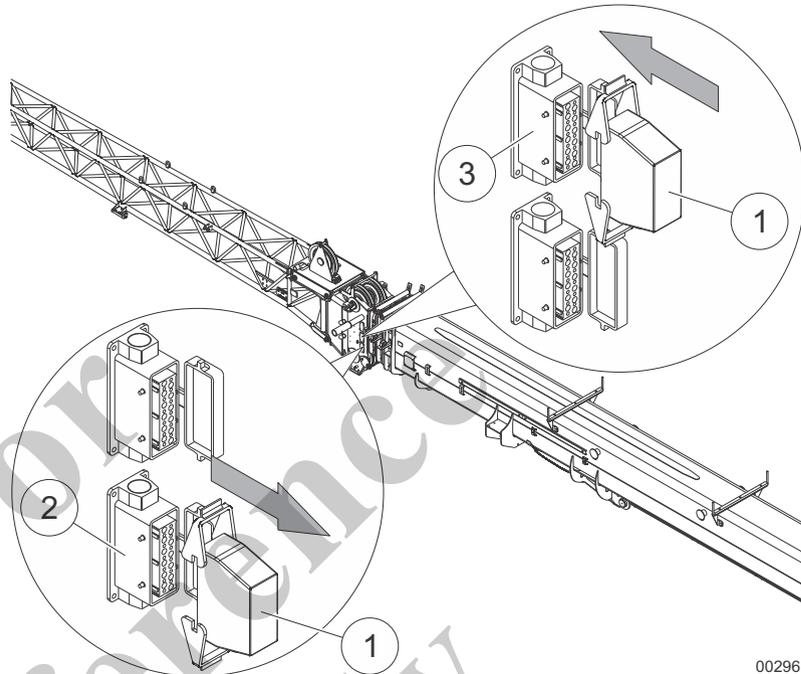


Fig. 131 Inserting the bypass plug on the telescopic boom

- 26 Attach the bypass flag of the lifting limit switch to the telescopic boom head.

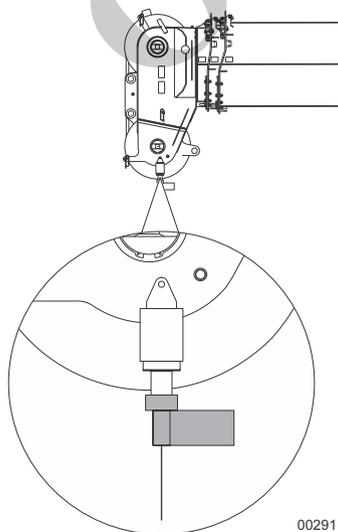
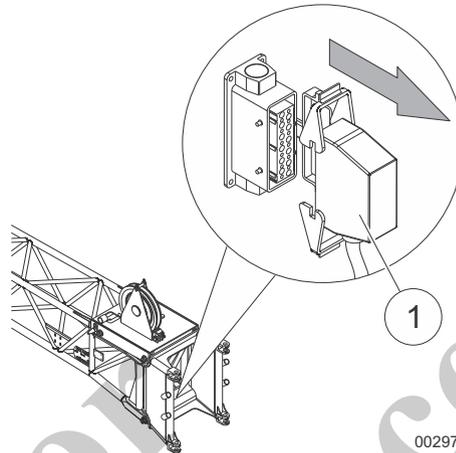


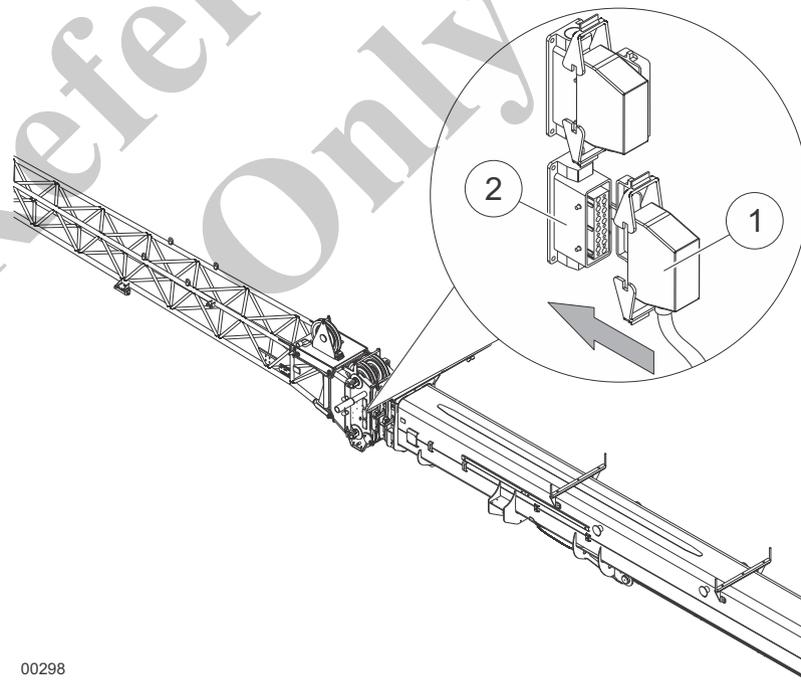
Fig. 132 Attaching the bypass flag on the telescopic boom head

27 Remove the lifting limit switch cable of the fly boom (1) in Fig. 133 from the socket.



00297
Fig. 133 Fly boom lifting limit switch cable

28 Insert the lifting limit switch cable of the fly boom (1) in Fig. 134 into the lower socket (2) in Fig. 134 on the telescopic boom.



00298
Fig. 134 Inserting the fly boom lifting limit switch cable into the telescopic boom

29	Attach the lifting limit switch weight and chain to the lifting limit switch of the fly boom.
30	Reeve the bottom hook block. See Section 11.16 REEVING DIAGRAM.

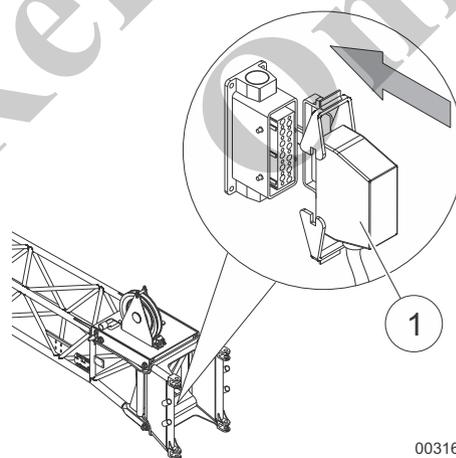
For
Reference
Only

7.12 Folding the fly boom (6.5 m) into transport position

Safety instructions

- Ensure that the fly boom is correctly bolted to the basic body and secured.
- This procedure requires at least 10 m of space on the right side of the machine.

1	Enter the cab.
2	Start the diesel engine.
3	Select Setup operating mode 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	Unreeve the hoist rope.
8	Lower the telescopic boom to 0° and retract it.
9	Remove the lifting limit switch cable of the fly boom from the telescopic boom and insert it into the storage socket (1) in Fig. 135 on the fly boom.



00316

Fig. 135 Inserting the lifting limit switch cable of the fly boom into the storage socket

10 Remove the bypass flag of the lifting limit switch on the telescopic boom.

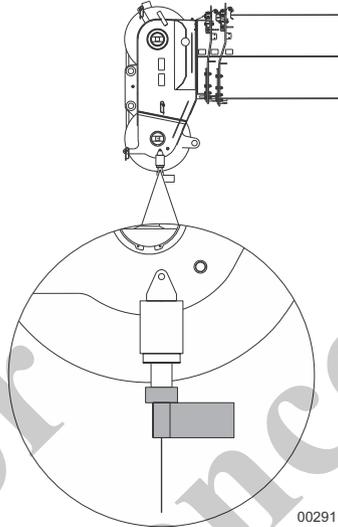


Fig. 136 Removing the bypass flag from the telescopic boom head

11 Remove the bypass plug (1) in Fig. 137 from the upper socket (3) in Fig. 137 and insert it into the lower socket (2) in Fig. 137.

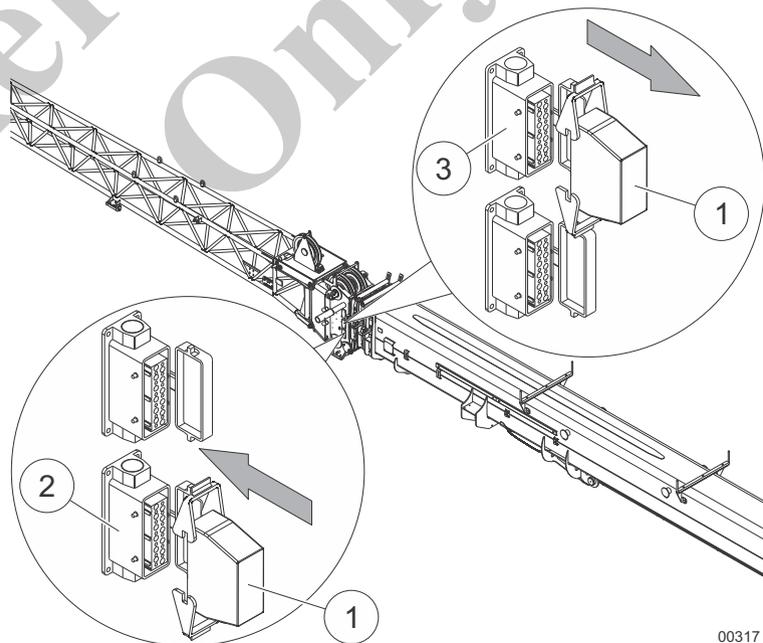
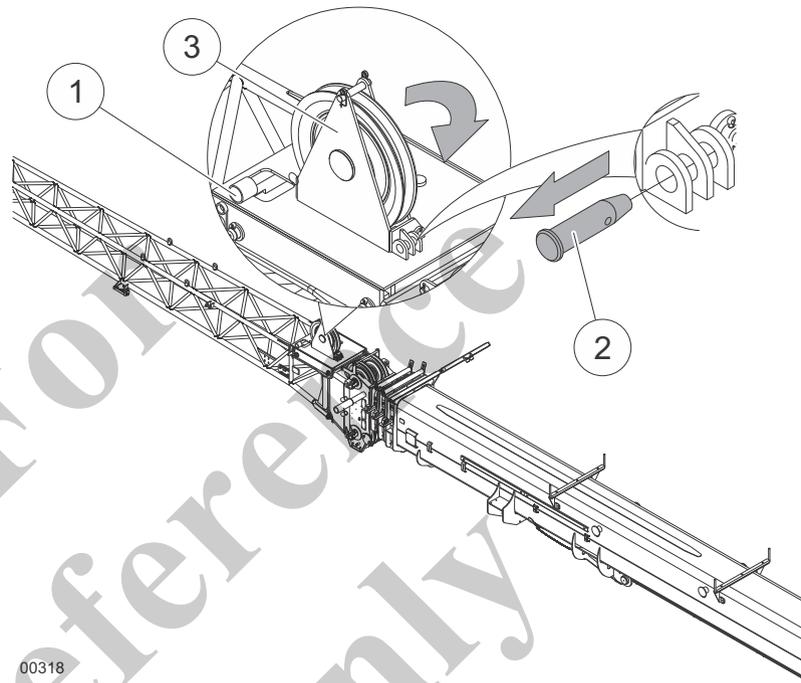


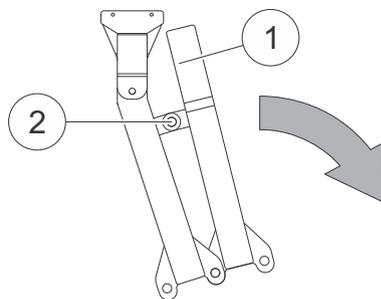
Fig. 137 Inserting the bypass plug on the telescopic boom

12	Release and remove the bolt (2) in Fig. 138 on the deflection sheave (3) in Fig. 138.
13	Fold the deflection sheave down.
14	Insert and secure the bolt in the retainer (1) in Fig. 138.



00318
Fig. 138 Folding down the deflection sheave

15	Release the bolt (2) in Fig. 139 on the ramp. Fold out the ramp on the basic body (1) in Fig. 139.
----	--



00319
Fig. 139 Releasing and unfolding the ramp

16 | Insert and secure the bolt (1) in Fig. 140 on the ramp.

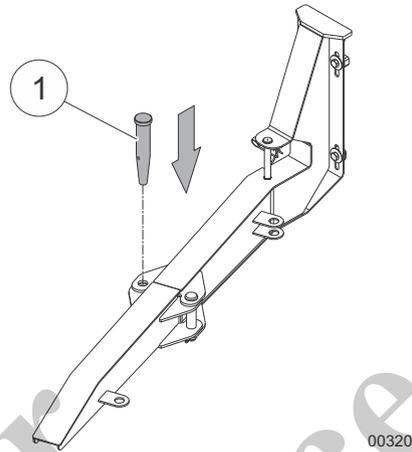


Fig. 140 Bolting the ramp

17 | Attach a rope (1) in Fig. 141 to the fly boom.

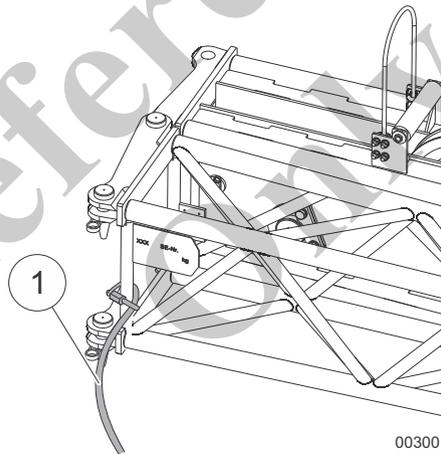


Fig. 141 Attaching a rope for pulling the fly boom around

- 18 Release and remove the vertical bolt (1) in Fig. 142 on the basic body.

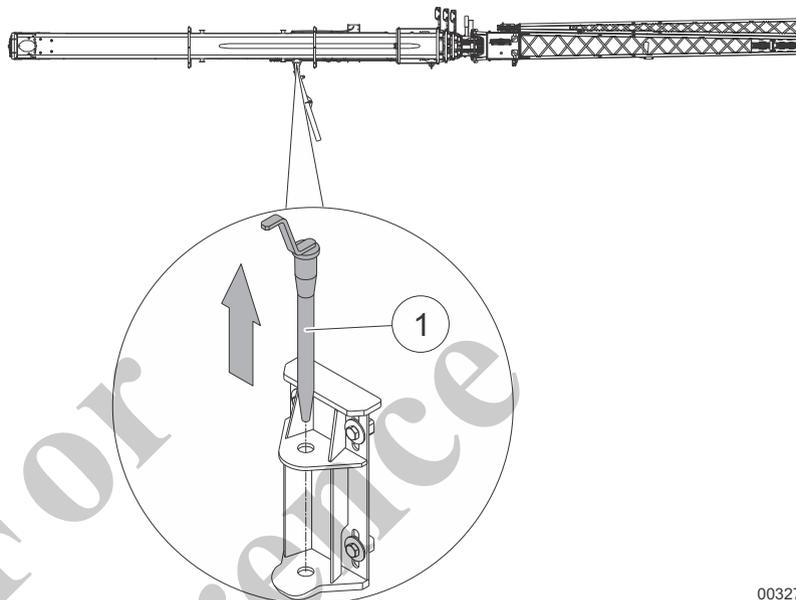


Fig. 142 Releasing the fly boom safeguard

00327

- 19 Release and remove the bolt (1) in Fig. 143 on the ramp.

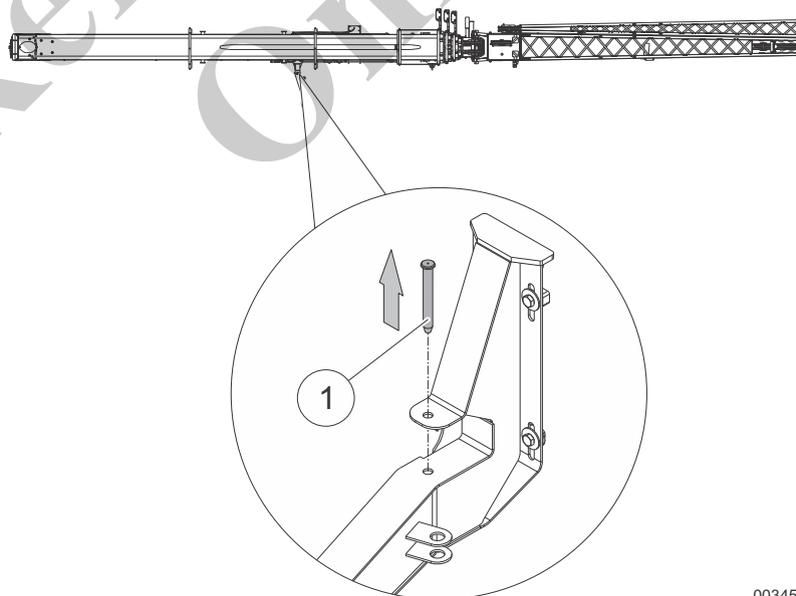


Fig. 143 Unbolting the ramp

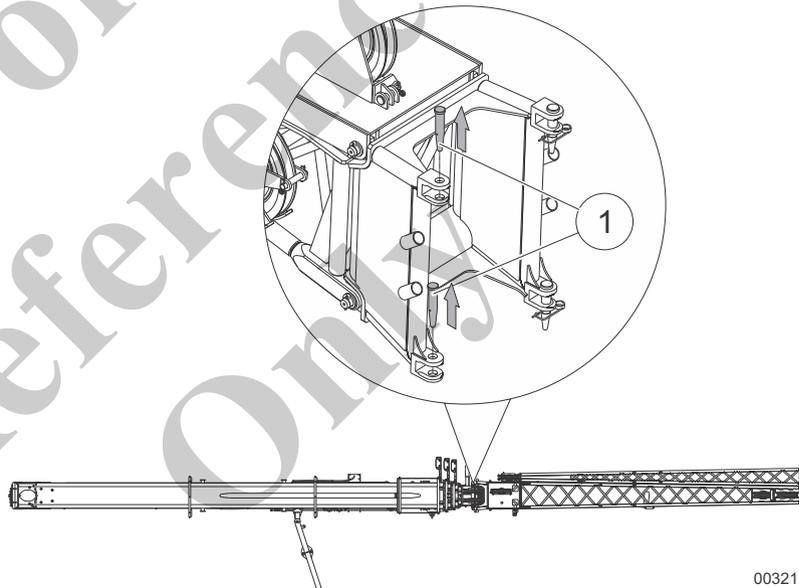
00345

⚠ 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 10 m.

- | | |
|----|---|
| 20 | Check the boom angle. The angle of the boom must be 0°. |
| 21 | Release and drive out the bolts (1) in Fig. 144 on the left side of the boom. |



00321

Fig. 144 Unbolting the fly boom for closing

- 22 Use the rope to move the fly boom around until the lock openings on the fly boom align with those of the telescopic boom (1) in Fig. 145.

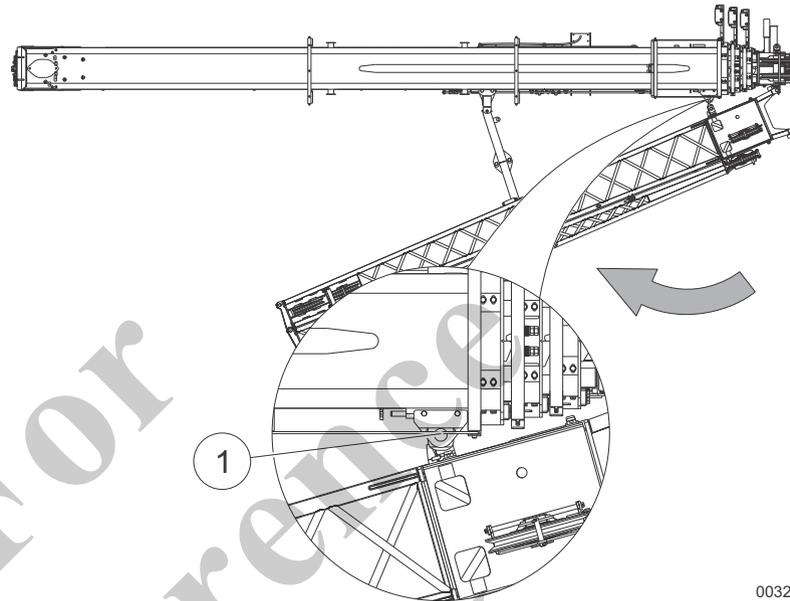


Fig. 145 Pulling the fly boom around

00322

- 23 Insert and secure the vertical bolt (1) in Fig. 142 into the fly boom lock on the basic body.

- | | |
|----|--|
| 24 | Release and drive out the bolts (1) in Fig. 146 on the right side of the boom. |
| 25 | Insert and secure the bolts in the parking position. |

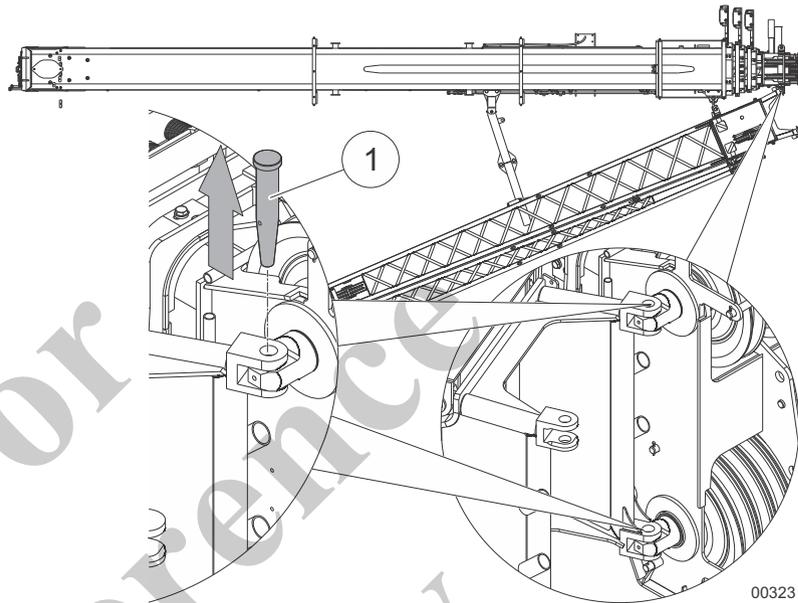


Fig. 146 Unbolting the fly boom on the boom head

- | | |
|----|---|
| 26 | Use the rope to move the fly boom (1) in Fig. 147 around until the fly boom can be secured to the ramp. |
|----|---|

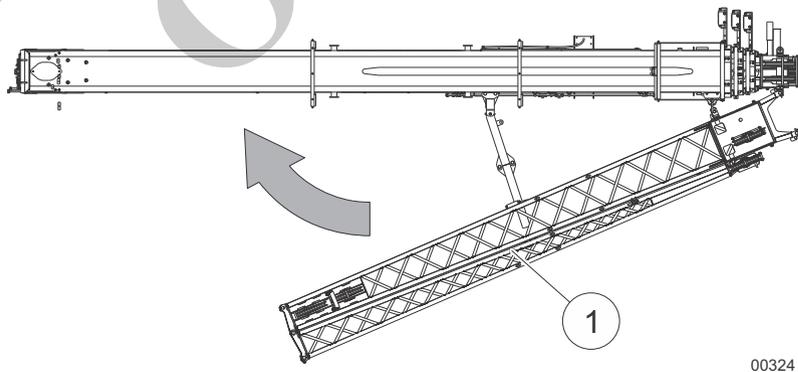
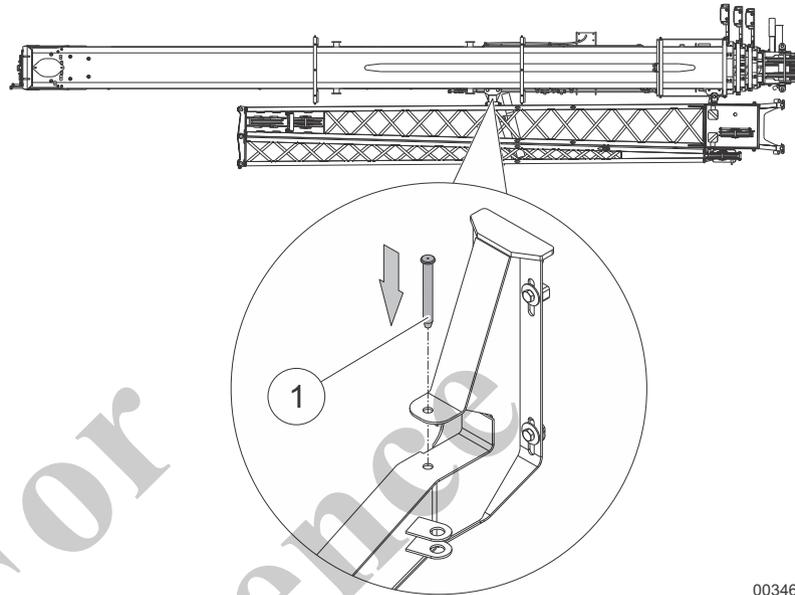


Fig. 147 Folding the fly boom into transport position

27 | Secure the fly boom to the ramp with the bolt (1) in Fig. 148.

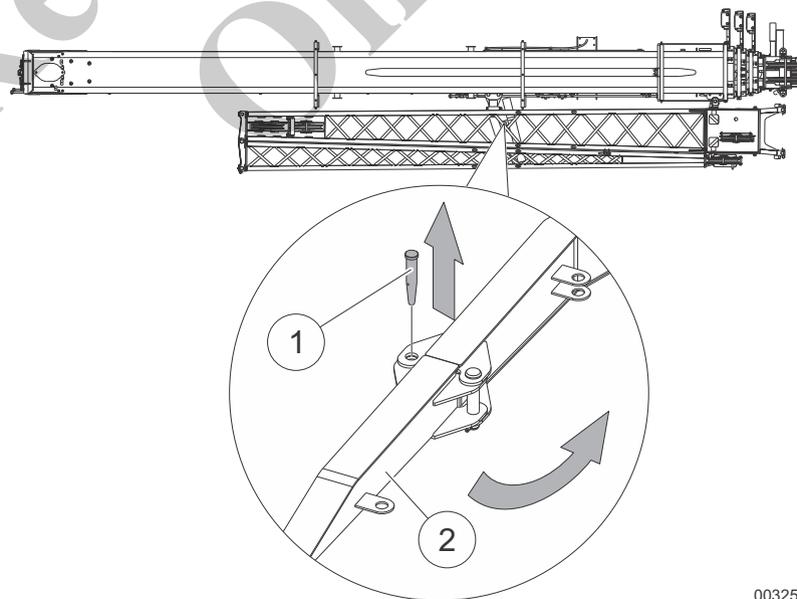


00346

Fig. 148 Securing the fly boom to the ramp

28 | Release and remove the bolt (1) in Fig. 149.

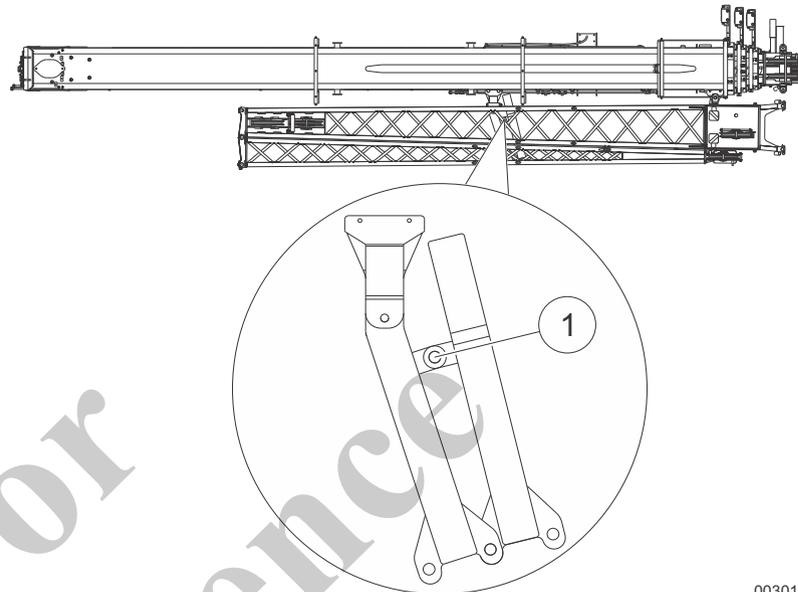
29 | Fold in the ramp (2) in Fig. 149.



00325

Fig. 149 Folding the ramp into transport position

- 30 | Insert and secure the bolt (1) in Fig. 150 on the ramp.



00301

Fig. 150 Bolting the ramp in transport position

- | | |
|----|--|
| 31 | Release the rope from the fly boom. |
| 32 | Reeve the hoist rope on the telescopic boom. |
| 33 | Attach and secure the lifting limit switch to the telescopic boom. |
| 34 | Reeve the bottom hook block. |

7.13 Folding the fly boom from 0° to 40°



Note

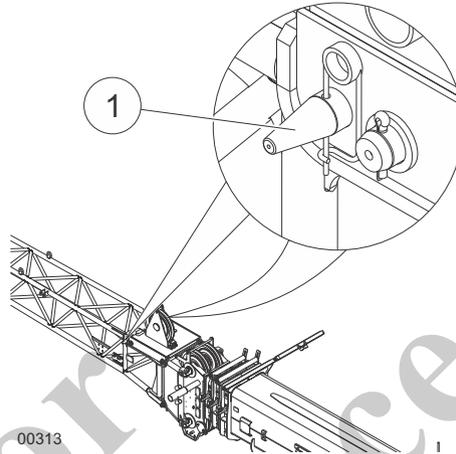
When folding in the fly boom, it slides approx. 1.5 m (4.9 ft) on the support toward the machine.



Fig. 151 Folding the fly boom from 0° to 40°

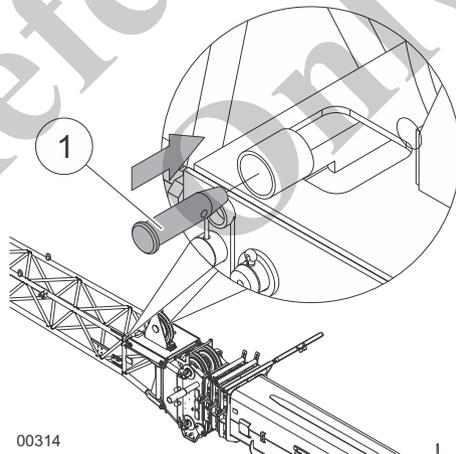
- | | |
|---|---|
| 1 | Enter the cab. |
| 2 | Start the diesel engine. |
| 3 | Select Setup operating mode on the SENCON. |
| 4 | Push the safety lever forward. |
| 5 | Place the bottom hook block on the ground. |
| 6 | Lower and extend the telescopic boom until the fly boom head rests on the ground. |

- 7 Release and remove both bolts (1) in Fig. 152 from the fly boom.



00313
Fig. 152 Removing the bolts from the fly boom

- 8 Insert and secure both bolts at the positions shown (1) in Fig. 153 on the fly boom. Do not push the fly boom into the ground.



00314
Fig. 153 Inserting the bolts in the fly boom

- 9 Carefully lift the telescopic boom until the fly boom is no longer touching the ground.
– Fold the fly boom downward by 40°.

7.14 Folding the fly boom from 40° to 0°



Information

When setting the boom down, the fly boom slides approx. 1.5 m (4.9 ft) on the support away from the machine.



Fig. 154 Folding the fly boom from 40° to 0°

1	Enter the cab.
2	Start the diesel engine.
3	Select Setup operating mode on the SENCON.
4	Push the safety lever forward.
5	Carefully lower the telescopic boom until the head of the fly boom is lying on the ground.
6	Carefully lower the telescopic boom until the fly boom is 0° relative to the telescopic boom.

- 7 Remove both bolts (1) in Fig. 155 on the fly boom from the positions shown. Do not push the fly boom into the ground.

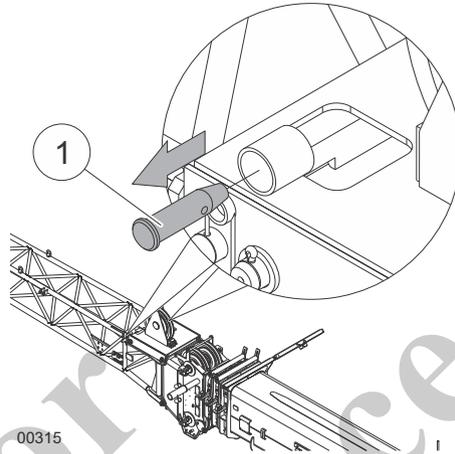


Fig. 155 Removing the bolts from the fly boom

- 8 Insert and secure both bolts (1) in Fig. 156 on the fly boom at the positions shown.

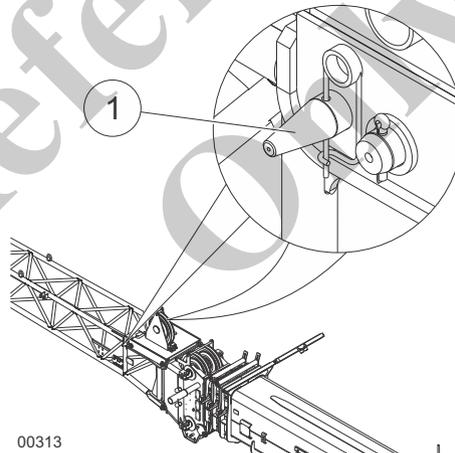


Fig. 156 Bolting the fly boom in the 0° position

- 9 Carefully lift the telescopic boom until the fly boom is no longer touching the ground.

7.15 Attaching the fly boom extension (6.5 m) (option)

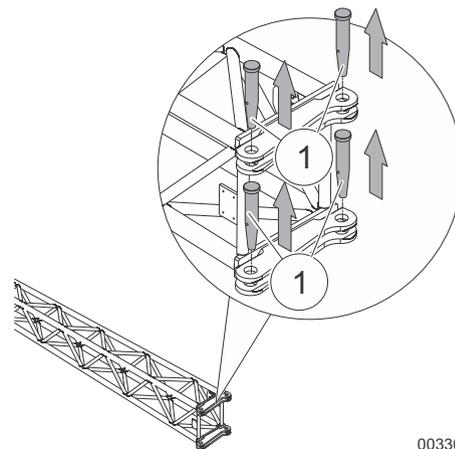
! WARNING

Danger of falling!

Climbing on the boom can result in a fall causing serious injury or death.

- Use a ladder with a minimum height of 1.40 m to insert/remove the bolts.
- Do not climb onto the boom.

1	Enter the cab.
2	Start the diesel engine.
3	Extend the undercarriage fully.
4	Select Setup operating mode on the SENCON.
5	Push the safety lever forward.
6	Place the bottom hook block on the ground.
7	Unreeve the hoist rope from the pulley head and bottom hook block and wind it into the winch.
8	Lower the telescopic boom to 0° and retract it.
9	Switch off the diesel engine and pull the safety lever towards you.
10	Release and remove the bolts (1) in Fig. 157 on the fly boom extension.



00330

Fig. 157 Removing the bolts from the fly boom extension

11	Attach the fly boom extension to an auxiliary crane (min. load capacity: 2,000 kg (4,400 lbs)) with suitable lifting gear.
12	Hoist the fly boom extension to the fly boom head.
13	Align the fly boom extension with the fly boom head. The holes on the fly boom extension (2) in Fig. 158 must be aligned with those of the fly boom (1) in Fig. 158.

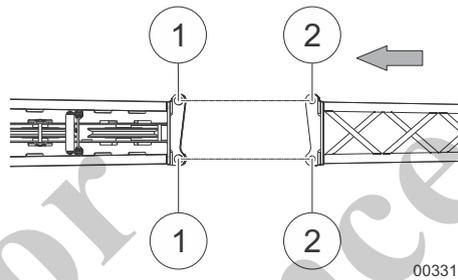


Fig. 158 Hoisting the fly boom extension to the fly boom

14	Bolt the fly boom extension to the fly boom at the bolting positions (1) in Fig. 159 and secure with retaining springs.
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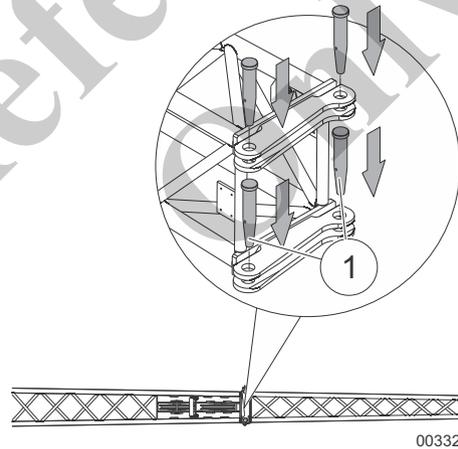


Fig. 159 Bolting the fly boom extension to the fly boom

15	Remove the lifting gear from the fly boom extension and move the auxiliary crane out of the work area.
16	Retract the hoist rope of winch 1 over the deflection sheave on the fly boom and the boom head of the fly boom extension.
17	Remove the lifting limit switch cable of the fly boom extension (1) in Fig. 160 from the socket.

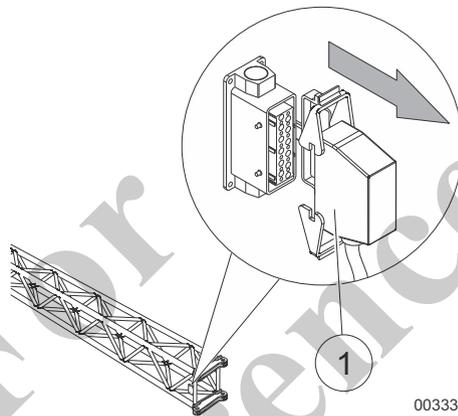


Fig. 160 Fly boom extension lifting limit switch cable

18	Insert the lifting limit switch cable of the fly boom extension (1) in Fig. 161 into the socket on the fly boom head.
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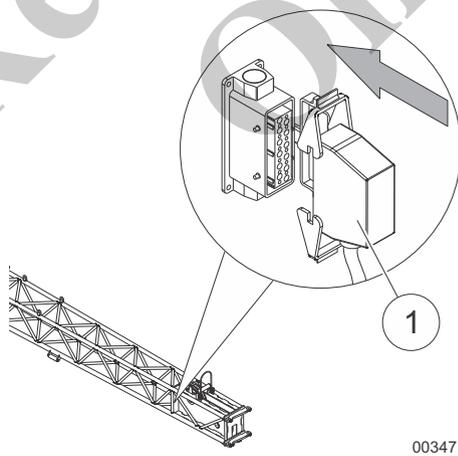


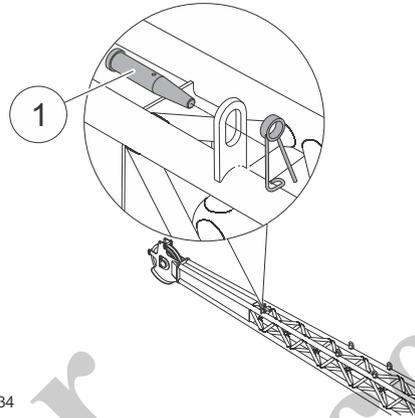
Fig. 161 Inserting the fly boom extension lifting limit switch cable into the fly boom head

19	Attach the lifting limit switch weight and chain to the lifting limit switch of the fly boom extension.
20	Reeve the bottom hook block. See Section 11.16 REEVING DIAGRAM.

7.16 Folding the fly boom extension (6.5 m) into transport position

1	Enter the cab.
2	Start the diesel engine.
3	Select Setup operating mode on the SENCON.
4	Push the safety lever forward.
5	Place the bottom hook block on the ground.
6	Unreeve the hoist rope from the pulley head and bottom hook block and wind it into the winch.
7	Lower the telescopic boom to 0° and retract it.
8	Switch off the diesel engine and pull the safety lever towards you.
9	Remove the lifting limit switch of the fly boom extension from the fly boom and insert it in the storage socket of the fly boom extension.

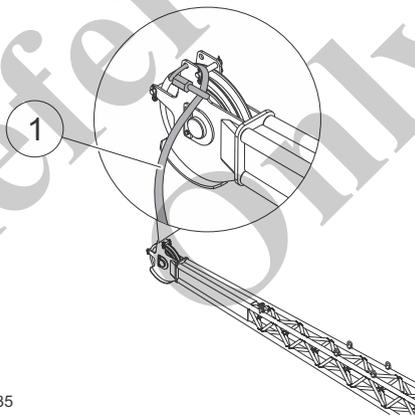
- 10 Release and remove the bolt (1) in Fig. 162 on the fly boom extension.



00334

Fig. 162 Releasing the bolt on the fly boom extension

- 11 Attach a rope (1) in Fig. 163 to the boom head of the fly boom extension.



00335

Fig. 163 Attaching a rope for pulling the fly boom extension around

⚠ 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 10 m.

12 Check the boom angle. The angle of the boom must be 0° .

13 Release and drive out the bolts (1) in Fig. 164 on the right between the fly boom and the fly boom extension.

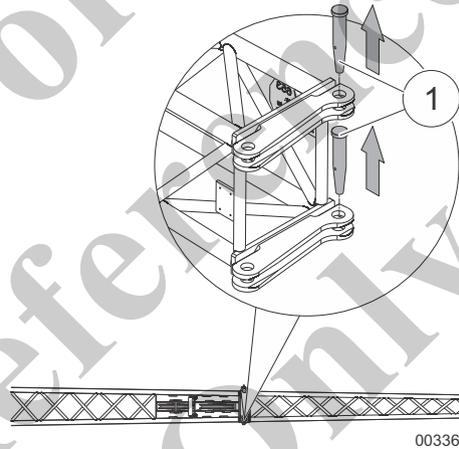


Fig. 164 Unbolting the fly boom head

14 Use the rope to pull the fly boom extension (1) in Fig. 165 to the fly boom.

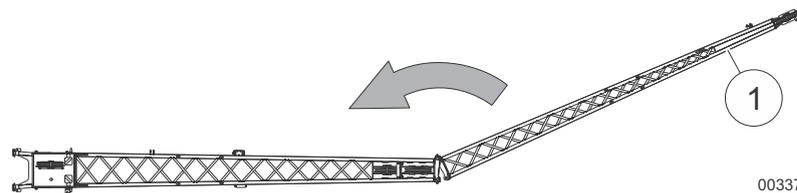


Fig. 165 Pulling the fly boom extension to the fly boom

- | | |
|----|--|
| 15 | Insert the fly boom extension to the fly boom with the bolt (1) in Fig. 166 and secure with a spring cotter pin (2) in Fig. 166. |
|----|--|

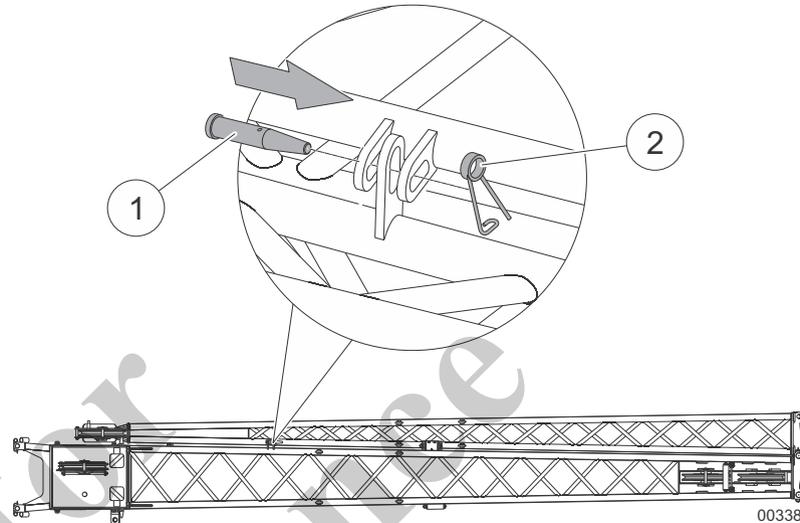


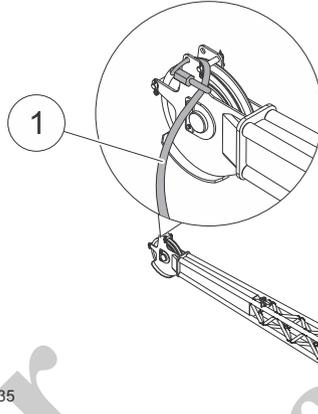
Fig. 166 Bolting the fly boom extension in transport position

- | | |
|----|--|
| 16 | Reeve the hoist rope over the fly boom head. |
| 17 | Attach the lifting limit switch weight and chain to the lifting limit switch of the fly boom. |
| 18 | Attach the bottom hook block or fold the fly boom in transport position, see See "FOLDING THE FLY BOOM (6.5 M) INTO TRANSPORT POSITION" on page 7-36.. |

7.17 Folding the fly boom extension to working position

- | | |
|---|---|
| 1 | Enter the cab. |
| 2 | Start the diesel engine. |
| 3 | Select Setup operating mode on the SENCON. |
| 4 | Push the safety lever forward. |
| 5 | Place the bottom hook block on the ground. |
| 6 | Unreeve the hoist rope. |
| 7 | Lower the telescopic boom to 0° and retract it. |

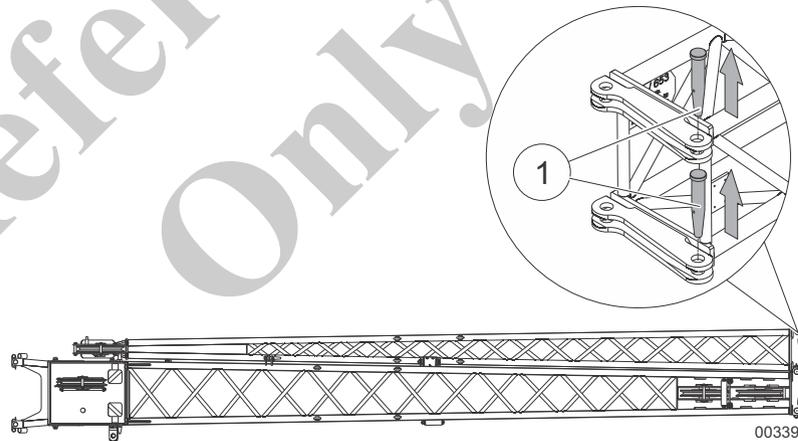
- 8 Attach a rope (1) in Fig. 167 to the boom head of the fly boom extension.



00335

Fig. 167 Attaching a rope for pulling the fly boom extension around

- 9 Release and remove the bolts (1) in Fig. 168 on the left side of the fly boom extension.



00339

Fig. 168 Removing the bolts from the fly boom extension

	<p>⚠ WARNING</p> <p>Danger of fatal injury due to the fly boom swinging around!</p> <p>The fly boom can swing off its support at high speed and severely injure anybody in its swing range.</p> <ul style="list-style-type: none"> ● Observe the deadweight of the fly boom. ● Ensure that no one is in the danger zone. The pivot radius is at least 10 m.
10	Check the boom angle. The angle of the boom must be 0°.
11	Release and remove the bolt (1) in Fig. 169 on the fly boom.

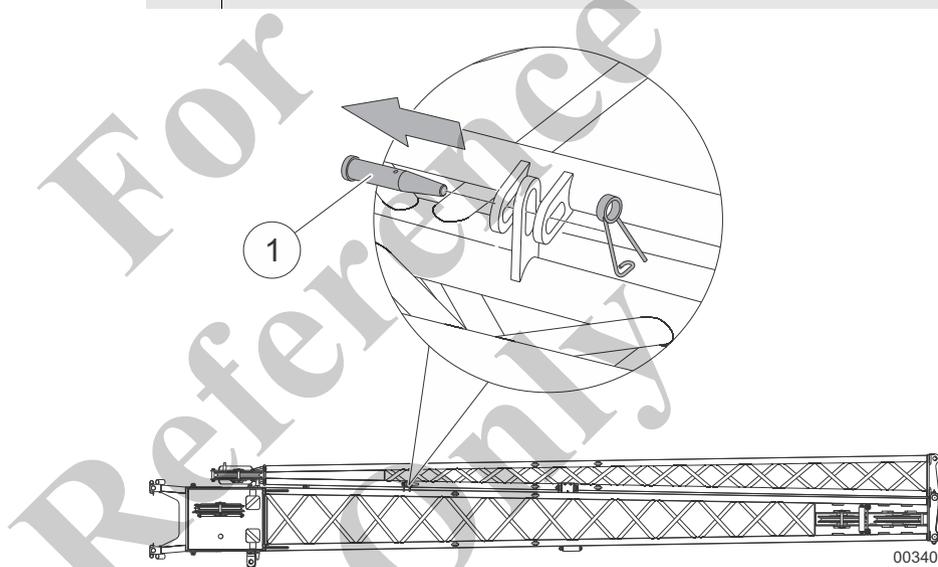


Fig. 169 Unbolting the fly boom extension

12	Use the rope to pull the fly boom extension (1) in Fig. 170 into working position.
----	--

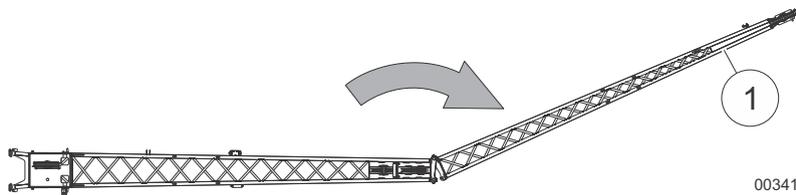


Fig. 170 Pulling the fly boom extension into working position

- 13 Bolt the fly boom extension to the fly boom with the bolt (1) and secure with spring cotter pins.

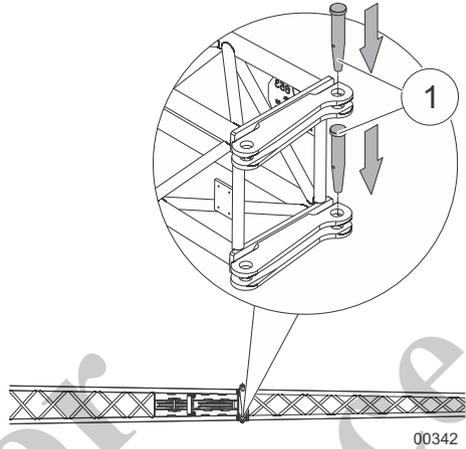


Fig. 171 Bolting the fly boom extension into working position

- 14 Remove the lifting limit switch cable of the fly boom extension (1) in Fig. 172 from the socket.

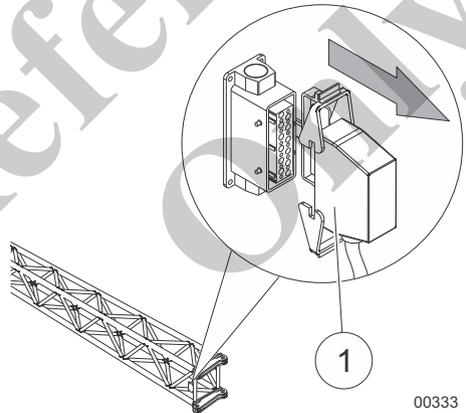


Fig. 172 Fly boom extension lifting limit switch cable

- | | |
|----|---|
| 15 | Insert the lifting limit switch cable of the fly boom extension (1) in Fig. 173 into the socket on the fly boom head. |
|----|---|

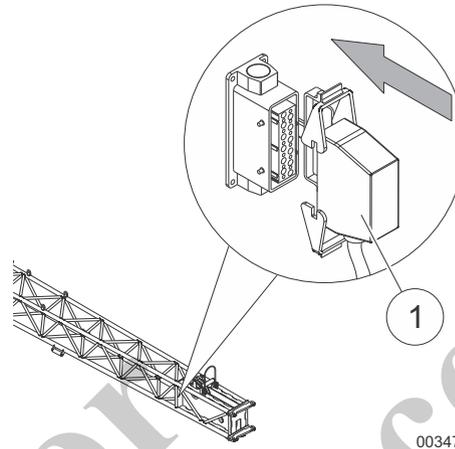


Fig. 173 Inserting the fly boom extension lifting limit switch cable into the fly boom head

- | | |
|----|---|
| 16 | Retract the hoist rope over the deflection sheave and the boom head of the fly boom extension. |
| 17 | Attach the lifting limit switch weight and chain to the lifting limit switch of the fly boom extension. |
| 18 | Attach the bottom hook block. |

7.18 Attaching the auxiliary jib

1	Start the diesel engine.
2	Select Setup operating mode 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. 174 to the boom pulley head (2) in Fig. 174 and attach it.

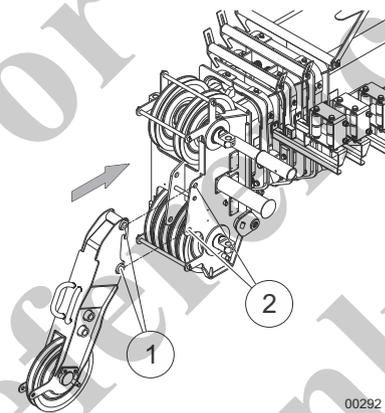


Fig. 174 Lifting the auxiliary jib to the telescopic boom

- | | |
|---|---|
| 7 | Insert the bolts (1) in Fig. 175 and secure with retaining springs. |
|---|---|

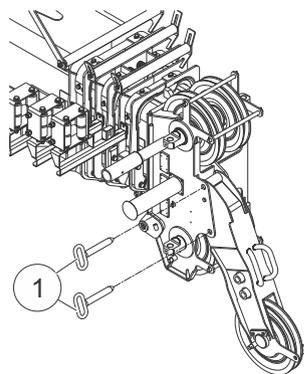


Fig. 175 Bolting the auxiliary jib to the telescopic boom

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	Remove the bypass plug (1) in Fig. 176 from the lower socket on the telescopic boom and insert it into the upper power socket.
3	Attach the lifting limit switch (3) in Fig. 176 to the auxiliary jib and insert it into the lower power socket on the main boom (2) in Fig. 176.

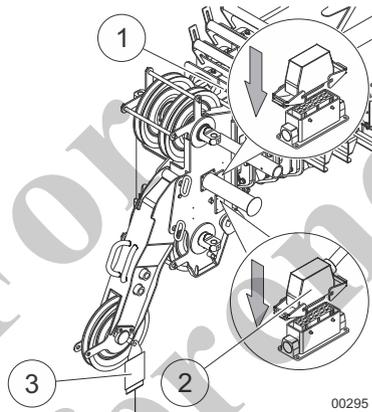


Fig. 176 Attaching the lifting limit switch of the auxiliary jib to the telescopic boom

4	Guide the hoist rope through the weight (2) in Fig. 177 and attach the chain (1) in Fig. 177 to the lifting limit switch on the left side as seen in direction of travel.
---	---

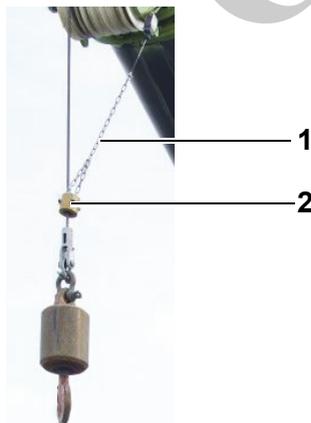


Fig. 177 Lifting limit switch weight

- 5 Insert the rope guard (1) in Fig. 178 into the auxiliary jib sheave and secure it with spring cotter pins (2) in Fig. 178.

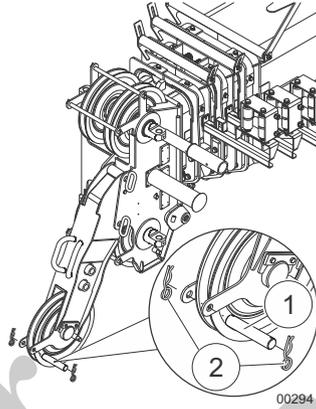


Fig. 178 Attaching the rope guard to the auxiliary jib

- 6 Attach the bottom hook block.



Information

Removal of the auxiliary jib is the reverse of installation.

For
Reference
Only

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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 8.5 .
- 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).

8.1 Controls for unloading the machine

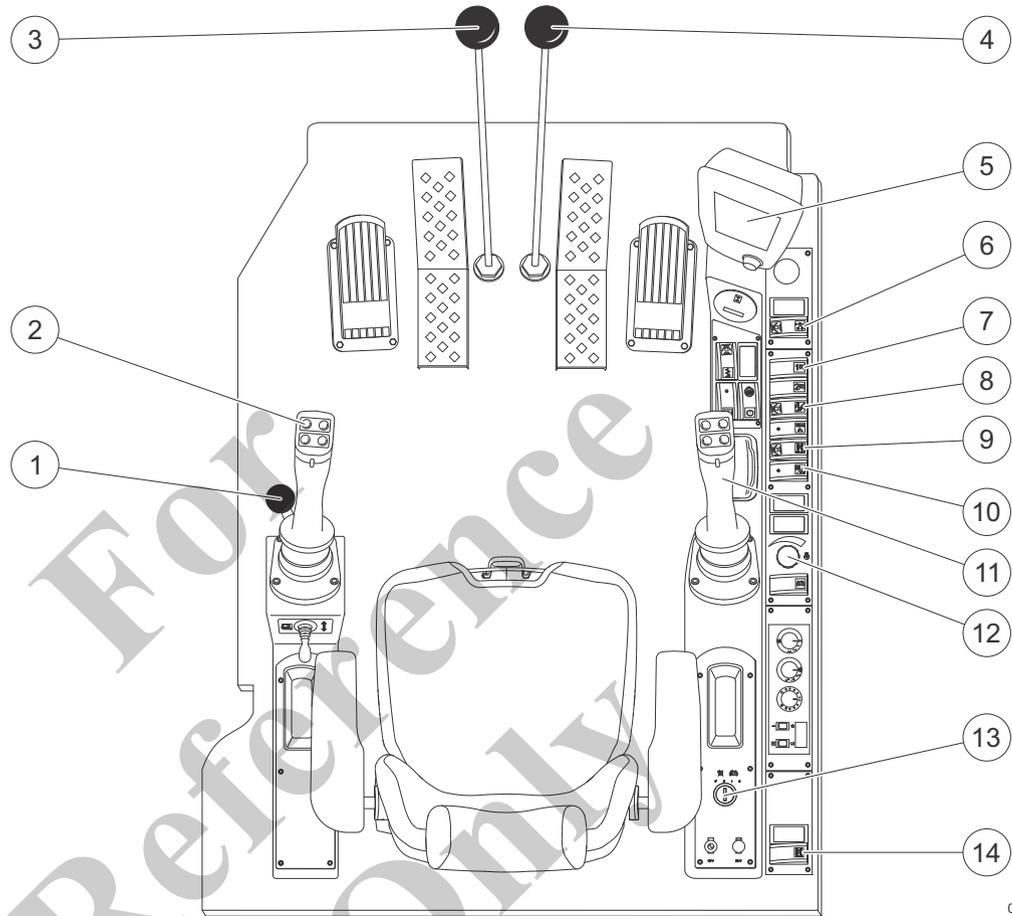


Fig. 179 Controls for unloading the machine

00148

1	Safety lever	8	Luff/telescope boom switch
2	Joystick, left	9	Release travel mode
3	Hand lever, left crawler	10	Travel slow/fast
4	Hand lever, right crawler	11	Joystick, right
5	SENCOn	12	Speed governor
6	Winch 1/Winch 2	13	Ignition lock
7	Release - winch 1	14	Release undercarriage telescoping

8.2 Switching on the battery disconnect switch

1	Open the left service access door (1) in Fig. 180.
2	Turn the battery disconnect switch (2) in Fig. 180 to position I.
3	Close the service door.

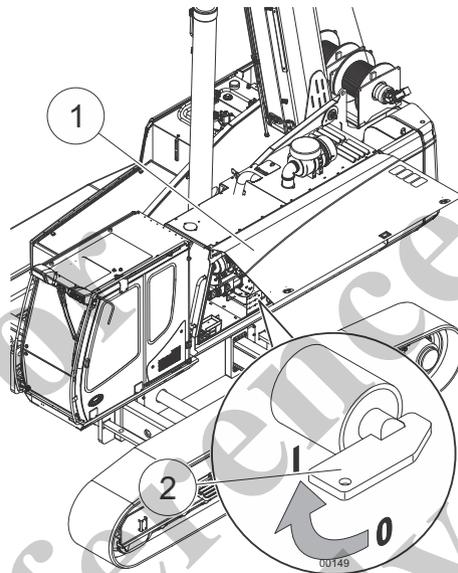


Fig. 180 Switching on the battery disconnect switch

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.

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.

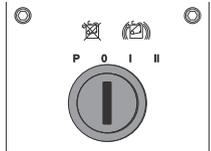


Fig. 181 Ignition lock



Fig. 182 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. 183 until the setting (2) in Fig. 183 is outlined in black.
- 7 Press the SCROLL wheel.

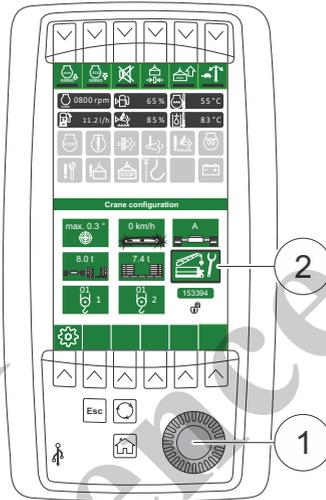


Fig. 183 Selecting setup program

00152

For Reference Only

- 8 Roll the SCROLL wheel until the setting (1) in Fig. 184 is outlined in black.



- 9 Press the  button on the SENCON.
 - The setup program is selected.

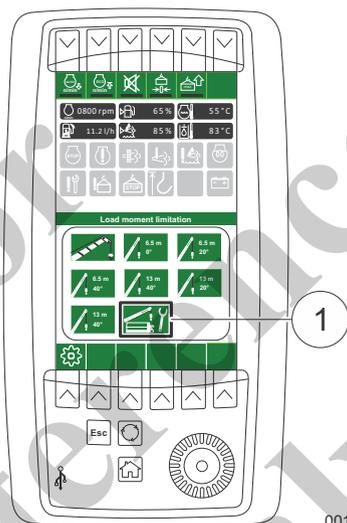
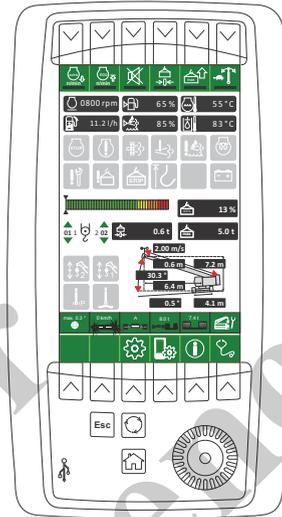


Fig. 184 Selecting attachment

00153

- 10 Press the  button on the SENCON.
- The setup program is configured.
 - The working diagram displays.

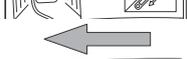
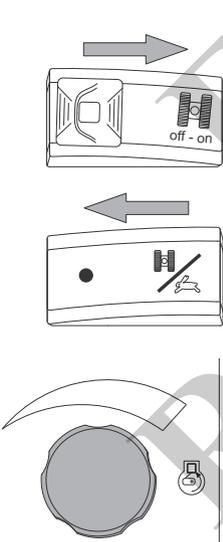


00154

Fig. 185 Working diagram

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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 Winch 1/Winch 2 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. 186 on the right joystick.
– The horn sounds. |
|---|---|

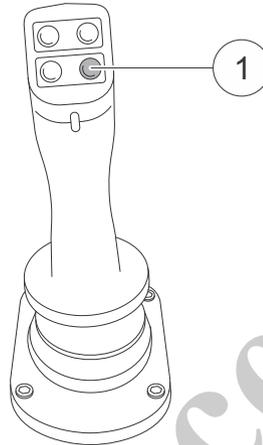
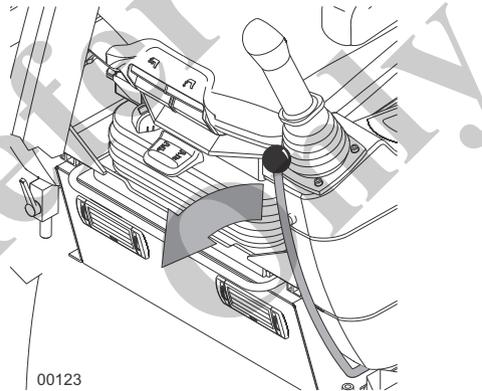


Fig. 186 Horn

- | | |
|---|--------------------------------|
| 9 | Push the safety lever forward. |
|---|--------------------------------|

00123
Fig. 187 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.

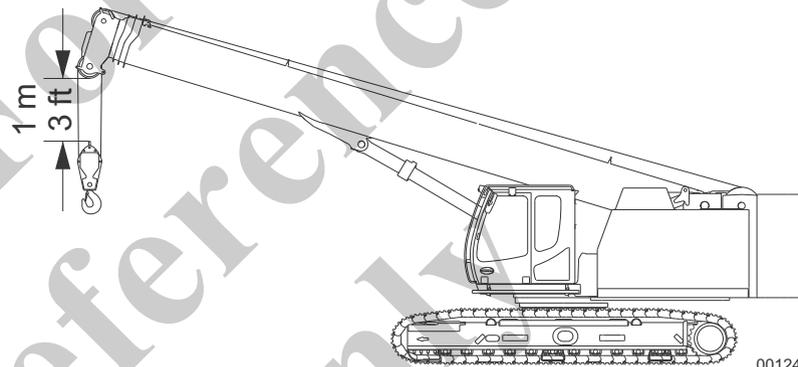


Fig. 188 Clearance between load hook and boom head

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 Lashing points

The lashing points on the machine are marked with a green symbol on a white background.

auf weißem Grund gekennzeichnet. The lashing points for transporting the machine are located on inside of the front and rear track wheel carriers and on the middle bridge.

sich vorne und hinten an den Innenseiten der Lauftradträger und an der Mittelbrücke.

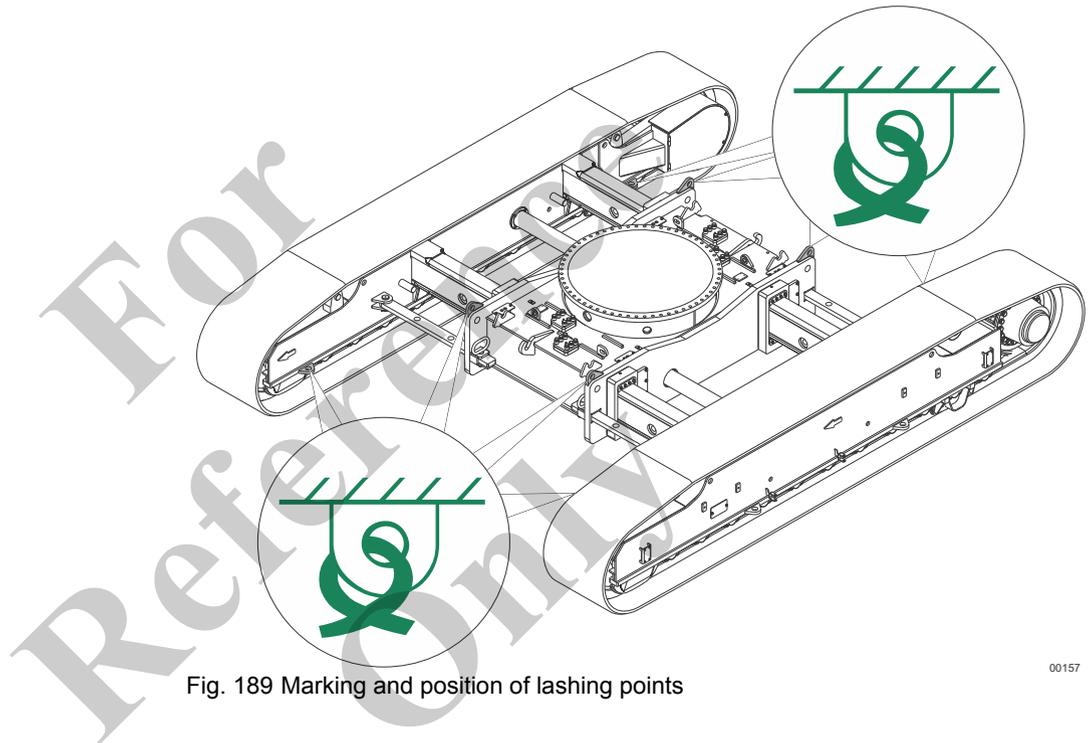


Fig. 189 Marking and position of lashing points

00157

8.5 Transport dimensions and weights

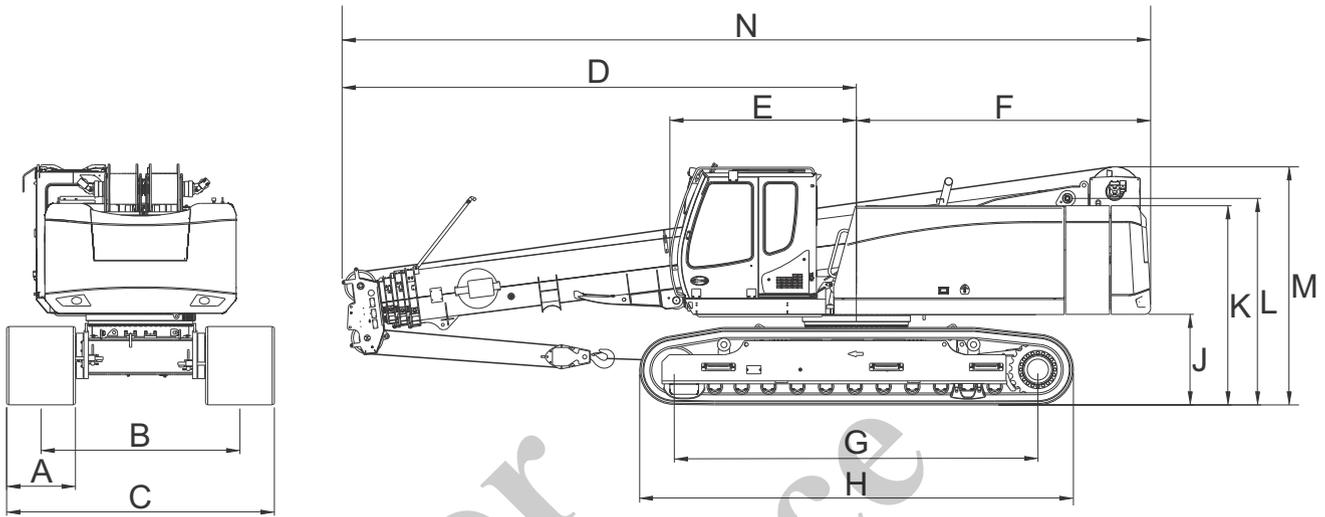


Fig. 190 Transport dimensions

00150

Dimensions

Dimensions in inches (mm)		Dimensions in inches (mm)	
A	35.4 (900)	H	225.7 (5 734)
W	102.4 (2 600)	J	47.6 (1 209)
C	137.8 (3 500)	P	104.7 (2 660)
D	267.7 (6 799)	L	108.5 (2 757)
E	97.1 (2 466)	M	125.2 (3 179)
F	153.2 (3 891)	N	420.9 (10690)
G	189.3 (4 808)		

Weights

	Weight in lbs (kg)
Machine with counterweight	99 869 (45 300)
Fly boom 6.5 m	1 323 (600)
Fly boom 13 m	1 874 (850)

8.6 Locking the uppercarriage

- | | |
|---|--|
| 1 | Place the uppercarriage in the direction of travel. |
| 2 | Apply parking and holding brake of the slewing gear. |

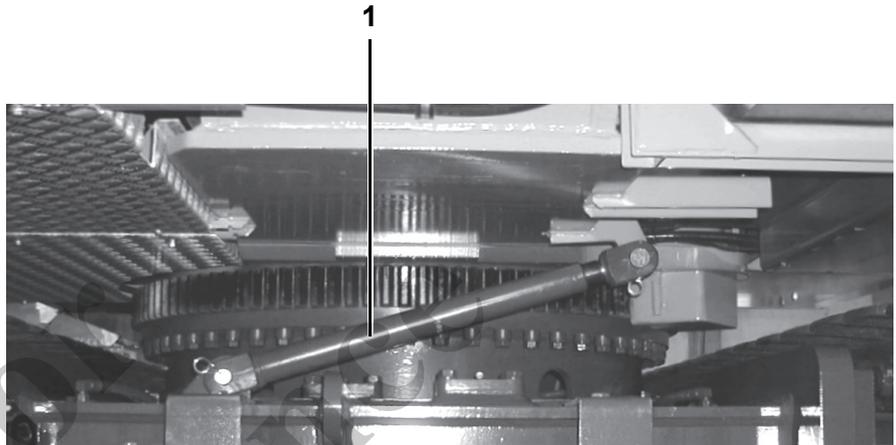


Fig. 191 Locking rod

- | | |
|---|---|
| 3 | Bolt and secure the locking bar (1) in Fig. 191 to the undercarriage and the uppercarriage. |
|---|---|

Reference Only

8.7 Lifting the machine

Safety instructions

- Only lash the machine at the designated lifting points. The lifting points are marked green and have a green load hook symbol.
- Ensure that the lifting equipment has a sufficient safe working load and secure stability.
- Ensure that the sling gear has sufficient load-bearing capacity and is undamaged.
- The following items are considered as suitable sling gear:
 - chain suspension
 - cable suspension
 - Round slings / strap suspension.
- Be aware of the danger zone!
There must be no one next to, 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. |

Lifting data

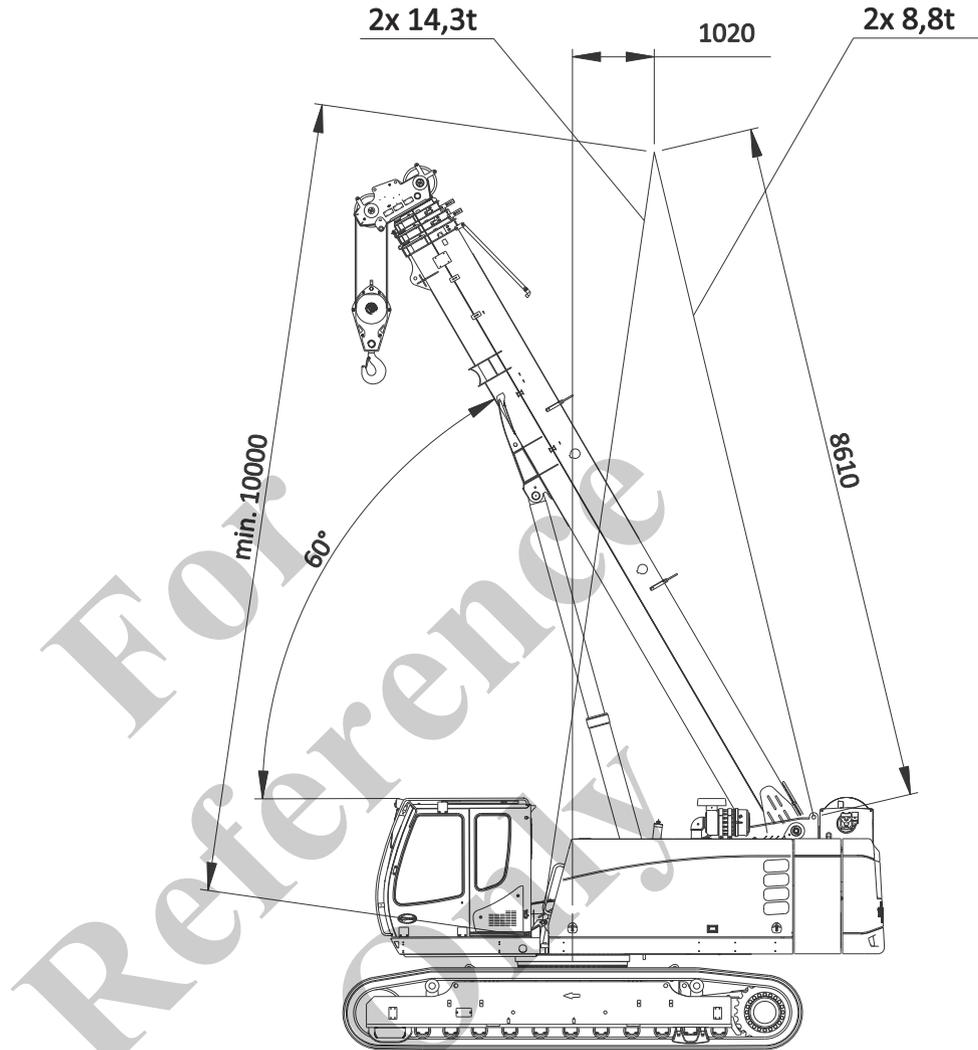


Fig. 192 Lifting data

The lifting data applies to the following machine configuration:

Counterweight	8.9 t
No. winches	2
Bottom hook block	35 t
Base plates	3-grouser, 900 mm
Overall weight	45.7 t

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Only

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9 Maintenance

WARNING

Risk of death due to machine moving suddenly or starting unintentionally.

Persons on or near the machine can suffer serious injury or death by the machine moving suddenly or starting unintentionally.

- Park the machine on secure ground. Move the machine away from the edge of any trenches or pits.
- Lower attached loads and the boom to the ground.
- Apply the brake.
- Turn off the machine and secure it against being restarted without authorization.
- Use wheel chocks to keep the machine from rolling away.

WARNING

Risk of falling due to exceeding the maximum weight limit of the walkway.

Exceeding the maximum weight limit of the walkway can damage the structure and cause serious injury.

- Do not exceed the walkway's maximum weight limit of 200 kg (440 lbs).
- Check the walkway every three months for cracks and overall damage and repair it immediately as needed.

Safety when performing maintenance

- The maintenance listed below may only be performed by trained and instructed specialists.
- Wear personal protective equipment (e.g., hard hat, hearing protection, protective gloves, safety shoes) if the work is potentially hazardous.
- Observe statutory accident prevention and safety regulations.
- Pull the left safety lever back.
- Place clear warning signs on the controls.
- No smoking.
- No open flames.
- Use secure access ladders or work platforms.
- Maintain a safe distance from rotating and moving parts.
- Depressurize the hydraulic system before beginning maintenance.
- The hydraulic valves may only be adjusted by trained Grove service personnel.
- Wear protective gloves when working with steel wire ropes.

- Use only original Grove spare parts.
- Do not lift heavy components manually, use lifting equipment instead.
- Disconnect the power with the battery disconnect switch.
- When working near the battery, cover it with insulating material.
- Do not place any tools on the battery.
- Reinstall all protective devices on completion of maintenance tasks.
- Keep the cab clean and orderly.
- Test functionality to ensure proper working order.
- Only the crane owner or his representative may release the machine following maintenance tasks.
- Always conduct a visual inspection and a function test following maintenance or repair.
- Dispose of hydraulic oil in accordance with regulations.
- Only use the oils, operating fluids and lubricants specified in the table of operating fluids.

For Reference Only

9.1 Cleaning tasks

Clean the machine every month, especially before maintenance or repair. Shorten the cleaning intervals depending on operating conditions and contamination.

WARNING

Danger of injury due to falling.

Danger of falling when performing work above body height.

- Park the machine.
- Lower the attachment tool to the ground.
- Only perform work from a safe standing surfaces.
- Use work platforms.
- Only climb on designated machine parts.

WARNING

Risk of injury from unintentional machine movements.

Risk of crushing or falling due to unintentional machine movements.

- Turn off the machine and secure it against being restarted.
- Place a sign in the cab indicating that cleaning is being performed.

Dry cleaning

For minor dust, use compressed air (max. 2 bar/29 psi) and a soft brush.

Wet cleaning

NOTICE

Environmental hazard due to improper handling of environmentally harmful substances.

If the machine is wet-cleaned, there is a risk that environmentally harmful cleaning agents and operating fluids can get into the environment.

- Only wash the machine on a surface equipped with an oil separator.

NOTICE

Danger of material damage due to improper cleaning.

In a dusty environment, e.g. with fine dust or paper dust, wet-cleaning the radiators or coolers may cause concrete-like clumping.

- Remove all foreign objects with compressed air before washing.

Lubricate all bearing points to prevent water ingress.

Close all openings where water is not allowed to ingress:

- Exhaust pipe
- Air filter
- Air conditioning system external air filter

Protect all components that must not be cleaned with water from the direct water jet:

- Electrical and electronic assemblies and components
- Exhaust aftertreatment system
- Rotary connection
- Bolt bearing points

NOTICE

Danger of material damage due to improper cleaning.

When using a pressure washer, excessive pressure and temperature can damage the paint.

- Only use neutral or slightly alkaline cleaning agents.
- Only use clean sponges, brushes and cloths.

- Observe the following for the first three months after startup or repainting:
 - Use cold water with a low dose of a neutral cleaning agent.
 - Operating pressure: max. 60 bar/870 psi
 - Spray distance: min. 30 cm / 1 ft
 - Spray angle: 30° to 60°
- Observe the following after three months:
 - Water temperature: max. 60 °C/140 °F
 - Operating pressure: max. 100 bar/1 450 psi
 - Spray distance: min. 30 cm / 1 ft
 - Spray angle: 30° to 60°

1	Apply water with cleaning agent and let it soak in.
2	Remove firmly adhering contamination with a sponge or brush.
3	Rinse off the machine with clean water.
4	Clean the cab windows and mirrors with a commercial glass cleaner.

After cleaning

- Remove all coverings that were attached for cleaning.
- Lubricate all bearing points and rotary connections.
- Warm up the engine so residual water can evaporate.
- Check all machine functions.
- Check all lines for damage and leaks.
- Treat rubber seals with a commercial rubber conditioner.
- Make sure warning signs and information signs are complete and legible. Replace missing or damaged signs.
- Check the paint for visible damage. Repair paint damage immediately. Pay attention to the corrosivity class of the coating.
- Check preservation (corrosion protection) and touch up or restore as needed.



Information

Repair paint damage as specified in the Grove Repair Manual for Paint Damage.

Apply anti-corrosive according to the Grove corrosion protection manual.

The manuals are available from your Grove Service Partner.

9.2 Oils and lubricants

NOTICE

Risk of damage to machine components due to mixing different lubricants and operating fluids.

Mixing different types of oils, lubricants or operating fluids can damage machine components.

- Only use the same type of oils, lubricants and operating fluids.
- Only use the oils, lubricants and operating fluids approved by Grove.
- Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.



Information

The oils and lubricants approved by Grove are found in the list of operating fluids. The ambient temperature for operating the machine must be between -20 °C and 50 °C (-4 °F and 122 °F). If the on-site temperature exceeds these limits, consult your Grove Service Partner before starting up the machine.

Oil diagnosis

The oil diagnosis is conducted by a qualified laboratory. Regular oil diagnosis helps to avoid unnecessary costs. A series of tests will determine the following:

- Oil condition
- Amount of abraded metal particles in the sample
- Wear rate of components

Conducting an oil diagnosis is recommended for the following components:

- Hydraulic system
- Drive engine
- Winch

Biodegradable oils and lubricants

If there a risk of mineral oil-based oils and lubricants leaking and harming the environment, biodegradable oils and lubricants must be used.

Environmentally friendly lubricants are mandatory especially in water conservation areas and nature reserves. Only synthetic, ester-based biolubricants may be used.

See the list of operating fluids for more information.

9.2.1 Disposing of lubricants and operating fluids

NOTICE

Risk of environmental damage due to improper disposal of lubricants and operating fluids.

Lubricants and operating fluids that are not properly disposed of contaminate ground water.

- Observe applicable environmental standards.
- Properly handle and dispose of solvents and lubricants in particular.

Observe the following:

- Do not mix used oil with other waste.
- Do not mix together used oils.
- Collect, store, transport and dispose of used oil filters separately from other waste.



Information

Dispose of lubricants and other operating fluids at a designated collection point.

In addition, any national environmental regulations applicable at the site of operation must be observed.

Batteries

Observe the relevant safety information and safety measures when handling batteries.



Information

Do not dispose of batteries with regular waste.

Dispose of defective batteries at a collection point for used batteries.

In addition, any national environmental regulations applicable at the site of operation must be observed.

9.3 Coolant

WARNING

Health hazard due to nitrosamines.

Mixing of nitrite-based coolants with amine-based agents produces harmful nitrosamines.

- Avoid skin contact with coolants.
- Avoid inhaling the vapors.
- Use skin protection products.

NOTICE

Risk of engine damage due to overheating.

Adding unapproved coolants and coolant additives can damage the radiator and cause the engine to overheat.

- Only add approved coolants of the same type.
- Only add approved coolant additives.

NOTICE

Risk of engine damage from adding coolant when hot.

Adding coolant to a hot engine can cause engine damage.

- Let the engine cool down before adding coolant.

NOTICE

Risk of environmental damage due to improper disposal of coolant.

Coolant that has not been properly disposed of or poured contaminates ground water.

- Make sure coolant does not seep into the soil or reach bodies of water.
- Observe applicable environmental standards for disposing of coolants.

The coolant manufacturer's usage guidelines/instructions for use also contain possible health or environmental hazards.

The coolant added to a specific engine at the factory can be found in the list of operating fluids. The antifreeze is effective down to -37 °C (-34 °F).

**Information**

Observe the coolant sticker near the radiator. If the ambient temperature on site is below -37 °C (-34 °F), check the engine manufacturer's operating manual or consult your Grove Service Partner before starting up the machine.

**Information**

If only a small amount (up to max. 5 l) is required to top up the cooling circuit and no suitable coolant is available, you can provisionally add clean drinking water.

The coolant not only prevents freezing, it is also important for corrosion protection. This is why the correct concentration must be checked regularly and adjusted as needed.

The concentration must be checked at the next opportunity, at the latest however before temperatures reach freezing. The appropriate coolant must be added to protect against freezing and corrosion.

For Reference Only



Information

- Use clean, pH-neutral, filtered and softened fresh water. Grove recommends distilled water.
- Cummins specifies the use of distilled water.
- Do not use ditch water, industrial drain water, salt water, sea water or rain water.
- Always fill using a water-coolant mixture. Observe the manufacturer's recommended mixing ratio. Mix before filling.

Make sure the water has the following properties:

pH value	7 – 8
Chloride content	max. 100 ppm
Sulfate content	max. 100 ppm
Water hardness	3–12 °dGH



Information

If the coolant concentration is too high, the cooling and antifreeze properties will be adversely affected. Observe the coolant manufacturer's specifications.

Use of other coolants

Grove cannot be held liable and will void any warranty if any coolant other than the one specified is used.

Reference Only

 **CAUTION****Risk of scalding from coolant steam.**

Opening the coolant tank will cause hot coolant to evaporate. Persons in the vicinity can be scalded.

- Let the engine cool down before draining coolant.

**Information**

Collect draining coolant and dispose of it in accordance with regulations.

NOTICE**Risk of cooling system failure and engine damage from using incorrect coolant or coolant additives.**

Adding or mixing different coolants or coolant additives can cause sludge accumulation or gelatinization and clog the radiator, causing the engine to overheat or the cooling system to fail (resulting in engine damage).

- Do not mix coolants.
- Do not use cooling system sealing agents or antifreeze containing sealing agents.

**Information**

The coolant must be changed if a routine check of the coolant level reveals the presence of lubricating oil or noticeable cloudiness.

Changing coolant

1	Switch off the diesel engine.
2	Let the diesel engine and combination cooler cool down.
3	Carefully open the sealing cap of the expansion tank to equalize the pressure.
4	Completely drain the cooling system before filling.
5	Flush the cooling system several times with clean water.
6	Fill the cooling system at a consistent rate not exceeding 9 l/min.
7	Check the level 5 minutes after filling and add coolant as needed.
8	Replace the sealing cap on the expansion tank.
9	Run the diesel engine at low idle for 5 minutes.
10	Check the coolant level and add as needed.

Change intervals

See the engine manufacturer's operating manual for change intervals.

9.4 Welding

Safety instructions

- Welding may only be performed by an authorized and qualified welding specialist.
- Cover vulnerable components with fireproof material.
- Drilling and welding is prohibited on the following components:
 - Boom parts
 - Load-bearing frame parts
 - Engine
 - Hydraulic tank
 - Fuel tank
 - Fuel-carrying and oil-carrying components

Preliminary work

Make the following preparations before beginning welding:

1	Press the battery disconnect switch or disconnect the battery to disconnect power.
2	Attach the ground connection as close to the welding site as possible.

9.5 Diesel engine

 **WARNING**

Risk of injury due to rotating parts or hot engine parts.

Persons can be injured by moving or hot engine parts when the engine is running.

- Only perform maintenance and repairs with the engine off and the cooling system cooled down.
- Secure the machine against being restarted without authorization.

NOTICE

Risk of environmental damage due to improper disposal of oils and coolants.

Oils and coolants that are not properly disposed of contaminate ground water.

- Make sure used oil and coolant do not seep into the soil or reach bodies of water.
- Observe applicable environmental standards for disposing of oil, oil filters and coolant.



Information

Observe the engine manufacturer's operating manual.

9.5.1 Cummins diesel engine QSB4.5, Tier 4f

Engine oil

NOTICE

Risk of environmental damage due to improper disposal of used oil.

Used oil that has not been properly disposed of contaminates ground water.

- Make sure used oil does not seep into the soil or reach bodies of water.
- Observe applicable environmental standards for disposing of oil and oil filters.

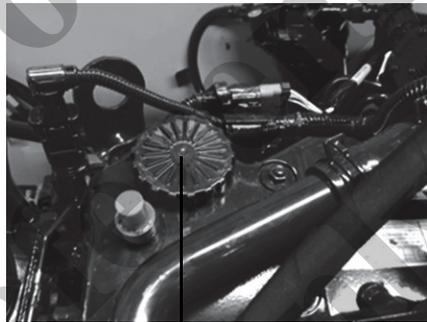


Information

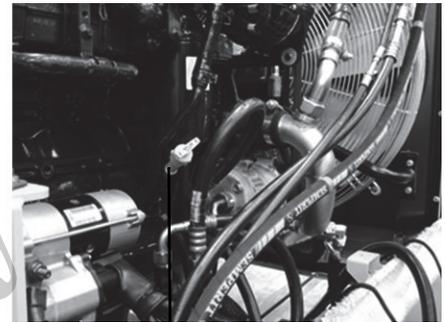
Observe the engine manufacturer's operating manual.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.

Checking the engine oil level



1 Oil filler neck



2 Oil dipstick

Fig. 193 Oil dipstick and filler neck

1	Park the machine on a level surface.
2	Let the diesel engine run for approx. 2 minutes until the oil has cycled through the system.
3	Switch off the diesel engine.
4	Open the left rear service door.
5	Remove the oil dipstick (2) in Fig. 193 and wipe it off with a clean, lint-free cloth.
6	Insert the oil dipstick as far as it will go and remove it again.
7	The oil level must be between the lower marking (MIN) and the upper marking (MAX).

8	Add engine oil to the filler neck (1) in Fig. 193 as needed according to the engine manufacturer's instructions.
---	--

Changing the engine oil and oil filter

1	Warm up the diesel engine.
2	Park the machine on a level surface.
3	Open the left rear service door.
4	Switch off the diesel engine.
<p>⚠ CAUTION</p> <p>Risk of burns from hot engine oil.</p> <p>Draining hot engine oil poses a burn risk.</p> <ul style="list-style-type: none"> ● Wear protective gloves and protective clothing when draining engine oil. 	
5	Change the engine oil and oil filter according to the engine manufacturer's instructions.
6	Check the oil level. The oil level must be between the lower marking (MIN) and the upper marking (MAX).
7	Add engine oil to the filler neck (1) in Fig. 193 as needed according to the engine manufacturer's instructions.

Air filter

NOTICE

Risk of engine damage from cleaning with compressed air.
 Cleaning with compressed air can allow contaminants to get into and damage the engine.
 ➤ Do not use compressed air to clean the inside of the housing.

**Air filter
 SENCON symbol**

The condition of the air filter is monitored by the SENCON. When contaminated, the SENCON displays the following symbol:



- Turn off the diesel engine immediately.
- Check the air filter and replace it as needed.

Replacing the air filter

Read through the safety information before starting work.



Information

- Replace the main filter during every cleaning.
- Replace the safety filter during every other cleaning.

1 | Open the locking clamps and remove the service cover.

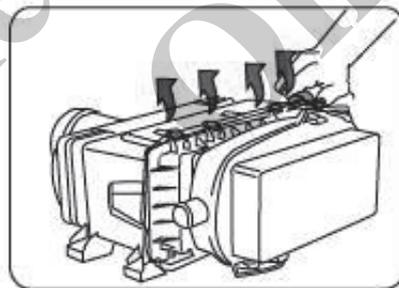


Fig. 194 Opening the air filter service cover

- 2 Carefully remove the contaminated main filter (A) in Fig. 195.
 - Make sure no absorbed dirt gets in the housing.
 - Check the filter for any uneven contamination pattern, which can indicate an inadvertent release of dust or sealing problems.

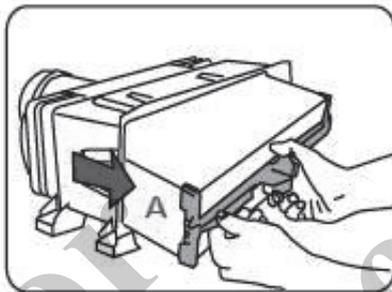


Fig. 195 Removing the main filter

- 3 Remove the safety filter (B) in Fig. 196.

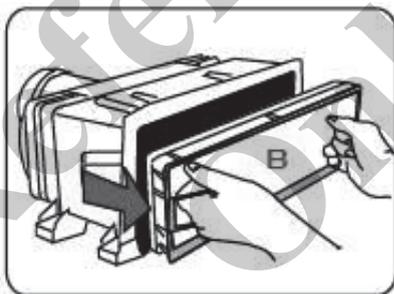


Fig. 196 Removing the safety filter

- 4 Clean the filter housing with a damp cloth, leaving no residue. A vacuum cleaner can also be used if available.
- 5 Insert the safety filter.
- 6 Insert the main filter.

- 7 Replace the service cover and secure it with the locking clamps.

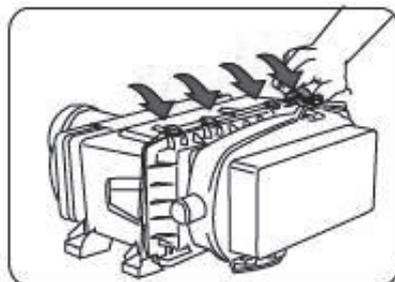


Fig. 197 Closing the air filter service cover

- 8 Check the entire line system for cracks and holes, especially between the air filter and the engine.
- 9 Make sure all clamps and connections are seated properly.

For Reference Only

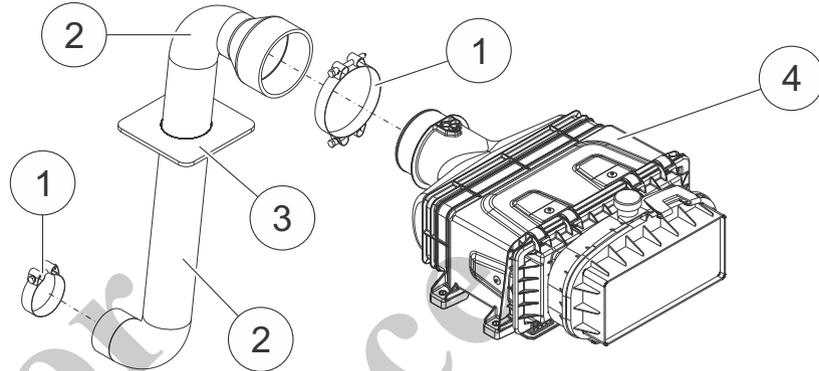
Air intake system



Information

Regularly checking the air intake system is the only way to ensure maximum protection of the drive motor against damage and destruction due to dust.

Checking the air intake system



00328

Fig. 198 Air intake system components

1	Hose clip	2	Suction hose
3	Seal	4	Air filter

1	Make sure the hose clamps (1) in Fig. 198 are seated properly.
2	Check the suction hoses (2) in Fig. 198 for leaks.
3	Make sure the suction hoses are in the correct position.
4	Check the gasket (3) in Fig. 198 for leaks.

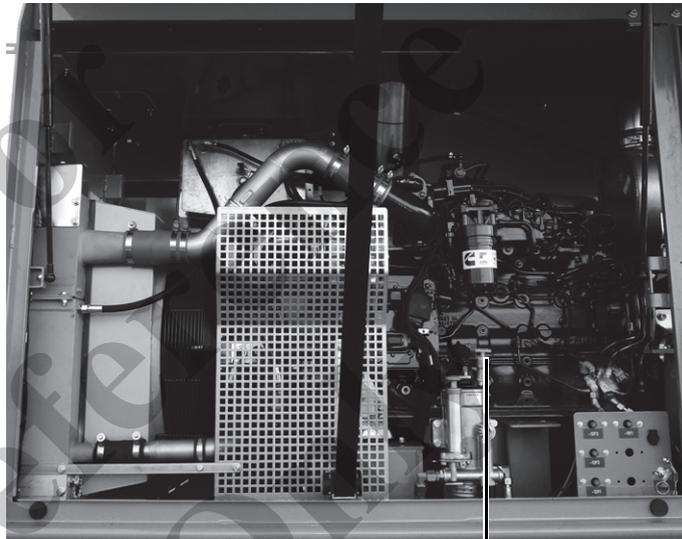
9.5.2 Cummins diesel engine QSB4.5, Tier IIIa

Engine oil

Safety instructions

- Proceed with the utmost caution when draining hot oil.
- Old oil must not seep into the ground or waterways. Dispose of oil and oil filters in accordance with statutory regulations.
- Comply with the instructions in the operating manual provided by the engine manufacturer.
- Only mix oils, lubricants and operating fluids that are of the same type, or identical (same specifications) from one manufacturer.

Checking the engine oil level



2

1



Fig. 199 Oil dipstick and oil filter neck

1 Oil dipstick

2 Oil filler neck

1	Place the machine in a horizontal position.
2	Run engine for approximately 2 minutes until the system is filled with oil.
3	Shut down drive engine.
4	Open rear right maintenance door.
5	Pull out oil dipstick (1) in Fig. 199 and wipe it off with a clean, lint-free cloth.
6	Insert oil dipstick to the stop and pull it out again.
7	Check oil level: The oil level must be between the lower marking (MIN) and the upper marking (MAX).
8	If necessary, top up engine oil via the filler neck (2), as specified in the operating manual provided by the engine manufacturer.

Changing the engine oil and oil filter

1	Warm up engine.
2	Place the machine in a horizontal position.
3	Open rear right maintenance door. Remove lower cover.
4	Change engine oil and oil filter in accordance with the instructions in the engine manufacturer's operating manual.
5	Check oil level: The oil level must be between the lower marking (MIN) and the upper marking (MAX).
6	If necessary top up engine oil as specified in the operating manual provided by the engine manufacturer.

Air filter

WARNING

Danger of burn injuries due to unsuitable cleaning agents!
 Persons suffer burn injuries when cleaning the air filter with hot or flammable cleaning agents.

- Never use gasoline, soap or hot liquids to clean the air filter.
- Only clean the air filter when the engine is shut off and cooled down.

NOTICE

Engine damage due to cleaning with compressed air!
 When cleaning the interior of the housing with compressed air, contaminants get into the engine.

- Never clean the interior of the housing with compressed air.

Air filter indicator light



The condition of the air filter is monitored by a sensor. The degree of contamination is determined by measuring the resistance to air flow through the filter. If the maximum permissible flow resistance is reached, the *air filter* indicator light is illuminated on the SENCON. A warning tone also sounds. Check and clean the air filter immediately.

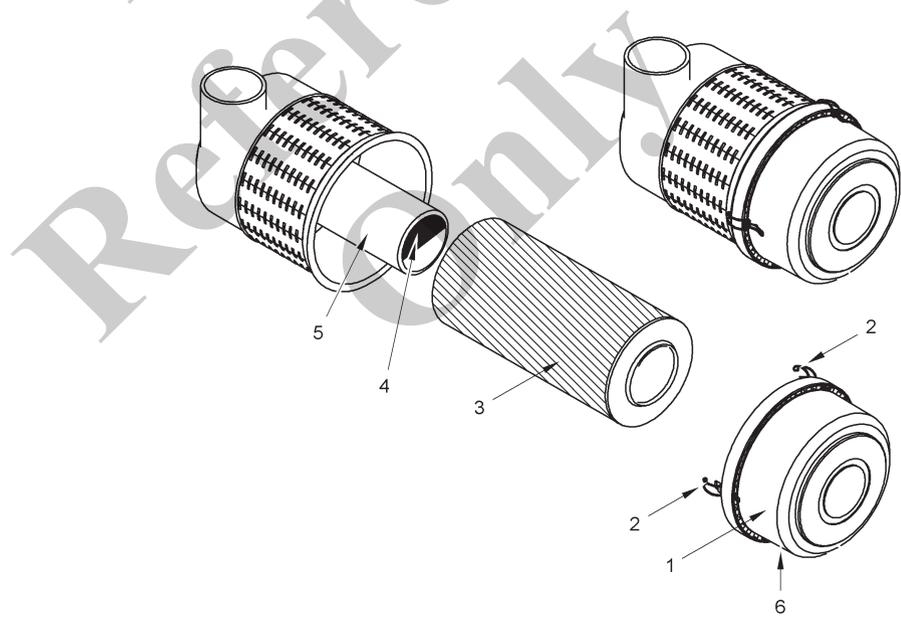


Fig. 200 Structure air filter

1 Air filter cover	4 Handle
2 Locking clamps (3 pc.)	5 Safety cartridge
3 Replacement cartridge	6 Tab

**Clean filter element,
replace if necessary**

1	Open the locking clamps (2) in Fig. 200 of the air filter cover (1) and remove the air filter cover.
2	Remove replacement cartridge (3).
3	Clean the replacement cartridge: <ul style="list-style-type: none"> – Blow out from inside to outside using dry compressed air (max. 2 bar/29 psi). – Only knock out in case of emergency!
4	Check replacement cartridge for damage to the filter paper and the seals. Exchange if necessary.
5	Exchange safety cartridge (5) after 5 filter service intervals (at least every 2 years): <ul style="list-style-type: none"> – Remove the safety cartridge by the handle (4). Never clean the safety cartridge! – Insert new safety cartridge.
6	Insert new or cleaned replacement cartridge (3).
7	Fit on the air filter cover (1) in such a manner that the tab (6) points downward, the "TOP" marking must be on top.
8	Reattach the air filter cover (1) using the locking clamps (2).

Cleaning the air filter pre-separator



Information

If dust escapes when pressing the dust discharge valve, the pre-separator of the air filter must be cleaned.

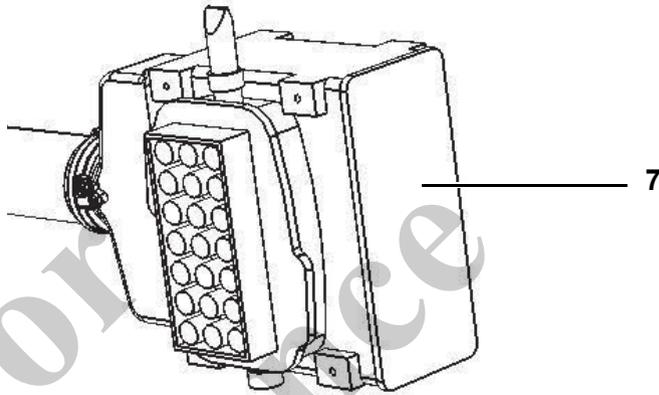


Fig. 201 Cleaning the air filter pre-separator

1	Set down loads and turn off the engine.
2	Open the service hatch (1).
3	Open the locking clamps of the pre-separator cover (7) in Fig. 201.
4	Carefully clean the pre-separator of the air filter with compressed air.
5	Refasten the pre-separator cover (7) using the locking clamps.
6	Re-close maintenance door.

Diesel preliminary filter

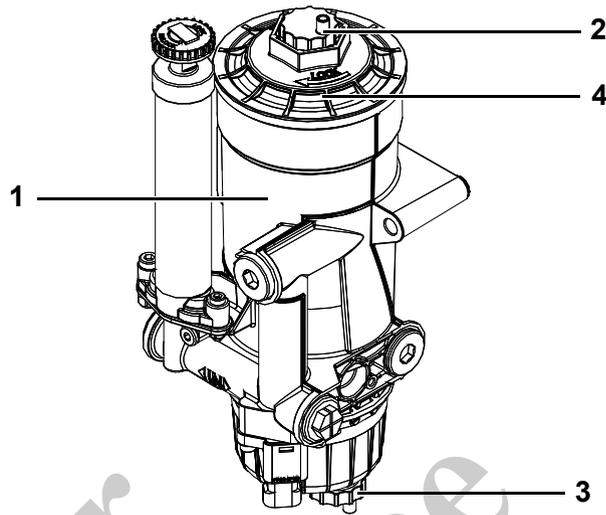


Fig. 202 Position and overview of the diesel preliminary filter

Item	Description
1	Housing - filter cartridge
2	Vent screw
3	Drain valve
4	Screw cap

Dewatering the diesel preliminary filter



Danger of injury due to rotating parts or hot engine parts!

Persons will be injured due to moving parts or hot parts of the running engine.

➤ Only execute maintenance tasks when the drive engine is shut down and the cooling system has cooled down.

1	Open the maintenance door.
2	Place a suitable collecting vessel under the drain valve (3) in Fig. 201.
3	Open drain valve (3).
4	Let the water and contamination run out of the water container, until fuel flows out.
5	Close the drain valve (3).
6	Close maintenance door.

Changing the filter cartridge



- Information**
- After dismantling the filter, clean all parts, check for damage or wear and replace parts if necessary.
 - Ensure the utmost cleanliness when replacing the filter element! In addition, pay attention to the description imprinted on the filter cartridge!

1	Open the maintenance door.
2	Place a suitable collecting vessel under the drain valve (4).
3	Open drain valve (3).
4	Let the water and contamination run out of the water container, until fuel flows out.
5	Close the drain valve (3).

- 6 Unscrew the screw cap (4) from the housing (1) and pull out the filter element that is fastened on it



- 7 – Unclip the filter element from the screw cap.



- Replace the O-ring of the screw cap (new O-ring is provided with the spare filter element)
- Moisten the O-rings on the filter element and on the screw cap with fuel
- Clip a new filter element into the screw cap.

8	Screw the screw cap (4) with new filter element into the housing (1) to the stop. Ensure tightening torque of 50 Nm!
9	Dispose of old filter element and O-rings.
10	Close maintenance door.

Diesel fine filter Replacement



Information

See the operating manual provided by the engine manufacturer for more information concerning replacement of the fuel filter.

For
Reference
Only

9.6 Combination cooler

WARNING

Risk of injury from rotating, sharp or hot parts.

Persons can be injured by moving, sharp or hot parts on or near the combination cooler.

- Only perform maintenance when the drive motor is off and the cooling system has cooled down.

NOTICE

Risk of environmental damage due to improper disposal of coolant.

Coolant that has not been properly disposed of or poured contaminates ground water.

- Make sure coolant does not seep into the soil or reach bodies of water.
- Observe applicable environmental standards for disposing of coolants.



Information

Observe the engine manufacturer's operating manual.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.

Checking and cleaning the combination cooler

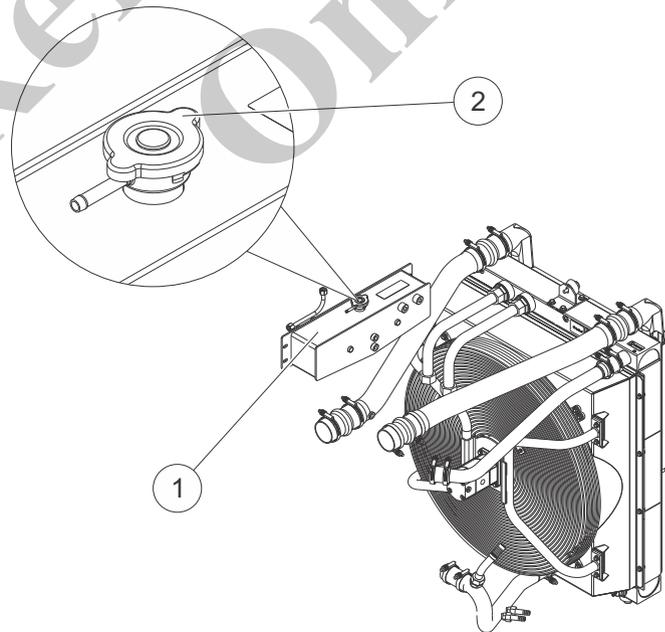


Fig. 203 Combination cooler

1	Let the diesel engine and combination cooler cool down.
2	Carefully open the sealing cap (2) in Fig. 203 of the expansion tank (1) in Fig. 203 to equalize the pressure.
3	Check the antifreeze and coolant level. Add coolant as needed. The coolant must contain at least 50% antifreeze throughout the year.
4	Close the expansion tank with the sealing cap.
5	Blow off the cooling fins on the exhaust side with dry, filtered compressed air (max. 2 bar). If contaminated with grease and oil, clean the cooling fins using cold-cleaning agent and a steam cleaner.
6	Check the combination cooler for leaks and damaged cooling fins.

**Information**

- See the engine manufacturer's operating manual for coolant change intervals.

Reference Only

9.7 Water separator

WARNING

Risk of injury from hot exhaust aftertreatment system.

Persons can be injured when the exhaust aftertreatment system is hot.

- Only perform maintenance when the drive motor is off and the cooling system has cooled down.



Information

Observe the engine manufacturer's operating manual.

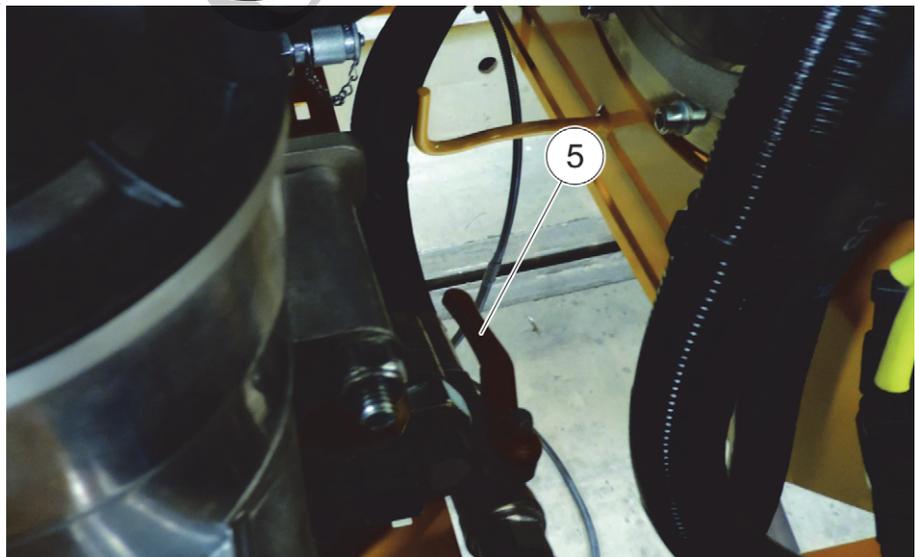
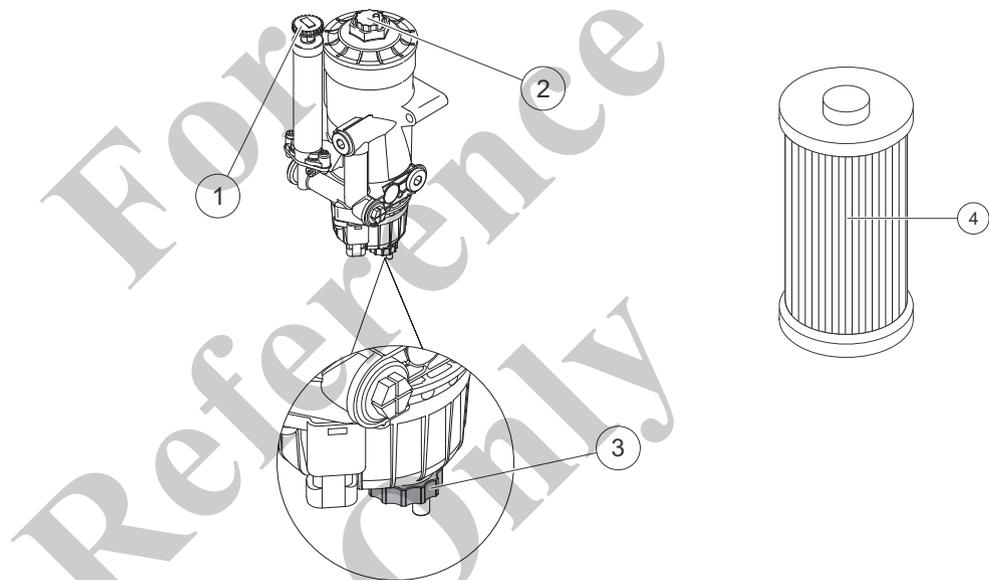


Fig. 204 Water separator

Drain water

1	Place a container under the hose connected to the drain plug (3) in Fig. 204.
2	Open the drain plug.
3	Drain water and dirt until fuel comes out.
4	Close the drain plug.
5	Dispose of the fluid in the container properly.

For
Reference
Only

Changing the filter element

Depending on filter design and conditions, the manufacturer recommends changing the filter element after 1 year of operating time at the latest.

If the element is exposed to greater dynamic strain, it can be necessary to keep shorter change intervals, as well as for startup, repairs, oil changes, etc. on the hydraulic system.

1	Turn the shut-off valve (5) in Fig. 204 one-quarter of a turn to the right to close it.
2	Loosen the housing cover with a fork wrench (AF 46) and remove it and the filter element together from the filter housing.
3	Remove the filter element (4) in Fig. 204 from the housing cover.
4	Replace the O-ring in the housing cover.
5	Dispose of the used filter element properly.
6	Press a new filter element with O-rings into the housing cover.
7	Insert the housing cover with filter element into the filter housing and tighten.
8	Turn the shut-off valve one-quarter of a turn to the left to open it.
9	Loosen the bleed screw (2) in Fig. 204 somewhat to bleed air.
10	Open the manual bleeder pump (1) in Fig. 204 and pump it several times until fuel comes out at the bleed screw.
11	Close the manual bleeder pump.
12	Tighten the bleed screw.

9.8 Belt drives

Safety instructions

- Before beginning maintenance, turn off the machine and secure it against being restarted without authorization.
- Only execute maintenance tasks with drive engine shut down and at a standstill.
- After maintenance, replace any protective coverings that have been removed.



Information

See the engine manufacturer's operating manual for details on checking, tensioning and replacing the belt drives.

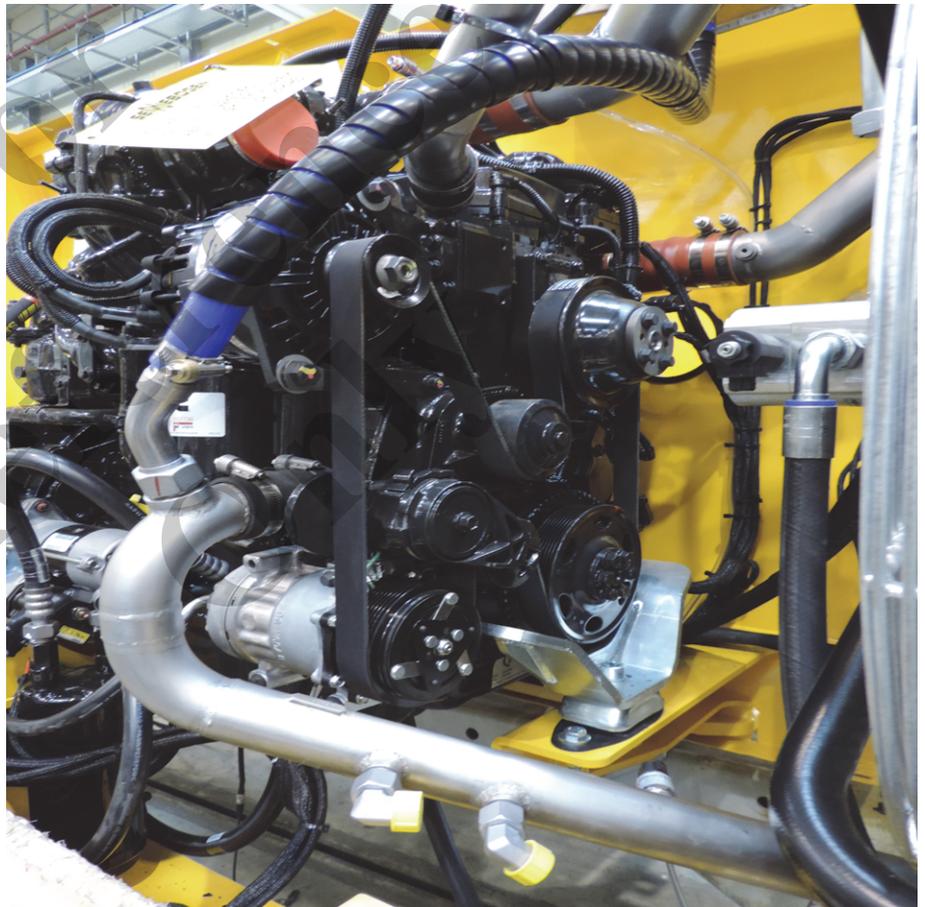


Fig. 205 Drive belts

9.9 Hydraulic system

WARNING

Risk of injury from loose hydraulic connections and hot hydraulic oil system.

Persons in the danger zone can be injured by leaking hydraulic oil.

- Seek immediate medical attention for injuries caused by hydraulic oil.
- Before beginning work on the hydraulic system, make sure it is depressurized.
- Depressurize the pressure accumulator.
- Only open the hydraulic lines and fittings when they are not pressurized.
- Only perform maintenance when the hydraulic oil system is cool.

Safety instructions

- Work on the hydraulic system may only be carried out by trained personnel with special knowledge and experience in hydraulics.
- The hydraulic valves may only be adjusted by trained Grove service personnel.
- Wear personal protective equipment (e.g., hard hat, hearing protection, protective gloves, safety shoes).
- Only perform maintenance when the engine is off and the impeller is stationary. The possibility of automatic start-up must be excluded.
- Ensure the following before restarting the machine:
 - There are no objects near the impellers (e.g., tools).
 - No objects can fall down near the impellers, e.g., due to vibration.
 - The safety devices are installed.

Cylinder Pressure cylinders are subject to slight leakage. Remove excess leak oil with a cloth. Dispose of the oil-soaked cloth as hazardous waste.

The sliding surfaces of the piston rods are chrome-plated. Heavier leakage indicates damaged sliding surfaces or defective seals.

Clean hydraulic cylinders:

- Do not use sharp tools, corrosive fluids or abrasives.
- Clean the piston rods regularly with a steam jet. Do not aim the jet directly at the sealing elements.
- Apply preservative to extended piston rods after cleaning. This protects the surface against environmental and weather conditions.

Threaded unions Check hydraulic fittings and couplings regularly for leaks. Seal leak points and remove oil spots.

Leaking hydraulic oil endangers the environment and presents a hazard due to danger of slipping.

Always seal opened threaded unions immediately with stoppers on both sides.

Shut-off flap Close the shut-off flap in the following situations:

- When working on the pump regulators.
- When replacing pumps.
- When performing maintenance or repairs.

This prevents larger amounts of hydraulic oil from leaking out.

An indicator light on the SENCON monitors the shut-off flap.

NOTICE

Risk of environmental damage due to improper disposal of hydraulic oil.

Hydraulic oil that has not been properly disposed of contaminates ground water.

- Make sure hydraulic oil does not seep into the soil or reach bodies of water.
- Observe applicable environmental standards for disposing of hydraulic oil.

9.9.1 Hydraulic hose lines

Storage and service life

Even with proper storage and use at permissible loads, hoses and hose lines are subject to natural aging. This means that their service life is limited.

The owner is responsible for ensuring that hose lines are replaced at suitable intervals, even if safety defects cannot be detected on the hose line.

Hose lines must be replaced at least every six years, including a possible storage period of two years.

Check

Have the hose lines inspected at least once per year by an expert to make sure they are safe to use.

Rectify any defects discovered immediately.

Defects

Replace hose lines in the following cases:

- Outer layer damaged down to the reinforcement (e.g. abrasion points, cuts, cracks)
- Outer layer embrittlement (cracks appearing in hose material)
- Deformations that do not conform to the natural shape of the hose or hose line, either in pressurized status or de-pressurized status, or when bent (e.g. layer separation, blistering)
- Leaks
- Damaged or deformed hose fittings (sealing function impaired)
- Hose has separated from fittings
- Corrosion of fittings that reduces function and strength
- Failure to comply with Installation requirements;
- Storage periods or service life exceeded

9.9.2 Depressurizing the hydraulic system

The hydraulic system must be depressurized before beginning any work.

1	Lower attached loads and the boom to the ground.
2	Turn off the diesel engine and turn the ignition key back to the 1 position.



Fig. 206 Ventilation filter

3	Open the aeration filter (1) in Fig. 206 on the hydraulic oil tank. – This relieves the charging pressure in the tank.
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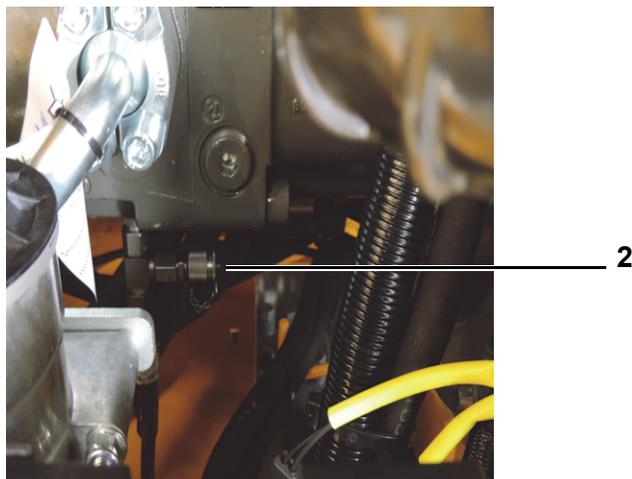


Fig. 207 M1 measurement connection

- | | |
|---|--|
| 4 | Connect the pressure gauge (up to 600 bar) to the M1 measurement connection (2) in Fig. 207. |
| 5 | Move both joysticks in the cab several times in all directions. Operate all pedals and switches with a hydraulic function several times. <ul style="list-style-type: none">– This relieves pressure in the hydraulic system. |

**Information**

The pressure gauge must show 0 bar. If the pressure has not been fully relieved, repeat the above steps.

9.9.3 Checking the oil level

WARNING

Risk of injury from hot or pressurized hydraulic oil.

Hot or pressurized hydraulic oil can cause serious scalding and injury.

- Work on the hydraulic system may only be carried out by trained personnel with special knowledge and experience in hydraulics.
- Only carry out maintenance tasks after the hydraulic oil system has cooled down.
The hydraulic oil can reach temperatures of 70 °C and higher.
- Only perform maintenance when the hydraulic system is depressurized.
- Only perform maintenance on the hydraulic system with safety equipment.

NOTICE

Risk of environmental damage due to improper disposal of hydraulic oil.

Hydraulic oil that has not been properly disposed of or poured contaminates ground water.

- Make sure hydraulic oil does not seep into the soil or reach bodies of water.
- Observe applicable environmental standards for disposing of hydraulic oil.



Information

Mixing different types of oils, lubricants and operating fluids is prohibited.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.

1	Lower attached loads and the boom to the ground.
2	Park the machine on a level surface.
3	Completely retract all hydraulic cylinders.
4	Switch off the diesel engine and secure it against being restarted.

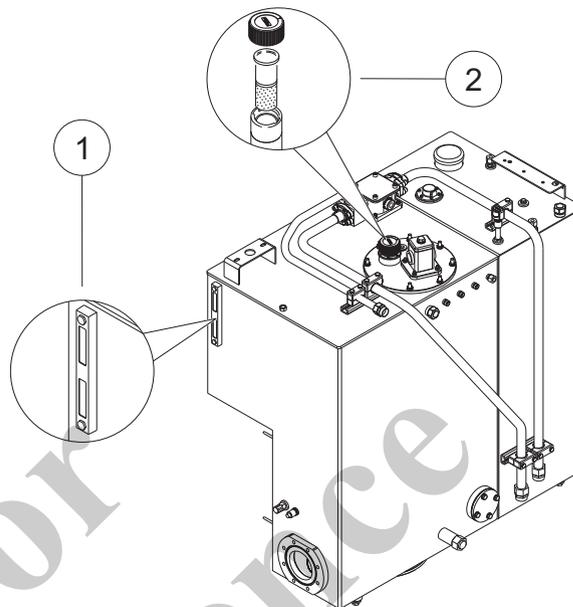


Fig. 208 Hydraulic tank

- | | |
|---|---|
| 1 | Check the oil level on the oil level indicator (1) in Fig. 208:
– The oil level must reach the upper marking on the sight glass. |
| 2 | Add hydraulic oil as needed. |

Top up hydraulic oil

- | | |
|---|---|
| 1 | Unscrew the cap to the oil filler neck (2) in Fig. 208. |
| 2 | Top up hydraulic oil and re-check. |
| 3 | Screw the cap back on. |

9.9.4 Changing the hydraulic oil

WARNING

Risk of injury from hot or pressurized hydraulic oil, or loose hydraulic connections.

Hot or pressurized hydraulic oil, or loose hydraulic connections can cause serious scalding and injury.

- Work on the hydraulic system may only be carried out by trained personnel with special knowledge and experience in hydraulics.
- Only carry out maintenance tasks after the hydraulic oil system has cooled down.
The hydraulic oil can reach temperatures of 70 °C and higher.
- Only perform maintenance when the hydraulic system is depressurized.
- Only perform maintenance on the hydraulic system with safety equipment.

NOTICE

Risk of environmental damage due to improper disposal of hydraulic oil.

Hydraulic oil that has not been properly disposed of or poured contaminates ground water.

- Make sure hydraulic oil does not seep into the soil or reach bodies of water.
- Observe applicable environmental standards for disposing of hydraulic oil.



Information

Mixing different types of oils, lubricants and operating fluids is prohibited.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.



Information

Pumping out as much oil as possible makes the work easier. Use the return filter openings to do this.

1	Lower attached loads and the boom to the ground.
2	Park the machine on a level surface.
3	Completely retract all hydraulic cylinders.
4	Depressurize the hydraulic system as specified in Section 9.9.2.

5 Replace the filter element of return filter as specified in Section 9.9.5.

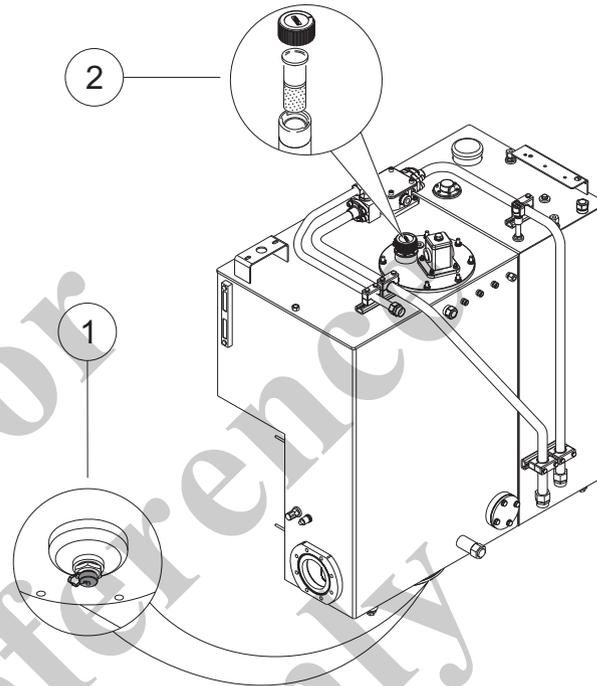


Fig. 209 Oil drain plug and filler neck

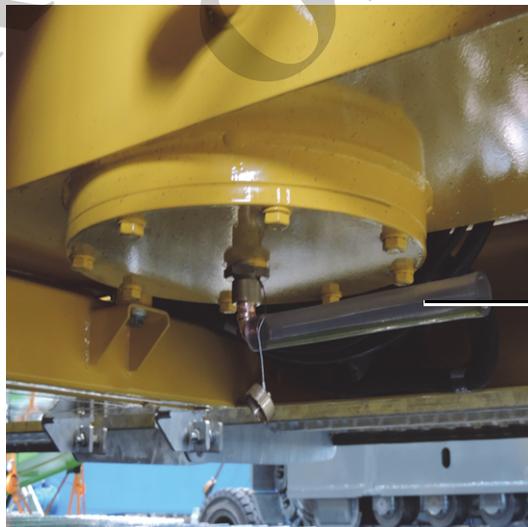


Fig. 210 Counterpart with hose on oil drain

6	Place a large enough container under the drain hole of the tank (see Section 9.17.3 for quantity).
7	Unscrew the oil drain plug (1) in Fig. 209 on the bottom of the tank and screw on the counterpart with hose (3) in Fig. 210.
8	Collect the used oil in the container.
9	Clean the cover, oil drain plug and inside of the hydraulic tank as needed.
10	Unscrew the counterpart with hose and screw in the oil drain plug.
11	Unscrew the cap to the oil filler neck (2) in Fig. 209.
12	Add new hydraulic oil through the filler neck.
13	Bleed the hydraulic pump: <ul style="list-style-type: none">- Loosen the bleed screw on the pump but do not remove, and hold it in place by pressing on it gently with your thumb.- Wait several seconds until the air has escaped.- Retighten the bleed screw.

For Reference Only

9.9.5 Return filter – changing filter element

The manufacturer recommends changing the filter element after 1 year of operating time at the latest.

If the element is exposed to greater dynamic strain, it can be necessary to keep shorter change intervals, as well as for startup, repairs, oil changes, etc. on the hydraulic system.

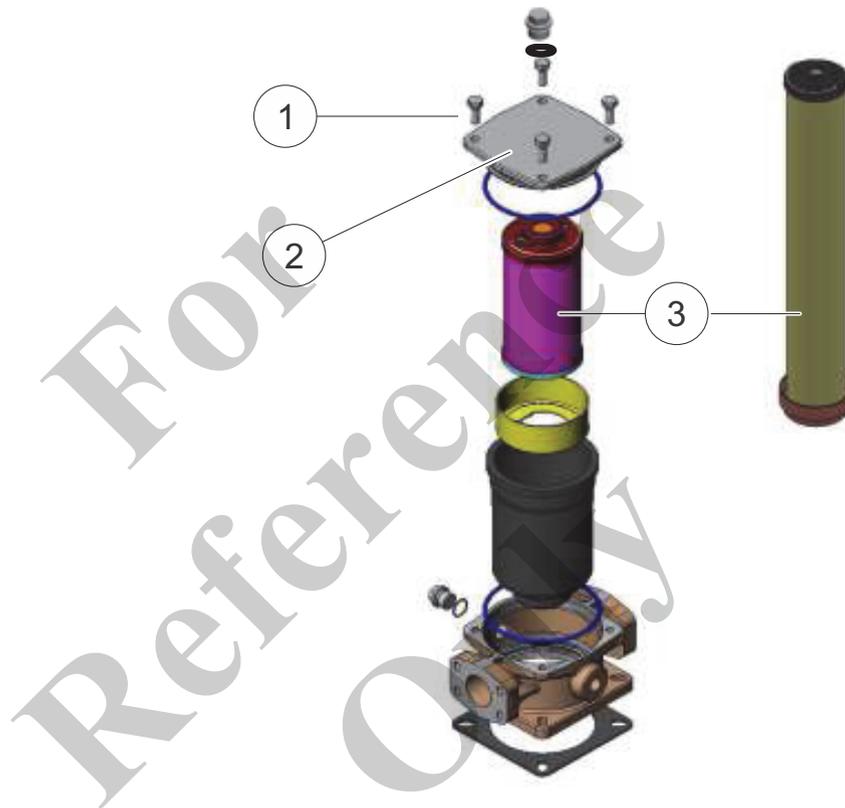


Fig. 211 Return filter

1	Depressurize the hydraulic system as specified in Section 9.9.2.
2	Unscrew the cover screws (1) in Fig. 211.
3	Remove the cover (2) in Fig. 211.
4	Pull out the filter element (3) in Fig. 211.
5	Check the surface of the element for residue and larger particles. These can indicate damage to the components.
6	Dispose of the filter element in accordance with applicable environmental standards.

7	Clean the housing and cover.
8	Check the filter, especially the sealing surfaces, for mechanical damage.
9	Check the O-rings and replace as needed.
10	Coat the sealing surfaces and the O-rings with a clean medium.
11	Carefully insert the new filter element.
12	Replace the cover and tighten the screws by hand (alternating between screws).
13	Insert the filter in the tank.
14	Turn on the hydraulic system.
15	Bleed the filter at a suitable location and check for leaks.

For Reference Only

9.9.6 Leak oil filter – changing the filter element

The manufacturer recommends changing the filter element after 1 year of operating time at the latest.

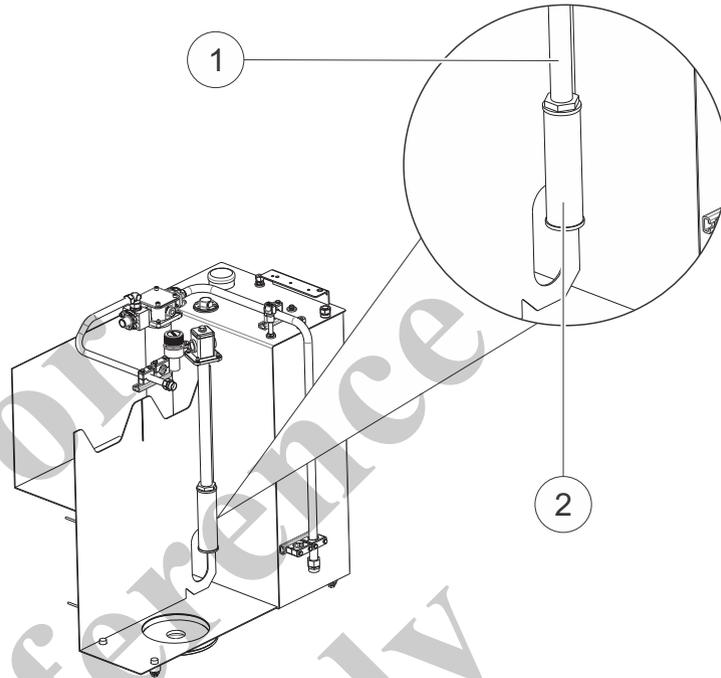


Fig. 212 Leakage oil filter

1	Loosen the four nuts on the square tube.
2	Remove the return pipe (1) in Fig. 212.
3	Unscrew the filter element (2) in Fig. 212 and remove it from the return pipe.
4	Screw the new filter element into the return pipe.
5	Insert the return pipe.
6	Tighten the four nuts on the square tube.

9.9.7 Replacing the aeration filter

Temperature changes and the use of cylinders or pressure accumulators cause the oil level in hydraulic system containers to vary constantly.

Exchanging air with the surrounding atmosphere is necessary to avoid unsafe pressure build-up in the container. When using an aeration filter, the air drawn in from the outside is filtered to prevent the ingress of contaminants.

The manufacturer recommends replacing the aeration filter every 1,000 operating hours, at the latest however every year.

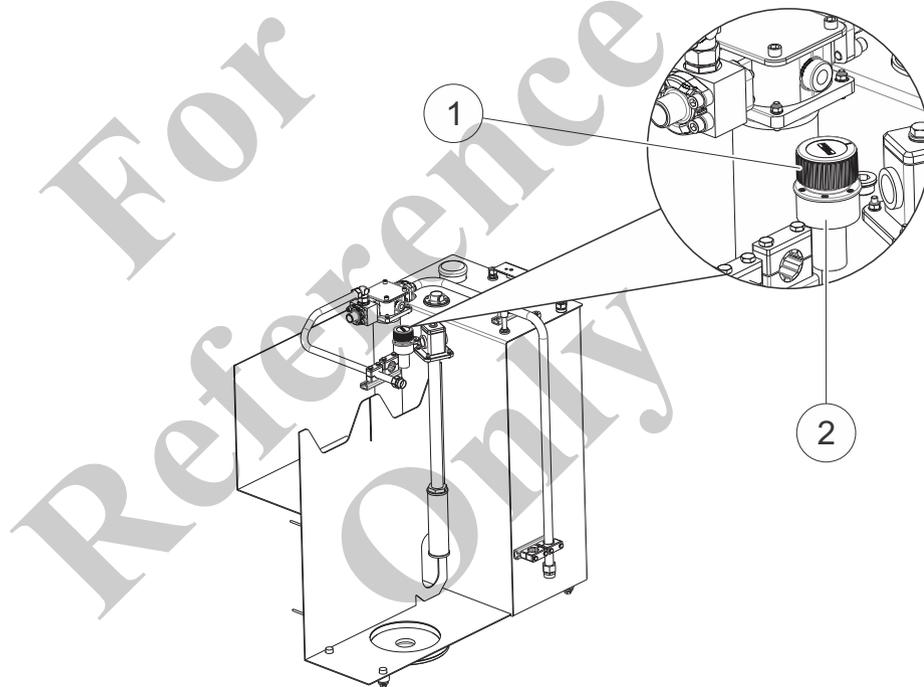


Fig. 213 Ventilation filter

1	Unscrew the screw cap (1) in Fig. 213 on the hydraulic tank.
2	Pull out the filter element (2) in Fig. 213 and dispose of it in accordance with applicable environmental standards.
3	Insert the new filter element.
4	Screw the cap back on.

9.9.8 Checking the pre-load of the pressure accumulator

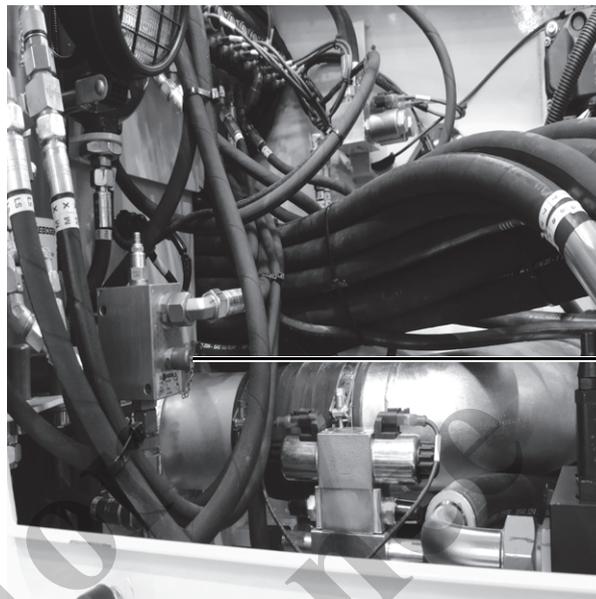


Fig. 214 Pressure accumulator measurement connection

1	Place attached loads and the boom on the ground.
2	Connect the pressure gauge to connection M25 (1) in Fig. 214.
3	Turn off the engine.
4	Immediately turn the ignition key back to position 1.
5	Push the safety lever forward.
6	Move both control levers in the cab several times in all directions.
7	Observe the pressure gauge. As soon as the preload pressure is reached, the valve in the pressure accumulator closes. The needle on the pressure gauge suddenly drops to 0. The value prior to the pressure drop equals the preload pressure in the pressure accumulator.
8	Compare the indicated value with the tolerances for the pressure accumulator. If the preload pressure is outside tolerance, replace the pressure accumulator or have it refilled with nitrogen.
9	Remove the pressure gauge.

9.9.9 Replacing the HydroClean micro-filter element



Risk of injury from hot engine parts.

Persons can be injured by the hot parts on a running engine.

➤ Only perform maintenance when the drive motor is off and the cooling system has cooled down.



Information

Before changing the filter element, space constraints require that first the oil filter and then the filter element for the water separator be removed.



Information

Contamination of the HydroClean filter element is monitored by the SENCON. When the warning icon appears in the SENCON error diagnostics, the filter element has to be replaced.

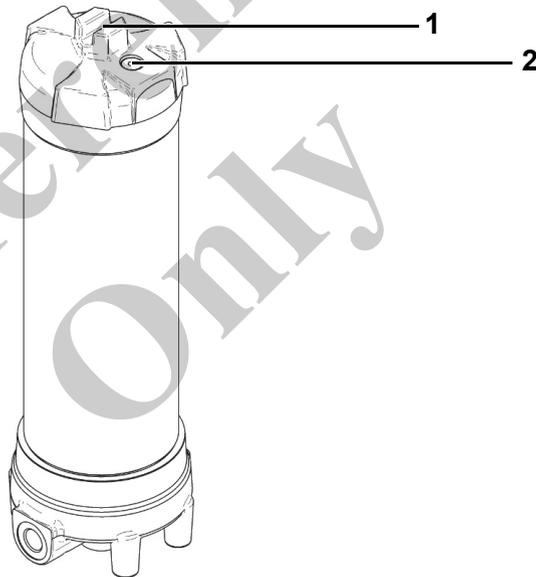
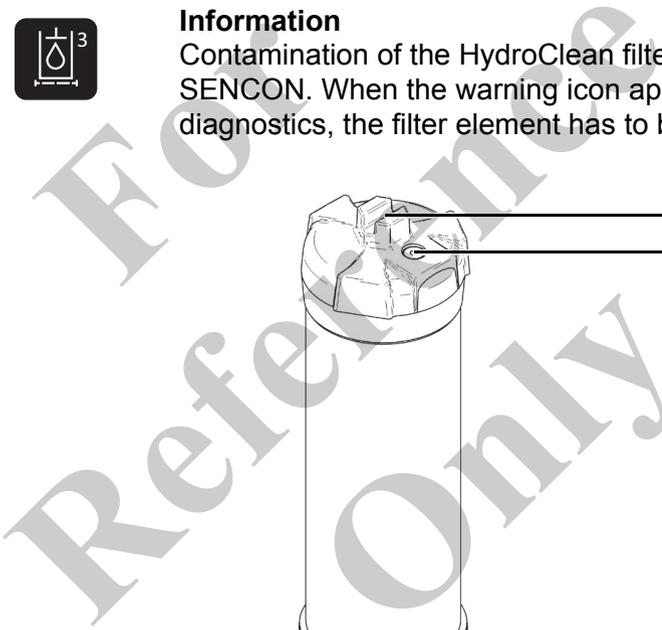


Fig. 215 HydroClean

1	Depressurize the hydraulic system as specified in Section 9.9.2.
2	Unscrew the cover (1) in Fig. 215 using the integrated hexagon head.
3	Remove the filter element.
4	Dispose of the filter element as hazardous waste.

5	Clean the components, check the seal and replace it as needed.
6	Insert the new filter element.
7	Screw the cover back on.
8	Start the drive motor.
9	Loosen the hex screw (2) in Fig. 215 until the breather hole is open.
10	Once oil begins to leak out, retighten the hex screw.
11	Turn off the drive motor and check the filter for leaks.

For
Reference
Only

9.10 Winch

WARNING

Risk of injury from high spring tension.

The winch brakes are under extreme spring tension and if opened can cause injury.

- Do not disassemble the winch brakes.
- Only work on the winch and its attachments when the machine is off and not under load.
- Before beginning work on the winch, secure its drive and attachments against being started unintentionally.
- Make sure the hydraulic supply lines are not pressurized.

WARNING

Risk of injury from rotating or hot parts.

Persons can be injured by moving or hot engine parts when the engine is running.

- Only perform maintenance when the drive motor is off and the winch is not moving.
- Wear safety equipment (e.g., protective gloves and clothing).

NOTICE

Risk of environmental damage due to improper disposal of oil.

Oil that has not been properly disposed of contaminates ground water.

- Make sure oil does not seep into the soil or reach bodies of water.
- Observe applicable environmental standards for disposing of oil.

Safety instructions

- Drain oil when the gearbox is warm.
- Make sure the screws in the load flow are seated properly after longer periods of continuous use and when frequently under maximum load.
- Do not disassemble the winch brakes. Always replace the winch brakes completely. Warranty is invalidated if winch brakes are dismantled.
- Remove the engine and brake once per year and check the spline shaft couplings on the drive end. These spline shaft couplings cannot show any plastic strain or abrasive wear (spline edges partially worn, spline bases uneven). If damage can be seen on the involute spline connections, the affected parts must be replaced immediately.
- The crane winch must undergo a general overhaul at the end of the

remaining service life, or every 10 years at the latest.

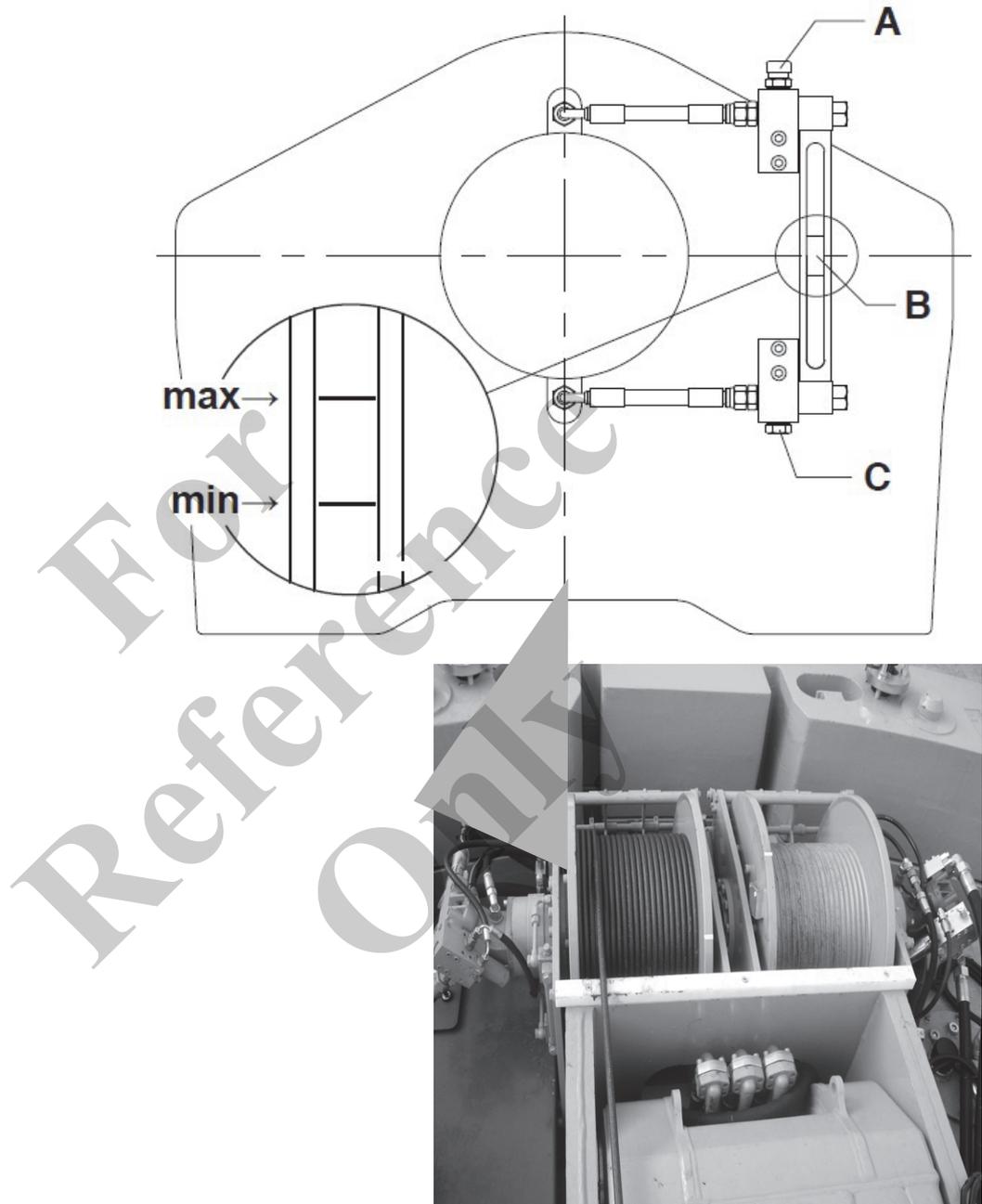


Fig. 216 Winch

A	Oil filler neck – gearbox
B	Oil level indicator
C	Oil drain – gearbox



Information

Mixing different types of oils, lubricants and operating fluids is prohibited.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.

9.10.1 Maintaining the brake

Safety instructions

- Do not disassemble the winch brakes. Always replace the brakes completely. Warranty is invalidated if winch brakes are dismantled.
- When replacing a seal, always replace all seals.

The brake adjusts itself automatically. At higher pressures and higher activation frequency, small amounts of leak oil on the pistons are unavoidable.

9.10.2 Checking the winch gearbox oil level



Information

Mixing different types of oils, lubricants and operating fluids is prohibited.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.

1	Park the machine on a level surface.
2	Turn off the drive motor.
3	Check the oil level on the oil level indicator (B) in Fig. 216. The oil level must be between the lower marking (MIN) and the upper marking (MAX).
4	Add gear oil as needed.
5	Remove the closure to the oil filler neck (A) in Fig. 216.
6	Add fresh gear oil until the oil level is between the MIN and MAX markings.
7	Replace the filler neck closure.

9.10.3 Changing the winch gearbox oil



Information

Mixing different types of oils, lubricants and operating fluids is prohibited.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.

1	Park the machine on a level surface.
2	Turn off the drive motor.
3	Place a collecting vessel under the oil drain (C) in Fig. 216.
4	Remove the oil drain plug (C) in Fig. 216.
5	Allow the old oil to drain completely.
6	Clean the components, check the seals and replace as needed.
7	Reinstall the oil drain plug (C) in Fig. 216.
8	Remove the closure to the oil filler neck (A) in Fig. 216.
9	Add fresh gear oil until the oil level is between the MIN and MAX markings.
10	Replace the oil filler neck closure (A) in Fig. 216.
11	Activate the winch.
12	Check the oil level again.

9.11 Undercarriage

 **WARNING**

Risk of injury from rotating and hot parts.
 Persons can be injured and scalded by rotating and hot parts.
 ➤ Only perform maintenance when the drive motor is off and the distributor gearbox is cool.

NOTICE

Risk of environmental damage due to improper disposal of oil.
 Oil that has not been properly disposed of contaminates ground water.
 ➤ Make sure oil does not seep into the soil or reach bodies of water.
 ➤ Observe applicable environmental standards for disposing of oil.

9.11.1 Cleaning and lubricating



Information

Mixing different types of oils, lubricants and operating fluids is prohibited.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.

1	Park the machine on a level surface.
2	Turn off the diesel engine.
3	Clean the undercarriage, crawler track and sheaves with a steam jet.
4	Lightly grease the guides and bolts.

9.11.2 Checking the travel drive oil level

WARNING

Risk of scalding from hot oil.

Persons can be injured when draining hot oil.

➤ Only drain the oil when the gearbox is warm.



Information

Mixing different types of oils, lubricants and operating fluids is prohibited.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.

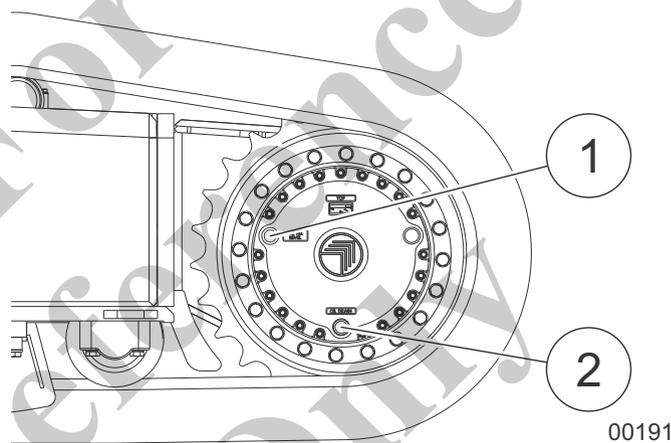


Fig. 217 Lubricating points (1) and (2) of the travel drive

1	Park the machine on an even and hard surface so the lubricating points (1) in Fig. 217 and (2) in Fig. 217 are as shown in the figure.
2	Switch off the diesel engine.
3	Place a collecting vessel under the lubricating point closure.
4	Slowly loosen closure of lubricating point until oil comes out of the threaded hole. If too much oil comes out, tighten the closure.
5	If no oil comes out, add oil.
6	To add oil, completely remove the closure of the lubricating point and pour fresh oil into the threaded hole until it overflows.
7	Tighten the closure of the lubricating point (1).

9.11.3 Changing the travel drive oil

WARNING

Risk of injury due to oil coming into contact with skin.

Contact with oil can cause severe skin disorders and other severe injuries.

- Wear gloves and safety glasses with side protection.
- Avoid skin contact with used oil.
- If skin contact occurs, thoroughly wash off the affected area.
- Do not inhale oil vapors or swallow oil.



Information

Mixing different types of oils, lubricants and operating fluids is prohibited.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.

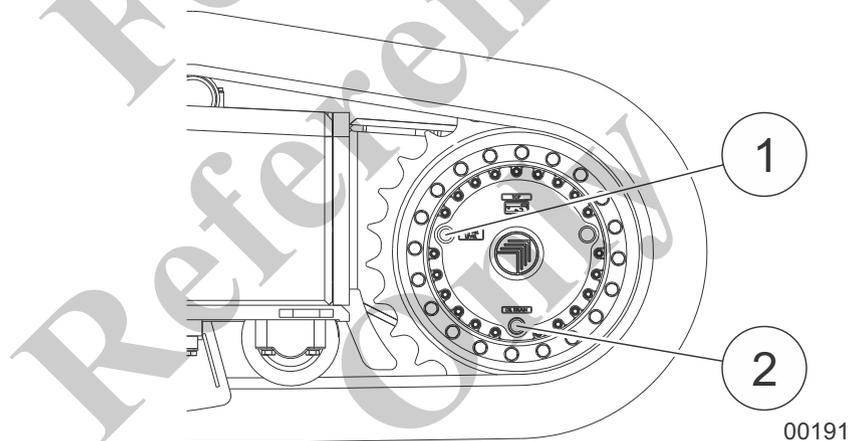


Fig. 218 Lubricating points (1) and (2) of the travel drive

1	Park the machine on an even and hard surface so the lubricating points (1) and (2) are as shown in Fig. 218.
2	Switch off the diesel engine.
3	Place a collecting vessel under the closure for lubricating point (1) and lubricating point (2).
4	Loosen the closure for lubricating point (1) so the oil can flow out better.
5	Loosen and remove the closure for lubricating point (2).
6	Let the used oil drain completely.
7	Tighten the closure of the lubricating point (2).
8	Add fresh oil through the threaded hole of the closure for lubricating point (1) until it overflows.
9	Retighten the closures for lubricating point (1) and lubricating point (2).
10	Check the oil level after 2 operating hours.



Information

Make sure the oil is warm so it can drain more easily. Keep the work area free and clean. Carefully clean the fill plug and drain plug before screwing them back in.

9.11.4 Crawler track



Information

Properly adjusted track tension will reduce the wear of running gear parts. Grease and a grease gun are needed for adjusting track tension. More detailed information can be found in the attached list of operating materials.

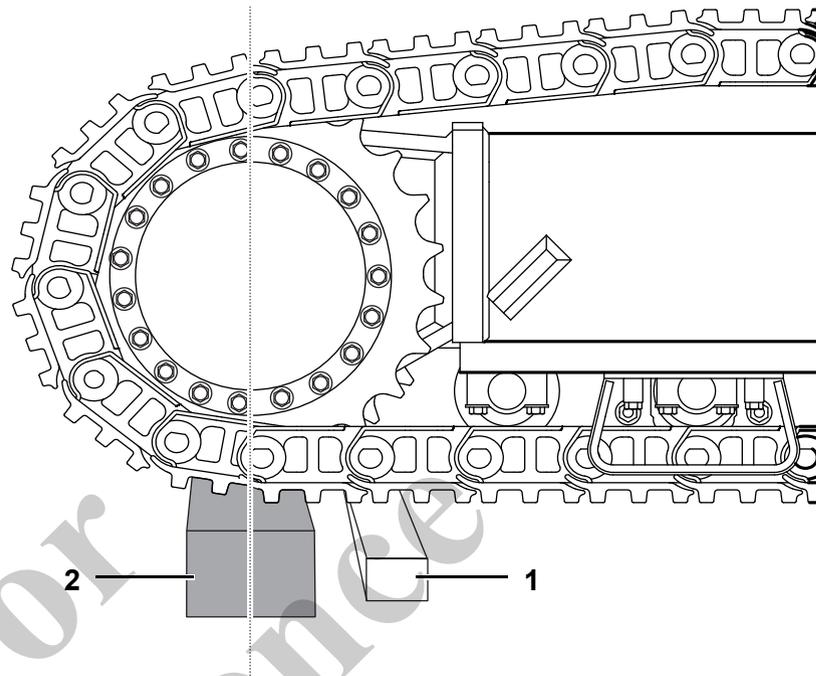
Clean the running gear and crawler tracks thoroughly before checking the chain tension.

Safety instructions

- Park the machine on even, hard ground.
- Ensure no one is in the danger zone of the machine.
- Slew the uppercarriage 180° to the undercarriage.
- Do not attach any loads.
- Completely retract the boom.
- Move the boom to 10°.
- Apply the slew gear brake.

Checking and adjusting track tension

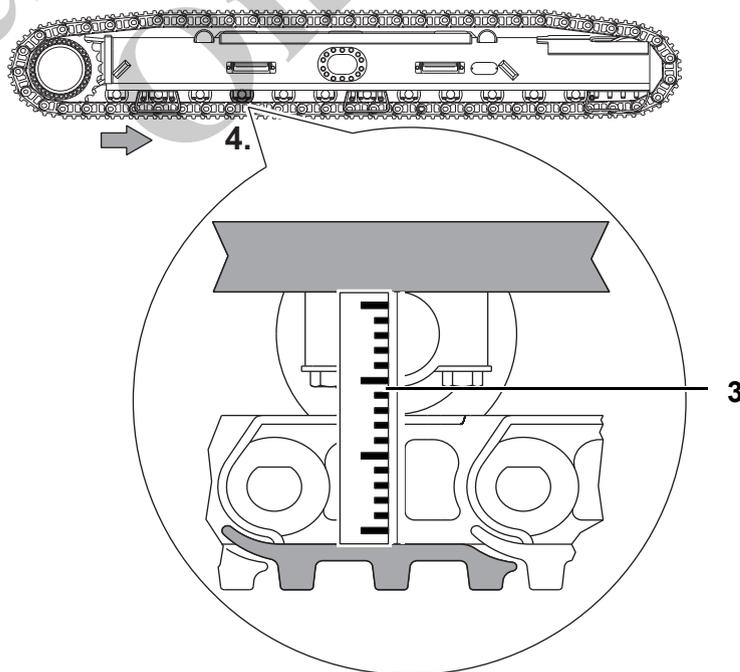
1	Place two sufficiently long and stable wooden planks (1) approx. 13 cm (5 in) thick and two sufficiently long and stable wooden planks (2) approx. 20 cm (8 in) thick in front of the crawler track as shown in Fig. 219.
2	Carefully drive onto the planks as shown in Fig. 219. The crawler track has to be completely on the planks that are approx. 20 cm (8 in) thick.



00447

Fig. 219 Driving the crawler undercarriage onto wooden planks

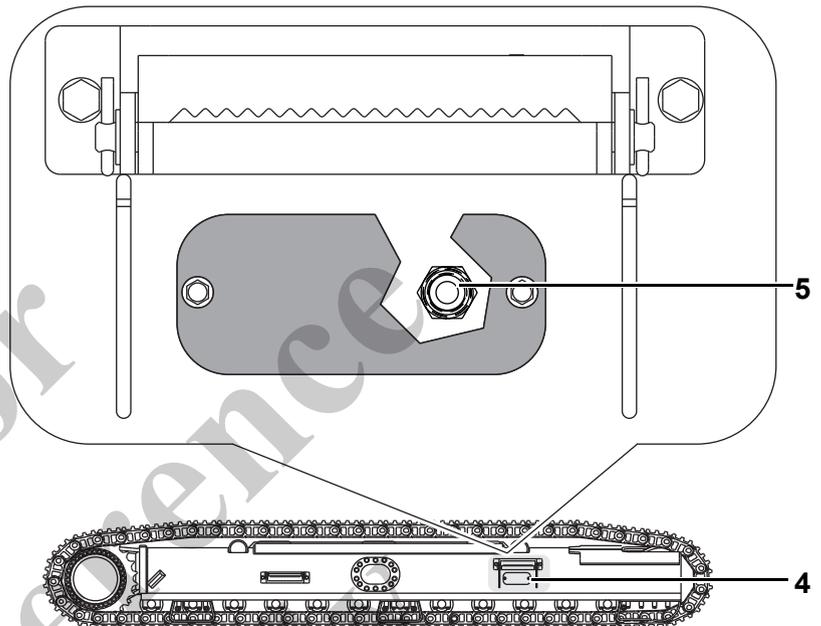
- 3 Measure the distance (3) between the frame of the track wheel carrier and the track shoe on the 4th track roller in Fig. 220. The distance has to be approx. 27 cm (11 in) to 30 cm (12 in).



00448

Fig. 220 Measuring track tension

- 5 To adjust the track tension, unscrew the service panel (4) in Fig. 221 on the back of the track wheel carrier and add grease through the lubricating nipple (5) with a grease gun.



00446

Fig. 221 Adjusting track tension

- 6 Check the track tension again. Readjust the track tension as needed.

9.11.5 Spring tensioning fixture - adjusting track tension

WARNING**Risk of death from ejecting grease.**

Without lubricating nipples or valve, the grease sprays out at high pressure and the valve is ejected from the machine. This can cause serious injury or death.

- Do not fully remove the valve or lubricating nipples.
- Always use an extension for the grease gun in order to be able to work at a safe distance from the access door.

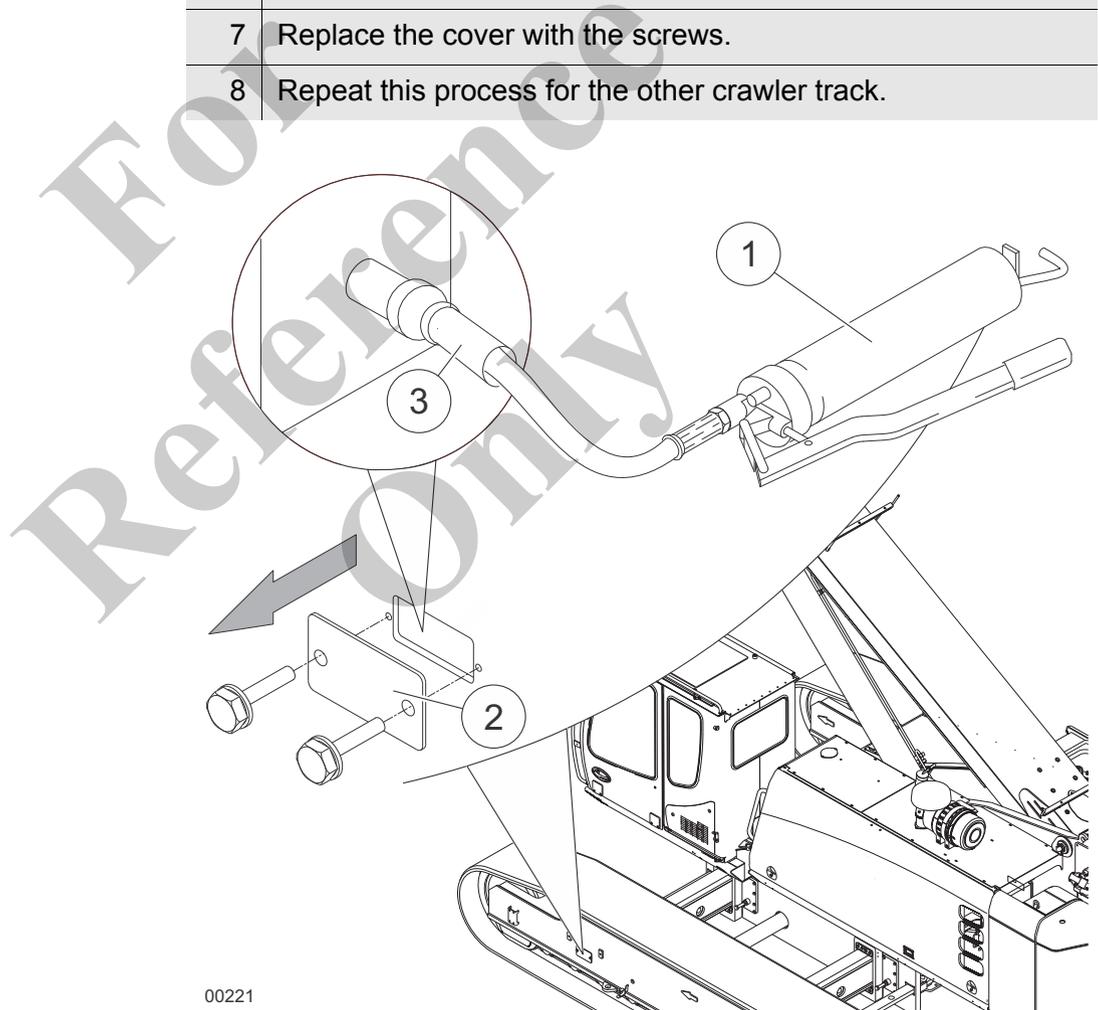
**Information**

Constant correct tension of the crawler tracks increases the service life of the components of the undercarriage.

The crawler track tension must be adjusted depending on the machine's operating conditions. If the ground is highly compact, the crawler track tension must be as low as possible.

For Reference Only

1	Part the machine on even, hard ground.
2	Prepare the grease gun (1) in Fig. 222.
3	Remove the screws and cover (2) in Fig. 222.
4	Insert the connection hose (3) in Fig. 222 into the lubricating valve.
5	Inject the grease. Interrupt the process from time to time to verify the sag.
6	If the chain is tensioned too tightly, loosen the valve slightly so the excess grease comes out of the breather hole and the track loosens.
7	Replace the cover with the screws.
8	Repeat this process for the other crawler track.



00221

Fig. 222 Adjusting track tension

9.11.6 Track rollers

Re-tighten screws



Fig. 223 Track rollers



Information

Retighten the screws (1) in Fig. 223 with a torque wrench. Observe the tightening torque specified in Section 9.17.4.

9.11.7 Sprocket

Re-tighten screws

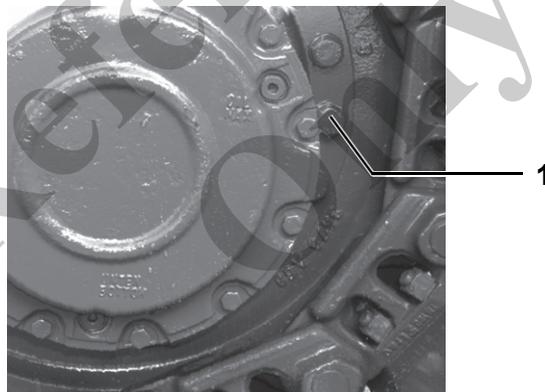


Fig. 224 Sprocket mounting screws



Information

Retighten the sprocket mounting screws with a torque wrench. Tighten M24x2 hex screw to a tightening torque of 1,150 Nm.

9.11.8 Base plates

Re-tighten screws

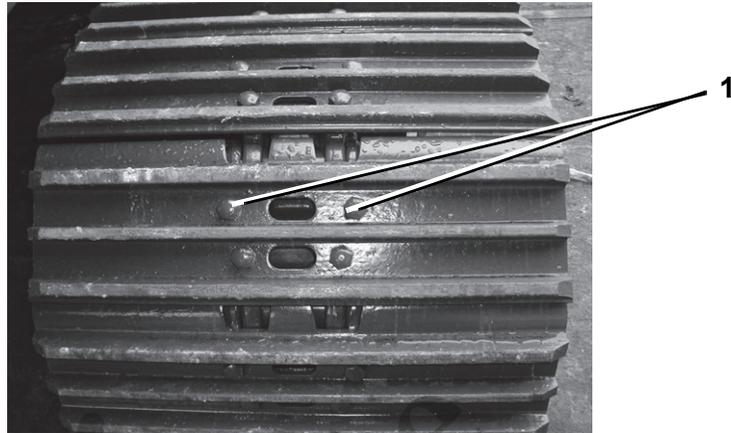


Fig. 225 Base plate mounting screw



Information

Retighten base plate mounting screws with a torque wrench. Tighten M18x1.5 hex screws to a tightening torque of 530 Nm.

Reference Only

9.12 Rotary connection

Make sure the rotary connection is well lubricated.

- Bearing race (1) in Fig. 226
 - via lubrication nipple
- Gearing (2) in Fig. 226
 - via lubricating nipples or
 - With gear spray
- Seal (3) in Fig. 226
 - Check the seal between the bearing race and the gear teeth for damage.



Information

Relubricating is necessary before and after longer periods of machine disuse (longer than 3 months).

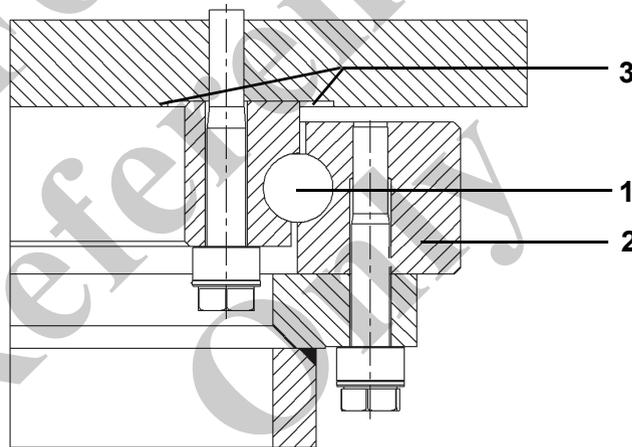


Fig. 226 Rotary connection components

1	Bearing race
2	Gearing
3	Seal

9.12.1 Lubricating the slewing ring bearing race



Information

Mixing different types of oils, lubricants and operating fluids is prohibited.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.



Information

The specified lubricating intervals can be shortened in the following situations:

- High humidity
- High levels of dust and contamination
- High temperature fluctuations
- Frequent slewing movements

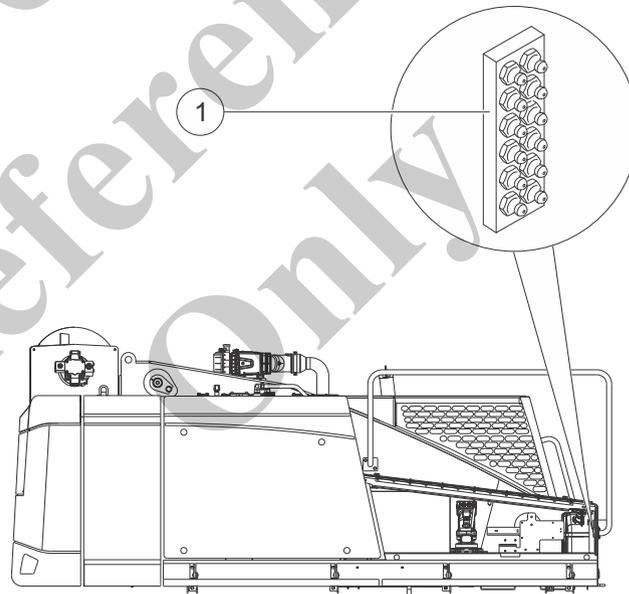


Fig. 227 Central lubricating strip

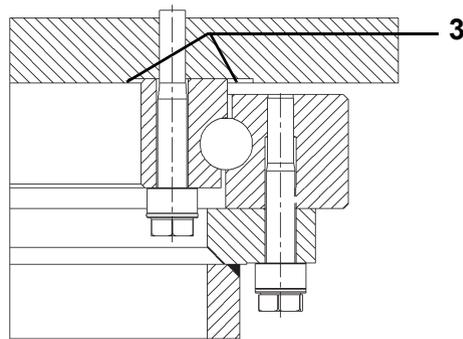


Fig. 228 Rotary connection sealing lips

1	Turn off the diesel engine.
2	Open the right service door.
3	Lubricate the top 8 lubricating nipples (1) in Fig. 227 (outlet no. 5–12) until grease comes out of the sealing lips (3) in Fig. 228.
4	Slew the uppercarriage several times in both directions to distribute the grease.
5	Repeat this process until fresh grease appears on the grease collar.
6	Close the service door.

9.12.2 Lubricating the slewing ring gearing

Lubricate the slewing ring every 10 operating hours or daily, depending on operating conditions.



Information

Mixing different types of oils, lubricants and operating fluids is prohibited.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.

Gear spray



Fig. 229 Lubricating the slewing ring gearing

1	Turn 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	Spray the gearing from approx. 30 cm away with Grove gear spray.
5	Slew the uppercarriage several times to evenly distribute the grease on the gearing.
6	Check whether an uninterrupted film of lubricant is present. Repeat the lubrication process as needed.

Pinion gearing lubrication (option)

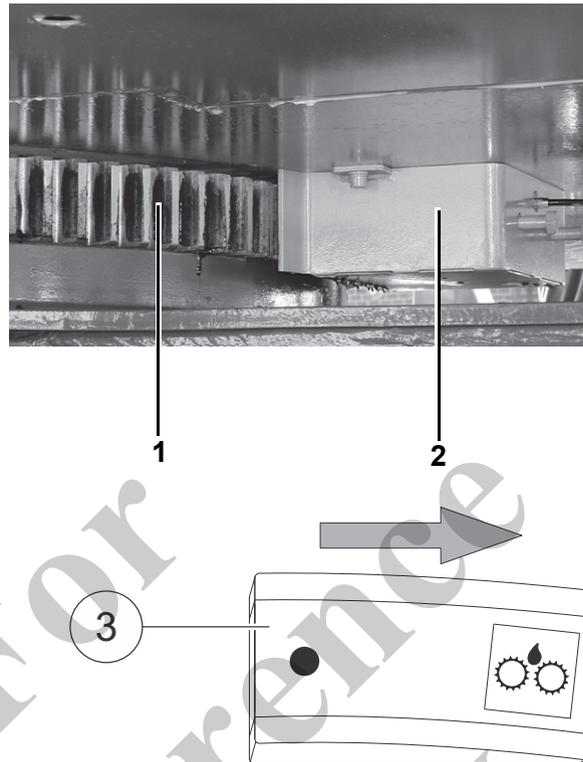


Fig. 230 Gear tooth lubrication

1	Slewing ring, outer teeth
2	Slew-ring pinion shaft
3	Pinion lubrication push-button



Information

Clean the lubrication point thoroughly down to the bare metal before the first application of lubricant to ensure that the lubricant creates a continuous film across the surface.

1	Switch off the diesel engine.
2	Thoroughly clean the gearing.
3	Check the slewing ring and slewing ring pinion for wear and replace as needed.
4	Start the diesel engine.

5	<p>Lubrication process:</p> <ul style="list-style-type: none"> - Press and hold the push-button (3) in Fig. 230 on the control panel. - Slew the uppercarriage with the left control lever 360° to the left and to the right to distribute the lubricant evenly over the gearing.
6	<p>Release the push-button.</p>



Information

Lubricate the slewing ring every 10 operating hours or daily, depending on operating conditions.

Check the lubrication reservoir once a week and add lubricant as needed (see list of operating fluids).

NOTICE

Risk of machine damage due to not observing the wear limit.

If the plastic skid (2) is not replaced when it has reached its wear limit, the machine can be seriously damaged.

- Check the plastic skid (2) in Fig. 231 in the lubrication assembly (1) in Fig. 231 once a month for wear.
- Observe the wear limit (min. width 16 mm).
- Replace the plastic skid (2) in Fig. 231 when it has reached its wear limit.



Information

The owner of the machine is solely responsible for this type of damage and any subsequent damage.

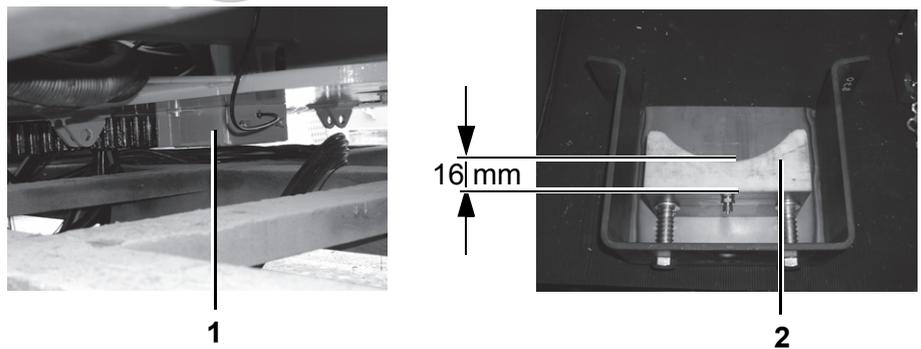


Fig. 231 Plastic skid on the pinion lubrication

Safety instructions

Proceed as follows before checking the plastic skid (2) in Fig. 231:

- Lower attached loads and the boom to the ground.
- Pull the left safety lever back.
- Before beginning maintenance, turn off the machine and secure it against being restarted without authorization.
- Place a warning sign on the controls.

1	Remove the lubrication device (1) in Fig. 231.
2	Check the plastic skid (2) in Fig. 231 for wear.
3	Install the lubrication device.

Topping up grease

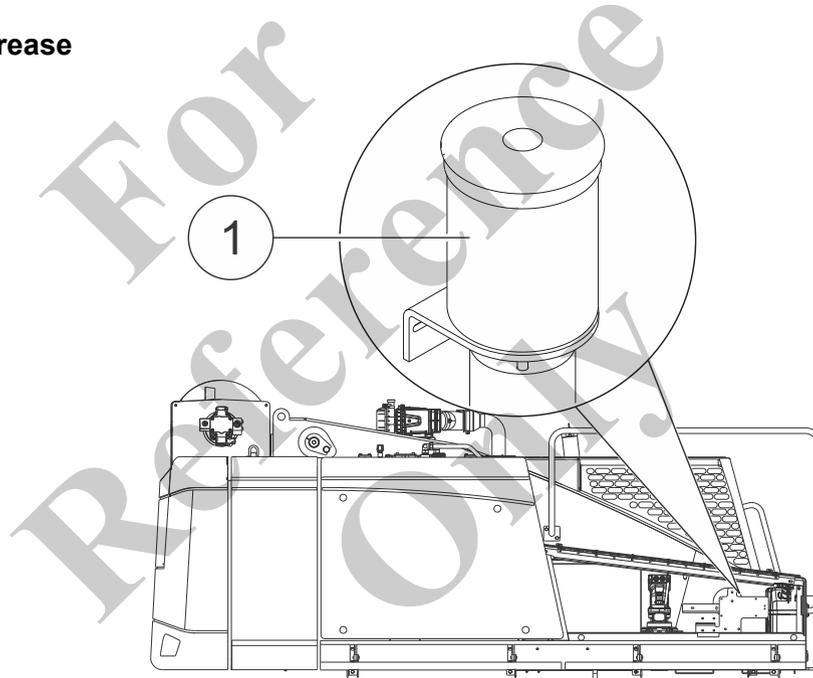


Fig. 232 Position of the lubricant reservoir

1	Open the cover of the lubricant tank (1) in Fig. 232.
2	Add lubricant (see list of operating fluids).
3	Close the cover.

9.12.3 Tightening the slewing ring bolts



Risk of death due to uppercarriage tipping over.

Defective slewing ring bolts can cause the uppercarriage to tip over, resulting in serious injury or death.

- Check the slewing ring bolts every 5,000 operating hours or every 5 years and replace as needed.



Information

The bolts must be tested by an expert from an independent, qualified company or institute.

Unrestricted further use of the slewing ring bolts must be verified with a certificate.

Otherwise the slewing ring bolts must be replaced.

Safety instructions

Corroded or damaged screws can shear and cause the uppercarriage to tip over.

- Do not tighten corroded or damaged screws, replace them immediately with new screws.
- Do not tighten loose screws, replace immediately with new screws.
- Retighten the slewing ring bolts with a torque wrench.
- Always observe the number and diameter of the screws.
- Use only original Grove spare parts.
- If you suspect the bolts have been damaged, have your Grove Service Partner check them.
- Contact your Grove Service Partner with any other questions.

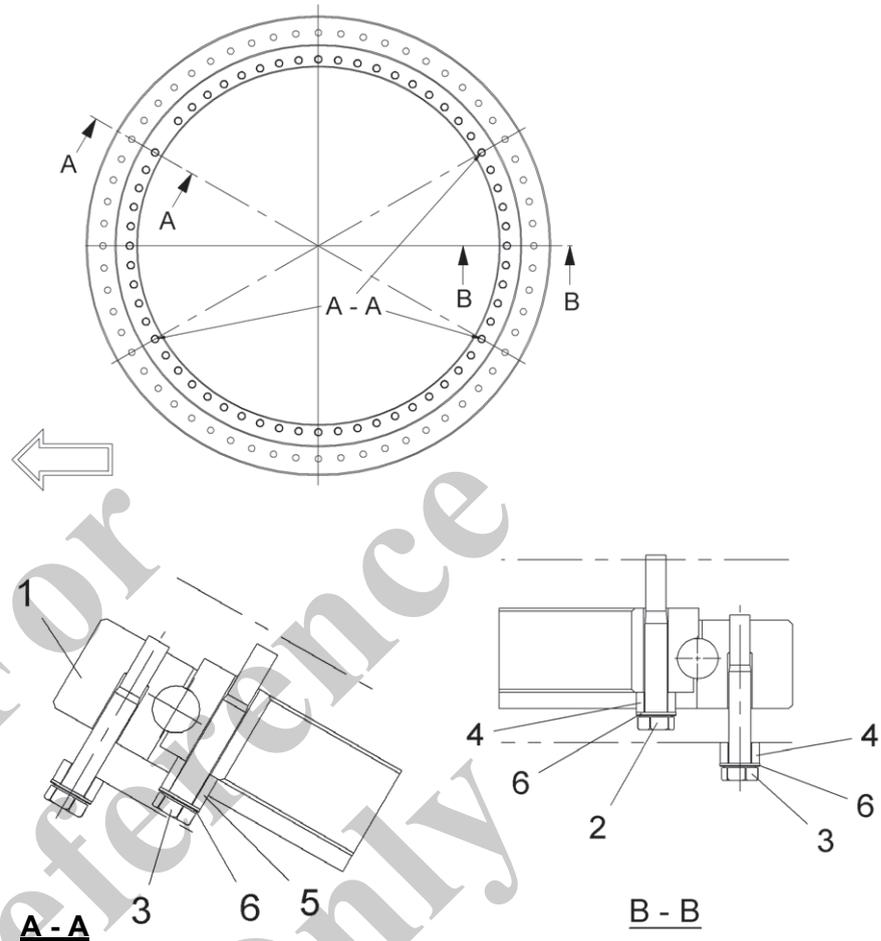


Fig. 233 Slewing ring bolts

1	Turn off the drive motor.
2	Retighten the slewing ring bolts (2, 3 – M22) in Fig. 233 with a torque wrench in a criss-cross pattern. Tighten M22 slewing ring bolts to a tightening torque of 750 Nm.



Information

- The initial tension of the first screw tightened will be affected by tightening the other screws. This is why at least two full turns are necessary.
- Screws larger than M30 should be tightened with a hydraulic bolt tensioner.

9.13 Telescopic boom

9.13.1 Lubricating the telescopic boom

Sufficient and regular lubricating is required for reliable boom operation.

The specified lubricating intervals can be shortened in the following situations:

- High humidity
- High levels of dust
- High levels of contamination



Information

Mixing different types of oils, lubricants and operating fluids is prohibited.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.



Information

Fully extend the undercarriage.

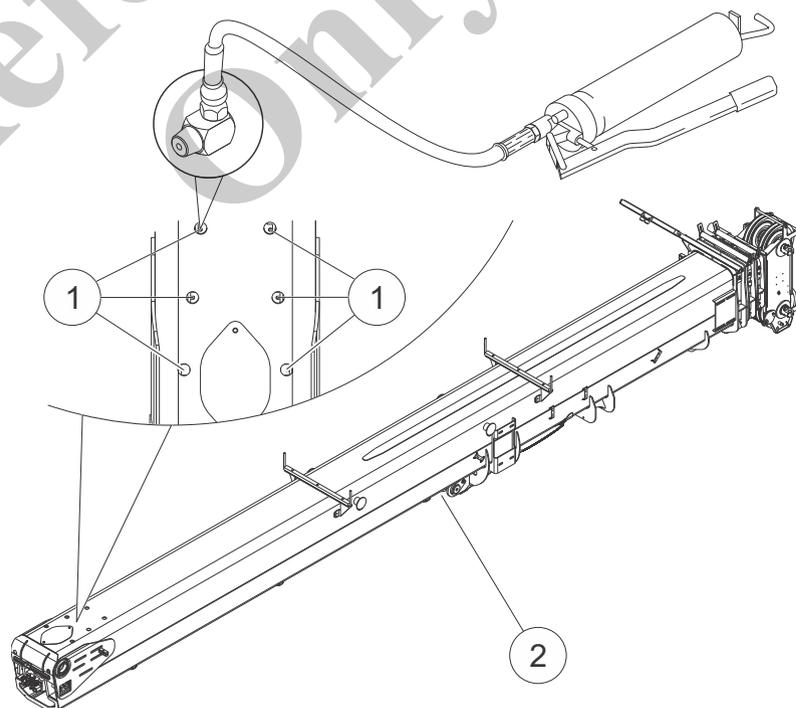


Fig. 234 Lubricating the telescopic boom

1	Thoroughly clean the telescopic boom before lubricating. Let the surfaces being lubricated dry completely.
2	Fully retract the telescopic boom and lower it as far as it will go.
3	Bring the telescopic boom in line with the vehicle.
4	The end of the shaft has 6 inspection openings. through which the lubricating nipples (2x3) on the rear upper sliding blocks can be accessed from the outside. The lubricating nipples are lubricated by the central lubricating nipple bar.
5	Lubricate the lubricating nipples with a grease gun.
6	Fully extend the boom horizontally and either spray or brush the exterior of all shaft parts near the guides with grease.
7	Extend and retract the boom several times so the grease is distributed evenly.
8	Grease the luffing cylinder pivot points via the lubricating nipples (2) in Fig. 234.

9.13.2 Inspect the telescoping boom

The telescopic boom should be disassembled after 10,000 operating hours or 10 years so the bearings, holding lines, haulback lines, sheaves and telescoping cylinders can be inspected.

The stop cables are held under tension by the return cables. If this tension is relieved as a result of the rope being stretched for long period of time, the haulback and holding lines must be re-tensioned.

9.13.3 Rope mechanism in the telescopic boom – holding lines and haulback lines

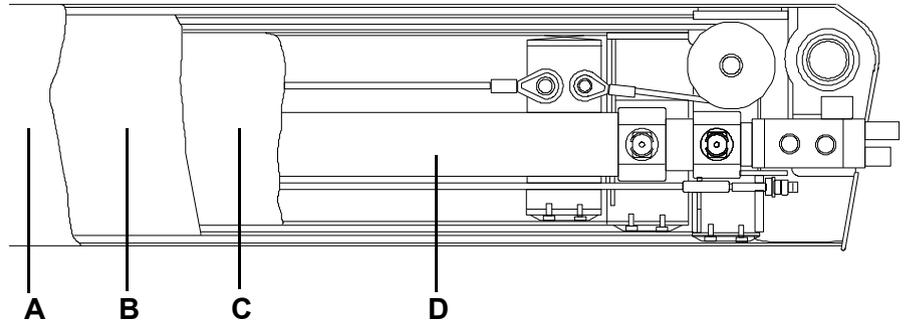


Fig. 235 Rope mechanism in the telescopic boom

A	Basic body
B	Telescope 1
C	Telescope 2
D	Telescope 3

Telescope 2 (C) in Fig. 235 is pushed out of the telescoping cylinder at the same time when telescope 1 (B) in Fig. 235 is pushed out by the rope mechanism.

Telescope 2 is pushed out by 6 holding lines and 2 haulback lines.

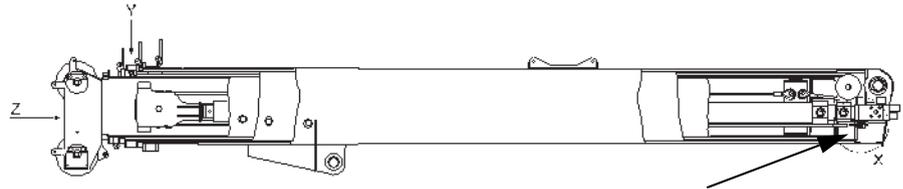
Telescope 2 is retracted by 2 haulback lines.



Information

When a new line rope is installed, it must be of the same make, tensile strength and diameter as the original line rope.

Re-tensioning holding lines (4)

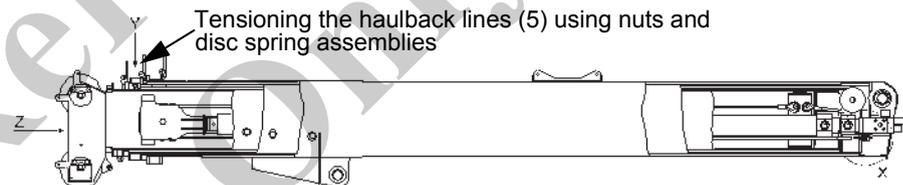


Tensioning the holding lines (4) using the nuts and disc spring assemblies

Fig. 236 Tension stopping cables

- 1 Tighten the nuts (14) in Fig. 236 until telescope 1 and telescope 2 move outward.
- 2 Tighten the counter nut (14a) in Fig. 236.
- 3 Tension all 6 holding lines.

Re-tensioning haul back lines (5)



Tensioning the haulback lines (5) using nuts and disc spring assemblies

Fig. 237 Tensioning haulback lines

- 1 Tighten the nut (13) in Fig. 237 until the disc spring assemblies (10) in Fig. 237 are slightly compressed.
- 2 Tighten the counter nut (13a) in Fig. 237.



Information

Make sure the telescopes are pushed in simultaneously each time you re-tension the lines.

Checking synchronization

3	Carefully retract the telescopes as far as they will go.
4	IF this is not the case, proceed as follows: <ul style="list-style-type: none">- Increase the stop of telescope 1 by placing a plate underneath it.or- Reduce the stop of telescope 2.

For Reference Only

9.14 Electrical system

Safety instructions

- Only qualified electricians may work on the electrical system.
- Observe the appropriate regulations for installing electrical equipment and preventing accidents.

9.14.1 Batteries

DANGER

Risk of death from exploding battery.

An exploding battery can cause serious injury or death.

- Do not smoke or have open flames near the battery.
- Avoid generating sparks near the battery.

WARNING

Risk of chemical burns from battery acid.

Persons can suffer severe chemical burns from battery acid.

- Avoid contact with eyes or skin.
- Wear protective goggles and gloves.
- Do not tip the battery.
- If skin contact occurs, immediately wash off with plenty of water.
- If eye contact occurs, rinse for several minutes under running water and consult a physician.
- If swallowing occurs, immediately drink plenty of water, take a dose of activated charcoal and consult a physician.

Safety instructions

- Do not set tools down on the battery.
- Disconnect battery before starting welding tasks.
- Do not switch battery connections.
- Observe applicable environmental standards for disposing of used batteries.

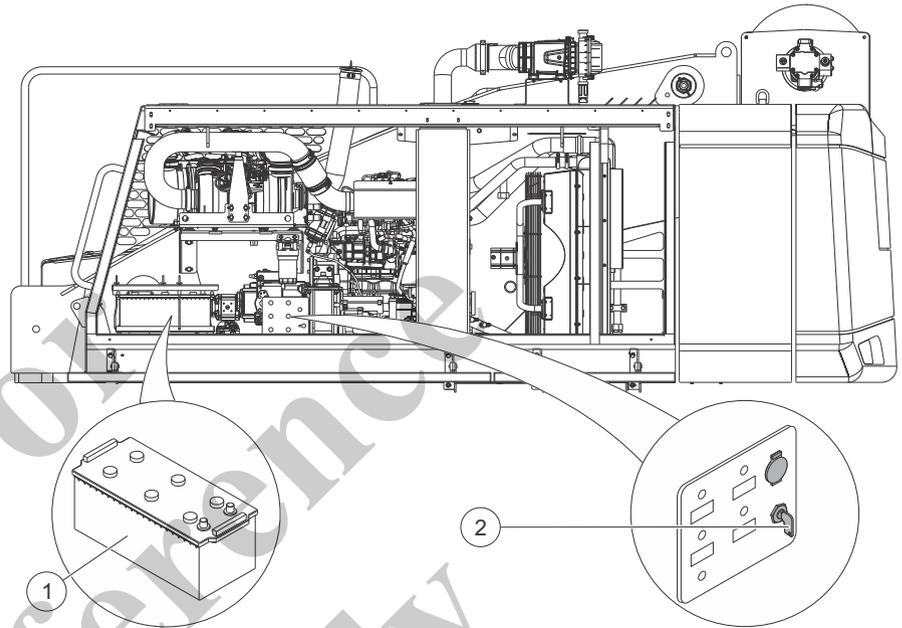


Fig. 238 Battery and battery disconnect switch

Checking battery terminals and cables

- | | |
|---|--|
| 1 | Press the battery disconnect switch (2) in Fig. 238. |
| 2 | Clean the terminals and cables of the battery (1) in Fig. 238, make sure they are seated properly and apply terminal grease. |
| 3 | Press the battery disconnect switch back to its initial position. |

9.14.2 Fuses

! WARNING

Risk of injury and burns from incorrect fuses.

Using incorrect fuses poses a risk of fire that can cause serious injury.

- Do not repair fuses.
- Always use new fuses with the same amperage.

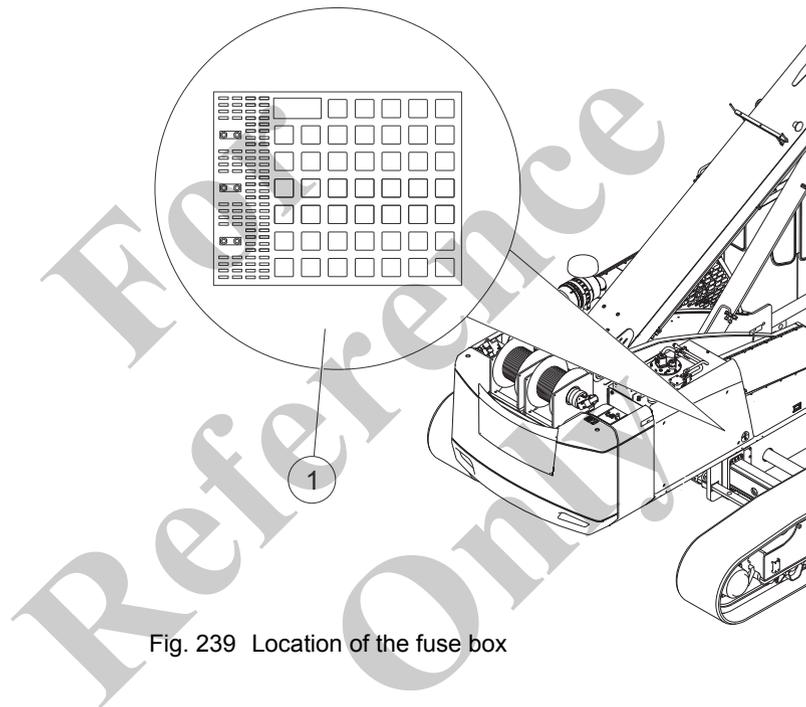


Fig. 239 Location of the fuse box

1	Switch off the diesel engine.
2	Open the fuse box cover.
3	Replace the defective fuse (1) in Fig. 239.
4	Check the contacts and clean any oxidized contacts.
5	Put the fuse box cover back on.

9.15 Automatic climate control

Safety instructions

Maintenance and repairs may only be performed by trained and authorized professionals.



Information

Check the following components monthly:

- wiring
- Condition of the heating and cooling lines
- Flow of condensed water
- Filter for visible damage
- Plug for proper seating and soiling

9.15.1 Cleaning the recirculating air filter



Information

The recirculating air filter for the air conditioning system is located in the cab behind the driver seat.

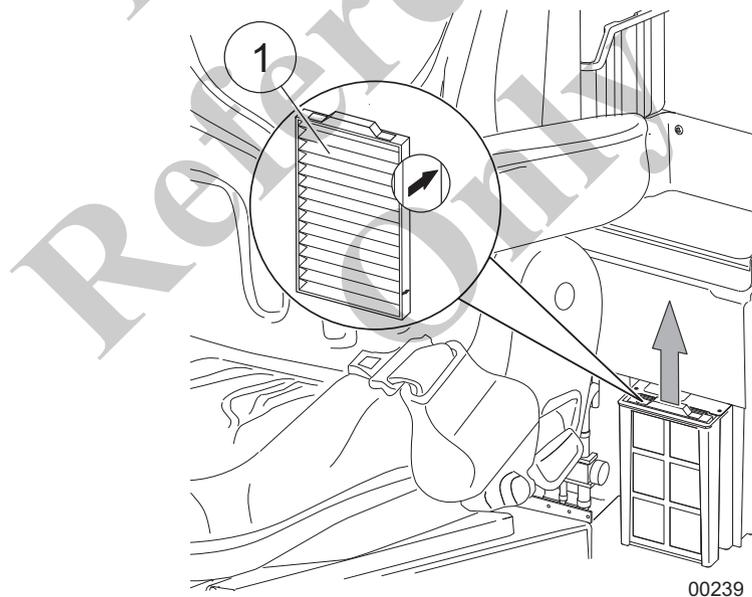


Fig. 240 Recirculating air filter

1	Use the handle to pull the filter element (1) in Fig. 240 out of the filter cartridge.
2	Beat out the filter element or carefully clean it with compressed air.

3	Replace the filter element if it has been damaged or it is too dirty.
4	Insert the cleaned filter element or a new filter element into the filter cartridge.



Information

The arrows on the filter element must point toward the back of the cab.

9.15.2 Cleaning the fresh air filter

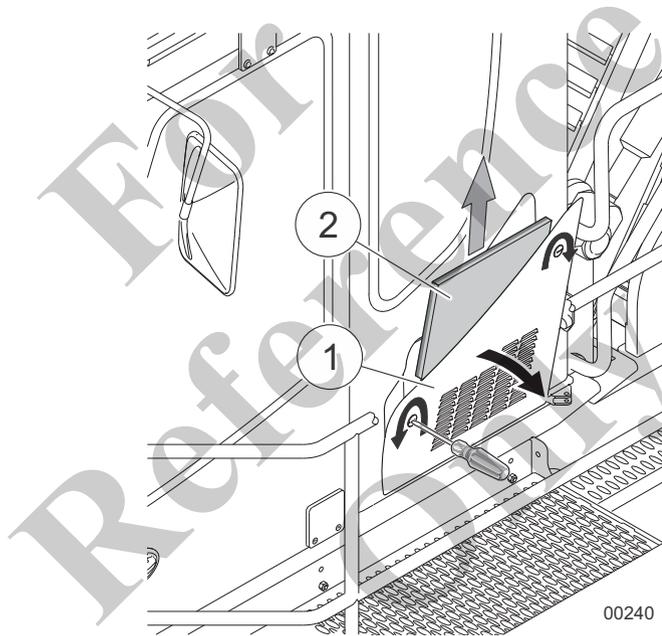


Fig. 241 Fresh air filter

1	Open the cover closures (1) in Fig. 241 with a screwdriver. – Turn the front closure to the left to open it. – Turn the rear closure to the right to open it.
2	Open the cover.
3	Pull the filter element (2) in Fig. 241 up and out.
4	Beat out the filter element or carefully clean it with compressed air.
5	Replace the filter element if it has been damaged or it is too dirty.

6	Insert the cleaned filter element or a new filter element. – The colored side of the filter element must point toward the interior of the cab.
7	Close the cover.
8	Close the cover closures with a screwdriver.

For
Reference
Only

9.16 Ropes

Steel wire ropes are lubricated during manufacture. This lubrication suffices for storage and for initial operation.

The lubrication intervals for ropes depend on the operating conditions (type of rope, weather conditions, uses) so they cannot be specified precisely by Grove.

Grove ensures that cable lengths are chosen according to customer specifications and that they correspond to the load lift chart. Ensure the following to keep wear and corrosion damage to a minimum:

- The wire ropes are always sufficiently lubricated in everyday operation.
- The wire ropes are always completely unreeled at intervals of 100 operating hours, checked for damage, sufficiently lubricated and then reeled in under sufficient tension.

This prevents loosening of the rope layers and potential risk of damage. This applies especially when the entire length of a rope is not used and remains wound around the drum.



Information

See supplemental documentation HANDLING, ASSEMBLING AND MAINTENANCE OF WIRE ROPES in Section 11.2 for more detailed information.

9.17 Maintenance schedule

The maintenance schedule lists activities that must be performed on individual assemblies.

The maintenance intervals are specified in operating hours (OH).

Safety instructions

- The maintenance work stated must only be performed by trained and instructed specialists.
- Wear personal protective equipment (e.g., hard hat, hearing protection, protective gloves, safety shoes).
- Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.
- Only use the oils, lubricants and operating fluids approved by Grove.



Information

- Shorter intervals may be necessary when operating in extreme conditions, e.g., high ambient temperatures.
- Observe the information in the supplemental manuals where applicable.

Activity	Every 10 operating hours/day	Every 50 operating hours/week	Once after 250 operating hours/6 weeks	Every 500 operating hours/3 months	Every 1,000 operating hours/year	Every 2,000 operating hours/2 years
– Execute visual inspection and function check in accordance with the operating manual.	X	X	X	X	X	X
– Cab – cab suspension: Check bolts and threaded connections.	X	X	X	X	X	X
– All detachable connections: (bolts, split pins, etc.) check for firm seat.	X	X	X	X	X	X
– Visual inspection of all ropes: Fastening, lubrication, and wear	X	X	X	X	X	X
– Ropes: Completely unreel and reel in under sufficient pre-tension. ¹⁾		X ¹⁾				
¹⁾ After 100 operating hours at the latest, then after every 100 operating hours.						
– Visual inspection of all straps and diagonal ties.	X	X	X	X	X	X

Activity	Every 10 operating hours/day	Every 50 operating hours/week	Once after 250 operating hours/6 weeks	Every 500 operating hours/3 months	Every 1,000 operating hours/year	Every 2,000 operating hours/2 years
– Check engine oil level. Comply with intervals as specified in the manual provided by the engine manufacturer.	X	X	X	X	X	X
– HydroClean micro-filter (option): Check contamination indicator at SENCON.	X	X	X	X	X	X
– Hydraulic system: Check oil level.	X	X	X	X	X	X
– Lubricate slewing ring gearing.	X	X	X	X	X	X
– Lubricate the rotary connection.		X	X	X	X	X
– Central lubrication system: Check fill level (option).		X	X	X	X	X
– Slewing ring pinion lubrication: Check level in lubricant tank.		X	X	X	X	X
– Check and clean engine cooler.		X	X	X	X	X
– Check coolant level.		X	X	X	X	X
– Water separator: Check filter		X	X	X	X	X
– Check and clean hydraulic oil cooling system.		X	X	X	X	X
– Check and clean combination cooler.		X	X	X	X	X
– Check heating system filter.		X	X	X	X	X
– Clean hydraulic cylinders and check for leaks.		X	X	X	X	X
– Lift winches: Check oil level and check for leaks.		X	X	X	X	X
– Rotary connection: Visually check all connection elements for damage and corrosion.		X	X	X	X	X

Activity	Every 10 operating hours/day	Every 50 operating hours/week	Once after 250 operating hours/6 weeks	Every 500 operating hours/3 months	Every 1,000 operating hours/year	Every 2,000 operating hours/2 years
- Batteries: Check cables and fuses.		X	X	X	X	X
- Lubricate the machine.		X	X	X	X	X
- Rope clamps: Retighten screws.		X	X	X	X	X
- Check heating system filter.			X	X	X	X
- Shut-off flap - hydraulic tank (option): Visual inspection for leaks			X	X	X	X
- Check antifreeze.			X	X	X	X
- Both crawler travel drives: Check oil level and check for leaks.			X	X	X	X
- Crawler track: Check chain tension.			X	X	X	X
- Sprocket: Check bolts for proper seating.			X	X	X	X
- Base plate: Check screws for proper seating.			X	X	X	X
- Check slewing ring bolts for proper seating.			X	X	X	X
- Steelwork: Clean and maintain.		X		X	X	X
- Steelwork: Check for structural damage (e.g., warping, damage, corrosion, cracks).			X	X	X	X
- Counterweight Check the counterweight elements for proper tightening to required torque.				X	X	X

Activity	Every 10 operating hours/day	Every 50 operating hours/week	Once after 250 operating hours/6 weeks	Every 500 operating hours/3 months	Every 1,000 operating hours/year	Every 2,000 operating hours/2 years
– Preload pressure: Have hydraulic accumulator checked by a qualified hydraulics company. ²⁾			x ²⁾	x ²⁾	x ²⁾	x ²⁾
²⁾ After 250 operating hours/6 weeks and after 500 operating hours/3 months, then every 1,000 operating hours/year.						
– Return filter: Replace filter element. ³⁾			x ³⁾		x ³⁾	x ³⁾
– Leakage oil filter: Change filter element. ³⁾			x ³⁾		x ³⁾	x ³⁾
– Aeration filter: Replace filter element. ³⁾			x ³⁾		x ³⁾	x ³⁾
– Hoisting winches: Change oil. ³⁾			x ³⁾		x ³⁾	x ³⁾
– Both travel gears: Change oil. ³⁾			x ³⁾		x ³⁾	x ³⁾
³⁾ After 250 operating hours/6 weeks, then every 2,000 operating hours or year.						
– Check walkway for cracks or overall damage. Repair any damage immediately.				x	x	x
– Air conditioning system (option): Have checked by an authorized service center.					x	x
– Air filter: Change replacement cartridge and safety cartridge.					x	x
– DEF tank filter: Replace. ⁴⁾						
– DEF supply module filter: Replace. ⁴⁾						
– Change coolant. ⁵⁾						x ⁵⁾
– Hydraulic system: Change oil. ⁶⁾						x ⁶⁾

Activity	Every 10 operating hours/day	Every 50 operating hours/week	Once after 250 operating hours/6 weeks	Every 500 operating hours/3 months	Every 1,000 operating hours/year	Every 2,000 operating hours/2 years
<p>6) Certain hydraulic oils do not have to be changed as often depending on the results of regularly performed hydraulic oil analyses. The machine must be equipped with Grove HydroClean. The hydraulic oils approved for extended use are included in the list of operating fluids located in the Appendix. The sampling intervals can be found in Section 9.17.1.</p>						
<p>– Check slewing ring bolts and replace as needed.⁷⁾</p>						x ⁷⁾

4) Every 4,500 operating hours.

5) Long life coolant as specified by Cummins > 2,000 operating hours.

7) Every 5,000 operating hours/5 years.



Information

The slewing ring bolts must be tested by an expert from an independent, qualified company or institute. Unrestricted further use of the slewing ring bolts must be verified with a certificate.

Otherwise replace the slewing ring bolts.

Reference Only

9.17.1 Hydraulic oil analysis

Every Grove machine is filled with Shell hydraulic oil at the factory. Performing regular hydraulic oil analyses allows this hydraulic oil to be used for extended periods.

These hydraulic oil analyses can detect critical states in the hydraulic system early and prevent damage.

However, the machine must be equipped with a Grove HydroClean filter in order to be able to extend the change intervals.

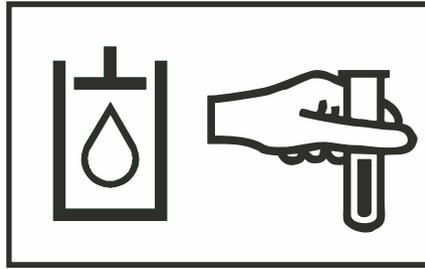
When performing the hydraulic oil analyses, samples of the hydraulic oil must be sent to a Grove authorized laboratory at fixed intervals.

Sampling intervals

The hydraulic oil analysis must be performed at the following intervals:

- A Grove service technician will take the first hydraulic oil sample after 250 operating hours.
- The owner must take the second hydraulic oil sample after 1,000 operating hours.
- The third hydraulic oil sample is taken by the owner after around 1,900 operating hours so the results are available to Service after 2,000 operating hours.
- After 2,000 operating hours, the owner must take a hydraulic oil sample every 500 operating hours.

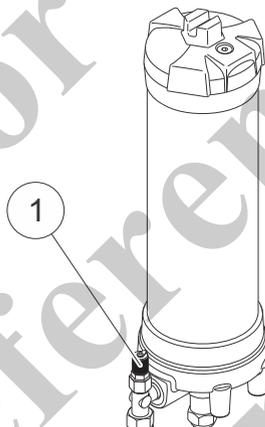
Sampling point The sampling point is designated by the sticker in Fig. 242.



00159

Fig. 242 Sampling point sticker

Take the sample from the measurement connection (1) in Fig. 243 on the HydroClean filter.



00401

Fig. 243 Sampling point on HydroClean filter

Sampling

NOTICE

Risk of machine damage due to incorrect hydraulic oil analysis.

The hydraulic system could be damaged if the results of the analysis are distorted due to an unclean hydraulic oil sample.

- Ensure absolute cleanliness when sampling.
- Only use new and unused sample containers.

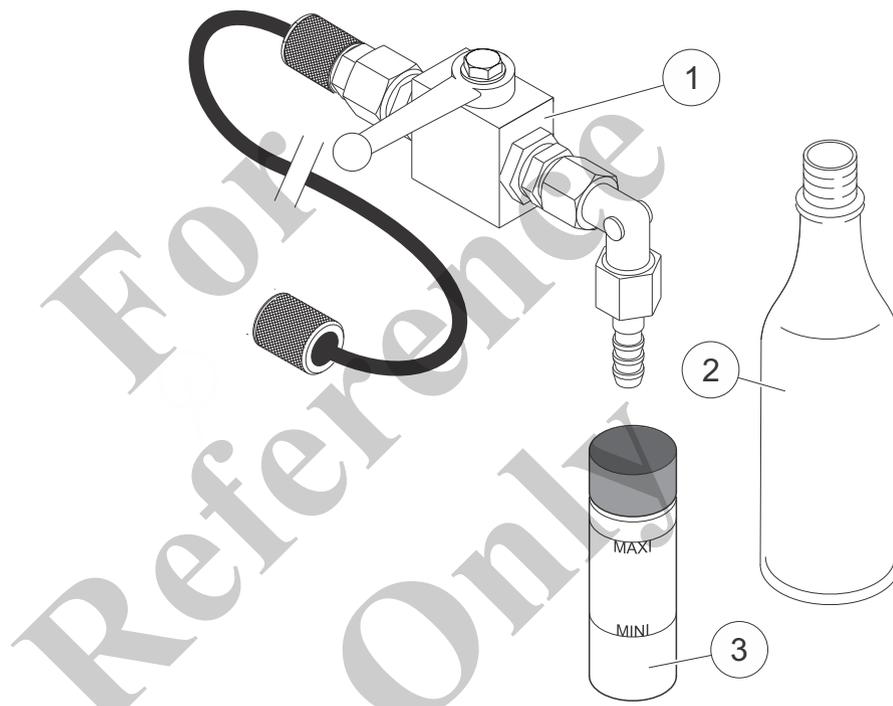


Fig. 244 Hydraulic oil sampling materials

1	Device for removing hydraulic oil samples
2	Container for flushing oil
3	Sample container

! WARNING

Risk of severe burns from hot parts and hydraulic oil.
 Contact with hot hydraulic system parts or hot hydraulic oil can cause severe burns.

- Avoid contact with hot parts.
- Wear protective clothing and protective gloves.

! WARNING

Risk of serious injury from pressurized hydraulic oil.
 Opening the hydraulic system can cause pressurized hydraulic oil to eject and result in serious injury.

- Wear protective clothing and protective gloves.

- | | |
|---|--|
| 1 | Start the machine and let it run for at least 15 minutes. |
| 2 | Set the tool on the floor and let the machine run to idle. |
| 3 | Thoroughly clean the area around the sampling point. |
| 4 | Remove the protective cap from the measurement connection (1) in Fig. 245. |

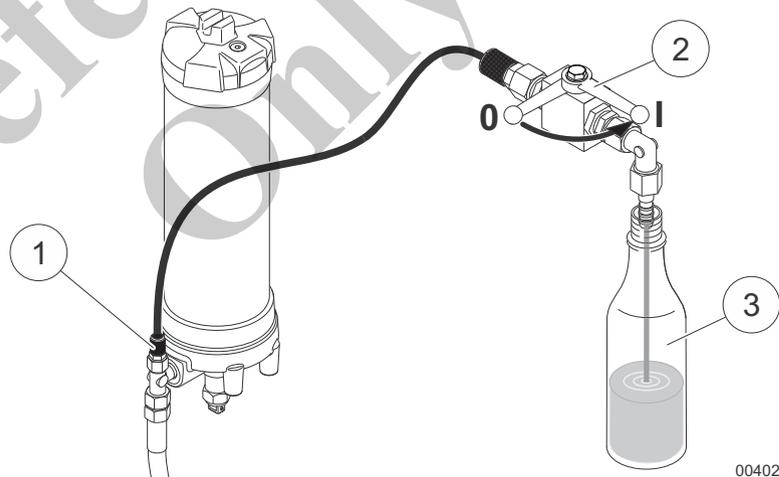


Fig. 245 Draining flushing oil

00402

- | | |
|---|--|
| 5 | Connect the device for removing hydraulic oil samples (2) in Fig. 245 to the measurement connection (1) in Fig. 245 and drain around 0.25 l hydraulic oil into an empty container (3) in Fig. 245. |
| 6 | Dispose of the drained hydraulic oil in accordance with regulations. |

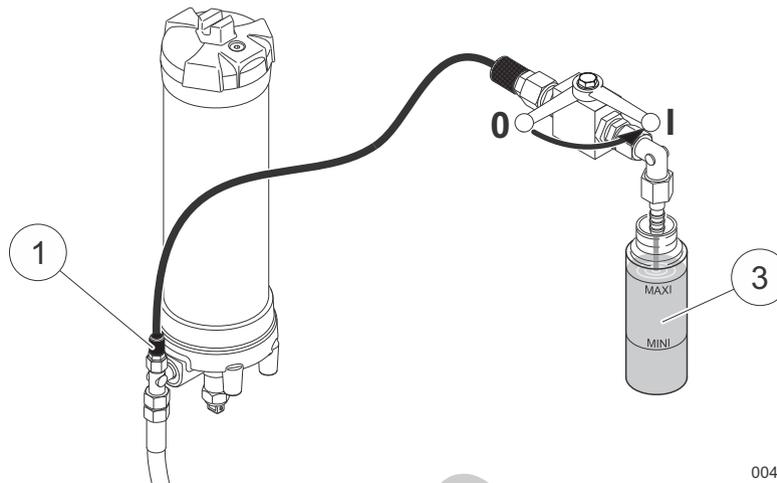


Fig. 246 Taking hydraulic oil sample

00403

7	Open a new, clean sample container (3) in Fig. 246 and fill it to the MAX mark with hydraulic oil. Make sure the sample container or closure do not become contaminated.
8	Carefully close the sample container.
9	Remove the device for taking hydraulic oil samples from the sampling point and clean it.
10	Cover the measurement connection (1) in Fig. 246 with the protective cap.
11	Send the sample container to the laboratory.

9.17.2 Lubrication point overview

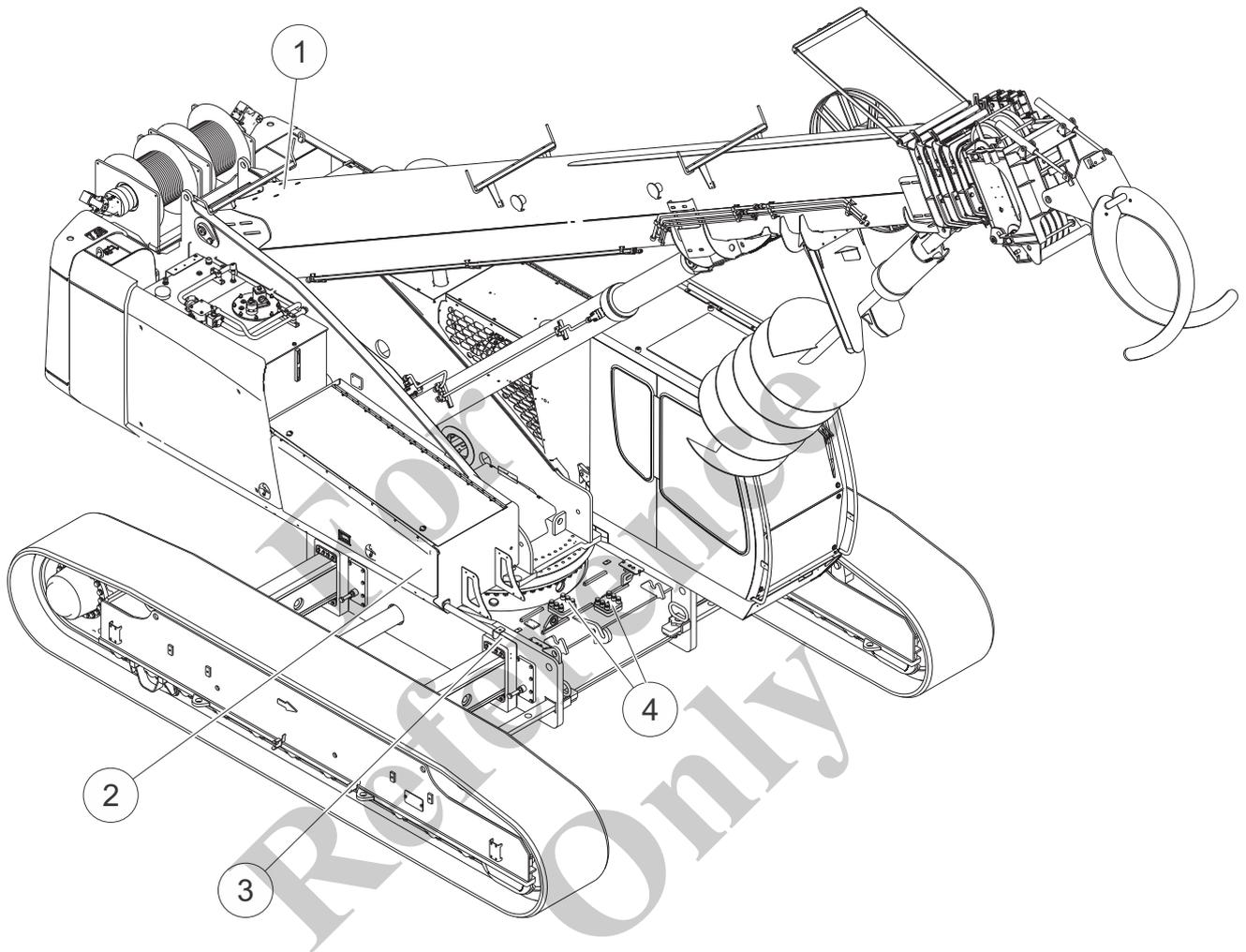


Fig. 247 Lubrication points on the machine

1	Telescopic boom, sliding surfaces
2	Central lubricating strip
3	Undercarriage
4	Cross member

9.17.3 Fill quantities



Information

Mixing different types of oils, lubricants and operating fluids is prohibited.

Only mix the same type of or identical (same specification) oils, lubricants and operating fluids from the same manufacturer.

The following values are guide values. The fill level shown on the respective part is authoritative.

Component	Quantity
Engine oil	15 l/4.0 US gal
Cooling system	35 l/9.2 US gal coolant
Fuel tank	360 l/95.1 US gal
Hydraulic tank	500 l/132.1 US gal
DEF [®] tank	30 l / 7.9 US gal
Winch	3 l/0.8 US gal
Lubrication points (see Lubrication schedule)	As needed
Grease tank for slewing ring gearing/pinion lubrication	1 l/0.3 US gal
Telescopic boom, sliding surfaces	As needed
Central lubrication system lubricant tank	2.0 l/0.5 US gal
Travel gear	9.0 l/2.4 US gal

9.17.4 Tightening torques for screws



Information

Values other than those in this table may apply for some mounting screws on the undercarriage. Observe the information in the appropriate sections.

Strength class 8.8
(black, lightly oiled, $\mu = 0.14$)

Coarse-pitch thread		Fine-pitch thread	
Screw	Tightening torque M_A [Nm]	Screw	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

(black, lightly oiled, $\mu = 0.14$)

Coarse-pitch thread		Fine-pitch thread	
Screw	Tightening torque M_A [Nm]	Screw	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
(black, lightly oiled, $\mu = 0.14$)

Coarse-pitch thread		Fine-pitch thread	
Screw	Tightening torque M_A [Nm]	Screw	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	455	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		

For
Reference
Only

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10 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 GROVE Cranecare organization.

10.1 Drive engine

Engine does not start

Cause	Remedy
Insufficient battery power	<ul style="list-style-type: none"> – 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 the machine.
Emergency stop switch pressed	<ul style="list-style-type: none"> – Pull out emergency stop switch.

Engine power drops

Cause	Remedy
Fuel filter and water separator clogged.	<ul style="list-style-type: none"> – Replace the filter element of the water separator.

Machine does not move

Cause	Remedy
Gearbox defective	<ul style="list-style-type: none"> – Contact your Grove Service Partner.

Oil or fuel leaks on the engine

Cause	Remedy
Hose clampings loose	<ul style="list-style-type: none"> – Contact your Grove Service Partner.
Hoses or seals damaged	<ul style="list-style-type: none"> – Contact your Grove Service Partner.

10.2 Hydraulic system

Oil leaks on the hydraulic system

Cause	Remedy
Hose clampings loose	– Contact your Grove Service Partner.
Hoses or seals damaged	– Contact your Grove Service Partner.

Hydraulic pump does not work

Cause	Remedy
Fault in pump circuit	– Contact your Grove Service Partner.

No function at all or malfunctions of the work equipment

Cause	Remedy
Hydraulic oil level too low	– Check the hydraulic oil level. – Add hydraulic oil as needed.
Leaks in the hydraulic system	– Check working cylinder, connections and hoses for leaks. – Contact your Grove Service Partner.
Fault in one of the working circuits	– Contact your Grove Service Partner.

Noises when moving a working cylinder

Cause	Remedy
Cylinder piston rod not lubricated	– Contact your Grove Service Partner.

No power or low power of the hydraulic system

Cause	Remedy
Hose clampings loose	– Contact your Grove Service Partner.
Hoses or seals damaged	– Contact your Grove Service Partner.
Pressure relief valve opens too soon	– Contact your Grove Service Partner.
Hydraulic pump worn or defective	– Contact your Grove Service Partner.

Noises in hydraulic system

Cause	Remedy
Hydraulic pump takes in air	– Contact your Grove Service Partner.
Hydraulic pump delivers insufficient oil	– Check the hydraulic oil level. – Add hydraulic oil as needed.
Pressure relief valve chatters	– Contact your Grove Service Partner.

For Reference Only

10.3 Heating/air-conditioning system

10.3.1 Heat output

Fan does not work

Cause	Remedy
Fuse defective or loose	<ul style="list-style-type: none"> – Make sure the fuse is properly seated 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. Contact your Grove Service Partner.
Power supply interrupted	<ul style="list-style-type: none"> – Check lines for loose contacts or breaks.
Blower motor defective	<ul style="list-style-type: none"> – Contact your Grove Service Partner.
Defective control element	<ul style="list-style-type: none"> – Check the control element and contact your Grove Service Partner.

Fan cannot be shut off

Cause	Remedy
Short-circuit in cable	<ul style="list-style-type: none"> – Contact your Grove Service Partner.

Fan works with reduced power

Cause	Remedy
Contacts soiled	<ul style="list-style-type: none"> – Clean the plug contact. Proceed with caution to avoid short circuit.
Heat exchanger heavily contaminated	<ul style="list-style-type: none"> – Carefully clean the heat exchanger and avoid damage that can cause leaks. Observe the safety instructions.
Air filter clogged	<ul style="list-style-type: none"> – Replace the filter element.

No or insufficient heat output

Cause	Remedy
Water intake temperature too low	– Wait until the diesel engine has warmed up.
Vehicle thermostat defective	– Contact your Grove Service Partner.
Heat exchanger lamellas are contaminated	– Check the heat exchanger and clean if necessary.
Water lines kinked or crushed	– Contact your Grove Service Partner.
Air filter clogged	– Clean or replace the filter element.
Resistor defective	– Replace the resistor.
Climate control defective	– Contact your Grove Service Partner.

Water leaks from device

Cause	Remedy
Loose hose connection	– Make sure the hoses are connected properly. – Contact your Grove Service Partner.
Water hose damaged	– Contact your Grove Service Partner.
Heat exchanger damaged	– Contact your Grove Service Partner.

Air flaps can no longer be adjusted

Cause	Remedy
Servomotor defective	– Contact your Grove Service Partner.
Foreign object is blocking flap	– Check flap, remove foreign object.
Flap deformed	– Check the flap. – Contact your Grove Service Partner.
Flap bearing is defective	– Contact your Grove Service Partner.

Cause	Remedy
Control system defective	– Contact your Grove Service Partner.

10.3.2 Cooling capacity

Compressor does not work

Cause	Remedy
Interruption in the solenoid coil of the compressor	– Check the power to the clutch.
V-belt loose or torn	– If loose, adjust the tension of the V-belt. If torn, replace the 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	– Contact your Grove Service Partner.

Evaporator is iced up

Cause	Remedy
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	– Contact your Grove Service Partner.

Cooling capacity insufficient

Cause	Remedy
Air filter clogged	– Replace the filter element.
Relay defective	– Contact your Grove Service Partner.
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	– Contact your Grove Service Partner.
Moisture in the system	– Contact your Grove Service Partner.
Collector drier saturated	– Contact your Grove Service Partner.

System cools intermittently

Cause	Remedy
Line break, faulty ground connection or loose contacts in the solenoid coil of the compressor	– Contact your Grove Service Partner.
Blower motor defective	– Contact your Grove Service Partner.

10.3.3 System very noisy

System very noisy

Cause	Remedy
V-belt loose or excessively worn	– If loose, adjust the tension of the V-belt. If worn, replace the V-belt.
Clutch noisy	– Repair the clutch.
The compressor bracket is loose or the internal components of the compressor are worn	– Contact your Grove Service Partner.
Excessive wear of fan motor	– Contact your Grove Service Partner.
System overfilled	– Contact your Grove Service Partner.
Insufficient refrigerant level in the system	– Contact your Grove Service Partner.

10.4 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.

10.5 Undercarriage

Oil leaks on the travel gear

Cause	Remedy
Plug is loose	– Fasten plug.
Seals damaged	– Contact your Grove Service Partner.

10.6 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. – Contact your Grove Service Partner.

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Reference
Only

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11 Appendix

11.1 Reeving Diagram

11.2 Handling, Installation, and Maintenance of Steel Wire Ropes

11.3 Driver Seat

11.4 Camera System

11.5 Radio Remote Control

11.6 Cleaning the Cooling System

11.7 Residual Useful Life of Winches

11.8 Installing Large Roller Bearings, Slewing Gears and Flange Connections

11.9 PFEIFER Pouch Lock System

11.10 List of Operating Fluids and Lubricants

11.11 Operating Console

11.12 Decal Scheme

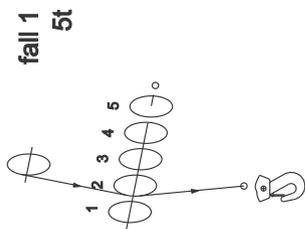
11.13 Auger

11.14 Personnel Basket

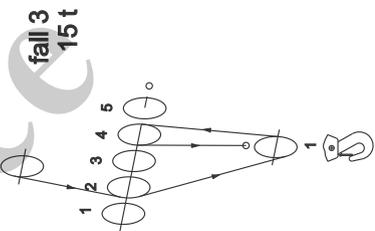
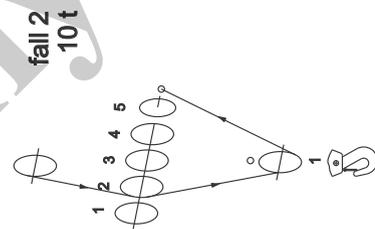
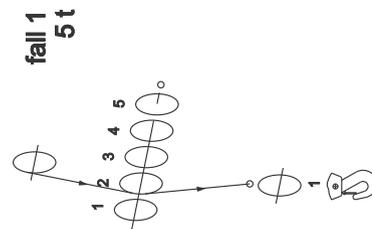
11.15 Pole Claw

11.16 Reeving diagram

hook block
 maximum lifting capacity: 5 t
 rope diameter: 16 mm

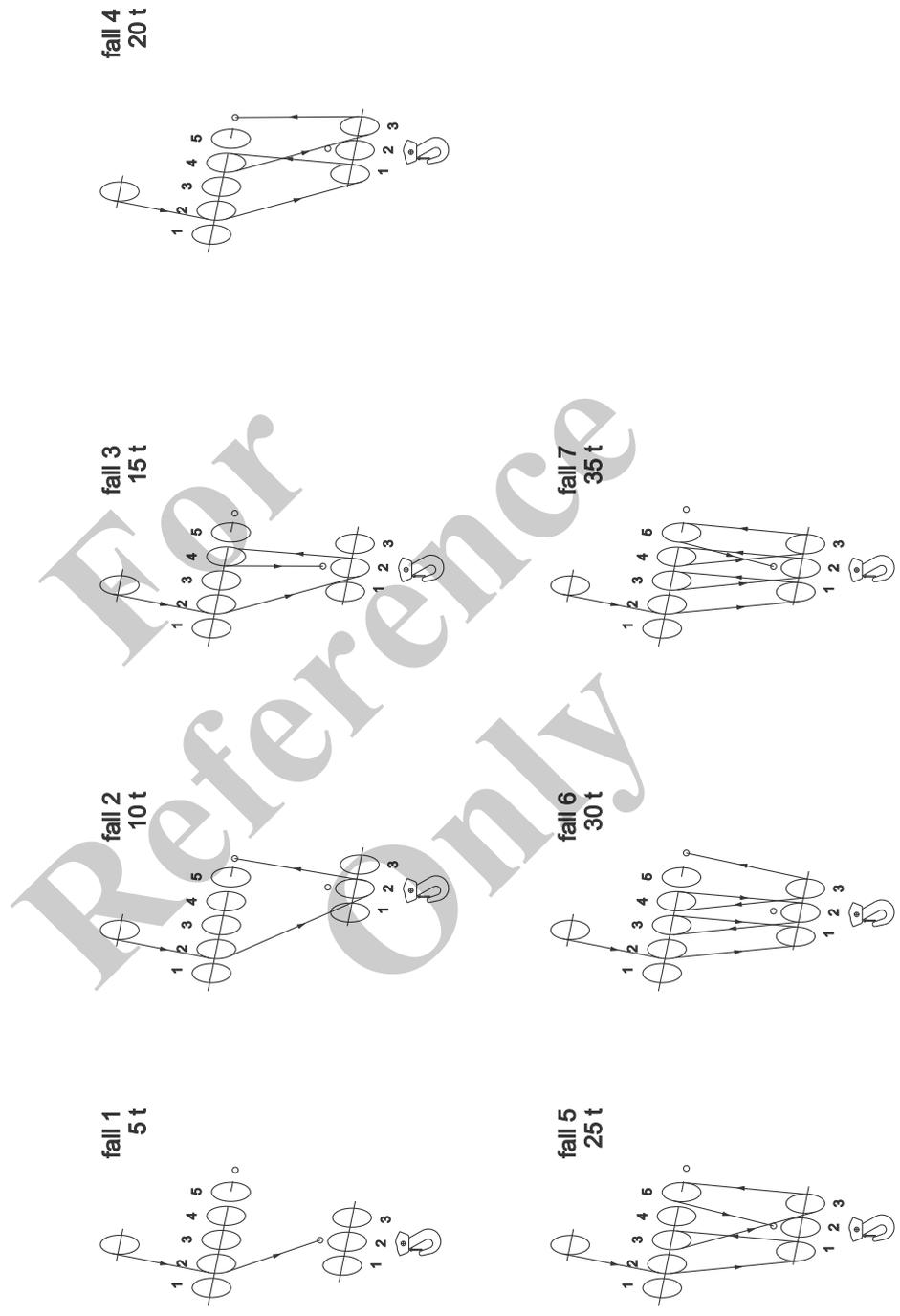


1-pulley hook block
 maximum lifting capacity: 15t
 rope diameter: 16 mm



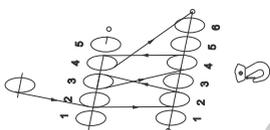
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3-pulley hook block
maximum lifting capacity: 35 t
rope diameter: 16mm

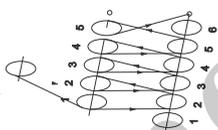


6-pulley hook block
 maximum lifting capacity: 60 t
 rope diameter: 16mm

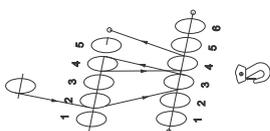
fall 5
20 t



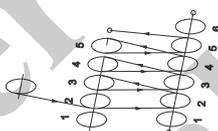
fall 9
40 t



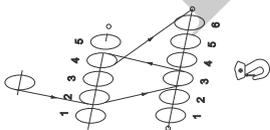
fall 4
15 t



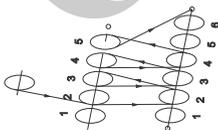
fall 8
35 t



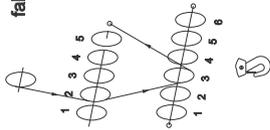
fall 3
10 t



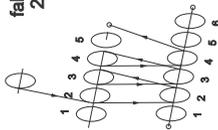
fall 7
30 t



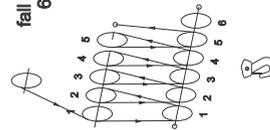
fall 2
5 t



fall 6
25 t



fall 10
60 t



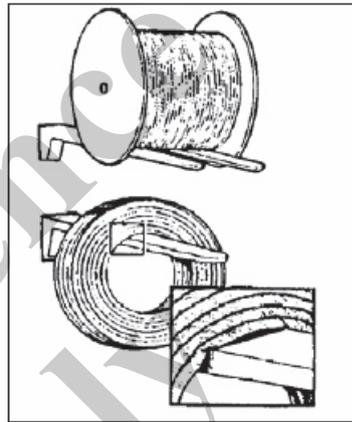
10 Appendix

10.1 Handling, Installation, and Maintenance of Steel Wire Ropes

10.1.1 Rope selection

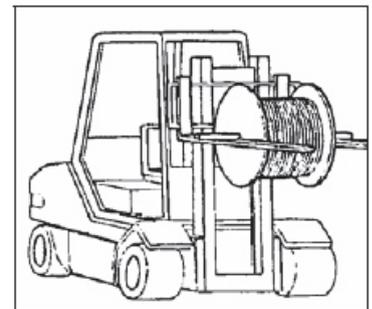
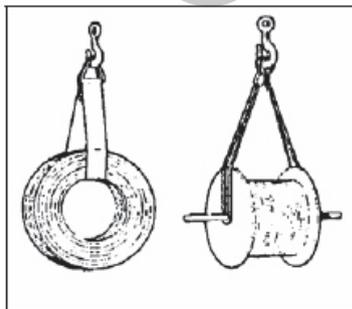
Grove cranes and excavators are already fitted with high-quality wire ropes on delivery. When ropes are ready for discarding they should be replaced by new wire ropes of the same type, with the same nominal diameter, identical wire strength and the same type and direction of lay. These details required 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?

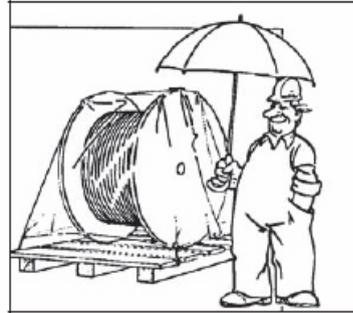
The first problems when handling wire ropes often already occur on delivery: the fork of the fork-lift truck passes under the reel or into the coil and damages the wire rope surface.



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.

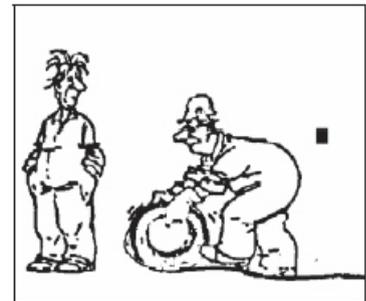
If storage outdoors is unavoidable, the ropes must be covered in such a way that they do not come into contact with water. Such a cover gives protection against rain, but condensation, which is unable to escape and possibly causes permanent damage to the wire rope, may form underneath. An intermediate 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.

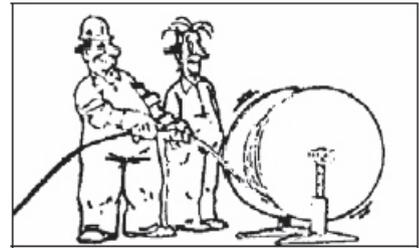
10.1.4.1 Unwinding from the coil



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



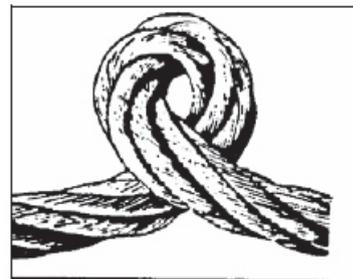
A wire rope wound on a reel is likewise preferably unwound by a turntable or a payoff stand.



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.

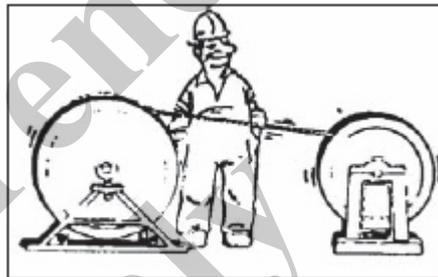
With some equipment it may be advisable first to discard the old wire rope and then assemble the new one; with other equipment, in particular larger units, it is advisable to draw in the new wire rope with the old one.

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.

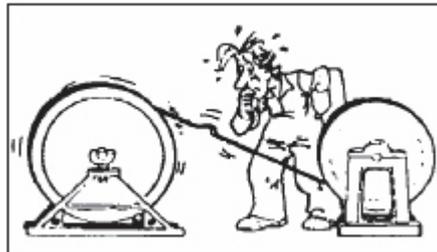
If a rope end is provided with an undetachable rope termination, the only option is to draw the free end through the entire reeving system.

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

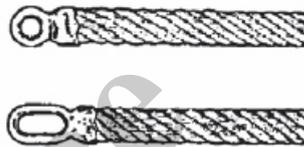
If the new wire rope is drawn in by the rope to be discarded or a leader rope, secure joining of these ropes should be ensured. Furthermore, it must be ensured that the

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.

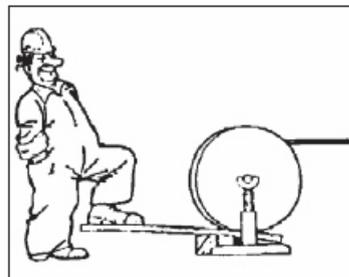
10.1.4.6 Winding on to drums under load

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.

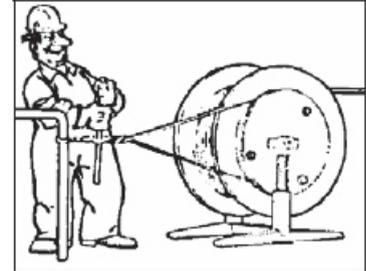
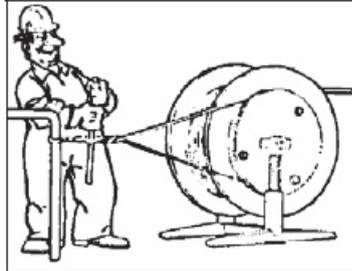
If the lower layers are too loose, the higher ones may be drawn in between lower rope sections under load. This may lead to serious rope damage.

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

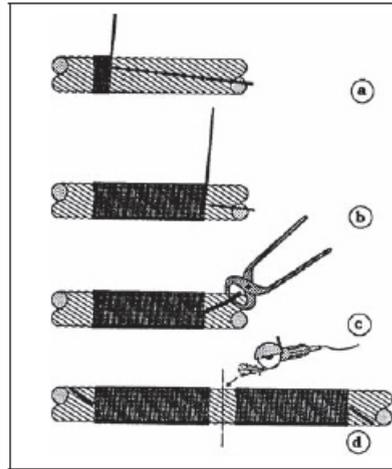
Before a wire rope takes over the actual work after its assembly, it should perform a certain number of load cycles with small partial loads. It should be “run in”, so that the rope elements settle and can adapt to the new environment. Unfortunately exactly the opposite of this recommendation is done 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.

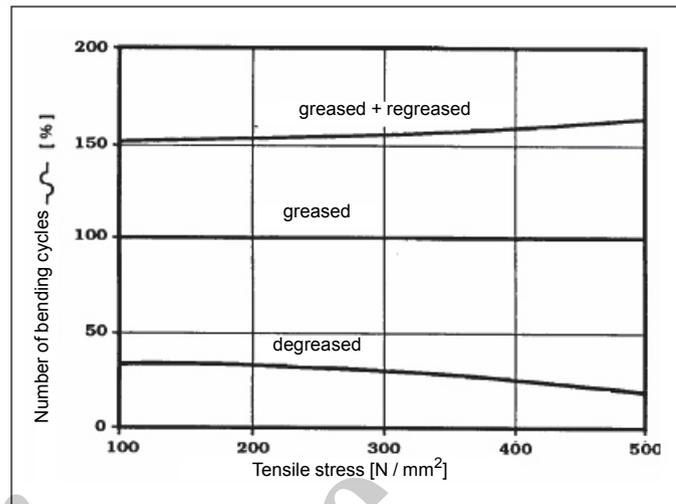
Instead of one long tying it is possible to provide each side of the cutting point with three tyings, each with a width of about one rope diameter.

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.

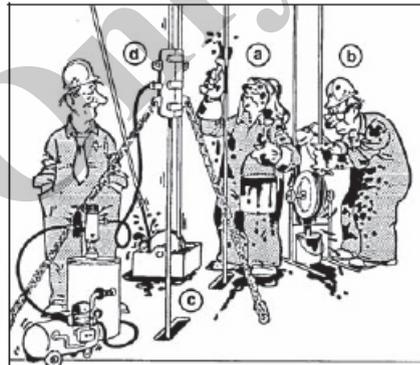


According to DIN 15020: "Wire ropes must be relubricated at regular intervals which depend on the operating conditions, in particular in the bending zone". It also states: "If relubrication of the rope must be discontinued for operating reasons, a shorter life should be anticipated and the monitoring 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

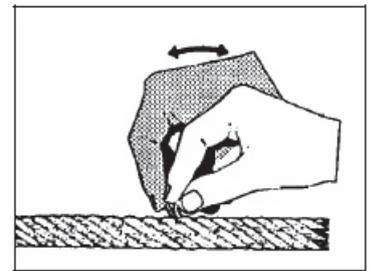
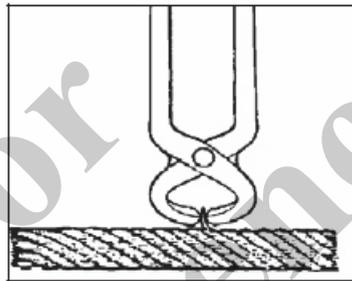
thing is that it takes place regularly from the outset and is not started only when the first damage has already been detected.

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.

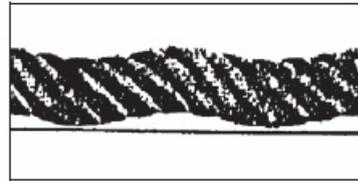
10.1.6.3 Survey of discard criteria

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.

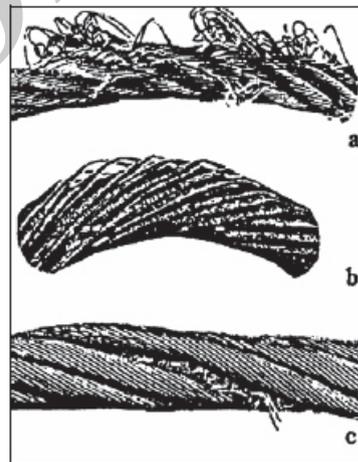
4. Wear. A wire rope must be discarded if its static breaking force or operating strength has been unduly reduced by metallic wear. The wire rope must be discarded in the case of a 10% reduction in diameter compared to the nominal dimension, even if no wire breaks are detected.
5. Rope deformations.



- 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.

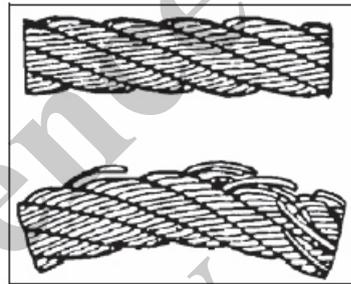


- b. Basket formations. If a basket formation occurs, a wire rope must be discarded.



- 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)

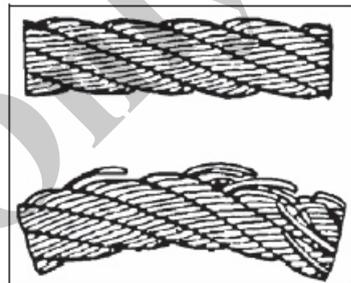
- a tape measure
- a piece of white chalk, a piece of black wax chalk
- an endless roll of paper tape
- a screwdriver
- a magnifier (possibly measuring magnifier, thread counter)
- two sets of groove gauges
- a cleaning rag
- a notepad or inspection form
- the records of the previous inspections
- a 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.

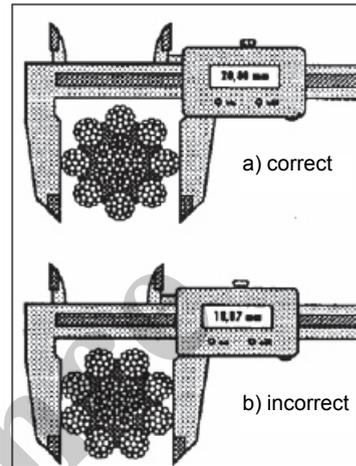
Determination of the rope diameter

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.

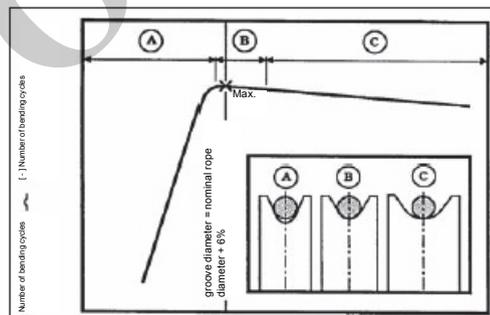
During the inspection the ropes should also be moved to enable evaluation of any rope zones that are temporarily inaccessible.

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.

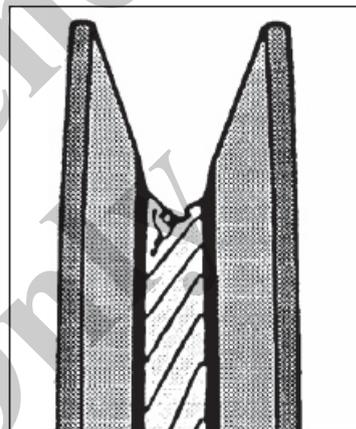
The grooves are checked by groove gauges. Although these gauges are commercially available, circular templates made on a lathe are the best method.

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.

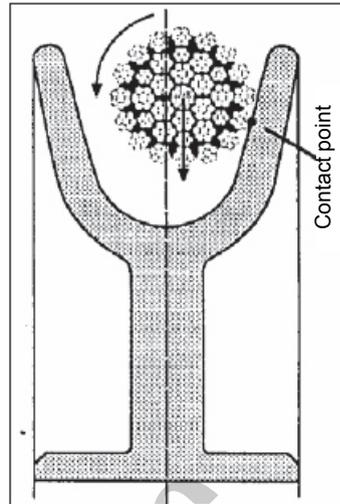
To check the groove dimension the groove gauge most suitable according to the above comments is placed in the groove and the support checked. If the template fits well over a large portion of the circumference, the groove dimension is in order. If the template rests only on the flanks, the groove is 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.

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10.2 Driver Seat

GRAMMER AG: Seating comfort for high demands!

You have acquired a GRAMMER seat. Congratulations!

Take your seat please, and enjoy the ultimate in seating comfort and safety. You will be enjoying a driver's seat characterized by user-friendliness and a high degree of adaptability.

With your new seat you are not only preserving your health; you are improving your performance and efficiency as well.

Have a good trip, with best wishes from your GRAMMER Team

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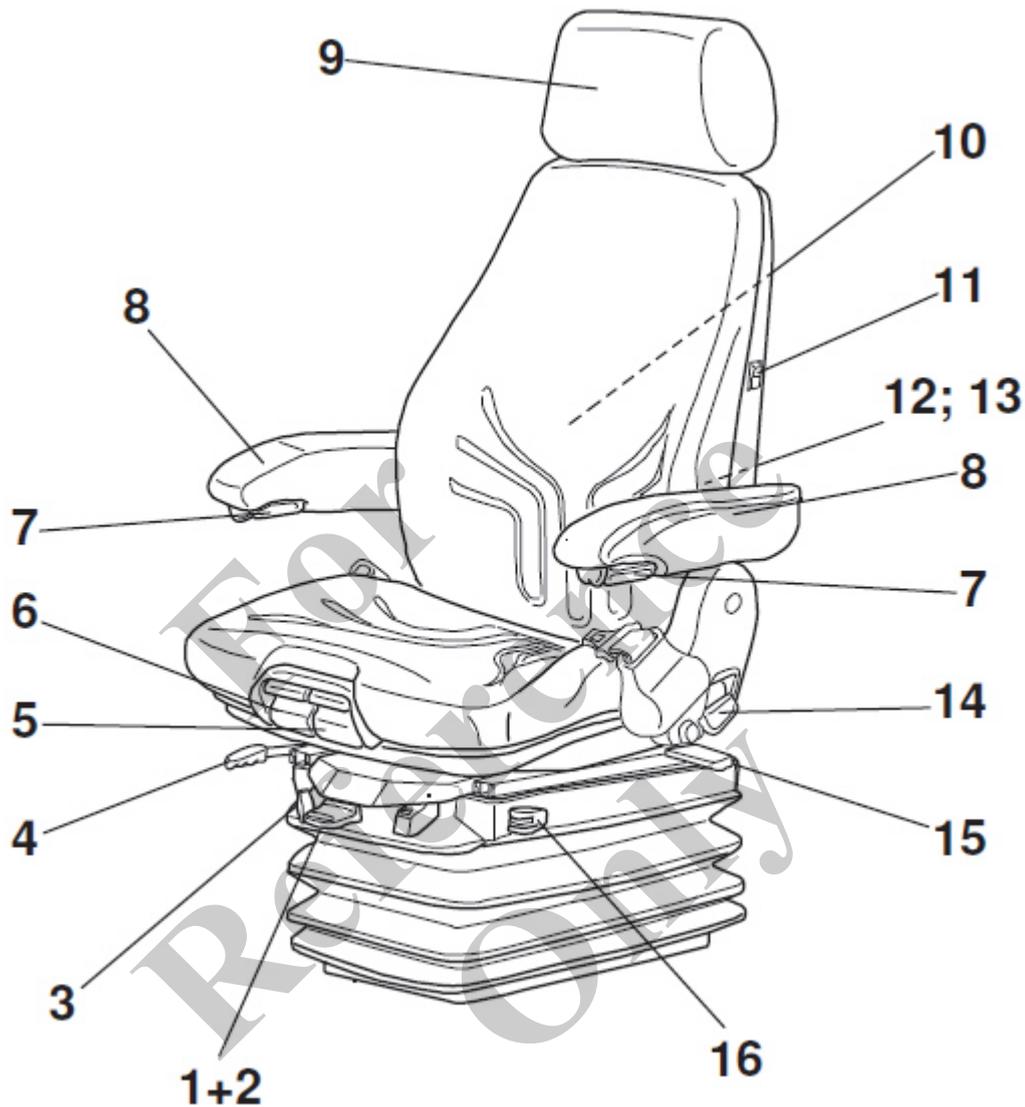
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Amberg, 10/2010

For Reference Only



Item	Description	Item	Description
1	Weight adjustment	9	Headrest* ***
2	Height adjustment	10	Storage box *
3	Absorber*	11	Seat heater*
4	Fore/aft adjustment	12	Lumbar support* ***
5	Seat pan angle adjustment*	13	Lumbar support* ***
6	Seat depth adjustment*	14	Backrest adjustment
7	Armrest adjustment*	15	Lateral isolator*
8	Armrests* ***	16	Fore/aft isolator*

* if fitted ** depending on model *** optional extra

10.2.1 General Instructions

- The operating instructions must be read in full before use.
- The operating instructions must be kept in the vehicle and always be at hand.
- The driver's seat may only be fitted, serviced and repaired by specialist personnel.
- The respective national regulations and the vehicle manufacturer's fitting instructions must be observed.
- The national fitting regulations can be obtained from **GRAMMER AG** or from agencies of the company, or from the vehicle manufacturer.
- Worn parts such as rollers, shock absorbers and the fixation must be checked from time to time.
- A correctly functioning and individually adjusted driver's seat is essential to your health. Take adequate care of your seat and have it serviced regularly to ensure that it functions correctly.



The functional checks are to be carried out at least as regularly as vehicle services (see maintenance plan for vehicle).

- These operating instructions should always be kept with the driver's seat. If the seat is passed on to a third party, it must be accompanied by the relevant operating instructions.
- Subject to modifications serving engineering progress and deviations compared to the standard type seat arising therefrom.



10.2.2 Safety instructions

- Driver's seats that have been adjusted incorrectly have a smaller moving area.
 - In order to prevent any personal injury, the seat must be adjusted for the driver's weight **before use** and **before every change of driver**.
 - To prevent injury, **no objects should be placed within the moving area** of the driver's seat.
 - **Before commissioning** of the driver's seat, possible **packaging material** has to be removed from the seat cushion and the backrest upholstery.
 - To eliminate any risk of accident, the settings must be checked to ensure they are correctly engaged **before the vehicle is driven**.
 - Adjustments must not be made **while driving**.
 - Only touch the handle for setting the fore/aft adjustment at the indented grip provided for that purpose.
- RISK OF CRUSHING –**
- **After removal of the backrest upholstery**, the backrest frame must be supported, for example held in place, before the backrest adjuster is operated. If you fail to do so, there is a danger that the backrest frame may jerk forward and **cause injury**.
 - **Any changes to the series standard of the seat** (for example fitting parts which are not original **GRAMMER AG** parts) may impair the safety standard to which it has been tested. **Functions may be impaired**, threatening your **safety**. For this reason, **any change in design of the seat** must be approved by **GRAMMER AG**.
 - During the removal and installation of the driver's seat, the corresponding instructions by the specific vehicle manufacturer must be strictly observed!
 - Do not hold onto the covers for lifting the driver's seats. If you do so anyway, there is an **increased risk of injury due to loosening or breaking covers**.
 - Before you remove the driver's seat, disconnect all plug-in connections between the seat and the vehicle supply network. When you replace the plug-in connectors, make sure they are tight (dust, water).

- Seatbelts are fitted or can be retrofitted to the driver's seat. Seatbelts **may only be fitted on the approval of the vehicle manufacturer**, as they increase the load in the seat mounting area.
- Seatbelts must be fitted in accordance with specific national regulations and guidelines, and must be approved by **GRAMMER AG**.
- Seatbelts must be fastened **before driving**.
The seatbelts must be replaced after an accident.
Where seatbelts are fitted to the driver's seat, the **seat** and **seat mounting** must be checked **additionally** by specialist personnel after an accident has occurred.
- Fasteners must be **checked regularly for tight seat**. If the seat wobbles, there may be loose bolts or other faults.
- If you find that the seat does not function correctly (for example a defective suspension of the driver's seat; improper curvature of the lumbar support, etc.) or is damaged (e.g. damaged bellows etc.) **contact a specialist workshop immediately** to arrange for repairs to be carried out.
- If you fail to do so, your health may be affected and the **risk of accident increased**.
- Before the vehicle is used, switches that might be in the seat (for shutting down mechanical equipment when the driver leaves his/her seat) must be checked for **proper function**.
If malfunctions are detected, the vehicle must not be driven.
– **INCREASED RISK OF ACCIDENT** –
- **Loads must not be placed on seats** (e.g. with a built-in switch) except for the driver's weight during normal use, as the vehicle may otherwise start to move by itself.
– **INCREASED RISK OF ACCIDENT** –
- If you take off the weight from the seat while driving, this will cause the vehicle to stop.
- Do not indent the bellows while there is load on the driver's seat.
– **RISK OF CRUSHING** –
- Make sure that the **interior of the driver's seat** remains free of **foreign particles** or **liquids**.
- The driver's seat is **not watertight** and must be protected against splashes of water!
- Any conversion or refitting work on a **GRAMMER AG** driver's seat must be performed exclusively in **authorized workshops** by **trained** or **suitably qualified personnel** and in adherence with the applicable operating, maintenance and installation instructions and in compliance with all relevant national regulations.
- **Improper installation and assembly** bear the risk of **bodily injury** or **property damage** and the proper function of the driver's seat or mounted parts can no longer be guaranteed.
- **Before driving**, you must check if all seat settings selected guarantee a **safe operation** of the vehicle.

10.2.3 Connecting data

- If you need to connect cables to the vehicle supply network, strictly observe the following instructions:

Before you connect an electrical consumer fitted in the driver's seat (e. g. the seat heater or the seat ventilation), you must obtain the relevant electrical data for the respective vehicle with reference to voltage, protection and the kind of connections from the manufacturer, from **GRAMMER AG** or the company's agencies.

For safety reasons, the installation and connection to the vehicle supply network must be carried out by authorized specialist personnel only. The seat connections must be protected independently of other vehicle components.

DC	Compressor	Seat heater	Seat heater compressor
12V	10A	10A	20A
24V	5A	4A	10A

For building an electric connection, select an electric circuit by means of which the electric consumers of the driver's seat are separated from the live network when the ignition is switched off.

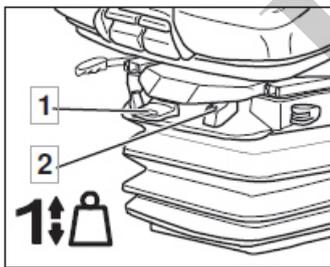
10.2.4 Guarantee and liability

- GRAMMER AG does not disclaim any guarantee or liability for damage resulting from incorrect assembly, use or repair of the seats.
- Further details on the guarantee granted by GRAMMER AG are stated in your contractual documents (see invoice or delivery note). Guarantee claims against **GRAMMER AG** beyond the guarantee obligations described there are excluded.

10.2.5 Seat functions and operation

* if fitted ** depending on model *** optional extra

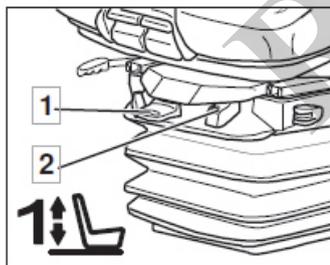
10.2.5.1 Weight adjustment



The seat must be adjusted for the driver's weight with the driver sitting on the seat. The adjustment is made by pulling out or pushing in the actuator lever (1) until the green marking is visible in the weight-and-height indicator (2).

☞ To prevent damage to the health, the setting for the driver's weight must be checked and adjusted as necessary before the vehicle is driven.

10.2.5.2 Height adjustment

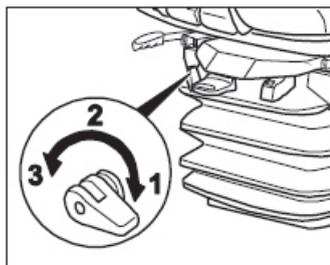


The seat height can be altered by pulling or pushing the adjustment lever fully up or down (1).

☞ The green marking in the weight-and-height indicator (2) must be visible.

☞ In order to avoid damage, do not operate compressor for more than 1 minute.

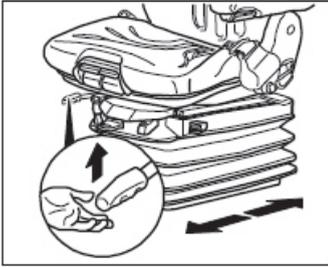
10.2.5.3 Absorber *



The absorber setting of the seat can be varied to suit the on and off-road driving conditions. The cushioning effect can be individually adjusted for this purpose.

Turn the lever to the desired position and release

- 1 soft
- 2 medium
- 3 hard



10.2.5.4 Fore/aft adjustment

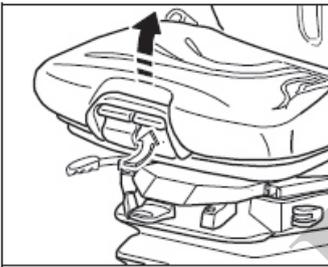
The fore/aft adjustment is released by lifting the locking lever.

! WARNING
Risk of accident!

Do not operate the locking lever while driving.

☞ After the adjustment, the locking lever must latch into the desired position with an audible click. It should not be possible to move the driver's seat into another position when it is locked.

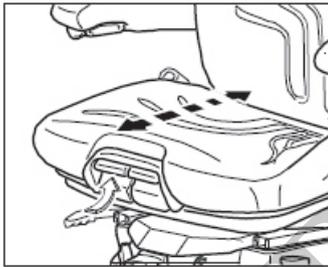
☞ Do not lift the locking lever with your leg or calf.



10.2.5.5 Seat pan angle adjustment *

The angle of the seat pan can be individually adjusted.

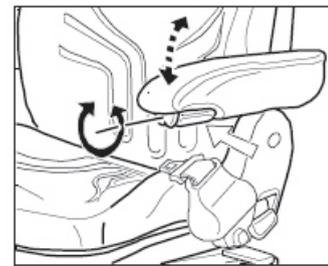
To adjust the angle of the seat pan, pull the left handle upwards. By exerting pressure on or off the front or rear part of the seat pan it can be moved to the desired position.



10.2.5.6 Seat depth adjustment *

The depth of the seat pan can be individually adjusted.

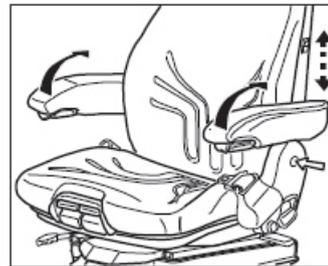
To adjust the depth of the seat cushion, pull the right handle upwards. By moving the seat cushion backwards or forwards the desired seating position can be reached.



10.2.5.7 Armrest adjustment *

The inclination of the armrests can be modified by turning the adjustment knob.

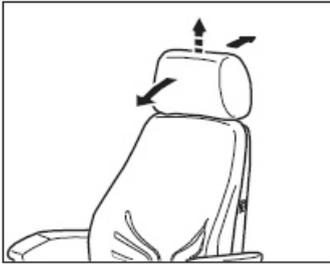
When turning the knob to the outside the front part of the armrest will be lifted, when turning the knob to inside it will be lowered.



10.2.5.8 Armrests * ***

The armrests can be folded up if required and the height individually adjusted.

To adjust the armrests for height, separate the round cap (see arrow) from the cover, loosen the hexagon nut (size 13 mm) behind it and adjust the armrests to the desired position (5-steps) and tighten the nut again (**25Nm**). Replace the cap onto the nut.

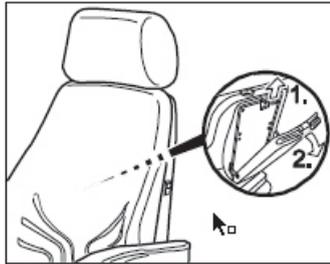


10.2.5.9 Headrest * ***

The headrest can be individually adjusted for height by pulling it upward over the various increments up the end stop.

By pushing forward or rearward the angle of the headrest can be adjusted individually.

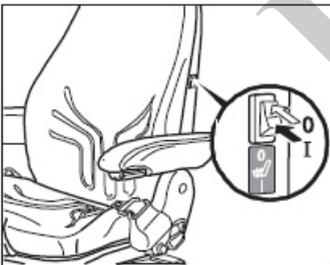
To remove the headrest, pull it over the end stop.



10.2.5.10 Storage box *

The storage box is placed on the rear upper side of the backrest.

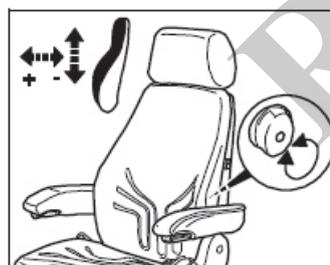
To open the storage box, first pull the fixing lug upwards (1.) and then, fold the cover of the storage box backwards (2.).



10.2.5.11 Seat heater *

The seat heater can be turned on/off by pressing the switch.

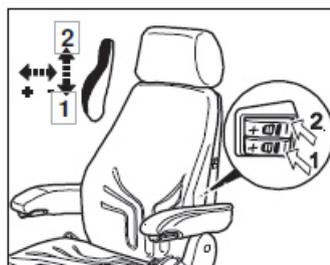
0 = seat heater OFF
1 = seat heater ON



10.2.5.12 Lumbar support * **

By turning the adjustment knob to the left or right, both the height and curvature of the backrest cushion can be individually adjusted.

This increases both the seating comfort and the performance of the driver.



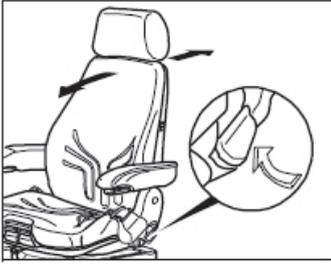
10.2.5.13 Lumbar support * **

With the upper and lower switch the curvature in the upper and lower area of the backrest upholstery can be individually adjusted.

This increases both the seating comfort and the performance of the driver.

The lumbar support curvature can be increased pressing "+" or reduced by pressing "-" on the relevant switch.

When the backrest upholstery does no longer react to pressing "+", the maximum curvature has been reached and the switch should be released.

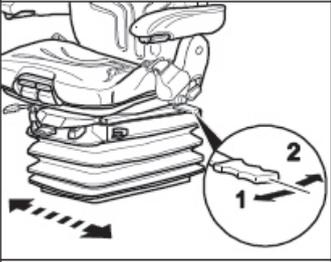


10.2.5.14 Backrest adjustment

Pull up the locking lever to release the backrest catch. When releasing the backrest catch, do not apply load to the backrest by pressing against it.

By exerting pressure on or off the front or rear part of the seat pan it can be moved to the desired position. Release the locking lever to lock the backrest.

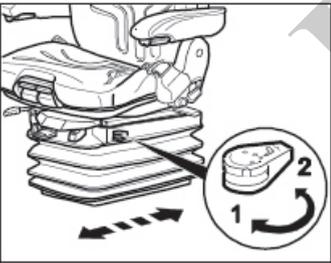
☞ It should not be possible to move the backrest into another position after it has been locked.



10.2.5.15 Lateral isolator *

Under certain driving conditions, it is useful to activate the lateral isolator. This means that lateral shock impacts can be better absorbed by the driver's seat.

Position 1 = lateral isolator on
Position 2 = lateral isolator off



10.2.5.16 Fore/aft isolator *

Under certain driving conditions (for example with a trailer attached), it is useful to activate the fore/aft isolator. This means that shock impacts in the driving direction can be better absorbed by the driver seat.

Position 1 = fore/aft isolator off
Position 2 = fore/aft isolator on

☞ After the adjustment of position 1, the locking lever must latch into the desired position.

For that, the seat must be pressed backwards until it latches with an audible click.

☞ It should not be possible to move the fore/aft isolator into another position when it is locked.

10.2.6 Maintenance

Dirt can impair the function of the seat, so make sure you keep your seat clean. Upholstery does not need to be removed from the seat frame for cleaning.



! CAUTION

Take care with the backrest - it may jerk forward and cause injury!

When cleaning the backrest cushion, the backrest must be held in place when operating the backrest lever

ATTENTION: Do not clean the seat with a pressure washer!

When cleaning the upholstery, make sure the upholstery is not soaked.

Use standard commercially available **upholstery or plastics cleaning agent**.

Test first for compatibility on a small, concealed area.

10.3 Camera system

MD3072B	Art.-no. 401 0040 000
MD3072B-Quad	Art.-no. 401 0041 000

10.3.1 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.

10.3.1.1 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.

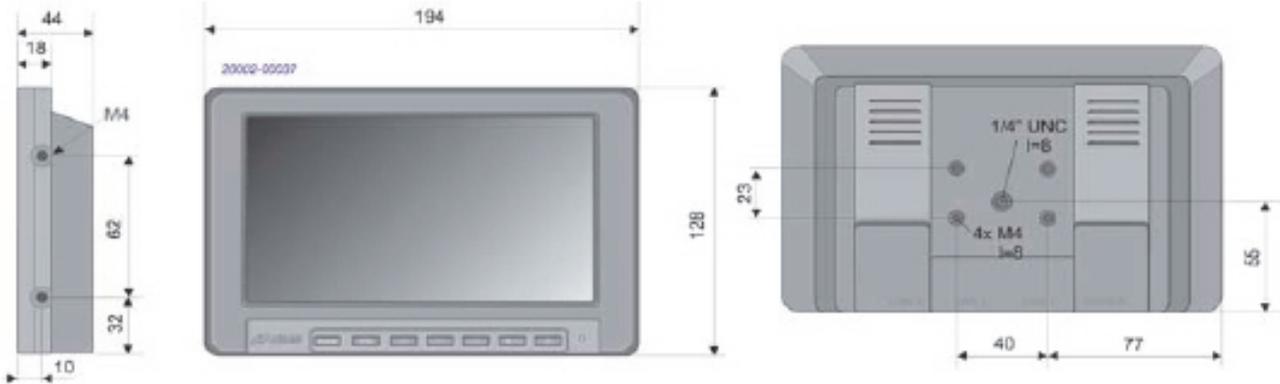
10.3.1.2 Declaration of conformity

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.

10.3.1.3 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



10.3.1.4 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

10.3.2 Safety Instructions



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.

10.3.2.1 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.

10.3.2.2 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.

For
Reference
Only

10.3.3 Operating and Display Elements



Display on / off



Menus are activated and toggled in the order:

BrightnessBrightness - 0(MIN) ... 60 (MAX)

ContrastContrast - 0(MIN) ... 60 (MAX)

ColorColor saturation - 0 (MIN) ... 60 (MAX)

StandardReset to factory settings

VolumeVolume - 0 (MIN) ... 10 (MAX)

LanguageEnglish, French, German, Spanish, Italian, Portuguese, Polish

MirroringThe camera image is mirrored. Select the "Entry" menu item to return to the main menu. Select "Exit" to terminate the menu.

VideoPAL, NTSC, Auto

PocOFF/ON. Monitor is activated via ignition

TimerOFF/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.



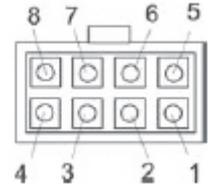
Press the Mode key to toggle to the individual display modes (single image, split screen (2), split screen (3), split screen (4) and timer mode.

For Reference Only

10.3.4 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.

10.3.5 Operating Modes

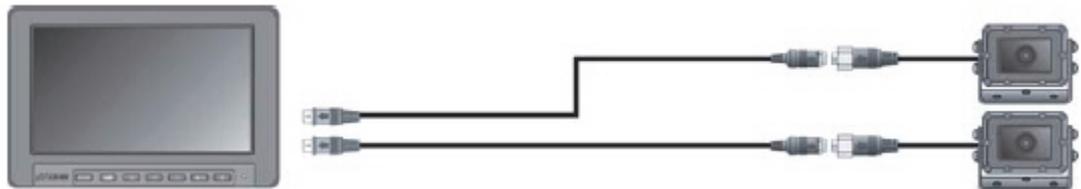
10.3.5.1 Single Camera Operation

A single camera is connected to C1 in this operating mode.



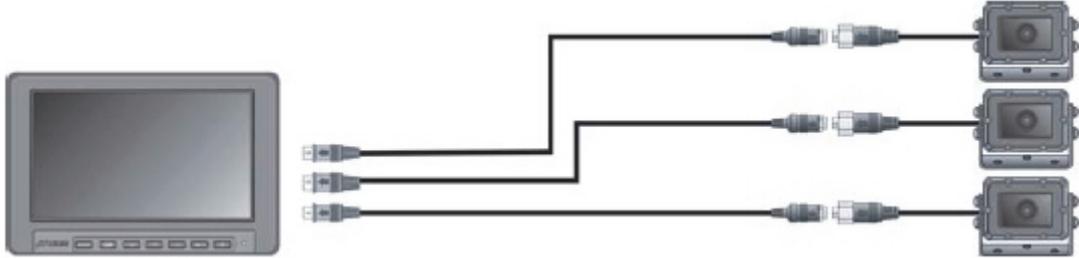
10.3.5.2 Twin Camera Operation

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.



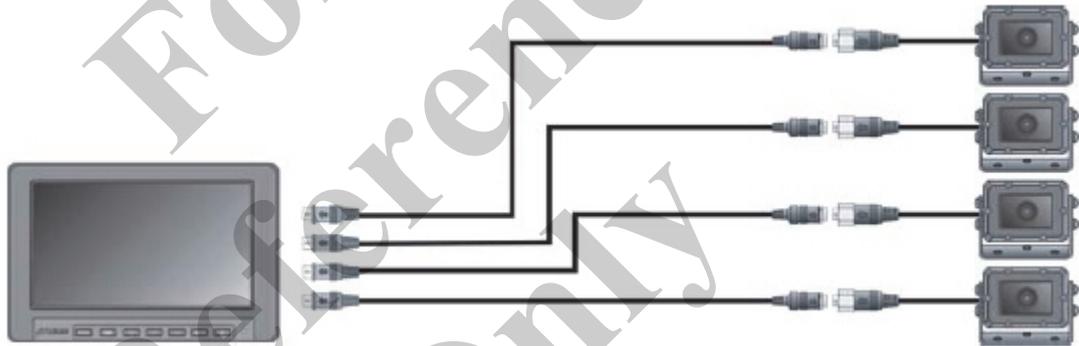
10.3.5.3 Three Camera Operation

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.



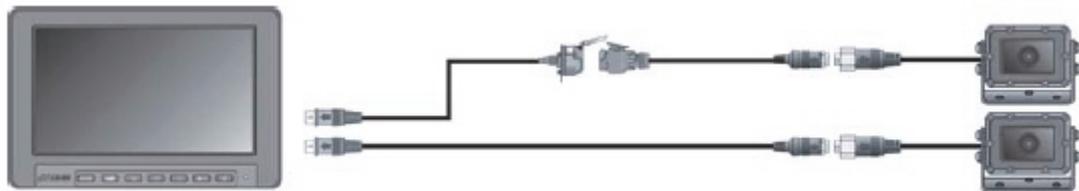
10.3.5.4 Four Camera Operation

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.



10.3.5.5 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).



10.3.6 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.

10.3.7 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.

10.3.8 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

10.3.9 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.

For Reference Only

10.4 Radio Remote Control

10.4.1 Introduction

10.4.1.1 The operating manual

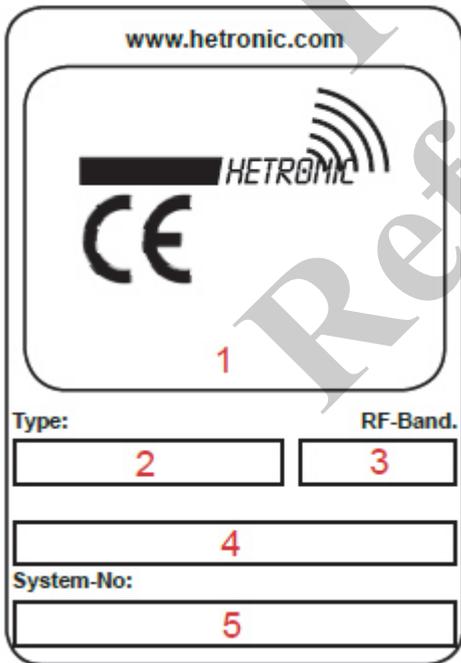
Read the manual of all system components carefully and completely before operating the system. The content will make yourself familiar with the safety instructions and the controls during standard operation and maintenance. Keep the manual in a place where the operator can access it at any time.

10.4.1.2 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.

10.4.1.3 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

10.4.1.4 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.

10.4.2 Safety precautions

10.4.2.1 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.

10.4.2.2 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.

10.4.2.3 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.

10.4.2.4 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.

10.4.2.5 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.

NOTICE

10.4.2.6 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.

10.4.2.7 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

10.4.3 Protection devices

10.4.3.1 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 accoustical 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.

10.4.3.2 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.

10.4.3.3 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.

10.4.4 Installation

10.4.4.1 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.

10.4.4.2 Installation of the output wiring

Switch the power supply of the machine off before attaching the voltage supply of the receiver.

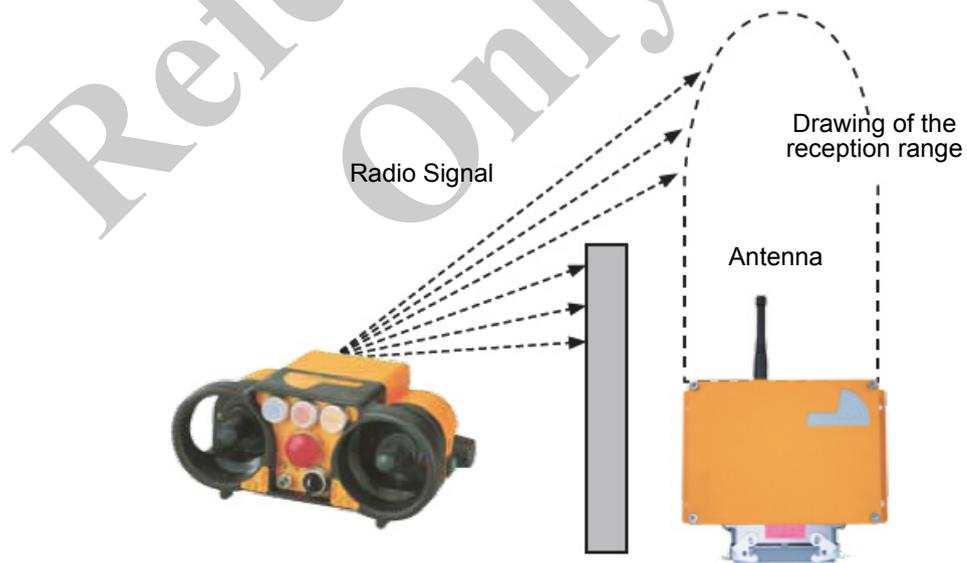
Charge a qualified technician with the wiring. Improper wiring may cause serious system damage and may void your guarantee. The output wiring has to be installed according to the connection diagram of the machine and the radio remote control. Only use contacts of good quality, to ensure a proper electric 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.

10.4.4.3 Correct installation of the receiver unit

(See drawings below)

When mounting the receiver unit ensure that no big metal surfaces shield the external antenna.



10.4.5 Checkup before operation

10.4.5.1 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!

10.4.5.2 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!

10.4.5.3 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!

10.4.5.4 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.

10.4.6 Startup procedure

10.4.6.1 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).



10.4.6.2 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

10.4.6.3 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)



10.4.7 Operation of MFS and HL systems

10.4.7.1 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



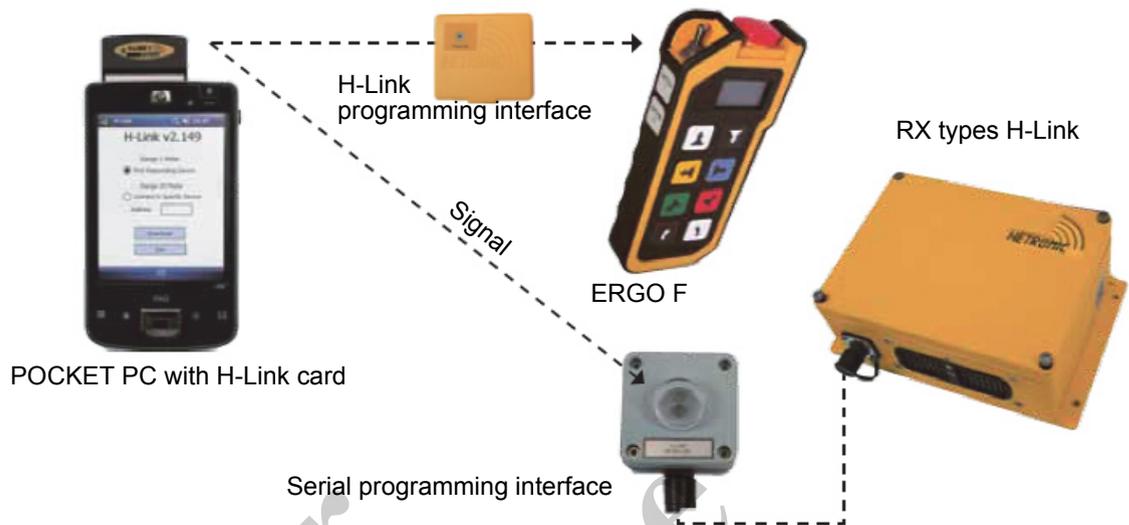
Transmitter	Red LED	Green LED
Low voltage	On	flashing
Transmitter failure	On	On
Transmitter normal	On	flashing
Emergency stop transmitter	flashing	On

Receiver	Red LED	Green LED	Buzzer
Low Failure main contact	On	Off	Off
Receiver activated	On	Off	Sounding
Receiving	On	flashing	Off

10.4.7.2 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.



10.4.8 Battery charger and rechargeable batteries

10.4.8.1 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!

10.4.8.2 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

10.4.9 Battery handling**10.4.9.1 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.

10.4.9.2 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

10.4.9.3 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

10.4.9.4 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!

10.4.10 Diagnostics

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

10.4.11 Special Technical Data

10.4.11.1 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)

10.4.11.2 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

10.4.11.3 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.

10.4.11.4 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

10.4.11.5 Technical data sheets

Technical data sheets with further information are available on the HETRONIC web site.

10.4.11.6 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.

10.4.12 Maintenance, Guarantee, Disposal

10.4.12.1 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.

10.4.12.2 Guarantee and warranty

You will find the terms of guarantee in our general terms and conditions.

10.4.12.3 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!

**10.4.12.4 Information about complaints report
(Page 10-393)****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.

10.4.12.5 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.

10.4.13 Complaint form

Complaints report									
HETRONIC Germany GmbH Adalbert-Stifter-Str. 2 D-84085 Langquaid www.hetronic.de Tel.: +49(0)9452/189-701, 711 or 531 Fax.: +49(0)9452/189-281 					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€)				
NOTE: According to our terms and conditions dated May 2010, warranty cases cannot be handled unless the system No., delivery No. and invoice No. are stated. Shipping costs will be charged!		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 1 Date Result1 Result2 _____ _____ _____ _____ 2 _____ 3 _____ 4 _____		<input type="checkbox"/> Warranty <input type="checkbox"/> No warranty <input type="checkbox"/> Repair free of charge <input type="checkbox"/> Functional, return free of charge							
Contact Date Signature Date Signature									
H-D-QS-04-08-Reklamationsbericht-06									

10.4.14 Abbreviations and definitions

10.4.14.1 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	Milliampere hours
mA.....	Milliampere
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

10.4.14.2 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.

10.4.15 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

For Reference Only

10.4.16 EC 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

Langquaid, 01.08.2010

10.4.17 HF-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
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 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

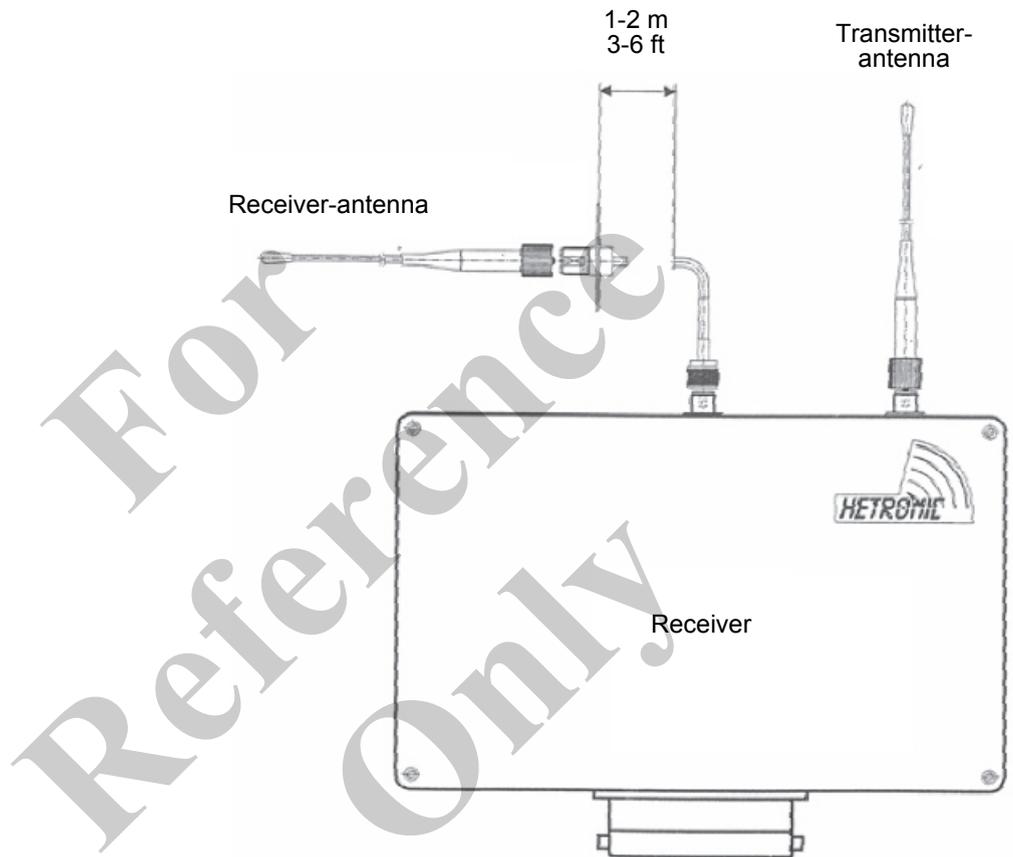
FOR
Reference
Only

10.4.18 Mounting Antennas for Feedback-Systems

Important!

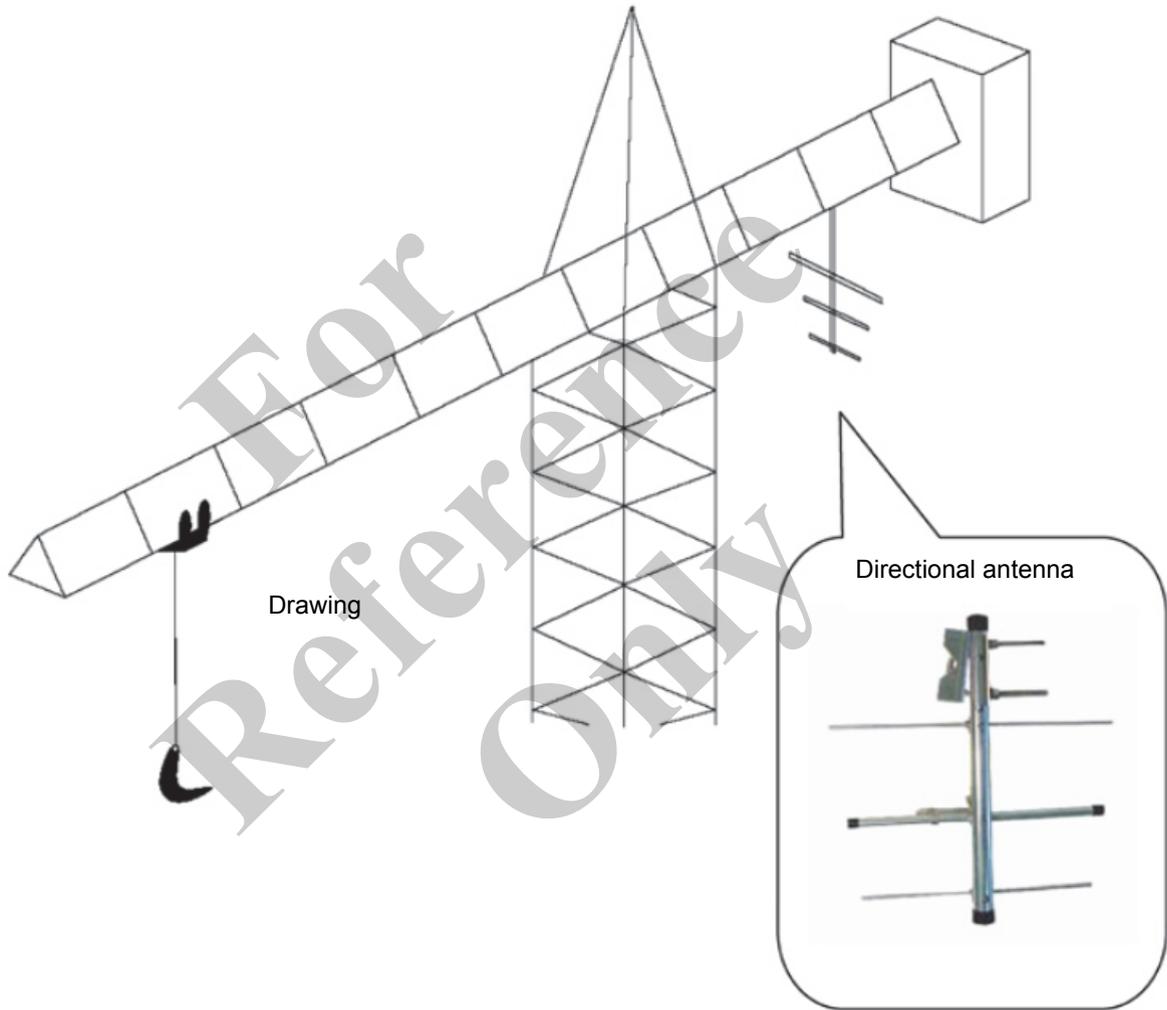
To guarantee a trouble free operation, follow the instructions given below to mount the antennas.

- 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.



10.4.19 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.



10.4.20 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 re-improve the same item three times because of the same fault. Only should the manufacturer fail to re-improve 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 non-regard 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.



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10.5 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.

10.5.1 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.

10.5.2 Coolant cooler

10.5.2.1 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.

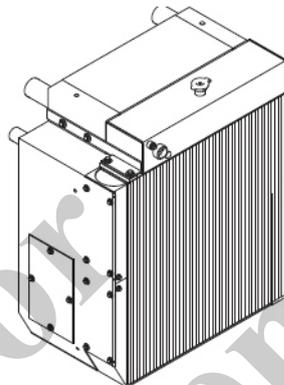


Fig. 252 Combination cooler, figure similar

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.

10.5.2.2 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.

10.5.3 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

10.5.4 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.

10.5.5 Charge-air cooler

10.5.5.1 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.

10.5.6 Oil cooler

10.5.6.1 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.

10.5.6.2 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.

10.6 Residual Useful Life of Winches

10.6.1 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.

10.6.2 Periodic inspection of cranes

10.6.3 Steps required to monitor the winches

10.6.3.1 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

10.6.3.2 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 10-414), 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:

$$S_i = \frac{km_i}{km} \cdot i \cdot T$$

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 10-412

T_i = Effective service hours in the inspection interval i , according to "ESTABLISHING THE EFFECTIVE SERVICE HOURS T_i " on page 10-414

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 10-412), 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.

10.6.3.3 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 L ₁ , 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 10-416).

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:

$$S_2 = \frac{0,5}{0,125} \times 480 - h = 1920 \text{ h}$$

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.

10.6.3.4 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.

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 = 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 10-412.
 Ti = Effective service hours in the inspection interval i. See "ESTABLISHING THE EFFECTIVE SERVICE HOURS T_i" on page 10-414.

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	Service hours of the crane as a whole	Service hours of the upper structure since the last inspection	Service hours of the winch	Service hours of the winch in the period since the last inspection T _i	Spent share of the theoretical length of the useful life D $Si = \dots \times Ti$	Residual theoretical length of useful life $Di = Di - Si$	Name of inspector	Signature	Notes
0	20.11.94	-	km	-	-	-	0	0	3200			
1	15.11.95	L1	0,125	800	800	-	160 (20% of 800)	160	3040	Müller		
2	17.11.96	L3	0,5	2000	1200	-	480 (40% of 1200)	1920	1120	Huber		
3	23.11.97	L2	0,25	3000	1000	-	300 (30% of 1000)	600	520	Meier		

ATTENTION: A general overhaul must be performed at least every 10 years.
 General overhaul performed on:

h/g/tb/notiz1/doku/NDWinde

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:.....

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 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 in the period since the last inspection T _i [h]	Spent share of the theoretical length of the useful life D $S_i = \dots \times T_i$ [h]	Residual theoretical length of useful life D _i = D - S _i [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/NDWinde

10.7 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.

10.7.1 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

10.7.2 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.

10.7.3 Assembly

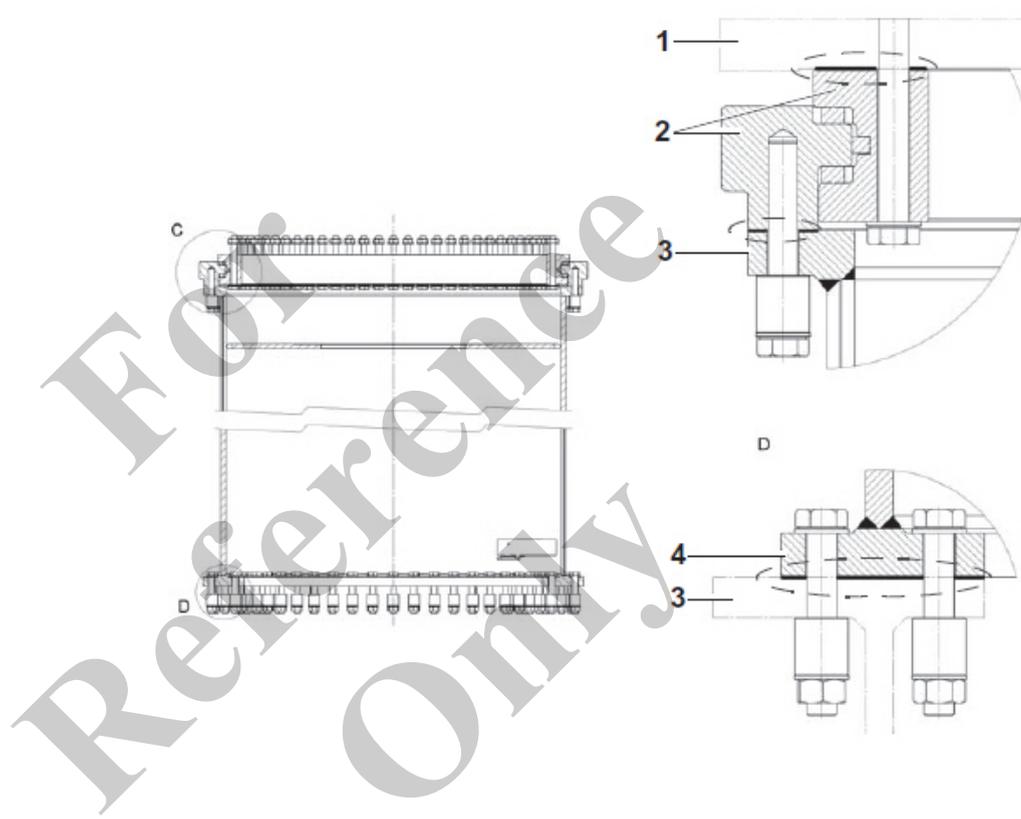
There are a few important points to observe for the installation:

- 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



10.7.4 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		

For Reference Only

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		

10.8 PFEIFER Pouch Socket System

10.8.1 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.

10.8.2 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

10.8.3 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!

10.8.4 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



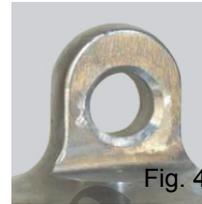
Fig. 1

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 EN13411
Field of application: High performance rotation resistant ropes
Characteristic: Without rotary locking device at the tail



Reeving eye for mounting of a reeving-rope on the end termination.

Fig. 4



CAUTION

Never exceed the working load limit of the reeving eye.



Fig. 3

PFEIFER swaged sleeve rotary locked Type 12A
PFEIFER resin socket rotary locked Type 14A
Tested according to EN13411
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. 5



CAUTION

Twisting of the rope can substantially reduce its breaking force and result in rope failure.

10.8.5 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).

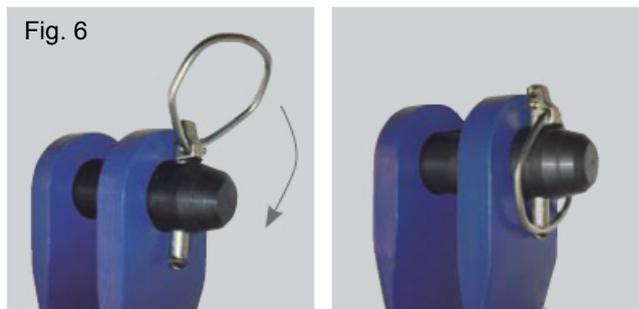


Fig. 6

Fig. 7

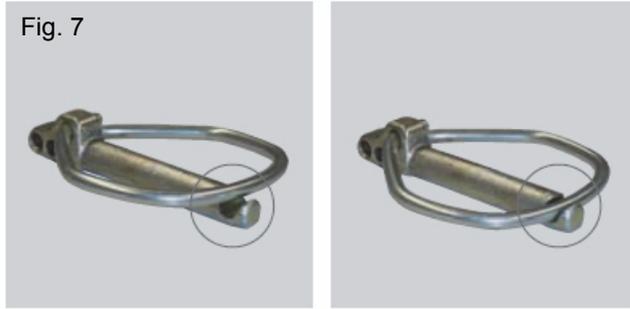


Fig. 8



Fig. 9

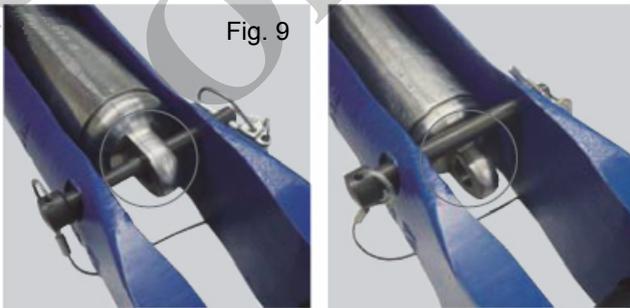


Fig. 10



10.8.6 Important security informations



WARNING

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.

10.8.7 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.

10.8.8 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.



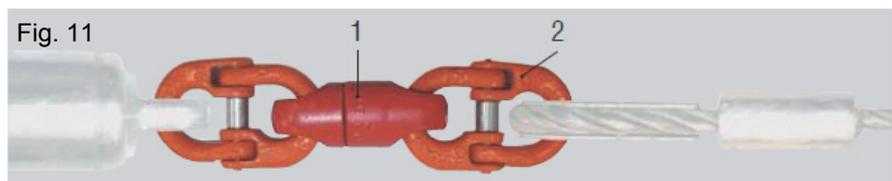
To pull the rope into the reeving system use a rotation resistant auxiliary reeving rope.



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



10.8.9 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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INTERNET: www.pfeifer.de

10.8.10 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

10.9 Operating Fluids and Lubricants

Foreword

This List of Operating Fluids and Lubricants contains the operating fluids and lubricants used and recommended.

The fluid or lubricant filled at the factory is specified on a sticker located at the corresponding filling point.

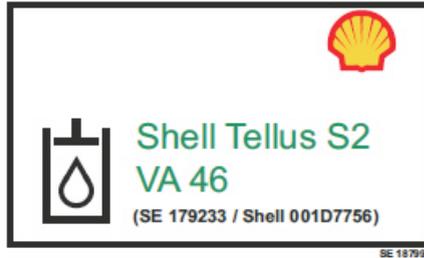


Fig. 1 Hydraulic oil sticker

The ambient temperature that can be expected at the work site is an important criterion for selecting an operating fluid or lubricant. Consequently, the temperature ranges are assigned to the respective operating fluid or lubricant in this list.



Fig. 2 Temperature ranges - hydraulic oil

Different equipment and packages are available if there is a change in the operating temperature range. These equipment items and packages contain supplemental measures and modified components in addition to the special operating fluids and lubricants. In case of deviating operating temperature ranges, contact your service partner.

The operating conditions of the machine are another important factor. These include the amount of dust in the machine environment and the number of tool changes. These factors significantly affect the service life of the operating fluids and lubricants.

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. Due to incompatibilities from such mixing, significant component damage and malfunctions can occur. Before changing the type, brand, or manufacturer of an operating fluid or lubricant, contact a your service partner.

10.9.1 Hydraulic system

10.9.1.1 Hydraulic oil

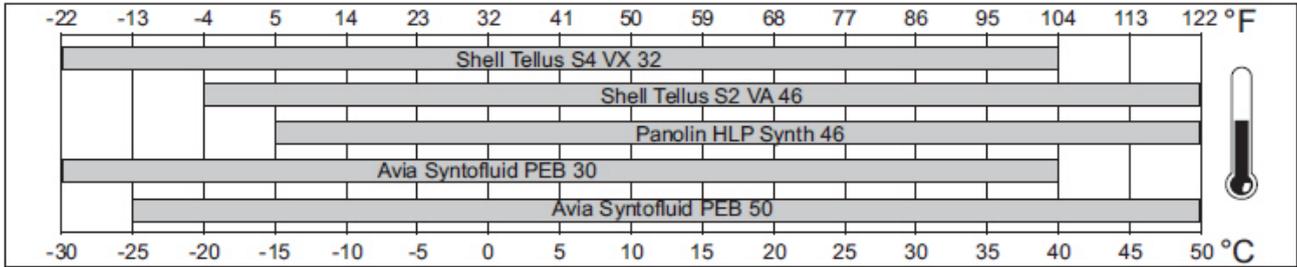


Fig. 3 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Tellus S4 VX 32	SE: 157284 Shell: 001D7769	DIN 51524-3 HVLP-D (ISO VG 32) PAO	Avia Syntofluid PEB 30 9999300308 9999300309 9999300310 Mobil DTE 10 Excel 32
Shell Tellus S2 VA	SE: 179233 Shell: 001D7756	DIN 51524-3 HVLP-D (ISO VG 46)	Mobil DTE 10 Excel 46;
Rapidly biodegradable hydraulic oil:			
Panolin HLP Synth 46	SE: 149198	ISO 15380 HEES saturated	Avia Syntofluid PEB 30 Mobil Envirosyn 46H
Rapidly biodegradable hydraulic oil, low temperature range:			
Avia Syntofluid PEB 30	SE: 149199	ISO 15380 HEPR; DIN 51524-3 HVLP-D	
Avia Syntofluid PEB 50	SE: 149200	ISO 15380 HEPR; DIN 51524-3 HVLP-D	

10.9.2 Diesel engine

10.9.2.1 Diesel engine oil

Cummins Diesel Engine

Emissions levels Tier 2 and Tier 3

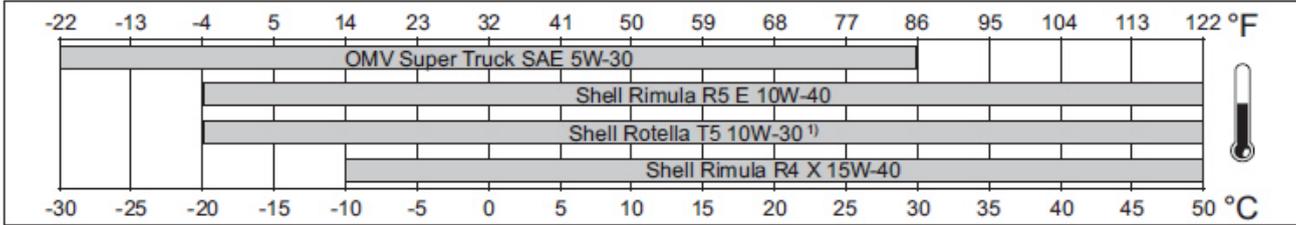


Fig. 4 Temperature ranges

Recommendation	ID no.	Specification	Alternative
OMV Super Truck SAE 5W-30	SE: 124846	API CI-4; Cummins CES 20078	9999300326 9999300327 Mobil Super Premium 5W-30
Shell Rimula R5 E 10W-40	SE: 181934 Shell: 001C4591	API CI-4; Cummins CES 20078	9999300186 90016497 Mobil Delvac 1 5W-40 Synthetic Motor Oil
Shell Rotella T5 10W-30 ¹⁾	SE: 179999 Shell: 001D5436	API CJ-4; Cummins CES 20081	Castrol Enduron Global 10W-40 9999300231 Shell Rotella T5 SB 10W-40
Shell Rimula R4 X 15W-40	SE: 181933 Shell: 001E7746	API CI-4; Cummins CES 20078	9999300007 9999300008 9999300211 9999300234 Exxon XD-3 15W-40

¹⁾ Comply with the fuel restrictions specified in the operating manual provided by the manufacturer of the diesel engine.

Emissions levels Tier 4 Interim and Tier 4 Final

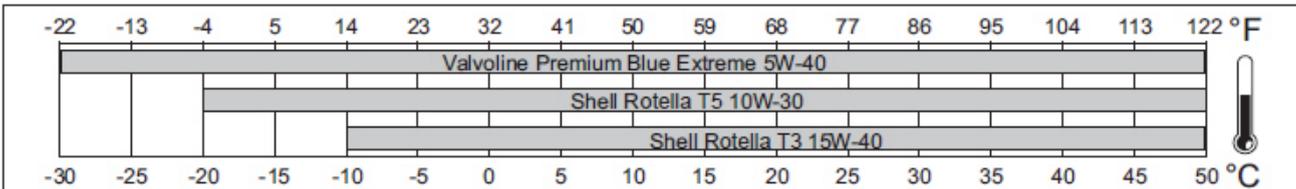


Fig. 5 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Valvoline Premium Blue Extreme 5W-40	SE: 157283	API CJ-4; Cummins CES20081	Shell Rotella T6 5W-40; Motorex Nexus FE 5W-30
Shell Rotella T5 10W-30	SE: 179999 Shell: 001D5436	API CJ-4; Cummins CES20081	Eni i-Sigma top MS 10W-30; Castrol Enduron Global 10W-40 9999300231 Shell Rotella T5 SB 10W-40
Shell Rotella T3 15W-40	SE: 187162 Shell: 001D5433	API CJ-4; Cummins CES20081	9999300255 9999300256 9999300257 Conoco Fleet Supreme EC Engine Oil 15W-40

10.9.2.2 Coolant

Engine	Recommendation	ID no.	Specification	Mixing ratio
Cummins	Cummins ES Compleat	SE: 181966	Cummins CES 14603	As specified in the operating manual ¹⁾ 9999300302 OWI Finalcharge Global Extended Life AFC 50/50 prediluted; (Standard AFC option 9999300201 9999300202 9999300203 9999300204 OWI Fleetcharge 50/50 fully formulated precharged antifreeze/coolant)

¹⁾ Year-round mixing ratio at least 50% coolant concentrate to 50% fresh water for frost protection to -37°C (-34 °F). Maximum 60% coolant concentrate to 40% fresh water for frost protection to -52 C (-61°F).

10.9.2.3 Fuel

Emissions level	Fuel specification	Sulfur content
Tier 2 and 3	Diesel fuel DIN EN 590; ASTM D975 LSD 1D, 2D	≤ 500 mg/kg
Tier 4 final	Diesel fuel DIN EN 590, ASTM D975 ULSD 1D, 2D	≤ 15 mg/kg

Observe the instructions concerning fuel in the operating manuals of the diesel engine manufacturers.

10.9.2.4 Diesel flow improvers

Recommendation	ID no.	Specification
Fuchs Maintain Winterfit	SE: 180464	MB 137.1; BMW BG 13
AUTOL TP 10	SE: 182173	MB 137.1; BMW BG 13

10.9.2.5 Diesel exhaust fluid for Tier 4 Final diesel engines

Recommendation	ID no.	Specification
DEF	SE: 149060	ISO 22241; DIN 70070; AUS 32

10.9.3 Gearbox

10.9.3.1 Slewing gear GHC75

Gear oil

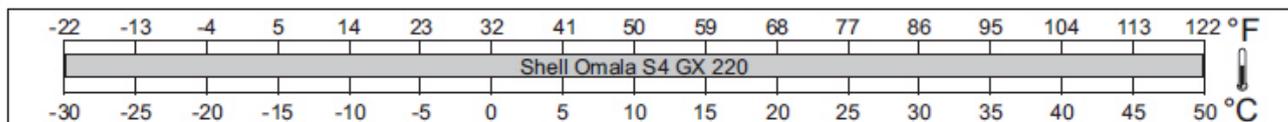


Fig. 6 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Omala S4 GX 220	SE: 179227 Shell: 001D7851	CLP HC (PAO) 220; DIN 51517 T3	OMV Gear oil SHG 220; Castrol Alphasyn EP 220 9999300236 Mobil SHC Series SHC 220 Synthetic

10.9.3.2 Winch gear

Gear oil

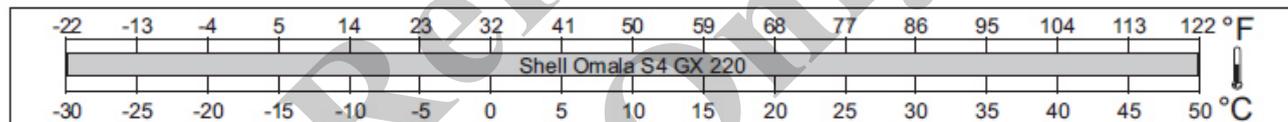


Fig. 7 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Omala S4 GX 220	SE: 179227 Shell: 001D7851	CLP HC (PAO) 220; DIN 51517 T3; API-GL5 (no LS)	OMV Gear oil SHG 220; Castrol Alphasyn EP 220 9999300236 Mobil SHC Series SHC 220 Synthetic

10.9.3.3 Grease lubricating points

Gear oil

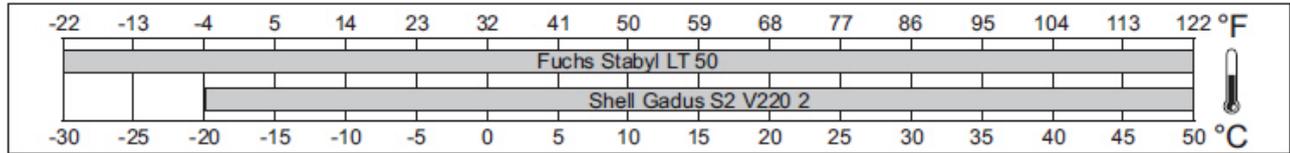


Fig. 8 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Fuchs Stabyl LT 50	SE: 157280	DIN 51502 -KPHC2N-50; NLGI 2	Avia Grease PE Polar 9999300306 Mobil Mobilith SHC 220 NLGI 2
Shell Gadus S2 V220 2	SE: 179226 Shell: 001D8451	DIN 51825 LI; NLGI 2; KP2K-20	AUTOL TOP 2000; Cas- trol Oliit 2 EP; OMV Signum CX2 Gearbox 24 9999300217 9999300247 Mobil Mobilgrease XHP 222; 9999300209 Mobilux EP 2 Grease

10.9.3.4 Crawler travel drive

Gear oil

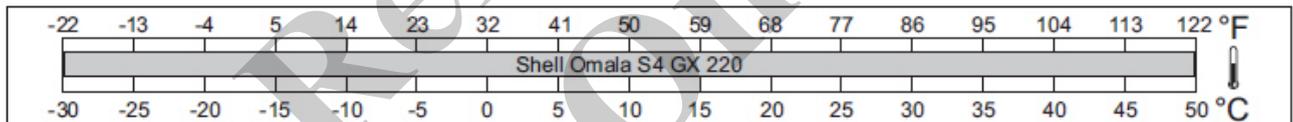


Fig. 9 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Shell Omala S4 GX 220	SE: 179227 Shell: 001D7851	CLP HC (PAO) 220; DIN 51517 T3	OMV Gear oil SHG 220; Castrol Alphasyn EP 220 9999300236 Mobil SHC Series SHC 220 Synthetic

10.9.4 Lubrication

10.9.4.1 Grease - slewing ring roller bearings

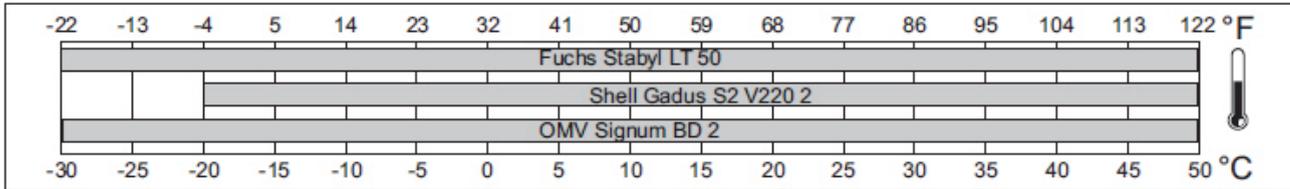


Fig. 10 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Fuchs Stabyl LT 50	SE: 157280	DIN 51502 -KPHC2N-50; NLGI 2	Avia Grease PE Polar 9999300306 Mobil Mobilith SHC 220 NLGI 2
Shell Gadus S2 V220 2	SE: 179226 Shell: 001D8451	DIN 51502 - KP2K-20; NLGI 2	OMV Signum CX 2; AUTOL TOP 2000; Castrol Olit 2 EP 9999300217 9999300247 Mobil Mobilgrease XHP 222; 9999300209 Mobilux EP 2 Grease
Rapidly biodegradable grease			
OMV Signum BD 2	SE: 180209	DIN 51825/DIN 51502 - KP E 2 K-30; NLGI 2	Avia Syntogrease 2; BP Biogrease EP 2

10.9.4.2 Grease - slewing ring, outer gearings

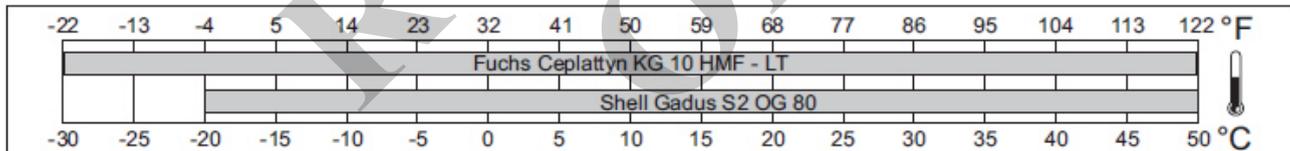


Fig. 11 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Fuchs Ceplattyn KG 10 HMF - LT	SE: 156982	DIN 51502 -KPHC2N-50; NLGI 2	9999300213 Fuchs Ceplattyn 300
Shell Gadus S2 OG 80	SE: 184872 Shell: 001D8496	DIN 51 502 OG PF 0 S-30; NLGI 0	OKS 490 9999300213 Fuchs Ceplattyn 300

10.9.4.3 Grease - manual lubricating points

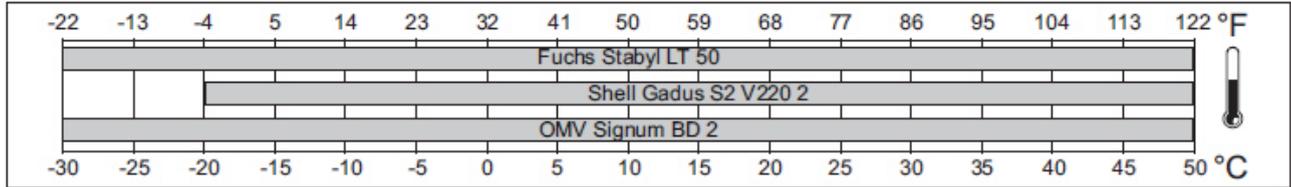


Fig. 12 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Fuchs Stabyl LT 50	SE: 157280	Specification DIN 51502 -KPHC2N-50; NLGI 2	Avia Grease PE Polar 9999300306 Mobil Mobilith SHC 220 NLGI 2
Shell Gadus S2 V220 2	SE: 179226 Shell: 001D8451	DIN 51502 - KP2K-20; NLGI 2	OMV Signum CX 2; AUTOL TOP 2000; Castrol Olit 2 EP 999930217 9999300247 Mobil Mobilgrease XHP 222; 9999300209 Mobilux EP 2 Grease
Rapidly biodegradable grease			
OMV Signum BD 2	SE: 180209	DIN 51825/DIN 51502 -KP E 2 K-30; NLGI 2	Avia Syntogrease 2; BP Biogrease EP 2

10.9.4.4 Grease - undercarriage, telescoping

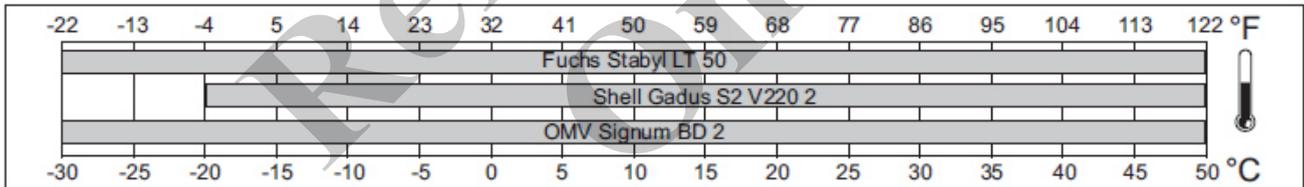


Fig. 13 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Fuchs Stabyl LT 50	SE: 157280	Specification DIN 51502 -KPHC2N-50; NLGI 2	Avia Grease PE Polar 9999300306 Mobil Mobilith SHC 220 NLGI 2
Shell Gadus S2 V220 2	SE: 179226 Shell: 001D8451	DIN 51502 - KP2K-20; NLGI 2	OMV Signum CX 2; AUTOL TOP 2000; Castrol Olit 2 EP 999930217 9999300247 Mobil Mobilgrease XHP 222; 9999300209 Mobilux EP 2 Grease
Rapidly biodegradable grease			
OMV Signum BD 2	SE: 180209	DIN 51825/DIN 51502 -KP E 2 K-30; NLGI 2	Avia Syntogrease 2; BP Biogrease EP 2

10.9.4.5 Grease - telescopic boom

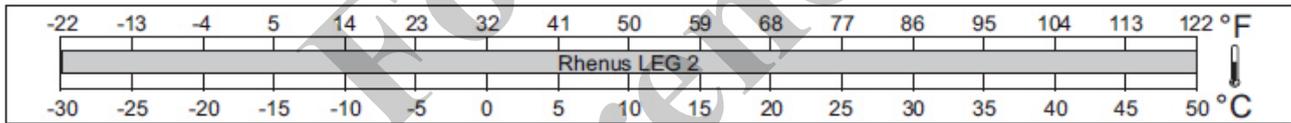


Fig. 14 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Rhenus LEG 2	SE: 185733	DIN 51502, KPF 2 N-30; NLGI 2	9999300306 Mobil Mobilith SHC 220 NLGI 2

10.9.4.6 Lubricants - wire ropes

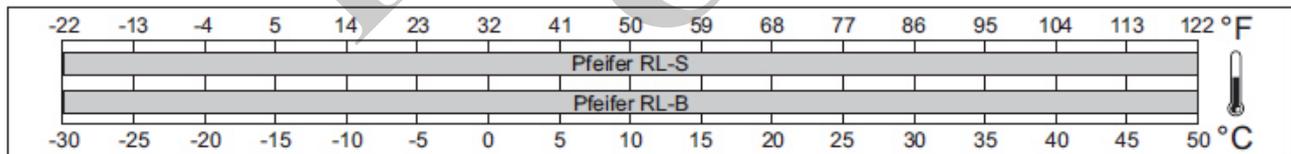


Fig. 15 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Pfeifer RL-S	SE: 185735	Rope spray	Rope grease F 315 L (adhesive grease in the spray can) 90022608 90022609 Crosby Vitalife 400 Wire Rope Lubricant
Pfeifer RL-B	SE: 185736	Rope oil	Rope grease F 315 L (adhesive grease in the spray can) 90022608 90022609 Crosby Vitalife 400 Wire Rope Lubricant

10.9.5 Air conditioning system

10.9.5.1 Refrigerant

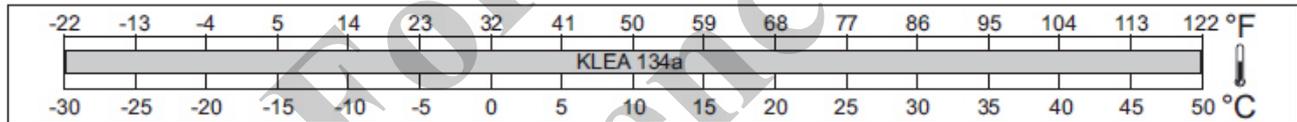


Fig. 16 Temperature ranges

Recommendation	ID no.	Specification	Alternative
KLEA 134a	SE: 185737	R134a	6829103460 R 134a Refrigerant

10.9.5.2 Refrigerant Oil

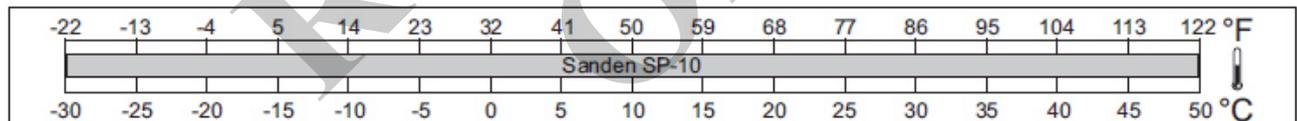


Fig. 17 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Sanden SP-10	SE: 185732		7604000513 6829013436 Chemtool 100 PAG Oil (A/C Compressor) 8898920006 Sunair PAG 46 Oil

10.9.6 Windshield washer system

10.9.6.1 Antifreeze

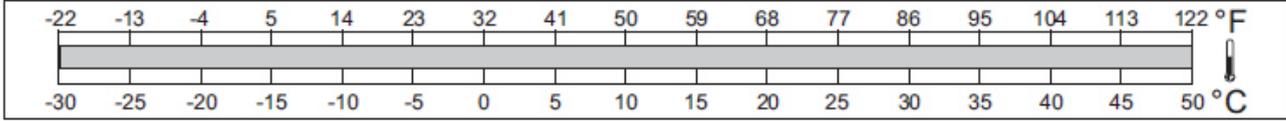


Fig. 18 Temperature ranges

Recommendation	ID no.	Specification	Alternative
Off-the-shelf window cleaners with antifreeze	SE: 185734	Fresh water with a proportion of at last 50%antifreeze	90037773 Splash Windshield Washer Fluid - 30° F

10.9.7 Starter batteries

10.9.7.1 Battery terminal grease

Recommendation	ID no.	Specification	Alternative
Battery terminal grease	SE: 071706		

10.9.7.2 Battery terminal spray

Recommendation	ID no.	Specification	Alternative
Battery terminal spray	SE: 113732		

Reference Only!

vSCALE D3

Operating console
Working Area Limiter
Sennebogen Telescopic Crane



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Issue A - 03/2015

This document has the order no.

50-700-19-6003_en

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VERSION OVERVIEW

Issue	Date	Description	Editor
A	2015-03-20	Translation from original German Issue A First issue Working Area Limiter for Sennebogen telescopic crane	cb. / rk.

Introduction

INTRODUCTION

About this manual	This manual is a component of the equipment or system supplied by Hirschmann Automation and Control GmbH. Keep this manual in a safe place and ensure that it is available to all users.
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Use for the intended purpose	This device / system is intended exclusively for the tasks described in this manual. Any other use shall be construed as being inappropriate. The manufacturer accepts no liability for damage caused by inappropriate or impermissible use. This device / system may only be used if it is in perfect technical condition.
Qualification of the operating personnel	Only appropriately qualified personnel may work with this device / system, i.e. persons: <ul style="list-style-type: none">▪ who are familiar with the operation or installation and commissioning▪ who know the current regulations for the prevention of accidents
Manufacturer	HIRSCHMANN Automation and Control GmbH Hertzstr. 32-34 76275 Ettlingen Germany Phone: +49 (0)7243 709-0

Introduction

Marking of notices

Dangers and other important notices are marked as follows in this user manual:



WARNING

Warning of direct threat of personal injury and damage to property.
Instructions on precautions to avert the danger.



CAUTION

Warning of dangerous situations. Also warns of damage to property.
Instructions for averting the danger.

IMPORTANT

Warning of possibly damaging situation for the product.
Instructions for avoiding the possibly damaging situation.



NOTE

Usage instructions and information, but no dangerous situation.



HINT

Supplementary comments and recommendations for the user.

Safety instructions

1 Safety instructions



WARNING

Imminent threat of personal injury and damage to property due to incorrect system settings!

The settings can only be carried out by operators who are completely familiar with the operation and functions of the crane and the SLI.

The correctness of these settings must be guaranteed before starting the crane operations!

IMPORTANT

Connection to the wrong power supply will cause damage to the device.

The device may only be connected to a DC voltage source of 9 V to 36 V!

1.1 EC conformity declaration



The technical design and construction of the **vSCALE D3** console corresponds to requirements of the EMC directive 2004/108/EC and therefore carries the CE symbol.

The device complies with the following harmonised standards:
EN 12895:200, EN 13309:2010, EN ISO 14982: 2009

The full conformity declaration is available from the manufacturer on request.

Product description

2 Product description

The **vSCALE D3** console is the operable component of the **working area limiter** of the programmable safe load indicator and contains following functions:

- Luffing angle limiting
- Height limiting
- Radius limiting
- Slewing angle limiting

The **vSCALE D3 console is used for:**

- programming and inputting limits
- displaying the current limits of the crane

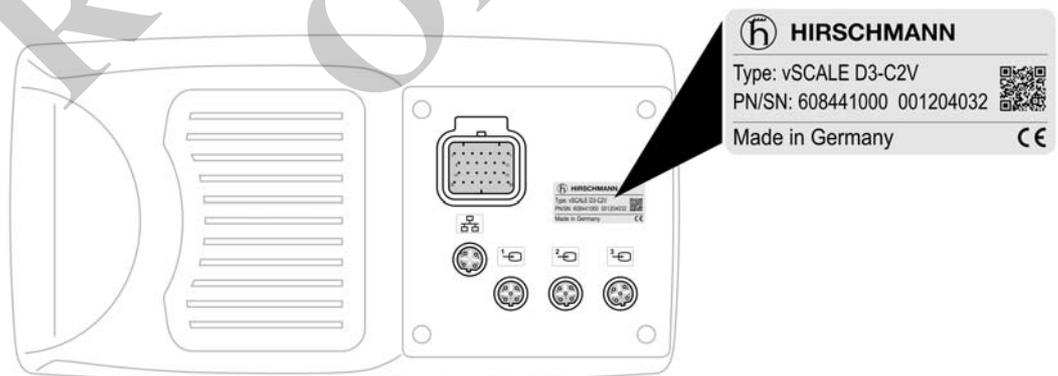
Scope of manual This user manual contains information about installation, commissioning, operation and sensor calibration and about repairs and maintenance.

2.1 Product identification

The type plate carries the unique identification of the operating console. It is located on the back of the device.

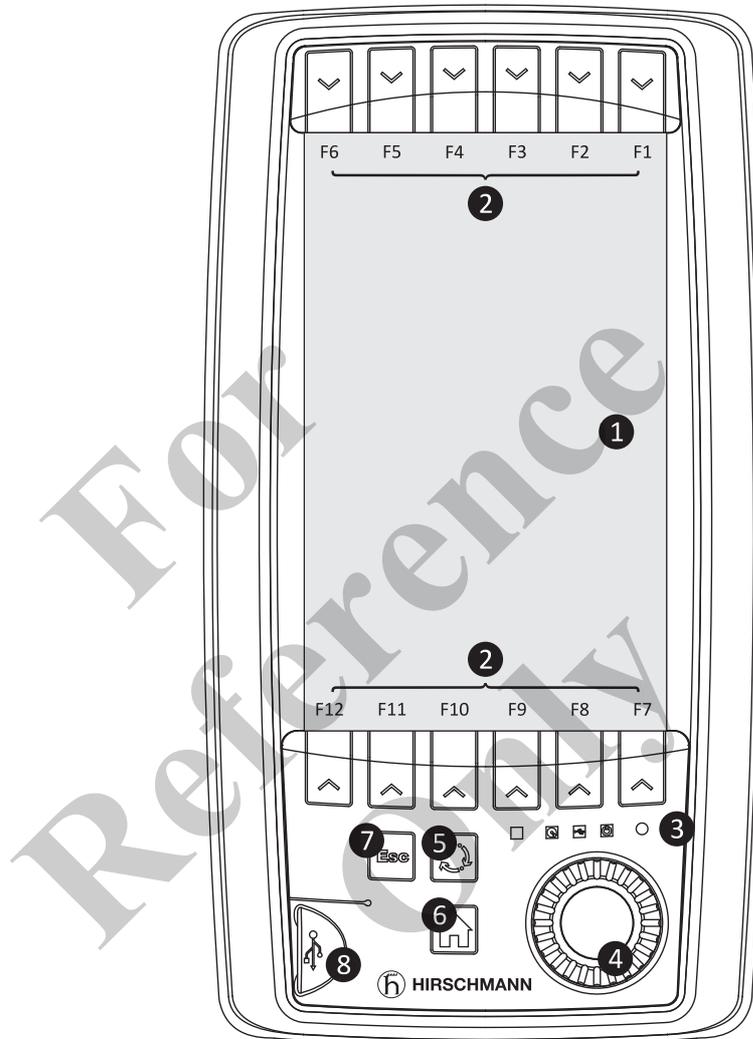
Please ensure you make a note of all the information on your type plate for queries about this product.

Type plate
(Example)



Product description

2.2 Overview of functional elements



- 1 TFT colour display
- 2 Function keys **F1 - F12**
- 3 Light sensor and status displays (LED)
- 4 Rotary control (encoder) with pushbutton function
- 5 Function key (SYSTEM) for system settings (*not used here*)
- 6 Function key (Home) for return to SLI main menu
- 7 Function key (Esc) for return or abort (*not used here*)
- 8 Front- USB 2.0 interface (use for service purposes)

Installation and wiring

3 Installation and wiring

This chapter contains instructions for mounting and installation of the console.

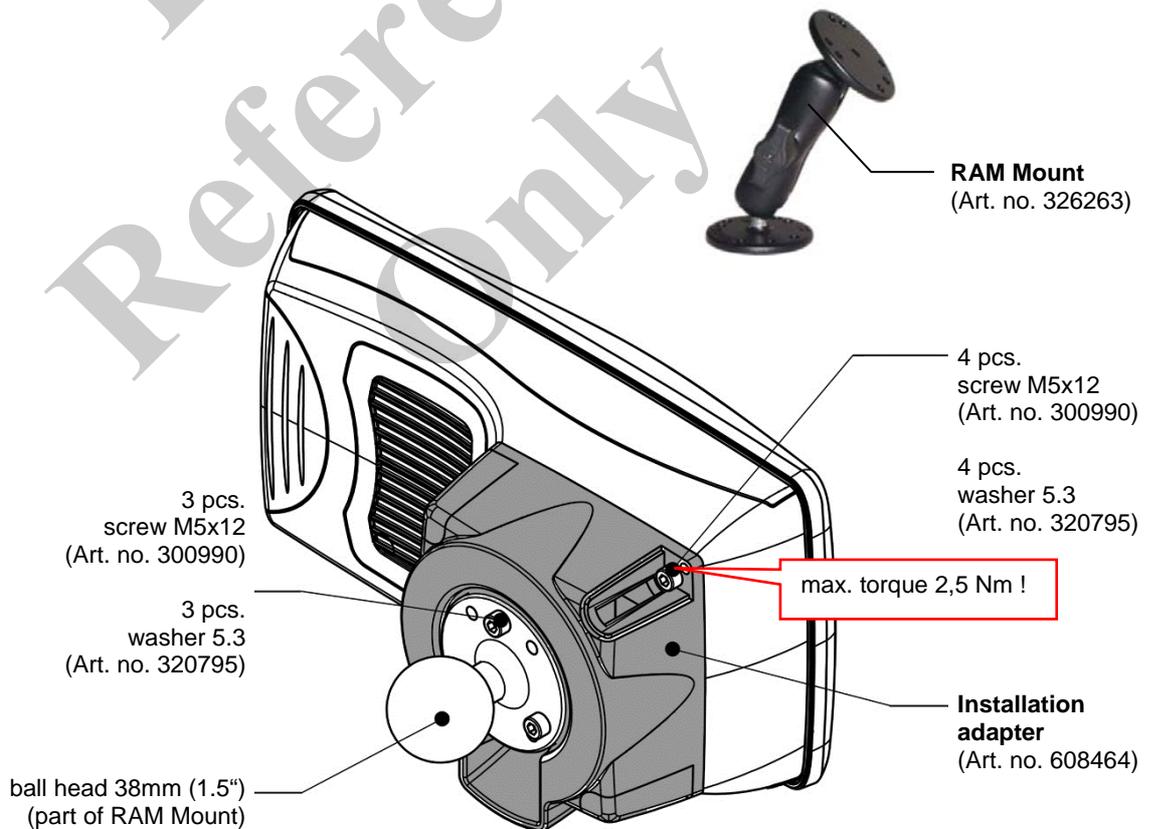
For the electrical wiring of the system and the console, please refer to the relevant connection and wiring diagram, which is not part of this manual.

3.1 Installation

The console is intended for vertical surface mounting or recessed mounting. Depending on installation type, corresponding installation accessories are required which may be supplied with the device depending on the version type.

3.1.1 Surface mounting

For surface mounting you will require the optionally available installation adapter and the RAM Mount™ articulated mounting.



Installation and wiring

3.1.2 Recessed mounting

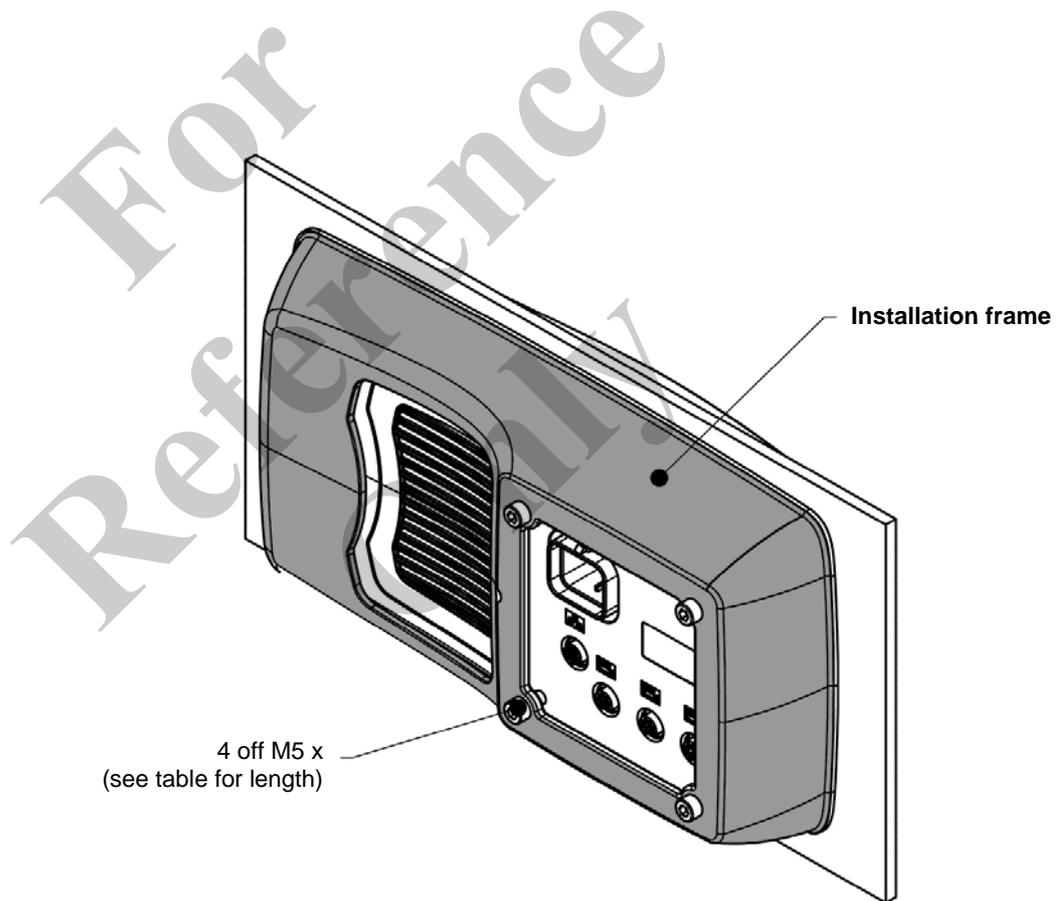
An installation frame, which is available as an accessory, is provided for recessed mounting in operating panels or instrument panels.

- **Installation frame:** Art. no. 608465



NOTE

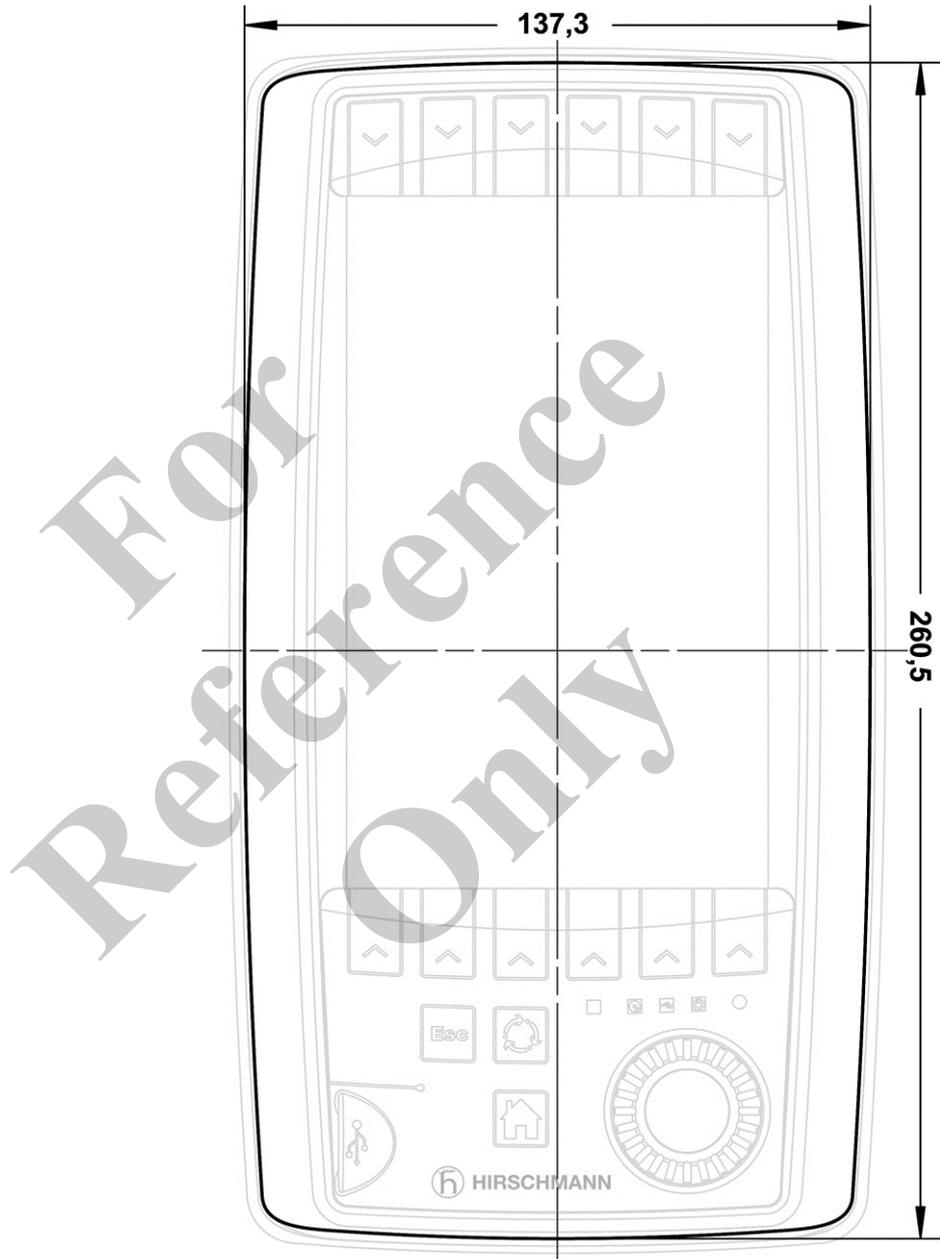
Please note that the material thickness of the operating panel may not exceed 10 mm!



Material thickness	Screw length
1...3 mm	M5 x 12
4...6 mm	M5 x 16
7...10 mm	M5 x 20

Installation and wiring

Cut-out dimensions The dimensions for the cut-out in the operating panel can be taken from the following sketch:



Template On request you can also print out the templates (last page in this manual).

Installation and wiring

Installation
Installation frame

4 x M5 screws, DIN EN ISO 4762 (DIN 912) and matching spacers are used for mounting of the installation frame.

IMPORTANT

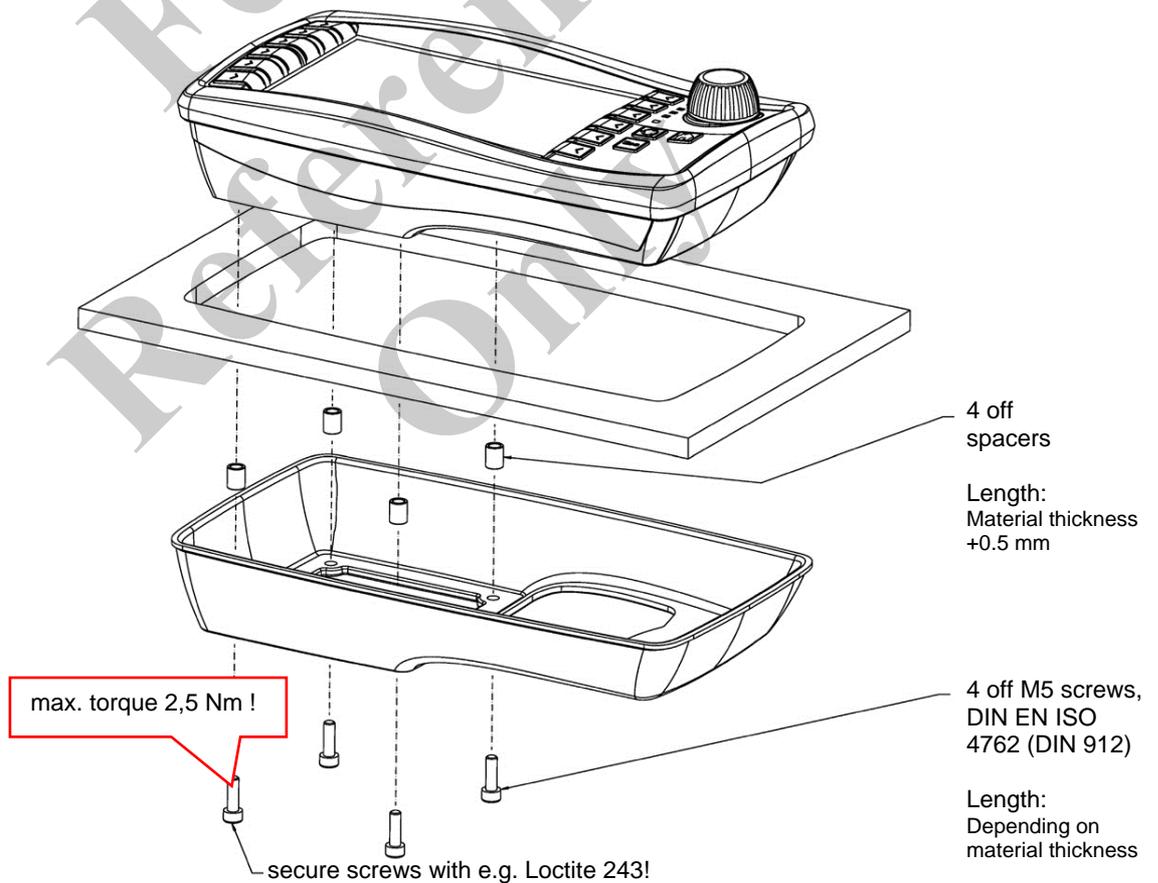
Console could be damaged by use of screws of the wrong length and excessive torque!

Note the screw length information in the following overview.

The maximum screw tightening torque is 1 Nm.

The length of the screws depends on the material thickness of the operating panel:

Material thickness 1 to 3 mm: M5 x 12 4 to 6mm: M5 x 16 7 to 10 mm: M5 x 20



Installation and wiring

3.2 Electrical connection

The electrical wiring for the system and the console can be found in the current connection and wiring diagram for your crane. It is not included in this manual.



CAUTION

Danger of electrical short-circuits.

Switch off all systems before commencing with the installation work!

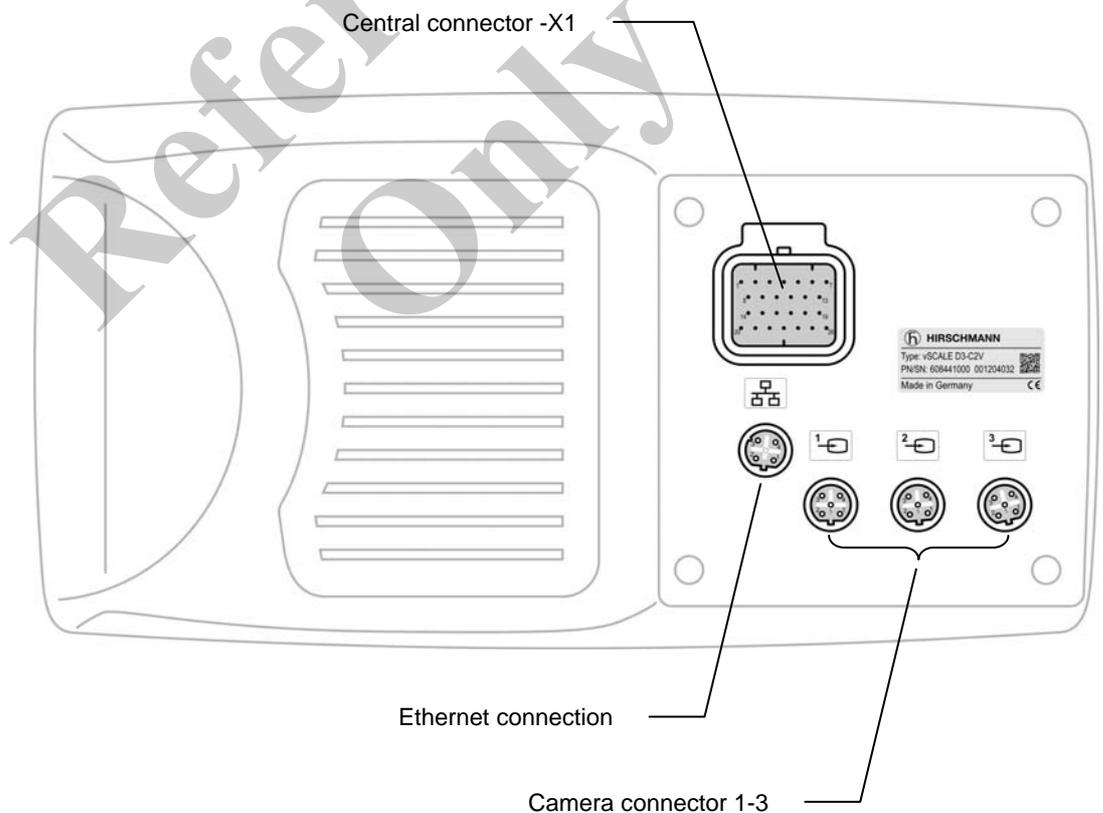
IMPORTANT

Connection to the wrong power supply will cause damage to the device.

The device may only be connected to a DC voltage source of 9 V to 36 V!

Connections and interfaces can be found on the back of the device. You need to remove this first if using the installation adapter.

Back of device



Installation and wiring

3.2.1 Central connector –X1

The central connector –X1 contains terminals for the power supply, ignition, grounds, CAN-Bus (1 and 2), USB, RS232 and further signals.

Matching counter-
connector parts

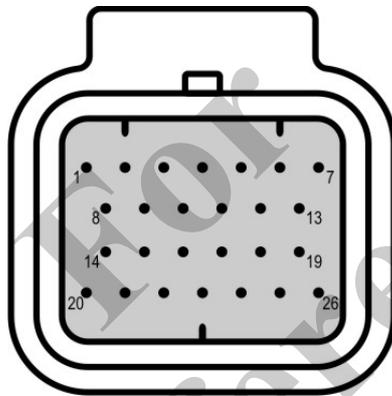
Connector kit: 1x connector, 26x crimp contacts, 26x dummy plug

Art. no. 536276

Crimping tool: special tool

Art. no. (on request)

Connector overview



Pin assignation

1	Vcc +8...36 V (terminal 30)	14	USB D-
2	Ignition (terminal 15)	15	USB D+
3	GND (terminal 31)	16	RS232 RxD
4	Chassis GND	17	RS232 TxD
5	<i>n.c.</i>	18	RS232 GND
6	<i>n.c.</i>	19	AI/DI 3 (optional)
7	<i>n.c.</i>	20	AI/DI 1 (optional)
8	CAN1 high	21	AI/DI 2 (optional)
9	CAN1 low	22	AI/DI 4 (optional)
10	CAN2 high	23	SERV_ENABLE
11	CAN2 low	24	DO 3
12	USB Vcc (+5 V)	25	DO 1
13	USB GND	26	DO 2

Installation and wiring

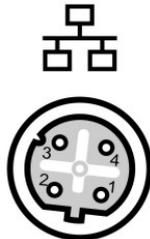
3.2.2 Ethernet connection

There is an Ethernet interface available for programming purposes.

Matching counter-connector parts

Ethernet Patch-Kabel, 1m, M12, 4-pin, <-> RJ45 Art. no. 326603
Ethernet Patch-Kabel, 5m, M12, 4-pin, <-> RJ45 Art. no. 325900

Connector overview



Pin assignment

- 1 TD+
- 2 RD+
- 3 TD-
- 4 RD-

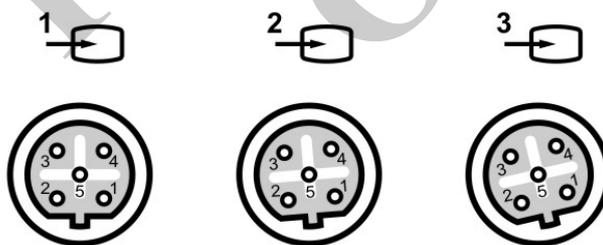
3.2.3 Camera connection (not used)

Three video interfaces are available for integrating video signals.

Matching counter-connector

Round connector M12, 5-pin, PIN, B-coded, according to EN 61076-2-101.
Cable available on request.

Connector overview



Pin assignment

- 1 Video Signal +
- 2 Camera Control
- 3 Camera +
- 4 Camera -
- 5 Video Signal GND

Commissioning

4 Commissioning

This chapter contains information, advice and instructions for commissioning the device.

4.1 Switching device on and off

The working area limiting device has no on/off switch. The console automatically switches on after connecting the power supply and control voltage (ignition, terminal 15)

Upon completion of the boot process and the internal system tests the main menu appears on the screen.

For
Reference
Only

Operation

5 Operation

This chapter contains information, advice and instructions for using the console. You will also find the description of function elements and menus.

5.1 Functional elements



Function keys F1 to F12: for calling operating functions



Light sensor: measures the ambient brightness for controlling the background lighting



Operating display: shines green when the supply voltage is connected



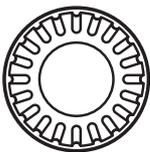
USB data display: shines yellow when data is exchanged via the front USB interface



Status display: (no function here)



Multi-function light, coloured: (no function here)



Encoder with pushbutton function: for selection and confirmation when making inputs



Function key (System): (no function here)



Function key (Home): calls up the SLI main menu:



Function key (Esc): (no function here)

Operation

5.2 Function keys (soft keys)

The F1...F12 key functions are displayed with assigned symbols:

Example



Colour bars

The function key symbols normally have grey sidebars.

Certain statuses are indicated by the change in colour or flashing of these sidebars:

Examples



Grey

Relevance here: no geometrical limit is programmed



Green

Relevance here: Geometrical limits are programmed and active



Red

Relevance here: Geometrical limit has been exceeded

Operation

5.3 Working area limiter

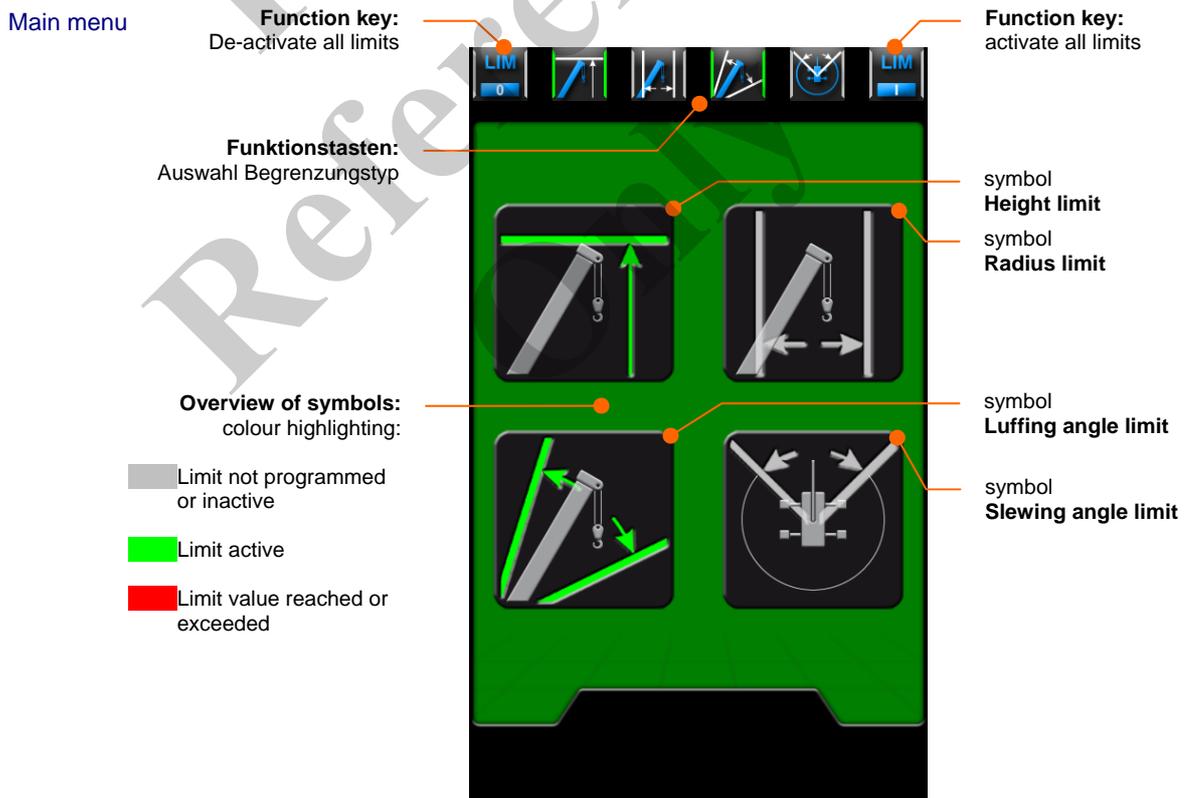
The SLI system has programmable functions to limit geometrical values of the working area:

- Height limitation > See chapter [5.3.1](#)
- Radius limitation > See chapter [5.3.2](#)
- Luffing angle limitation > See chapter [5.3.3](#)
- Slewing angle limitation > See chapter [5.3.4](#)

Programming is carried out via an interactive menu.

The functions can be set individually or in combination. Active limit values are indicated by the display of colour-highlighted symbols.

Exceeding a programmed limit value causes a corresponding flashing symbol to be displayed and an acoustic alarm warning to be sounded. With the correct wiring of the LMB the corresponding crane movement is cut-off by the LMB.



Operation

5.3.1 Height limitation

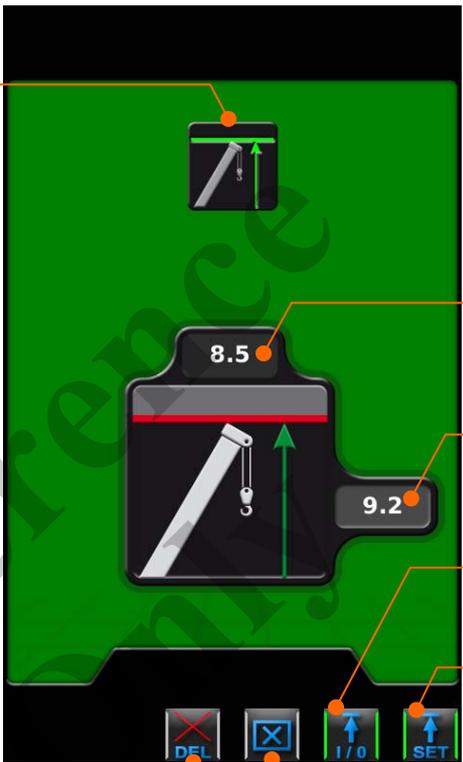
Programmable function to limit the maximum boom tip height.



Calling up the height limitation function from the main menu:

Height limit symbol:

-  Limit not programmed or inactive
-  Limit active
-  Limit value reached or exceeded



Current height

Saved limit value

Switch on/off height monitoring

Save current boom tip height as limit value

Back to the main menu

Reset all limits

Operation

5.3.2 Radius limitation

Programmable function to limit the minimum/maximum boom radius.



Calling up the radius limitation function from the main menu:

Radius limit symbol

- Limit not programmed or inactive
- Limit active
- Limit value reached or exceeded

Current radius: 8.9

Saved limit value of minimum radius: 5.2

Saved limit value of maximum radius: 9.7

Switch on/off minimum radius monitoring

Save current radius as minimum limit value

Switch on/off max. radius monitoring

Save current radius as maximum limit value

Back to the main menu

Reset all limits

Buttons: SET, I/O, DEL, I/O, SET

Operation

5.3.3 Luffing angle limitation

Programmable function for monitoring the upper/lower luffing angle.



Calling up the luffing angle limitation function from the main menu:

Luffing angle limit symbol:

- Limit not programmed or inactive
- Limit active
- Limit value reached or exceeded

Current luffing angle: 39.6

Saved limit value of upper luffing angle: 61.8

Saved limit value of lower luffing angle: 32.5

Switch on/off upper luffing angle monitoring

Save current angle as upper limit value

Switch on/off lower luffing angle monitoring

Save current angle as lower limit value

Back to the main menu

Reset all limits

Operation

5.3.4 Slewing angle limitation

Programmable function to limit the left / right slewing angle.



Calling up the slewing angle limitation function from the main menu:

Slewing angle limit symbol:

- Limit not programmed or inactive
- Limit active
- Limit value reached or exceeded

Current slewing angle

Display of current slewing angle limits

Saved limit value of right-hand slewing angle

Saved limit value of left-hand slewing angle

Switch on/off left-hand slewing angle monitoring

Switch on/off right-hand slewing angle monitoring

Save current radius as left-hand limit value

Save current radius as right-hand limit value

Back to the main menu

Reset all limits

Operation

5.4 Error messages

In case of disconnection of the CANopen communication with the LMB following screen appears:



If the error can not be reset by shutting down and restarting the system, there is probably a wiring fault.

6 Maintenance and Repair

Maintenance The **vSCALE D3** operating console contains no wearing parts and therefore cannot be opened. If you notice malfunctions or differences between actual and displayed measured values, you should switch the device off and have it checked and, if necessary, repaired immediately by an authorised Hirschmann service partner.

You must always keep the full details contained on the type plate to hand.

Cleaning Clean the surface and the front screen of the device occasionally with a damp cloth and a mild detergent. Never use abrasive or aggressive detergents however as these may damage the device.

IMPORTANT

Device may be damaged by the use of high pressure cleaners.

The device must not be treated with a high pressure cleaner or similarly aggressive methods under any circumstances!

Repair Damage to the front foil can lead to the penetration of moisture and dirt into the interior of the device, so that it must then be repaired properly without delay.

Keep the contacts and the area around the device connectors clean and check occasionally that all connections are secure.

If parts are damaged, these must be repaired properly or replaced immediately.

Technical Data

7 Technical Data

Part no.	608415 Console vSCALE D3-C1 (w/o Touch) 608416 Console vSCALE D3-C2 (with Touch)
Operating voltage	9...36 V DC, suitable for 12 and/or 24 V on-board power supply
Overvoltage protection	overvoltage up to max. 48V DC / 2 minutes
Reverse polarity protection	up to -48V DC
Display	7" TFT Color Graphic LCD, 800 x 480 Pixel (WVGA)
Brightness	400 cd/m ² typical
Contrast	400:1
Illumination	LED, adjustable brightness
Acoustic alarm	built-in
Dimensions	H 267 mm x W 144 mm x D 76,2 mm (without plugs or installation accessories)
Operating temperature range	-40°C to +75°C
Storage temperature range	-40°C bis +85°C
Protection class	IP 67, suitable for outdoor use
Scope of supply	- vSCALE D3 operating console (depending on scope of delivery with pre-fitted bracket for RAM Mount) - User manual (PDF file)

Feedback

Suggestions for improvements and amendments:

.....
.....
.....
.....
.....
.....
.....
.....

General comments:

.....
.....
.....
.....
.....
.....
.....
.....

Sender:

Company / Department

Name / Telephone no.

Street

Town / Post code

Date

Dear user,

**please complete both sides of this feedback form
and return it:**

- by fax to: +49 (0)7243 709 3222
- by post to: Hirschmann Automation and Control GmbH
Technische Dokumentation
Hertzstr. 32-34
76275 Ettlingen

Thank you very much!





Feedback

Notes

For
Reference
Only

*For
Reference
Only*

690496_en, 2, en_US

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.

For
Reference
Only

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For
Reference
Only

For
Reference
Only

1 ANSI signage for the Maxcab cab

1.1 Overview graphics of Maxcab cab

Exterior cab

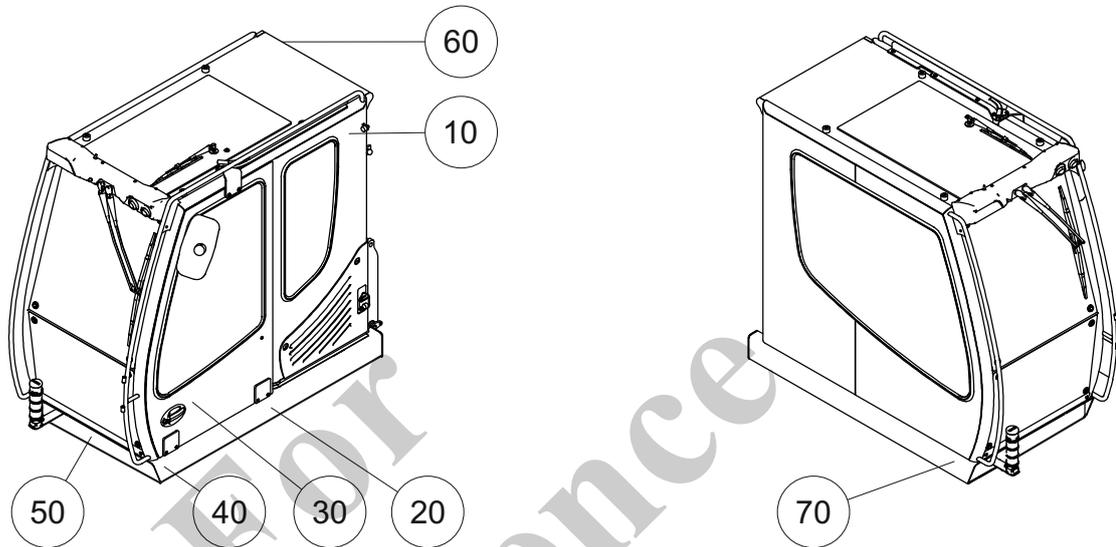


Fig. 1: Exterior cab signage

Interior cab

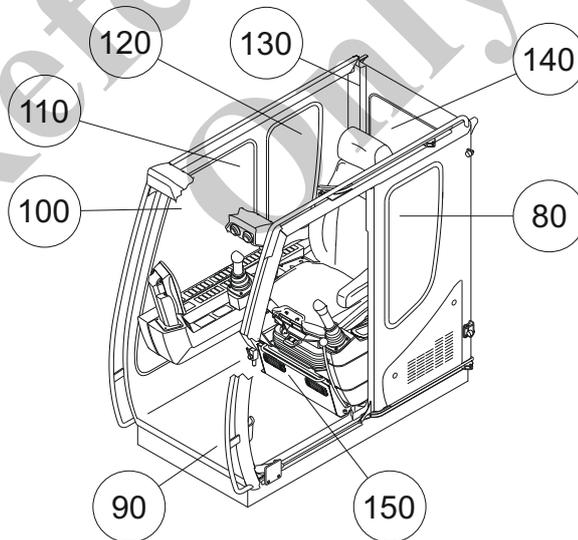


Fig. 2: Interior cab signage

ANSI signage for the Maxcab cab

ANSI warning and safety signage for Maxcab cab

Cab platform and safety guard

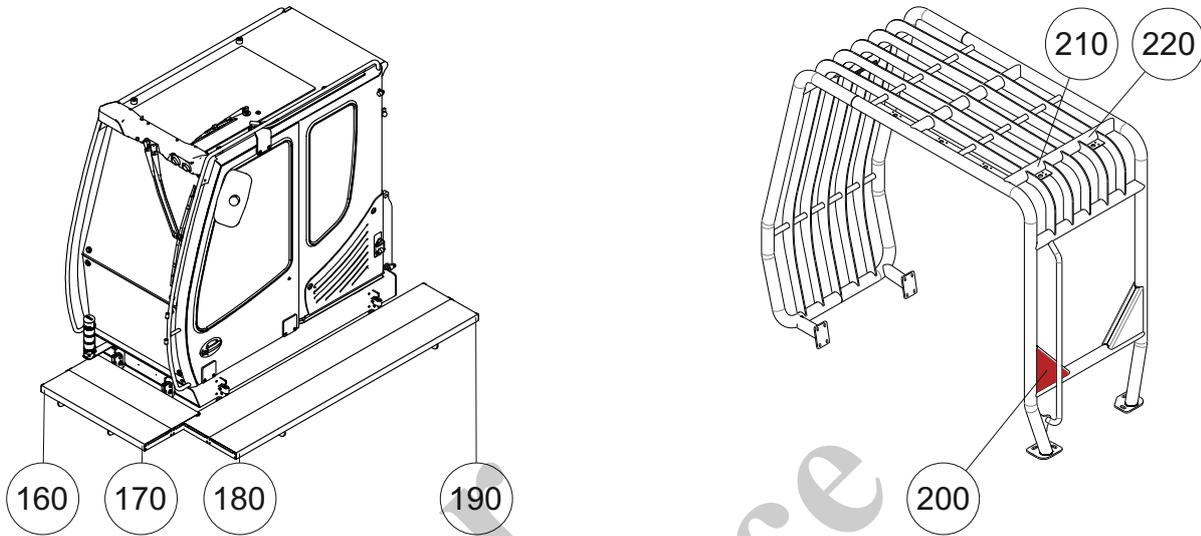


Fig. 3: Cab platform and FOPS signage

1.2 ANSI warning and safety signage for Maxcab cab

10

Fire extinguisher label



General application area	Fire extinguisher storage locations
	Option 1 ANSI
Option 2	Fire extinguisher
SE	187974

20

ANSI signage for the Maxcab cab

ANSI warning and safety signage for Maxcab cab

Risk of collapse/falling when exceeding maximum platform load per section as per DIN EN ISO 2867 and ISO 11660-2. Do not exceed maximum platform load.

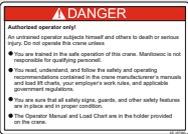
	General application area	Exterior cab, exterior uppercarriage
	Option 1	ANSI
	Option 2	Cab platform
	Option 3	Uppercarriage platform
SE	187962	

30

Danger. Electric current from overhead lines can result in death or serious injury. Maintain a safe distance.

	General application area	Interior cab Exterior cab
	Option 1	ANSI
	Option 2	Crane
SE	187236	

Danger. Operation by authorized personnel only.

	General application area	Interior cab, exterior cab
	Option	Grove
SE	187983	

ANSI signage for the Maxcab cab

ANSI warning and safety signage for Maxcab cab

Crane Star

	General application area	Exterior cab
	Option	Grove
SE	187881	

40

Warning. Rotating machine can cause death or serious injury. Stay clear of the danger zone.

	General application area	Exterior cab, exterior uppercarriage
	Option	ANSI
SE	187233	

50

Warning. Lowering cab can result in crushing. Stay clear of the danger zone.

	General application area	Front exterior cab
	Option 1	ANSI
	Option 2	Cab adjustment
SE	187973	

ANSI signage for the Maxcab cab

ANSI warning and safety signage for Maxcab cab

Warning. Falling loads can result in death or serious injury. Never stand under suspended loads.

	General application area	Exterior cab, uppercarriage access ladder
	Option	ANSI
SE	187957	

60

24 V socket label

	General application area	On every 24 V socket
	Option	24 V socket
SE	186587	

70

Warning. Rotating machine can cause death or serious injury. Stay clear of the danger zone.

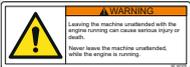
	General application area	Exterior cab, exterior uppercarriage
	Option	ANSI
SE	187233	

ANSI signage for the Maxcab cab

ANSI warning and safety signage for Maxcab cab

80

Never leave the machine unattended with the engine running.

	General application area	Interior cab
	Option	ANSI
SE	187979	

If you do not understand the language in the operating manual, you are not allowed to start the machine.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Grove
SE	187963	

Sound power level dB(A), Outdoor Guideline L_{WA}

Values: 85–115 dB

	General application area	Interior cab
	Option	EU
SE	186761, 186762, 186851 - 186879	

90

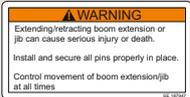
ANSI signage for the Maxcab cab

ANSI warning and safety signage for Maxcab cab

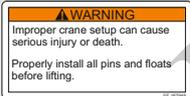
Danger. Electric current from overhead lines can result in death or serious injury. Maintain a safe distance.

	General application area	Interior cab Exterior cab
	Option 1	ANSI
	Option 2	Crane
SE	187236	

Warning. Folding boom extension or boom can cause death or serious injury. Only operate crane when properly assembled. Exercise caution in the danger zone.

	General application area	Interior cab
	Option	ANSI
SE	187947	

Warning. Improper crane assembly can result in death or serious injury. Only operate crane when properly assembled.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Crane
SE	187948	

ANSI signage for the Maxcab cab

ANSI warning and safety signage for Maxcab cab

Emergency exit label

	Material handling machine application area	Rear interior cab
	Other application area	Right interior cab
	Option	ANSI
SE	187970	

Danger. Crane falling backward can result in death or serious injury. Only operate crane when properly assembled.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Crane
SE	187951	

Danger. 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.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Crane
SE	187955	

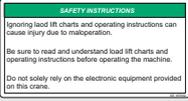
Warning. Suspended loads can cause death or serious injury to personnel below. Never swing suspended loads over personnel.

	General application area	Interior cab
	Option	ANSI
SE	187953	

ANSI signage for the Maxcab cab

ANSI warning and safety signage for Maxcab cab

Failure to observe load lift charts and operating instructions can result in death or serious injury.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Crane
SE	187952	

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Machine controller sticker

	General application area	Interior cab
	Option	---
SE	Various	

Operating mode sticker

	General application area	Interior cab
	Option	Material handling machine, telescopic cranes
SE	Various	

Crane Star

	General application area	Interior cab
	Option	Grove
SE	187877	

ANSI signage for the Maxcab cab

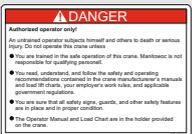
ANSI warning and safety signage for Maxcab cab

120

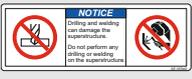
Danger. Improper use of the crane can cause death or serious injury. For proper use only as described in the manual.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Crane
SE	187950	

Danger. Operation by authorized personnel only.

	General application area	Interior cab, exterior cab
	Option	Grove
SE	187983	

Drilling and welding prohibited.

	General application area	Interior cab
	Option 1	ANSI
SE	187949	

130

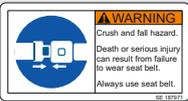
ANSI signage for the Maxcab cab

ANSI warning and safety signage for Maxcab cab

Warning. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

Risk of falling out of cab. Wear seat belt.

	General application area	Interior cab
	Option 1	ANSI
	Option 2	Seat belt
SE	187971	

140

Emergency exit label

	Material handling machine application area	Rear interior cab
	Other application area	Right interior cab
	Option	ANSI
SE	187970	

150

ANSI signage for the Maxcab cab

ANSI warning and safety signage for Maxcab cab

Emergency drop label

	General application area	On emergency drop levers
	Option 1	ANSI
	Option 2	Cab adjustment
SE	194111	

160

170

180

190

Warning sign hatching

	General application area	Outer edges of platform (machine boundaries), on shearing points
	Option	Platform
SE	187969	

180

Warning. Rotating machine can cause death or serious injury. Stay clear of the danger zone.

	General application area	Outer edges of platform (machine boundaries)
	Option 1	ANSI
	Option 2	Platform
SE	187993	

ANSI signage for the Maxcab cab

ANSI warning and safety signage for Maxcab cab

Other decals

Warning sign hatching

	General application area	On shearing points
	Option 1	Cab adjustment
	Option 2	Mobile undercarriage with claw support
SE	186734	

For
Reference
Only

ANSI signage for the Maxcab cab

ANSI warning and safety signage for Maxcab cab

For
Reference
Only

2 ANSI signage for GHC55 undercarriage

2.1 Overview graphics of GHC55 undercarriage

Crawler undercarriage

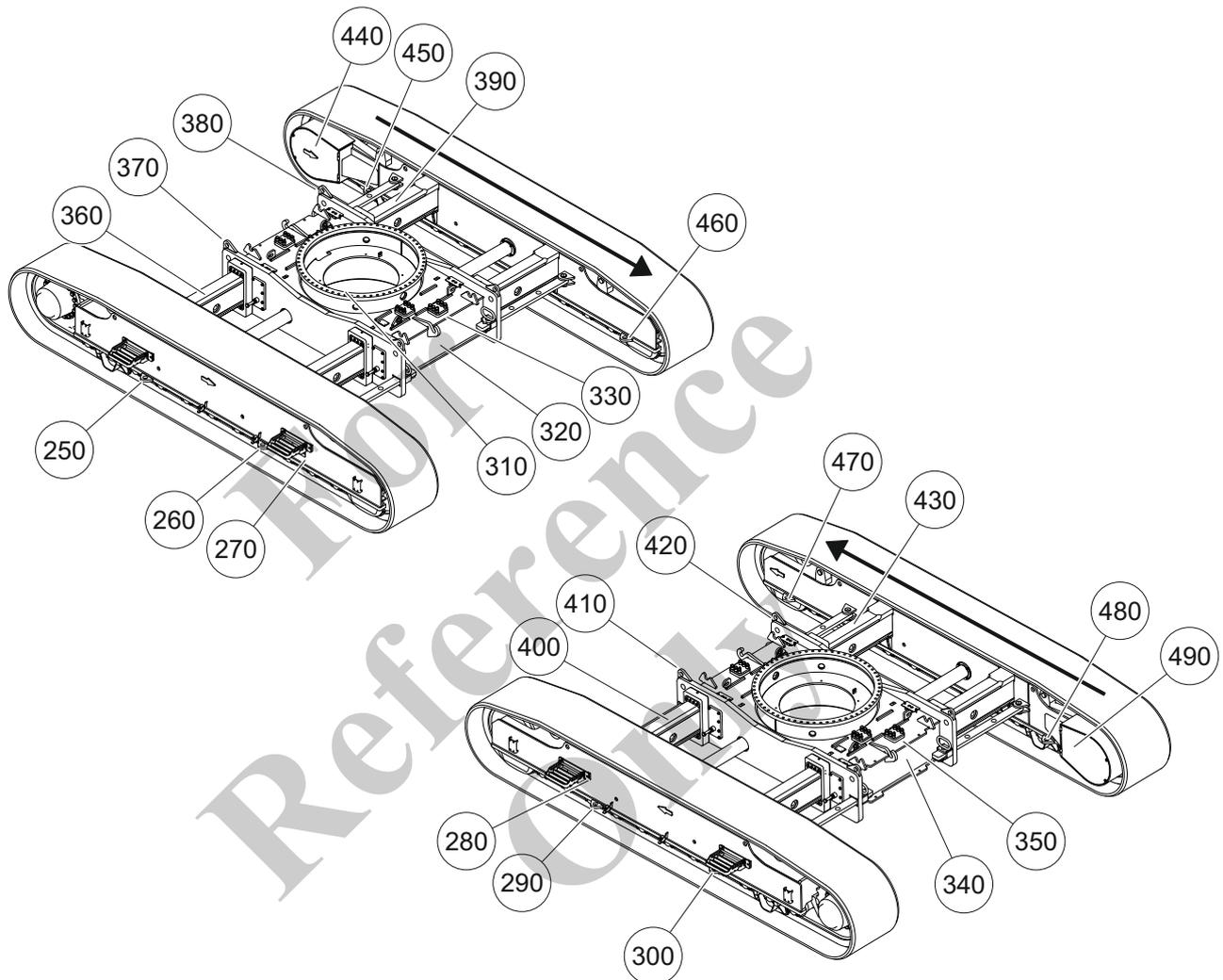


Fig. 4: Crawler undercarriage signage, front/rear view

2.2 Warning and safety signs on GHC55 undercarriage



ANSI signage for GHC55 undercarriage

Warning and safety signs on GHC55 undercarriage

Lashing point label

	General application area	On lashing points
	Option	---
SE	186793	

360

390

400

430

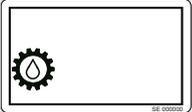
Insertion track label

	General application area	Stabilizer insertion tracks
	Option	Telescopic crawler undercarriage: MS40, MS30, MS16, T119, T73, T41/410HD
SE	187964	

440

490

Transmission oil

	General application area	Transmission lubricating point
	Option 1	Uppercarriage: diesel engine
	Option 2	Undercarriage: mobile and crawler
SE	See List of Operating Fluids and Lubricants	

ANSI signage for GHC55 undercarriage

Warning and safety signs on GHC55 undercarriage

270

280

Warning. Pressurized sealing cover can cause serious injury. Maintain a safe distance.

	General application area	Undercarriage
	Option 1	ANSI
	Option 2	Crawler undercarriage
SE	187944	

320

340

Warning. Retracting track wheel carrier can cause serious crushing injury. Stay clear of the danger zone.

	General application area	Between track wheel carriers
	Option 1	ANSI
	Option 2	Telescopic crawler undercarriage
SE	187942	

330

350

ANSI signage for GHC55 undercarriage

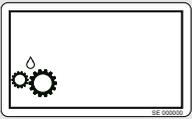
Warning and safety signs on GHC55 undercarriage

Grease

	General application area	Manual grease points
	Option	---
SE	See List of Operating Fluids and Lubricants	

310

Slewing ring grease

	General application area	Grease cylinder
	Option	---
SE	See List of Operating Fluids and Lubricants	

3 ANSI signage for GHC55 uppercarriage

3.1 Overview graphics of GHC55 uppercarriage

Exterior uppercarriage

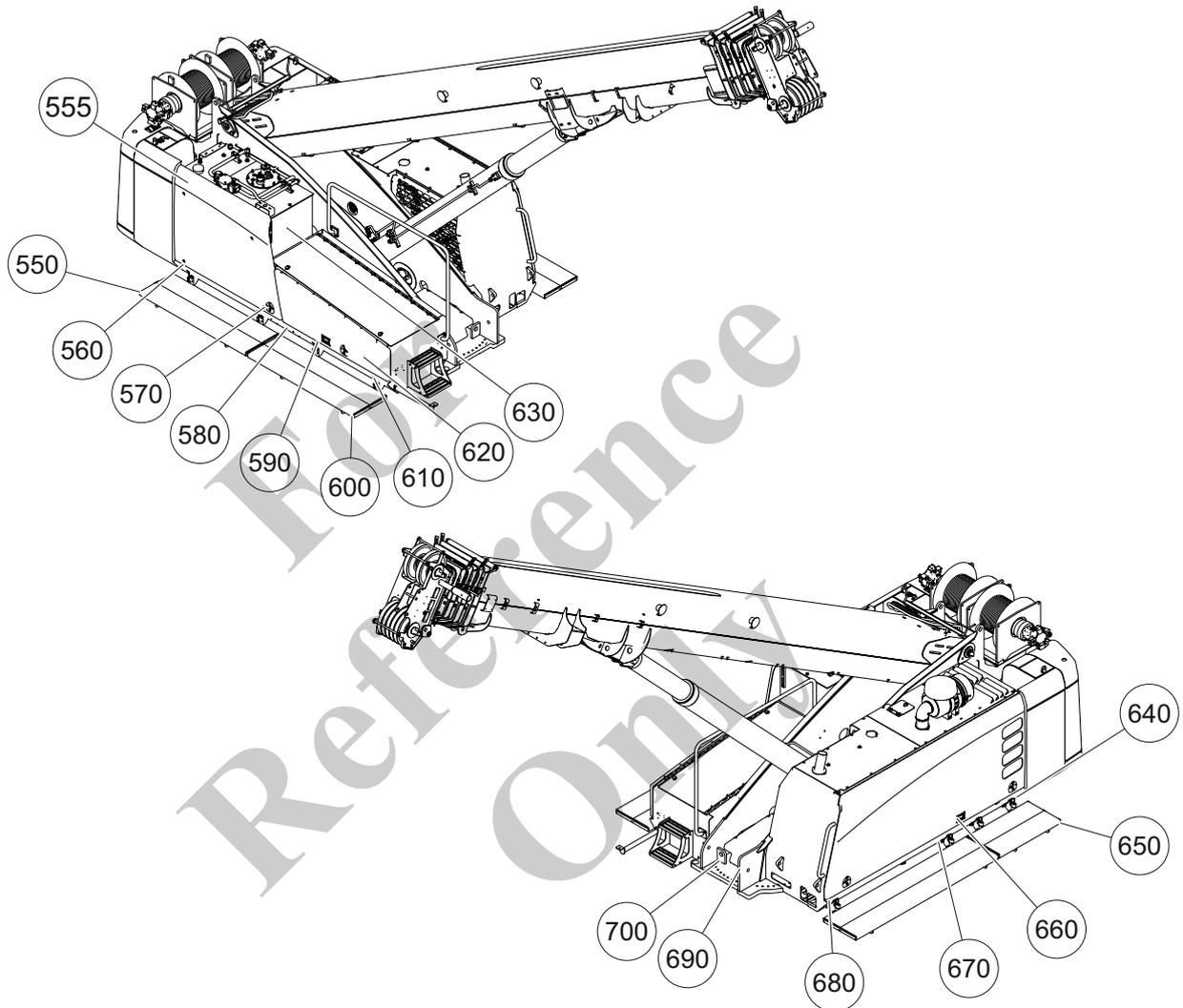


Fig. 5: Left/right exterior uppercarriage signage

ANSI signage for GHC55 uppercarriage

Overview graphics of GHC55 uppercarriage

Top uppercarriage

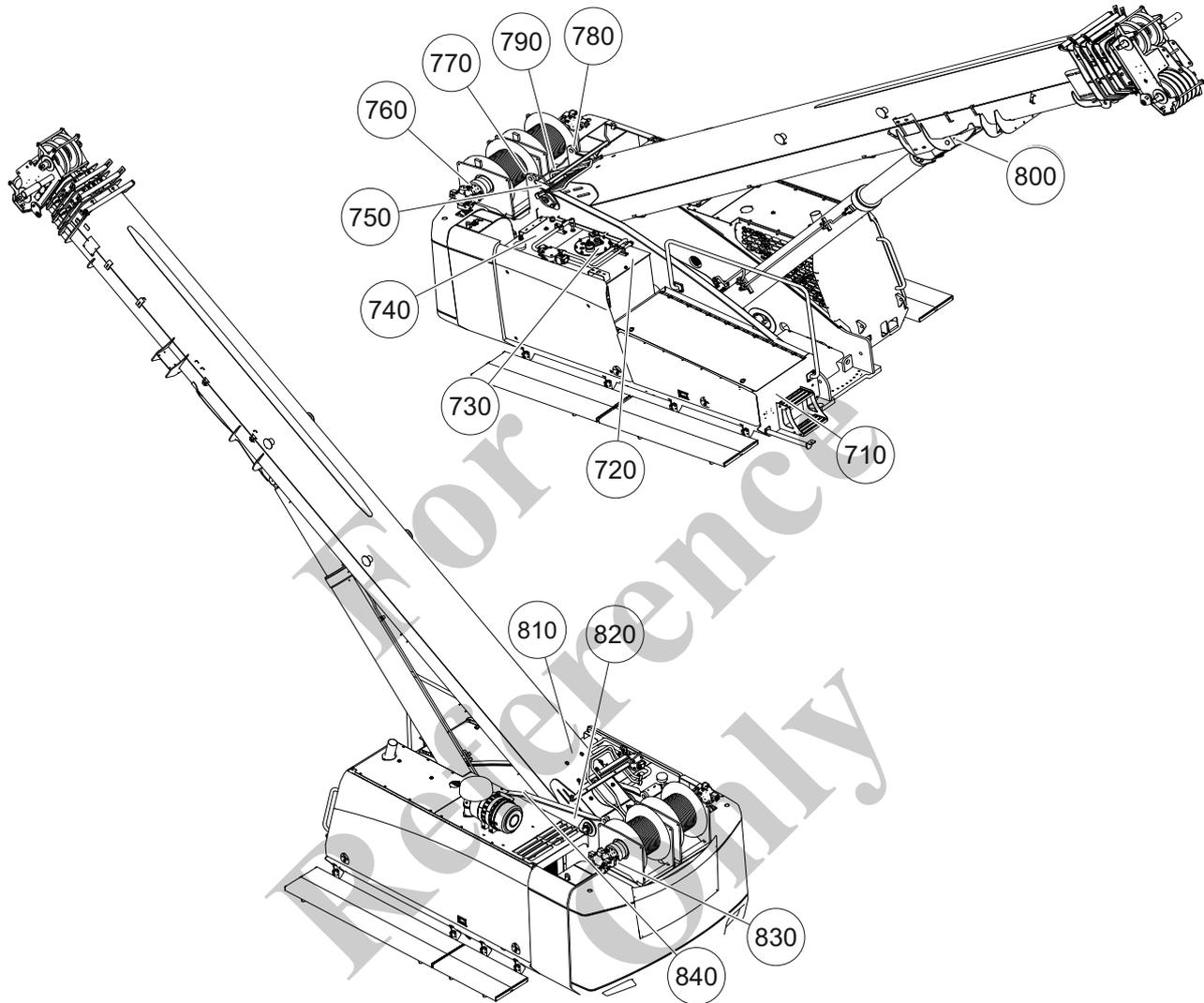


Fig. 6: Top left/right uppercarriage signage

Interior uppercarriage

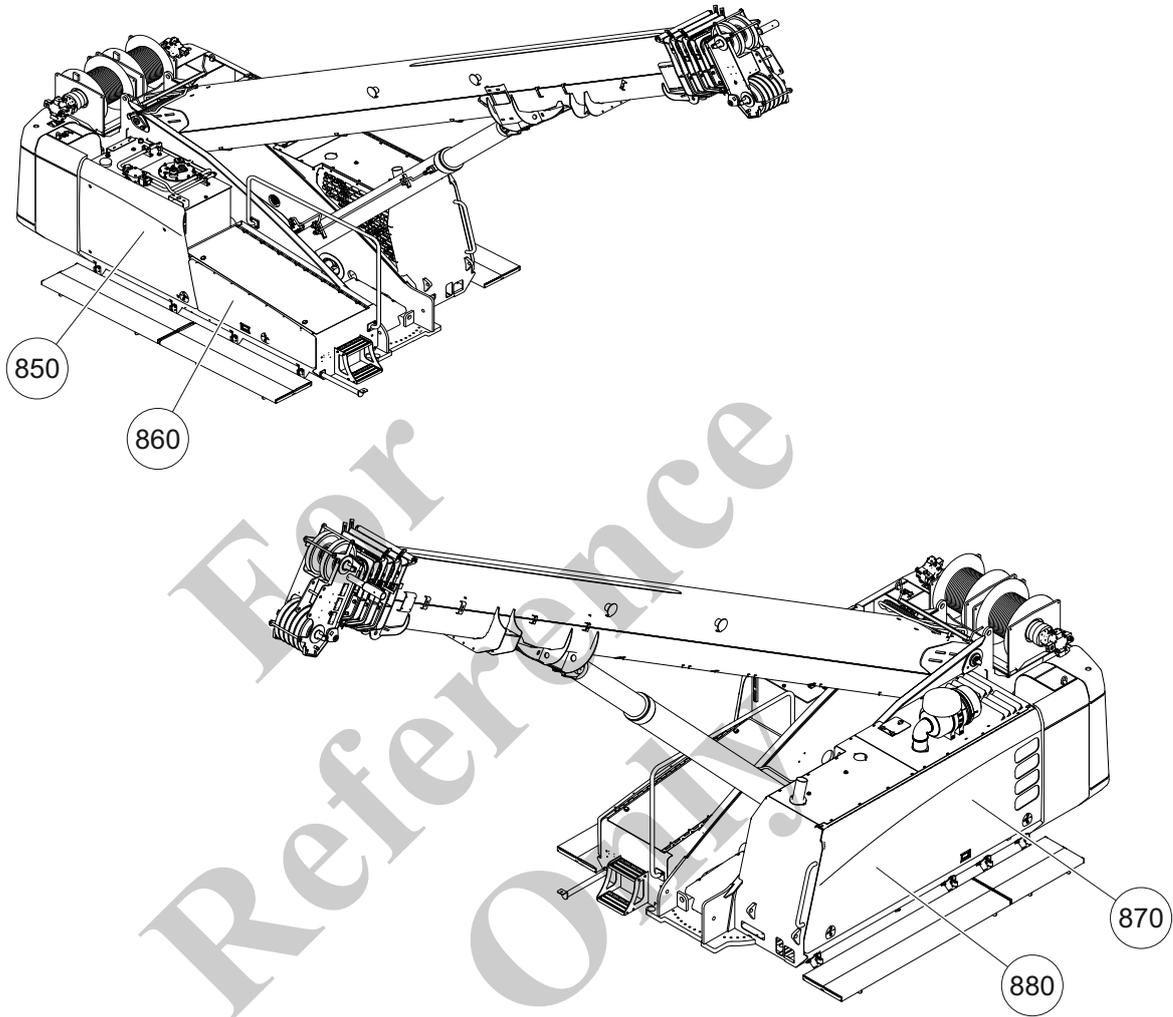


Fig. 7: Left/right interior uppercarriage signage

3.2 Warning and safety signs on GHC55 uppercarriage

550

600

650

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

Warning sign hatching

	General application area	On shearing points
	Option 1	Cab adjustment
	Option 2	Mobile undercarriage with claw support
SE	186734	

555

No smoking

	General application area	Diesel filler neck
	Option 1	ANSI
	Option 2	Diesel engine
SE	187984	

570

590

660

Warning. Risk of injury during maintenance. Turn off engine and remove ignition key before performing maintenance. Wear hard hat, eye protection, protective gloves and protective clothing. Read the manual.

	General application area	Exterior uppercarriage, uppercarriage access ladder
	Option	ANSI
SE	187976	

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

690

700

Lifting point label



General application area

On lifting points

Option

SE

186792

560

610

640

Warning. Rotating machine can cause death or serious injury. Stay clear of the danger zone.



General application area

Exterior cab, exterior uppercarriage

Option

ANSI

SE

187233

580

670

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

Risk of collapse/falling when exceeding maximum platform load per section as per DIN EN ISO 2867 and ISO 11660-2. Do not exceed maximum platform load.

	General application area	Exterior cab, exterior uppercarriage
	Option 1	ANSI
	Option 2	Cab platform
	Option 3	Uppercarriage platform
SE	187962	

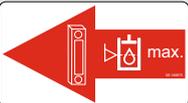
620

Crane hand signals

	General application area	Exterior uppercarriage
	Option 1	ANSI
	Option 2	Crane
SE	187888	

630

Max. oil capacity label

	General application area	Hydraulic oil level indicator
	Option	---
SE	186975	

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

680

Warning. Lowering cab can result in crushing. Stay clear of the danger zone.

	General application area	On shearing points between cab and uppercarriage
	Option 1	ANSI
	Option 2	Cab adjustment
SE	187972	

760

830

Warning. Winding winch can cause serious injury. Do not touch while in operation.

	General application area	Winch spool (rope guide)
	Option 1	ANSI
	Option 2	Winch spool (rope guide)
SE	187943	

Transmission oil

	General application area	Transmission lubricating point
	Option 1	Uppercarriage: diesel engine
	Option 2	Undercarriage: mobile and crawler
SE	See List of Operating Fluids and Lubricants	

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

750

820

Warning. Improper fastening of the rope can cause serious injury. Read the manual.

	General application area	Top uppercarriage
	Option 1	ANSI
	Option 2	Winch with rope
SE	187961	

Warning. Moving machine parts can cause serious crushing injury. Do not touch while in operation.

	General application area	Boom
	Option 1	ANSI
	Option 2	Retractable boom
SE	187945	

710

Warning. Risk of injury during maintenance. Turn off engine and remove ignition key before performing maintenance. Wear hard hat, eye protection, protective gloves and protective clothing. Read the manual.

	General application area	Exterior uppercarriage, uppercarriage access ladder
	Option	ANSI
SE	187976	

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

Warning. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

No unauthorized access

	General application area	Uppercarriage access ladder
	Option	ANSI
SE	187956	

Warning. Falling loads can result in death or serious injury. Never stand under suspended loads.

	General application area	Exterior cab, uppercarriage access ladder
	Option	ANSI
SE	187957	

Risk of falling. Attach safety harness and wear safety shoes.

	General application area	Top uppercarriage
	Option	ANSI
SE	187946	

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

Warning. Unauthorized use of the ladder can cause injury from falling. Authorized personnel only.

	General application area	Uppercarriage access ladder
	Option	ANSI
SE	187958	

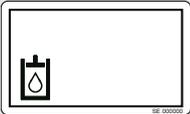
720

Risk of falling. Keep off.

	General application area	Top uppercarriage
	Option	ANSI
SE	187985	

730

Hydraulic oil

	General application area	Hydraulic oil tank
	Option	---
SE	See List of Operating Fluids and Lubricants	

ANSI signage for GHC55 uppercarriage

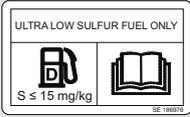
Warning and safety signs on GHC55 uppercarriage

740

No smoking

	General application area	Diesel filler neck
	Option 1	ANSI
	Option 2	Diesel engine
SE	187984	

Sulfur-free diesel fuel or diesel fuel with less than 15 mg/kg sulfur content only.

	General application area	Top uppercarriage: diesel filler neck
	Option 1	Diesel engine
	Option 2	Tier IIIb/Tier 4i/Tier 4f
SE	186976	

770

780

Lifting point label

	General application area	On lifting points
	Option	---
SE	186792	

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

790

Warning. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

800

Grease

	General application area	Manual grease points
	Option	---
SE	See List of Operating Fluids and Lubricants	

840

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

Warning. Overflow or boil-over can cause serious injury or scalding. Maintain a safe distance.

	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187960	

Warning. Hot surface can cause burns. Maintain a safe distance.

	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187978	

810

Keep off

	General application area	Top uppercarriage, AdBlue [®]
	Option 1	ANSI
	Option 2	Installing AdBlue [®] tank on exterior uppercarriage
SE	187987	

850

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

Warning. Voltage can cause electric shock or burns. Turn off machine before performing maintenance.

	General application area	Interior uppercarriage, top uppercarriage
	Option 1	ANSI
	Option 2	Generator
SE	187980	

Warning. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

24 V socket label

	General application area	On every 24 V socket
	Option	24 V socket
SE	186587	

HydroClean label

	General application area	Interior uppercarriage: HydroClean
	Option 1	HydroClean
	Option 2	Grove
SE	187994	

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

Hydraulic oil sampling point label

 <p>SE 186594</p>	General application area	Hydraulic oil sampling point
	Option	---
SE	186594	

860

Warning. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

 <p>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>	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

Warning. Pressurized and/or corrosive fluids can cause serious injury. Wear protective gloves and eye protection.

 <p>WARNING Skin injection hazard due to high pressure and/or caustic fluids. Failure to follow this warning can result in amputation or serious injury. Protect hands and eyes from high pressure and caustic fluids. Relieve pressure before disconnecting hydraulic lines and tighten all connections before applying pressure. In case of accidental skin injection seek immediate medical attention.</p>	General application area	Interior uppercarriage: drive motor Interior uppercarriage: central hydraulic system Top uppercarriage: drive motor Top uppercarriage: hydraulic connections
	Option	ANSI
SE	187981	

ANSI signage for GHC55 uppercarriage

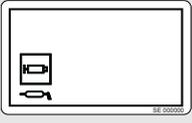
Warning and safety signs on GHC55 uppercarriage

AdBlue®

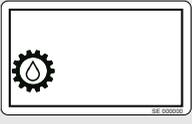
Diesel exhaust fluid for US EPA Tier 4 final/EU Level IV diesel engines

	General application area	At filling point
	Option 1	AdBlue®
	Option 2	Tier IIIb/Tier IVi/Tier IVf
	Option 3	Grove
SE	187996	

Grease

	General application area	Manual grease points
	Option	---
SE	See List of Operating Fluids and Lubricants	

Transmission oil

	General application area	Transmission lubricating point
	Option 1	Uppercarriage: diesel engine
	Option 2	Undercarriage: mobile and crawler
SE	See List of Operating Fluids and Lubricants	

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

Do not clean with high-pressure cleaner.

	General application area	Interior uppercarriage: central hydraulic system Interior uppercarriage: switch cabinet Top uppercarriage: optional generator
	Option 1	ANSI
	Option 2	Generator
SE	187977	

Warning. Overflow or boil-over can cause serious injury or scalding. Maintain a safe distance.

	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187960	

Coolant

	General application area	Coolant reservoir
	Option	---
SE	See List of Operating Fluids and Lubricants	

Warning. Hot surface can cause burns. Maintain a safe distance.

	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187978	

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

Warning. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

Warning. Rotating fan blades can cause serious injury. Maintain a safe distance.

	General application area	Interior uppercarriage and top uppercarriage: fan
	Option	ANSI
SE	187941	

Warning. Rotating belt drive can cause serious injury. Maintain a safe distance.

	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187982	

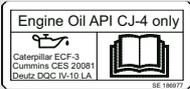
Warning. Pressurized and/or corrosive fluids can cause serious injury. Wear protective gloves and eye protection.

	General application area	Interior uppercarriage: drive motor Interior uppercarriage: central hydraulic system Top uppercarriage: drive motor Top uppercarriage: hydraulic connections
	Option	ANSI
SE	187981	

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

Only use engine oils as per specification ACEA E9-08 or API CJ-4.

 <p>Engine Oil API CJ-4 only Caterpillar ECF-3 Cummins CES 20081 Deutz DQC IV-10 LA SE 186977</p>	General application area	Interior uppercarriage: diesel engine
	Option 1	Diesel engine
	Option 2	Tier IIIb/Tier IVi/Tier IVf
SE	186977	

Engine oil

 <p>SE 02020</p>	General application area	Engine oil reservoir or dipstick
	Option	Diesel engine
SE	See List of Operating Fluids and Lubricants	

880

Warning. Hot surface can cause burns. Maintain a safe distance.

 <p>WARNING Hot surface. Contact can result in serious burn. Do not touch. SE 187978</p>	General application area	Interior uppercarriage, top uppercarriage
	Option	ANSI
SE	187978	

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

Warning. Failure to read the operating manual and safety information can result in death or serious injury. Manual must be kept in the machine at all times.

	General application area	Interior cab, interior uppercarriage, undercarriage hitch, other
	Option 1	ANSI
	Option 2	Hitch
SE	187975	

Warning. Risk of explosion from overheated battery. No smoking or open flame.

	General application area	Interior uppercarriage: battery
	Option 1	ANSI
	Option 2	Diesel engine
SE	187989	

Warning. Corrosive battery acid and lead can cause serious injury. Maintain a safe distance.

	General application area	Interior uppercarriage: battery
	Option 1	ANSI
	Option 2	Diesel engine
SE	187988	

Warning. Pressurized and/or corrosive fluids can cause serious injury. Wear protective gloves and eye protection.

	General application area	Interior uppercarriage: drive motor Interior uppercarriage: central hydraulic system Top uppercarriage: drive motor Top uppercarriage: hydraulic connections
	Option	ANSI
SE	187981	

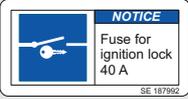
ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

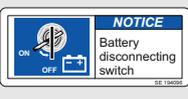
24 V socket label

	General application area	On every 24 V socket
	Option	24 V socket
SE	186587	

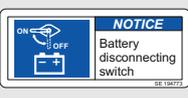
40 A ignition fuse label

	General application area	Interior uppercarriage: battery
	Option 1	ANSI
	Option 2	Diesel engine
SE	187992	

Battery disconnect switch label

	General application area	Interior uppercarriage: battery
	Option 1	ANSI
	Option 2	"Key" switch
	Option 3	Diesel engine
SE	194096	

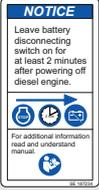
Battery disconnect switch label

	General application area	Interior uppercarriage: battery
	Option 1	ANSI
	Option 2	"Bone" switch
	Option 3	Diesel engine
SE	194773	

ANSI signage for GHC55 uppercarriage

Warning and safety signs on GHC55 uppercarriage

Leave battery disconnect switch on for at least 2 minutes after turning off diesel engine. Read manuals for more information.

	General application area	Interior uppercarriage: battery disconnect switch
	Option 1	ANSI
	Option 2	Diesel engine
SE	187234	

For Reference Only

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*For
Reference
Only*

OPERATOR MANUAL

This manual has been prepared for and is considered part of the

Auger Option

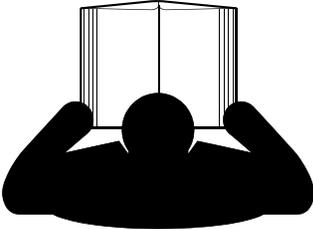
This Manual is divided into the following sections:

1-1	SAFETY
1-1	OPERATION
1-1	AUGER SYSTEM DESCRIPTION
1-7	SPECIFICATIONS
1-7	LUBRICATION - DIGGER DRIVE GEAR
1-8	TROUBLESHOOTING

NOTICE

The crane serial number is the only method your distributor or the factory has of providing you with correct parts and service information.

Always furnish crane serial number when ordering parts or communicating service problems with your distributor or the factory.



DANGER

An untrained operator subjects himself and others to death or serious injury. Do not operate this crane unless:

- You are trained in the safe operation of this crane. Manitowoc is not responsible for qualifying personnel.
- You read, understand, and follow the safety and operating recommendations contained in the crane manufacturer's manuals and load charts, your employer's work rules, and applicable government regulations.
- You are sure that all safety signs, guards, and other safety features are in place and in proper condition.
- The Operator Manual and Load Chart are in the holder provided on crane.

 **CALIFORNIA
PROPOSITION 65 WARNING**

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

 **CALIFORNIA
PROPOSITION 65 WARNING**

Battery posts, terminals, and related accessories contain chemical lead and lead compounds, chemicals known to the State of California to cause cancer, birth defects or other reproductive harm. Wash hands after handling.

The original language of this publication is English.

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OPTIONS AUGER

The following safety rules apply specifically to the auger 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 crane Operator Manual.

The contents of this section are provided as follows:

- Safety
- Operation
- Service & Maintenance
- Specifications

The information provided in these sections should be read carefully before attempting to operate or service the auger system.

SAFETY

The safe operation of the auger system depends on you, the condition of your equipment, and your maintenance and inspection procedures. As an integral part of the crane, the "Safety and Operation" section of this manual applies to the auger system, an should be read carefully and the procedures there-in followed.

The crane operator and service mechanic are the key in any safety program, study all sections of the safety manual to be aware of the safety precautions presented to help prevent serious injury to themselves and other personnel. The following is designed to present some of the daily work problems which may be encountered by the operator, service, and other personnel.

Safety Tips - Auger Equipped Cranes

- Do not operate cranes or accessories within 6 m (20 ft) of live powers lines.
- Check for buried underground utilities service, i.e. power lines, telephone lines and gas lines before digging.
- Before transporting units, maker sure auger is stowed properly and that all pins, fasteners, and latches are in place and secure.
- Inspect all auger system components prior to operation. Check fasteners, pins, stow rope, hydraulic components and weldments.
- Prior to operation of the auger, set track width following normal procedures described in the Operation Section of this manual.
- Never stow or unstow auger until all persons are clear of the area.

- Stow only in the proper direction as indicated on the controls.
- Stand clear of auger flighting and rotating shaft during digging, cleaning and stowing operation to avoid entanglement.
- While digging, feed the auger downward **slowly** with the boom to avoid "cork-screwing" the auger into the ground. **Not booming down while digging can cause the auger to overload the crane.**
- Do not push down excessively with the boom to force the auger into the ground. This could cause machine to raise from the ground.

AUGER SYSTEM DESCRIPTION

The auger system hydraulic schematic is called out on the full crane hydraulic schematic which is provided with the crane service manuals.

An over wind protection valve on the stow bracket diverts flow from the digger when contact occurs between the flighting and this valve during the stowing procedure. This will prevent rope, stow bracket, and flighting damage due to inadvertent overwind by the operator.

The digger drive is provided with a two speed hydraulic motor providing shift on the fly operation

Speed Shift Circuit

The auger shift shifts the auger motor speed from low to high as the pressure changes to provide a constant torque while digging.

Pilot pressure of 35 bar (500 psi) is required to shift the motor from low to high speed, with a spring return to low speed. A pressure reducing valve circuit maintains pressure, an electric solenoid valve and a de-acceleration valve in the digger head provides instant speed selection when the auger drilling speed shift switch (3 Figure 1) is pressed.

Latch Circuit

The cylinder used to open and close the stow bracket latch is operated using oil from the reverse/stow circuit. The cylinder is a double acting hydraulic cylinder with both ports connected together with a orifice in between, The base side of the cylinder is plumbed to a line that goes to a normally closed solenoid valve. The rod side of the cylinder is connected to the reverse/stow line. The pressure used to stow the auger or keep it from falling is therefore present on both sides of the cylinder.

Pushing the auger latch switch (4, Figure 1) opens the normally closed solenoid allowing the oil in the cylinder to

return to the tank. The orifice creates a pressure drop across the cylinder, which retracts the cylinder. Once the button is pressed again both sides are pressurized by the oil to create equal pressure on both sides of the cylinder. The area ratio of the cylinder keeps the cylinder closed. Because of this it is necessary to be operating the auger rotation/stow joystick (1) in the reverse/stow position to retract the cylinder and open the latch.

Auger System

The auger system consists of:

- Hydraulically shifted two speed digger motor which drives the auger flighting.

- A stow bracket and lock mechanism with wind-up rope for storing auger on the boom.
- An auger mount assembly and boom transfer mechanism.
- Digger hydraulic control circuit for forward, reverse and digging speed.
- Digging and stowing controls.

Auger Controls

The Auger controls are located in the crane Operator Cab.

The following information will cover only the functionality of the Auger controls shown in Figure 1; for information on all other Operator's controls see the crane Operator Manual.

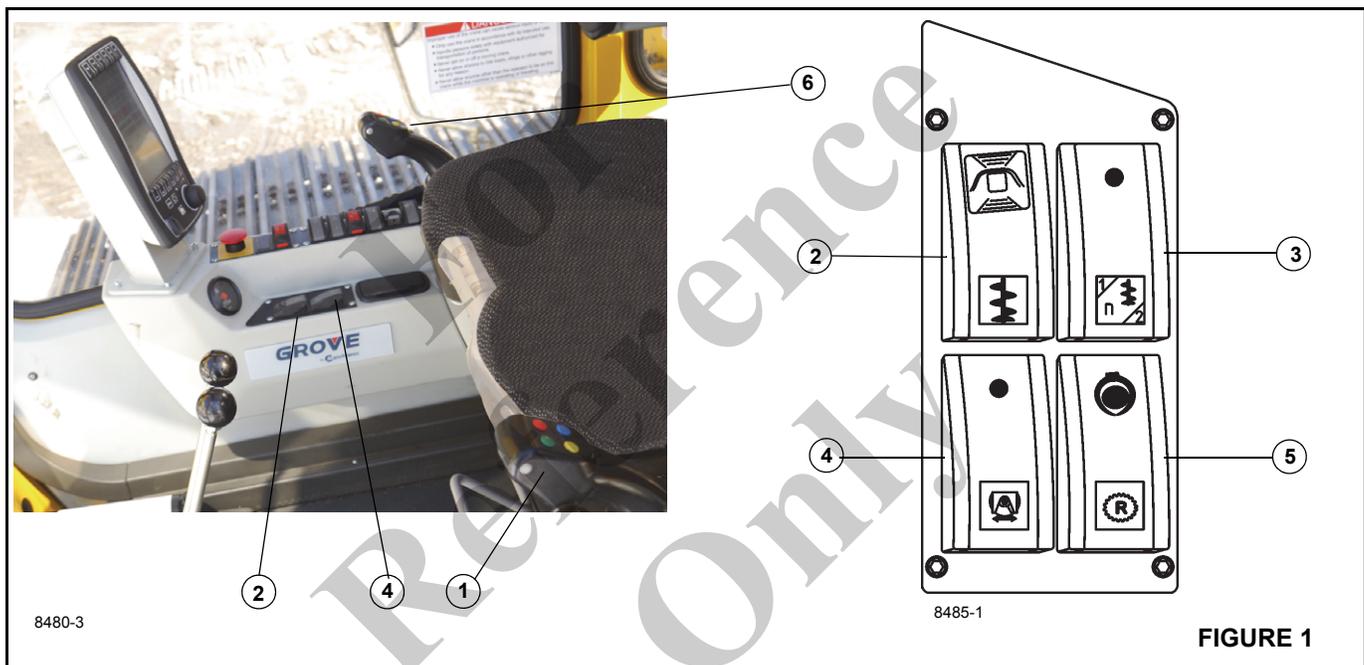


Figure 1 Item Numbers

Item	Description
1	Joystick (LH)
2	Auger Power Switch, On/Off (Option)
3	Drilling Speed Switch, Slow/Fast (Option)
4	Auger Latch Switch (Option)
5	Supplemental Hydraulic System (Option)
6	Joystick (RH)

Auger Power Switch

The auger power switch (2, Figure 1) controls electrical power on/off to the auger system components. This is a two position safety release switch. Slide the safety release tab on

the switch and press the rearward side of switch toward the symbol to turn power on. Slide the safety release tab on the switch and press the forward side of switch away from the symbol to turn power off.

This switch must be activated before operating the auger and switched off immediately after finished using the auger.

NOTE: Do not leave this switch on when the auger is not being used.

Auger Control

The left joystick controls rotation direction and speed of the hydraulic motor controlled auger. (1, Figure 1) Pushing the left joystick forward turns the auger in the drilling direction. Pulling the left joystick rearward turns the auger against the drilling direction.

Auger Latch Switch

Press the auger latch switch (4, Figure 1) to open the stow bracket latch, press the switch again to close the latch.

Auger Stow Control

The auger stow control joystick (1, Figure 1) rotates the auger for digging (forward or reverse) and is also used to stow or unstow the auger (See "Auger Control" on page 2.) Push the left joystick control lever forward for auger rotation when *unstowing* the auger, pull the lever backward for auger rotation and when *stowing* the auger.

⚠ DANGER

Free Swinging Auger Hazard

- Never stow or unstow the auger until all persons are clear of the auger area.
- Never permit any part of the body or any clothing to come in contact with the free swinging auger.

Failure to observe this Danger could result in Death or Serious Injury.

⚠ DANGER

Electrocution and Explosion Hazard

- Check for buried gas lines, electrical cable and utility lines.
- Determine their location before digging. Contact appropriate utility or government agency before any work is done.

Death or Serious Injury will occur if contact is made with any of these lines or cables.

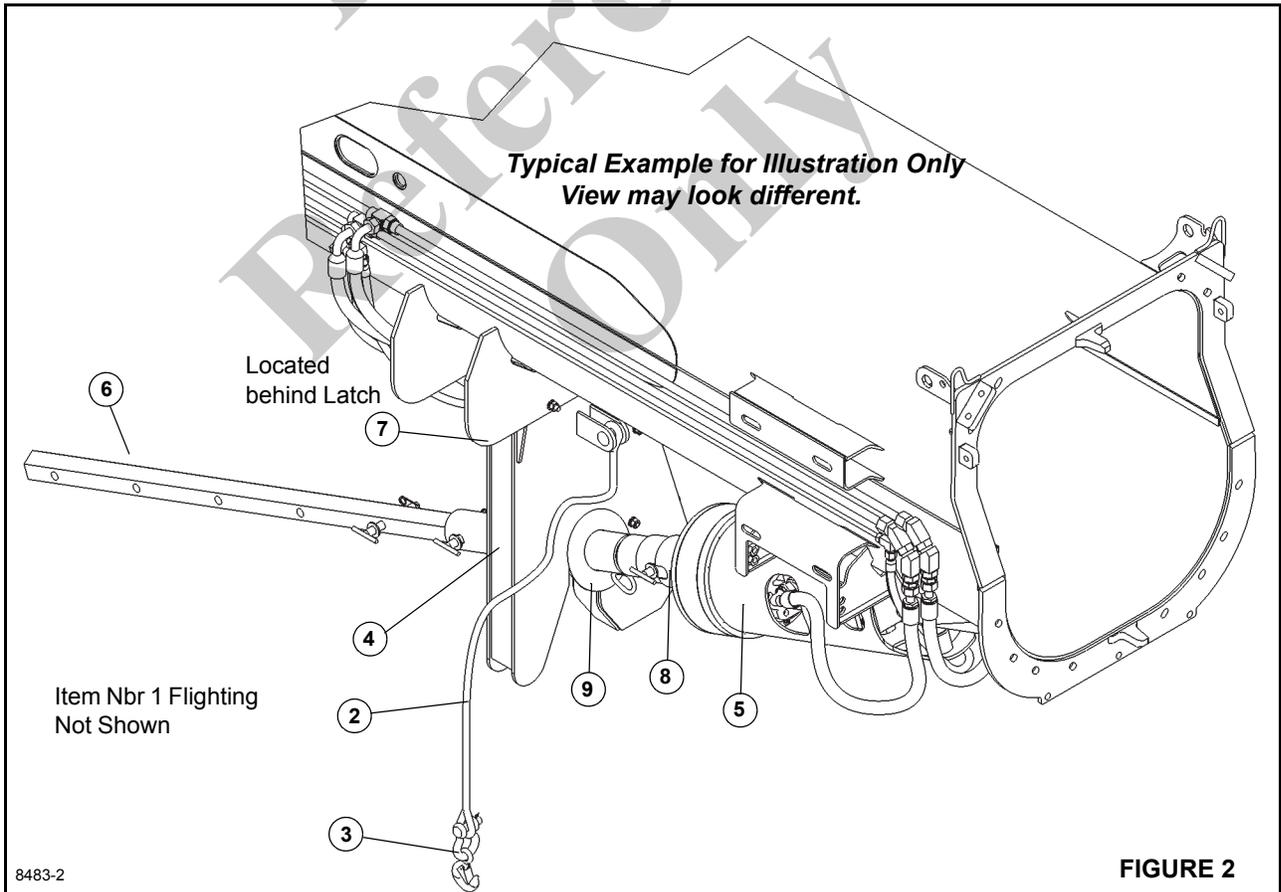


FIGURE 2

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Figure 2 Item Numbers

Item	Description
1	Flighting
2	Rope
3	Hook
4	Auger Latch
5	Auger
6	Driveshaft
7	Overwind Valve
8	Spacer
9	Tube Assembly
10	Pin - Latch

AUGER OPERATION

Before removing the auger from its stowed position (as shown in Figure 2) a series of visual inspection must be performed as outlined in the following steps. Also be sure the crane is set-up and operating per the crane operator manual.

The auger may be stowed without the fighting attached by attaching the rope to the auger windup tube (1).

1. Visually inspect the auger system to ensure that all pins and keepers are in place and all cap screws are properly tightened. Repair or replace damaged parts as required.
2. Inspect all tubes, fittings and hoses for damage, kinks or looseness. Repair or replace damaged parts as required.
3. Inspect wind-up rope (2) rope end connections and safety hook for damage to ensure that the rope is taut and properly connected to the fighting tube assembly and stow bracket. Repair damaged parts as required.
4. Inspect (over wind) valve (3) and latch assembly (4) for damage or improper condition. Repair or replace damaged parts as required.
5. Set crane up into its proper operating condition following normal operating procedures outlined in the operation section of the operator manual.
6. Telescope the undercarriage fully outward.
7. Attach the maximum counterweight.
8. Clear all personnel from the work area.
9. Start engine and push the safety lever forward.
10. Select operating mode Setup2 on the SENCON.
11. Retract the boom.

12. Remove latch pin from transport latch assembly.
13. Raise the bottom hook block. Leave a distance of 0.5 m between bottom hook block and lifting limit switch.
14. Lower the boom to approximately 45° so the auger can swing into working position.
15. Release the switch auger ON and push it toward the symbol. The auger is ready for operation.
16. Push and hold the switch open auger lock. The transport tab is unlocked.
17. Push the left joystick forward until the auger has swung out of the transport tab.
18. Release the switch open auger lock.
19. Push the left joystick forward until the auger points perpendicularly downward.
20. Detach the rope and stow it away.
21. Swing the auger into working position.
22. Release the switch auger ON and push it toward the symbol.
23. Push the left joystick forward.
The auger turns in the drilling direction.
24. Pull the left joystick rearward.
The auger turns against the drilling direction.
25. The drill speed, slow/fast switch has (2) two switching positions:
Forward: Slow drill speed, high torque
Rear: Fast drill speed, low torque

Unstow Auger

1. Retract the boom before unstowing/deploying auger.
2. Remove safety pin from transport latch assembly.
3. Raise the bottom hook block. Leave a distance of approximately 0.5 m (20 in) between bottom hook block and lifting limit switch.
4. Lower the boom to approximately 45° of elevation and swing into working position.
5. Release the auger power switch (2 See “Auger Power Switch” on page 2.) to **ON** by sliding lock rearward toward the symbol and push down on switch. The auger is ready for operation.
6. Push the auger latch switch (4) to open auger latch (See “Auger Latch Switch” on page 3.) The transport tab is unlocked. (4, Figure 1). Increasing the engine RPMs might be necessary to open the latch.

 **WARNING**

Severe Personal Injury Hazard

- Do not continue rotating the auger if contact with the overwind valve does not stop the auger from rotating.
- Damage may occur to the wind-up rope or stow bracket.
- Damage to the wind-up rope or stow bracket could allow the auger to drop from the stow bracket.

Failure to observe this Warning could result in severe personal injury.

7. Push the left joystick forward until the auger has slewed out of the transport tab on the latch.
8. Push the left joystick forward until the wind-up rope unwinds and the auger (5, Figure 3) points perpendicularly downward.
9. Detach the rope and stow it away for future use.

Operating Auger

 **DANGER**

Entanglement Hazard

- Death or Serious injury may result if entanglement occurs during operation.
- Keep all body parts and loose clothing clear while auger is running.
- Avoid pinch points.

Remove the tube assembly (9, Figure 2) if auger was stowed without flighting attached and secure the flighting (1) and spacer (8) to the auger.

1. With the auger power switch activated, (2, Figure 1), position the flighting (1, Figure 3) over the desired digging area and lower boom to the ground, then slowly push the left joystick control lever (1, Figure 1) forward and start the auger into the surface. If the auger begins a whipping (side to side) motion; stop digging momentarily, then restart digging.
2. Apply slight *boom down* force to the auger while digging.
The boom downward pressure keeps the auger penetrating into the ground.
Be sure to follow the auger with the crane as it digs downward.
3. Depending upon soil conditions, care should be exercised when digging, so that the auger does not

screw itself into the ground (corkscrew) and cause a machine overload.

NOTE: When the flighting (1, Figure 3) is filled with dirt, pull the auger from the hole and deposit the dirt in a desirable location. Dirt can be removed from the flighting by rotating the auger in the forward direction then the reverse direction. **Do not remove dirt by changing auger directions violently back and forth.**

4. After dirt is removed from the flighting, replace the auger in the hole and extend or retract the boom as necessary to maintain a vertical hole.
5. Continue digging the hole following steps 2, 3 and 4 until the desired hole length is made.

Digging Depth

To increase or decrease the auger digging depth the flighting may be raised or lowered on the auger drive shaft as needed.

To adjust the depth, remove the pin assembly securing the flighting to the auger drive shaft, reposition the flighting on the drive shaft using the drilled holes on the shaft. Re-attach the flighting to the drive shaft with the pin assembly.

Stowing Auger

The auger system is designed to be stowed with the standard 24 inch flighting attached to the auger. Larger diameter flightings may not be stowable with flighting attached to auger. (Refer to Figure 2). Check for interference during operation and stowing of auger to avoid possible damage to surrounding components.

 **WARNING**

Severe Personal Injury Hazard and Crane Damage

- Contact may occur at the cab or boom and auger flighting during rope wind-up into auger latch.
- Do not continue rotating the auger if contact with the overwind valve does not stop the auger from rotating.
- Damage to the wind-up rope or stow bracket could allow the auger to drop from the auger latch.

Failure to observe this Warning could result in severe personal injury.

See "Machine Usage with Auger Stowed" on page 7.

Clean the flighting (1, Figure 3) before stowing to maintain a longer flighting life and reduce excessive strain on the stow ear due to additional weight and to avoid dirt falling off the flighting during the stow procedure.

To stow the auger **with the flighting attached**, connect the wind-up rope to the attachment hole in the flighting using the hook (7) and stow as shown.

To stow the auger **without the flighting attached**; remove flighting (1) and attach windup tube and spacer to driveshaft and connect the wind-up rope to the to the tube using the hook (7) and stow as shown.

1. Start engine and push the safety lever forward.
2. Select operating mode Setup2 on the SENCON.
3. Release the auger power switch ON locking switch by sliding it rearward toward the symbol and pushing down on the switch.
4. Attach the wind-up rope (2) to the auger and the auger latch (4).

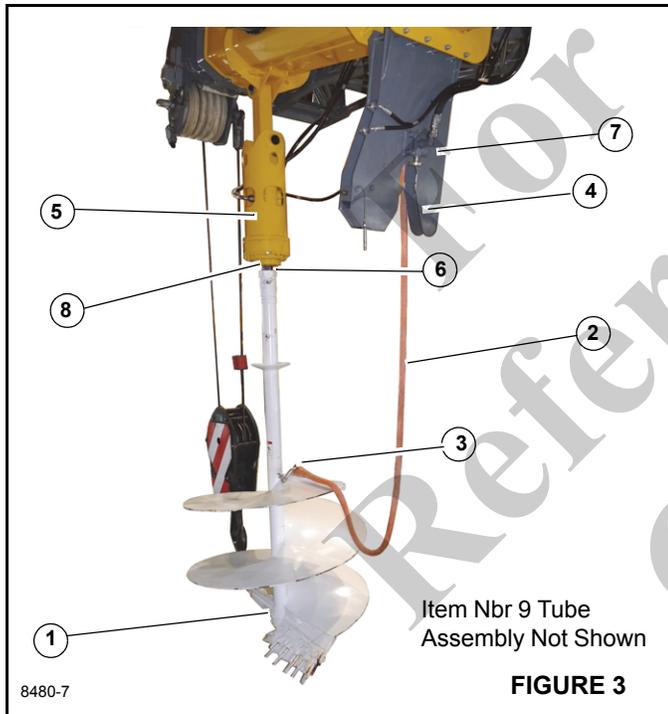


Figure 3 Item Numbers

Item	Description
1	Flighting
2	Rope
3	Hook
4	Auger Latch
5	Auger
6	Driveshaft

Item	Description
7	Overwind Valve
8	Spacer
9	Tube Assembly
10	Pin - Latch

5. Clear all personnel from the work area.
6. Raise the boom to approximately 45°, a lesser boom angle may cause the rope to wind improperly on the auger (5).
7. Pull the left joystick control (1, Figure 1) to the Reverse and Stow position to start wrapping the wind-up rope (2 Figure 2) around the auger.
8. Push the auger latch switch. The transport tab is unlocked.
9. Using caution, slowly pull the left joystick in the rearward position until the auger is positioned into the transport latch assembly and the latch is closed. If the latch doesn't close, press the auger latch switch (4, Figure 1), the latch should close.

NOTE: It is recommended but not necessary to open the latch before stowing the auger as stated in step 8 above. If the latch is left closed during the stowing process; the auger will force the stow latch open, the latch will then re-close on its own.

NOTE: When the auger is stowed, push the auger power switch ON locking switch away from the symbol on the switch Figure 2.

WARNING

Severe Personal Injury Hazard

Do not continue rotating the auger if contact with the overwind valve does not stop rotation.

Damage may occur to the wind-up rope or stow bracket which could cause the auger to drop.

Failure to observe this Warning could result in severe personal injury.

10. Ensure transport latch has fully engaged in the closed position and install latch pin in transport latch assembly.
11. Visually check the complete auger system after it is stowed to ensure that the auger is properly locked in stowed position and that all ropes, pins and keepers are properly installed prior to machine shutdown.
12. Refer to the Operator Manual when stowing the machine after use.

Machine Usage with Auger Stowed

1. Refer to normal operating and set-up procedures as outlined in the crane Operator Manual.
2. Inspect the auger stow mechanism to ensure all ropes, pins and keepers are in place so that the auger is securely stowed.

NOTICE

- Reference load chart for rated capacities of the stowed auger and the fighting.

Travel with Auger

1. Manitowoc recommends stowing the auger when traveling. Damage may occur to auger and surrounding components if auger is allowed to swing during travel. (Reference Stowing Auger)
2. Inspect the auger stow mechanism to ensure all ropes, pins and keepers are in place so that the auger is securely stowed.
3. Refer to normal operating and set-up procedures as outlined in the crane Operator Manual.

Auger Specifications

Performance

Performance listed below is based on 65 GPM and a pressure differential at the digger drive motor of 2500 psi.

TORQUE	SPEED
Low 5,597 ft/lb.	36 RPM
High 12,128 ft/lb.	79 RPM

Hydraulic System

- Flow for the digger drive is approximately 65 GPM.
- Pressure is 2500 psi at the digger drive.
- Shifting pressure in the speed shift circuit is 35 bar (500 psi).

Inspection

Daily

1. Loose parts or damage to structures or weld.
2. Condition of wind-up (stow) rope and its end connections.
3. Securing pins and keepers in drive shaft and auger fighting for proper installation.
4. Operation of over wind valve.

5. All other securing hardware such as snap rings, cotter pins, hair pins, and pin keepers for proper installation.

Weekly

1. Lubrication of digger drive gearbox.
2. Tightness of all mounting or securing bolts for first month of operation of new machine and then monthly thereafter.

Monthly

1. Latch cylinder, digger shift valve, digger drive and motor, selector (over wind) valve for signs of leaks.
2. Tightness of all mounting and securing bolts. See torque chart in operator and service manuals.
3. All structural members (mount assembly, stow bracket, link assembly, drive shaft and auger fighting) for bends, cracks or broken members.
4. All welds for cracks or breaks.
5. All pins for proper installation, signs of wear or damage.
6. All control and safety placards for readability and secure attachments.

Periodic

1. All items listed under daily weekly and monthly inspections.
2. Loose bolts and fasteners in all areas.
3. Hydraulic system for proper operating pressure.
4. Cylinders for: damaged rods, dented barrels, Drift from oil leaking by piston, leaks at rod seals or welds.
5. Hydraulic hose and tubing for evidence of damage such as blistering, crushing or abrasion.
6. Auger mount assembly for signs of wear and proper fit.

LUBRICATION - DIGGER DRIVE GEAR

1. Lube fill location and oil level check is the 1/2" NPT hex socket head pipe plug located in the top surface of the upper case housing.
2. The digger gearbox units do not contain breathers or vents.
3. Lube capacity is 3.03 liters (6.5 pints) of high quality GL-5 EP-80/90 gear oil or equivalent.
4. When in the vertical position, the proper oil level will be near the middle of primary planet gears. This level is 2 1/4" to 2 1/2" below the top of the gearbox, measuring through the fill port. It may be necessary to rotate the planetary gears to allow measurement of the oil level. To check the oil level, slowly loosening the oil fill-drain plug located on the under side of the gearbox. As you reach

the ends of the threads on the plug, oil should start to come out. This is an indication the oil level is adequate, but in order to correctly measure the amount of oil, the gearbox should be drained and the correct amount of oil replenished. It is important to change lube oil after the first 50 hours of operation and then after each additional 500 hours of operation.

- 5. It is recommended that geardrive be partially disassembled to inspect gears and bearings at 1000 hr. intervals.

Changing the Gear Oil

- 6. To assist in draining lube oil, position digger unit in a horizontal plane with drain hole rotated to allow oil to drain. To help ventilate oil while draining, loosen or remove oil plug located in top corner.

- 7. Drain lube oil immediately after oil has reached operating temperature. This will ensure that any loose particles will be flushed out when oil is drained.
- 8. Position the gearbox for filling by orientating the unit so that the same port used for draining can now be used to fill.
- 9. Refill with 3.03 liters (6.5 pints) of high quality GL- 5 EP-80/90 gear oil or equivalent.
- 10. Be sure lube fill and check plug are tight after servicing to avoid seepage. Tighten drive motor bolts if loosened during draining procedure.
- 11. It is important that lube oil level is maintained if any seal leakage is noticed.
- 12. Do not overfill with lube oil because excessive heat buildup and internal pressure could harm unit operation.
- 13. Check oil level every 40 hours (or less) or if applicable, seepage could develop from any point on the digger.

TROUBLESHOOTING

TROUBLESHOOTING	
CONDITION	ACTION
Auger rotates wrong direction from control lever.	Switch hoses at boom pivot connection
Auger doesn't rotate	Pull auger out of ground to assure auger is not at maximum load.
Latch won't open or close	<p>Latch cylinder is damaged. Repair or replace as required. If auger is resting on latch, raise auger by operating auger control lever to reverse/stow then open latch.</p> <p>If latch is locked in closed position, check electrical system to ensure that pushing the momentary latch control switch energizes the solenoid.</p> <p>If the latch opens slowly or not at all, try increasing flow by increasing engine RPM's.</p> <p>RCL boom length needs recalibrated. RCL override can be used in an emergency.</p>
Can not shift auger speeds.	<p>Auger torque loaded. Eliminate load on auger.</p> <p>Electric shift circuit not functioning properly, repair or replace as required (loose wire, bad switch, etc.).</p> <p>Check digger shift valve for proper function. Repair or replace as required</p> <p>Insufficient pilot pressure. Determine source of problem, pressure reducing valve, relief valve</p>

TROUBLESHOOTING	
Auger wind-up torque not limited during stowing or unstowing	<p>Make sure there is contact between the auger flighting tube and the selector (over wind) valve spool. Adjust selector (over wind) valve location as required.</p> <p>Check selector (over wind) valve for proper function. Repair or replace as required.</p>
Boom won't raise auger out of hole	<p>Auger is corkscrewed in or other wise overloaded with dirt. Reverse auger out of hole until boom will raise.</p> <p>Drive (kelly) shaft can be lengthened to increase boom angle and therefore increase lift capacity.</p> <p>See operating procedures concerning the lifting operation</p>
Boom won't extend loads during normal crane operation	<p>Proximity switch damaged or out of adjustment, repair or replace.</p> <p>Solenoid valve on extend circuit not operating properly. Determine cause, repair or replace.</p>
Slow Speed (RPM) or Insufficient Digging Power	<p>Low oil flow.</p> <p>Auger Drive is too large for machine.</p> <p>Check auger and teeth for excessive wear, Repair or replace as required.</p>
No Output Rotation	<p>Quick release couplers not engaged.</p> <p>Quick release coupler is faulty, Replace.</p> <p>Hydraulic oil reservoir is low, Fill.</p> <p>Planetary gear failure.</p> <p>Machine or hydraulic pump failure.</p>
Bail Housing Leaking Oil	<p>Hose(s) or fitting(s) leaking, Tighten or replace.</p> <p>Motor O-ring failure, Replace.</p>
Output Shaft Leaking Oil	<p>Oil seal failure</p> <p>Hydraulic motor failure.</p>
Auger Bit Will Not Engage or Dig	<p>Auger bit is worn or damage, Replace cutting head or bit.</p>
No Torque	<p>Oil pressure is too low.</p> <p>Drive unit is too small for parent machine.</p> <p>Hydraulic system is overheating.</p>
Hydraulic Oil Overheating	<p>Oil pressure is too low, Set relief valve.</p> <p>Hydraulic line is restricted, Inspect and repair.</p> <p>Auger continually stalling, Limit down pressure.</p> <p>Hydraulic oil reservoir is low, Fill.</p> <p>Insufficient oil capacity, Check oil cooler.</p> <p>Parent machine is too small.</p>

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OPERATOR MANUAL

This manual has been prepared for and is considered part of the

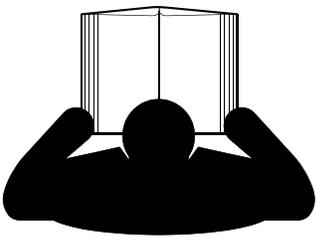
Personnel Basket Option

NOTICE

The basket serial number is the only method your distributor or the factory has of providing you with correct parts and service information.

Always furnish crane serial number when ordering parts or communicating service problems with your distributor or the factory.

For Reference Only

	<h2> DANGER</h2> <p>To prevent death or serious injury:</p> <ul style="list-style-type: none">• Avoid unsafe operation and maintenance.• This basket must be operated and maintained by trained and experienced personnel. Manitowoc is not responsible for qualifying these personnel.• Do not operate or work on this basket without first reading and understanding this Operator Manual the crane Operator Manual and Rating Plate supplied with crane.• Store Operator Manual in holder provided.• If the Operator Manual is missing from cab, contact your distributor for new ones.
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PERSONNEL BASKET

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.

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 meters (20 feet) away from any electrical component. Consult minimum clearance table or Electrocutation Hazard decal for additional clearance information (Figure 1-1). Hoisting personnel within 20 feet of a power line that is up to 350kV, and hoisting personnel within 50 feet of a power line that is over 350kV, is prohibited (Figure 1-1). 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:
- 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.
 - 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.
 - A boat with appropriate rescue personnel shall be available at all times during a personnel lift over water.
 - 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.

Equipment Operator

Equipment Operator shall:

- Comply with any applicable qualification criteria. As a minimum the qualification requirements shall include, but not be limited to:
 - Qualification to operate the specific type hoisting equipment used in the personnel lift.
 - 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.
 - Successfully meeting the training and qualification criteria established in the applicable hoisting equipment ASME B30.5 volume for telescoping cranes.
- Be qualified to operate the platform controls of a platform with controls.
- 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:
 - The operator does not feel physically or mentally fit to perform the operation.
 - 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.
 - The operator did not have at least eight hours off immediately prior to the work shift containing the personnel lift operation.
- Not engage in any practice that will divert their attention while actually engaged in operating the hoisting equipment.
- 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.
- 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.
- When involved with a boom mounted platform without controls, remain at the hoisting equipment controls whenever personnel are in the platform.
- 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.
- Consult the Safety and Operation sections in the Operator Manual for specific instruction on the equipment operation.
- 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:
 - Excessive load or radius.
 - Overhead obstructions and electrical transmission lines.
 - Hazardous locations.
 - Inadequate surface and support to withstand all forces imposed.
 - Wind, weather and other unstable conditions.
 - Any potentially hazardous conditions.
- 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.
- 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 out- lined 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 1.(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.

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).

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.

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).

Lifting Personnel Near Power Lines



FIGURE 1-1

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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 Electrocutation Hazard decal (Figure 1-1). 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 Electrocutation 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 Electrocutation Hazard decal (Figure 1-1) shall be maintained between the hoisting equipment, load line and personnel platform at all times. Hoisting personnel within 20 feet of a power line that is up to 350kV, and hoisting personnel within 50 feet of a power line that is over 350kV, is prohibited (Figure 1-1).
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.

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.

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 7.

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 7.

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.

PERSONNEL LIFT PLATFORM PRE-LIFT INSPECTING				
Inspector	Date	Platform ID		
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Satisfactory</th> <th style="width: 50%;">Unsatisfactory</th> </tr> </table>	Satisfactory	Unsatisfactory
Satisfactory	Unsatisfactory			
1. Markings				
Platform decals and placecards (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:				
<hr/> <hr/> <hr/> <hr/>				
<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 _____ _____ _____ _____		
Name	Signature	Date

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 apprentices ().
- 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 7. 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 7) 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 1-2, Figure 1-3 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 1-2, Figure 1-3).
2. Install two web sling shackles and two slings to the basket, Figure 1-2.
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 1-2, Figure 1-3).
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.

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 1-2)

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

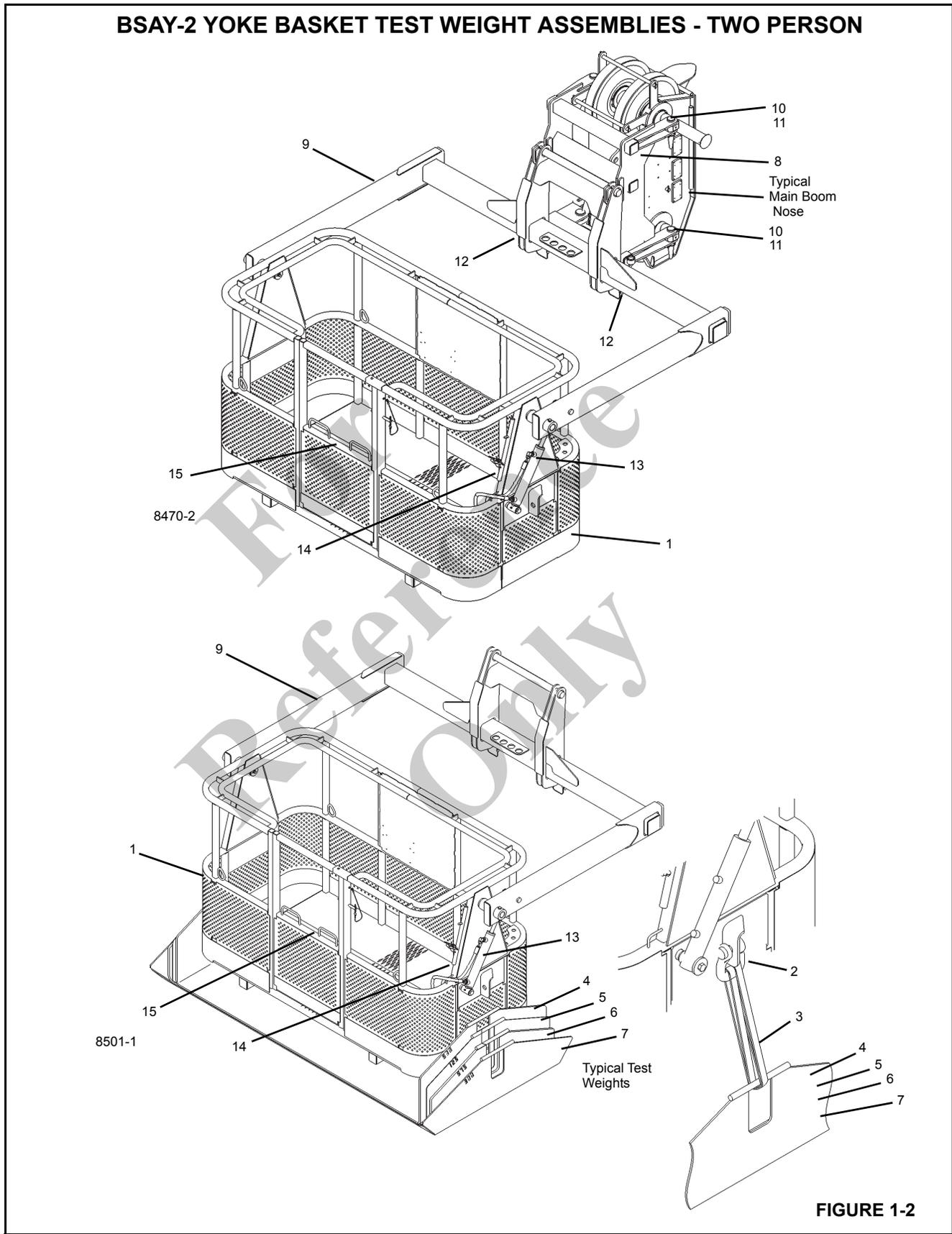


FIGURE 1-2

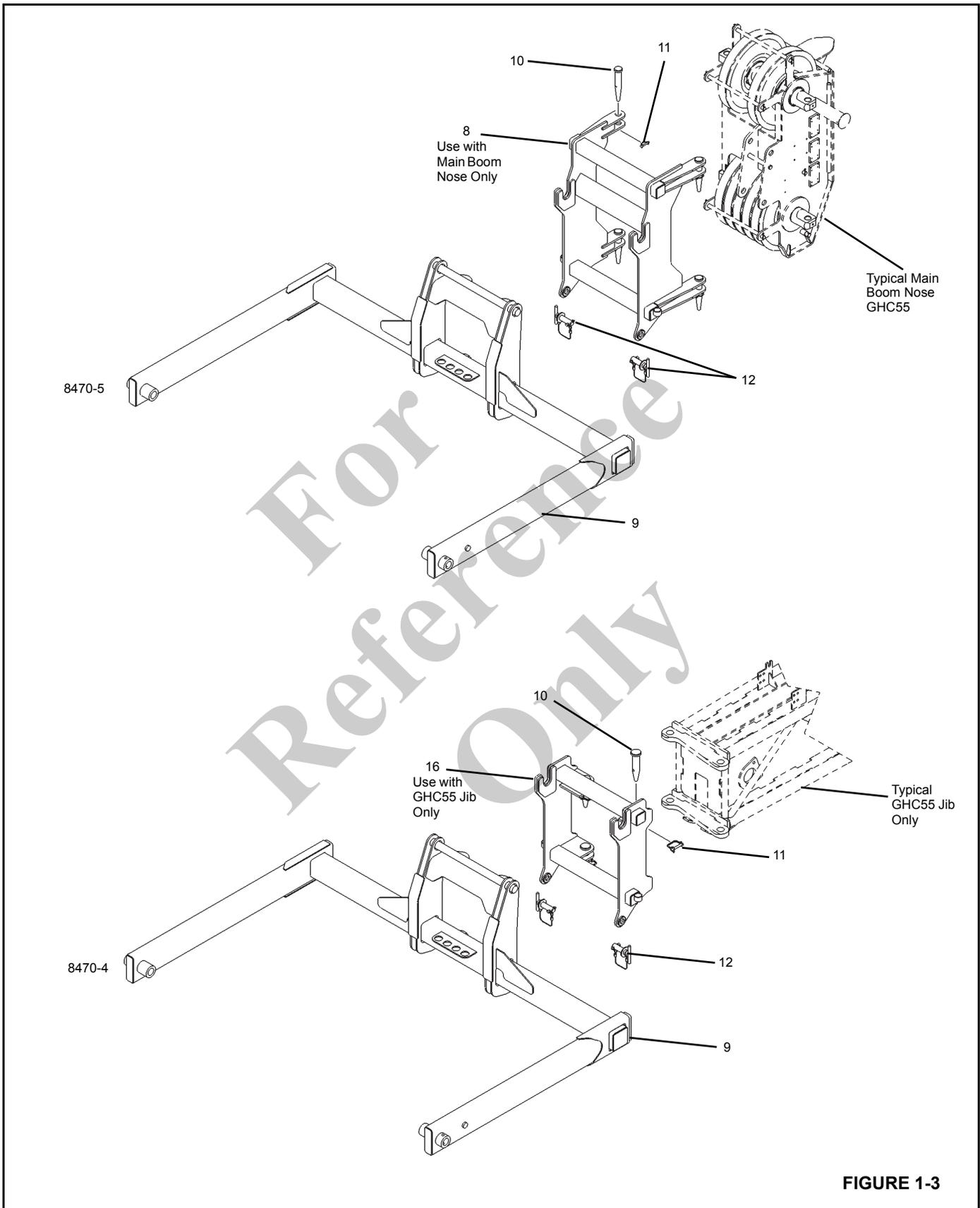


FIGURE 1-3

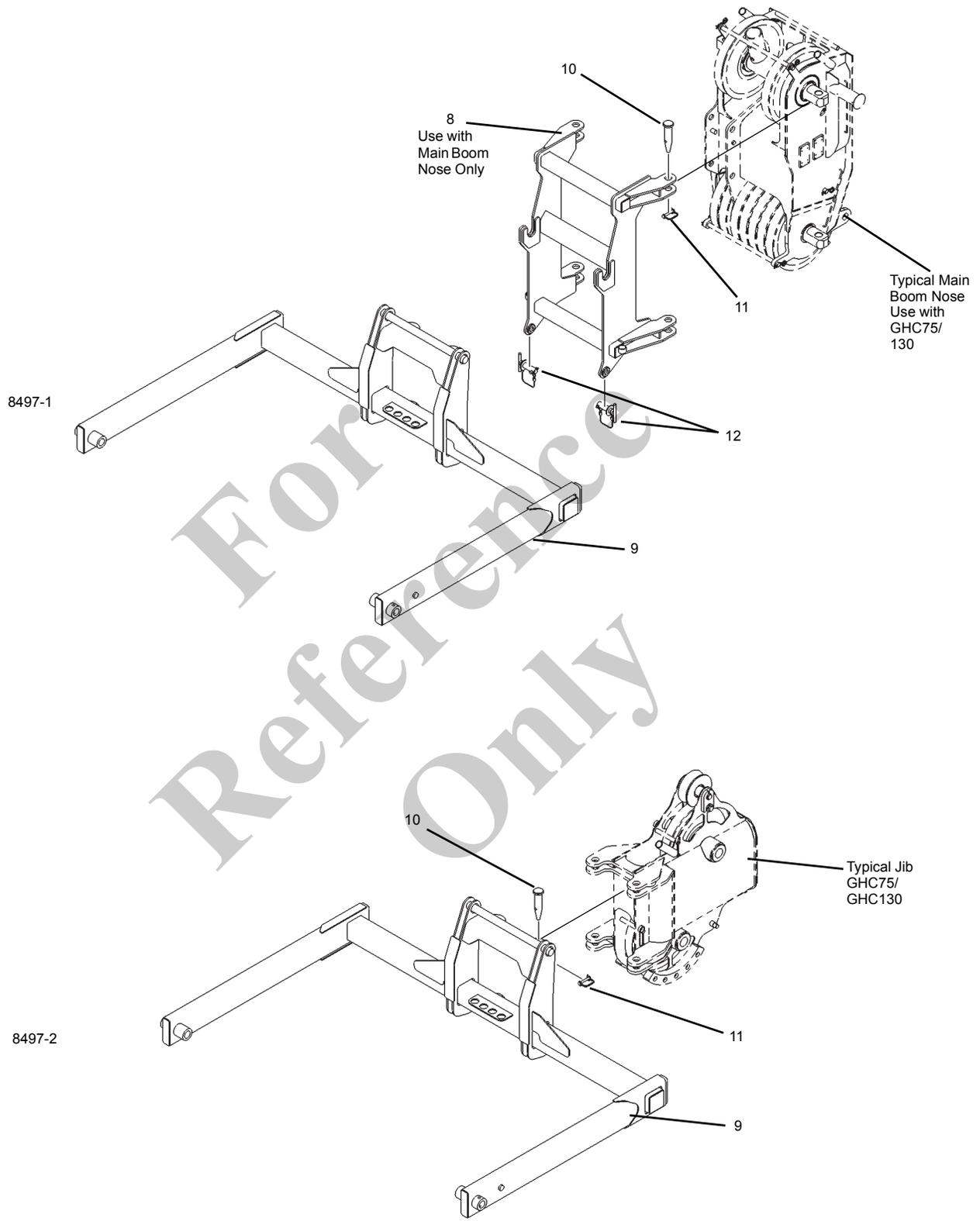


FIGURE 1-4

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.

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.

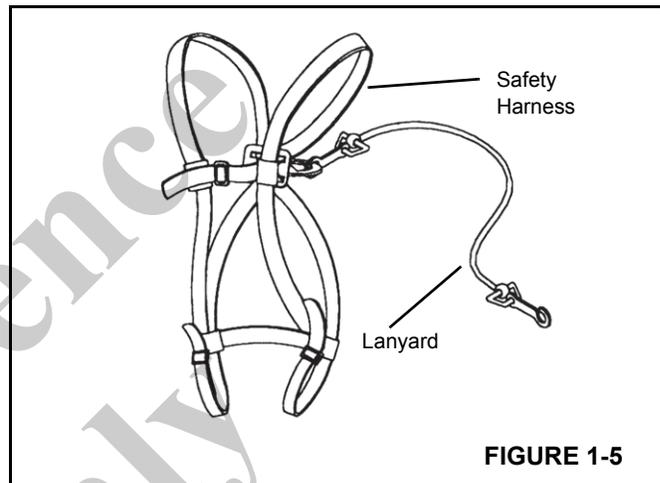


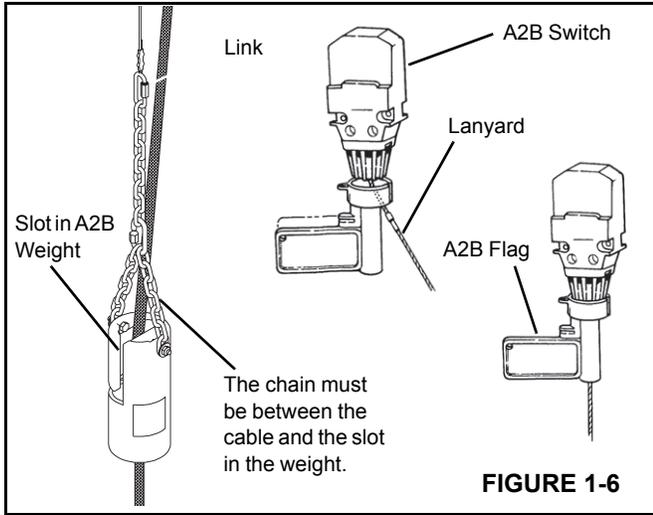
FIGURE 1-5

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.

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) & (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).

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) & (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.

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 1-9). 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 16. to attach the yoke basket to the main boom or jib.

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 5.

Hoist Cable

The hoist cable must be disconnected from the hook block and properly secured to the stowing point when using the basket assemblies.

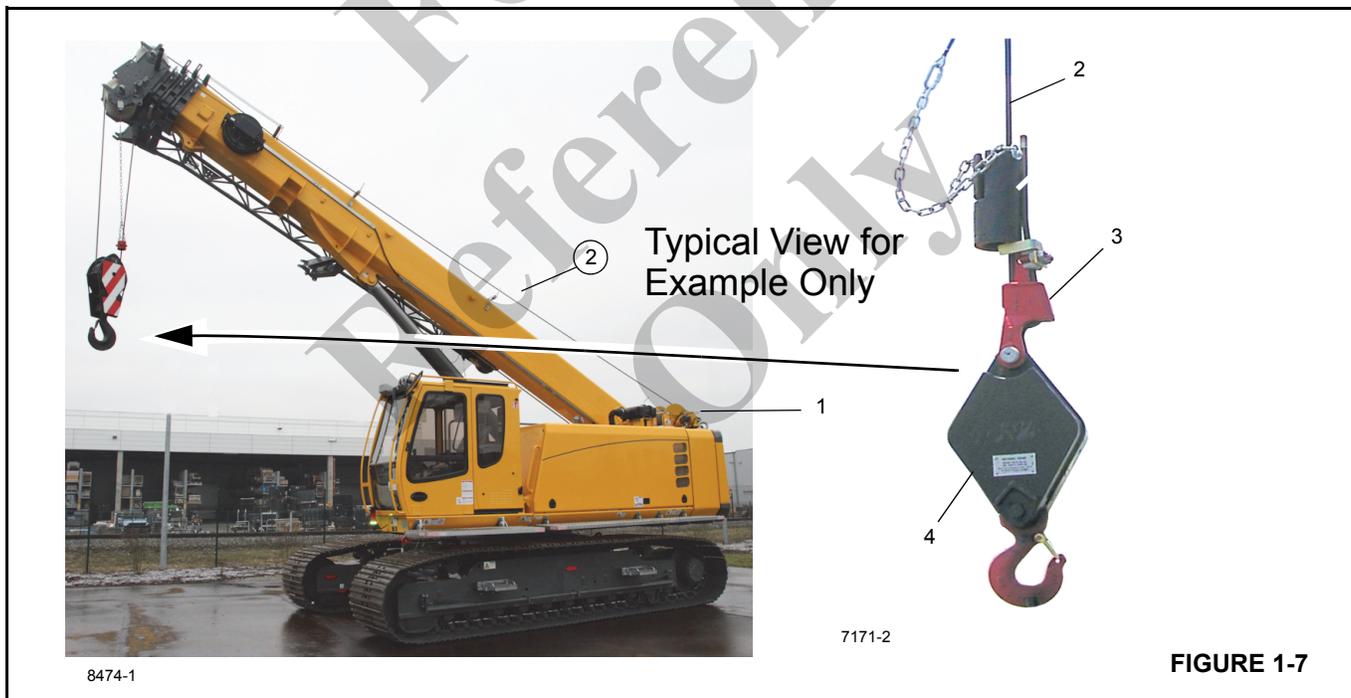
If your crane has the hoist mounted to the turret (as shown in Figure 1-7) - DO NOT connect the hoist cable to any place on the boom.

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

- 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.
- Slowly re-wind the hoist cable until the wedge socket (3) is within several feet of the stowing point.
- Slowly rewind the hoist cable (2) until any remaining slack is removed and the cable is snug.

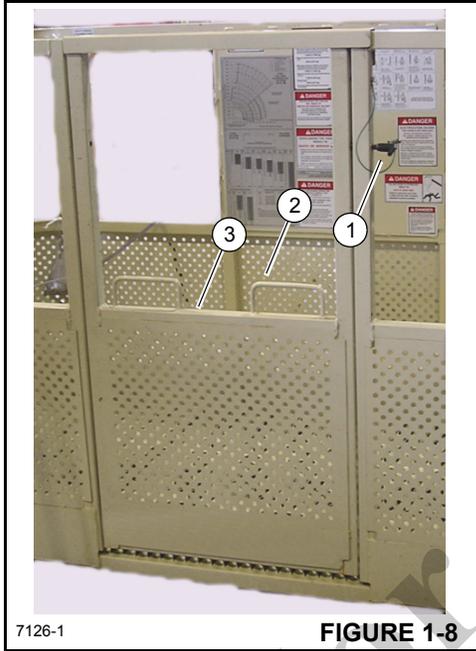


Yoke Basket Operation

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 14 before starting these operating instructions.

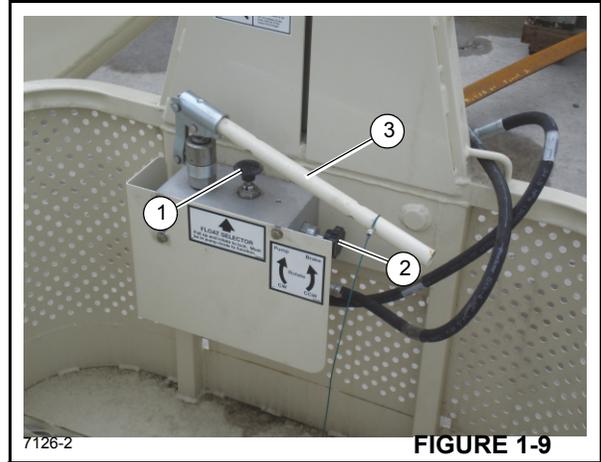
- To enter the basket, remove the gate locking pin (1, Figure 1-8), pull up on the grab handle (2) and swing the gate (3) open.



7126-1

FIGURE 1-8

2. Connect the safety harness. Close the basket gate (3, Figure 1-8) 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 1-9) 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 1-9

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 is attached to the boom nose.

CAUTION

Rotate the brake selector (2, Figure 1-9) 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 1-9) should not be used when the crane is operating. The hand pump is to be used *only* when installing the yoke to the crane.

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OPERATOR MANUAL

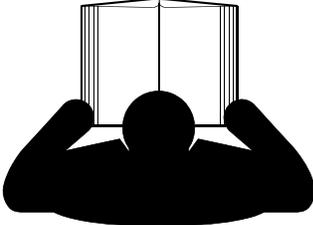
This manual has been prepared for and is considered part of the

Pole Claw Option

NOTICE

The crane serial number is the only method your distributor or the factory has of providing you with correct parts and service information.

Always furnish crane serial number when ordering parts or communicating service problems with your distributor or the factory.

	<h2> DANGER</h2> <p>An untrained operator subjects himself and others to death or serious injury. Do not operate this crane unless:</p> <ul style="list-style-type: none">• You have been trained in the safe operation of this crane. Manitowoc is not responsible for qualifying personnel• You read, understand, and follow the safety and operating recommendations contained in the crane manufacturer's manuals and load charts, your employer's work rules, and applicable government regulations.• You are sure that all safety signs, guards, and other safety features are in place and in proper condition.• The Operator Manual and Load Chart are in the holder provided on crane.
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OPTIONS POLE CLAW

The following safety rules apply specifically to the pole claw 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 crane Operator Manual.

The contents of this section are provided as follows:

- Safety
- Operation
- Service & Maintenance
- Specifications

The information provided in these sections should be read carefully before attempting to operate or service the pole claw system.

SAFETY

The safe operation of the pole claw system depends on you, the condition of your equipment, and your maintenance and inspection procedures. As an integral part of the crane, the "Safety and Operation" section of this manual applies to the pole claw system, and should be read carefully and the procedures there-in followed.

The crane operator and service mechanic are the key in any safety program, study all sections of the safety manual to be aware of the safety precautions presented to help prevent serious injury to themselves and other personnel. The following is designed to present some of the daily work problems which may be encountered by the operator, service, and other personnel.

DANGER

Electrocution and Explosion Hazard

- Check for buried gas lines, electrical cable and utility lines.
- Determine their location before digging. Contact appropriate utility or government agency before any work is done.

Death or Serious Injury will occur if contact is made with any of these lines or cables.

DANGER

Avoid pinch points when working around pole claw or
Death or Serious Injury will result.

DANGER

Two blocking the loadline will result in
Death or Serious Injury.

- Do not two-block the loadline by contacting the sheave head with the downhaul weight.
 - Failure to observe this Danger could result in Death or Serious Injury.
-

DANGER

Overloading the pole claw will result in Death or Serious
Injury

Reference the load chart for stability and load capacities.

CAUTION

The function of the tilting pole claw is only for placing and aligning poles in position - not for transporting. Loading and/unloading the winch loadline must be used to lift the pole.

Safety Tips - Pole Claw Equipped Cranes

- Do not operate cranes or accessories within 6 m (20 ft) of live power lines.
- Check for utilities service, i.e. power lines, telephone lines and gas lines before operation.
- Before transporting units, make sure pole claw is stowed properly and that all pins, fasteners, and latches are in place and secure.
- Inspect all pole claw fasteners, pins, hydraulic components and system components prior to operation.
- Prior to operation of the pole claw, set track width following normal procedures described in the Operation Section of this manual.
- Operate the controls as indicated by the directions given in crane operator cab.
- Do not attempt to pull or lift poles from the ground, such as those frozen in the ground or pole that are not completely loosened
- Do not loosen poles in the ground by pulling, pushing or rotating the boom into the pole.
- Do not handle loads other than poles while utilizing the pole claw.

- Never operate pole claw until all persons are clear of the area.
- Stow only in the closed position.
- Stand clear of pole claw during operation, cleaning and stowing operation to avoid entanglement.
- Do not push/pull excessively with the boom to force the pole claw during operation.

DESCRIPTION

Pole Claw System

A supplemental hydraulic system is used to operate the tilting pole claw system. It is a hydraulically operated device that will stabilize and assist in setting poles by aligning them vertically when operating the boom at angles between 20° and 80° above horizontal.

The following information will cover only the functionality of the pole claw controls shown in Figure 1. For information on all other Operator's controls see the Crane Operator Manual.



Figure 1 Item Numbers

Item	Description
1	Safety Lever
2	Changeover Clamping Tong/Supplemental Hydraulics Switch
3	Joystick (RH)
4	Joystick (LH)
5	Lower Pole Claw
6	Raise Pole Claw
7	Close Pole Claw
8	Open Pole Claw

Attaching the Pole Claw

1. Start the diesel engine and push the safety lever forward.
2. Select operating mode Setup2 on the SENCON.
3. Telescope the boom fully in.
4. Raise the bottom hook block. Leave a distance of 0.5 m between bottom hook block and lifting limit switch.
5. Lower boom to 0°.
6. Lift the clamping tongs to the boom head using suitable hoisting gear and secure to the boom head with attaching pins.
7. Connect the pole claw hydraulic hoses to the quick-change couplings (4 Figure 2) at the boom head.

Switching on the Supplemental Hydraulic System

- Push the Changeover Clamping Tong/Supplemental Hydraulics Switch (2 Figure 1) to the **Rearward** position (R) to activate the supplemental hydraulic system.

NOTE: Pushing the Changeover Clamping Tong/Supplemental Hydraulics Switch (2 Figure 1) at anytime during the operation of the clamping tongs to the **Rearward** position (R) will activate the tongs to the **Full Closed** position.

- Push the safety lever (1 Figure 1) **Forward** to engage hydraulic functions.
- Push the Changeover Clamping Tong/Supplemental Hydraulics Switch (2 Figure 1) to the **Center** position to switch off the supplemental hydraulic system.

Joystick Control

The right joystick raises and lowers the pole claw.

- Push button (5 Figure 1), lowers pole claw.
- Push button (6 Figure 1), raises pole claw.

The left joystick opens and closes the pole claw.

- Push button (7 Figure 1), closes pole claw.
- Push button (8 Figure 1), opens open pole claw.

Operating the Clamping Tongs

1. Telescope the undercarriage outward for stability during operation.

NOTE: Reference the load chart for stability and load capacities.

2. Attach the counterweight.

NOTE: Reference the load chart for stability and load capacities.

3. Start the engine and push the safety lever **Forward** (1 Figure 1).

4. At the SENCON, select operating mode Maximum track width and Maximum counterweight.

5. Raise the boom higher than 25°.

6. Push the switch (2 Figure 1) Changeover Clamping tongs/Supplemental Hydraulic System Clamping tongs to the **Rearward** position (R) to activate the supplemental hydraulic system.

CAUTION

Pushing the Changeover Clamping Tong/Supplemental Hydraulics Switch **Rearward** position (R) on switch (2 Figure 1) at anytime during the operation of the clamping tongs will cause the clamping tongs to activate the tongs to the **Full Closed** position.

7. Push the button (8 Figure 1) on the left joystick.
The clamping tongs open.
8. Push the button (7 Figure 1) on the left joystick.
The clamping tongs close.
9. Push the button (5 Figure 1) on the right joystick.
The clamping tongs are lowered.
10. Push the button (6 Figure 1) on the right joystick.
The clamping tongs are raised.

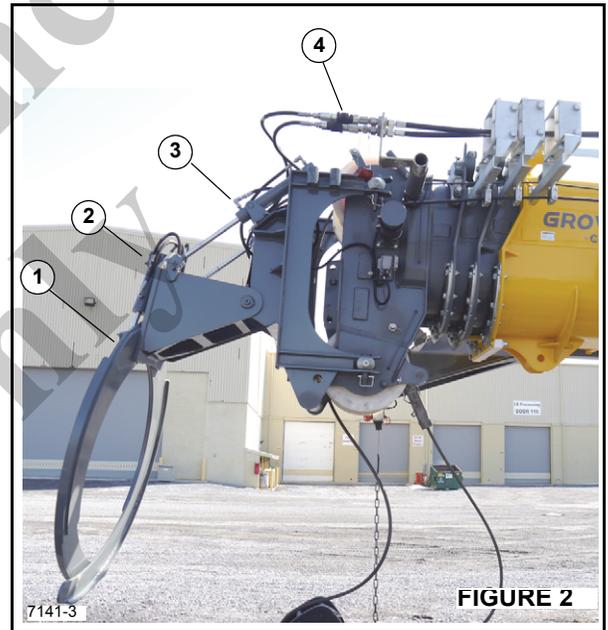


Figure 2 Item Numbers

Item	Description
1	Clamping Tongs
2	Cylinders - Open/Close Tongs
3	Cylinders - Tilt Clamp
4	Couplings - Quick Change

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